Appendix I

Potential Adverse Change to Wetland Function – Methodology and Results

Technical Memorandum
North Florida Regional Water Supply Plan
Potential Adverse Change to Wetland Function – Methodology and Results
January 3, 2017

Introduction

As part of North Florida Regional Water Supply Plan (NFRWSP) development, the St. Johns River Water Management District (SJRWMD) and Suwannee River Water Management District (SRWMD)(Districts) assessed the extent to which water resources and related natural systems may be impacted by projected increases in water use through 2035. Adverse Change to wetland function is one component of the water resource assessment, along with saltwater intrusion/upwelling, minimum flows and levels (MFLs), priority waterbodies without MFLs, and water reservations. In addition to serving as an educational tool, this information helps guide the delineation of water resource caution areas and the formulation of project options.

This technical memorandum details the methods used to assess wetlands in the NFRWSP area associated with projected water demand at the planning horizon (2035) and the assessment results. Although significantly altered wetlands have occurred in the past due mainly to farmland conversion and urbanization, wetlands can be altered by factors other than groundwater withdrawals (e.g., modification of surface water hydrology), therefore, this analysis focused exclusively on assessing the adverse change to existing wetlands due to projected increases in water demand. The outcome of this assessment was used with other factors in determining whether traditional water supply (i.e., fresh groundwater) sources are sufficient to meet future water demands.

Stakeholder Advisory Committee Recommendation

District staff briefed the North Florida Regional Water Supply Partnership Stakeholder Advisory Committee (SAC) on the wetlands assessment methodology in March 2014 and December 2015. The Districts received a favorable recommendation on the methodology from the SAC on January 25, 2016.

Background

In previous SJRWMD Water Supply Assessments, the probability of adverse change in wetland functions was determined using variations of the Kinser-Minno method (Kinser and Minno, 1996; Kinser et. al., 2003). Changes to the analysis timeframe and minor soil/vegetation classification revisions have occurred over time with changes in the planning horizon, geographic scope of individual planning projects, and improvements to the input data and groundwater models. In 2008, a modified Kinser-Minno method (Dunn et. al., 2008) was developed for assessing the adverse change to wetland function in areas where the upper Floridan aquifer (UFA) is unconfined. The modified method includes two additional steps that effectively remove those areas where the vegetative community and the Surficial Aquifer System (SAS) are not hydraulically connected to the UFA and therefore would not be

influenced by changes in UFA levels. With some minor modifications discussed below, the Kinser-Minno method and the modified Kinser-Minno method were used for the NFRWSP wetland assessment in the confined and unconfined portions of the planning area, respectively. For purposes of the NFRWSP, the terms sensitive vegetation and wetland are considered interchangeable as the majority of the vegetation community types that are highly sensitive to SAS drawdowns are wetlands (see Table I2).

Both methods use a geographic information system (GIS) model to conduct a matrix analysis of soil permeability, sensitivities of plant communities to dewatering, and projected declines in the SAS to estimate the potential adverse change to individual plant communities that may occur if future water demands were met with traditional sources. The modified method adds depth from land surface to the potentiometric surface of the unconfined UFA to the final matrix. The results of the GIS analyses highlight wetlands with low, moderate and high potential for adverse change due to potential declines in the SAS from 2009 (the reference year) to 2035.

Data and Information Sources

GIS data used in the wetland analysis included:

1. 2012 Soil Survey Geographic Database for Florida (SSURGO)
2. 2009 Land Cover/Land Use GIS Data Layer, SJRWMD
3. 2010 Land Cover/Land Use GIS Data Layer, SRWMD
4. Unconfined Floridan Aquifer System Boundary, United States Geologic Survey (Miller, 1986)
5. 2008 Digital Elevation Model for the State of Florida, Florida Department of Environmental Protection (FDEP)
6. May 2014 UFA Potentiometric Surface GIS Data Layer, SJRWMD

Soil permeability classifications were derived from the county soil survey for each county (Title 430-VI, United States Department of Agriculture, Soil Conservation Service). Vegetation type classifications were derived from the Land Cover/Land Use GIS database and classified based on technical expertise from District wetland scientists (P. Kinser, SJRWMD; M. Minno, SRWMD).

