SYDNEY COASTAL COUNCILS GROUP INC.

COUNCILS CARING FOR THE COASTAL ENVIRONMENT

Desalination Fact Sheet

This fact sheet has been produced to provide general information on the process of desalination and address the environmental issues associated with the NSW Government proposal to construct a desalination plant in Sydney.

As moved at the Sydney Coastal Councils Ordinary meeting on the 18th of June. The Sydney Coastal Councils Group (SCCG) has collated and provided information to member councils to address issues and concerns including:

- The potential locations of desalination plant(s);
- The substantial energy requirements required to operate such facilities;
- The issues of sustainable disposal and potential reuse of brine effluent;
- Consultation with Local Government and the community on this issue; and
- The needs to address and investigate alternative water supplies such as stormwater harvesting.

This fact sheet addresses issues including:

- What is desalination?
- How is desalination by reverse osmosis achieved?
- Desalination in the Sydney coastal region.
- Distribution of water from a desalination plant in Sydney.
- The Impacts of construction and operation of a desalination plant.
- Alternatives to desalination.

What is desalination?

Desalination is the process of removing dissolved minerals (including but not limited to salt) from seawater, brackish water, or treated wastewater. A number of technologies have been developed for desalination, including reverse osmosis, distillation, electrodialysis, and vacuum freezing.

The NSW Government has stated that if a desalination plant were to be built in NSW. The technology employed to achieve desalination of sea water would be reverse osmosis (*Planning for Desalination 2005*)

How is desalination by reverse osmosis achieved?

Reverse Osmosis is a process of desalination in which seawater diffuses through a membrane under high pressure, removing salts and impurities to ensure the water is suitable for drinking. It is used on most ocean-going vessels (including cruise ships and navy vessels) and by industries that require very pure water.

In reverse osmosis, seawater is pumped at high pressure through permeable membranes, separating salts from the water (Figure 1). The seawater is pre-treated to remove particles, such as sand, shells or seaweed, which would clog the membranes. The quality of the water produced depends on the pressure, the concentration of salts in the seawater, and the size of the membranes.

Water quality can be improved by adding a second pass of membranes, whereby product water from the first pass is fed to the second pass. This strategy will be employed in Sydney if a desalination plant is constructed.

Reverse osmosis is the desalination process that has been has chosen for other desalination plants in Australian such as the Swan Brewery in Perth because it is considered the most economical and environmentally friendly form of desalination (Making water- hold the salt 2005).

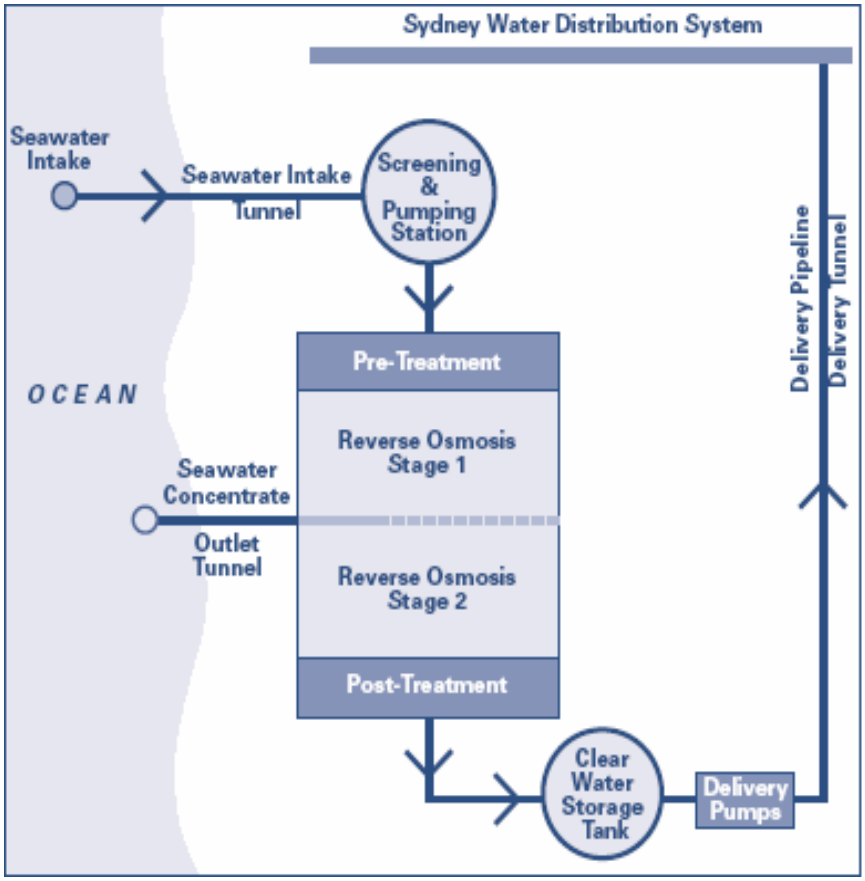

Figure1. The process of desalination through reverse osmosis (*Planning for Desalination 2005*)

Desalination in the Sydney Coastal Region

The NSW Government announced on the July 12 2005 that if a desalination plant were to be built in Sydney the location would be Kurnell. Two other sites, at Malabar and Port Kembla, were considered but Kurnell was favoured due to factors including:

- close proximity to the ocean and good quality seawater;
- close proximity to a power source;
- adequate land is available;
- the land is already zoned for industrial purposes; and
- The site is away from homes and schools.

