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Permits and Regulatory Requirements

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There are two major regulatory and permitting issues that relate to planning and implementing desalination plants. Issue 1 relates to developing the water sources, i.e., brackish water or seawater. Issue 2 relates to discharge and disposal or management of concentrate and other byproducts of the desalination plants. Regulations that specifically apply to desalination are almost non-existent. However, there are several federal regulations pertinent to desalination and a number of federal agencies have jurisdiction over those regulations. A few states have regulations and permitting requirements that relate to desalination. This chapter provides an overview of federal agencies and federal regulations pertinent to desalination followed by an overview of regulations pertinent to desalination in four states. California is the leading state in implementation of desalination technology, which uses mostly seawater and some brackish water as the source water. There are several desalination facilities in Texas and Florida, mostly using brackish water as the source water and planning for large-scale seawater desalination is underway. There are a few small-scale desalination plants in the commonwealth of Virginia using brackish groundwater as the source water. Regulations in these four states described in this chapter represent diverse systems and can be considered representative of desalination regulation in the United States.

Federal Agencies and Regulations Pertinent to Desalination

Federal agencies are responsible for implementing and enforcing the statutes legislated by the U.S. Congress. Federal agencies that have jurisdiction over various rules and regulations or have interest in the implementation of desalination technologies include such groups as the U.S. Environmental Protection Agency (USEPA), the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the U.S. Coast Guard (USCG), the U.S. Bureau of Reclamation (USBR), and the National Marine Fisheries Service (NMFS). The U.S. Minerals Management Service (US MMS) interest is limited to issues related to the Gulf of Mexico's Outer Continental Shelf (OCS) platforms.

Federal Laws and Regulations

Federal laws that are pertinent to desalination include The Clean Water Act, The Safe Drinking Water Act, The Resource Conservation and Recovery Act, The Superfund Amendments and Reauthorization Act, The Endangered Species Act, and The Water Desalination Act. Some brief descriptions of these laws and how they apply to desalination are provided below.

The Clean Water Act. The 1972 amendments to the Federal Water Pollution Control Act (known as the Clean Water Act or CWA) provide the statutory basis for the National Pollution Discharge Elimination System (NPDES) permit program and the basic structure for regulating the discharge of pollutants from point sources to waters of the United States. Sections 402 and 404 of the CWA are particularly applicable to desalination.

Section 402 requires the USEPA to develop and implement the NPDES program. The CWA gives USEPA the authority to set effluent limits on an

industry-wide (technology-based) basis and on a water-quality basis, which ensures the protection of receiving waters. Brine and concentrate disposal from desalination plants are regulated as a point source of pollution through the NPDES Permit Program. The CWA allows the USEPA to delegate the authority to state governments, enabling states to perform many of the permitting, administrative, and enforcement aspects of the NPDES Program. In states that have been authorized to implement CWA programs, USEPA still retains oversight responsibilities.

Section 404 of the CWA authorizes the USACE to issue permits for disposal of dredge or fill materials to U.S. navigable waters. If a desalination plant intends to construct, excavate, or fill navigable waters of the U.S., a permit must be obtained from the USACE to authorize such an action. Navigable waters may include streams, rivers, lakes, wetlands, and coastal waters. In addition, the USACE administers a permitting program under Section 10 of the Rivers and Harbors Act of 1899 to regulate obstructions to navigable waters (U.S. Army Corps of Engineers Regulatory Program). Depending on the scope of the project, several other entities (NMFS, USCG, NMFS and USFWS) may review the USACE permits. For example, the USCG may consult and review the USACE permits for their potential impact on navigation, the NMFS may comment on permits that may affect National Marine Sanctuaries and their resources, and the USFWS may also comment on permits that may impact endangered species.

Furthermore, Sections 316(a) and 316(b) of the CWA authorizes the USEPA to address issues related to discharging heated water into receiving waters. The regulation applies to desalination, particularly if the desalination plant is co-located with a power plant. Section 316(a) of the CWA addresses issues related to discharging heated water into receiving waters. Section 316(b) addresses issues related to entrainment (in which aquatic organisms, eggs, and larvae are drawn into the cooling system, passed through the heat exchanger, and then pumped back out with the discharge) and impingement (the trapping of fish and other aquatic life at the entrance of cooling water intake structure) of marine life. These sections of the CWA require the operator of desalination plants to mitigate any impacts that may occur due to discharge of heated water to receiving waters and to reduce or eliminate the effects of entrainment and impingement on marine life in the receiving waters.

