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Water Reuse Report

Water Reconciliation Strategy for Richards Bay and Surrounding Towns

Department of Water and Sanitation

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DEPARTMENT OF WATER AND SANITATION

Directorate: National Water Resources Planning

Water Reconciliation Strategy for Richards Bay and Surrounding Towns

WATER REUSE REPORT

Final: February 2015

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Department of Water and Sanitation
Directorate: National Water Resources Planning

WATER RECONCILIATION STRATEGY FOR RICHARDS BAY AND SURROUNDING TOWNS

APPROVAL

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Acronyms

DWS	Department of Water and Sanitation
EIA	Environmental impact assessment
HFYs	Historical firm yields
IDZ	Industrial Development Zone
Mℓ/d	Megalitre per day
RBM	Richards Bay Minerals
DTM	digital terrain models
URV	Unit reference value
WC/WDM	Water Conservation and Water Demand Management
WSS	Water Supply System
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works

1 INTRODUCTION

1.1 Background

Richards Bay is the economic centre of the uMhlathuze Local Municipality which further comprises Empangeni, Ngwelezane, Nseleni, eSikhaleni and a number of rural villages. Richards Bay is one of the strategic economic hubs of the country. Though the water resources available to the uMhlathuze Municipality are currently sufficient to cater for the existing requirements, should anticipated growth and industrial development materialise the current water sources are likely to come under stress. There is a need for long-term planning to ensure that shortfall in water supply is avoided in the long term.

1.2 Objectives of the Reconciliation Strategy

The objective of the study is to develop a strategy to ensure adequate and sustainable reconciliation of future water requirements within the uMhlathuze Local Municipality with potential supply up to 2040, especially that of Richards Bay / Empangeni, their significant industries, as well as the smaller towns and potential external users that may be supplied with water from the system in future.

1.3 Strategy area

Richards Bay is an established city with well-developed industries, commercial areas and business centres. Significant development is currently taking place in the town, particularly in the industrial development zone (IDZ), adjacent to the Richards Bay harbour. Significant growth in water requirements has been experienced in recent years, and this trend is expected to continue, driven primarily by growth in industrial development, but also by growth in domestic water use.

The strategy area considered includes the entire uMhlatuze River catchment, as well as all existing and potential future transfers into and out of the catchment. The focus area of long term supply is however the uMhlathuze Local Municipality area and its significant industries.

In the strategy area, water is sourced from the Mhlatuze River, various natural lakes in the catchment, limited use of boreholes, transfer from the Thukela River (via the Thukela-Mhlatuze (Middledrift) transfer scheme) and the Richards Bay Minerals (RBM) transfer from the lower Mfolozi River.

The strategy focus area is shown on the following page (Figure 1-1).

1.4 Purpose and scope of this Report

It is necessary to identify the potential interventions or groups of interventions that could be implemented to meet the potential future supply shortfalls. The most favourable interventions need to be evaluated to be able to devise the set of best possible alternatives to meet the water requirements of the Richards Bay Water Supply System (WSS) up to 2040.

The purpose of this report is to explain the process followed to identify the potential interventions to augment the WSS, and to describe the features of the interventions that have been evaluated.

1.5 What is an Intervention?

An Intervention can be any measure that makes additional water available i.e. that improves the water balance of the Richards Bay WSS. It can therefore be demand-side or supply-side focussed.