Distribution of water from a desalination plant in Sydney

A new series of pipes or tunnels would be built to carry the water from the desalination plant to the water distribution network. The water will be pumped into a local reservoir or, back to Sydney's main distribution network at Waterloo.

From Waterloo the water would be delivered via the existing pipes to a broad cross-section of suburbs south of Sydney Harbour. Figure 2 outlines the distribution of water from a desalination plant at Kurnell (*Planning for Desalination 2005*).

Figure 2. Distribution of desalinated water from Kurnell (*Planning for Desalination 2005*)

Impacts

Construction phase

To assess the full impact construction of a desalination plant would have at Kurnell a comprehensive Environmental Impact Statement (EIS) is needed. Under recent planning reforms to the *Environmental Planning and Assessment Act 1979* the Minister for Planning and Infrastructure can decide that an EIS for the plant does not have to be released for public comment. Further, as the project has been designated as "critical infrastructure" approval for a desalination plant can be given without any opportunity for Local Government or the community to legally challenge the decision on environmental grounds.

It is assumed that a desalination plant at the proposed site would have a significant environmental impact on delicate local ecosystems containing heritage listed sand dunes, sensitive wetlands and protected marine and intertidal areas.

Operation phase

There are a number of environmental concerns associated with the operation of a desalination plant. These include:

High energy use and resulting green house gas production.

The energy used in the desalination process is primarily electricity and heat. Energy requirements for desalination plants depend on the:

- The volume of water produced;
- Salinity and temperature of the feedwater;
- The quality of the water produced; and
- The desalination technology used.

Large amonts of greenhouse gasses are produced by deslaination plants due to the high enegry requirements. A desalination plant using reverse osmosis technologhy would require less energy than other desalination technologies such as distilation.

Sydney Water have projected that a desalination plant that produces up to 500 Mega litres (ML) of water per day through reverse osmosis would require 906 Giga Watt hours (GWh) per year and would produce between 950,000 tonnes (using the existing energy grid) and 480,000 tonnes (a gas power station adjoining the desalination plant) of greenhouse gasses per year depending on the source of energy.

The NSW Government has stated that operators of a desalination plant may be able to "offset" the potential greenhouse impacts of high energy use through startegies such as purchasing NSW Greenhouse Abatement Certificates or Renewable Energy Credits or carbon sequestration.

Irrespective of the energy source, a desalination plant in Sydney would result in a significant increase in the use of non-renewable energies and the subsequest realease of greenhouse gassess such as carbon dioxide.

Impacts to marine ecology

Physical Destruction to the marine environment

Overseas research has suggested that the greatest single ecological problem associated with desalination plants that use seawater is that organisms living with in the vicinity of the desalination plant are sucked into its equipment.

Recent analyses have noted that the impacts to marine life associated with intake designs were greater than first considered, hard to qualify and may represent the most significant direct adverse environmental impact of seawater desalination. This issue would need to be fully addressed in a comprehenive EIS.

Waste

Environmental impacts associated with concentrated discharge have historically been considered the major environmental concern with desalination plants. By some estimates, a desalination plant at Kurnell could produce 1.5 billion litres of brine a day to be released back to the ocean.

Further, desalination plants produce liquid wastes that may contain all or some of the following constituents:

- high salt concentrations, chemicals used during defouling of plant equipment and pre-treatment, and
- Toxic metals (which are most likely to be present if the discharge water was in contact with metallic materials used in construction of the plant facilities).

Liquid wastes may be:

- discharged directly into the ocean;
- combined with other discharges (e.g., power plant cooling water or sewage treatment plant effluent) before ocean discharge;
- discharged into a sewer for treatment in a sewage treatment plant, or
- dried out.

The environmental impacts of liquid waste treatment will vary depending on factors including the location of a desalination plant and method of waste disposal. Potential environmental impacts resulting from the increased turbidity, reduced oxygen levels and increased density of any discharged waste water would need to be fully addressed in an EIS.

Desalination plants also produce a small amount of solid waste (e.g., spent pre-treatment filters and solid particles that are filtered out in the pre-treatment process) that would have to be disposed of in land fill.

