

Permitting Practices for Seawater Concentrate Disposal

Mike Mickley, P.E., PhD

Mickley & Associates LLC

2017 MSSC Annual Salinity Summit
“Less Water, More-Salt...The New Reality

March 2-3, 2017

Las Vegas

Acknowledgements

WaterReuse Research Foundation Project WRRF-13-07

Database of Permitting Practices for Seawater Desalination Concentrate

Final report submitted Fall 2015

Principal Investigators:

Mike Mickley

Nikolay Voutchkov

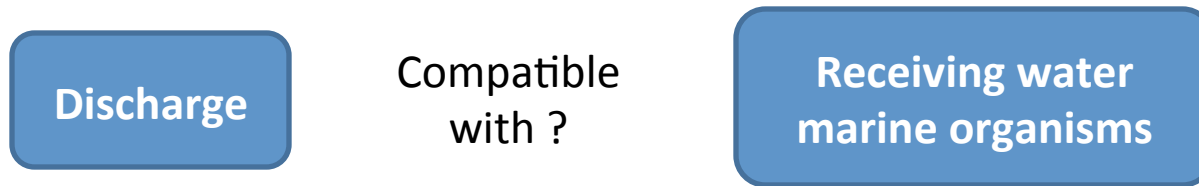
Background – U.S. Municipal Desalination & Regulation

- **< 4% of over 350 U.S. facilities are SWRO**
- **YET much interest (CA, FL, TX)**
- **Drivers include:**
 - **growing coastal populations**
 - **Drought**
 - **Decreasing desalination costs**
 - **High quality product water**
- **At time of development of primary regulations there were few SWRO desalination plants in the U.S.**
 - **very limited precedents for the states**
 - **U.S. regulatory issues and permitting protocols are in various stages of investigation, definition, and clarity**
- **PROJECT OBJECTIVE: “Identify the discharge information that permitting agencies need and the decision-making process they go through to permit discharge**

U.S. Federal Regulatory Framework

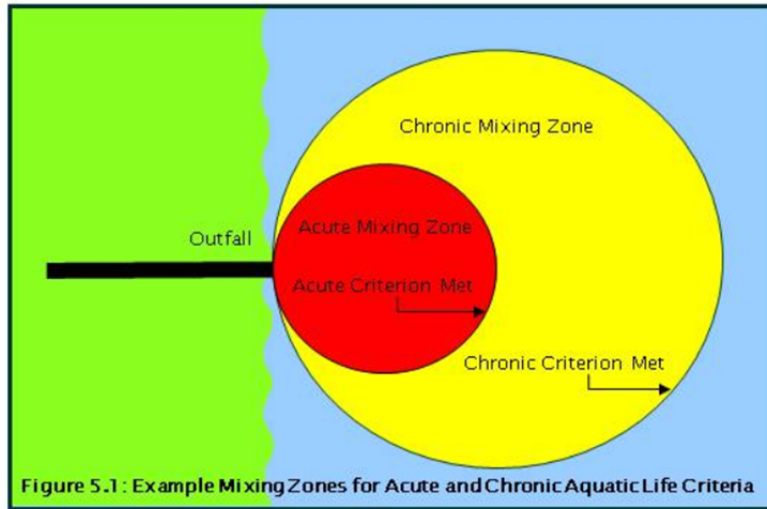
EPA (guidelines) → State regulations [if state is delegated]

- Basic question:

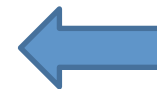


- Receiving **water quality standards** based on its use classification.
- Standards may be defined by:
 - Numeric limits for specific constituents and parameters
 - Narrative standards of specific constituents and parameters
 - Whole effluent toxicity (WET) test requirements
 - Meeting biological diversity parameters
- **Numeric water quality standards are to be met by the concentrate**

