Seawater Desalination
Written Testimony before the House Committee on Natural Resources

By
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The Harte Research Institute

The Harte Research Institute (HRI) for Gulf of Mexico Studies is part of Texas A&M University-Corpus Christi. HRI was established in 2000 when Mr. Ed Harte donated $46 million to establish a research institute at the university. HRI uses a multi-disciplinary approach to promote an ecologically and economically healthy Gulf of Mexico. The *Harte Model* is an integration of science, economic and policy expertise with the unique ability to process complex issues about the health and sustainability of the incredible resource that is the Gulf of Mexico. The institute is built around the synergy created by the focus of diverse expertise: coastal and marine geospatial sciences; ecosystems and modeling; biodiversity and conservation; ocean health; marine policy and law; and, socio-economics. It is the interdisciplinary collaboration between disciplines to address ecosystem scale problems and the understanding that people and the environment are inexorably linked in their solution, which makes HRI unique in the community of marine science institutes.

The institute's vision is a Gulf of Mexico that is ecologically and economically sustainable. Its mission is science driven solutions for Gulf of Mexico problems.
For more information please see - https://www.harteresearchinstitute.org/ .

Desalination – Brief Overview

Desalination of seawater has been the standard way of obtaining freshwater in the Middle East for over 50 years because it is the only water available and abundant energy resources allow it. However, in recent decades desalination has spread to other parts of the world due to increasing human population, degraded water quality in many places, and now extensive drought conditions in some regions. The United States has joined other countries of the world in looking at desalination as a means to obtain more freshwater resources to sustain humans, industry, and possibly even agriculture, as well as to maintain natural environmental flows of freshwater in streams and rivers.

In general, the high cost of energy to drive the desalination process and various detrimental environmental impacts have kept desalination in the background as a means to obtain new freshwater resources. However, with rising water costs, new reverse osmosis technology, and possible ways to mitigate environmental damage, the desalination option has become viable. Small desalination plants operate in many places within the United States and two very large projects are now underway in southern California (Carlsbad) and Tampa, Florida. In Texas there are more than 50 small inland desalination plants converting brackish groundwater to potable uses. The city of El Paso has demonstrated the viability of large-scale desalination in meeting water needs as an inland city. No such example exists for a Texas coastal city. Several Texas coastal cities and water entities have been considering desalination in recent years as a means of supplementing current freshwater resources but none has developed into a functioning project. Corpus Christi and the Coastal Bend are actively pursuing a viable option.

HRI Expertise – Desalination

HRI is an advocate of desalination as an option to providing freshwater, especially where it can relieve pressure on freshwater inflows into bays and estuaries, vital for their health and productivity.

The Harte Research Institute (HRI) has considerable expertise regarding the impacts of high salinity discharges into coastal waters, including brine discharges associated with oil and gas development; solution mining of salt domes for strategic oil reserve storage; and, desalination plants for production of water for various uses, including human consumption. HRI scientists have almost 200 years of combined expertise relevant to these issues. Two examples of the institute's expertise in these areas are:

Identification and Characterization of Potential Environmental Impacts Mitigation Measures Related to Intake and Discharge Facilities of Seawater Desalination Plants – Dr. Greg Stunz, Endowed Chair for Ocean Health and Fisheries at Harte research Institute and Dr. Paul Montagna, Endowed Chair for Ecosystems and Modeling at Harte Research Institute

Regulatory and Permitting Issues Relating to Desalination Seawater Intakes and Concentrate Disposal in Coastal Texas – Dr. Richard McLaughlin, Endowed Chair for Marine Policy and Law at Harte Research Institute

These reports (attached) were prepared for the City of Corpus Christi's Variable Salinity Desalination Demonstration Project. The project was an initiative investigating the feasibility of alternative desalination technology options for the Coastal Bend Region. Freese and Nichols, Inc. (https://www.freese.com/) led the investigation.

Oral Testimony – Dr. McKinney

Dr. McKinney will provide oral testimony regarding the environmental issues associated with coastal desalination. Dr. McKinney has studied brine discharges from both oil and gas production and development of the strategic petroleum reserve. The later involved solution mining of onshore salt domes along the Texas and Louisiana coast and is the largest brine disposal project ever done. The Bryan Mound site (one of three) discharged 55 million gallons of 100ppt brine (three times normal seawater) every day for eight years into water 15 miles off the coast of Freeport Texas..

