APPENDIX A

SUPPLEMENTAL REGIONAL WATER SUPPLY PLAN COMPONENTS FOR THE CSEC RWSP SUB-REGIONS

Table of Contents

A1: Regional Water Supply Plan Components for Volusia County

Chapter 1: Introduction to Volusia County

Population

The estimated population in Volusia County during the base year, 2015, was just under 0.53 million.

Primary Surface Water Basins

The primary surface water basins located within Volusia County include portions of the Lower St. Johns River, Middle St. Johns River, Upper St. Johns River, Lake George, Northern Coastal, and Indian River Lagoon basins.

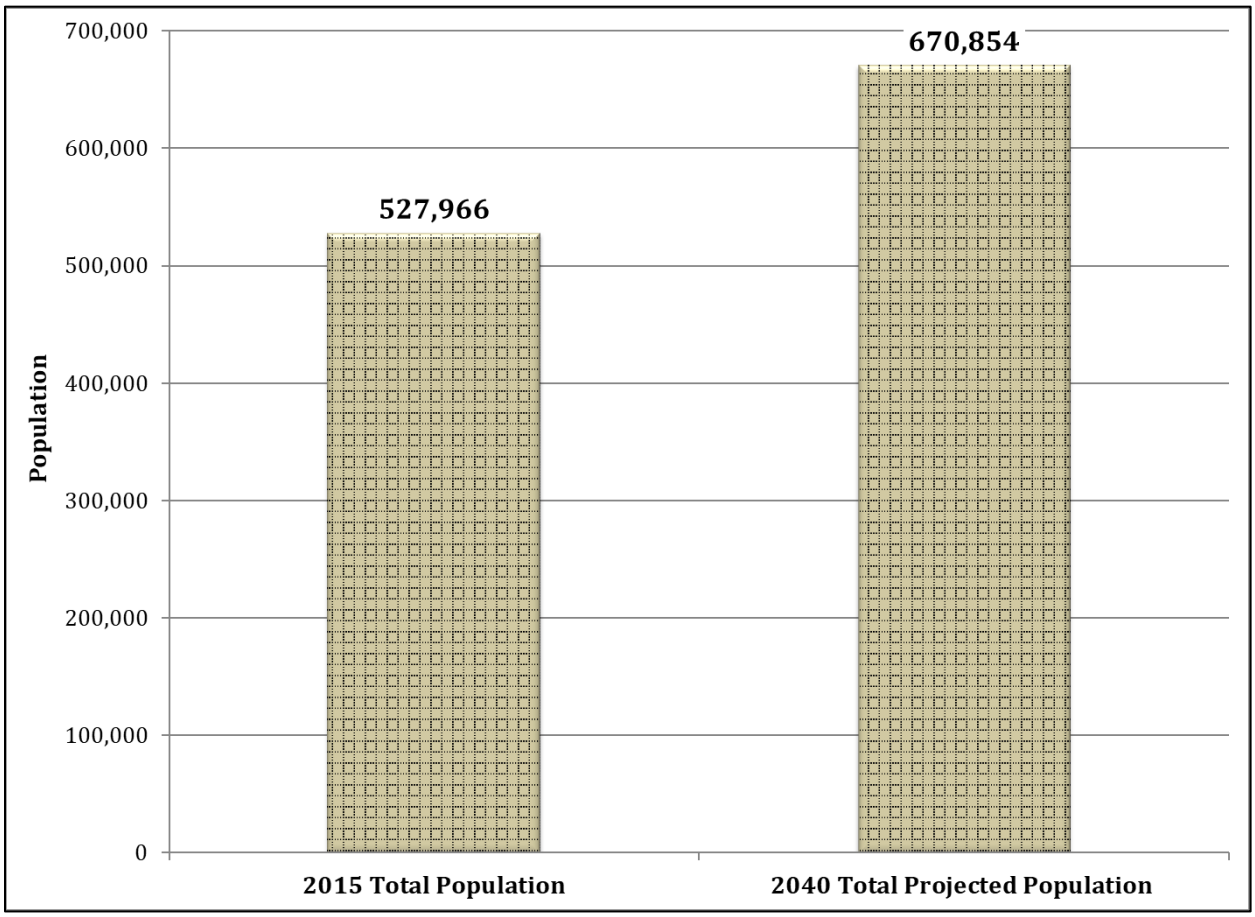
Springs

There are three Outstanding Florida Springs (OFS) in Volusia County, pursuant to subsection (ss.) 373.802(4), *Florida Statutes* (F.S.); Blue, De Leon, and Gemini springs. Blue Springs is the only first-magnitude in Volusia County, defined as having flows of at least 100 cubic feet per second (cfs). De Leon and Gemini springs are the only two second-magnitude springs, defined as having flows between 10 and 100 cfs.

Chapter 2: Water Demand, Reclaimed Water and Water Conservation Projections for Volusia County

Population

Total population for Volusia County is expected to increase by 143,000 people (27% to approximately 671,000 people) by 2040 (Figure A1-1). For a breakdown of population by type (public supply versus domestic self-supply served), see Appendix B.



Water Demand

Total water demand in Volusia County is anticipated to increase from 88.4 million gallons per day (mgd) in 2015 to 109.6 mgd in 2040 (24%). Public supply represents the largest demand in Volusia County (61%), followed by agriculture (20%) and recreation/ landscape/aesthetic (LRA; 7%)(Figure A1-2). It is estimated that 2040 total water demand could increase by an additional 10 percent (11.2 mgd) if a 1-in-10 year drought event occurred.

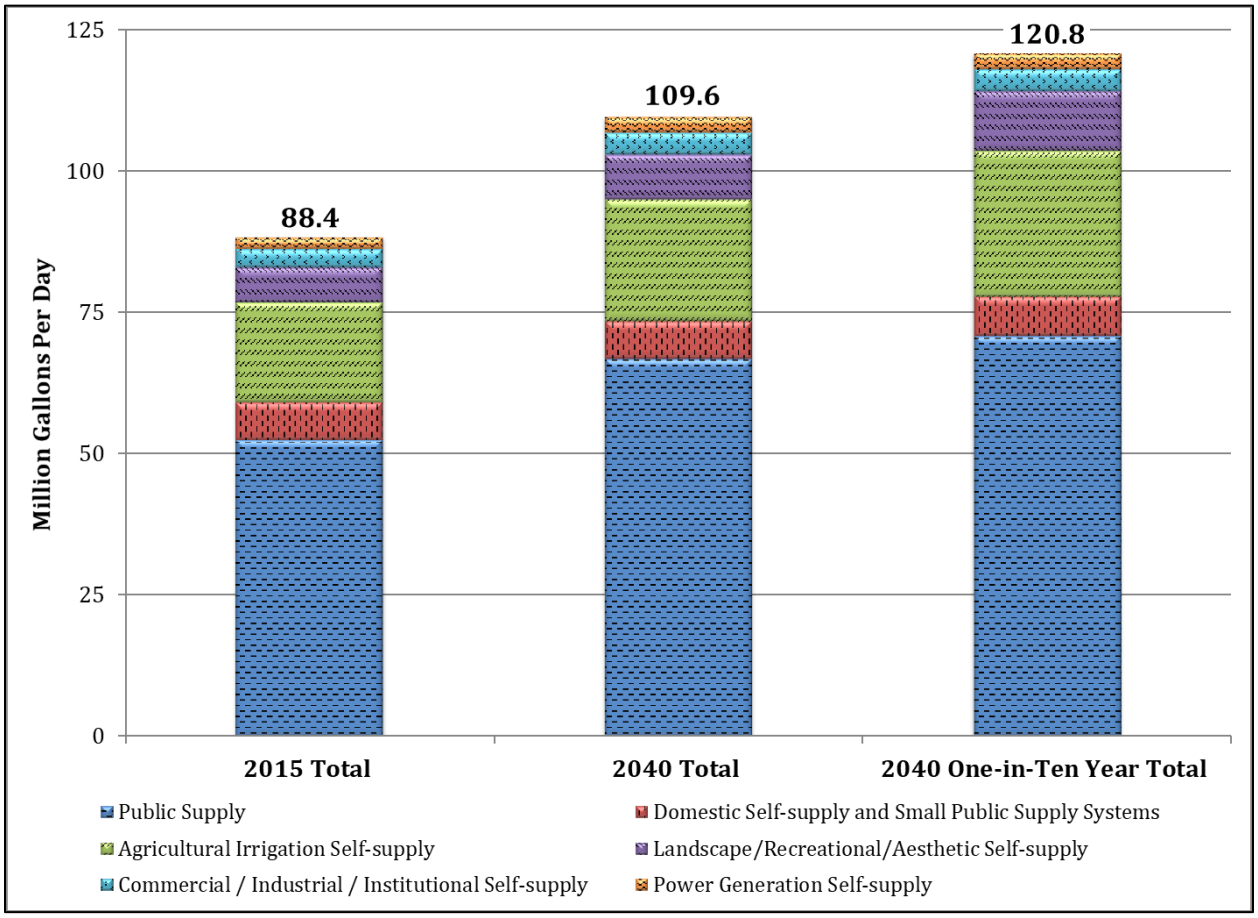
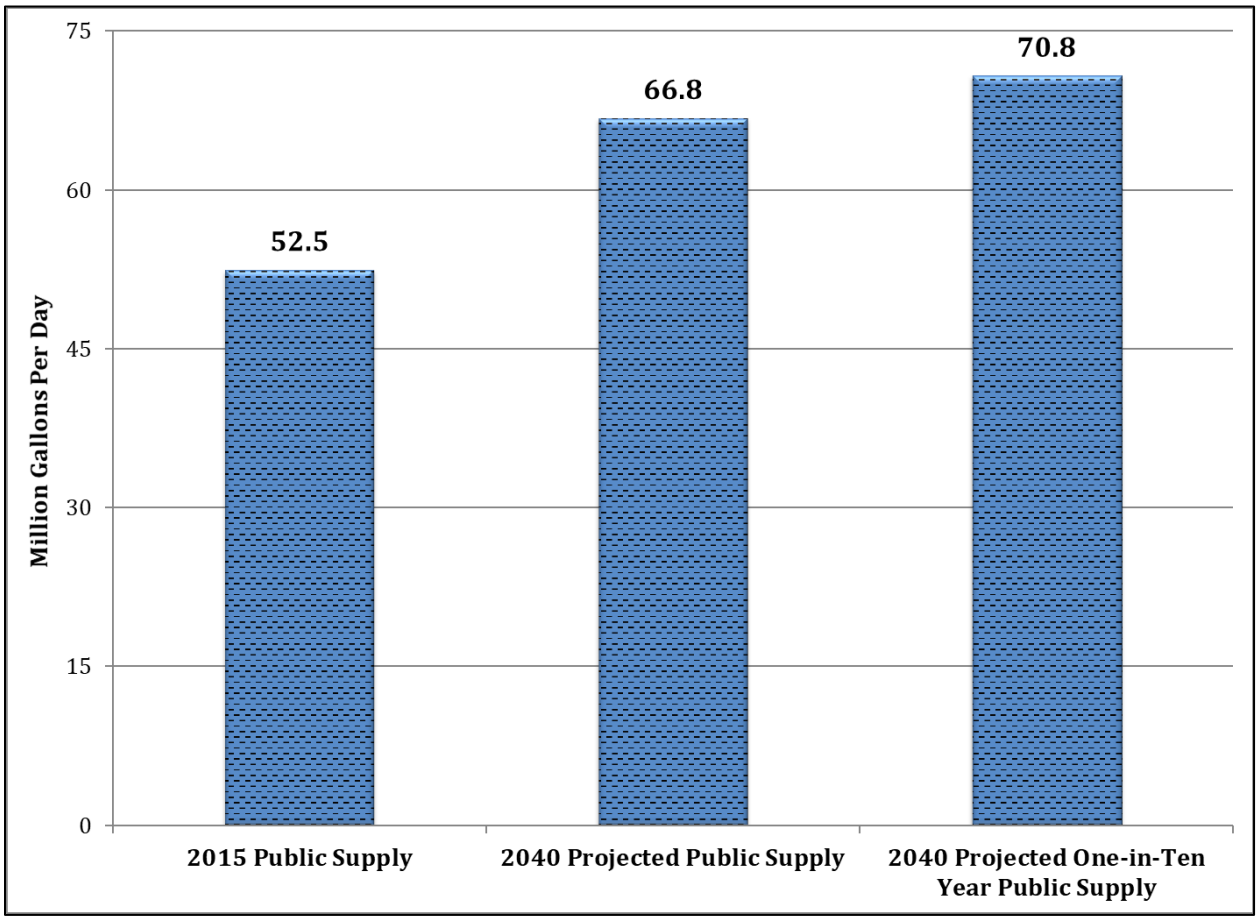