Soil Permeability Classification

Soil permeability describes the capacity of a soil to allow fluids to pass through it. For purposes of the wetlands assessment, permeability is a key component because it dictates how quickly an area of sensitive vegetation becomes dewatered when the water table declines in elevation.

The Natural Resources Conservation Service (NRCS) provides estimates of the inches of water per hour that can move downward through a saturated soil based upon laboratory measurements. For the NFRWSP, NRCS permeability classes in Florida (U.S. Department of Agriculture, NRCS, National Cooperative Soil Survey) were grouped in high, moderate, or low categories of drawdown sensitivity, as shown in Table I1.

Table I1: Soil Permeability Classification (SCS)

SCS Permeability Class	SCS Permeability Rate (inches/hour)	NFRWSP Class
Very Slow	Less than 0.06	Low sensitivity to drawdown (1)
Slow	0.06 – 0.2	
Moderately Slow	0.2 – 0.6	
Moderate	0.6 – 2.0	Moderate sensitivity to drawdown (2)
Moderately Rapid	2.0 – 6.0	
Rapid	6.0 – 20	High sensitivity to drawdown (3)
Very Rapid	Greater than 20	

Vegetation Type Classification

The extent to which vegetation types are sensitive to SAS drawdown varies dramatically. Hydric vegetation communities such as swamps are highly sensitive to water table elevation, whereas more xeric communities such as sand pine are much less affected by adverse changes in the water table.

Input data for vegetative communities included the land use/land cover GIS layers from SJRWMD (2009) and SRWMD (2010/2011; FDEP Bureau of Watershed Restoration). Both data sources rely on digitized aerial photography, with classifications derived from the Florida Land Use and Cover Classification System.

For purposes of the NFRWSP, polygons in the land cover/land use layers were classified as "high, moderate or low" sensitivity to drawdown, relative to their dominant vegetation type, per Table I2.

Table I2: Classification of Sensitive Vegetation Types

Land Use Code	**NFRWSP Class** 1 = Low Sensitivity 2 = Moderate Sensitivity 3 = High Sensitivity
4100: Upland Coniferous Forests	1
4110: Pine Flatwoods	2
4120: Longleaf Pine - Xeric Oak	1
4130: Sand Pine	1
4140: Pine - Mesic Oak	1
4190: Hunting Plantation Woodlands	1
4200: Upland Hardwood Forests	2
4210: Xeric Oak	1
4270: Live Oak	1
4271: Oak - Cabbage Palm Forests	1
4280: Cabbage Palm	2
4340: Upland Mixed - Coniferous / Hardwood	2
4400: Tree Plantations	1
4410: Coniferous Plantations	2
4420: Hardwood Plantations	1
4430: Forest Regeneration Areas	2
6100: Wetland Hardwoods Forests	3
6110: Bay Swamps	3
6111: Bayhead	3
6120: Mangrove Swamps	1
6130: Gum Swamps	3
6140: Titi Swamps	3
6150: Stream and Lake Swamps (bottomland)	3
6170: Mixed Wetland Hardwoods	3
6172: Mixed Shrubs	3
6180: Cabbage Palms	3
6181: Cabbage Palm Hammock	3
6182: Cabbage Palm Savannah	3
6200: Wetland Coniferous Forests	3
6210: Cypress	3
6215: Cypress- Domes/Heads	3

Table I2: Classification of Sensitive Vegetation Types

Land Use Code	**NFRWSP Class** 1 = Low Sensitivity 2 = Moderate Sensitivity 3 = High Sensitivity
6216: Cypress - Mixed Hardwoods	3
6220: Pond Pine	3
6240: Cypress - Pine - Cabbage Palm	3
6250: Hydric Pine Flatwoods	3
6260: Pine Savannah	3
6300: Wetland Forested Mixed	3
6400: Vegetated Non-Forested Wetlands	3
6410: Freshwater Marshes	3
6411: Freshwater Marshes - Sawgrass	3
6420: Saltwater Marshes	1
6430: Wet Prairies	3
6440: Emergent Aquatic Vegetation	3
6460: Mixed Scrub-shrub Wetland	3
6500: Non-Vegetated Wetlands	3
6510: Tidal Flats	1
6520: Shoreline	1
6530: Intermittent Ponds	3
6600: Salt Flats	1