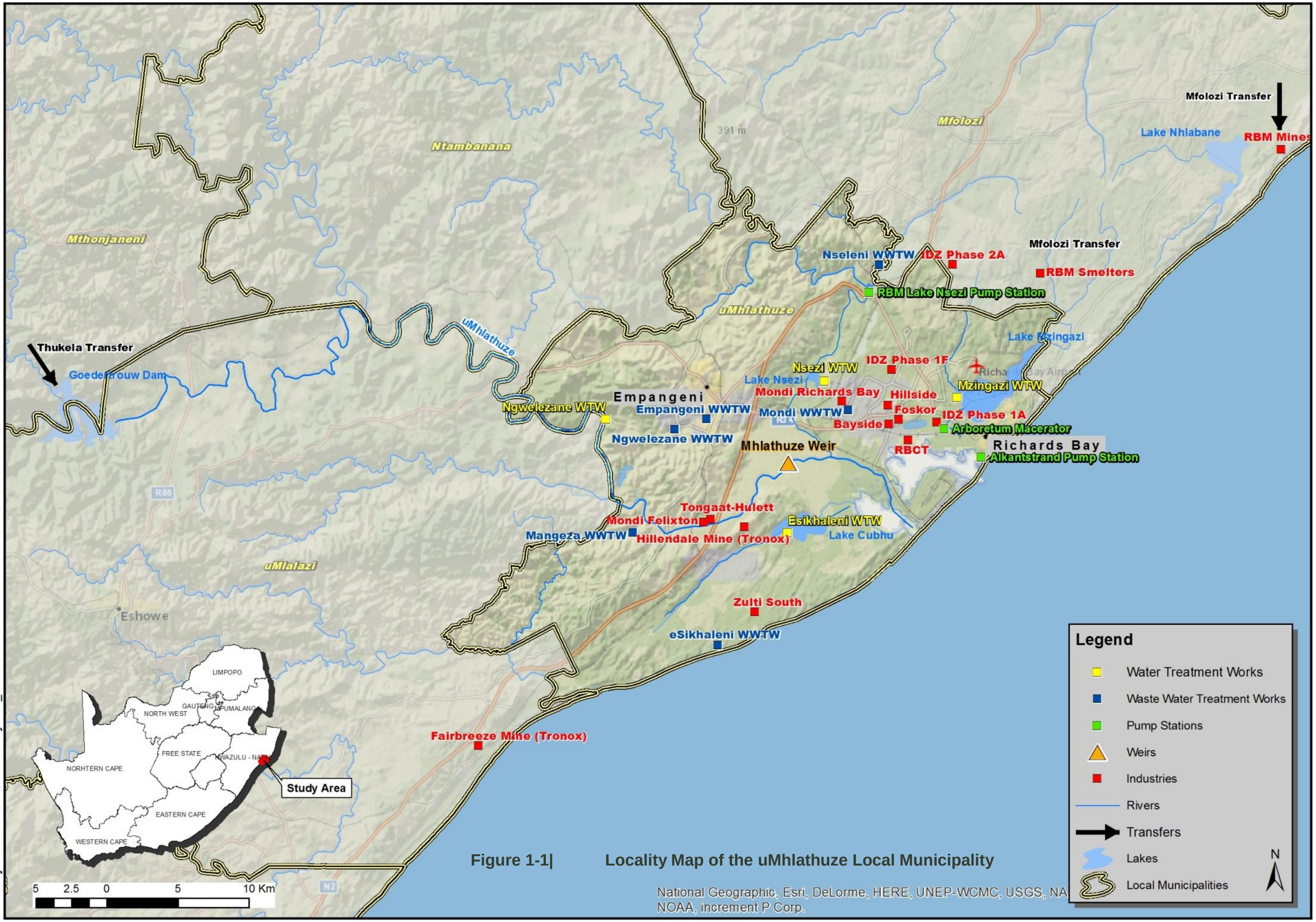

Figure 1-1| Locality Map of the uMhlathuze Local Municipality

1.6 Approach and methodology

The following process has been followed:

a) Compilation of a Long List of potential interventions,
b) Screening of the Long List of interventions,
c) Compiling a list of interventions to be evaluated further – the Short List,
d) Evaluation of short-listed interventions,
e) Documentation of evaluated interventions according to a standard template,
f) Holding an Interventions Workshop with key stakeholders,
g) Preparation of the Interventions Report.

