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COMPARATIVE REVIEW OF USE OF WETLAND CONSTRAINTS IN THE WATER SUPPLY PLANNING PROCESS

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SUBJECT: Comparative Review of Use of Wetland Constraints in the Water Supply Planning Process by St. Johns River Water Management District, Southwest Florida Water Management District, and South Florida Water Management District
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Purpose

The St. Johns River Water Management District (SJRWMD) is conducting a districtwide, strategic water supply planning effort called *Water 2020*. This effort seeks to identify sustainable water supply sources adequate to meet the needs of natural systems and a growing population through the year 2020. A key element of *Water 2020* is the protection of water resources and their dependent natural ecosystems, such as native vegetative communities. The *Water 2020* planning approach to resource protection is to incorporate water resource constraints for aquifer water quality, springs, lakes, and wetland communities in optimization modeling that results in the identification and analysis of possible water supply alternatives. In the modeling process the constraints provide water resource protection by limiting ground water withdrawals to levels that preclude unacceptable impacts to these resources and related natural systems. SJRWMD, in its *Water 2020* planning process, used water resource constraints as a tool to screen potential sources for key planning areas, the priority water resource caution areas (PWRCAs).

The *Water 2020* planning efforts to date show that the inclusion of water resource constraints can significantly affect the outcome of water supply planning in several of the PWRCAs. The constraints exert control in the modeling process by limiting groundwater withdrawal scenarios, especially in east-central Florida (ECF). The significant control these constraints exert on water supply planning prompted SJRWMD to further examine their effects using sensitivity and uncertainty analyses.

This Technical Memorandum (TM) compares use of wetland protection criteria in water supply planning by SJRWMD to South Florida Water Management District (SFWMD), and Southwest Florida Water Management District (SWFWMD).

Background

Protection of sensitive natural resources requires that two relationships be specified: 1) first the causal relation between a management action, such as ground water withdrawal, and the effect of that action on the resource(s) of interest; and 2) a threshold effect or impact level, which will cause an unacceptable level of impact to that resource.

Methods

CH2M HILL based the comparative review of wetland constraints used in water supply planning by SJRWMD, SFWMD, and SWFWMD on reports, documents, and other written information provided by the WMDs, and discussions with SJRWMD, SFWMD and SWFWMD personnel (Table 1).

Management Approaches for Water Resource Protection

All three WMDs have established methods to protect sensitive natural resources in the water use permitting process and have to varying degrees employed these or related methods in their historical and current water supply planning efforts. For the permitting process, these approaches typically use site-specific information in focused data collection modeling, and analysis. However, such detailed information is often unavailable at the planning level. The WMDs are responsible to protect water resources and related natural systems. Because of this responsibility, resource protection must be an integral part of water supply planning as well as permitting. For water supply planning the type of available data and the length of the data record largely dictate the approach utilized. In fact, the availability of long-term monitoring data is a critical factor in selecting the appropriate management approach by each of the three WMDs.

Typical Management Approaches for Resource Protection

Table 2 summarizes WMD management approaches used in developing MFLs and resource protection criteria. These approaches fall into four general categories:

1. **Statistical hydrology**: Establishes site specific MFLs using long-term hydrological records and ecological benchmarks.
2. **Statistical inference**: Uses general criteria for MFLs, developed by extension from specific cases, where long-term records are not available.
3. **Maximum allowable drawdown**: Sets protective limits as a maximum steady-state drawdown value for specific wetland types, based on an analysis of mean annual hydrographs.
4. **GIS screening for sensitive areas**: Identifies relative sensitivity to harm of wetland areas based on potential water level declines due to groundwater withdrawal.

Differences in WMD Management Approaches

In addition to the various means through which these WMDs determine water resource protection criteria, each WMD may apply these criteria in the planning and permitting processes differently as well. For instance, SFWMD uses adopted MFLs in the permitting process. In water supply planning SFWMD utilizes existing MFLs, drawdown limits, and GIS screening. For example, GIS screening is being used in Kissimmee Basin water supply planning.

The SJRWMD wetland constraints were developed expressly for water supply planning, but are reasonably consistent with the consumptive use permitting (CUP) process. A *Water 2020* districtwide technical subgroup developed the wetland constraint and other water resource constraints. The results of this are summarized in the document entitled *Water Resource Constraints Handbook (*CH2M HILL 1998*).*

SWFWMD uses MFLs and drawdown criteria for wetland protection in water use permitting, however, SWFWMD does not currently incorporate wetland constraints into water supply planning.

Interdistrict Comparison of Wetland Constraints in Water Supply Planning

SJRWMD

Unacceptable Impact

In the *Water 2020* process, SJRWMD identifies areas where unacceptable impacts to water resources and related natural systems are likely to occur as a result of projected future water uses. SJRWMD defines unacceptable impacts to water bodies with established MFLs as significant harm, as the moderate to high likelihood of harm to other wetlands, and as unacceptable impacts to other lakes. In all these cases, an unacceptable impact is considered to occur when dominant plant and animal species are replaced by those characteristic of drier communities. Table 3 compares the respective standards of unacceptable impacts to wetlands employed by the WMDs.

Water 2020 Water Resource Constraints

Table 4 lists the wetland drawdown values used in the SJRWMD *Water 2020* planning process. These wetland drawdown values were developed based on a modeled steady-state drawdown condition. The *Water 2020 Constraints Handbook* and other *Water 2020* background documents (CH2M HILL 1996) outline the development of these drawdown values. The constraints represent maximum drawdown values for specific wetland community types (Table 4), ranging from 0.35 to 1.2 ft of decline in the surficial water table, under long-term, steady-state conditions. The purpose of the wetland constraint is to provide for protection of the type, nature, and function of these wetland communities from unacceptable impacts caused by reductions in the elevation of the water table of the surficial aquifer due to ground water withdrawals. SJRWMD has worked to make water resource constraints and the application of these constraints consistent to the extent possible with wetland impact evaluation approaches used in the consumptive use permit (CUP) process. However, these constraints are not followed as limiting criteria in the CUP process.

SJRWMD has routinely used water resource constraints in its water supply assessment and planning. The District's *1994 Needs and Sources Assessment* (Vergara et al. 1994) used potential impacts to native vegetation resulting from lowered surficial water tables as a primary determinant of the PWRCA boundaries. Kinser and Minno (1995) describe the development of a GIS screening model to identify SJRWMD areas within which the native vegetative communities are most susceptible to pumpage-induced harm. The model incorporated vegetative characteristics, soils, and estimated declines in the surficial aquifer to identify PWRCAs.

For *Water 2020*, SJRWMD developed maximum allowable drawdown values for specific wetland communities. The drawdowns were developed by analyzing mean annual hydrographs for each wetland type and evaluating the impacts of drawdown on targeted ecological parameters (CH2M HILL 1996). In the decision and optimization modeling efforts for *Water 2020* these wetland drawdown limits are associated with specific wetland areas as control points in the model's spatial domain. The spatial distribution of control points provides a regional array for resource protection that guides the selection of water supply alternatives.

For springs classified as sensitive, a background constraint was applied in the decision model limiting springflow reductions to 15 percent. In addition to the use of the constraint values, the decision model can also incorporate the established MFL values, which represent the limits of significant harm, adopted by SJRWMD.

SFWMD

Significant Harm

SFWMD defines three standards of harm used in resource protection:

- Harm - Temporary harm where recovery will occur within one or two seasons
- Significant harm - Harm requiring many years for water resource recovery
- Serious harm - Permanent or irreversible damage to the water resource

SFWMD applies the standard of significant harm to its water supply permitting process.

Regional MFLs for the Everglades, Lake Okeechobee, and Biscayne Aquifer

SFWMD used statistical hydrologic analysis of a long period of record to develop site-specific MFLs for the Everglades system, as well as for Lake Okeechobee and the Biscayne Aquifer. SFWMD approached the development of site-specific MFLs by first determining:

- Priority functions to be protected
- Baseline conditions of the resource
- Level of protection to be provided

SFWMD selected specific water resource functions to define significant harm for each surface or ground water system. For the Everglades, SFWMD selected the protection of hydric soils as the criteria of choice in defining significant harm (Table 5). MFLs for the Everglades consist of four components: a minimum water depth, a duration, a frequency of occurrence, and potential for causing significant harm to the environment, which defines the resource functions to be protected. The MFL addresses the potential for organic soils to burn. This is an extreme event, which would take many years for recovery. These types of hydrologic statistics can only be developed with extensive long-term records. Once developed, they can be applied at either the planning or permitting level. The existing MFLs for the Everglades, Lake Okeechobee and the Biscayne Aquifer are not currently applied in water supply planning.