Figure A1-2: 2015 Water Use Estimates and 2040 Water Demand Projections in Volusia County by Category

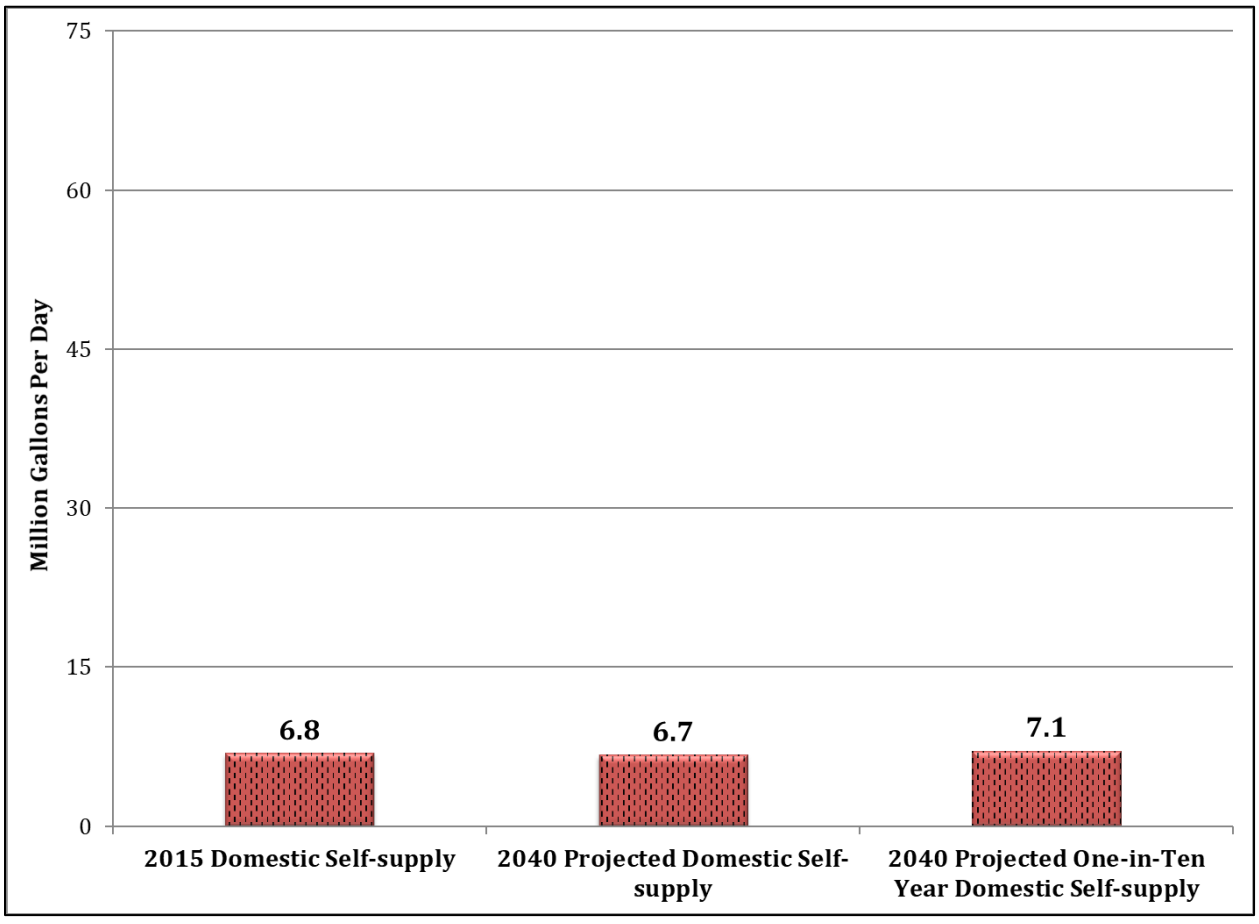
Public Supply Demand

Total public supply water demand for Volusia County is expected to increase by 14.3 mgd (27% to approximately 67 mgd) by 2040 (Figure A1-3). Public supply represents 61 percent of the 2040 projected water demand in Volusia County. Of note, public supply also represents 67 percent of the total increase in water demand in Volusia County. It is estimated that 2040 public supply water demand could increase by an additional 6 percent (4.0 mgd) if a 1-in-10 year drought occurred.



