APPENDIX H

POTENTIAL ADVERSE CHANGE TO WETLAND FUNCTION — METHODOLOGY AND RESULTS

APPENDIX H

POTENTIAL ADVERSE CHANGE TO WETLAND FUNCTION — METHODOLOGY AND RESULTS

Introduction

As part of Central Springs/East Coast (CSEC) Regional Water Supply Plan (RWSP) development, St. Johns River Water Management District (SJRWMD) assessed the extent to which water resources and related natural systems may be impacted by projected increases in water use through 2040. Assessing the potential for adverse change to wetland function was one component of the CSEC water resource assessment, along with a saltwater intrusion analysis and an evaluation of water bodies with minimum flows and minimum water levels (MFLs). 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 document details the methods used to assess the potential adverse change to wetland function associated with the increase in projected water demand at the planning horizon (2040) and includes the assessment results. The historic alteration of wetlands has been significant in the CSEC RWSP area (and statewide), resulting mostly from farmland conversion and urbanization. In addition, wetlands can be altered by factors other than groundwater withdrawals, including modification of natural surface water hydrology. Due to these complexities, this analysis focused exclusively on assessing the potential for adverse change to existing wetlands resulting only from the projected increase in water demand from 2015 (or 2014 for Brevard, Indian River and Okeechobee counties) to 2040. The outcome of this assessment was used with results of the other water resource assessments in determining whether traditional water supply sources (i.e., fresh groundwater) are sufficient to meet future water demands.

Background

In previous SJRWMD water resource assessments, the potential of adverse change to wetland function was determined using variations of the Kinser-Minno method (Kinser and Minno 1995; Kinser et. al. 2003). Changes to the analysis time frame and minor soil/vegetation classification revisions have occurred over time, along with shifting geographic scopes and improvements to the input data and groundwater flow models. In 2008, a modified Kinser-Minno method (Dunn et. al. 2008) was developed for assessing the potential 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 increases in UFA withdrawals. With some minor modifications discussed below, the

Kinser-Minno method and the modified Kinser-Minno method were used for the CSEC RWSP wetland assessment in the confined and unconfined portions of the planning area, respectively. For purposes of the CSEC RWSP, the terms sensitive vegetation and wetland are considered interchangeable as the majority of the vegetation community types that are highly sensitive to SAS drawdown are wetlands.

Both Kinser-Minno methods use a geographic information system (GIS) model to conduct a matrix analysis of soil permeability, sensitivity 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 2015 (or 2014) to 2040.

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. Unconfined Floridan Aquifer System Boundary, United States Geologic Survey (Miller 1986)
4. 2008 Digital Elevation Model for the State of Florida, Florida Department of Environmental Protection (FDEP)
5. May 2014 UFA Potentiometric Surface GIS Data Layer, SJRWMD

Soil permeability classifications were derived from the 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 SJRWMD wetland scientists (P. Kinser, SJRWMD — retired; M. Minno, Suwannee River Water Management District).

Soil Permeability Classification

Soil permeability describes the capacity of a soil to allow fluids to pass through it. For purposes of the wetland assessment, permeability is a key component since 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 CSEC RWSP, 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 H-1.

Table H-1: Soil Permeability Classification (NRCS)

NRCS Permeability Class	NRCS Permeability Rate (inches/hour)	CSEC RWSP Soil Permeability Classification
Very Slow	Less than 0.06	Low
Slow	0.06 – 0.2	Low
Moderately Slow	0.2 – 0.6	Low
Moderate	0.6 – 2.0	Moderate
Moderately Rapid	2.0 – 6.0	Moderate
Rapid	6.0 – 20	High
Very Rapid	Greater than 20	High

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 water table level changes.

The SJRWMD 2009 land use/land cover GIS layer was used as the input data for vegetative community classification. This data source relies on digitized aerial photography with classifications derived from the Florida Land Use and Cover Classification System.

