KEY POINT: The location of desal intakes below the seabed (i.e. subsurface) can eliminate environmental impacts related to impingement and entrainment (I&E).

SUMMARY OF ISSUES

- Subsurface intakes take their feedwater from below the floor of the ocean using naturally occurring sand and geologic formations to provide filtration. They pose minimal environmental concern because impacts associated with I&E are eliminated.

- **Impact on adjacent fresh water aquifers or wetlands.** If located within the vicinity of existing coastal aquifers or wetlands, the operation of large subsurface intakes may result in a substantial drawdown of the groundwater table and could ultimately drain or impair wetlands and cause significant environmental damage.

- **Benthic impact.** Digging trenches for subsurface intakes and the placement of intake pipelines can adversely impact the habitat of benthic organisms. The excavation and installation of collecting wells, pipes, tunnels or seabed filters may result in substantial impact on the area’s marine flora and fauna and on the surrounding environment, including the beach.

- **Visual and aesthetic impact.** Beach well intake structures for large seawater desal plants can have a visual and aesthetic impact on the shore line on which they are located. Typically, beach wells are often constructed as large-diameter caissons and are tall aboveground concrete structures. Pumps and service equipment are located above the wet-well of the caisson. Because beach wells are usually located close to the ocean, the well intake pumps have to be installed at an elevation that assures the protection of the pumps and associated auxiliary equipment from coastal flooding. Therefore, the height of the structures of large intake wells with above-grade pump houses may exceed ten feet above beach ground level.

- **Potentially higher energy requirements.** One of the potential disadvantages of beach wells is that deep wells may result in lower water temperature and thus, higher viscosity. Higher pressure (and increased energy) will therefore be required to pump the water through the RO membranes.
STRATEGIES

The first step to minimize adverse environmental impacts is to choose a location with relatively low ecological significance. It is proposed to use environmental assessments for site selection to avoid high-risk ecologically sensitive areas (including benthic communities, wetlands and coastal aquifers).

The design and construction of intake structures should minimize visual impacts or blend architecture to harmonize with the coastal environment and landscape (CDWR 2003).

BENEFITS & COSTS

Benefits

- The use of subsurface intakes minimizes I&E.
- By taking advantage of the natural filtration provided by sediments, subsurface intakes can produce higher-quality feedwater, thereby reducing pretreatment requirements.
- Subsurface intakes can protect desal process from shock loads of contaminants associated with unusual events such as algal blooms and oil spills.

Costs

- A significant area is required to generate water from beach wells. It is estimated that for a 10 MGD plant, 4.2 acres of beach shore may be needed for horizontal beach wells, infiltration galleries or seabed infiltration galleries, as opposed to 2 acres for open surface intake (Voutchkov 2005).
- Deep wells may result in lower water temperature and thus higher viscosity. Higher pressure (and increased energy) is therefore required to pump the water through the RO membranes.
- The feasibility of subsurface intakes depends largely on surrounding hydrogeology and substrates, and often may not be practical for large desal plants. Subsurface intake systems have been proven economically justifiable for seawater RO desal plants with a capacity of up to 13 mgd (49,000 m³/d) (CDWR 2003). (See related PIM cell discussion on financial and economic issues associated with subsurface intakes).
KEY UNCERTAINTIES

The water quality from a subsurface intake system can be affected by adjacent groundwater aquifers. For example, water abstracted from beach wells for seawater desal in Morro Bay and in Salne Cruz, Mexico, exhibit high concentrations of manganese and/or iron caused by water contributed by adjacent aquifers (Voutchkov 2005). The high-iron concentration problem was resolved by the installation of a pretreatment filter designed for a loading rate of 2.5 gpm/ft².

It is not always evident whether a subsurface intake will perform reliably (e.g., produce sufficient yields without clogging) over the expected life of the desal facility. A thorough assessment should be conducted, especially in warm tropical or semi–tropical waters, to address the issue of potential carbonate scaling of the formation above/around the intake.

ADDITIONAL RESOURCES