Upper East Coast Water Supply Plan

SFWMD incorporates resource protection criteria into its ground water modeling tools to provide for the prevention of unacceptable adverse impacts to the environment and to ground water. In the SFWMD document *Upper East Coast (UEC) Water Supply Plan – Planning Document,* resource protection criteria aim to prevent harm to the resources in most conditions, including a 1-in-10-drought event. In this plan, SFWMD clearly states that the resource protection criteria are not intended to be MFLs.

The UEC wetland protection criterion states that ground water level drawdowns induced by cumulative pumping withdrawals in wetland areas should not exceed 1 foot at the edge of the wetland for more than one month during a 12-month drought condition occurring as frequently as once every ten years. SFWMD uses this same narrative rule criterion for protecting wetlands in consumptive use permitting; however it is not currently generally applied in water supply planning throughout the remainder of SFWMD.

Kissimmee Basin Water Supply Plan

In addition to site-specific MFLs, SFWMD is in the preliminary stages of identifying wetland areas that may be especially at risk for adverse impacts resulting from ground water withdrawals. In its current Kissimmee Basin planning area effort (an area that borders SJRWMD's Work Group Area I), SFWMD addresses wetland resource protection through a GIS screening approach (see Attachment 1). The screening approach is very similar to that used by SJRWMD in the *1994 Needs and Sources Assessment* (Vergara 1994). The approach identifies areas within which wetland and aquatic resources may be at risk from increased ground water withdrawals.
The screening approach identifies the following:

- Areas with leaky confining layers
- Areas with wetland and aquatic resources
- Areas of existing and proposed withdrawals

This approach differs from the integration of constraints into optimization and decision models used in the SJRWMD water supply planning process, but does establish a basis for eventually incorporating wetland protection criteria into planning models.

SFWMD Isolated Wetland Study—Guidance for Developing Wetland Drawdown Criteria

SFWMD is conducting ongoing research on the hydrology and ecology of isolated wetlands. A goal of the study is to provide a scientific basis for developing wetland protection criteria for water use permitting. The study includes twenty wetland sites located in Martin, St. Lucie, Lee, Osceola, and Polk counties. Study sites are located near public water supply wellfields and unimpacted reference areas. A recent draft report by Shaw and Huffman (2000), *Hydrology of Isolated Wetlands in South Florida: Results of 1997-98 Monitoring and Data Analysis and Guidance for Developing Drawdown Criteria*, provides a comparative summary of hydrologic regimes and ecological conditions.

Initial findings given in the report include the following: 1) wetlands are surface expression of the water table; 2) wetting of wetlands in the rainy season is governed by the vertical rise

in the water table in response to rainfall; 3) drying of wetlands in the spring is governed by the rate of decline of the water table, rate of drying in wetland is more strongly influenced by external controls than site specific soil or geological features.
The report lists three recommendations:

1—Setting different drawdown criteria for different wetland community types and hydrologic regimes
2 – Using different criteria for the wet season and dry season
3—Setting criteria and evaluating drawdown such that wetland functions are protected for all hydrologic functions up to and including a 1-in-10-year drought.

Three wetland categories are recognized in the study, the general characteristics of each are provided in Table 6. Summary hydrologic data are provided in Table 7, and wet and dry season criteria for each of the three types of wetlands are given in Table 8.

The report highlights the nature of drawdown impacts using the wetlands in the Flint Penn (FP) study group in Lee County and summarizes the characteristics of altered and unaltered hydrologic regimes. The report provides a discussion of wetland FP2 on pages 42 through 44. Effects of wellfield pumping are reported to be evident during dry season and drought. The reported symptoms include 1) delayed wetting and reduced hydroperiod, 2) invasion by transitional and exotic species, and 3) long-term or periodic shifts in plant and animal communities.

The authors relate the hydrologic changes and ecological impacts in the wetland to the SJRWMD definition of unacceptable impacts and the wetland drawdown constraint methodology utilized in the SJRWMD water supply planning process, *Water 2020*. In their discussion the authors conclude that the "nature and severity of changes observed at FP2 would appear to fall just short of the threshold for unacceptable harm." This point can be expanded upon by comparing the stage in FP2 relative to other Flint Pen wetlands. From Figure 5-1 in the report, it appears that water levels in FP2 are approximately 0.5 below stage in the other wetlands. Other data in the report show that the central tendency for the departure is approximately 0.5 ft. Table 7 summarizes wet season water level data for the seven FP wetlands. With the exception of wetland FP2 the other six wetlands are not considered to be adversely affected by drawdown. The median wet season water levels, normalized to the wetland's margin elevation, show that except for FP2, the median wet season water level in the FP wetlands approximates the margin elevation. The average of the departure for these six wetlands is – 0.03 ft. In contrast the departure value for FP2 is 0.56 ft.

The wetland drawdown constraints used in *Water 2020* are defined by wetland type. Wetland FP2 is a freshwater marsh with fringing stands of cypress. Under the Water 2020 wetland drawdown constraint for freshwater marshes and cypress swamps are the same. Thus the maximum allowable drawdown for the FP2 wetland would be 0.55 feet under steady state conditions. This value is almost exactly the wet season central tendency departure of 0.56 ft measured for this wetland. Thus, the drawdown at FP2 is close to the Water *2020* threshold of unacceptable harm. The ecological conditions described by the authors indicate that it is at or close to the threshold of unacceptable change. The authors specifically conclude that water table drawdown in the vicinity of wetland FP2 has likely resulted in some alteration of plant and animal communities and loss of some wetland function.

SWFWMD

Significant Harm

As used in permitting, SWFWMD defines "significant harm" as a significant change in the wetland system determined through targeted ecological benchmarks, such as changes in dominant vegetative species and soil subsidence. Examples of the development and application of MFLs in SWFWMD are described below.

Cypress Wetland MFL for Northern Tampa Bay

SWFWMD established minimum levels for isolated cypress wetlands as a median pool elevation of 1.8 ft below normal pool (NP) elevation. This value was determined through hydrological and ecological evaluations of 36 isolated cypress swamps, each of which had six or more years of stage data. SWFWMD assumed that maintaining hydrologic conditions protective of cypress swamps would in turn protect other types of wetlands within the landscape.

This analysis relied on the premise that a direct relationship exists between the ecological condition of a wetland and its hydrological conditions. The analysis found that four ecological parameters significantly correlate with the median stage elevation of the wetland:

- Succession – changes in vegetation zonation
- Weedy species – abundance of opportunistic invaders
- Soil subsidence – soil loss
- Shrubs - wetland indicator status of shrubs

The results indicated that stage duration curves could distinguish "healthy" wetlands from those that had been significantly harmed, or significantly altered, based on comparison to SWFWMD's adopted standard, the NP elevation. SWFWMD established the NP as a standard reference elevation to allow comparisons of stage-duration relationships among wetlands. The NP corresponds to the water level exceeded 10 percent of the time, or P10. SWFWMD used the median (P50) stage as the reference point to characterize the stage-duration curve for comparison with other wetlands. The bottom of the range of P50 values for "healthy" systems defines the threshold below which significant harm occurs (Figure 1). This threshold value has been calculated to be 1.87 ft below NP.

The data, methodology, and assumptions used in developing the cypress wetland minimum level were evaluated by a peer review panel, which reported that the procedures and analyses were generally reasonable, and proposed alternative approaches where deficiencies were identified.

Example of Application of Cypress Wetland MFL in Water Use Permitting (WUP)

SWFWMD has made extensive use of available site-specific hydrogeologic and ecologic data to assess the effects of proposed water supply development. The ongoing investigations for the proposed Cone Ranch Wellfield illustrate how the newly developed wetland MFL criteria may be applied in SWFMWD's water-use permitting process. Tampa Bay Water, the regional water supply authority for Hillsborough, Pinellas, and Pasco counties, intends to submit a water use permit (WUP) application in late 1999 for a new groundwater supply facility at Cone Ranch in northeast Hillsborough County. An appointed panel of experts is developing a scientific basis of review for this application. SWFWMD developed the MFL approach for wetland protection based on an analysis of measured wetland water levels in northwest Hillsborough County and Pasco County.

Wetland minimum level criteria are available only for isolated cypress wetlands, but because cypress wetlands are common in the southwest Florida landscape, SWFWMD used them to assess site-specific effects. After a series of MFL standard-setting workshops, SWFWMD adopted the guideline of a median (P50) water level 1.8 feet below the NP for isolated cypress wetlands as a threshold for significant harm, a threshold SWFWMD will evaluate every six years. Similar protection criteria for isolated herbaceous wetland water levels and minimum stream flow are not yet available.