1.7 Structure of this Report

This report is presented in ten chapters. Chapters 1 to 3 provide the background to and context of effluent reuse. Chapters 4 to 10 provide the information of the evaluation and findings of the identified reuse intervention.

2 INTERVENTIONS LONG LIST

2.1 Compilation of the Long List of Interventions

A significant number of potential interventions, which could contribute to meeting the future water requirements of the Richards Bay WSS, were identified from previous and on-going studies, liaison with officials and stakeholders, as well as formulating some new potential interventions. The list of these initial potential interventions has been termed the "*Long List*" of interventions. The Long List describes potential interventions that could be considered for the strategy area, classed under twelve categories of interventions:

The following categories of interventions were identified:

- Water conservation and water demand management (WC/WDM),
- Improved operation of the Richards Bay WSS,
- Water reallocation,
- Reducing users' assurances of supply,
- Land care,
- Thukela River inter-basin transfer schemes,
- Mfolozi River inter-basin transfer schemes,
- Mhlathuze River dams,
- Groundwater schemes,
- **Use of treated effluent**,
- Desalination, and
- Water supply infrastructure.

Figure 2-1 shows the Long List of potential interventions according to the Intervention Categories. The interventions shown in bold blue font have been evaluated further.

Figure 2-1 | Long List of Potential Interventions

Intervention Category	Potential Interventions
Water conservation and water demand management (WC/WDM)	• **Bulk Industrial WC/WDM** • **Urban WC/WDM** • WC/WDM by irrigated agriculture • **Rainwater harvesting** • Stormwater harvesting
Improved operation of the Richards Bay WSS	• **Limiting supply from "over-abstracted" coastal lakes** (negative intervention) • Raising of Lake Nsezi • Artificial recharge and/or raising of WSS coastal lakes • Pipeline from Goedertrouw Dam to Lake Nsezi/Nsezi WTW • Improved abstraction measurement and billing of irrigators
Water reallocation	• Verification and validation of water use • Phasing out of marginal irrigation and allocation for urban/industrial use
Revisiting users' assurances of supply	• Reducing assurances of supply
Land care	• Eradication and control of invasive alien vegetation
Thukela River inter-basin transfer schemes	• **Increased capacity of the Thukela-Mhlathuze Transfer Scheme** • **Coastal pipeline from the lower Thukela River** • Other supply route/s from the Thukela River to Richards Bay WSS
Mfolozi River inter-basin transfer schemes	• **On-channel dam transfer scheme: Kwesibomvu Dam** • **Off-channel dam transfer scheme**
Mhlathuze River dams	• **Raising of Goedertrouw Dam** • Dam on the lower Mhlatuze River / Dam replacing current weir • Dam on the Mfule River • **Dam on the Nseleni River**
Other surface water supply schemes	• Transfers from the Mlalazi or Matigulu rivers
Groundwater schemes	• **Groundwater scheme**
Use of treated effluent	• Consolidation of supply from WTWs and WWTWs • **Effluent treated to non-potable standards for industrial reuse, urban irrigation or indirect urban reuse** • Effluent treated to non-potable standards for non-potable domestic use • Effluent treated to potable standards for direct use • Exchange of treated effluent with irrigators • Potential reuse of water from a Jindal mine slurry pipeline
Desalination	• Desalination of brackish water • **Desalination of seawater**
Water supply infrastructure	• Upgrades at WTWs and intakes – Nsezi and eSikhaleni WTWs • Nsezi Mondi/City of Mhlathuze Pump station • Pipeline from Nsezi WTW to eSikhaleni (Forest Hills reservoir) • Water supply to the future Fairbreeze Mine • Water supply to future Zulti-South mine • Water supply to future Port Durnford mine • Future Jindal mine water infrastructure • Middledrift Regional Water Supply Scheme • Ngcebu Regional Water Supply Scheme • Lake Phobane Water Supply Scheme

2.2 Screening of the Long List of interventions

Potential interventions in the Long List of interventions were interrogated by the Study Team to ascertain which of these could be seriously considered for further evaluation, and the reasons were documented. The Long List was then circulated for contributions and reviews by key stakeholders, and discussed with stakeholders at the 4th Study Stakeholder Meeting held on 13 August 2014. The outcome of this screening process was the identification of the interventions that should be evaluated further (termed the “Short List” of interventions).

