APPENDIX G

Summary of Treated Effluent Options Investigated as Part of Other Studies

USE OF TREATED EFFLUENT

Domestic and industrial wastewaters are discharged into sewer networks, which generally convey the wastewater to a wastewater treatment works, where biological treatment of various forms takes place. The treated wastewater is then either discharged into an adjacent watercourse or the sea, often with some negative environmental impact.

The use of treated effluent therefore entails the interception of the treated effluent immediately after discharge from the works, recycling it and using the reclaimed water for other uses, as an alternative to potable water. Possible uses for treated effluent include:

- Urban irrigation of sports fields and public open spaces;
- Use in certain industrial processes;
- Agricultural irrigation;
- Dual reticulation systems for garden watering and toilet flushing;
- Aquifer recharge; and
- Potable use.

The various re-use options presented above would have differing quality requirements to ensure that the treated effluent is fit for purpose with the most economical re-use options generally being those that require the least amount of subsequent treatment. The practicality and costs of using treated effluent from a single water treatment works for a number of re-use options, therefore requires careful consideration.

A total of in excess of 500 Ml/day (182.5 Mm^3/a) of wastewater is treated at the various wastewater treatment works in the Cape Town Metropolitan area, of which approximately 10 % is currently being re-used, primarily for summer irrigation purposes.

Treated effluent therefore represents a significant potential water source, whose development has to a large extent been inhibited by people's aversion to the notion of coming into contact with treated effluent. It must however be noted that there are potential health risks associated with the use of treated effluent, the majority of which can be avoided through good engineering practice.

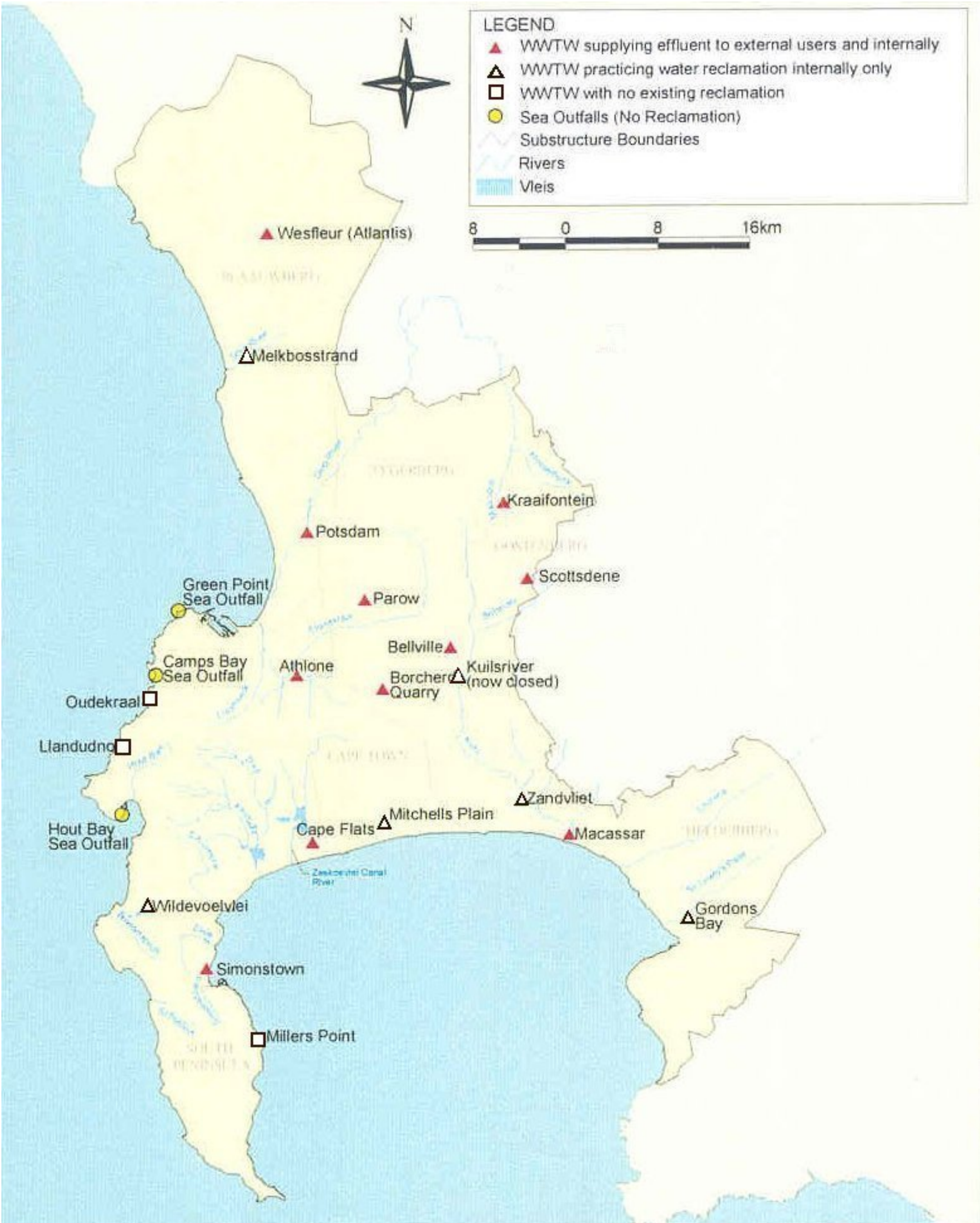
Previous studies undertaken have indicated that local irrigation, agriculture and industrial use could potentially utilise about 40 % of the effluent treated during summer, with the irrigation and agricultural usages falling away during winter. It can therefore be seen that the use of treated effluent to potable standards is required in order to maximise the exploitation of this source.

