Guidelines for Desalination Projects

Scope: The guidelines are intended to provide a basis by which to address the environmental issues associated with the desalination of seawater, brackish groundwater, brackish surface waters, and recycling municipal wastewater.

Definition: Desalination is the process used to reduce the dissolved salts and other chemicals in a water source to meet the water quality standards for non-potable and potable uses.

1. Desalination should not be used for water supply needs that can be met by water conservation, water recycling, and other water use efficiency practices.

2. The Sierra Club believes that state and federal agencies should encourage water use efficiency projects in preference to all types of water supply projects, including desalination.

3. Oppose state and federal policies that would give desalination projects the same priority as water use efficiency for assistance and funding.

4. Desalinated water quality shall meet all applicable local, state, and federal water quality standards for potable and non-potable use

5. Evaluate desalination projects using an ecosystems approach by integrating these applicable sections of the following Sierra Club conservation policies:

Water Resources
- Marine Conservation
- Water
- Wetlands
- Commodification

Energy Conservation and Renewables
Environmental Justice
Oceans
Pollution and Waste Management
Precautionary Principle
Urban and Land Use Policies

6. The desalination process produces potentially hazardous by-products that include a concentrate of the source water and chemical additives used to facilitate the process. These by-products must be tested for toxicity and handled in a manner to safeguard the environment.

7. Seawater desalination for potable water supply

(a) Seawater is defined here as water with salinity greater than 20,000 milligrams per liter (mg/L). Typical seawater salinity is 35,000 mg/L.

(b) The environmental impacts of seawater desalination projects to be proposed and in operation in U.S. coastal waters must be carefully reviewed. These waters are public trust resources. Our coastal fisheries are in decline, and wetlands are continually being destroyed. The marine ecosystems in these waters have been degraded by human activities. The task is to determine if seawater desalination plants, individually and cumulatively, can be located, constructed, and operated to assure that they will not add further environmental stresses that would jeopardize efforts to restore these valuable natural resources to be healthy and sustainable.

(c) Seawater is the habitat for marine life including larvae, fish egg, planktons, fishes, and marine mammals. Seawater desalination plants can if not properly designed cause significant and irreparable losses of marine life. Seawater desalination plants withdraw seawater by one of two means: from surface water with the intake above the sea bottom and from subsurface water with the intake below the seabed surface to use the substrate as a filter.

(d) Surface seawater intakes have screens to prevent the larger marine life from entering and fouling the desalination plant. For example fishes that are trapped (impinged) on the screen are killed. Marine life smaller than the screen size are entrained inside the desalination plant are also killed. Desalination plants using surface water should be opposed because the technology to effectively reduce the killing of marine life by impingement and entrainment to environmentally acceptable levels is economically prohibitive.

(e) Subsurface intakes may be located offshore (e.g., beach wells) or short distance inland. Subsurface intakes avoid or limit the direct impacts to the marine life. Documentation for proposed subsurface intakes documentation must provide factual evidence that there are no adverse impacts such as potential loss of beach recreational area, seawater intrusion into nearby freshwater aquifers, and harm to benthic communities that may take residence over subsurface intakes located offshore.

(f) The seawater quality should be periodically monitored to assure that it meets acceptable limits and to prevent intake of highly contaminated seawater caused by fuel spills or other sources that could damage the plant and contaminate the potable water output

(g) The by-products of the seawater desalination process shall be tested for toxicity and disposed in an environmentally sound manner to comply with all applicable state and federal laws.

(h) Siting desalination in enclosed bays[1] and estuaries should be opposed as these water bodies are valuable natural resources and sensitive even to the very act of withdrawing their waters for desalination. Enclosed bays by definition have limited tidal circulation with the ocean waters. This limits

[1] *Enclosed bays means indentations along the coast which enclose an area of oceanic water within distinct headland or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay.* California State Water Resources Control Board Water Code

the available volume of water to dilute the desalination brine by-product. The circulation of the water flow in the bay caused by the withdrawal of desalination plant can be significant enough to alter the bay hydrology. These bays and estuaries serve as nurseries for fish and important shellfish habitats. This means that the population density of juvenile fish and larvae in these waters will be higher than that in the open coastal waters. It is very questionable that the intake structures can reduce impingement and entrainment to acceptable levels of this critical population that would promote a biologically diverse and sustainable marine ecosystem. Furthermore, enclosed bays and estuaries where desalination plants are being proposed are by nature in urbanized areas where it very likely that these water bodies are under stress from urban activities and that added stresses from desalination plants would defeat efforts to restore these water bodies.