2.3 Description of the Reuse Interventions in the Long List

Use of treated effluent, alternatively called water reuse is the use of reclaimed wastewater. As conventional water sources diminish, more attention needs to be given to this possibility. The interventions considered are described below.

2.3.1 Consolidation of supply from WTWs and WWTWs

The possibility of centralising and rationalising the effluent treatment infrastructure in the WSS for potential reuse has been considered in the past. This pertains to improved operation and is unlikely to make more water available.

2.3.2 Effluent treated to non-potable standards for industrial reuse, urban irrigation or indirect urban reuse: Arboretum Effluent Treatment Scheme

This involves the indirect reuse of wastewater effluent by pumping treated effluent for storage in dams and subsequent reuse. Alternatively, treated wastewater can be used directly by suitable bulk industry.

Reuse of treated effluent would require treatment to a tertiary level. This option could potentially pose a health risk to users, arising from incorrect operation or poor maintenance. Actual risks should therefore be carefully assessed. Potential water users/takers would need to be identified. Non-domestic use could include industrial use, as well as the local irrigation of parks, sports fields and public gardens. Irrigation of the Mzingazi golf course is an option. Foskor could e.g. potentially use the treated effluent in their processes in lieu of clarified water.

Reuse is not considered viable for commercial irrigated agriculture, as apart from the cost of treatment the treated water would have to be pumped back up the valley, which would be too expensive.

The total volume of discharge through the sea-outfall system is estimated to be 11.5 million m^3/a. A possible scheme could pump effluent from a new WWTW to be located at the Arboretum Macerator to the Mzingazi WTW for blending or to Lake Mzingazi for indirect reuse. Instead of pumping directly into Lake Mzingazi, artificial recharge into the dune on the seaward side of the lake could be considered, to create a barrier to prevent sea water intrusion, such as at the Cape Flats artificial recharge scheme. The quality of water reaching the lake would then be further polished by groundwater filtration.

2.3.3 Effluent treated to non-potable standards for non-potable domestic use

Non-potable domestic use would entail expensive dual distribution system with the risk of misuse and accidental connection. To reduce the risk, effluent might be used only for toilet flushing, thereby eliminating garden taps and other access points. The risks would possibly be too high to consider further.

2.3.4 Effluent treated to potable standards for direct use

This involves the direct use of secondary effluent treated for potable use. There are very few places in the world where this is practised. This requires very stringent control; risks are high and are not recommended.

2.3.5 Exchange of treated effluent with irrigators

Irrigators are located quite far away from WWTWs with potential for reuse and recycled water would need to be pumped to irrigation farmers willing to trade. This would likely be costly, but costs could potentially be offset. Irrigation with wastewater is however regarded as risky.

2.3.6 Potential reuse of water from a Jindal mine slurry pipeline

This option could only be considered if Jindal decides to go ahead with a slurry pipeline, for pumping pellet slurry should their processing plant be located in Richards Bay. This is currently their alternate approach and should only be revisited should Jindal decide to locate their processing plant in Richards Bay and to make use of a slurry pipeline.

2.3.7 Actions

The following actions were recommended for the *Use of Treated Effluent* interventions:

- Evaluate the *Effluent treated to non-potable standards for industrial reuse, urban irrigation or indirect urban reuse* further.

3 INTERVENTIONS EVALUATION PROCESS

3.1 Screening of potential interventions

Potential interventions in the Long List of interventions were interrogated by the Study Team to ascertain which of these could be seriously considered for further evaluation, and the reasons were documented. The Long List was then circulated for contributions and reviews by key stakeholders, and discussed with stakeholders at the 4th Study Stakeholder Meeting held on 13 August 2014. The outcome of this screening process was the identification of the interventions that should be evaluated further (Short List of interventions).