The following criteria would impact on the re-use potential of effluent from a particular works:

- Size of supply
- Extent of local demand
- Nature of influent
- Quality of treated wastewater
- Impact on downstream environments
- Intended use of treated effluent

Various re-use options are presented in this document as individual supply augmentation options. However, the collective use of a number of treated effluent re-use options, which may be appropriate to a particular area or wastewater treatment works, may be more appropriate. Therefore, the various options need to be considered as part of an overall strategy for the use of treated effluent.

The locations of the WWTW within the CCT are shown in the Figure below.



Use of Treated Wastewater Local Irrigation and Industrial Use

1. "SCHEME"/OPTION LAYOUT

Potential exists for re-use in proximity to all WWTW and surrounds.

2. "SCHEME"/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from the CCT *Investigation into the distribution of treated effluent;* series of reports on the various wastewater treatment works (WWTW) within the CMA, dated November 2003 and August 2004 respectively.

This option entails the use of treated wastewater, primary for the irrigation of sportsfields and public open space, but also for agricultural and industrial purposes, via a separate treated wastewater distribution networks, emanating from existing WWTW's within the CCT.

Although the investigation undertaken by the CCT resulted in the proposal of a number of specific schemes, one for each of the thirteen (13) WWTW's investigated; the information has been collated and considered as a collective option for comparison purposes with other augmentation schemes. It must however be noted that some of the individual schemes proposed are more cost effective than others and that some schemes may become less cost effective as they extend further from the WWTW. Each of the complete schemes proposed have been factored into this option.

Finally, it can be noted that, apart form further filtration, no further treatment of the wastewater is considered for this option. Greater potential for the use of treated wastewater for industrial processes may exist, provided that further treatment of the wastewater is considered. This may however not be practical to implement and has therefore not been considered for this option.

3. "SCHEME"/OPTION YIELD

Based on the investigations undertaken, the potential yield for this option was estimated at 34.0 Mm^3/a, which takes into account the seasonal nature of irrigation use.

It can be noted that this study only investigated 13 of the 20 WWTW within the CMA and although it excluded most of the minor WWTW, it did exclude the Borcherds Quarry WWTW, where other investigations have identified a fairly significant potential for the use of treated wastewater for industrial process purposes.

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) (1)
Capital cost (R million)	206.0
Annual operating cost (R million)	2.8[3]
NPV Cost (R million)	195.1
Unit Reference Value (R/m^3)	**0.55**

1) Capital and O&M costs are escalated at 7% pa to 2005
2) URV calculated at an 8% pa discount rate
3) This figure is an annual average of maintenance, overhaul costs and electrical costs over a specific time period.
4) The URV does not include the possible difference in the tariffs between the potable water and the treated effluent.

5. ENVIRONMENTAL

Limited environmental impact is anticipated. A possible impact is the build-up of the salinity levels in the soils with time (or toxins if industrial wastewaters are used). However, as irrigation will only take place during the summer moths, it is anticipated that much of the salinity build-up will be leached out during the winter months.

6. SOCIO-ECONOMIC

This option will provide limited temporary work opportunities but does pose some potential health risks, linked to possible exposure to treated effluent.

7. STRATEGIC

Specific strengths and weaknesses of the option include:

- *Strengths*
  - There is already a demand for treated wastewater, especially in terms of the irrigation of sportsfields and for agriculture. This demand is however largely driven by tariffs and/or the scarcity of water.
  - This option provides a fairly significant yield potential.