Potential for Future Impacts

A key component of the wetlands assessment is the magnitude to which the projected increase in future groundwater withdrawals through the planning horizon will affect the water table elevation of the SAS throughout the planning region and, thus, potentially alter wetlands. For these steps in the analysis, each polygon was assigned a potential for impact ranking through combination of the soil permeability and vegetation type classes (Table I3). This potential for altered classification assigns high and medium rank to only those vegetation communities that have a high sensitivity to water table drawdown, the wetland communities. The North Florida-Southeast Georgia regional groundwater model (NFSEG) was used to calculate the change in SAS elevation (i.e., SAS drawdown) between the reference year (2009) and 2035 for each model grid cell. Surficial Aquifer System drawdown for each vegetation polygon was derived from the most applicable model grid cell. The change potential classification and projected drawdown in the SAS were combined into a polygon-specific potential for wetland change classification (Table I4). Surficial aquifer drawdown breakpoints were derived from published literature and unpublished data, as

discussed in the Water 2020 Constraints Handbook (CH2M Hill, 1998). This assessment provided an estimate of magnitude (acres), degree (moderate vs. high), and spatial distribution of the potential of future adverse change to wetland functions throughout the portion of the NFRWSP area where the UFA is confined.

Table I3: Potential for Wetland Change Classification (Integrated Soil Permeability and Vegetation Type Sensitivity)

	Vegetation Sensitivity Classification		
Soil Permeability Classification	*High*	*Moderate*	*Low*
High	High	Low	Low
Moderate	Moderate	Low	Low
Low	Low	Low	Low

Table I4: Potential Future Wetland Change Classification (Confined)

	Potential Future Wetland Change Classification		
Projected SAS Drawdown	*High*	*Moderate*	*Low*
> 1.2 ft.	High	High	Low
0.35 – 1.2 ft.	High	Moderate	Low
< 0.35 ft.	Low	Low	Low

Modified Kinser-Minno Method – Additional Steps

There are two additional steps in the modified methodology for assessing adverse changes to wetlands in areas where the Floridan aquifer is unconfined. A spatial representation of the unconfined areas of the Floridan aquifer was used to extract a new dataset showing only those polygons identified as having a high and moderate potential for change (Table I4) within the unconfined portions of the NFRWSP area. Depth from land surface to the 2014 Floridan aquifer potentiometric surface was calculated and categorized into three 15-ft intervals (Table I5). The initial potential adverse change designation of wetland polygons (Table I4) was then reclassified based on the depth to the Floridan aquifer.

Table I5: Potential Future Wetland Change Classification (Unconfined)

	Potential Future Wetland Change Classification (Confined)		
Depth from Land Surface to Unconfined Aquifer	*High*	*Moderate*	*Low*
0 – 15 ft.	High	Moderate	Low
15 – 30 ft.	Moderate	Low	Low
>30 ft.	Low	Low	Low

Results

When assessing potential adverse change to existing wetlands due to 2035 conditions solely within the NFRWSP area (all other areas in NFSEG domain held at 2009 conditions), it is estimated that 20,175 acres of wetlands have a high or moderate potential of being altered (Table I6, Figure I1). The estimated acreage increases to 24,083 acres when assessing alteration potential using 2035 demand conditions within the entire NFSEG domain (Figure I2).

Table I6: Wetland Acreage Identified as Having a Moderate or High Potential for Adverse Change

County	**WMD**	**Potential Wetland Adverse Change at 2035 Conditions (NFRWSP Area) (acres)**	**Potential Wetland Adverse Change at 2035 conditions (NFSEG Domain) (acres)**
Alachua	SJR	1,392	1,615
Alachua	SR	209	220
Baker	SJR	0	0
Baker	SR	0	0
Bradford	SJR	8	8
Bradford	SR	116	116
Clay	SJR	3,879	4,063
Columbia	SR	54	54
Duval	SJR	955	1,124
Flagler	SJR	3,532	4,197
Gilchrist	SR	798	1,103
Hamilton	SR	998	2,586

Table I6: Wetland Acreage Identified as Having a Moderate or High Potential for Adverse Change