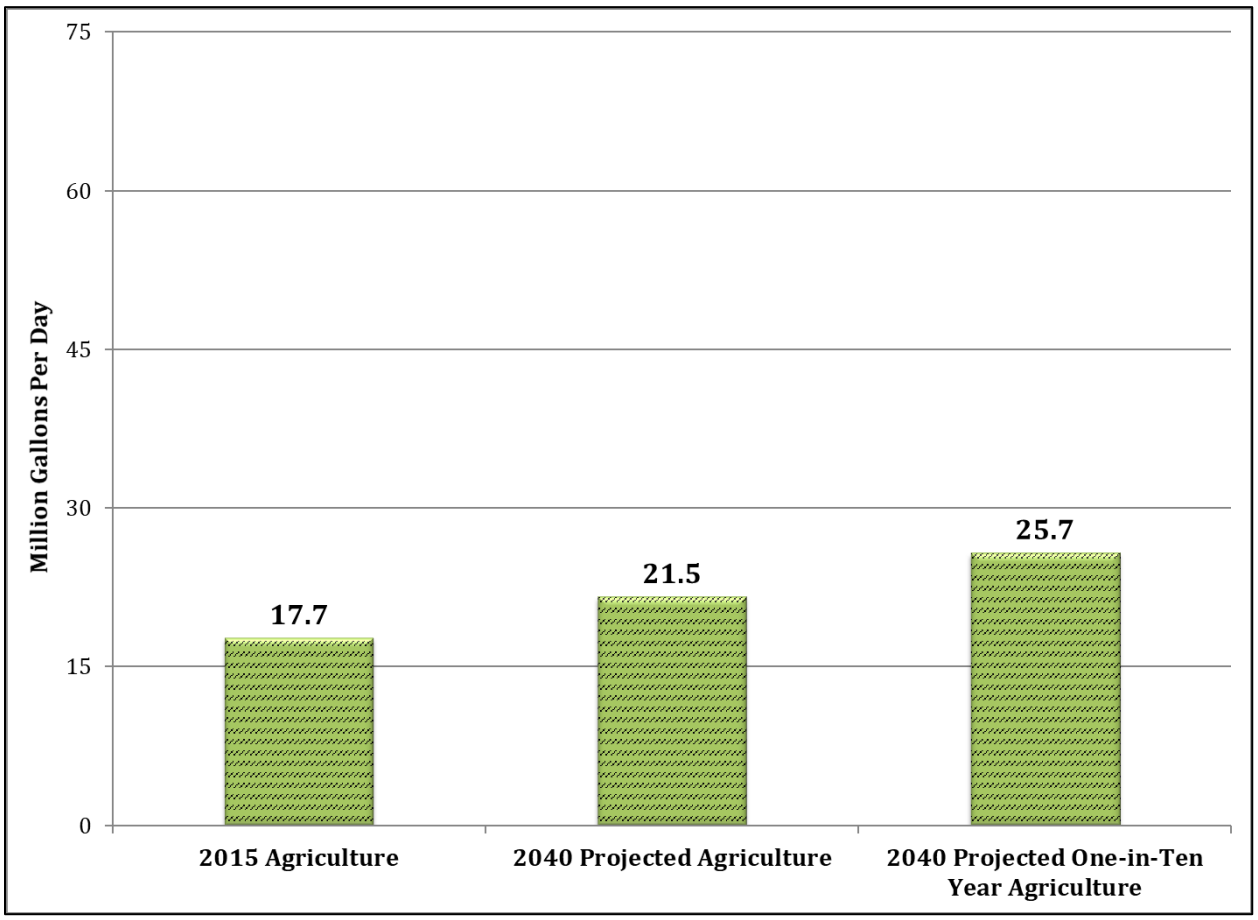
Domestic Self-Supply Demand

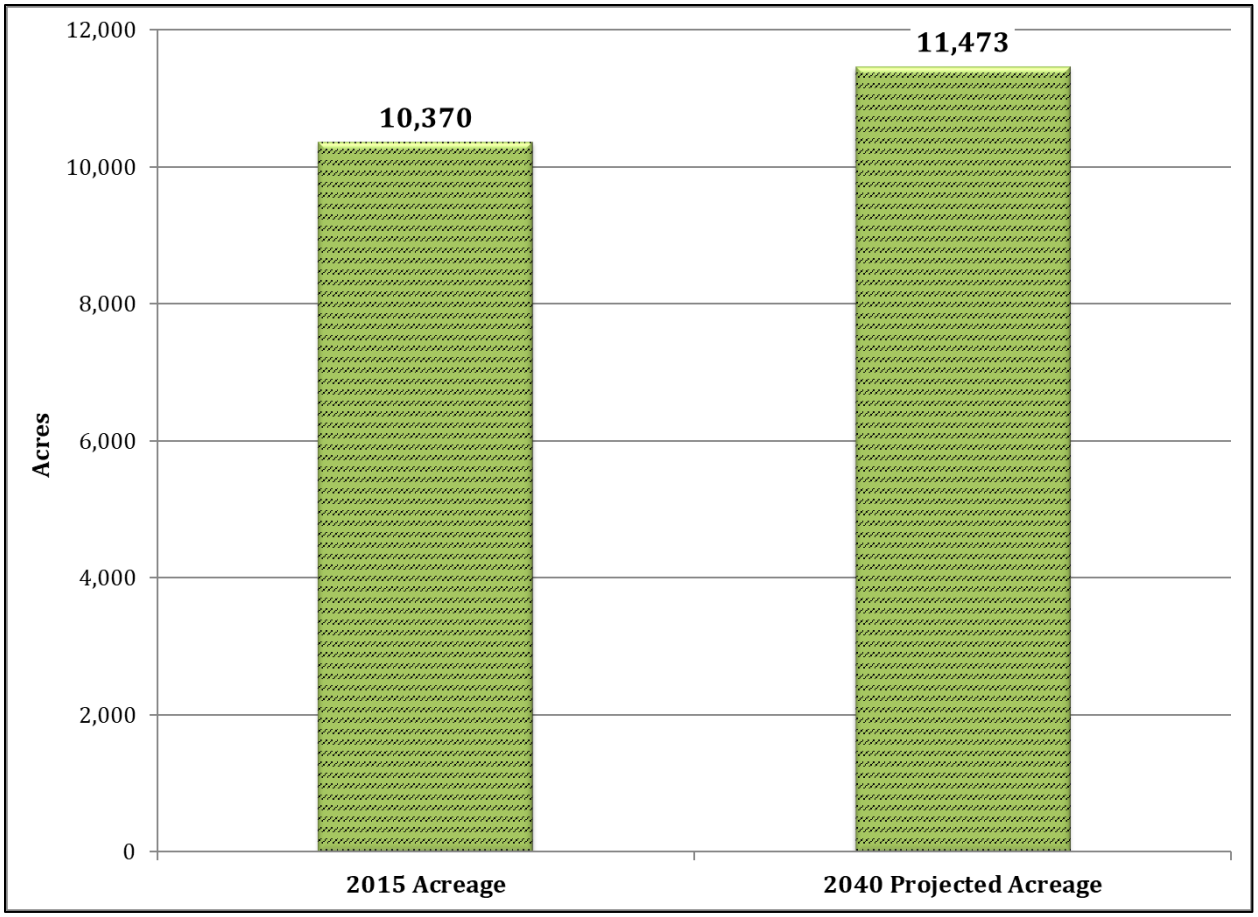
In Volusia County, total combined domestic self-supply (DSS) water demand, which includes small public supply systems as defined in Appendix B, is expected to remain fairly stable through 2040 with a slight predicted decrease to approximately 6.7 mgd (Figure A1-4). While DSS population does increase over the planning horizon, the increase is offset by the five-year (2011 to 2015) average residential per capita (85 gallons per capita per day, gpcd) being lower than the 2015 per capita (107 gpcd). As shown in Appendix B, projected DSS water demand does increase between 2020 and 2040 as a result of population growth. Of the 2040-combined DSS water demand, DSS wells represent 96 percent of the projected water demand (with small public supply systems representing the remaining 4%). It is estimated that 2040-combined DSS water demand could increase by an additional 6 percent (0.4 mgd) if a 1-in-10 year drought occurred.



Agriculture Acreage and Demand

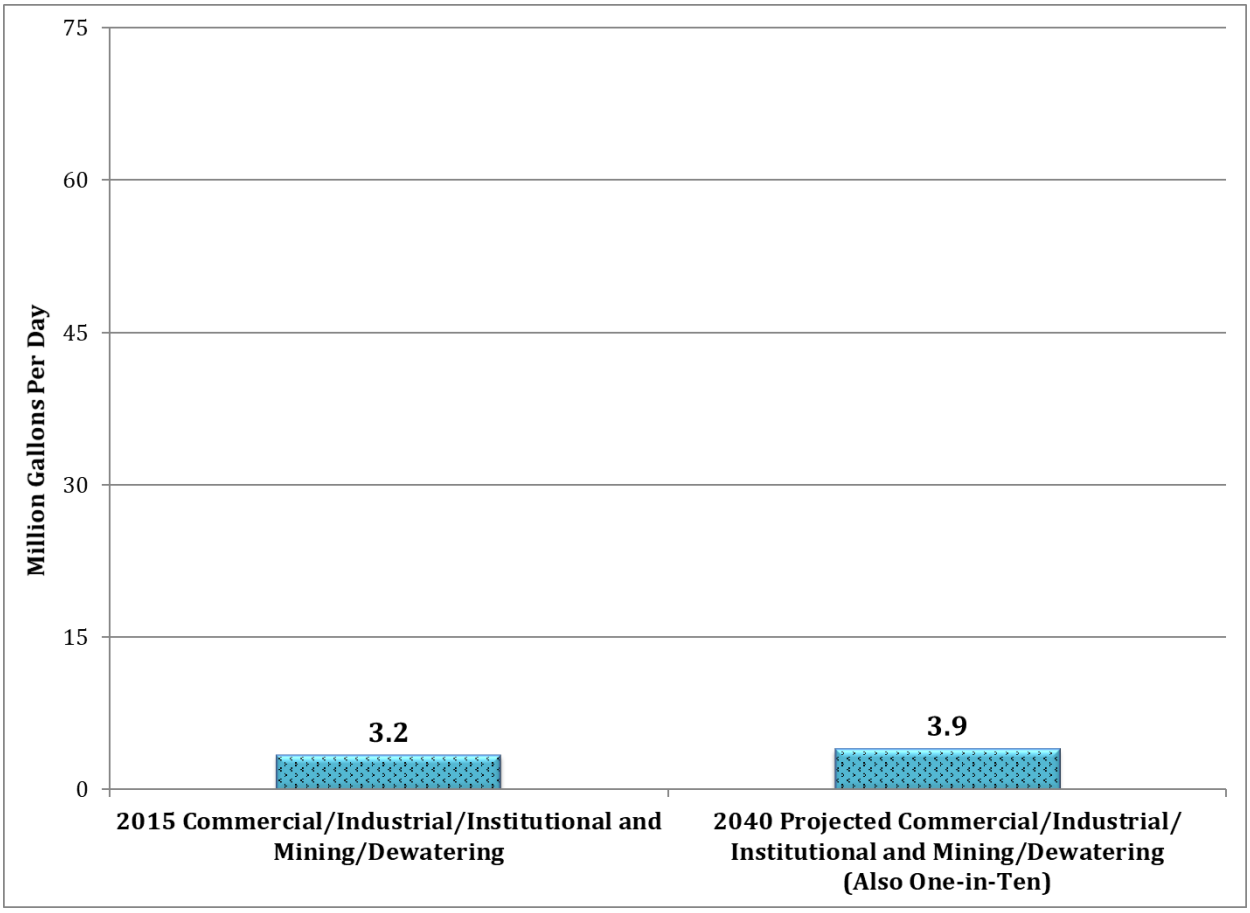
Total agricultural water demand for Volusia County is expected to increase by 3.8 mgd (22% to 21.5 mgd) by 2040 and acreage is expected to increase by 1,100 acres (11% to approximately 11,500 acres) (Figures A1-5 and A1-6). The Florida Department of Agriculture and Consumer Affairs' (FDACS) Florida Statewide Agricultural Irrigation Demand (FSAID) IV estimates that 2040 agricultural water demand (which was based on a 5-in-10 year, or average, drought condition) could increase by an additional 19 percent (4.2 mgd) if a 1-in-10 year drought occurred (FDACS 2017).