Summary of Oral Testimony

The primary environmental issue for coastal desalination operations are related to intake of water and discharge of concentrated brine.

Intake issues are similar to those of power plants, etc., these issues are documented in many studies, and mitigations measure well known. Two factors that have the most impact are impingement and entrainment. Impingement of larger fish, marine mammals, and sea turtles can reduce the spawning stock biomass due to an increased mortality rate. In addition, entrainment of smaller ichthyoplankton and eggs can reduce recruitment (Stunz and Montagna, 2015 – attached). The literature are full of ways to address and mitigate these concerns but location of intakes are a key factor and there are locations that cannot be mitigated, so as in real estate – location, location, location.

Discharge issues do have unique issues related to the concentrated brine and potential for concentrating constituents. Heavy metals and Harmful Algal Blooms (HABs) being examples. These concerns are typically mitigated through careful monitoring along with inflow and discharge management. As with intakes, discharge location may determine if mitigation is possible.

When considering the locations for desalination plant discharge facilities, several factors need to be considered but the most critical is intake and discharge. The addition of concentrated brine can have negative environmental impacts on the marine community. As a result, the salinity tolerance of marine organisms need to be considered when determining the locations of a desalination plant discharge locations. Changes in salinity and temperature can have deleterious effects on many marine species, particularly

those in early developmental stages (Stunz and Montagna, 2015 – attached). Minimizing potential discharge impacts requires adequate area, including depth, and water movement, to promote mixing, sufficient to dilute brine to ambient conditions.

Location of water intake and concentrated brine discharge is the single most important way to mitigate environmental concerns. Stunz and Montagna (2015 study attached) evaluated a number of sites in Corpus Christi Bay. Their assessment is instructive in how to evaluate potential desalination intakes and discharges, as well as, engineering means to mitigate possible impacts in relatively shallow waters of the bay.

An area they did not evaluate but that has been of great interest in recent months has been the area adjacent to the Aransas Pass, specifically Harbor Island. It is a particularly sensitive area as it is the primary conduit between the Gulf of Mexico and the most productive reaches of the Corpus Christi Bay, including Redfish Bay and other adjacent waters.

One important issue for the health and productivity of this ecosystem is larval transport. The impact of drawing water (often loaded with these larvae) from the relatively narrow high-energy channels of the Aransas Pass complex, in the volumes noted for desalination, is unknown. That information is critical to any evaluation of a desalination plant adjacent to any of the three waterways connection Aransas Pass with the estuary. The productivity of the Coastal Bend estuaries depend on this larval transport.

Similarly, the impact of discharge is unknown. The potential for creating a high salinity wedge of water blocking movement of fish and other sea life at all stages, from egg to adult, is of primary concern.

At present the information to evaluate such projects is not adequate. It would take considerable study to provide the information to make an informed decision regarding ways to avoid, minimize or mitigate impacts of a desalination plant with intake or discharge into these channel areas. It is possible that such studies would identify the means of meeting operational and environmental objectives.

The Aransas Pass and the three channels depending from it into the Coastal Bend estuarine ecosystem are critical features, perhaps the most critical to maintaining its health and productivity. It is also a dynamic area and one that has, and can, absorb the type of coastal development important to the future of the region. It is resilient but not without limits that we may be rapidly approaching. It is for this reason that any future development must be carefully considered before proceeding.

Regarding the location of desalination facilities, there are two ways to avoid potentially negative impacts affecting these critical transit corridors. One, locate the desalination facility in some other area of the bay. Stunz and Montagna evaluated several. Two, move both intake and discharge sites offshore a sufficient distance to avoid negative impacts.

Concluding Statement

The use of desalination to meet growing water needs of Texas, especially coastal Texas, holds great potential. Environmental benefits can far outweigh potential negatives. Both goals are desirable and both are achievable.

ATTACHMENTS

Identification and Characterization of Potential Environmental Impacts Mitigation Measures Related to Intake and Discharge Facilities of Seawater Desalination Plants – Dr. Greg Stunz, Endowed Chair for Ocean Health and Fisheries at Harte research Institute and Dr. Paul Montagna, Endowed Chair for Ecosystems and Modeling at Harte Research Institute

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