Mixing Zone and Diffuser

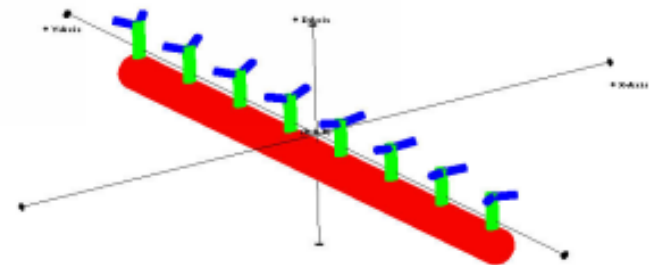


Mixing zones are a dilution allowance



Mixing Zones

Diffuser (example)

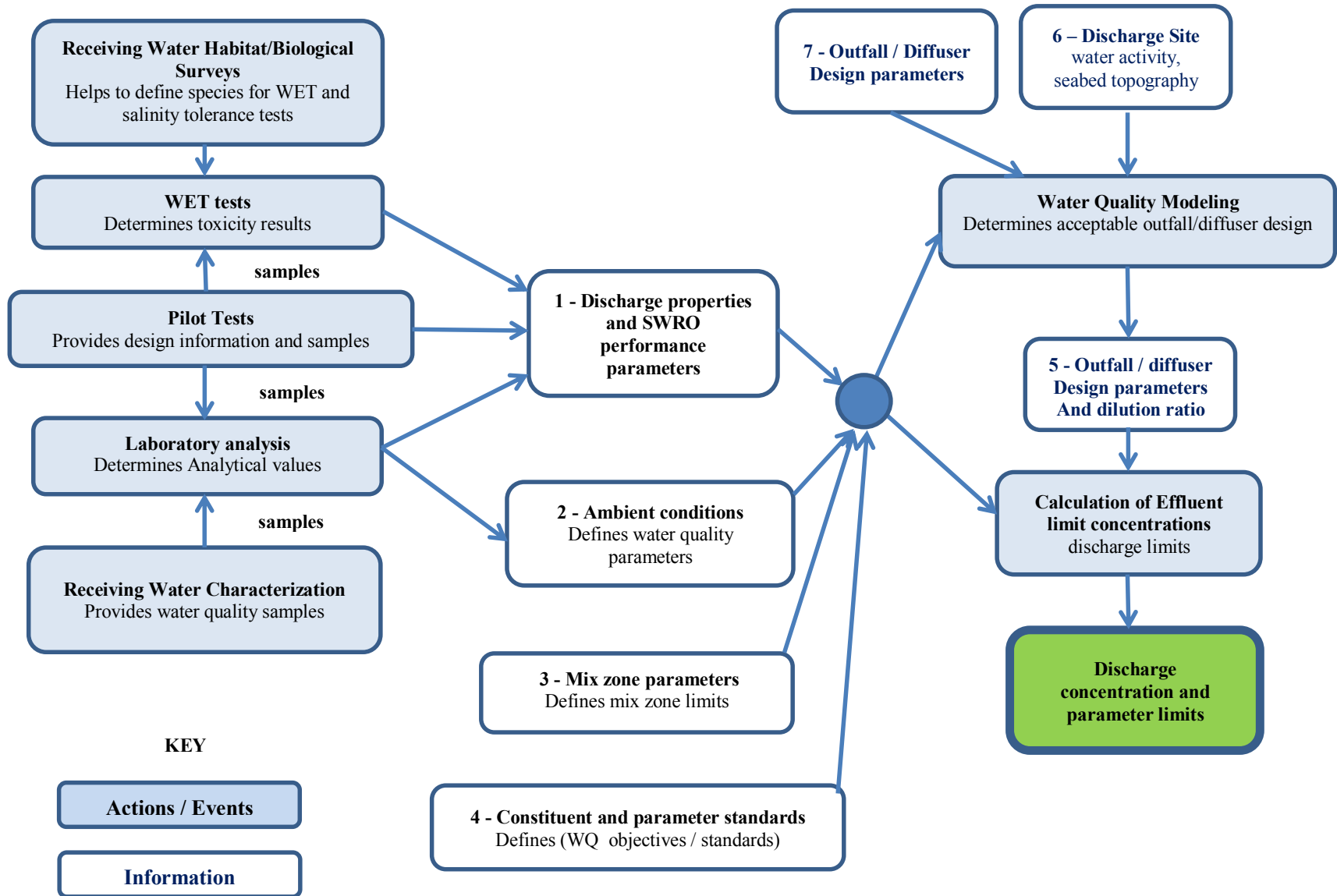


from MIXCON website

Determination of Effluent Limitations

- If water quality standard **CAN** be met by the concentrate:
 - Effluent Limitation (for the concentrate) = Water Quality Standard
- If water quality standard **CANNOT** be met by the concentrate:
 - **mixing zone / dispersion modeling effort is undertaken** to see water quality standards can be met at the edge of an acceptable mixing zone based on a reasonable, cost-effective diffuser discharge system.

Events and Information in Determination of Effluent Limitations



Issues Associated with Determination of Effluent Limits

- **Environmental and Health Issues (reasons for regulation)**
 1. **Maintaining the receiving water quality** within the **salinity tolerance** of aquatic species (determination of salinity tolerance of marine organisms in region of discharge)
 2. **Avoiding concentration of source water constituents to harmful levels**
 3. **Discoloration and lowering of oxygen content** in the area of the discharge.
 4. **Shear and turbulence effects** due to diffuser discharge of concentrate.
- **Issues associated with regulatory guidance and process**
 - **Items associated with events and information in the previous figure...
WET tests, Modeling, Protocols, lab analysis, Guidelines**

Overview of Differences – California, Florida, & Texas Discharge Regulations

- **Minor differences**
 - **Inclusion of mixing zones** automatic (Texas) vs. mixing zones being granted on a case-by-case basis (CA and FL).
 - **Definition of mixing zone parameters**
 - **Automatic inclusion of WET tests** for municipal membrane concentrate (FL) vs. case-by-case inclusion (TX)
 - **Different water quality standards** (all must be as stringent as Federal guidelines)
- **Major differences**
 - **Number of regulatory bodies involved in permitting**
 - California has several who issue permits or give permit approvals
 - Texas and Florida have only a few...
 - **Salinity standards**