For purposes of the CSEC RWSP, polygons in the land cover/land use layers were classified with "high, moderate, or low" sensitivity to drawdown, relative to their dominant vegetation type, per Table H-2.

Table H- 2: Classification of Vegetation Type Sensitivity

Land Use Code	CSEC RWSP Vegetation Sensitivity Classification
4100: Upland Coniferous Forests	Low
4110: Pine Flatwoods	Moderate
4120: Longleaf Pine — Xeric Oak	Low
4130: Sand Pine	Low
4140: Pine — Mesic Oak	Low
4190: Hunting Plantation Woodlands	Low
4200: Upland Hardwood Forests	Moderate
4210: Xeric Oak	Low
4270: Live Oak	Low
4271: Oak — Cabbage Palm Forests	Low
4280: Cabbage Palm	Moderate
4340: Upland Mixed — Coniferous /	Moderate
4400: Tree Plantations	Low
4410: Coniferous Plantations	Moderate
4420: Hardwood Plantations	Low
4430: Forest Regeneration Areas	Moderate
6100: Wetland Hardwoods Forests	High
6110: Bay Swamps	High
6111: Bayhead	High
6120: Mangrove Swamps	Low
6130: Gum Swamps	High
6140: Titi Swamps	High
6150: Stream and Lake Swamps (bottomland)	High
6170: Mixed Wetland Hardwoods	High
6172: Mixed Shrubs	High
6180: Cabbage Palms	High
6181: Cabbage Palm Hammock	High
6182: Cabbage Palm Savannah	High
6200: Wetland Coniferous Forests	High
6210: Cypress	High
6215: Cypress — Domes/Heads	High
6216: Cypress — Mixed Hardwoods	High
6220: Pond Pine	High

Land Use Code	CSEC RWSP Vegetation Sensitivity Classification
6240: Cypress — Pine — Cabbage Palm	High
6250: Hydric Pine Flatwoods	High
6260: Pine Savannah	High
6300: Wetland Forested Mixed	High
6400: Vegetated Non-Forested Wetlands	High
6410: Freshwater Marshes	High
6411: Freshwater Marshes — Sawgrass	High
6420: Saltwater Marshes	Low
6430: Wet Prairies	High
6440: Emergent Aquatic Vegetation	High
6460: Mixed Scrub — Shrub Wetland	High
6500: Non-Vegetated Wetlands	High
6510: Tidal Flats	Low
6520: Shoreline	Low
6530: Intermittent Ponds	High
6600: Salt Flats	Low

Potential for Future Impacts

A key component of the wetland 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 wetland function. For this step in the analysis, each polygon was assigned a potential for wetland change classification (Table H-3) through a combination of the soil permeability (Table H-1) and vegetation sensitivity (Table H-2) classes. The potential for wetland change classification assigned a high and moderate rank to only those vegetation communities that have a high sensitivity to water table drawdown, mostly freshwater wetland communities.

Table H-3: Potential for Wetland Change Classification (Integrated Soil Permeability and Vegetation Type Sensitivity)

	High Vegetation Sensitivity	Moderate Vegetation Sensitivity	Low Vegetation Sensitivity
High Soil Permeability	High	Low	Low
Moderate Soil Permeability	Moderate	Low	Low
Low Soil Permeability	Low	Low	Low

Regional groundwater models were then used to predict the change in SAS elevation (i.e., SAS drawdown) between the base year (2014 or 2015) and 2040 for each model grid cell. Surficial Aquifer System drawdown for each vegetation polygon was derived from the most applicable model grid cell. The potential for wetland change classification (Table H-3) and the projected SAS drawdown were combined into a polygon-specific potential future wetland change classification (Table H-4). The surficial aquifer drawdown divisions categorized in Table H-4 were derived from published literature and unpublished data, as discussed in the Water 2020 Constraints Handbook (CH2M Hill 1998). The results of this assessment provided an estimate of magnitude (acres), degree (moderate vs. high), and spatial distribution of the potential for future adverse change to wetland function throughout the portion of the CSEC RWSP area where the UFA is confined.

