SALINE WATER INTRUSION MONITORING (SWIM)
PROGRAM GUIDELINES
1985

Introduction

Inland movement of saline water in coastal areas as well as upcoming of brackish water in inland areas is a major concern to the South Florida Water Management District. Consequently, there is a need to monitor movement of saline or brackish water, as it may affect water availability for existing and future users, both potable and non-potable. These guidelines are intended to assist the Permittee in designing a Saline Water Intrusion Monitoring (SWIM) Program.

Because of the complexity of the saline intrusion problem, these guidelines are general in nature. Specific details and requirements for each program will be prepared on a case-by-case basis within the context of these guidelines. Prior to the beginning of the design and implementation of the Permittee's SWIM Program, the Permittee should schedule a meeting with the District Staff to reach a consensus on the scope of the Permittee's SWIM Program.

The SWIM Guidelines are organized in two sections. The first section reviews the general hydrogeologic conditions under which a Permittee may be required to develop a SWIM program. This section should not be considered exhaustive as there may be additional hydrogeologic conditions in which a SWIM Program is required. The second section outlines the general requirements of a SWIM Program, the data to be collected, the frequency of data collection, the method of reporting, monitoring well construction details, and the sampling methodology.

1.0 Conditions Under Which a Permittee will be Required to Develop a SWIM Program

1.1 The wellfield is within one mile of a brackish or saltwater body including canals and tidal creeks.

1.2 The wellfield is located seaward of the 250 mg/l chloride line mapped at the base of the aquifer and/or located seaward of a line between two adjacent salinity control structures.

1.3 The land on which the wellfield is located is between the Intracoastal Waterway and the Atlantic Ocean; between a tidal creek and the Gulf of Mexico; or between the Intracoastal Waterway and the Gulf of Mexico.

1.4 Non-potable saline water is located either above or below the producing zone by a distinct and definable confining layer.

1.5 A history of saline water intrusion or increasing chloride concentrations exists for either groundwater or surface water in the vicinity of the wellfield.

1.6 Staff evaluation indicated that, at projected withdrawal rates, saline water intrusion may occur to the extent that the existing treatment process will no longer be capable of producing potable water.

1.7 Staff evaluation indicated that, at projected withdrawal rates, saline water intrusion may occur in neighboring wellfields.

1.8 Staff evaluation indicated that the use of brackish water for irrigation purposes may contaminate a potable aquifer.

2.0 Monitoring Program

2.1 General SWIM Requirements

2.1.1 Locate the saline water interface. That is, the 250 mg/l isochlor (line of constant concentration). The method of locating the saline water interface is dependent upon the well construction technique employed. If the Cable-Tool method is used, then water samples are taken after each casing length is installed. The samples are evaluated for chlorides in the field, usually by some titration method, and subsequently verified by a commercial laboratory. If the Rotary Drilling method is used, then a resistivity log is run on the well. Because resistivity is influenced by the conductivity of the water in the aquifer, the saline water interface is shown by a significant decrease in resistivity. In locating the saline water interface the first monitoring well should be completed in the most permeable beds above but near the bottom of the aquifer unless the interface has been located at a shallower depth. If the saline water interface is located, then the process is complete. If the saline water interface is not located, then an additional well should be constructed to the depth of the producing zone. All wells should be developed to ensure good interconnection with the aquifer.

2.1.2 Monitor advance or retreat of the saline water interface. This is accomplished by measuring the chloride concentrations, usually monthly, at the predefined interface. The chloride concentration versus time data obtained are used to infer movement of the interface.

2.1.3 Monitor water levels in specified wells. This is usually done monthly. Water levels are measured because they provide estimates of the saline water interface. For every one-foot of fresh water head, the saline water interface is maintained approximately forty feet deep when ground water flow is not taken into account. Thus, for a measured fresh water head of two feet, the saline water interface would be approximately 80 feet deep.

2.2 Monitoring Data

2.2.1 Chloride Concentration: The Permittee may be required to monitor one or more of the following:

1) saline water in the proximity of the 250 mg/l isochlor at the base of the aquifer;

2) saline intrusion from shallow tidal canals or creeks;

3) saline intrusion due to upconing;

4) saline intrusion from an adjacent formation;

5) chloride concentration levels at the wellfield site; and/or

6) chloride concentration levels at the level of the production zone in the area between the wellfield and the source of saline water.

2.2.2 Water Levels: Water levels from monitoring wells should be collected to obtain information regarding the direction of groundwater flow in the area of influence of the wellfield. The vertical distribution of water levels should be monitored in cases in which upconing or intrusion from an adjacent formation is suspected. Water level records supplied to the District as part of the limiting conditions of the Permittee's water use permit shall suffice to satisfy this requirement.

2.2.3 Rainfall: Daily or weekly accumulations of rainfall data may be required. Rainfall records supplied to the District as part of the limiting conditions of the Permittee's water use permit shall suffice to satisfy this requirement.

2.2.4 Wellfield withdrawals: Pumping records supplied to the District as part of the limiting conditions of the Permittee's water use permit shall suffice to satisfy this requirement.

2.3 Frequency of Data Collection and Reporting

2.3.1 Frequency of data collection: The frequency of data collection will depend on each data item and on the risk of saline intrusion faced by the wellfield under the current annual allocation or the requested increase in annual allocation.

In general the following frequencies are recommended:

Item	Frequency
Rainfall	Daily or weekly accumulations
Water levels	Monthly or quarterly (except when recorders are required)
Pumpage records	As required by water use permit
Chloride data	Monthly or quarterly

During or in anticipation of a water shortage declaration, more frequent data collection and submission may be required.

2.3.2 Frequency of data reporting: Collected data shall be submitted to the District during the month following the month of collection.

2.3.3 Format for reporting data: Data shall be submitted in tabular and graphical form. The graphical presentation of the data will reflect the historic trends of the measured parameter.

2.4 Well Construction

Wells must be constructed and developed so that point measurements of chlorides are obtained. The following are general guidelines:

2.4.1 Location: The location of the monitoring wells should be decided on a case-by-case basis in accordance with the site hydrogeological data available to the District and/or the Permittee.

2.4.2 Depth: The depth of the monitoring wells should be decided on a case-by-case basis in accordance with the site hydrogeological data available to the District and/or the Permittee.

2.4.3 Diameter: Monitoring wells should be at least two inches in diameter, or four inches in diameter for wells with recorders.

2.4.4 Screen Length: Monitoring wells which are required to measure chlorides at a given point should be screened at that depth. For most wells a length of screen between three and six feet is recommended. The screen length must not exceed six feet.

2.4.5 Well Material: Metallic or non-metallic casings can be used for the monitoring wells.

Note: For wells constructed by the Cable-Tool method no screen is required, but the well should be developed. To insure the well has been properly developed, the District recommends the following test:

1) measure water level;

2) bail out the equivalent of one well casing, if possible, but at least 10 feet of water; and

3) measure recovery of the well (water levels versus time).

If the well does not recover within one hour, then the well must be redeveloped or further constructed. No more than one foot of sand should be within the casing above the bottom of the casing.

2.5 Monitoring Program - Sampling Method

2.5.1 The sampling method to be used should be such that the formation water is sampled.

2.5.2 If the monitoring well is being pumped, extract a volume of water equivalent to three times the casing volume. This should

present few problems and the final water sample can be taken at any desired depth.

2.5.3 If the monitoring well is deep and the bailing technique is being employed, then bailing thirty feet of water will be sufficient. The sample should then be taken at the screened depth or bottom of the casing with a "thief" type sampler. Information regarding this type of sampling device can be obtained from the District.