3.2 Selected potential Interventions (Short List)

The following potential augmentation options have been selected for further evaluation. The findings following evaluation of these interventions are presented later in this document:

- Bulk industrial WC/WDM
- Urban WC/WDM
- Rainwater harvesting
- Limiting supply from over-abstracted coastal lakes
- Increased capacity of the Thukela-Mhlathuze Transfer Scheme
- Coastal pipeline from the lower Thukela River
- On-channel transfer scheme/s from the Mfolozi River: Kwesibomvu Dam
- Off-channel transfer scheme/s from the Mfolozi River
- Raising Goedertrouw Dam
- Dam on the Nseleni River
- Groundwater schemes
- **Arboretum Effluent Reuse Scheme**
- Desalination of seawater

3.3 Evaluation of selected interventions

3.3.1 Technical evaluation

Pertinent information on technical, financial, ecological and social aspects were assembled or generated and where necessary, improved at desktop level. In so doing, available information from many disparate sources and levels of confidence were brought to a more common level of understanding, in a fairly standard format.

It is noted that the current considerations are based mainly on 1:50 000 mapping. Levels between 20 metre contour lines have been interpolated on the mapping. In some cases digital terrain models (DTMs) were generated to obtain more detailed levels. Pipeline long sections, dam wall sections and dam volumes were determined using these levels.

Bulk pipelines and pump stations were sized to cater for modelled or assumed scheme yields to be conveyed. Dam sizes were based on the available topography and an appropriate variation in dam sizes. In-house developed spreadsheets were used for desktop level design and costing. Run-of-river abstraction rates were determined as a function of the flow regime in the relevant rivers, approximate scheme sizing and size of an off-channel dam, where appropriate. Reservoirs were provided for between rising main and gravity pipelines to provide some operation flexibility, as well as at the delivery points of some interventions where adequate storage was not available.

Water treatment has been considered, but treatment costs have not included in the technical evaluation. For reuse where further treatment is not required to attain potable water quality, an allowance has been made to reduce costs appropriately so that reuse can be compared with the other interventions on an equal cost footing.

3.3.2 Ecological and social considerations

Potential ecological and social impacts on the proposed site and pipeline routes were considered, as well as the removal of sludge. Positive impacts have been noted as well.

3.3.3 Implementation programmes

Implementation programmes for interventions were compiled, to ascertain practical dates at which first water from such schemes can be delivered or savings can be made. This will be useful for the Water Balance Scenario Planning. The Arboretum Effluent Reuse Scheme is expected to have a conventional implementation time of 9 years, although this could be fast-tracked.

3.3.4 Yields

Some yields of interventions were based on scheme size, such as the reuse scheme. Diversion curves were developed to determine diversion volumes of off-channel schemes. Indicative yields for surface water schemes were determined using the updated Water Resource Yield Model. Historical firm yields (HFYs) were determined, which are mostly conservative yields as it the scheme yield where all the water demand can be met for the duration of the scheme.

3.3.5 Costing

Where possible, capital costs were based on costs available from previous studies or costs of similar sized infrastructure. Costs were escalated to be representative of the base year costs if such costs were not too dated. In some cases, costs have been estimated from basic principles, as some options have not been evaluated before.

An evaluation period of 37 years was selected for all water augmentation schemes, for determination of unit reference values (URV). Social discount rates of 6%, 8% and 10% were used in unit reference value (URV) calculations.

Multiplication factors were added to allow for additional costs as follows:

- *Preliminary and General* costs of 25% was first added to the capital costs.
- A 15% *Contingency* sum was then added to the previous sub-total.
- A 15% Professional *fees*/site supervision sum was further added to the previous sub-total, to get the total construction cost estimate.