Table H-4: Potential Future Wetland Change Classification (Confined UFA)(Integrated Potential for Wetland Change and Projected SAS Drawdown from 2015[1] to 2040)

	High Potential for Wetland Change	Moderate Potential for Wetland Change	Low Potential for Wetland Change
Projected SAS Drawdown > 1.2 ft	High	High	Low
Projected SAS Drawdown from 0.35 – 1.2 ft	High	Moderate	Low
Projected SAS Drawdown < 0.35 ft	Low	Low	Low

[1] Or 2014 for Brevard, Indian River, and Okeechobee counties.

Modified Kinser-Minno Method — Additional Steps

There are two additional steps in the modified methodology for assessing potential adverse change to wetland function in areas where the UFA is unconfined. A spatial representation of the unconfined areas of the UFA was used to extract a new dataset showing only those polygons identified as having a high and moderate future potential for change (Table H-4) within the unconfined portions of the planning region. Depth from land surface to the 2014 UFA potentiometric surface was calculated and categorized into three 15-ft intervals. The initial potential future adverse change designation of wetland polygons (Table H-4) was then reclassified based on the depth to the unconfined UFA (Table H-5).

Table H-5: Potential Future Wetland Change Classification (Unconfined UFA)(Integrated Potential for Future Change for Confined UFA and Depth to the Unconfined UFA)

	High Potential for Future Change[1]	Moderate Potential for Future Change[1]
0 – 15 ft to Unconfined UFA	High	Moderate
15 – 30 ft to Unconfined UFA	Moderate	Low
>30 ft to Unconfined UFA	Low	Low

[1] As determined for areas where the UFA is confined (Table H-4).

Results

When assessing potential future change to the function of existing wetlands due to 2040 projected water demand within the CSEC RWSP area, it is estimated that 34,091 acres of wetlands have a high or moderate potential of being altered (Table H-6, Figures H-1, H-2, and H-3). This represents 4 percent of the sensitive vegetation acreage in the CSEC RWSP area.

Table H- 6: Wetland Acreage Identified as Having a Moderate or High Potential for Adverse Change in the CSEC RWSP Area

County	Wetland Acreage at Risk for Potential Future Adverse Change at 2040 Water Demand
Volusia	4,558
Marion	4,686
North Lake[1]	24,504
Brevard	327
Indian River	7
Okeechobee	10
CSEC RWSP Total[2]	**34,091**

[1] Within the CSEC RWSP, North Lake County is defined as that portion of Lake County that is not included in the Central Florida Water Initiative.
[2] Total may be slightly different due to rounding of county values.