The Safe Drinking Water Act. The Safe Drinking Water Act (SDWA), announced by Congress in 1974, amended in 1986 and 1996, establishes a Federal program to monitor and increase the safety of the nation's drinking water supply (The Safe Drinking Water Act). The SDWA authorizes the USEPA to set and implement health-based standards to protect against both naturally occurring and man-made contaminants in drinking water. The EPA is also responsible for assessing and protecting drinking water sources; protecting wells and collection systems; making sure water is treated by qualified operators; ensuring the integrity of distribution systems; and making information available to the public on the quality of their drinking water. The SDWA applies to desalination plants that treat brackish or seawater for public consumption and to desalination plants that inject or discharge the brine into a source of water that may be used for public consumption.

The Resource Conservation and Recovery Act (RCRA). In 1976, the U.S. Congress enacted the Resource Conservation and Recovery Act (RCRA, Public Law 94-580) (DOE Environmental Policy & Guidance). RCRA established a system for managing non-hazardous and hazardous solid wastes in an environmentally sound manner. RCRA applies to the disposal of the concentrate and brine discharge to receiving waters.

The Superfund Amendments and Reauthorization Act. The Superfund Amendments and Reauthorization Act (SARA) amended the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) on October 17, 1986 (The Superfund Amendments and Reauthorization Act). The SARA applies to discharge from desalination plants if the discharge contains any substances found on the Extremely Hazardous Substances list described in Section 313 of SARA.

The Endangered Species Act. The Endangered Species Act (ESA) of 1973 provides a program for the conservation of threatened and endangered plants

and animals and the habitats in which they are found (U.S. Fish and Wildlife Service 2004). The USFWS maintains the list of endangered species and threatened species. The USFWS can require a desalination plant to prepare a formal biological opinion if the plant operation may impact the endangered species.

The Water Desalination Act. The Water Desalination Act of 1996 (Public Law 104-298) authorizes the Secretary of Interior and the U.S. Bureau of Reclamation to award grants and to enter contracts through the Desalination and Water Purification Research and Development (DWPR) Program for desalination research, development, and demonstration projects (U.S. Bureau of Reclamation 1997).

California Regulations

A desalination task force issued two reports in 2003 (Desalination Task Force 2003). These reports provide details about critical issues related to desalination in California including regulatory and permitting issues. The draft report lists 12 desalination plants along the California coast using seawater (four plants use dual sources of seawater and brackish groundwater) as the source water. Five of these facilities are intended for domestic consumption. An additional 21 facilities have been proposed from which fourteen are intended for domestic consumption. Seventeen of the proposed plants will use seawater (six plants will have a dual source of seawater and brackish groundwater) as the source water.

California State agencies that have permit and approval authority over implementation of desalination include the Coastal Commission, the State Lands Commission (SLC), the Department of Fish and Game (DFG), the Public Utilities Commission (PUC), the Department of Health Services (DHS), and the California Department of Transportation (CalTrans). In addition, the State Water Resources Board (SWRCB) and Regional Water Quality Control Boards may review and approve the permits.

The California Environmental Quality Act (CEQC) of 2003 (amended in 2004) contains provisions for desalination plant permitting (California Environmental Quality Act 2003). The brine discharge from a desalination plant is regulated through the NPDES. The NPDES is enforced by Regional Water Quality Control Boards.

The California Coastal Act (CCA) includes policies that specifically address desalination (California Coastal Act 1976). The State Legislature enacted CAA in 1976 to provide long-term protection of California's 1,100-mile coastline. The CCA as it applies to desalination plants operates under the "Public Trust Doctrine." The Public Trust Doctrine is invoked in portions of the California Constitution (Article 1 Sec. 25) and ensures protection of public lands with approved uses, i.e., navigation, fishing, recreation, and ecosystem preservation. The CCA created a unique partnership between the state (acting through the California Coastal Commission) and the local governments (15 coastal counties and 58 cities) to manage the conservation and development of coastal resources through a comprehensive planning and regulatory program. With regards to seawater, the Doctrine extends to lands underneath the surface of the water and even to the water itself.