Equipment replacement periods for e.g. pumps (mechanical and electrical) and desalination membranes were considered.

3.4 Interventions Workshop

This stakeholder workshop held on 4 February 2015 in Richards Bay addressed the evaluated potential interventions to achieve a water balance over the evaluation period. Interventions which are appropriate for the Richards Bay Reconciliation Strategy were presented to a group of key stakeholders, in order to consider the interventions in terms of its technical features, potential impacts, strategic value, yield, cost and implementation programme. Specific objectives were to:

- Shortly revisit the screening process undertaken, in terms of the Long List of possible interventions, to select the interventions that were evaluated,
- Present further evaluated interventions in more detail.
- Obtain comment and suggestions regarding the tabled interventions or further potential variants of the interventions,
- Obtain input on the interventions to be evaluated in the Strategy Scenario Planning to follow.

4 KEY REUSE DOCUMENTATION

In the evaluation of this intervention as an option for the Richards Bay water supply area the following documents formed the key reference documents:

- "*To Conduct a Feasibility Study for the Reuse of Effluent (waste water) in the City of uMhlathuze*" draft report, dated December 2014. This evaluation was undertaken by the CSIR for the City of uMhlathuze to determine the feasibility of using waste water from its two macerator stations Alton and Arboretum. The investigation *inter-alia* proposed beneficial use opportunities and methods of disposal of sludge and waste water. This intervention option is based to a very large extent on the recommendations made in this report.
- Letter from the City of uMhlathuze, dated 5 June 2014 to potential water users requesting their requirements for the uptake of treated waste water. The feedback from potential users to the municipality has not yet been obtained.

5 REUSE SCHEME LAYOUT

The preliminary recommended location (Figure 5-1) is where the emergency pond is currently located at the Arboretum macerator. A distinct advantage is that the proposed area is within the boundary of the pump station and is therefore on property that is owned by the municipality.

Figure 5-1 | Proposed treatment works location and pipeline route

6 SCHEME DESCRIPTION

6.1 Existing Richards Bay wastewater infrastructure

All industrial and domestic effluent from Richards Bay is pumped via Alkantstrand pump station (owned and operated by Mhlathuze Water) out to sea, thus there is no municipal WWTW in Richards Bay. Some elementary screening takes place beforehand at the Alton and Arboretum macerators (owned and operated by the municipality), but there is no further treatment beyond screening.

Sewage and waste water emanating from urban and industrial areas of Richards Bay are disposed of via the marine outfall-pumping scheme after screening at the Arboretum and the Alton Macerator Pump stations, and dilution of effluent with seawater. There are three sea-outfall pipelines from Alkantstrand, which extend more than 4km out to sea. The outfall discharge is approximately 140 Ml/d or 51 million m^3/a, which includes seawater that is added prior to discharge of effluent to the marine environment.
The Arboretum Macerator pump station receives predominantly domestic sewage from surrounding areas including the central business district of Richards Bay and the Alton Macerator pump station receives a combination of domestic and industrial waste water.

The preliminary treatment at both pump stations consists of a series of course and fine hand-raked screens to remove large objects such as rags, bottles, etc. Following the screens are the horizontal flow grit chambers which are alternated for the removal of sand, gravel and other inorganic material that may have passed through the screening process. The screenings and grit are disposed of by an external service provider (Wasteman). In previous years the two pump stations were each equipped with macerator/choppers before the screened sewage/waste water was pumped into the marine outfall sewer, but these macerators were subsequently removed. The screened waste water from the Alton Macerator Pump station combines with the screened sewage from the Arboretum Macerator Pump station before it is discharged into the marine outfall sewer.

6.2 Scheme description

The flow rate through the Arboretum pump stations is on average almost 12 Mℓ/d and the Alton pump station handles approximately 8 Mℓ of wastewater per day. The CSIR adopted a flow of 20Mℓ/d as the combined current flow through the two pump stations. The City of uMhlathuze Water Services Development Plan estimated that the combined flow at the two pump stations would increase by approximately 2 Mℓ/d by 2020 and 6 Mℓ/d by 2030.