SWFWMD has developed guidance on the methods to be used to assess potential wetland impacts associated with future water use permits. This guidance is included as Attachment 2. The following steps describe the process of evaluating the effects of ground water withdrawals on water levels in selected isolated cypress wetlands on Cone Ranch:

1. Tampa Bay Water initiated ecological wetland monitoring on the Cone Ranch in Water Year 1988. Water levels in cypress, marsh, and floodplain wetlands were monitored on a monthly basis through Water Year 1997, and biweekly since then. At each wetland selected for monitoring, a staff gage was installed near the wetland center, and a shallow piezometer was installed near the edge of the wetland.
2. From the total database of wetlands located within Cone Ranch, 16 isolated cypress wetlands were selected for analysis based upon wetland type and data record consistency. Shallow well and staff gage measuring point and grade elevations were surveyed to National Geodetic Vertical Datum (NGVD). Water elevations were referenced to NGVD.
3. NP elevations were set at each wetland based on biological indicators (e.g., cypress buttress inflection points, fetterbush root crowns on cypress stems, and adventitious rooting). NP elevations were then surveyed to NGVD.
4. From the water elevation data, stage-exceedance curves were prepared for all staff gages and wells. Median water elevations (P50) were calculated for all measuring stations for the period of record. The staff and piezometer P50 values were regressed to develop a relationship between changes in surface water levels in the wetland and changes in surficial aquifer water levels, as measured in the nearby piezometer.
5. The difference between the existing P50 and the minimum level (ML) (NP-1.8 feet) was determined for each wetland. This level was used as an estimate of the potentially allowable drawdown in wetland water elevations.
6. A computer model, the Cone Ranch Integrated Surface and Ground Water Model (ISGW), is being used by a Tampa Bay Water contractor to predict drawdowns in the Floridan and surficial aquifers at the ranch for various pumping scenarios. ISGW uses MODFLOW (groundwater) and HSPF (surface water) for its predictive capabilities. The model has recently completed an extensive calibration and review process for the Cone Ranch area.
7. Based on the predicted surficial aquifer water level changes resulting from pumping scenarios, changes to the wetland stage duration were calculated using the regression relationships described in step 3.

8. The predicted wetland water level changes are then compared to the allowable drawdowns (step 6). Modeled water level changes that extend below the wetland ML are considered to exceed the threshold for significant harm. Subsequent modeling efforts are then used to minimize the extent and magnitude of ML exceedance.

Southern Water Use Caution Area (SWUCA)

SWFWMD Governing Board established the Southern Water Use Caution Area (SWUCA) in 1992 to include all of Manatee, Sarasota, Hardee, and DeSoto counties and portions of Hillsborough, Charlotte, Polk, and Highlands counties. Portions of SWUCA in Polk County are within model domain of Work Group Area 1 of SJRWMD. SWFWMD is currently developing a revised SWUCA management plan intended to meet the water supply needs of the region while protecting the water resource and related natural systems, although these planning efforts do not incorporate wetland protection criteria. The stated objectives of the management plan are (1) to minimize saltwater intrusion to protect the ground water system as a supply and (2) to minimize the effect of surface and ground water withdrawal on lake levels to protect lake functions. SWFWMD will develop and apply MFLs for the Floridan aquifer and selected lakes in support of these goals. The established lake regulation levels are not MFLs. There is no indication at present that SWFWMD intends to develop wetland protection criteria or formal wetland MFLs for SWUCA.

Discussion

The three water management districts (WMDs) employ a variety of approaches for the development and application of MFLs and other types of wetland protection limits (Table 2). Long-term hydrologic and ecological data are limited for most wetland and aquatic systems. Where sufficient monitoring records exist to calibrate a surface water model, or extensive monitoring records exist, such as in the Water Conservation Areas (WCAs) and Everglades National Park (ENP), it is possible to use statistical hydrologic analyses combined with ecological data to develop site-specific MFLs. However, wetland protection criteria used in planning efforts like *Water 2020* are typically developed using more general approaches that incorporate the best available data. Within each WMD more than one method for providing for wetlands protection in water use planning and permitting has been applied.

The use of different methods within and between WMDs for different planning areas make direct comparative analyses difficult. For example, some minimum levels are set for mean annual conditions, while others are set for extreme, infrequently occurring events. Each of these single level methods would protect different structural and functional components of the community and are not readily comparable.

One solution to this dilemma would be to establish a standardized set of multiple levels for the full range of flow events. An array of MFLs can be set to address a full regime of hydrologic events; each tied to temporal and spatial requirements of the larger ecosystem and its component subsystems. SJRWMD applied this flow regime approach to set MFLs for the Wekiva River. The Wekiva River MFL flow regime consists of five events, recognizing that natural systems must experience a variety of flows and/or levels to maintain biological communities and overall environmental health. The Wekiva MFL approach is based on two key assumptions: (1) that a flow regime rather than a single flow value is required to protect the key functions of the river system, and (2) that for each flow condition within the regime, specific ecological benchmarks can be used to define stage, flow duration and recurrence interval. For the Wekiva MFL the flow regime includes the following five flow events with their respective ecosystem protection goal:

- **Minimum infrequent high**—complete inundation of riparian wetlands to support ecological processes of transport of sediments, detritus and nutrients
- **Minimum frequent high**—saturation or shallow flooding of hydric hammock community to serve the habitat and life cycle needs of the stream biota that use the floodplain habitat for feeding, reproduction and refuge
- **Minimum average**—water table sufficient to sustain riparian hydric soils needed to support floodplain biota and impede encroachment of upland plant species
- **Minimum frequent low**--water levels sufficient to allow boat or canoe passage without damage to sensitive eelgrass beds located in shallow riffles. Level protects eelgrass beds and associated periphyton community, which form the basis of the food chain.
- **Minimum infrequent low**—maintain fish passage and health of eelgrass beds to provide refuge habitat for recovery from severe low-flow conditions during extreme drought

The *Water 2020* wetland constraint values can be directly compared to impact thresholds derived in key wetland hydrology studies by SFWMD and SWFWMD. Specifically the Water 2020 constraint values compare very favorably to results of SFWMD's isolated wetland study, and SWFWMD's cypress wetland MFL. The three are remarkably similar in their definition of impact or harm, and in their threshold drawdown values triggering harm for average conditions.

As already noted in the discussion of SFWMD's isolated wetland study, the median wet season water level for an adversely impacted marsh/cypress dome at the Flint Pen study site is depressed 0.56 ft relative to unaffected wetlands. The threshold drawdown for this type of wetland under the Water 2020 criteria is 0.55 ft for steady state conditions.

The wetland drawdown limit established by the SJRWMD and SWFWMD's cypress wetland MFL yield comparable values for long-term, steady state conditions, although the WMDs developed and implement the criteria differently. The SWFWMD MFL for cypress wetlands is a median pool elevation of 1.8 ft below NP (P10). SWFWMD determined the mean P50 value for cypress swamps to be 1.0 ft below NP elevation; therefore under steady state conditions, the maximum allowable median value would be 0.8 feet below P50 for a typical cypress swamp. This steady state drawdown estimate is close to the wetland constraint value developed for *Water 2020*. *Water 2020* established a maximum water level drawdown relative to the mean water level (P50), which is 0.55 ft for a cypress swamp (Table 4).

Another example of a consistent planning application among WMDs is the use of GIS screening. The GIS screening method that SFWMD will apply to the Kissimmee Basin Plan is similar to the GIS approach used by SJRWMD for its 1994 Needs and Sources Assessment (Vergara 1994). However, the SFWMD GIS screening method does not use a numerical constraint value, as was developed and used by SJRWMD.

In addition to similarities in threshold drawdown value, SFWMD, SWFWMD and SJRWMD use changes in dominant vegetative species as ecological benchmarks for evaluating unacceptable impacts and significant harm. However, SJRWMD developed criteria as maximum allowable mean drawdown values to be used in water supply planning, whereas SFWMD and SWFWMD determined their criteria using monitoring data, which they apply to resource regulation, but not to planning.

Insufficient data are available to compare the level of protection provided by the SFWMD narrative rule criterion with that provided by the SJRWMD and SWFWMD wetland protection criteria.

Summary

General Issues

The three WMDs typically employ four approaches to develop resource protection criteria:

1. Statistical hydrology
2. Statistical inference
3. Maximum drawdown criteria; and
4. GIS screening for resource areas at risk.