Alternatives to desalination

Construction of a desalination plant in Sydney is estimated to cost $2 billion.

Desalination is not a substitute for good water saving practices, nor would it effectively 'drought proof' Sydney. Restrictions, in combination with other water conservation and water supply options, are key aspects of effective management of drought in Australia.

Sydney's water supply is drawn from dams on the Hawkesbury-Nepean and Shoalhaven River Systems. The problem of Warragamba dams positioning in a low

rainfall catchment is compounded by the fact that rainwater runs off nearly 1 million rooftops and enters Sydney's water ways via the stormwater system in the high rainfall coastal areas of Sydney (PENGOs 2004).

Options such as those outlined below must be improved and expanded before an option such as desalination is considered.

Improved recycling and re-use
In 2004 the 4th Sydney Water Project Report identified prepared by the PENGOs (PENGOs 2004) that less than 2% of the total amount of water used in Sydney is recycled. Recycling and reuse options, including but mot limited to grey water recycling. As well as opportunities for the capture and reuse of stormwater on a broader scale don't require more water and are considered cost effective and environmentally friendly compared to desalination.

Demand management strategies
In development of the Sydney Metropolitan Water Plan, the NSW Government allocated $780 million for large infrastructure works and $30 million for demand management (Meeting the Challenges- Securing Sydney's Water Future 2004).

Through appropriate demand management strategies (for example education) and regulation (for example water restrictions) Sydney's water use has been 10% lower than the 10-year average use since the introduction mandatory water restrictions were accompanied by an awareness raising campaign.

Local Government and residents in Sydney are aware of the problem and have demonstrated an ability to respond to education and government regulation. Further financial support to demand management strategies such as regulation, pricing and incentives would improve water saving in Sydney with significantly less financial cost and environmental impact than desalination.

References
Planning for Desalination (GHD Fichter and Sydney Water, 2005)
Meeting the Challenges- Securing Sydney's Water Future (NSW Government, 2004)
Sydney Water, Going to Waste (Peak Environment NGOs, 2004)
Making water - hold the salt (ECOS Magazine APR–MAY 2005)

For further Reading

General
Urbanwater.info
www.urbanwater.info

Sydney Water
http://www.sydneywater.com.au
Email**:** desalination@sydneywater.com.au

Desalination
Desalination a quick Guide
(Australian Water Association)
http://www.awa.asn.au/Content/NavigationMenu/Information/FactsSheets/Desalination.pdf

Planning for Desalination
(GHD Fichter and Sydney Water, 2005)
http://www.sydneywater.com.au/EnsuringTheFuture/Desalination/

Sydney Metropolitan Water Plan
Meeting the challenges - Securing Sydney's water future
(NSW, Department of Infrastructure Planning and Natural Resources)
http://www.dipnr.nsw.gov.au/waterplan/pdf/waterplanbroadband.pdf

Water Sensitive Urban Design
Water Sensitive Urban Design in the Sydney Region
http://www.wsud.org/

Comparison of construction costs for water sensitive urban design and conventional stormwater design
http://www.wsud.org/downloads/Info%20Exchange%20&%20Lit/Danny%20B%20WSUD%20vs%20Traditional%20Paper.pdf

Urban Stormwater
Urban Stormwater Connections to Natural Systems
(Commonwealth, Department of Environment Heritage)
http://www.deh.gov.au/coasts/publications/stormwater/urban.html

NSW Stormwater Trust
(NSW Department of Environment Conservation)
http://www.epa.nsw.gov.au/stormwater/usp/index.htm

Treatment Techniques for Managing Urban Stormwater
(NSW Department of Environment Conservation)
http://www.dec.nsw.gov.au/resources/treattech.pdf

Urban Stormwater Device Guide and BASIX Assessment
(iPlan – NSW Department of Infrastructure Planning and Natural Resources)
http://www.iplan.nsw.gov.au/basix/pdf/method_stormwater_full.pdf

Water Conservation and Reuse
WaterSmart Guidelines
(Master Plumbers Association of Australia)
http://www.plumber.com.au/consumer/watersmart.asp

BASIX guide to selecting and installing water-efficient fittings and fixtures
(NSW Department of Infrastructure Planning and Natural Resources
http://www.basix.nsw.gov.au/information/tips.jsp

Wastewater reuse
(Water Sensitive Urban Design in the Sydney Region)
http://www.wsud.org/downloads/Planning%20Guide%20&%20PN%27s/09-Wastewater.pdf

Australian literature on greywater from WSUD.org
http://www.wsud.org/literature.htm#fifth

Review of National & State Plumbing Codes to facilitate Domestic Water Reuse
(Commonwealth Scientific and Industrial Research Organisation (CSIRO)
http://www.clw.csiro.au/priorities/urban/awcrrp/stage1files/awcrrp_7_final_23apr2004.pdf