(i) Seawater desalination plants should not be co-located with existing coastal power plants that use seawater for once-through-cooling of their steam condensers in order to provide the discharged cooling water as their seawater source. One reason is that the return of the capital investment of the desalination plant perpetuates the operation of these existing and generally obsolete power plants. The costs to retrofit the cooling water intake structures to comply with the Clean Water Act provisions on impingement and entrainment would be prohibitively expensive.

(j) Dry cooling technology has advanced to be an acceptable alternative to once-through-cooling thereby eliminating the need to locate power plants adjacent to coastal water, inland bays and estuaries. Eliminating power plants using once-through-cooling also eliminates one of the causes for the decline of the coastal fisheries.

(k) Cumulative impacts of seawater desalination plants that withdraw seawater from a contiguous body of seawater must be assessed. Potential adverse cumulative effects on the marine ecology include species decline, reduction in biodiversity, and intrusion on public recreational resources.

(l) Seawater desalination is energy intensive. Both the direct and indirect environmental consequences to supply the energy needs should be evaluated. Assure that the desalination plant is energy efficient.

(m) Seawater desalination plants must not induce growth.

8. Brackish groundwater desalination for potable and non-potable use

(a) Brackish groundwater desalination projects by their nature are dispersed over wide and varied geological and geohydrological areas. These characteristics pose unique environmental issues to be addressed. Legal issues such as ownership of these groundwater aquifers should be noted but are beyond the scope of these guidelines.

(b) Brackish groundwater is defined as water with salinity between 1,000 to 10,000 mg/L. This range is that defined by the Texas Water Development Board as being practicable for desalination and is within the range a sufficient number of brackish groundwater aquifers. The cost of

desalination increases with the salinity so 10,000 mg/L was selected as the upper limit.

(c) A non-potable use generally means that the salinity can be higher than drinking water standards but adequate for the intended end use and comply with the applicable non-potable water quality standards.

(d) The following are a list of key environmental issues that should be addressed in evaluating a brackish groundwater desalination project:

- Water quality of the groundwater. Salinity alone is not sufficient. The chemical constituents and their concentrations and toxicity in the groundwater source should be analyzed. (Geochemical studies)
- Geohydrological studies that provide the vital statistics of the aquifer such as the volume, sustainable yields if any, potential infiltration of seawater, potential for subsidence of the overlying lands
- Non-sustainable aquifers should not be used for desalination
- The desalination by-products must be tested for toxicity and disposed in an environmentally acceptable manner that does not degrade air quality or water resources and protects human and wildlife health.

9. Brackish surface water desalination for limited applications

Desalination plants should not use very valuable and ecologically sensitive brackish surface water resources such as marshes, wetlands, and estuaries. The following are potential candidates for brackish surface water desalination. In each case the brine by-products should be tested for toxicity and disposed in an environmentally acceptable manner.

- Projects to reduce the salinity of irrigation tail-water for reuse
- Desalination projects that are primarily designed to provide environmental benefits such as restoring degraded natural water bodies may be acceptable if enforceable legal mechanisms exist to assure achievement of the environmental benefits.

10. Recycling municipal wastewater

(a) This section supplements Guideline 1 on the use water recycling.

(b) The technologies for the desalination of seawater and brackish water are applicable for recycling municipal wastewater for non-potable and indirect potable reuse.

(c) Definition: Indirect potable reuse refers to the practice required by health and safety requirements to store highly treated wastewater for a period of time in a groundwater basin or in a surface water reservoir where is then blended with the raw water source and retreated in the municipal water treatment facility for drinking water.

(d) Sierra Club should promote indirect potable reuse of municipal wastewater.

Approved by the Environmental Quality Strategy Team & the Conservation Governance Committee