The approaches are listed in order of decreasing strength of their supporting data, the long term monitoring record. The WMDs are consistent in how they develop protective criteria within each of the four methods

Because each approach utilizes different data sources, comparison is often difficult. Examples of the range of conditions are:

- Minimum levels defined as a drawdown amount along with a duration and return frequency are difficult to compare with drawdown limits developed under steady state conditions. Specifically, different approaches may protect wetland ecosystems from different events, the Everglades MFL protects for extreme, infrequently occurring events while the *Water 2020* wetland constraint seeks to protect for a steady state condition. Comparing these two criteria is an "apples to oranges" exercise.
- The impact assessment done by SFWMD for the wetlands in the Flint Penn study area shows that the threshold of an adverse effect of water table drawdown occurs with a 0.56 ft depression of the median wet-season water level for a freshwater marsh. The *Water 2020* drawdown threshold for a freshwater marsh is 0.55 ft.
- The SWFWMD's cypress wetland minimum level can be described for steady state conditions and therefore has a means of comparison to the *Water 2020* wetland constraint. For steady state conditions the two approaches yield very similar water level decline constraints of 0.55-ft and 0.8-ft, respectively.
- Water resource constraints, such as the 0.5-ft lake level drawdown constraint for the steady-state condition used in *Water 2020*, can be compared in a general way with the *Water 2020* wetland constraints. The two are more or less the same value, because the wetland values are within a narrow range of 0.5-ft.
- *Water 2020* wetland constraints can be compared with triggers used to identify likelihood of harm in GIS screening methods. In fact, steady state drawdown

constraints can be used in GIS screening as the indicator of potential likelihood for harm at a coarse, regional scale.

SJRWMD

For some recent planning efforts, such the 1994 Needs and Sources Assessment and 1998 Water Supply Assessment, SJRWMD utilized GIS screening to identify areas within which wetlands may be at risk under projected groundwater withdrawals. Wetland protection criteria are a critical part of the *Water 2020* planning process. While MFLs are used where available, the SJRWMD approach to determining wetland resource protection criteria in *Water 2020* planning was driven by the scarcity of long-term monitoring data. As a result, drawdown limits were estimated by ecosystem type under long-term steady state conditions. SJRWMD took a districtwide approach to developing water resource protection criteria for use in the *Water 2020* planning process. An essential element of the *Water 2020*'s uncertainty management plan is the development and implementation of a districtwide adaptive water resource-monitoring program.

SFWMD

SFWMD does include wetland protection in its water supply planning efforts. The type of constraint used is determined by the availability of long term monitoring data. SFWMD has developed a regional wetland MFL for the Everglades and Lake Okeechobee. This criterion can be incorporated into models used in water supply allocation and water resource management. For its Kissimmee Basin planning area, SFWMD applies a GIS screening approach. For the UEC planning area, SFWMD applies a default minimum level for the 1-in-10-year drought condition. SFWMD is using the results of its isolated wetland study to guide the development of wetland drawdown criteria.

SWFWMD

SWFWMD is not currently applying wetland protection criteria to water supply planning. However, for the Northern Tampa Bay Area, SWFWMD developed a minimum level for cypress wetlands. SWFWMD applies this minimum level through the WUP, but does not use the level in its water supply planning efforts. Wetland drawdown limits for SWFWMD's Northern Tampa Bay and the SJRWMD wetland constraint are approximately the same for cypress wetlands. Under long-term steady state conditions, SWFWMD's minimum level for cypress wetlands is generally similar to the wetland drawdown value SJRWMD developed for its *Water 2020* process. For the SWUCA, SWFWMD plans to develop and apply MFLs for salt-water intrusion and lake levels in its planning process, but does not anticipate development and use of wetland MFLs or constraints.

Recommendations

This review makes the following recommendations to begin forging consistency in terms of wetland protection in water supply planning efforts:

1. Verify observations, interpretations, and conclusions of this Technical Memorandum through review by staff from the three districts.

2. Clearly define unacceptable impacts and harm for planning and permitting processes respectively. In order to have consistent levels of protection this definition should be generally uniform among and between WMDs. There is general agreement in the definition of unacceptable impact/harm between and among the SFWMD isolated wetland study, the SWFWMD cypress MFL, and *Water 2020* wetland constraints.
3. Develop interdistrict consensus as to what constitutes a resource-impact threshold. Beyond merely defining unacceptable impact/harm, the biological changes that indicate that an unacceptable impact/harm has occurred must be stated as clearly possible.
4. Develop a unified protocol for approaching resource protection in the water supply planning process. This process must recognize the limits of available data and sources of uncertainty in ground water and surface water models and other predictive tools. Clearly, a toolbox approach is needed, because the amount and quality of monitoring data are the limiting factor.
5. Develop research efforts focused on reducing the level of error in model parameters and on reducing the number of assumptions used in the prediction equations and models. Uncertainty is inherent in planning (predicting the future) and is generated in part by the level of error in the data used in prediction, and by assumptions substituted for data.
6. Implement and/or refine district-wide water resource monitoring programs. The lack of long term monitoring data limits the development of MFLs which is critical to successful planning, permitting, and overall resource management efforts.
7. Develop MFLs for wetland systems as the period of record for monitoring becomes sufficient (5 or more years).
8. Adopt an uncertainty management plan (UMP) for planning efforts associated with any resource protection criteria used in water supply planning. The UMP should define: (1) the current, practicable, acceptable level of uncertainty for estimates used in planning and permitting; (2) the categories and magnitude of uncertainty by source; and (3) approaches for information gathering and monitoring targeted at reducing the uncertainty of key estimates used in planning, permitting, and rule-making processes. This approach has been embraced by *Water 2020*.
9. Incorporate adaptive management as the key organizational paradigm for moving forward with water resources protection tools and efforts in the water supply planning and permitting.

References

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Kinser and Minno. 1995. *Estimating the Likelihood of Harm to Native Vegetation from Ground Water Withdrawals, St. Johns River Water Management District*. Technical Publication SJ95-8. Palatka, FL.

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Wetland Drawdown Criteria. South Florida Water Management District. West Palm Beach, Florida.

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TABLE 1
Information Sources

District	Personnel Interviewed	Documents Reviewed*
SFWMD	Mark Ellsner, Larry Pearson, Chris Sweazy, Dave Swift	DRAFT Conceptual Plan: *Mapping Vulnerability of Wetlands from Floridan Aquifer Withdrawals*, Kissimmee Basin Planning Area
		DRAFT *Wetland Protection CUP Criteria*, February 17, 1999.
		DRAFT, LEC2020 Plan, Alternative Evaluation and Design Cycles, February, 1999.
		DRAFT Proposed Minimum Water Level Criteria for Lake Okeechobee, the Everglades, and the Biscayne Aquifer within the SFWMD, July 8, 1998.
		DRAFT *Technical Support for Development of Wetland Drawdown Criteria for Florida's Lower West Coa*st, Water Resources Evaluation Department, January 27, 1995.
		DRAFT D.T. Shaw and A.E. Huffman. *Hydrology of Isolated Wetlands of South Florida: Results of 1997-98 Monitoring and Data Analysis and Guidance for Developing Wetland Drawdown Criteria*. January 2000
		Hydroperiod Conditions of Key Environmental Indicators of Everglades National Park and Adjacent East Everglades Area as Guide to Selection of an Optimum Water Plan for Everglades National Park, *Florida,* March 1990.
SJRWMD	*Water 2020* Project Team	*Constraints Handbook*, September 1998.
		Establishment of Minimum Flows and Levels for the Wekiva River System, 1994, Technical Publication SJ94-1
		Presentation materials from Constraints Subgroup, *Water 2020* Planning Process, 1998-1999.
		SJRWMD *Minimum Flows and Levels Project Plan*, June 1984.
		CH2M HILL *Alternative Water supply Strategies Investigation. Wetlands Impact, Mitigation, and Planning-level Cost Estimating Procedure*. 1996 Special Publications SJ-SP7.
		CH2M HILL *Water supply Needs and Sources Assessment – Alternative Water supply Strategies Investigation Wetlands Impact, Mitigation, and Planning-Level Cost Estimating Procedure,* July 1996.
SWFWMD	Clark Hull, Mark Barcelo	DRAFT *Establishment of Minimum Levels for Category 1 and Category 2 Lakes*, February 1999, Resource Conservation and Development Department.
		DRAFT *Establishment of Minimum Levels in Wetlands*, February 1999.
		Notices of Rule Development , Chapters 40D-2, 40D-4, and 40D-8, F.A.C., June 6, 1997.
		Determination of Minimum Flows and Levels for the Northern Tampa Bay Region, established by Rule40D-8 F.A.C, December 15,1997
		Peer Review Panel, *Report of the Scientific Peer Review Panel on the Data, Theories, and Methodologies Supporting the Minimum Flows and Levels Rule for the Northern Tampa Bay Area*, *Florida*, August 3, 1999.
		Biological Research Associates, Summary Statistics and Stage Duration Curves for Reference Wetlands, 1997.
		DRAFT *An Analysis of Hydrologic and Ecological Factors Related to the Establishment of Minimum Flows for the Tampa Bypass Canal at Structure 160*. February 9, 1999.
		Southern Water Use Caution Area Information Report, April 1998.

