Chapter 2, Appendix 2-2

Minimum Flows and Levels (MFLs) Methodology

The District's minimum flows and levels methodology is briefly described in this appendix. Detailed descriptions of the methodology used for establishing MFLs can be found in documents cited in Hancock et al. (2010) and at the District's MFLs (Environmental Flows) Documents and Reports web page at *WaterMatters.org/projects/mfl/mfl_reports.php*.

Technical Approach to the Establishment of MFLs

The District's technical approach for establishing MFLs addresses all relevant requirements expressed in the Florida Water Resources Act of 1972 (Section 373, Florida Statutes (F.S.)) and the Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code (F.A.C.)). The approach assumes that alternative hydrologic regimes may exist that differ from Historic conditions but are sufficient to protect water resource features from significant harm. Chapter 62-40-8.021, F.A.C. defines "Historic" as a Long-term period when there are no measurable impacts due to withdrawals and Structural Alterations are similar to current conditions. "Long-term" is defined as a period that spans the range of hydrologic conditions, which can be expected to occur based upon historical records, ranging from high water levels to low water levels. "Structural Alterations," as defined in the Rule, are man's physical alteration of the control point of a lake or wetland that affects water levels. For example, consider a Historic condition for an unaltered river or lake system with no local ground or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from small withdrawals that have no measurable effect on the Historic regime, to large withdrawals that could substantially alter the regime. A threshold hydrologic regime may exist that is lower or less than the Historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. Thus, MFLs may represent minimum acceptable rather than Historic or potentially optimal hydrologic conditions.

Ongoing Work, Reassessment and Future Development

The District continues to conduct the necessary activities to support the adoption of MFLs into its Water Levels and Rates of Flow rules (Chapter 40D-8, F.A.C.) according to the District Priority List and Schedule. Refinement and development of new methodologies are also ongoing. In accordance with the Florida Water Resources Act, MFLs are established based upon the best available information. The District plans to conduct periodic reevaluations of adopted MFLs based on consideration of the significance of particular MFLs in water supply planning, the relevance of new data that may become available, and rule-specified reevaluation schedules.

Scientific Peer Review

The Florida Water Resources Act permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to determine MFLs. In addition to supporting any requested peer review processes, the District voluntarily seeks

independent scientific peer review of MFL methodologies that are developed for all priority water bodies, as well as the review of proposed MFLs for specific priority water bodies in accordance with criteria identified in the Water Resource Implementation Rule.

Methodology

Wetlands

The District has developed a minimum levels methodology for palustrine cypress wetlands (isolated, freshwater, cypress-dominated wetlands). Data collection and analysis is ongoing for the development of minimum level methodologies for other wetland types. The method for establishing minimum levels for palustrine cypress wetlands is based on a statistical assessment of the relationship between hydrology and certain ecologic parameters in a number of wetlands. The goal for the methodology and Minimum Wetland Levels (MWLs) developed using the method is to identify a hydrologic threshold, expressed as a water level, beyond which it would be reasonable to expect that significant harm may occur in a wetland. A MWL for palustrine cypress wetlands is determined by surveying a normal pool elevation based on "Hydrologic Indicators" occurring within the wetland, and calculating an elevation 1.8 feet below the normal pool. Chapter 40D-8.021, F.A.C., defines "Hydrologic Indicators" as those biological and physical features which are representative of previous water levels, as listed in the Rule. A complete description of the methodology used for establishing MWLs can be found in SWFWD (1999c) and the District Water Levels and Rates of Flow rules.

Wetland water levels are determined to be above the MWL if the Long-term (as defined in the Rule) median stage is at or above the adopted minimum level. If insufficient hydrologic data exists to determine if water levels in a wetland are above or below an adopted MWL, a wetland can be evaluated based on a comparison with wetlands that are hydrologically or hydrogeologically similar, located in close proximity, or by use of aerial photographs or evaluation of available hydrologic data or Hydrologic Indicators in the subject wetland.