12,000
10,000
8,000
6,000
4,000
2,000
0
Acres
10,370
11,473
2015 Acreage
2040 Projected Acreage

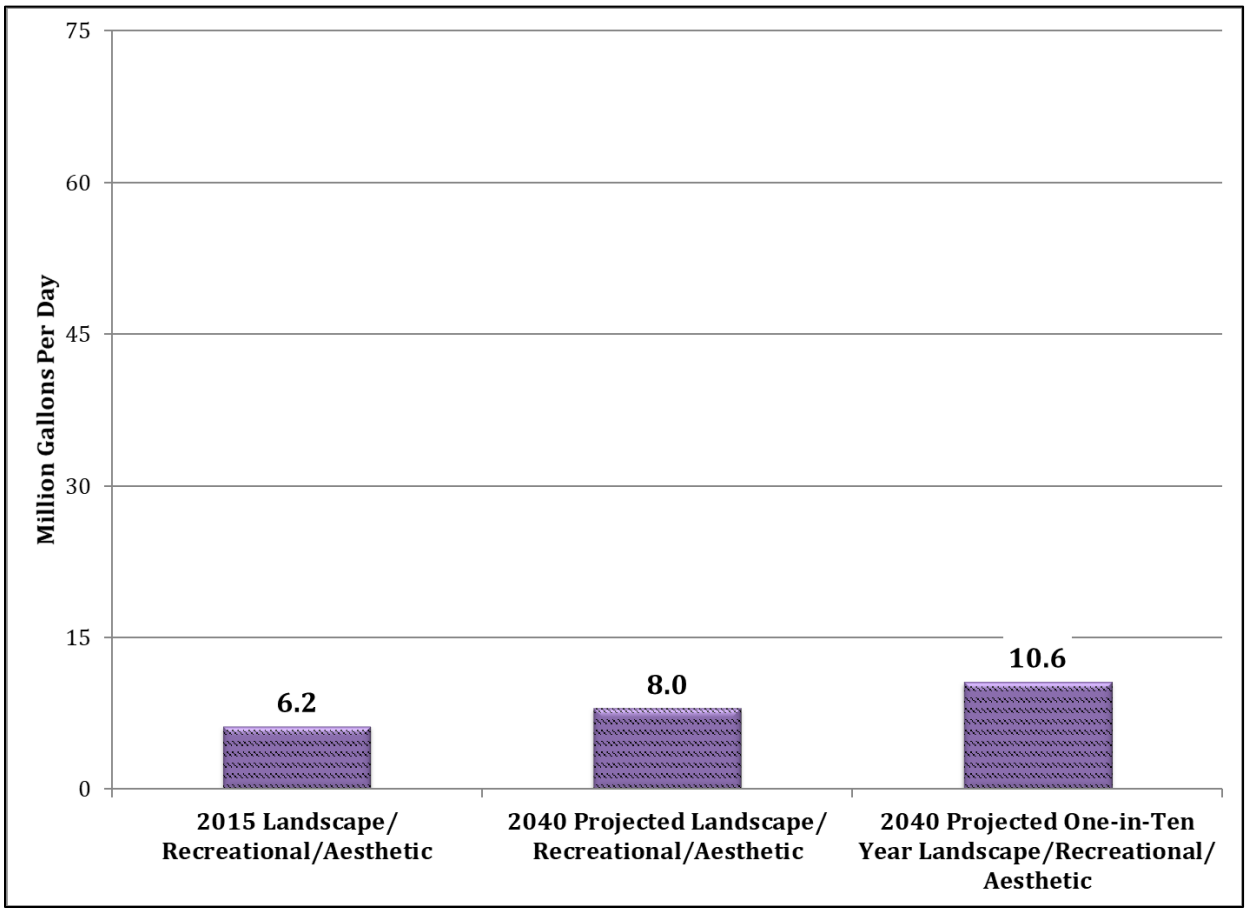
Commercial/Industrial/Institutional and Mining/Dewatering Demand

Total combined commercial/industrial/institutional and mining/dewatering water demand for Volusia County is expected to increase by 0.7 mgd (19% to approximately 3.9 mgd) by 2040 (Figure A1-7).



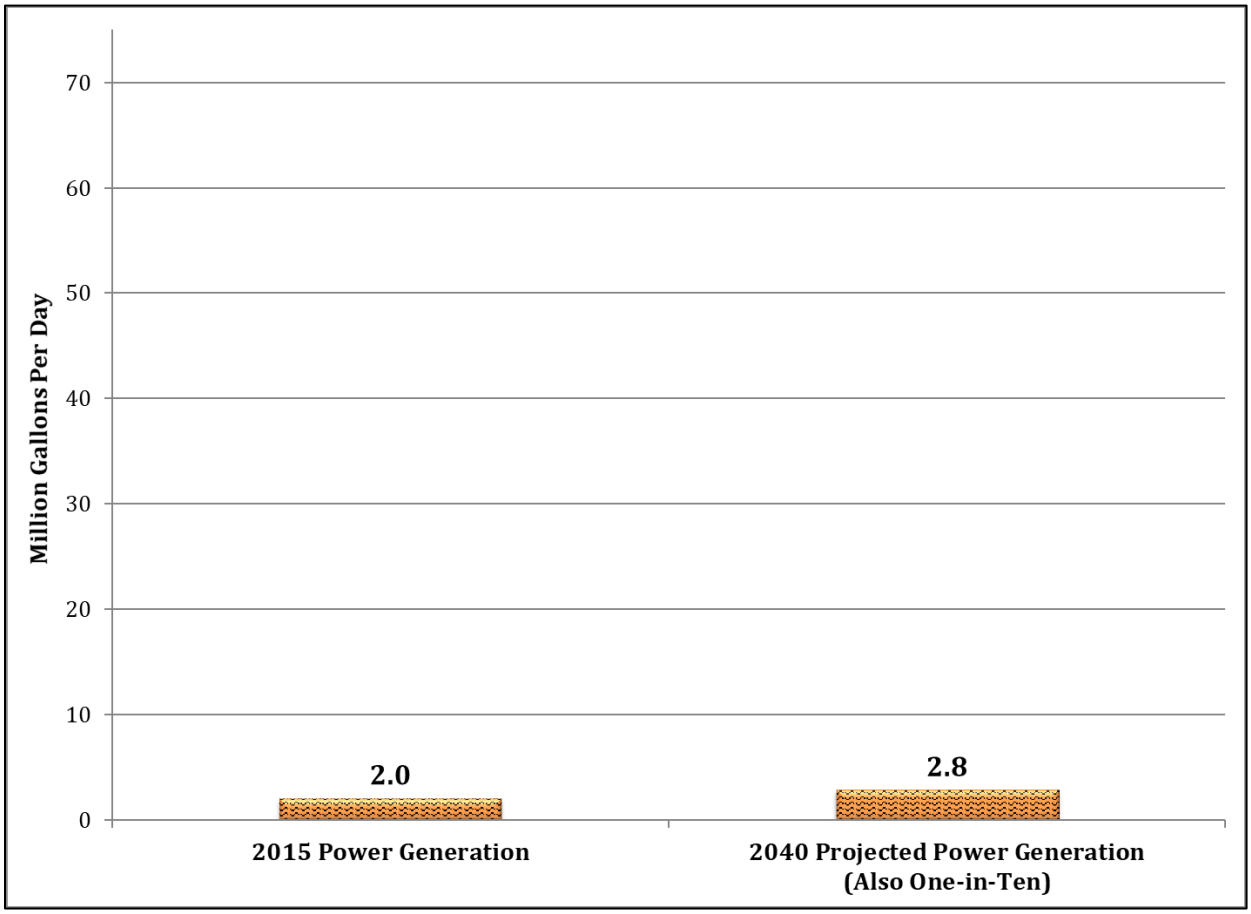
Landscape/Recreation/Aesthetic Demand

Total LRA water demand for Volusia County is expected to increase by 1.8 mgd (28% to approximately 8.0 mgd) by 2040 (Figure A1-8). It is estimated that 2040 LRA water demand could increase by an additional 33 percent (2.6 mgd) if a 1-in-10 year drought occurred.



Power Generation Demand

Total power generation water demand for Volusia County is expected to increase by 0.8 mgd (40% to approximately 2.8 mgd) by 2040 (Figure A1-9).



Reclaimed Water Projections

Existing Flows

Figure A1-10 displays 2015 reclaimed water flows, both beneficial and disposal, in Volusia County. The relative size of the pie charts represents the magnitude of total flow. The yellow shading represents disposal, and the purple shading represents the beneficial use of reclaimed water. The values utilized for Figure A1-10 are provided in Table A1-1. Approximately 62 percent (21.8 mgd) of 2015 treated wastewater flows was used beneficially in Volusia County, while the remaining 38 percent (13.2 mgd) was considered disposal. Recognizing the potential for increased beneficial reuse of existing flows, the St. Johns River Water Management District (SJRWMD) estimated that between 4.9 mgd and 9.9 mgd of the existing disposal flows could reasonably be utilized beneficially going forward.

Table A1-1: Detailed Summary of 2015 Reclaimed Water Flows in Volusia County

Facility	2015 Total Treated Flow[1] (mgd)	Beneficial Utilization (mgd)	Disposal (mgd)
Daytona – Westside Regional WWTF	11.1	2.7	8.4
DeLand Regional WWTF (Wiley M Nash)	3.2	3.2	0.0
Deltona Lakes	0.8	0.8	0.0
Edgewater WWTF	1.6	1.0	0.6
Holy Hill WWTF	1.6	0.3	1.3
N. Peninsula Utilities - Seabridge	0.1	0.0	0.1
New Smyrna Beach WWTF	3.8	3.8	0.0
Ormond Beach WWTF	5.0	3.4	1.6
Port Orange WWTF	5.7	4.7	1.0
Tymber Creek	0.1	0.1	0.0
Volusia Co. Utility Dept. (VCUD) – Deltona North	0.4	0.4	0.0
VCUD- Four Townes	0.2	0.0	0.2
VCUD – Halifax Plantation WWTF	0.1	0.0	0.1
VCUD – Southeast Regional WWTF	0.2	0.2	0.0
VCUD – Southwest Regional WWTF	1.4	1.4	0.0
Total[1]	**35.0**	**21.8**	**13.2**

Note: mgd = million gallons per day; WWTF = wastewater treatment facility

[1] Totals may be slightly different due to rounding of individual values.

Future Flows

SJRWMD estimated that increased future reclaimed water flows of approximately 6.3 mgd to 6.7 mgd could be used for beneficial purposes. When considered together with existing disposal flow that could be utilized beneficially, between 11.6 mgd to 16.2 mgd of total potential reclaimed water for reuse will be available in 2040 to potentially offset

withdrawals from traditional water sources and predicted impacts within Volusia County.