TABLE 1
Information Sources

District	Personnel Interviewed	Documents Reviewed*
		Southern Water Use Caution Area – Conceptual Management Strategy, September 1998.
		Analysis of Water Level Indicators in Wetlands: Implications for the Design of Surface Water Management Systems, Wetlands: Concerns and Successes, American Water Resources Association, September 1989.
		DRAFT *SOP for Establishment of Lake Levels within the Southwest Florida Water Management District*, May 1997.
		SDI Environmental Services, Inc., DRAFT *Methodology to Assess Potential Median Water-Level Changes in Isolated Cypress Wetlands at Cone Ranch,* October 1999, Prepared for Tampa Bay Water, Clearwater, Florida.

* All documents produced by the respective Water Management District, except where noted.

TABLE 2
Comparative Summary of MFL Approaches and Application

Management Approach	Rationale	Type of Criteria	Integration into Planning Process	Examples of Application	Comments
1) **<u>Statistical Hydrology</u>:** MFLs set through the statistical analysis of long-term modeled or observed hydrological records, using ecological benchmarks	Long-term data available Detailed topographic survey data are available Ecological "benchmarks" can be established and correlated with hydrologic data	Site-specific MFL hydrologic regime defined by stage, flow, duration, and recurrence. Detailed ecological surveys required to define ecological benchmarks and establish elevation datum for each. Single or multiple criteria can be set as appropriate to protect target ecological functions.	**<u>SJRWMD</u>** MFLs are incorporated as constraints directly into the east-central Florida and Volusia models. MFLs are re-evaluated based on feedback from the models, and used to guide the decision process. **<u>SFWMD (LEC)</u>** MFLs are incorporated into the models as specific objectives. The models yield performance indicators that measure how well alternatives meet these objectives, thereby providing the basis for modifications to alternatives. Several iterations are run. When the best alternative is selected, a Recovery Plan is developed to ensure compliance with MFLs. **<u>SWFWMD</u>** For SWUCA lake level and Floridan MFLs will be developed	**<u>SJRWMD</u>** Five minimum levels and flows were adopted for the Wekiva River and Blackwater Creek. **<u>SFWMD</u>** MFLs were established for Lake Okeechobee, the Everglades, and the Biscayne Aquifer based on long-term hydrologic and ecological data. **<u>SWFWMD</u>** Northern Tampa Bay	**Advantages:** More accurate assessment of hydrologic regime may result in less uncertainty in water supply planning and more effective resource management. Information gained through site-specific investigation, such as the correlation of hydrologic conditions with ecological parameters, will be useful in the development of more generalized criteria. **Disadvantages**: The long-term hydrologic and ecological data records required by this approach are not available for most water resources. Process may be prohibitively complex and/or costly for many surface water systems.
2) **<u>Statistical Inference</u>:** MFLs set by general criteria where long-term records are not available or not of sufficient duration for setting site-specific MFLs. Screening levels MFLs set using regional data, or are based on other MFLs in region.	MFL analysis extended from specific cases to general cases Site-specific long-term data not available for vegetation and hydrology Other MFL studies are available for use in setting general criteria	Maximum allowable drawdown (lakes or wetlands) or percentage reduction in existing average springflow	**<u>SJRWMD</u>** Default MFLs for some lakes and springs are incorporated as constraints directly into the east-central Florida and Volusia models. MFLs are re-evaluated based on feedback from the models, and used to guide the decision process. **<u>SFWMD</u>** MFLs interim MFLs can be incorporated into the models as specific objectives.	**<u>SJRWMD</u>** Springflow reductions will be limited to 15% based on low flow MFL set for major springs in the Wekiva Spring System. Springs are classified as having either high or moderate sensitivity to declines in ground water level. Generalized lake level constraint set at 0.5 ft change in the average lake level, based on average lake level declines of lakes with MFLs. **<u>SWFWMD</u>** Based on long-term evaluation of reference wetlands, MFLs for certain isolated, cypress dominated wetlands is set at 1.8 ft below Normal Pool elevation	**Advantages:** Generalized levels may allow level of interim protection until site specific levels are set. May be appropriate for systems where there is low potential for impacts from consumptive water use. Also, could be included as a best available estimate in an overall adaptive management plan. **Disadvantages**: Results in greater uncertainty than the statistical hydrology approach because of less refined assessment of hydrologic conditions.
3) **<u>Maximum allowable steady-state drawdown</u>:** MFLs set by steady-state water level drawdown based on analysis of mean annual hydrographs for individual wetland types	Limited hydrologic data available and ecological benchmarks not established Amount of steady-state drawdown required to alter hydrograph to community type indicative of drier conditions can be estimated	Maximum allowable drawdown (steady-state) set by individual wetland type. Drawdown limit set at a point that prevents significant change in type, nature and function of the wetland.	**<u>SJRWMD</u>** Key wetlands are assigned maximum drawdown values and serve as control points in the models. These control points are re-evaluated based on feedback from the models, and used to guide the decision process. **<u>SFWMD</u>** **NA** **<u>SWFWMD</u>** **NA**	**<u>SJRWMD</u>** Hydrologic thresholds were developed for major wetland types that, if violated, lead to successional changes resulting in the replacement of currently dominant species by those characteristic of drier community types. **<u>SFWMD</u>** NA **<u>SWFWMD</u>** NA	**Advantages:** Generalized levels may allow level of interim protection until site specific levels are set. Also, could be included as a best available estimate in an overall adaptive management plan. **Disadvantages**: Results in greater uncertainty than the statistical hydrology approach due to less refined assessment of hydrologic conditions. Also, a single drawdown value does not include a temporal element and is assumed to be protective throughout the year, which may or may not be valid for all systems. A particular wetland may be sensitive to minor hydrologic changes at given times of the year, to the extent that the community may change in response. Historically difficult to defend in permitting litigation.

TABLE 2
Comparative Summary of MFL Approaches and Application

Management Approach	Rationale	Type of Criteria	Integration into Planning Process	Examples of Application	Comments
4) <u>GIS Screening for Regionally Sensitive Areas</u>: MFLs are not set using this approach. Wetland areas determined to be most susceptible to harm are identified and mapped for eventual use in resource protection	Areas most at risk for harm resulting from water supply withdrawals are identified and mapped. Can be used as a tool for both resource protection and planning.	Greater restrictions on consumptive use, or more rigorous monitoring requirements may be established in these areas to insure protection of the resource.	**<u>SJRWMD</u>** Areas identified as being at risk are designated as control points in the regional models **<u>SFWMD</u>** Currently used in planning for Kissimmee River Basin **<u>SWFWMD</u>** **NA**	**<u>SJRWMD</u>** A GIS model was developed to estimate the likelihood of harm to native vegetative communities in the WMD resulting from ground water withdrawals. **<u>SFWMD</u>** Efforts are underway in the Kissimmee Basin Planning Area to map wetland areas vulnerable to impacts from ground water withdrawal. **<u>SWFWMD</u>** **NA**	**Advantages:** Identification of vulnerable areas may be used to limit the consumptive use of certain water resources, thereby protecting local wetland resources **Disadvantages:** Identification of sensitive areas alone does not insure resource protection.

