SECTION H

DESALINATION

H1. Desalination

1. SCHEME LAYOUT

The information presented is taken from the *City of Cape Town's CMA Bulk Water Supply Study* of April 2002. Two specific sites were investigated, at reconnaissance level, both of which are located on the West Coast. One site is at Melkbos and the other at Koeberg Nuclear Power Station. The two potential sites are shown in the figure below.

2. SCHEME DESCRIPTION

The two potential sites, although located in reasonably close proximity to one another, differ in their energy requirements. The Melkbos Site would utilise cold water whereas the Koeberg Site would utilise heated water. There is a benefit in utilising heated water (lower viscosity than cold water) in that it reduces the energy costs associated with the reverse osmosis process. Furthermore, water of constant temperature ensures a more efficient desalination plant than one in which the water temperature varies.

The CCT is awaiting the results of a study into the optimum site for a 0,5 Mℓ/d pilot plant. This plant will be utilised for up to 10 years and will serve as the first initiative towards further development of desalination as an option to augment the Western Cape Water Supply System.

Factors influencing site location include :

- locating the intake works at a favourable position on the coast and prefiltration requirements
- available inlet structure
- available energy supply
- potential to use heated water from Koeberg Nuclear Plant
- the availability of existing water conveyance infrastructure
- the location of water demand centres in relation to the desalination site
- the extent of post treatment to balance pH and increase alkalinity
- the return of brine to the sea.

The Blaauwberg area is one of the most rapidly expanding urban areas in the Western Cape and could benefit from the pilot desalination scheme, whilst reducing the current over-allocation on Voëlvlei Dam. The disposal of the resulting brine would be direct to the sea.

3. SCHEME YIELD

For the purposes of this assessment, a treated water output of 60 Mℓ/d (21,9 million m^3/a) was considered for both the Koeberg and Melkbos sites.

4. UNIT REFERENCE VALUE

The URVs for the two options were based on the 2002 cost estimates from the CCT's study. The URV calculation is based on a discount rate of 8%.

ITEM	Koeberg Site	Melkbos Site
Total capital cost (R million)	850	1 130
Annual operating cost (R million)	130	140
NPV Cost (R million)	1 855	2 188
Unit Reference Value (R/m^3)	9,8	11,6

Comment on URV calculations:

1) The URV excludes escalation. The costs of desalination processes have reduced in recent years.
2) The URV includes the following :
   - o the capital costs for the intake, pumping mains, desalination process and storage reservoirs.
   - o the operating costs, including conveyance.

3) For the surface and groundwater options, water treatment costs have been excluded in the URV calculation. This resulted in a reduced URV of between 20% and 30% for those options. An equivalent saving is therefore applicable to the desalination URVs as no water treatment process is applicable. This results in the Koeberg URV reducing to about R7/m^3 and the Melkbos URV to about R9/m^3.
4) These desalination URVs are likely to further reduce primarily as a result of the strengthening Rand in recent years.

Desalination costs quoted by equipment suppliers often exclude the civil and mechanical capital costs associated with :

- intake infrastructure
- conveyance and pumping infrastructure, and operating costs
- reservoir storage costs

However, technologies are improving and becoming less expensive. Consequently, desalination is likely to be a favourable option as the surface water resource becomes ever more limited.

5. ECOLOGICAL

The desalination process produces highly saline residual brine which is disposed of to sea. Most of the treatment processes use anti-fouling chemicals to some extent and these can have an impact on the marine environment.

As the Koeberg site does not require any inlet works to be constructed, and is located in a disturbed area, the direct ecological impacts are minimal. The Melkbos site has more significant marine and terrestrial footprint impacts. Both options use considerable amounts of electricity and this has secondary environmental impacts associated with coal or nuclear power stations.

6. SOCIO-ECONOMIC

There would be potential visual impacts associated with any intake structure and pump station at the Melkbos site. This can be mitigated to some extent by making use of a pump station below natural ground level.

7. OTHER ISSUES

The strengths and weaknesses of the desalination scheme are :

- **Strengths**
  - Unlimited source of raw water.
  - Process costs can be reduced through integration with a nuclear power plant.
  - Direct environmental impacts can be minimal.
  - Plants can be easily upgraded to increased capacities.
  - Desalination processes are becoming less expensive.

- **Weaknesses**
  - Very few existing desalination plants of equivalent size, therefore no available information on actual annual operating costs.

- Relatively more expensive option than surface water.
- Energy requirements result in secondary environmental impacts.
- Possible public opposition associated with the perception of nuclear related health risks at Koeberg
- URV estimates require updating to take into account the reduction in process costs in recent years.