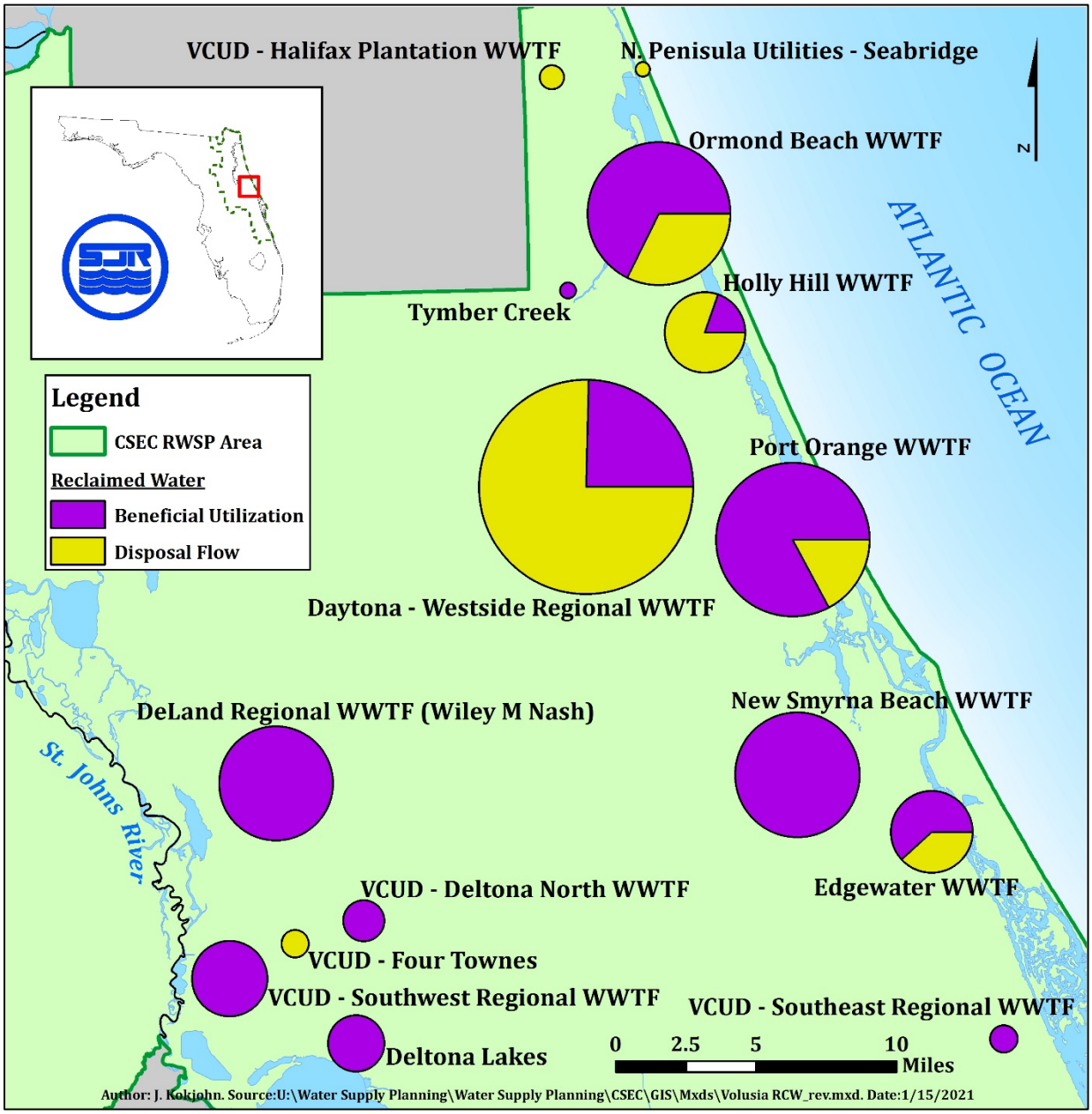


Figure A1-10: Summary of 2015 Reclaimed Water Flows in Volusia County

Water Conservation and Irrigation Efficiency

For the first scenario of water conservation and irrigation efficiency [using the Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP) methodology (CFWI 2015) and FDACS' FSAID IV (FDACS 2017)], it is estimated that approximately 6.1 mgd of the projected 2040 demand in Volusia County could be reduced by water conservation (Table A1-2).

For the second scenario, using the average 2011–2015 gross per capita rate for Volusia County for public supply and applying the same percent reduction to DSS, it is estimated that water conservation could be increased by about 3.7 mgd to a total of 9.8 mgd, potentially offsetting some future demand (Table A1-2).

Table A1-2: 2040 Water Conservation and Irrigation Efficiency Potential in Volusia County

Category	**2040 Low Conservation Potential (mgd)**	**2040 High Conservation Potential (mgd)**
Public Supply	2.7	6.1
Domestic Self-supply	0.3	0.6
Agriculture	2.8	2.8
Landscape/Recreation/Aesthetic Self-supply	0.2	0.2
Commercial/Industrial/Institutional Self-supply	0.1	0.1
Power Generation Self-supply	< 0.1	< 0.1
Total	**6.1**	**9.8**

Chapter 3: Assessment of Groundwater Conditions Associated with Future Water Demand Projections for Volusia County (Volusia Model Modeling Simulations)

Volusia Groundwater Model Overview

The Volusia model was developed by SJRWMD (Williams 2006), in part, to support the SJRWMD's regional water supply planning process. Developed using the MODFLOW code, the Volusia model explicitly represents aquifer systems and implicitly simulates the exchange of water through semi-confining layers using a leakance term. The model grid consists of 100 rows and columns with uniform grid spacing of 2,500 feet. The model extends from Crescent City in the northwest corner to near Rock Springs in Orange County in the southwest corner (Figure A1-11). The Atlantic Ocean/Mosquito Lagoon form the model's eastern boundary. The model includes three layers simulating the surficial, Upper Floridan, and Lower Floridan aquifers.

Originally calibrated to 1995 steady-state conditions, the Volusia model was later re-calibrated to include a second steady-state period representing hydrologic conditions for 2002. SJRWMD recently updated the steady-state model to 2010 and 2015 water use and boundary conditions. All simulations performed in support of this plan utilized 2015 boundary conditions with various water use stresses as determined by the specific analysis.

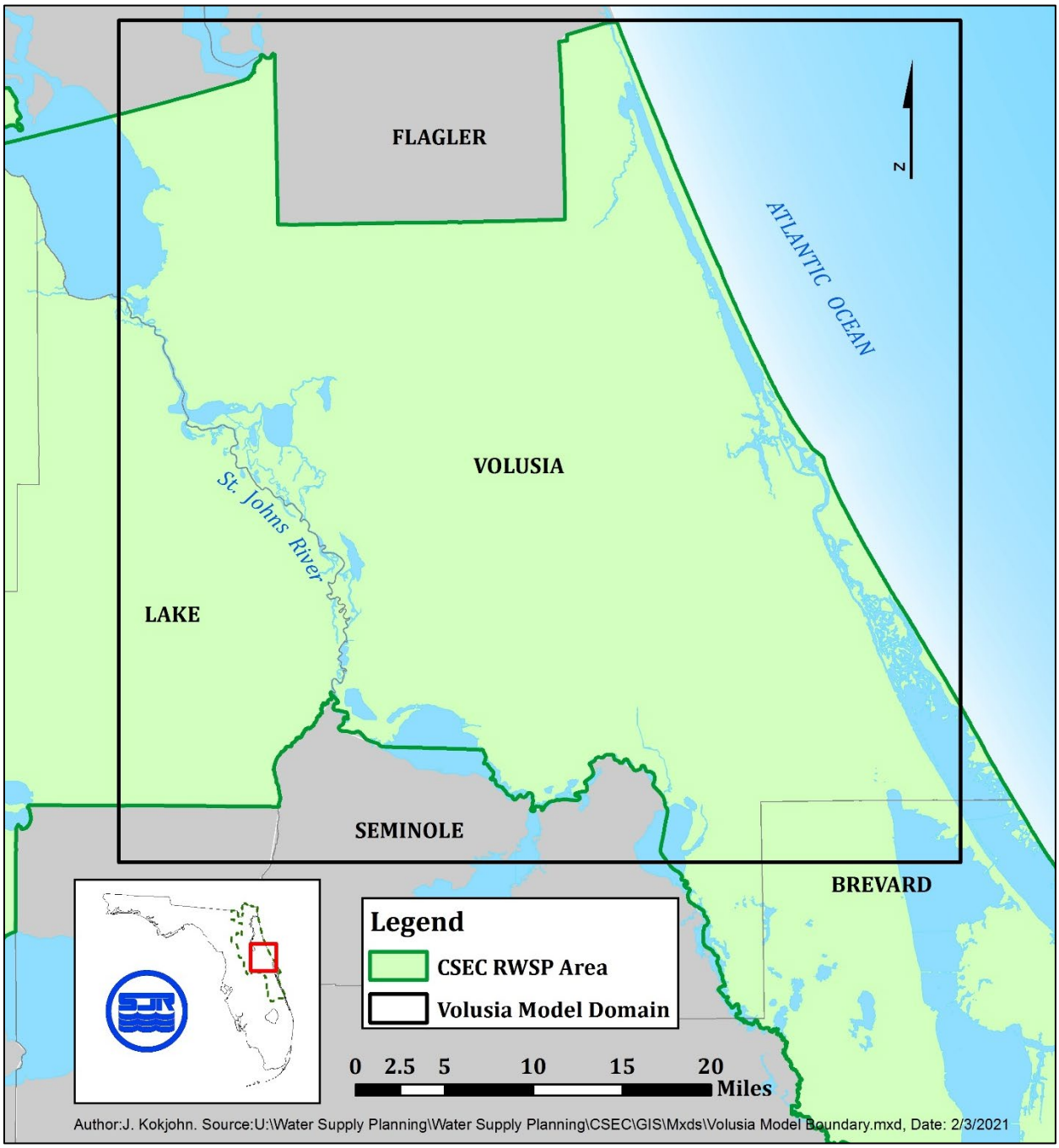


Figure A1-11: Volusia Model Domain

Methodology

SJRWMD completed a water resource assessment using the Volusia model to estimate the potential impacts from 2015 through the 2040 planning horizon. The assessment addressed the potential impacts of groundwater withdrawals with respect to adopted minimum flows and minimum levels (MFL) and wetlands in Volusia County.

Three modeling scenarios and two comparisons, listed below, were performed as part of the Volusia water resource assessment and to predict the benefits of water supply and water resource development projects. Modeling of additional water use scenarios was performed to determine current (i.e., 2015 base year) MFL status and is described in Appendix C.

Scenarios

- Scenario 1: 2015 water use (calibrated base year condition)
- Scenario 2: 2040 projected water demand
- Scenario 3: Scenario 2 with water supply and water resource development projects included

Comparisons

Comparison 1 was performed to assess potential water resource impacts due to projected increases in groundwater withdrawals within the Volusia model domain. Comparison 2 was used to demonstrate the effectiveness of the water supply and water resource development projects summarized in Chapter 6.