TABLE 3
Definitions of Significant Harm

District	Application	Definition
SFWMD – protective of specific function	Limit of permittable water MFLs	Harm= Temporary harm, such that recovery will occur within 1 or 2 seasons Significant harm= Harm requiring multiple years for the water resource to recover Serious harm= Permanent or irreversible damage to the water resource
SJRWMD – protective of community type	Wetland constraint in water supply planning process	A change in wetland community types, such that if a maximum drawdown value is exceeded; dominant vegetative species are replaced by those characteristic of drier community types
SWFWMD – protective of community type	MFLs	A significant change in a wetland, as measured in reference wetlands by assessment of targeted ecological parameters

TABLE 4
SJRWMD Drawdown Values for Specific Wetlands Types

Wetland Type	Feet of Drawdown
Bay Swamp	0.35
River/Lake Swamp	0.35
Cypress Swamp	0.55
Mixed Forest	0.35
Freshwater Marsh	0.55
Saltwater Marsh	Not Used
Wet Prairie	0.35
Emergent Aquatic Vegetation	0.85
Submergent Aquatic	1.20
Mixed Scrub-Shrub	0.75
Non-Vegetated Wetland	1.20

TABLE 5
SFWMD Minimum Flows and Levels Criteria for Organic Peat and Marl Forming Soils Located within the Remaining Everglades

Area	Soil Type	Depth Below Ground (ft.)	Duration Below Ground (days)	Allowable Return Frequency (years)
Water Conservation Areas	Peat	1.0	30	1 in 5 to 1 in 7
Holey Land/Rotenberger	Peat	1.0	30	1 in 2 to 1 in 3
Shark River Slough (ENP)	Peat	1.0	30	1 in 6 to 1 in 10
Marl-Forming Wetlands Located within ENP	Marl	1.5	90	1 in 5

TABLE 6
SFWMD Wetland Categories

Characteristics	Type 1	Type 2	Type 3
Hydroperiod	Permanently inundated	Seasonally inundated	Temporarily inundated
Wet Season Water Depth (ft)	> 2	1-2	< 1
Community	Lakes, ponds, sloughs, rivers	Dome swamp, depression marsh	Wet prairie, hydric flatwoods
Soils	Peat or sand	Sand, often with muck deposits	Sand, marl
Landscape Position	Water	Depression	Flats

TABLE 7
Median wet-season water levels for isolated wetlands in the Flint Penn study area, Lee County.

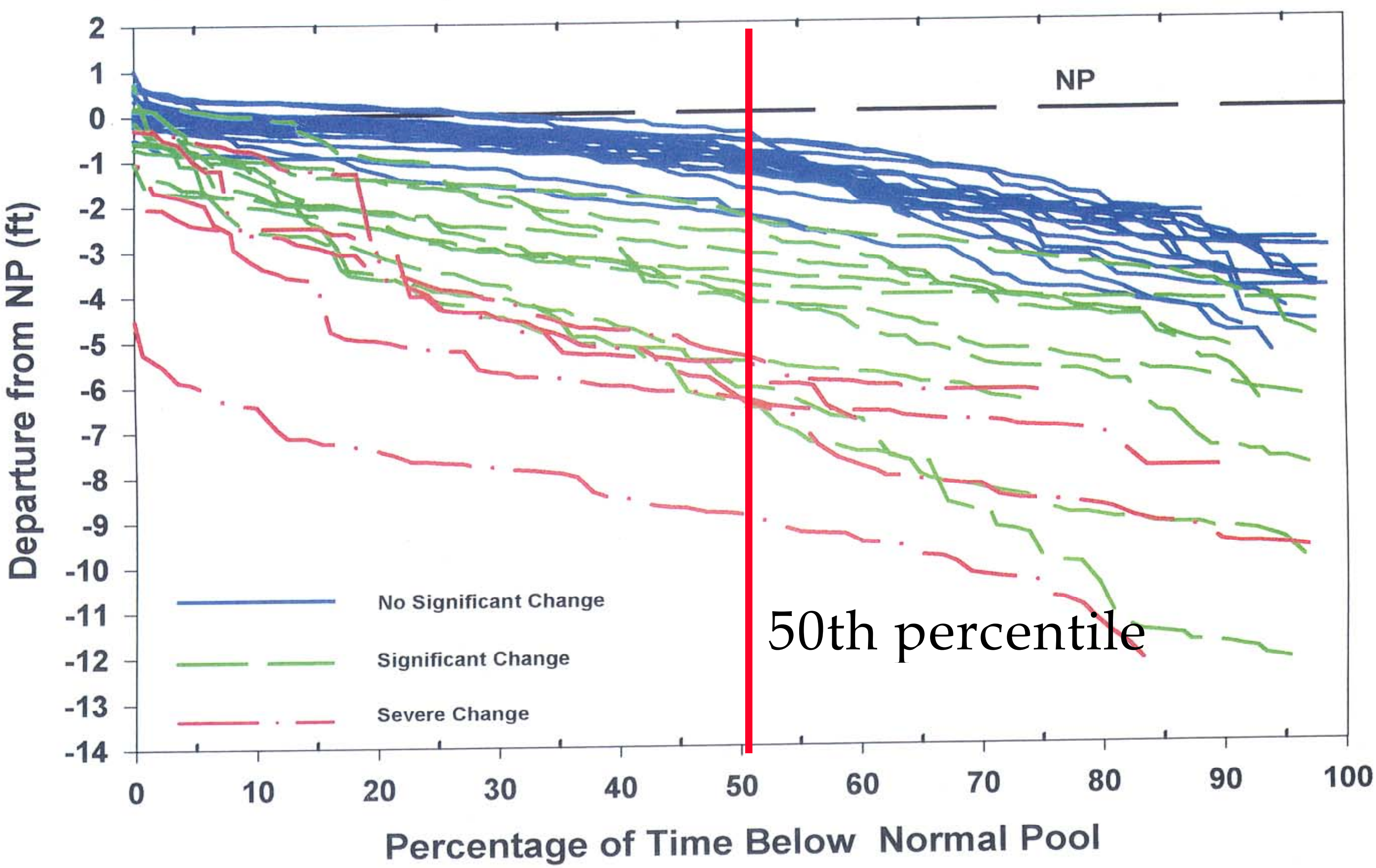
Wetland Site	Ecological Condition	Median Wet-Season Water Level (ft. NGVD)	Departure from Margin Elevation (margin – median)	Departure as Percentage of Total Wetland Relief (%)
FP2	Impacts from drawdown	18.04	0.56	21.5
FP3	Unaffected	17.16	0.24	7.1
FP4	Unaffected	16.90	-0.30	-10.0
FP5	Unaffected	17.07	-0.07	-2.5
FP6	Unaffected	16.82	-0.12	-4.6
FP7	Unaffected	16.59	0.11	3.5
FP8	Unaffected	16.72	-0.02	-0.8

Source: Shaw and Huffman (2000) Table G.3

TABLE 8
Draft wetland protection criteria recommended for use in isolated wetlands in the SFWMD.

Wetland Type	Dry Season	Wet Season
Type 1	Dry Season—Water table position should be limited so that a minimum standing water depth is maintained during a normal dry season to provide refuge for alligators and sustain aquatic conditions for fish and invertebrates. Surface water depth should not fall below the upper threshold for foraging by wading birds, or approximately 2 feet (Mahoney, 1997). The dry season water table should at no time drop below the bottom of the wetland.	Wet Season—Due to the large volume/depth of water in Type 1 wetlands, drawdown impacts during the wet season are considered unlikely. Performance standard should be based on maintaining aquatic productivity through adequate surface water depth.
Type 2	Dry Season—Drawdown should be limited so that the capillary fringe above the water table remains in contact with the ground surface of the wetland throughout a normal dry season. This standard will ensure that the wetland substrate remains saturated throughout the dry season.	Wet Season— Drawdown should be limited so that the median wet season surface water stage during a normal year stays within ± 10 percent of the wetland margin elevation to ensure adequate biological productivity and hydrologic connectivity with adjacent flatwoods. Water levels should equal or exceed margin elevation continuously for a duration of 90 days at least once each wet season.
Type 3	Dry Season—Minimum dry season water table position should be limited in normal year such that the subsequent hydroperiod is reduced no more than 20% due to delayed wetting.	Wet Season—Drawdown should be limited so that the wetland is inundated continuously for a period of at least 90 days during a normal wet season

Figure 1. SWFWMD Cypress Wetland MFL--Stage Frequency Hydrographs



Attachment 1

SFWMD—Draft Conceptual Plan for

Mapping Vulnerability of Wetland From Floridan Aquifer Withdrawal, Kissimmee Basin Planning Area

Draft Conceptual Plan

Mapping Vulnerability of Wetlands from Floridan Aquifer Withdrawals,

Kissimmee Basin Planning Area

Proposed Method of Addressing Potential Wetland Impacts

An important aspect of the water supply planning process involves identifying areas expected to have water resource problems related to the development of water supplies. In some areas of the Kissimmee Basin region, ground water withdrawals from the Floridan aquifer may potentially harm wetlands. Therefore, during the development of the Kissimmee Basin Water Supply Plan (KBWSP) it is proposed that harm to wetlands be addressed as one of the criteria that would possibly limit the availability of certain water resources in the future. This paper outlines the process to be used in the development of the KBWSP to address this criterion.

Methodology

The basic theory in evaluating possible wetland impacts is based upon two concepts: First, that a change in hydroperiod may cause harm to wetlands, and second, that this change may be caused by changes in water table due to underlying ground water withdrawals. The general approach to be used in this study will be to identify and map the location of existing wetlands and compare that information with those areas expected to have the highest potential for changes in the surficial aquifer system.

