located parallel to and 300 m from the Delaware River and the 5 extraction wells were located 600 m from the river. Only 0.014 m^3/s was pumped from each extraction well and reintroduced into the aquifer through the adjacent injection well. This resulted in a freshwater "mound" that performs as a barrier to saltwater inflow. Following the drought, the injection wells are used as extraction wells (0.014 m^3/s) with the water returned to the river, thereby reducing the salinity in the aquifer further.

8.4.5 Okinawa-jima Island

The construction of underground flow barriers through pumping of cement grout near the coastline can create underground impoundments similar to surface reservoirs. In 1978, such an experimental subsurface barrier was constructed in a small buried valley on Miyako-jima Island (Sugio et al., 1987). The barrier was constructed in a very porous limestone aquifer and is 16.5 m high, 5 m wide and 500 m long. Based on field monitoring studies conducted over a four year period, the installation was judged a success; the hydraulic conductivity and porosity were reduced from 0.17 cm/s and 20% to $5x10^{-5}$cm/s and 6%, respectively. Plans are underway to construct a much larger barrier at Komesu on Okinawa-jima Island where the annual rainfall is 2,400 mm and occurs during a nine month period. With the present high permeability, much of this fresh water flows to the sea and saltwater intrusion tends to occur during the remaining three months when heavy pumping is conducted for irrigation purposes.

Based on numerical modeling with a particular barrier design of 5 m thickness, it is concluded that with the barrier no salinity intrusion will occur for a 60 day period during the drought and that if a longer period is desired, the barrier thickness must be increased or the pumping rate (6,000 m^3/day) must be decreased.

8.5 RESEARCH NEEDS

Given the ambient flow conditions in a coastal aquifer, the transmissive and porosity properties of the aquifer and various scenarios of extraction "demand" on the aquifer, it appears that the characteristics of the salinity intrusion, including any time dependencies can be predicted reasonably reliably by state-of-the-art numerical modeling. However, at present the