 - Site-specific WET test-based salinity limit (all 3 states)
 - Non-site specific salinity limit (2,000 mg/L above ambient) – CA (in addition)

2015 **California** Desalination Amendment to Ocean Plan (non-site-specific salinity standard)

- Result of **multi-year study** involving research and expert panels.
- **Expert witness report** on Impacts and Effects of Brine Discharges (2012) **was not a consensus document** and raised important research issues that should be taken into consideration in developing a policy on regulating the salinity of discharges.
- Yet the updated Ocean plan incorporated the discharge **regulatory option of a non-site-specific salinity standard.**
- **The situation raises several questions**, may lead to more complicated permitting, and bypass important research needs.

Case Studies

- **United States**
 - 50 MGD Carlsbad SWRO Desalination Project
 - 50 MGD Huntington Beach SWRO Desalination Project
 - 25 MGD Tampa Bay SWRO Desalination Plant
- **Australia**
 - 38 MGD Perth I Desalination Plant
 - 35 MGD Gold Coast Desalination Plant
- **Spain**
 - 63 MGD Torrevieja SWRO plant
 - 6 MGD Javea Plant
 - 18 MGD Alicante 1 Plant
 - 18 MGD San Pedro del Pinatar Plant
 - 0.8 MGD Maspalomas II SWRO Plant (Canary Islands)
- **Israel**
 - 85 MGD Ashkelon Desalination Plant
 - 108 MGD Sorek Desalination Plant



Desalination Facilities

Case study Outline



- Facility description
- Receiving water characterization
- Description of discharge stream
- Description of plant outfall
- Key discharge permits and permit requirements – tables of permit requirements
- Support studies
- Permit compliance observations

Key Findings & Recommendations

1 – REGULATORY SYSTEMS & PROCESS

Findings

- **Considerable similarities** exist between the US states
- **The process to define discharge limitations in the U.S. generally applies to all large desalination plants in Australia, Israel, and Europe:**
- Currently - **no legally binding regulatory guidelines for desalination** in California, Florida, and Texas or Australia, Israel, and Spain containing technical requirements and engineering guidance.

