Excerpts from the Summary of *Desalination: A National Perspective* (National Research Council, 2008)

Water for the Future: the Role for Desalination

"When considering future water supplies, it is important to recognize that past patterns of water use will not always be a reliable indicator of future demand. In particular, the assumption that water demands will inevitably parallel population and economic growth no longer appears to be correct. Nevertheless, water scarcity in some regions of the United States will certainly intensify over the coming decades, and no one option or set of options is likely to be sufficient to manage this intensifying scarcity. Desalination, using both brackish and seawater sources, is likely to have a niche in the future water management portfolio of the United States.

The committee was specifically asked to address the potential for seawater and brackish water desalination to help meet anticipated water supply needs in the United States. The committee concluded that the potential for desalination cannot be definitively determined because it depends on a host of complicated and locally variable economic, social, environmental, and political factors…. and these factors are far more important than technological desalination process constraints in limiting the potential for desalination to help meet anticipated water supply needs.

Current Investment in Desalination Research and Development

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- There is no integrated and strategic direction to the federal desalination research and development efforts.
- Some states, especially California, have also made sizeable recent investments in desalination research and development.
- The private sector appears to fund the majority of desalination research, with total annual spending estimated to be more than twice that of all other surveyed sources of such funding.

State of Desalination Technology

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Reverse osmosis (RO) technology is relatively mature, and current energy use is within a factor of 2 of the theoretical thermodynamic minimum value for separating solutes from water….Meanwhile, opportunities exist to further reduce cost and energy use of current technologies by small but economically significant amounts.

- In RO desalination, the costs and energy requirements of water production can be further reduced by mitigating fouling through pretreatment; developing high-

permeability, fouling-resistant, high-rejection, oxidation-resistant membranes; and optimizing membrane module and membrane system design.
- Seawater desalination using thermal processes can be cost effective when waste heat is utilized effectively.
- Few, if any, cost-effective, environmentally sustainable concentrate management options exist for inland desalination facilities.

Environmental Impacts

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There is a considerable amount of uncertainty about the environmental impacts of desalination, and, consequently, concern over its potential effects. Therefore, the following research is recommended:

- Site-specific assessments of the impact of source water withdrawals and concentrate management should be conducted and the results synthesized in a national assessment of potential impacts.
- Monitoring and assessment protocols should be developed for evaluating the potential ecological impacts of surface water concentrate discharge.
- Longer-term, laboratory-based assays on the sublethal effects of concentrate discharge should be conducted to understand the range of environmental impacts from desalination plants.
- Water quality guidance, based on an analysis of the human health effects of boron in drinking water and considering other sources of exposure, is needed to support decisions for desalination process design.
- Further research and applications of technology should be carried out on how to mitigate environmental impacts of desalination and reduce potential risks relative to other water supply alternatives.

Costs and Benefits of Desalination

Historically, the relatively high financial costs of water production via desalination have constrained the use of desalination technologies in all but a few very specific circumstances…the financial cost picture has changed in a number of important ways. There have been significant reductions in membrane costs and improvements in the energy efficiency of the desalination process. Perhaps mores significant, the cost of other alternatives for augmenting water supplies have continued to rise, making desalination production costs more attractive in a relative sense. The trend in cost reduction may be abetted through a program of strategically directed research aimed at achieving potentially large cost reductions. Nevertheless, the costs of concentrate management are potentially large and vary from site to site.

- Substantial reductions in the financial cost of producing desalinated water will require substantial reductions in either energy costs or capital costs.
- For brackish water desalination, the costs of concentrate management can vary enormously from project to project and may rival energy and capital costs as the largest single component of cost.
- Conservation and transfers from low-to high-value uses will usually be less costly than supply augmentation schemes, including desalination.
- There are small but significant efficiencies that can be made in membrane technologies that will reduce the energy needed to desalinate water, and, therefore, offer potentially important process cost reductions.
- To make the true costs of desalination transparent, the economic costs should be accounted for and reported accurately.