The CCA is applied to desalination on the following issues: environmental policies, growth inducement and coastal dependent versus coastal related development, and feasibility of the maintenance of coastal areas. Sections 30230, 30231 and 30224.5 of the CCA are applicable to environmental issues related to desalination. Section 30230 states that where feasible, marine resources will be maintained, enhanced, and restored. Section 30231 states that the biological productivity of coastal waters (among others) will be enhanced, maintained, or restored. Section 30234.5 states that the importance of fishing, in economic, commercial, and recreational capacities is recognized. All of the above sections can claim jurisdiction over desalination plants because of the problems associated with water intake (entrainment and impingement) and brine discharge.

Sections 30213, 30222, 30222.5, 30234, 30250, 30254, 30255 and 30260 of the CCA establish policies aimed at controlling growth and development in coastal areas. Some major issues addressed are as follows: 1) It is stipulated that increasing water supplies in the coastal areas will encourage additional growth; therefore, if a desalination plant is planned as a new water supply system, it must take into consideration coastal planning efforts and the new plant must not encourage growth outside of set boundaries; 2) if a new plant should replace an existing plant, then the new plant should reduce or eliminate the adverse impacts of the existing plant;

3) certain types of development such as recreational and aquaculture facilities receive high priority in coastal areas and a new desalination plant may inhibit the development of a high priority facility; 4) the service area of a desalination plant will be reviewed to ensure that the proposed plant provides service for the potential maximum build out of the service area; and 5) coastal dependent developments receive priority over coastal related development. There are three exceptions to this; (a) alternative locations are infeasible or environmentally damaging, (b) proposed development would otherwise affect public welfare, and (c) coastal development would mitigate adverse impacts.

Section 30001.5 of the CCA addresses the feasibility of the maintenance of coastal areas. It states that "to protect, maintain, and, where feasible, enhance and restore the overall quality of the coastal zone environment and its natural and artificial resources." Some feasibility issues addressed include economic, environmental, social, and technological issues. Economic feasibility checks the cost of mitigation, while environmental feasibility measures the potential of successful mitigation of adverse effects. Social feasibility gauges the public's acceptance of the mitigation. Technological feasibility looks at the level of technology available and the ease of its implementation to mitigate adverse effects. Some feasibility alternatives related to desalination required by the CCA include: water conservation methods, using reclaimed or recycled water, reallocating existing supplies, and market based measures.

If the desalination plant is situated outside of the jurisdiction of the California Coastal Commission, then the plant operator needs to file an Environmental Impact Report or a negative declaration.

Texas Regulations

In Texas, there are about 80 small desalination plants using brackish groundwater sources for public water supplies (TWDB 2003). In addition, recently the Texas Water Development Board (TWDB) commissioned several studies to investigate the feasibility of implementing seawater desalination plants in Texas (TWDB 2002), (LBG-GUYTON Associates 2003). In 2003, a consulting firm under contract with TWDB developed a guidance manual for desalination facilities permitting requirements using reverse osmosis (RO) processes (Beck 2004). The manual provides a tool for local communities and other stakeholders to use in the planning process of implementing desalination plants in Texas. The manual recommends that a permitting plan should be developed in conjunction with the early stages of preliminary design to ensure that design and permitting activities are coordinated.

Three categories of permits are required: facility construction (16 permits), feedwater (1 water rights permit and 5 permits related to developing groundwater), and residual management (16 permits). State agencies in Texas that may be administering, coordinating review of or approving desalination plant permits include: the Texas Commission on Environmental Quality (TCEQ), the Texas General Land Office, the Texas Department of Transportation, the Railroad Commission of Texas, and the Texas Historical Commission. Local city and county permits most often consist of building permits to ensure compliance with local building codes and rules. Additionally, some communities also have special permitting requirements for removal and replacement of trees, right of way/easement use, and methods for erosion control. Groundwater conservation districts are local organizations that provide various permits pertaining to the use of groundwater. Other permits include those required by railroads. TCEQ is the responsible agency for issuing most permits. Cities and counties issue a few facility construction permits. Groundwater conservation districts are responsible for a large number of permits related to water well production, while the Army Corps of Engineers is responsible for permits related to wetlands and navigable waters.

The Texas guidance manual also includes a Permit Decision Model. The Model is applicable to desalination facilities with an RO process (brackish water or seawater) and provides a systematic approach to identify major permit requirements via a set of decision tree analyses. The model is constituted of three main modules. The first is associated with raw water source permitting. The second module applies to permits required for all facilities. The third is used for concentrate and membrane cleaning solution disposal methods. Once a decision has been reached about using brackish water or seawater and concentrate disposal method, the Model provides guidance through responses to a series of yes-no questions to identify major permit requirements. The third module also address permit requirements for a typical seawater desalination facility that is co-located with a power plant.