The two pump stations are only designed for the pre-treatment (i.e. screening and grit removal) of the wastewater/sewage before it is discharged to the sea. Therefore in essence the effluent discharged is raw sewage or screened sewage/wastewater that require further treatment if it is to be considered for reuse.

Various options for reuse have been considered and the recommended option is to construct a regional wastewater treatment works at the Arboretum pump station that can accommodate both the existing and future load of the Arboretum and Alton pump stations. The flows from the Alton pump station already combine at the Arboretum pump station.

An activated sludge plant with a design capacity of about 30 Mℓ/d is proposed for the regional WWTW as this takes into account the existing and future loads projected for after 2030. The City of uMhlathuze could build this in a phased process as 2 modules, each treating 15 Mℓ/d.

A proper geotechnical investigation and topographical survey is required to determine the suitability of the Arboretum macerator site for such a facility, as well as an environmental impact assessment (EIA) and licencing process.

6.3 Indirect effluent reuse

Treated effluent could be discharged to Lake Mzingazi for indirect potable and industrial reuse. The inlet would need to be located sufficiently far away from the Mzingazi WTW intake works. A pipeline of about 600 mm diameter of 2,5 km (CSIR estimation) would be required to convey the treated effluent to the lake. It is proposed to follow the same route as the potable water lines that supply the area.

6.4 Uptake by industrial users

The treated effluent could alternatively be utilised by bulk industry immediately surrounding the Arboretum macerator. Some potential industries to investigate re-use are listed below.

- RBIDZ
- Kynoch Fertilizer (Fermentech)
- Hillside Aluminium
- Foskor
- Shincel wood chips
- Transnet port Authority

It will be necessary to determine what level of treatment these stakeholders require, however it is recommended that the municipality endeavours to meet (or exceed) requirements for disposal to surface water bodies. Industrial users located further away such as Mondi could also potentially also be considered.

The route of the conveyance pipeline of about 600 mm diameter would depend on the specific industrial users that will take up the treated effluent. It is assumed that the water would be conveyed to the edge of the industrial properties.

6.5 Biological nutrient removal process

The recommended components for the biological nutrient removal process include the following:

- A balancing tank that has sufficient storage to accommodate a peak flow of 2 to 3 times the Annual Average Daily Flow (AADF). The balancing tank can be included ahead of the reactor and its main function is to even out the organic and hydraulic load variations on the plant.
- Two primary settling tanks.
- Two bioreactors, each able to treat 15 Mℓ/d.
- Two secondary settling tanks.
- A chlorine contact chamber for disinfection.
- A sludge handling facility that comprises of digesters to stabilise the raw sludge from the primary settling tanks.
- Drying beds to dewater the digested sludge.

Brine could potentially be discharged into the ocean via the outfall pipelines. No changes have been allowed for in the current infrastructure to pump the wastewater to Alkantstrand.

Further investigation or engineering design is required to determine the sizes of various structures listed above and whether these structures would physically fit on the proposed site.

6.6 Process configuration

Various process configurations have been developed for the removal of nutrients, such as carbon, phosphorus and nitrogen. The reactor is divided into different zones that are either aerobic (free oxygen present), anaerobic (no forms of oxygen present) and anoxic (containing no free oxygen, only nitrates). The various systems in common use in South Africa are the Phoredox, Bardenpho, UCT and Johannesburg process configurations. The selection of these is dependent on the TKN/COD (Total Kjedahl Nitrogen/Chemical Oxygen Demand) ratio of the wastewater being treated.

7 EFFLUENT REUSE YIELD

The design capacity is 30 Mℓ/d to be developed in 2 modules, each treating 15 Mℓ/d.