Lakes

Minimum Lake Levels (MLLs) are determined through analysis of measured and modeled lake stage and other hydrologic data, consideration of Structural Alterations, evaluation or surveying of basin-specific features or conditions, and through identification of appropriate lake-class-specific significant change standards.

Priority lakes are classified as Category 1, 2 or 3. Systems with fringing cypress wetlands greater than 0.5 acres in size, where water levels regularly rise to an elevation expected to fully maintain the viability of the wetlands (i.e., the median lake stage is not more than 1.8 feet below the normal pool elevation) are classified as Category 1 lakes. Lakes with fringing cypress wetlands greater than 0.5 acres in size that have been Structurally Altered such that the median lake stage is more than 1.8 feet below the normal pool elevation are classified as Category 2 lakes. Lakes without fringing cypress wetlands or with less than 0.5 acres of fringing cypress wetlands are classified as Category 3 lakes.

MLLs are established using lake-specific significant change standards and other available information. For Category 1 or 2 lakes, a significant change standard is established 1.8 feet below the normal pool elevation. This standard identifies a desired median lake stage that, if

achieved, may be expected to preserve the ecological integrity of the lake-fringing wetlands. For Category 3 lakes, six significant change standards associated with dock-use, aesthetics, basin connectivity, recreational/ski use, water column mixing, and maintenance of species richness, are developed and used for preventing significant harm to environmental values associated with the standards. Potential changes in the coverage of herbaceous wetland vegetation and aquatic plants are also taken into consideration.

The MLL is the elevation that a lake's water levels are required to equal or exceed 50 percent of the time on a Long-term basis. For Category 1 lakes, the MLL is established at the standard elevation 1.8 feet below the normal pool. The MLL for Category 2 lakes is established at the median lake stage that would be expected in the absence of withdrawal impacts, with existing Structural Alterations in place. For Category 3 lakes, the MLL is established at the most conservative (i.e., the highest) appropriate standard elevation, except where the standard elevation is above the median lake stage that would occur in the absence of withdrawals, with existing Structural Alterations in place. In these cases, the MLL is established at the median lake stage.

The High Minimum Lake Level (HMLL) is the elevation that a lake's water levels are required to equal or exceed ten percent of the time on a Long-term basis. For Category 1 lakes, the HMLL is established 0.4 feet below the normal pool. The HMLL for Category 2 lakes is established at the elevation water levels would be expected to equal or exceed ten percent of the time, given existing Structural Alterations and the absence of withdrawal impacts. For Category 3 lakes, the HMLL is developed by summing the MLL elevation and the expected difference between the median lake stage and the water level equaled or exceeded ten percent of the time. A complete description of the methodology used for establishing MLLs can be found in SWFWD (1999b), Leeper et. al. (2001) and the District Water Levels and Rates of Flow rules.

Lake MFLs are met when the Long-term median lake stage is at or above the MLL and the Long-term water level equaled or exceeded ten percent of the time is at or above the HMLL. If insufficient data exists to determine if lake levels are above or below the MFLs, the lake can be evaluated based on a comparison with lakes that are hydrologically or hydrogeologically similar, located in close proximity, or by use of aerial photographs or evaluation of available hydrologic data or Hydrologic Indicators at the lake.

Aquifers

Saltwater Intrusion Minimum Aquifer Levels (SWIMALs) have been developed for the Upper Floridan aquifer (UFA) in the Northern Tampa Bay Water Use Caution Area (NTBWUCA) to prevent regional saltwater intrusion and in the Southern Water Use Caution Area (SWUCA) to slow the rate of saltwater intrusion. A Minimum Aquifer Level (MAL) has been developed for the Dover/Plant City Water Use Caution Area (Dover/Plant City WUCA) to maintain UFA levels above a level that was associated with formation of a large number of sinkholes and well failures during an extreme frost/freeze event in 2010. Due to differing hydrogeologic conditions and water use patterns, the approaches used to determine SWIMALs or MALs differed slightly in these three areas.