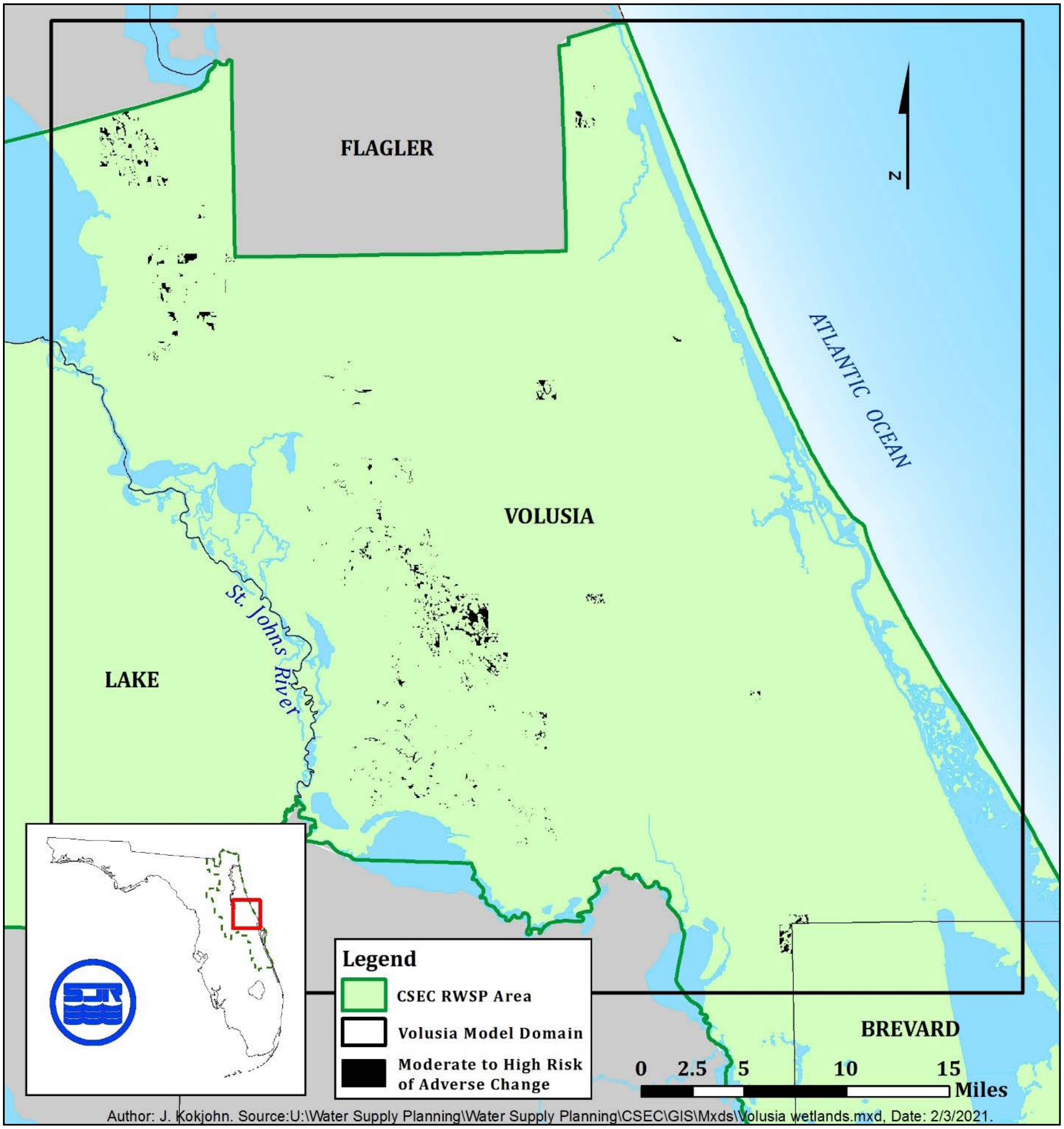

Figure H-1: Wetlands at Risk of Adverse Change Due to 2040 Projected Withdrawals within Volusia County