Due to the limitations of the ground water modeling effort, impacts to the surficial aquifer system will not be directly calculated. However, those factors involved in determining possible wetland impacts can be addressed in a non-quantitative means to estimate the vulnerability of given areas to this potential. The factors considered in this evaluation are the location of wetlands, thickness of the confining materials separating the Floridan and the surficial aquifers, and the predicted change in water level in the shallow aquifer. Each of these influence factors will be ranked and then delineated in map coverages using a geographical information system (GIS). NWI wetland locations will be combined with the latest land use/land cover information to create an updated wetlands location coverage. The resulting coverage will then be compared to estimated changes in water level within the Floridan system (from modeling effort) and thickness of confining materials shallow to identify those areas that are most susceptible.

Delineating potential wetland vulnerability is a three-step process. The three steps are:

1. Create the three GIS-based coverages needed to complete the evaluation
2. Assign ranking values for each coverage "Score Card"
3. Overlay coverages to create "Score Sheet" and assign high, medium or low ranking to resulting scores.

RANKING PROCESS

Determining the sensitivity of each of the factors requires development of "score card" based upon a ranking system for each of the three influencing factors. For example, the change in potentiometric levels in the Floridan may be ranked as high, medium or low based upon the amount of change predicted to occur. Likewise, the thickness of the confining units may be ranked according to the likelihood of transmitting the changes in the Floridan aquifer levels upward to the surficial aquifer.

The rankings of each factor will then be combined to create a "score sheet" or matrix for each wetland in the coverage. The resulting scores will be displayed as high, medium or low vulnerability to impacts.

GIS OVERLAY PROCESS

A GIS will be used to overlay ranked data about wetlands, soils, and changes in the water level. From an analysis of these data, a map of the relative vulnerability of wetlands from Floridan ground water withdrawals will be created. This map will display the three levels of vulnerability as different colors.

Other District Influences

Unlike the modeling efforts made for the KBWSP, the adjacent water management districts have created tools for the direct calculation of shallow aquifer impacts. The SJRWMD has pursued a similar approach to the one proposed here but has incorporated the calculated shallow water level changes in the methodology. In addition, they have taken the step of tying levels of harm to native vegetation to specified changes in water level (in inches). The SFWMD has a Memorandum of Understanding (MOU) with SJRWMD that facilitates the use of the East-Central Florida model for the Orange County area by both Districts. The SFWMD proposes to utilize the SJRWMD analysis for Orange County as a comparative tool to the results determined by this analysis.

The SWFWMD has not completed an effort of mapping wetland impacts in their analysis of the Lake Wales Ridge area. They have, however, related impacts to several lakes within their district to water table drawdowns. Their modeling efforts to date shows a decline in shallow aquifer levels which SWFWMD has interpreted as worsening an existing problem. SWFWMD is trying to establish minimum flows and levels on these lakes. It is the SFWMD's intent to tie our Floridan aquifer analysis to their modeling efforts to estimate any impacts we may be contributing along the Lake Wales Ridge area.

References

SFWMD and U.S. Army Corps of Engineers. 1997. Water Preserve Areas – Land Suitability Analysis. Draft documentation. SFWMD, West Palm Beach, FL. vari. pag.

SJRWMD. 1995. Estimating the Likelihood of Harm to Native Vegetative from Ground Water Withdrawals. Technical Publication SJ95-8. SJRWMD, Palatka, FL. 44 pp.

Attachment 2

SWFWMD—August 17, 1998 Guidance for Evaluation of Future WUP Applications with Potential Wetland Impacts

August 17, 1998

MEMORANDUM

TO: John W. Heuer, P.G., Deputy Executive Director, Resource Regulation

THROUGH: Paul W. O'Neil, P.E., Director, Technical Services

FROM: H. Clark Hull Jr., Chief Regulation Environmental Scientist, Technical Services
John M. Emery, Chief Regulation Environmental Scientist, Technical Services

SUBJECT: Evaluation of Future WUP Applications With Potential Wetland Impacts

Background

We have received questions regarding methods that the District will use to evaluate an application for a new water use following adoption of proposed rules 40D-2 and 40D-8. In particular, these questions are focused on the quantity of groundwater that the District can permit to be withdrawn without causing harm to water resources and the monitoring program that would be required to demonstrate compliance. One way to address these questions is to explain the approach that we are developing with Tampa Bay Water for the evaluation of the proposed Cone Ranch Wellfield, a site where potential wetland impacts are a concern.

Determination of a Permittable Withdrawal Quantity under Chapter 40D-2

Obtaining site specific information is the first step in determining a permittable withdrawal quantity. Pre-withdrawal site conditions are documented by locating wetlands and other surface waters, assessing wetland conditions, monitoring water levels, and collecting other relevent site specific hydrogeological and ecological data. Hydraulic head differentials, transmissivity and leakance values, and an estimate of groundwater flow patterns can be derived from aquifer pump tests[1] and included into modeling scenarios for various pumpage quantities. Predicted Floridan and surficial aquifer drawdown contours generated by the model for various pumping scenarios can then be transferred to aerial maps on which wetlands and other surface waters have been located.

For each pumping scenario, the location of drawdown contours relative to wetlands and other surface waters allows an approximation of the degree of impact that these resources may incur. For certain wetlands with sufficient water level information available, one can predict the specific effects of a modeled drawdown on those individual wetlands. For many wetlands, however, insufficient water level information exists to make such precise predictions. In these

[1]Regional values, when applicable, may be substituted for site specific information to model the effects of smaller proposed withdrawals.

cases, we are able to estimate the probability that an individual wetland will be adversely impacted by a predicted level of drawdown based on our knowledge of wetland water levels in the region and previous observations of wetland responses to reduced water levels.

Knowing the probability that an individual wetland will be adversely impacted by particular level of drawdown allows an estimation of the number of wetlands within a drawdown contour likely to be impacted. With this information, the applicant should be able to determine the total number of wetlands likely to be impacted under a given pumping scenario. This is the number of wetlands likely to require "tools" to prevent impacts.

Based on the anticipated number of wetlands likely to be impacted, an applicant must demonstrate reasonable assurance that these impacts can be prevented. In other words, one must show that sufficient tools are available at the specific withdrawal/impact site(s) to prevent harm. This demonstration by the applicant would include an inventory of available tools (e.g. ability to connect to a effluent re-use line, ability to install ditch blocks in drained wetlands, ability to use a proportion of groundwater for wetland hydration, etc.). An appropriate and permittable withdrawal quantity is determined from the model scenario which predicts a reasonable and beneficial groundwater yield while preventing adverse impacts (harm) to water resources.

Compliance Monitoring Under Chapter 40D-2

Adverse impacts to wetlands and other surface waters will be detected and prevented through implementation of an Environmental Management Plan (EMP) developed by the applicant and approved as part of the water use permit. The EMP will contain details regarding monitoring site locations, methods for collection and analysis of data, and procedures for implementation of prevention measures once impacts are detected. An EMP is also included in the Northern Tampa Bay Consolidated Wellfield Permit.

An EMP wetland monitoring program includes varying levels of water level and ecological assessments for all wetlands potentially affected by the proposed withdrawal. Brief inspections of a large number of wetlands will be performed to provide periodic "snapshots" of the pattern of wetland conditions. These brief inspections include employment of a Rapid Assessment Procedure intended to take less than 15 minutes per wetland. Certain representative wetlands are monitored more intensively so that wetland responses can be more completely understood and inferences can be made to the larger population of wetlands potentially affected by reduced water levels. Water levels in those intensively monitored wetlands will be recorded bi-weekly and detailed, quantitative data on vegetation and soils will be collected at least annually.