Results of these comparisons are described in Chapters 4 and 5.

- Comparison 1: MFL water bodies and wetland assessment (Scenario 2 minus Scenario 1)
- Comparison 2: Benefits of water supply and water resource development projects (Scenario 3 minus Scenario 2)

Chapter 4: Evaluation of Potential Effects of Projected Water Demand on Water Resources within Volusia County (Water Resource Assessment)

Water Resource Assessment Results

A water resource assessment was performed for Volusia County at 2040 projected water demand. The results for the MFL, groundwater quality, and wetland analyses are provided in this chapter, along with a list of approved MFL prevention/recovery strategies applicable to the area.

MFLs

The MFL analysis results are summarized in Table A1-3 and then discussed by water body type below. Additional details regarding the analysis are provided in Appendix F.

Table A1-3: Status of Assessed MFL Water Bodies in Volusia County

Type	Name	MFLs Status at 2040
Lake	Big	Met
Lake	Butler	Prevention
Lake	Colby	Met
Lake	Coon Pond	Met
Lake	Daugharty	Met
Lake	Davis	Met
Lake	Emporia	Met
Lake	Helen	Met
Lake	Hires	Met
Lake	Indian	Prevention
Lake	Lower Louise	Met
Lake	Scoggin	Prevention
Lake	Shaw	Prevention
Lake	Three Island	Met
Lake	Upper Louise	Met
Lake	Winnemisett	Met
Lake	Winona	Met
River	St. Johns at S.R. 44 (DeLand)	Met
Spring	Blue	Recovery
Spring	De Leon	Met
Spring	Gemini	Met

Lakes with MFLs

Results of the MFL lake analysis indicate that 13 of the 17 evaluated lakes in Volusia County are meeting their MFLs under current conditions and are projected to meet their MFLs throughout the 2040 planning horizon. The MFLs for Butler, Indian, Scoggin, and Shaw lakes are considered to be in prevention since their MFLs are met under current conditions but not under 2040 projected conditions. The amount of Upper Floridan aquifer (UFA) level rebound needed to ensure achievement of these MFLs in 2040 is provided in Table A1-4.

Table A1-4: Summary of UFA Rebound Requirements for MFL Lakes in Volusia County

Lake	2015 Freeboard (ft)	2015 to 2040 Drawdown (ft)	UFA Rebound Needed (ft)
Butler	0.2	0.6	0.4
Indian	0.3 [1]	1.3	1.0
Scoggin	0.4	0.8	0.4
Shaw	0.7	1.3	0.6

[1] Includes benefit of the Tiger Bay weir (0.47 ft), constructed in 2016.

Rivers with MFLs

The MFL status assessment for the St. Johns River near DeLand shows the MFLs are met under current and 2040 projected water use conditions.

Springs with MFLs

Results of the MFL springs analysis show that De Leon and Gemini springs are meeting their MFLs under current conditions and will continue to meet their MFLs through the planning horizon.

The Blue Spring MFL is unique in that it defines a minimum flow regime that increases in five-year increments with the final minimum flow of 157 cfs becoming effective in 2024 (40C-8, *Florida Administrative Code* (*F.A.C.*)) A Blue Spring MFL status evaluation was performed in 2018 to support the first five-year assessment of the 2013 Volusia prevention and recovery strategy (SJRWMD 2019; see *MFL Prevention and Recovery Strategies* below). Results from the analysis showed that the Blue Spring MFL applicable to 2018 (142 cfs) was being achieved under current pumping conditions and the MFL status remained in prevention. On April 1, 2019, the Blue Spring minimum flow increased to 148 cfs, pursuant to the adopted MFL. An updated MFL status determination showed that the higher minimum flow was not being met and, therefore, the status of the Blue Spring MFL shifted to recovery. Pursuant to 40C-8.031(13)(a), *F.A.C.*, SJRWMD will perform a causation analysis to evaluate the potential impacts of various stressors on Blue Spring, including whether groundwater pumping is a factor. Based on the results of this analysis,

SJRWMD will evaluate existing MFL criteria and may adjust any existing prevention/recovery strategies, if necessary, to ensure the protection of Blue Spring from significant harm due to consumptive uses of water. In addition, SJRWMD may request Governing Board authorization to include Blue Spring on the MFL Priority List and Schedule for re-evaluation prior to the next Central Springs/East Coast (CSEC) RWSP.

The existing Blue Spring MFL requires a final minimum flow increase to 157 cfs by 2024. Table A1-5 shows the amount of flow needed to meet the current (148 cfs) and final (157 cfs) Blue Spring MFL at current and projected pumping conditions. Currently, there are sufficient projects and measures identified in the MFL prevention/recovery strategy and five-year assessment to ensure achievement of the final Blue Spring MFL at 2040 projected water demand. Additional details regarding the Blue Spring MFL assessment are provided in Appendix F.

Table A1-5: Summary of Flow Recovery Requirements for Blue Spring

Year	MFL (cfs)	Recovery Needed at Current Pumping[1] (cfs)	Additional Impacts due to Projected Pumping Increases (cfs)	Total Recovery Needed (cfs)
2019	148	4.6	1.3	5.9
2040	157	12.0	5.0	17.0

[1] Current pumping represents average withdrawals from 2011 through 2015

MFL Prevention and Recovery Strategies

The Prevention/Recovery Strategy for the Implementation of Minimum Flows and Levels for Volusia Blue Spring and Big, Daugharty, Helen, Hires, Indian, and Three Island Lakes (2013 Volusia Strategy; SJRWMD 2013), which addresses MFLs for Volusia County, was approved by the SJRWMD Governing Board on November 12, 2013. A five-year assessment of the 2013 Volusia Strategy was performed in 2018. The 2018 Five-Year Strategy Assessment for the *Implementation of Minimum Flows and Levels for Volusia Blue Spring and Big, Daugharty, Helen, Hires, Indian, and Three Island Lakes* (2018 Volusia Strategy Assessment; SJRWMD 2019) updated the prevention/recovery status of the Volusia County MFL water bodies (with the exception of Lake Butler, whose MFLs were not adopted at the time) and identified additional projects to ensure achievement of the listed MFLs at 2040 projected water demand. Lake Butler MFLs were approved for adoption on August 11, 2020, at which time the Governing Board concurrently approved the Prevention Strategy for the Implementation of Lake Butler Minimum Levels (2020 Lake Butler Strategy). Since the projects listed in the 2013 Volusia Strategy were sufficient to ensure achievement of Lake Butler MFLs through 2040 with additional benefits predicted as a result of the projects listed in the 2018 Volusia Strategy Assessment, the 2020 Lake Butler Strategy included only those previously identified projects. All three strategy documents are included in Appendix G.

Groundwater Quality (Saltwater Intrusion)

The groundwater quality analysis results are summarized below by well type. Additional information including data on specific wells is provided in Appendix D.

District Observation Well Network Wells

Three District Observation Well Network (DOWN) wells showed increasing chloride concentrations at rates ≥ 3 milligrams per liter per year (mg/L/yr)(high rate of change), and one DOWN well showed increasing chloride concentrations at a rate within the range ≥ 1 and < 3 mg/L/yr (medium rate of change)(Table A1-6). Three of the four wells with high and medium rates of chloride change currently exceed the chloride secondary drinking water standard (SDWS) and are generally located near the St. Johns River in the St. Johns River valley (Figure A1-12). This area is characterized as a groundwater discharge zone where hydraulic conditions allow relict sea water from the Lower Floridan aquifer to mix with freshwater from the UFA through upward leakage or direct flow through fractures or faults (Boniol 2002). Here, the UFA freshwater lens can be thin, and the open hole interval of monitoring wells may extend beneath this lens within a zone of lower quality water. It is possible that saltwater intrusion via upconing is occurring in a select group of analyzed DOWN wells, specifically those located close to pumping centers. However, the upconing appears to be localized as other monitoring wells in the area did not show increasing chloride concentration trends.

Of the four DOWN wells that showed a statistically significant decreasing rate of change, two have chloride concentrations that currently exceed the SDWS. All the DOWN wells analyzed in Volusia County were constructed in the UFA.

Table A1-6: Analyzed UFA DOWN Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Volusia County

Chloride Trend Category	Number of Wells Currently Exceeding 250 mg/L	Number of Additional Wells Projected to Exceed 250 mg/L by 2040
High Rate of Change (3 wells)	3	---
Medium Rate of Change (1 wells)	0	0
Decreasing Rate of Change (4 wells)	2	NA