- *Weaknesses*
  - Potential health risks e.g. if un-sterilised effluent is used to irrigate sportsfields where contact sports are played.
  - The potential for cross-connection of treated wastewater distributed networks with the potable water network.
  - The potential for the build-up of toxins in the soils, especially if industrial effluent enters the wastewater treatment streams.
  - The current absence of a formal tariff structure and policy for the supply of treated effluent. Unless specific by-laws are passed, this option will largely be demand driven and the tariff structure will determine the attractiveness of this option. Furthermore, there is at present no a policy for the basis for providing a treated wastewater supply e.g. specific return periods or PPP type arrangements.
  - Increased institutional implications in terms of the operation and maintenance of the WWTW (quality of effluent produced), the management of the dual networks and the monitoring of the above. (The demand has decreased in some areas due to ongoing blockages of sprinkler systems and odours).

Use of Treated Wastewater Dual Reticulation Network

1. “SCHEME”/OPTION LAYOUT

Applicable throughout the study area, particularly where new developments are taking place, offering the opportunity for implementation during construction of new infrastructure.

2. “SCHEME”/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from CMC’s Strategic Evaluation of Bulk Wastewater of June 1999: Report of 25 of 37 – *Water Reclamation; A Strategic Guideline.*

As gardening accounts for approximately 35% of domestic water consumption and toilet flushing a further 29%, the use of lower grade water for these purposes, would result in a significant reduction in potable water use.

This option therefore entails the use of treated effluent, conveyed to domestic users via a separate reticulation network, specifically for gardening and toilet flushing use. This option therefore needs to be considered in conjunction with several of the Water Demand Management Options (i.e. ‘use of grey water’, ‘private boreholes’, ‘rainwater tanks’ and ‘user education’) and the “local irrigation and industrial” treated effluent use option presented earlier, as the demand management options target the same uses, whilst this option may need to utilise the same reticulation network as the treated effluent option.

3. “SCHEME”/OPTION YIELD

Previous studies have indicated a potential yield of 28.0 Mm^3/a (based on 91 050 erven being reticulated).

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) (1)
Capital cost (R million)	375.4
Annual operating cost (R million)	4.9[3]
NPV Cost (R million)	325.8
Unit Reference Value (R/m^3)	**1.25**

1) The capital and O&M costs have been escalated from 1997 at 7 % pa.
2) URV is calculated at an 8 % pa discount rate.
3) This figure is an annual average of maintenance, electrical and overhaul costs over a specific time period.
4) The URV does not take into account the impact of a possible difference in tariff between treated effluent and potable water.

5. ENVIRONMENTAL

The use of treated effluent will have a positive impact on the environment, as a result of reduced river abstraction and reduced effluent discharge into the environment. However, there is a potential negative impact, as a result of medium to long-term build of pollutants in the soil and possibly the groundwater.

6. SOCIO-ECONOMIC

This option would have a slight positive impact in terms of employment. There are however possible negative health implications linked to the possible exposure to treated effluent (e.g. potable and treated effluent networks being interconnected).

7. STRATEGIC

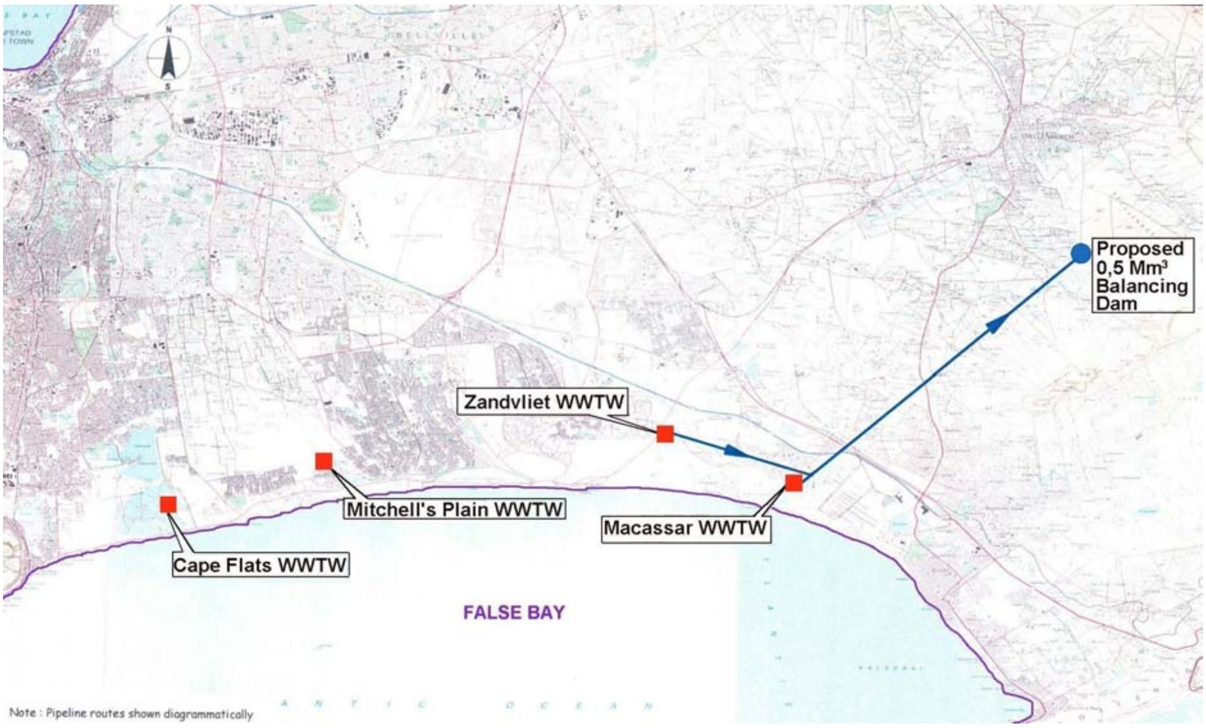
Specific strengths and weaknesses of the option include:

- *Strengths*
  - Readily implementable for new housing developments, but not for retrofitting existing developments.
  - Could possibly utilise the ‘local irrigation’ network, if only for toilet flushing (if the quality is appropriate).
  - Could consider closed loops for toilet flushing.

- *Weaknesses*
  - No quality standards in place as yet within South Africa for gardening and toilet use.
  - Potential health hazard.
  - System will only be used during the summer months for gardening purposes.
  - This option will have an institutional implication on municipal staff, both at the wastewater treatment works and on the network supervision staff.

Use of Treated Wastewater Commercial Irrigation - Exchange with irrigation schemes' fresh water allocation

1. "SCHEME"/OPTION LAYOUT



2. "SCHEME"/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from the CCT Integrated Water Resource Planning Study of 2001: Report 8 of 12 – *Potential for the use of treated wastewater within the CMA.*

This option entails the exchange of treated domestic wastewater effluent for commercial irrigation with freshwater (untreated) currently being supplied to farmers, in order that the freshwater be available for treatment and subsequent domestic usage.

The Helderberg and Stellenbosch irrigation schemes, which currently receive some 20 Mm^3/a of water from the Riversonderend – Berg River Government Water Scheme, have been identified for the possible large-scale use of treated wastewater.

In order to achieve the above, treated domestic wastewater will need to be pumped from the Zandvliet and Macassar Wastewater Treatment Works (WWTW) via a 45 km long pipeline and against a 350 m head, to a small balancing dam (0.5 Mm^3 capacity) near the exit of the Stellenbosch Tunnel. From the balancing dam, existing infrastructure will be used for the distribution and irrigation of the wastewater.

Due to the nature of the irrigation demands and the limited area available for storage at the Stellenboschberg Tunnel exit, the scheme proposed is based on the summer usage of treated wastewater only.

It must be noted that this option entails no additional treatment of the wastewater to that currently being provided at the respective WWTW's. These WWTW treat predominantly domestic effluent.

3. "SCHEME"/OPTION YIELD

During previous investigation, it was considered that farmers would only be willing to exchange 25% of their allocation, implying a probable yield of 5.0 Mm^3/a.

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) [(1)]
Capital cost (R million)	134.0
Annual operating cost (R million)	2.4[3]
NPV Cost (R million)	114.0
Unit Reference Value (R/m^3)	**2.77**

1) Capital and O&M costs escalated at 7% pa to 2005
2) URV calculated at an 8% pa discount rate
3) This figure is an annual average of maintenance and overhaul costs over a specific time period.
4) The URV does not take into account the impact of any possible differences in the tariffs between the freshwater and the treated wastewater.

5. ENVIRONMENTAL

Limited environmental impact is anticipated. A possible impact is the build-up of the salinity levels in the soils with time. However, as irrigation will only take place during the summer months, it is anticipated that much of the salinity build-up will be leached out during the winter months.

6. SOCIO-ECONOMIC

This option will provide limited temporary work opportunities but does pose some potential health risks, where crops irrigated with wastewater are eaten raw or where workers are in direct contact with the wastewater (e.g. where overhead sprays are used).

7. STRATEGIC

Specific strengths and weaknesses of the option include:

- *Strengths*
    - Potentially a relatively large treated wastewater consumer.

- *Weaknesses*
    - There is a general public aversion to the idea of being exposed to wastewater.
    - The ability to reach agreements with the farmers may be problematic.
    - Possible negative international perceptions which could reduce the marketability of the produce.
    - The salinity of the treated wastewater and the possible impacts on the soils and the crops.
    - Increased institutional implications due to the need for effective monitoring.
    - Guidelines from the Department of Health which advise against the use of treated wastewater for crops which are eaten raw.
    - Relatively long implementation period.