8 UNIT REFERENCE VALUE

Capital and operational and maintenance costs have been determined for the required infrastructure components to treat the effluent and to pump the effluent to either industrial users or to Lake Mzingazi.

The costs are based on an assumed treated volume of 30 Ml/day. The following factors were assumed in the calculations. Escalation has been excluded and all costs are present day values (2014).

Infrastructure Lifetime:

- Pumps, motors and electric installation: 15 years
- Structures, buildings and pipelines: 30 years

Power Costs:

- Eskom Tariff: an averaged energy tariff of R0.87 per kWh was used, that makes allowance for future planned ESKOM tariff increases in the cost analyses.

Operation and Maintenance Costs:

- Mechanical and electrical costs: 4 % per annum
- Civil Works and pipelines: 0.5 % per annum
- Membrane life for the MBR system: 7 years

The URVs (Figure 8-1) includes the WWTW, pump station, pipeline and operating capital and operating costs. Provision for infrastructure to dispose of the brine has been excluded as it has been assumed that brine could be pumped to the Alkantstrand pump station for disposal to sea utilising existing infrastructure.

Figure 8-1 Intervention URVs

ITEM	Discount Rate 6%	Discount Rate 8%	Discount Rate 10%
Total capital cost (R million)	569	569	569
Annual operating cost (R million/annum)	34.9	34.9	34.9
NPV Cost (R million)	1264.5	1059.1	928.9
Unit Reference Value (R/m^3) *No adjustment for treatment saving*	8.41	8.96	9.69
Unit Reference Value (R/m^3) *Adjusted for treatment saving*	6.41	6.96	7.69

The unit cost is relatively high, which is explained by the fact that a full WWTW needs to be constructed as part of the reuse infrastructure.

For the surface and groundwater options, water treatment costs have been excluded in the URV calculations. This resulted in a reduced URV of between 20% and 30% for those options. An equivalent saving is therefore applicable to the reuse URVs as no further water treatment process is applicable. The total URV of the reuse process (which is assumed to supply water to approximately potable standard) was therefore reduced by R2/m^3 to bring the treated effluent to a raw water basis.

9 ECOLOGICAL AND SOCIO-ECONOMIC IMPACT

The proposed site is located on disturbed land that is owned by the municipality. Furthermore, the proposed pipeline/s would be routed adjacent to existing pipeline, road and rail reserves in areas that are already disturbed. This would reduce the extent of new areas of disturbance.

The reuse of sewage effluent has a positive ecological impact as it delays the development of other sources that may impact on the environment.

The removal of sludge will impact on landfill areas. The continued use of the sea outfall pipelines to dispose of some brine will limit new impacts associated with the scheme.

The assumption is made that the discharge into the catchment would be a permissible water use in terms of the Water Act and in addition, that this practice would be socially acceptable for the affected and interested parties. Especially indirect potable reuse has the potential to trigger opposition from the public.

Additional water provided by this scheme would contribute to the development of Richards Bay. In addition, this water resource is not dependent on rainfall, providing the Municipality with a strategic advantage.

Visual impacts associated with the development would be minimal since the plant would be located opposite an existing industrial area. Furthermore, the plant would not release odours or gases that could be a nuisance or have any other negative social impacts on the public

10 FINDING

Possible positive impacts of this system include:

- Utilisation of a potential water source previously “lost” by being discharged into the sea at Alkantstrand;
- Reduced demand on natural resources by industrial users;
- Augmentation of the Municipality’s potable water resources through a source capable of producing a constant reliable output, influenced to a limited extent by drought cycles, as water demand is expected to slightly decrease when water restrictions are implemented.

Possible negative impacts include:

- High concentrations of reject water/brine disposal into the sea;
- Impacts related to the construction of the scheme;
- Institutional implications regarding the operation and maintenance of the WWTW/ reclamation plant;
- A large component of the project requires the importation of specialist equipment. The cost of equipment is thus dependent on the Rand exchange rate.

11 REFERENCES

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