Key Findings & Recommendations

1 – REGULATORY SYSTEMS & PROCESS (Continued)

Recommendations

Development of Federal Regulatory Permitting Guidelines

- Creation of a guidance document similar to the USEPA Water Reuse Guidelines

Preparation of Statewide Desalination Guidelines

- Guidelines would address desalination-specific permitting challenges and define state-specific regulatory requirements, data collection procedures and scope, and successful desalination project permitting practices.

Key Findings & Recommendations

2 - TIME FOR PROJECT ENVIRONMENTAL REVIEW AND PERMIT ISSUANCE

Findings

- In General, the **Time to Permit Desalination Projects in the US is Longer than Any Other Country**

Factors that contribute to shorter timeframes in other countries include:

- Streamlined regulatory processes
- Priority review of desalination plants
- Superior expertise of regulatory agencies
- Sharing of regulatory expertise

U.S. situation due to lack of funding

Recommendations

- **Maintain staff with the expertise**
- **Create Frequent Opportunities for State Regulatory Staff** to Exchange Information, Share experiences and Practices

Key Findings & Recommendations

3 - DISCHARGE SALINITY LIMIT

Findings

- Presently, **all groups** studied have salinity standards determined via whole effluent toxicity (WET) tests and **regulate through WET test-based limits**.
- **BUT, in addition, California** has recently (2015) implemented a **non-site-specific general numeric salinity limit** of 2,000 mg/L above ambient salinity at the edge of the mixing zone.
- **This raises questions** including:
 - What is gained by the introduction of the TDS limit?
 - Why WET Testing is Not Adequate?
 - What are the implications of non-site-specific limitations in terms of project permitting time and costs?

Recommendations

- **Eliminate the Need for Non-site Specific Salinity Limit**
- **Use Enhanced WET Tests Instead**

Key Findings & Recommendations

4 - WET TEST SPECIES AND CONDITIONS

Findings

- Typically, **WET test methods vary** by several key issues:
 - adult vs. embryo organisms
 - gradually adapted to salinity vs. un-adapted organisms
 - artificial seawater or concentrate within tests vs. actual seawater
 - site-specific test organisms collected from the area of the plant discharge vs. standard test organisms.
 - Lack of standard protocol for conducting salinity tolerance tests

Key Findings & Recommendations

4 - WET TEST SPECIES AND CONDITIONS (continued)

Recommendations

Modify Existing WET Testing Procedures for Seawater Discharges

- Provide clarity to standard WET testing procedures and simplify the permitting of desalination projects.
 - Desalination project-specific guidelines for the selection and gradual adaptation of marine species to elevated concentrate salinity and the determination of their salinity tolerance.
 - Clear definition of the test species' developmental phase (adult or embryo).

Key Findings & Recommendations

5 - STANDARD METHODS OF ANALYSIS OF WATER AND WASTEWATER

Findings

- **Most laboratory analysis guidelines worldwide are developed for testing freshwater.**
 - Specifically, total suspended solids, copper, nickel, and radionuclides are originally developed for fresh (low-salinity) water

Recommendations

- **Develop suitable guidelines** for testing of high salinity samples where needed.

Contact Information

President

Mickley & Associates LLC

Lafayette, CO

303 499 3133

mike@mickleyassoc.com

Technical Assessment Group

O2 Environmental / BlueTech Research

Cork, Ireland and Vancouver BC

www.o2env.com