Note: mg/L = milligrams per liter

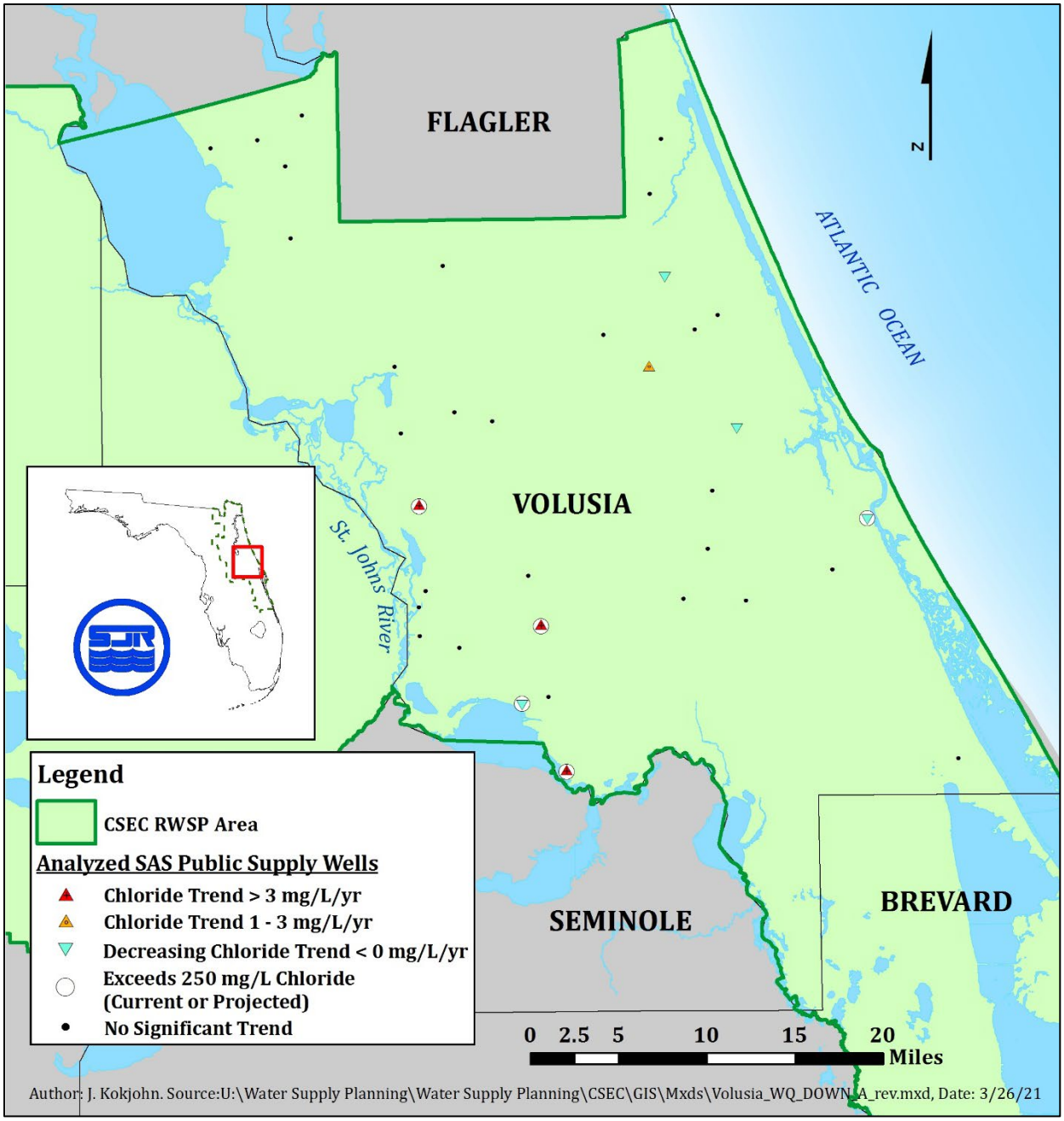


Figure A1-12: Spatial Summary of UFA DOWN Well Chloride Trend Analysis in Volusia County

Public Supply Wells

Fourteen public supply wells showed increasing chloride concentrations at rates ≥ 3 mg/L/yr (high rate of change), and three public supply wells showed increasing chloride concentrations at rates within the range ≥ 1 and < 3 mg/L/yr (medium rate of change)(Table A1-7). These 17 wells with high and medium rates of chloride change were generally located in the St. Johns River valley or near the Atlantic coastline (Figure A1-13). None of these 17 wells currently exceed the chloride

SDWS; however, 10 wells are projected to exceed the SDWS by 2040. The DOWN well analysis did not show signs of lateral saltwater intrusion, therefore it is possible that these trending public supply wells are experiencing water quality changes as a result of upconing. Current, or potentially enhanced, wellfield management strategies implemented by affected utilities may decrease or reverse the increasing chloride trends.

Finally, of the 70 public supply wells that showed a statistically significant decreasing rate of change, only one has a chloride concentration that currently exceeds the SDWS. All the public supply wells analyzed in Volusia County were constructed in the UFA.

Table A1-7: Analyzed UFA Public Supply Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Volusia County

Chloride Trend Category	**Number of Wells Currently Exceeding 250 mg/L**	**Number of Additional Wells Projected to Exceed 250 mg/L by 2040**
High Rate of Change (14 wells)	0	10
Medium Rate of Change (3 wells)	0	0
Decreasing Rate of Change (70 wells)	1	NA

Note: mg/L = milligrams per liter

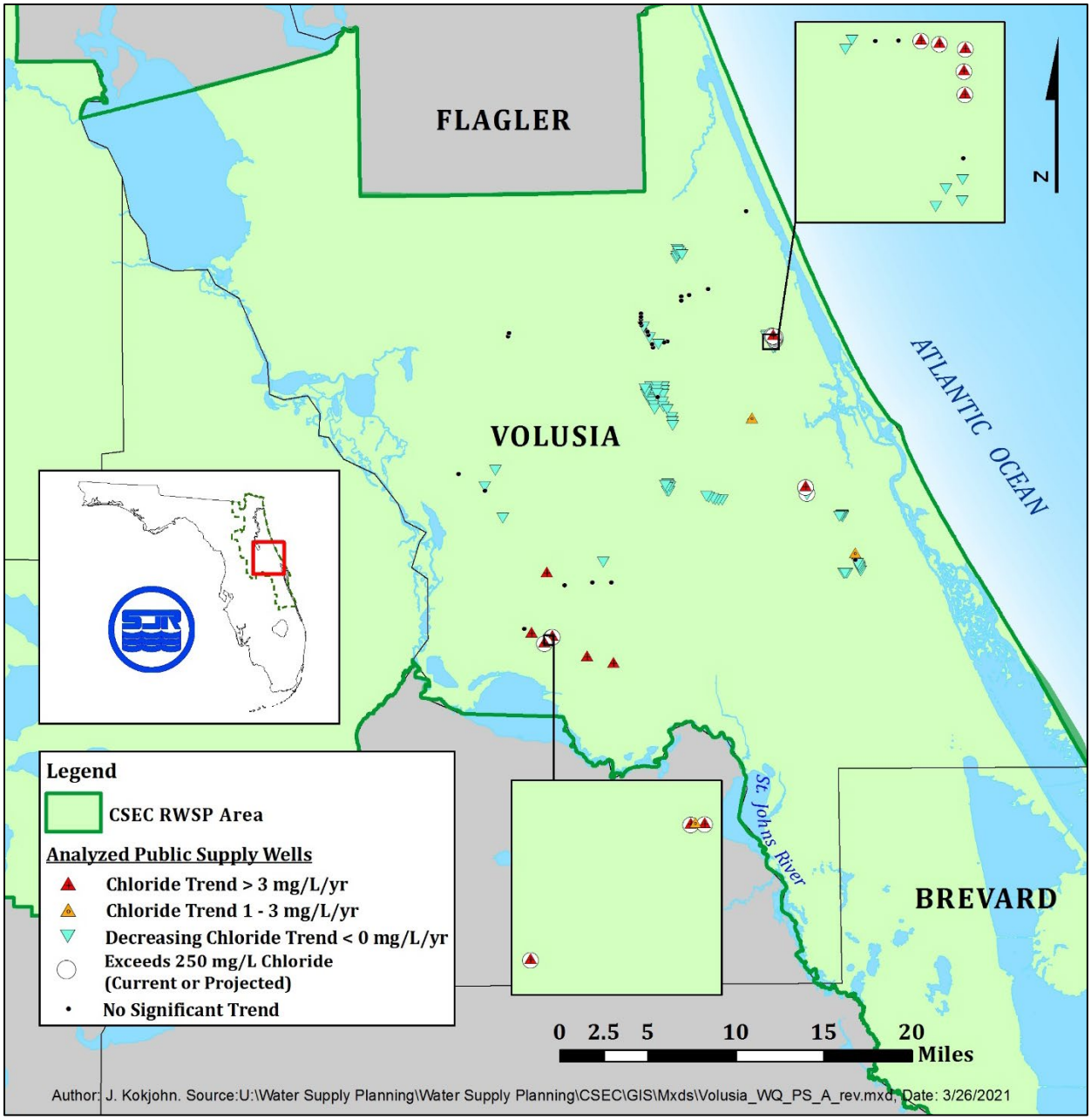


Figure A1-13: Spatial Summary of UFA Public Supply Well Chloride Trend Analysis in Volusia County

Agricultural Wells

One of the two analyzed agricultural wells showed an increasing chloride concentration at a rate ≥ 3 mg/L/yr (high rate of change) and currently exceeds the chloride SDWS (Table A1-8). This well is located in southern Volusia County and is a UFA monitor well associated with a proposed agricultural operation (Figure A1-14). This well monitors the lower zone of the UFA, which is brackish in this region. Although the agricultural facility is not yet in operation, it is possible that upconing

from other withdrawals in the area are influencing this well. However, the period of record for the agricultural monitor well is only four years. A monitor well associated with a nearby wellfield has a six-year period of record and shows no apparent trend with the additional two years of data. SJRWMD will re-evaluate the chloride trend during the next CSEC RWSP update when the period of record includes an additional five years.

Table A1-8: Analyzed UFA Agricultural Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Volusia County

Chloride Trend Category	Number of Wells Currently Exceeding 250 mg/L	Number of Additional Wells Projected to Exceed 250 mg/L by 2040
High Rate of Change (1 well)	1	---
Medium Rate of Change (0 wells)	---	---
Decreasing Rate of Change (0 wells)	---	NA