Florida Regulations

In Florida, there are 11 desalination plants of which 10 use brackish water as the source water (Desalination in Florida and Worldwide 1999). The Florida Department of Environmental Protection (FDEP) holds the jurisdiction over the regulation of desalination plants (Florida Department of Environmental Protection). The FDEP jurisdiction is derived from the State Code Section 62. The Florida Fish and Wildlife Conservation Commission (FFWCC) provide comments to the FDEP on possible effects of a desalination plant on marine life. FFWCC also comments on Section 404 permits under review by the USACE (Florida Fish and Wildlife Conservation Commission). Local and regional entities do not have significant jurisdiction in desalination matters compared to the state at large. However, regional or local governmental agencies can force the desalination plant operator to submit a Standard General Environmental Resources Permit.

State Code Section 62 addresses the following issues related to desalination plants: permitting process (Section 62-4); brine and concentrate discharge to surface waters (Section 62-4.200); discharge quality and toxicity requirements (Section 62-4.244); guidelines for the testing of receiving waters (Section 62-4.246); surface waters and water quality standards (Section 62-301 & Section 62-302); ground water classes, standards, exemptions (Section 62-520); underground injection control (Section 62-528); drinking water standards, monitoring, and reporting (Section 62-550); reclaimed water and land application (Section 62-610); water quality based effluent limitations (Section 62-650); and industrial wastewater facilities (Section 62-660).

Virginia Regulations

There are five operating desalination plants in Virginia using brackish groundwater. The discussion below provides insight into regulatory issues pertinent to water source development and concentrate management in Virginia (Younos 2004).

Developing Groundwater Sources. Developing brackish groundwater follows the established permitting regulations for developing aquifers in Virginia. These regulations are defined in Section 62.1–256 of the Ground Water Management Act of 1992 (Chapter 25, Title 62.1 of the Code of Virginia) and the Ground Water Withdrawal Regulation (9 VAC 25-610-10 et seq) (Virginia Administrative Code 2001). The Ground Water Act allows the Virginia Department of Environmental Quality (DEQ) to review the permit applications for the proposed withdrawals in groundwater management areas. Permits are required for those entities that withdraw or plan to withdraw, on average, 300,000 gallons (or more) of groundwater per month. The Virginia Water Withdrawal Reporting Regulation (9 VAC 25-200-10 et seq.) requires that individuals or facilities that withdraw water at volumes greater than 10,000 gallons per day (one million gallons per month for crop irrigators) to measure and report annually to DEQ the monthly volume of water withdrawn. A withdrawal renewal permit is required every ten years.

The DEQ staff has adapted the Virginia Coastal Plain Model (VCPM), developed by the USGS experts, to make groundwater management decisions (McFarland 2000) (Virginia Coastal Plain Model 2002). The State Water Control Board authorizes or declines the permit to withdraw water and use the groundwater. The permit includes information on groundwater withdrawal points (aquifer and its location), maximum pump settings for each target aquifer, water level and water quality monitoring wells. The permit may also include a "water conservation and management plan" and a "mitigation plan." The purpose of the mitigation plan is to provide a dispute resolution mechanism that existing and grandfathered groundwater users can use to resolve claims that may arise due to groundwater withdrawals from the wells owned and operated by the permitee.

Developing Surface Water Sources. For surface water development, the current Local-State-Federal Joint Permit Application (JPA) process is used to review proposed intake structures. The JPA process allows for review by the Army Corps of Engineers (401 Certification), the Virginia Marine Resources Commission (VMRC), the Virginia Department of Environmental Quality (VWP Permit), and local Wetlands Boards. In addition to the regulatory agencies listed above, the JPA is also sent to other agencies for comment. Depending on the nature and location of a project, VMRC generally requests comments from the Virginia Institute of Marine Science, the Virginia Department of Health, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation

and Recreation, the Chesapeake Bay Local Assistance Department, the Virginia Department of Historic Resources and others prior to issuing a construction permit. The JPA is used by the Corps to coordinate review and comment by other federal agencies such as the USEPA, the U.S. Fish and Wildlife Service, and the National Marine Fishery Service.