The development and implementation of a SWIMAL is a three-step process. The first step is to assess the current status and anticipated future advancement of saltwater intrusion. For the NTBWUCA, current and future status of regional saltwater intrusion was assessed through use

of a sharp interface model. For the SWUCA, the number of wells and water supply potentially at risk to saltwater intrusion over the next 50 years was determined through review of existing hydrogeologic and water-use data and use of a solute transport model. The second step for SWIMAL development involves identification of a proposed goal for the SWIMAL. In the NTBWUCA, the goal was preventing further advancement of regional seawater intrusion. In the SWUCA, the goal for the SWIMAL was to slow the rate of saltwater intrusion to the rate that occurred for the period from 1990 to 1999, based on the number of wells and water supply potentially at risk to saltwater intrusion in the Most Impacted Area of the SWUCA. Finally, for development and implementation of a SWIMAL, a network of monitor wells and corresponding water levels is selected to evaluate SWIMAL status based on a Long-term average (NTBWUCA) or ten-year moving annual average (SWUCA) UFA water levels. A complete description of methodology used for developing SWIMALS can be found in SWFWMD (1999a, 1999d and 2002).

The MAL for the Dover/Plant City WUCA was developed through review of regional well complaints and information on reported sinkholes that occurred in association with groundwater withdrawals used for frost/freeze protection during an extremely cold period in January 2010 (Weber and Peterson 2010). Maximum regional aquifer-level drawdown information was also used, along with other available geologic and hydrogeologic data and groundwater flow modeling to identify an appropriate MAL. The goal for the MAL was to identify a regional potentiometric level for the UFA that would reduce the likelihood of well failures and other potential impacts during future prolonged freeze events.

The status of the Dover/Plant City WUCA MAL is evaluated using a groundwater flow model simulation of the permitted groundwater frost/freeze withdrawals in the Dover/ Plant City WUCA. Based on an annual simulation, the MAL is met if the resulting potentiometric level of the UFA is at or above the MAL elevation.

Rivers, Estuaries, and Springs

Development of minimum flows for flowing surface waters, including freshwater or estuarine river segments and springs, typically involves characterization of existing and historical withdrawal impacts and Structural Alterations; identification of seasonal high, medium and low flow periods or blocks; identification of benchmark flow records; and development of significant harm standards. Measured and modeled/estimated flow records, water-use information and other hydrologic data are used along with groundwater flow and other hydrologic modeling for characterization of withdrawal impacts. These data may be used along with other information (e.g., water control structure operation schedules, land-use changes, etc.) to assess effects of Structural Alterations on flows.

Seasonal flow blocks are typically identified to address system characteristics associated with components of the flow regime (*e.g.*, maintenance of water depths sufficient for fish passage across shoals during low flow periods and inundation of floodplains during high flow periods). Benchmark water level records reflecting the hydrologic regime expected in the absence of water withdrawals for specific time-periods, based on identified Structural Alterations and/or climatic cycles, are used along with significant harm/change standards for environmentally relevant criteria (e.g., allowable change in fish habitat; availability, areal and volumetric changes in specific salinity zones; changes in abundances of fish; macroinvertebrates and phytoplankton; thermal refugia for the endangered manatee; and probability of benthic hypoxia) to identify block-specific percent-flow reductions that are used to establish minimum flows. The

MFLs are typically expressed as allowable flow-reduction percentages associated with no more than a 15 percent change in standard-specific criteria, based on daily flow measurements, and may also include absolute flow thresholds that serve to limit withdrawals.

River, estuary and spring MFLs are met if measured or modeled flows indicate that allowable percent-of-flow reductions or low flow thresholds are not exceeded. These assessments may be based on analysis of measured and/or modeled flow records, including consideration of Long-term flow statistics expected based on natural climatic variation, and consideration of other hydrologic and hydrogeologic information.

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