County	WMD	Potential Wetland Adverse Change at 2035 Conditions (NFRWSP Area) (acres)	Potential Wetland Adverse Change at 2035 conditions (NFSEG Domain) (acres)
Nassau	SJR	389	471
Putnam	SJR	5,392	5,766
St. Johns	SJR	63	63
Suwannee	SR	13	18
Union	SR	2,377	2,699
Total		**20,175**	**24,103**

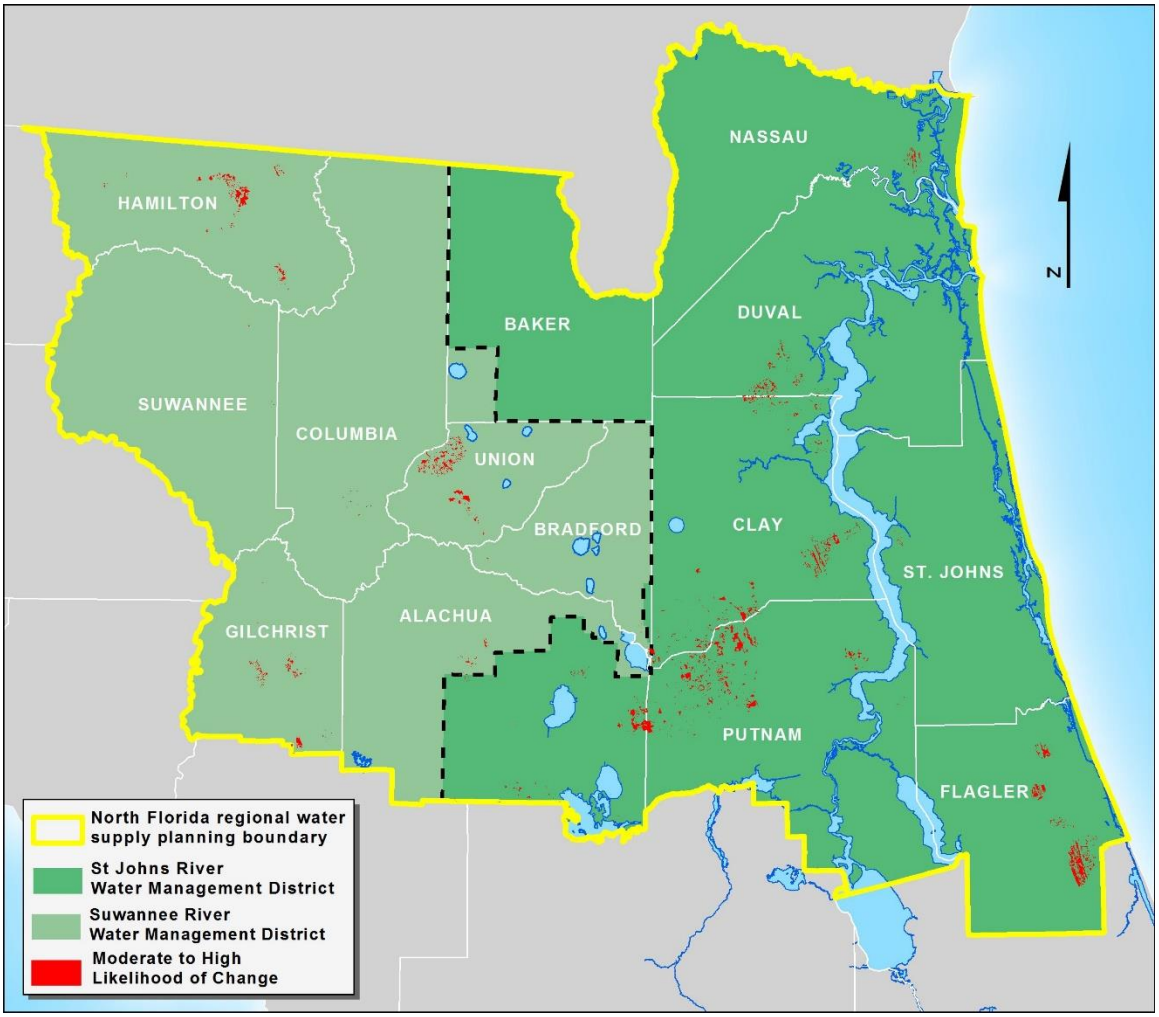

Figure I1: Wetlands at Risk of Adverse Change Due to 2035 Projected Withdrawals within the NFRWSP Area