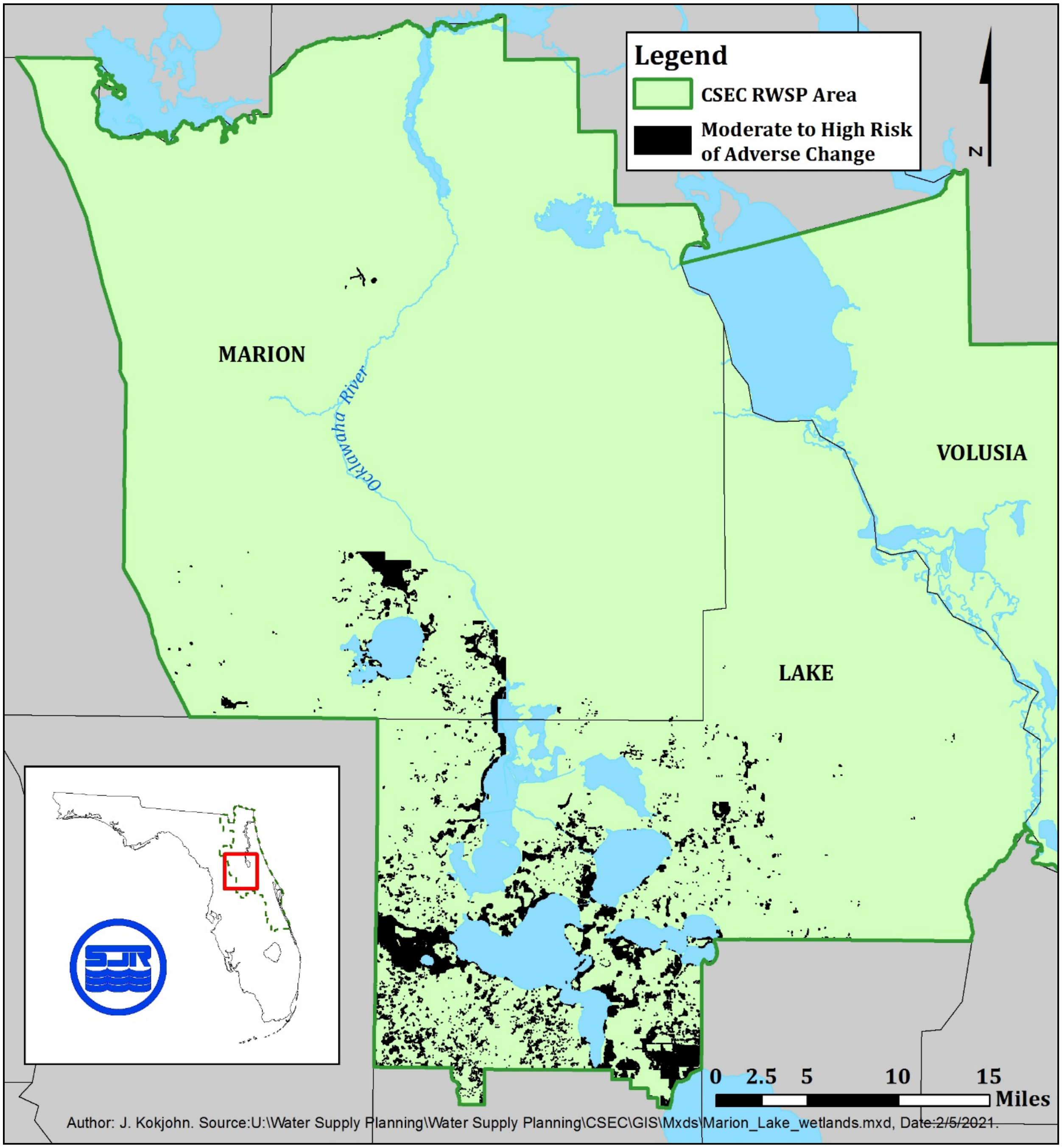

Figure H-2: Wetlands at Risk of Adverse Change Due to 2040 Projected Withdrawals within Marion and North Lake Counties