Permits would be required from the Marine Resources Commission (VMRC) for the placement and operation of any intake structures on or over state-owned submerged lands pursuant to Section 28.2-1204 and 28.2-1205 of the Code of Virginia. Section 28.2-1205 requires that, in addition to other factors, consideration shall be given to the public and private benefits of the encroachments over state-owned submerged lands and the effect of any structures on other reasonable and permissible uses of state waters and state-owned bottom lands; marine and fisheries resources of the Commonwealth; tidal wetlands; adjacent or nearby properties; water quality; and submerged aquatic vegetation. This code section also specifies that the Commission when determining to grant or deny any permit shall be guided by the provisions of Article XI, Section I of the Constitution of Virginia and shall exercise its authority consistent with the public trust doctrine. It should be noted that VMRC does not authorize withdrawal limits, but would respond to a request for comments by the DEQ as part of its review for withdrawal authorization. Intake structures would need to be sited and operated to avoid or minimize the effects to those resources identified in Section 28.2-1205 and to avoid conflicts with other uses. Such uses could include, but may not be limited to, commercial and recreational fishing, navigation, recreational boating, as well as shellfish harvest and aquaculture.

Developing a surface water source requires permit review from the Army Corps of Engineers (U.S. Army Corps of Engineers 1991). The legislative origins of the program are the Rivers and Harbors Acts of 1890 (superseded) and 1899 (33 U.S.C. 401, et seq.). The geographic jurisdiction of the Rivers and Harbors Act of 1899 includes all navigable waters of the United States defined (33 CFR Part 329) as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce." This jurisdiction extends seaward to include all ocean waters within a zone three nautical miles from the coastline (the "territorial seas"). Limited authorities also extend across the outer continental shelf for artificial islands, installations and other devices (see 43 U.S.C. 333 (e)).

Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States. In 1972, amendments to the Federal Water Pollution Control Act added what is commonly called Section 404 authority (33 U.S.C. 1344) to the program. The Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. The selection of such sites must be in accordance with guidelines developed by the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army; these guidelines are known as the 404(b)(1) Guidelines. The discharge of all other pollutants into waters of the U.S. is regulated under Section 402 of the Act, which supersedes the Section 13 permitting authority mentioned above.

Concentrate Discharge and Disposal. In Virginia, the discharge from desalination plants is regulated and permitted as industrial discharge for manufacturing operation (SIC Code 4941). The manufacturing operation consists of the owner operating a potable water treatment plant. The authorization to discharge concentrate is issued under the Virginia Pollutant Discharge Elimination System (VPDES) and the Virginia State Water Control Law in compliance with the provisions of the Clean Water Act as amended. The owner of the desalination plant can be authorized to discharge the concentrate in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in the permit.

Effluent limitation and monitoring requirements include eight effluent characteristics: Flow (MGD), pH (S.U.), dissolved oxygen (mg/L), total suspended solids (mg/L), total phosphorus (mg/L), total nitrogen (mg/L), total dissolved solids (mg/L), and total residual chlorine (mg/L). No limit is set for total dissolved solids (TDS) concentration in the effluent, although monthly monitoring and reporting is

required. The disposal of concentrate (brine) should be managed, limited or sited to avoid impacts to marine fishery resources and their habitats. The permit may include requirements for special conditions such as discharge into nutrient enriched waters, compliance with the toxic management program[1] (biological monitoring of receiving waters), and a toxicity reduction evaluation plan. Effluent limitations are based on state water quality standards and best professional judgment.

The Virginia Department of Health conducts reviews and comments on discharge permits. VMRC would only comment on the review of discharge permit limits as requested by the Virginia Department of Environmental Quality. Ocean disposal of concentrate is practiced in other states and remains a future option in Virginia. Commonwealth ownership of submerged lands extends offshore to the 3-mile limit and includes all the beds of the Chesapeake Bay and tributaries. All Virginia laws for water use and concentrate disposal apply to this 3-mile limit.

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Notes

1. Virginia follows the national goals set out by National Pollutant Discharge Elimination System (NPDES) that regulates water quality. It requires Whole Effluent Toxicity (WET) tests to be performed by persons responsible for discharging a pollutant that may be considered toxic to organisms in the receiving water. The authority to use WET tests for regulating discharge is found under 9VAC 25-31-220 D.1. a.-d. Brine disposal and discharge from water treatment plants fall under this category (U.S. EPA 2002, Lawson 2004).