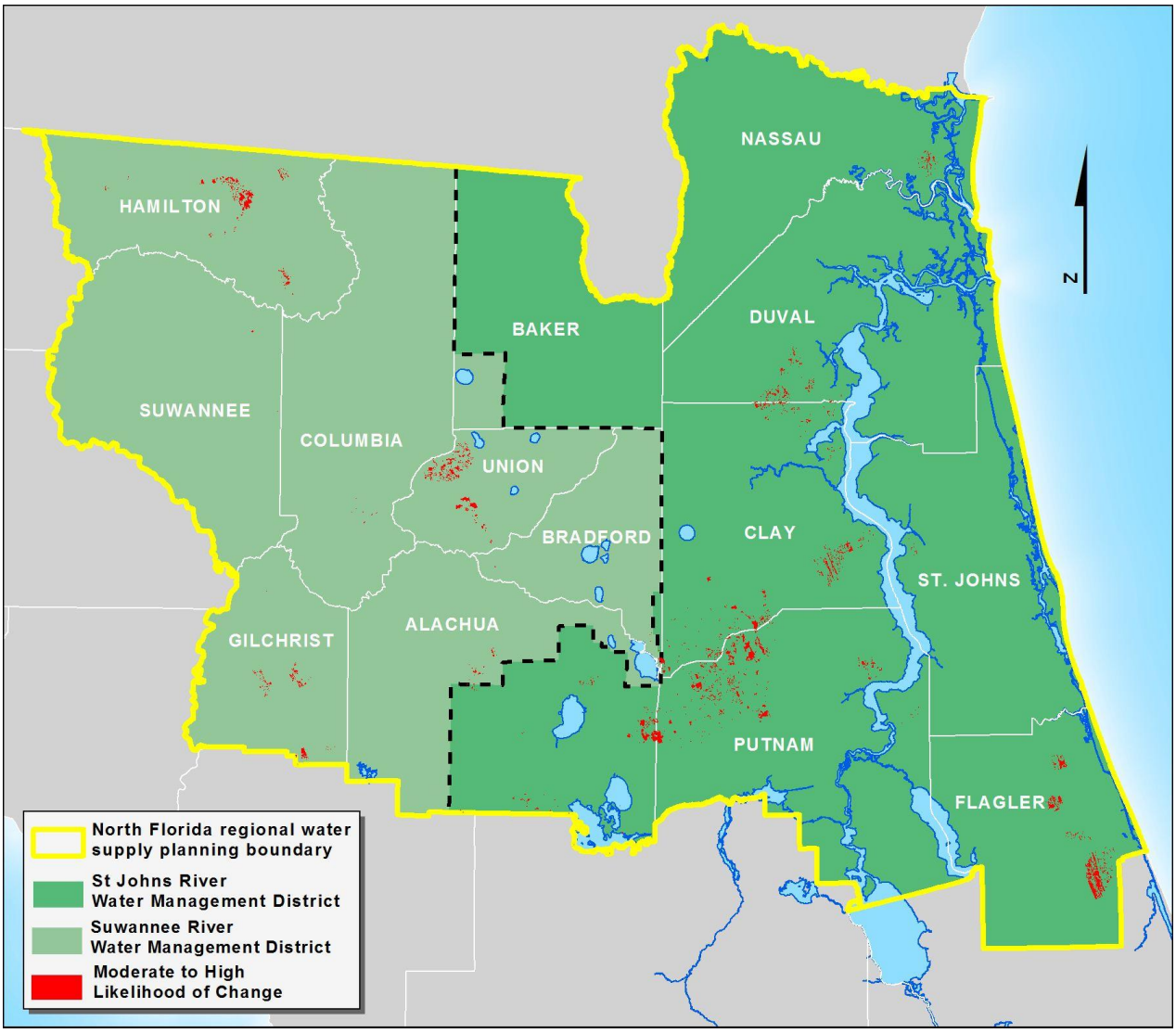

Figure I2: Wetlands at Risk of Adverse Change Due to 2035 Projected Withdrawals within the NFSEG domain

References

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