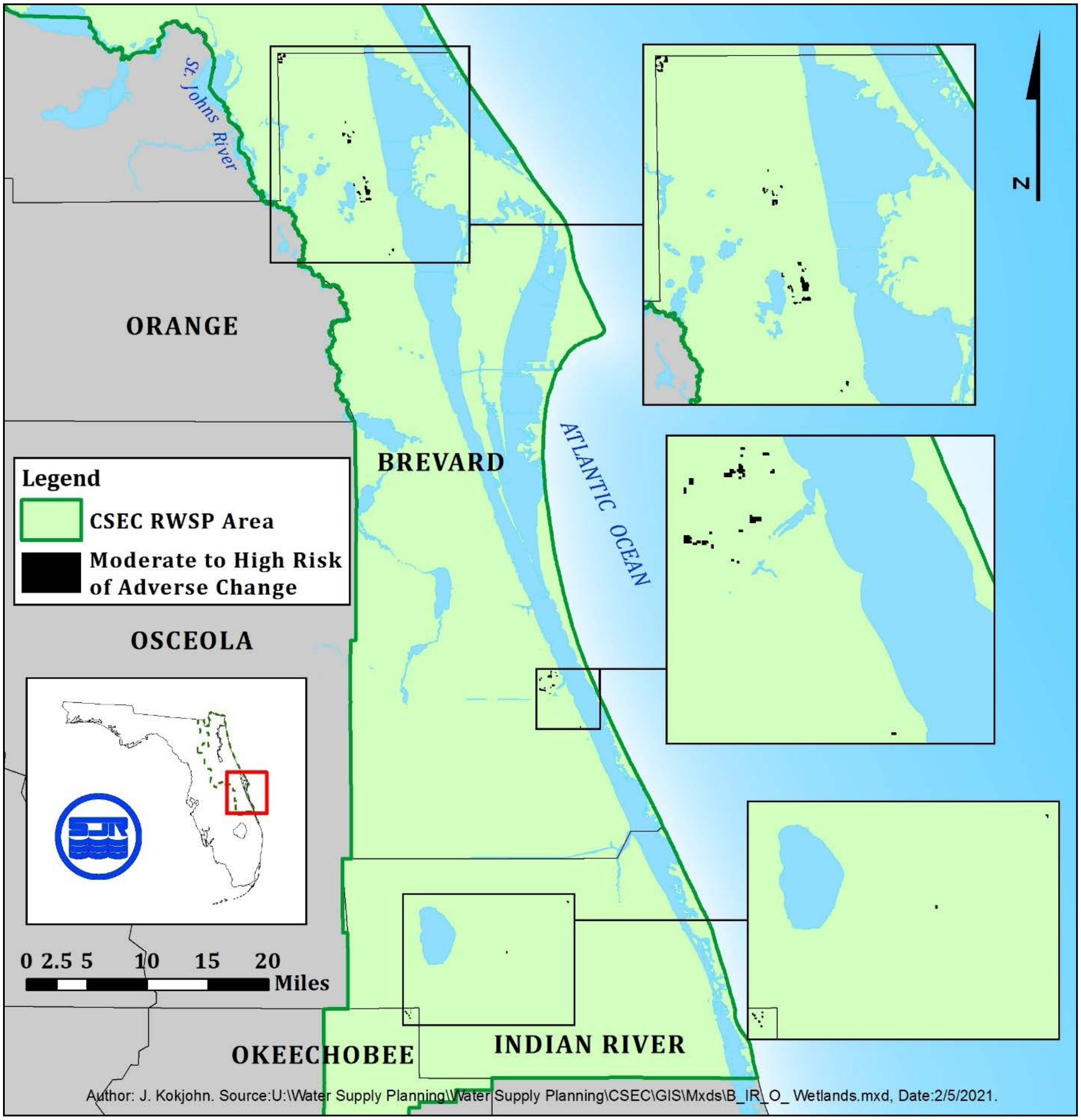

Figure H-3: Wetlands at Risk of Adverse Change Due to 2040 Projected Withdrawals within Brevard, Indian River, and Okeechobee Counties

References

CH2M HILL. 1998. *Water 2020 Constraints Handbook*. SJRWMD Special Publication SJ2005-SP8.

Dunn, W., P. Burger, S. Brown, and M. Minno. 2008. *Development and Application of a Modified Kinser-Minno Method for Assessing the Likelihood of Harm to Native Vegetation and Lakes in Areas with an Unconfined Aquifer*. SJRWMD Special Publication SJ2008-SP24.

Kinser, P. and M. Minno. 1995. *Estimating the Likelihood of Harm to Native Vegetation from Groundwater Withdrawals*. SJRWMD Technical Publication SJ95-8.

Kinser, P., M. Minno, P. Burger, and S. Brown. 2003. *Modification of Modeling Criteria for Application in the 2025 Assessment of Likelihood of Harm to Native Vegetation*. SJRWMD Professional Paper SJ2003-PP3.

Miller, J. 1986. *Hydrogeologic Framework of the Floridan Aquifer System in Florida and Parts of Georgia, Alabama, and South Carolina*. U.S. Geological Survey Professional Paper no. 1403-B. 91 p.