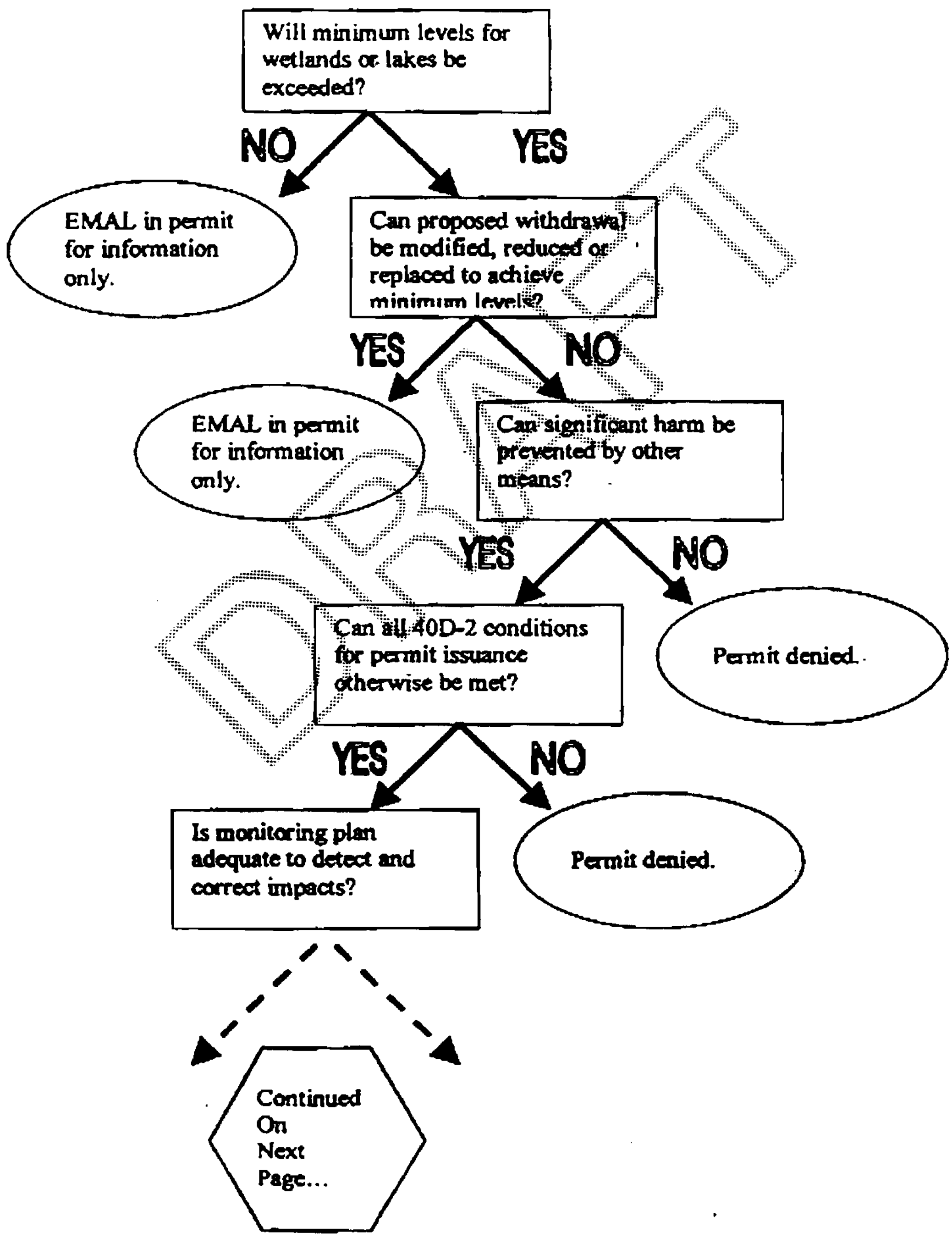
If, during the course of EMP monitoring, wet season water levels and hydroperiods begin to deviate from their normal range and duration to the extent that 40D-2 wetland performance standards are violated, or it can reasonably be predicted that performance standards will be violated, then prevention measures are implemented according to a sequence of preferences identified in the plan. This sequence will include reduced pumping, well rotation, reversal of previous drainage alterations, surface water diversion, supplemental hydration by sources other than groundwater (e.g., reclaimed water), and supplemental hydration with groundwater.

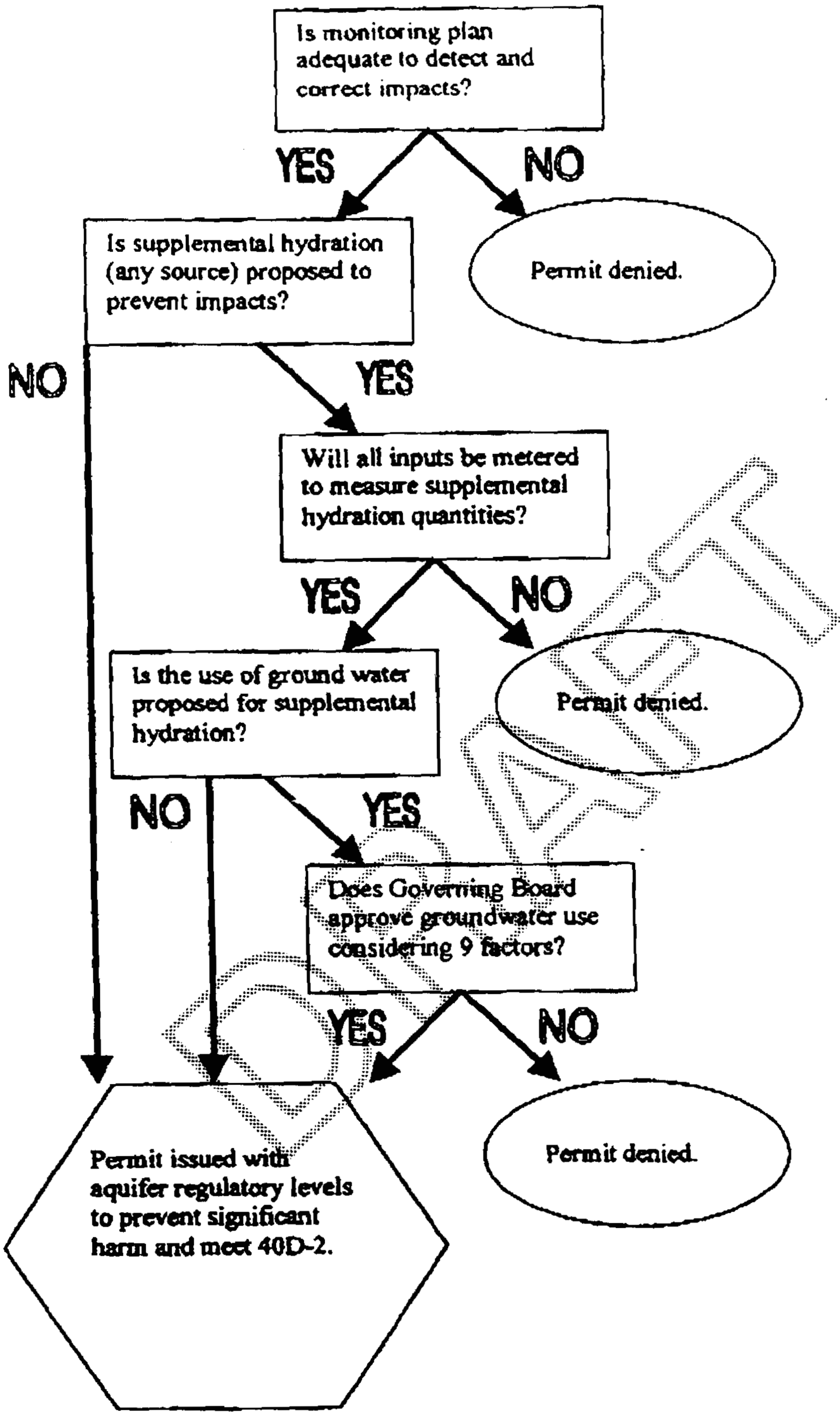
Chapter 40D-8 FAC Minimum Flows and Levels sites

Wetlands at Cone Ranch for which minimum wetland levels have been established in Chapter 40D-8 will be incorporated into the EMP monitoring program. Water levels will be recorded bi-weekly at these sites in addition to other representative wetlands with bi-weekly monitoring. Impacts to MFL "sentry" wetlands at Cone Ranch cannot be used as the sole determinant of the maximum drawdown allowable under WUP rules. Rather, all of the EMP monitoring sites will be evaluated based upon the Performance Standards found in Chapter 40D-2 FAC Basis of Review. MFL sentry sites serve more as regional indicators to quantify the probable level of harm expected from a proposed or ongoing withdrawal and to quantify the level of prevention measures anticipated as necessary to prevent harm from occurring.

copy: Gene Heath
Dave More
Ken Weber
Bob Peterson

MFL evaluation process following a submittal of a permit application for a specific withdrawal quantity in an area currently above minimum levels:




Is monitoring plan adequate to detect and correct impacts?
YES
NO
Is supplemental hydration (any source) proposed to prevent impacts?
Permit denied.
NO
YES
Will all inputs be metered to measure supplemental hydration quantities?
YES
NO
Is the use of ground water proposed for supplemental hydration?
Permit denied.
NO
YES
Does Governing Board approve groundwater use considering 9 factors?
YES
NO
Permit issued with aquifer regulatory levels to prevent significant harm and meet 40D-2.
Permit denied.
DRAFT