Note: mg/L = milligrams per liter

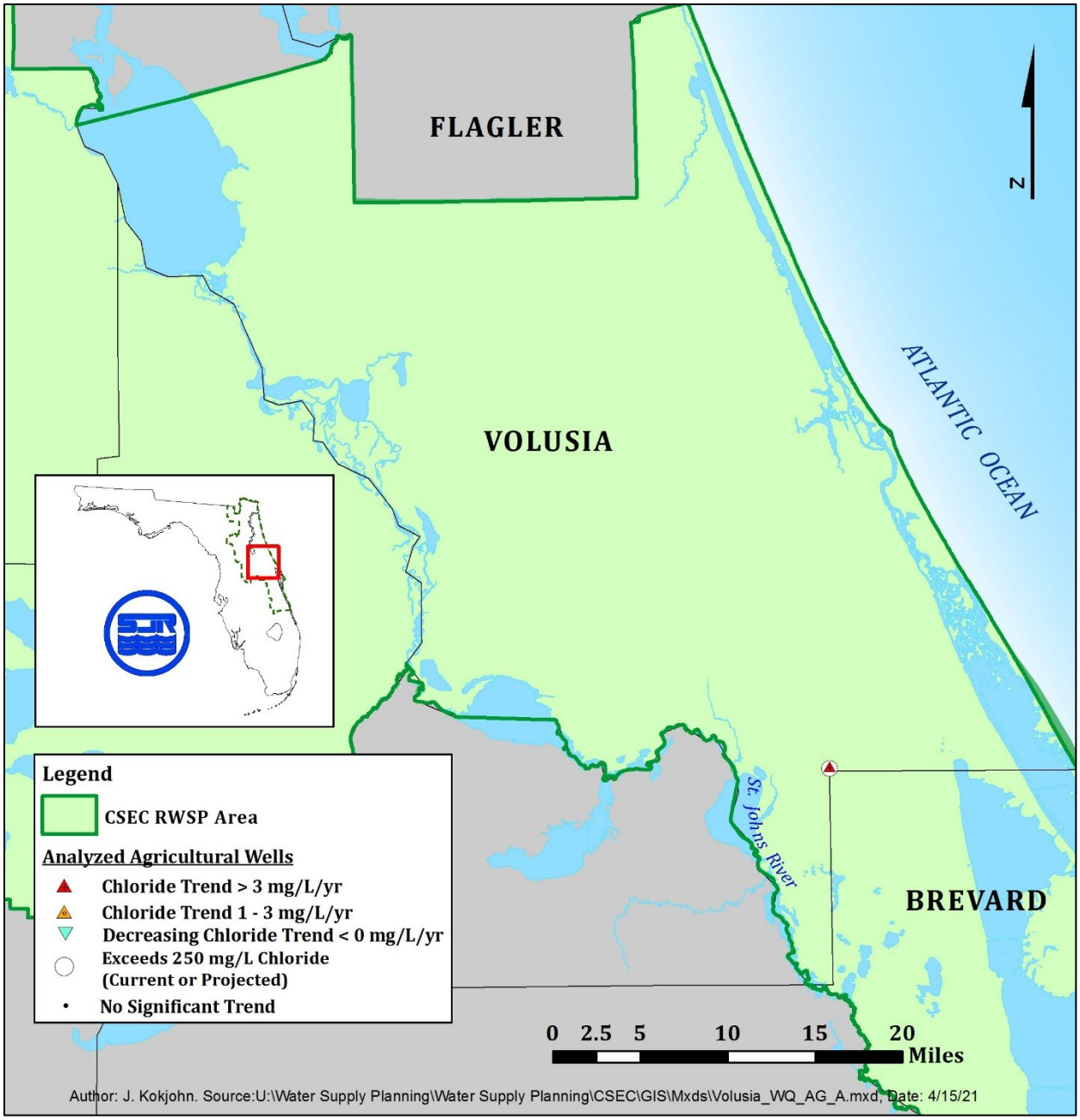


Figure A1-14: Spatial Summary of Agricultural Well Chloride Trend Analysis in Volusia County

Wetlands

The wetland assessment identified 4,558 acres with a moderate or high potential for adverse change based on 2040 projected water demand within Volusia County (Figure A1-15). Due to the geographic extent of the Volusia model, the southeast corner and southernmost part of Volusia County was not included in this analysis. The potential for adverse change does not necessarily correspond to realized adverse change due to the uncertainty with the analysis. As a result, field verification and monitoring, typically carried out for the SJRWMD regulatory program, is required when it is determined to be necessary to ensure the prevention of impacts from groundwater pumping. In 2015, the SJRWMD regulatory program implemented an enhanced wetland monitoring protocol that was developed and approved by stakeholders during the CFWI planning process (CFWI 2018). This new protocol results in a more comprehensive and defensible strategy to monitor for and prevent adverse change to wetlands resulting from groundwater withdrawals. The CSEC wetland assessment is not a replacement for the analysis of the specific potential of a proposed consumptive use to individually or cumulatively impact wetland systems, however, the spatial coverage of wetland acreage identified as being at risk for change can be utilized by regulatory staff as a screening tool to locate general areas where potential wetland impacts are more likely to occur.

Additional detailed information regarding the wetland assessment methodology is included in Appendix H.

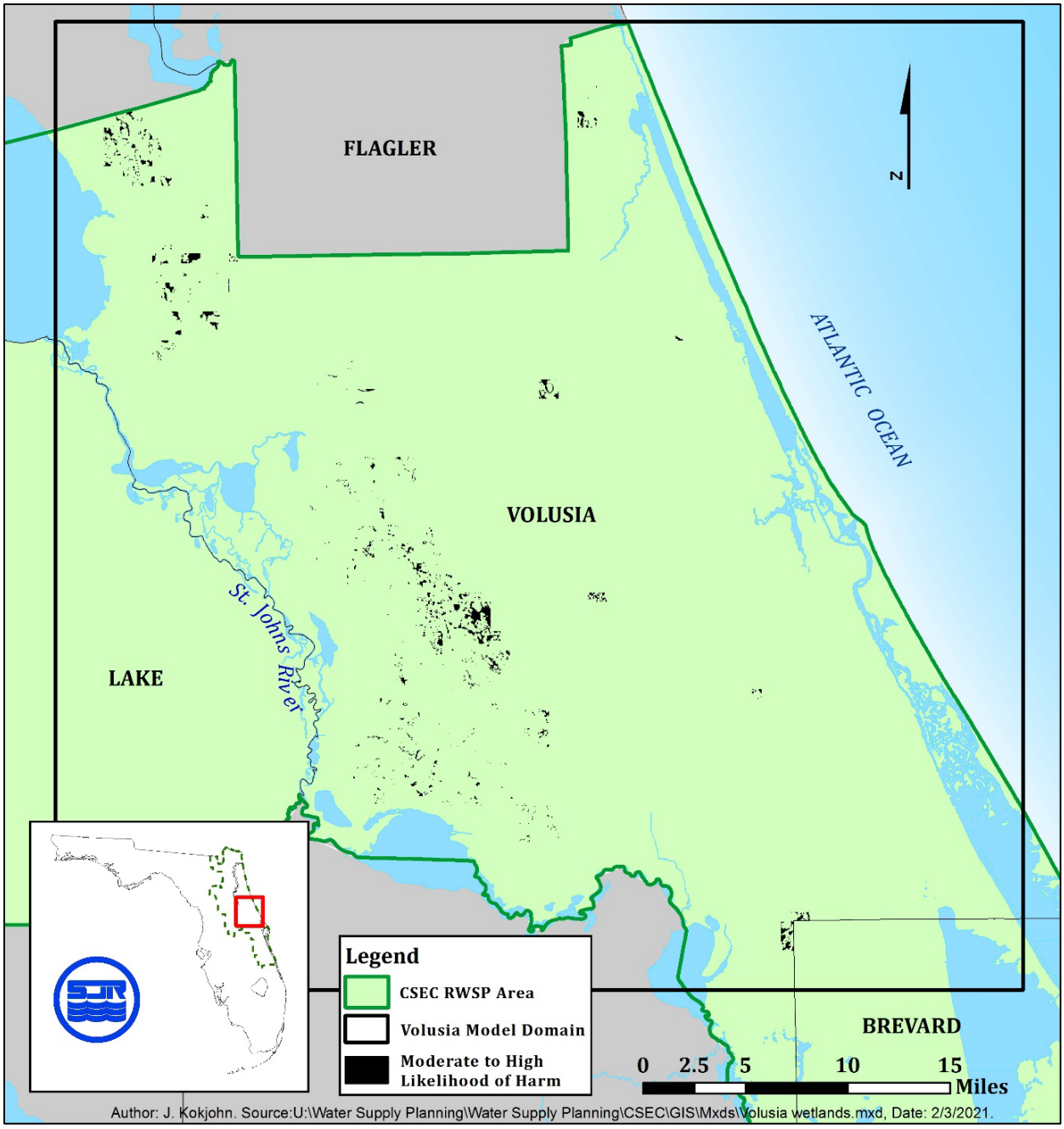


Figure A1-15: Wetlands at Risk of Adverse Change in Volusia County Due to 2040 Projected Withdrawals within the Volusia Model Domain

Chapter 5: Alternative Water Supply Needs Assessment and Delineation of Water Resource Caution Area for Volusia County (Sufficiency Analysis)

Sufficiency Analysis

Within Volusia County, results of the MFLs, water quality, and wetland analyses demonstrate the potential water resource impacts associated with 110 mgd of future demand at 2040. Since water quality issues and wetland impacts are typically dealt with locally through wellfield management or regulatory restrictions, the focus of the suite of projects options in Chapter 6 is to address potential impacts to MFL water bodies, specifically those water bodies identified as being in prevention or recovery.

As required by Chapter 373.709, F.S., SJRWMD has included the 2013 Volusia Strategy, the 2018 Volusia Strategy Assessment, and the 2020 Lake Butler Strategy within the CSEC RWSP (Appendix G). By incorporating the specific projects identified in these strategies, the CSEC RWSP provides assurance that Volusia County's future water needs will be met while sustaining water resources and related natural systems.

Using the Volusia model, SJRWMD assessed the benefits of 41.1 mgd of water conservation potential and water supply and water resource development projects. The modeling results demonstrate that implementation of the suite of projects is sufficient to provide the increase in springflow and aquifer levels required to ensure achievement of MFLs at 2040 projected water demand.

MFL Water Bodies in Prevention or Recovery

As mentioned previously, implementation of the projects summarized in Chapter 6 is sufficient to ensure achievement of Volusia County MFLs at the 2040 planning horizon. Specific details regarding each MFL water body identified as being in prevention or recovery are provided below.

Lake Butler

Maximizing the beneficial use of reclaimed water from the West Volusia Water Suppliers (WVWS) along with the implementation of conservation measures is sufficient to achieve Lake Butler MFLs at 2040. Recharge and wellfield optimization projects provide additional benefits to Lake Butler, which cumulatively contribute to 1.0 ft of available freeboard at 2040 with project implementation.

Indian Lake

With implementation of water conservation measures, the Bennett Swamp rehydration project, and maximized utilization of additional reclaimed water to offset groundwater withdrawals within the vicinity of the lake, the Indian Lake

MFLs will be achieved at 2040 with 1.0 ft of remaining freeboard. This analysis assumed that nearby utilities would continue to implement the wellfield management plans memorialized by condition in their respective consumptive use permits. These wellfield management plans are not listed as project options due to full implementation prior to 2015, however, the permitted withdrawal distributions were incorporated into the modeled 2040 projected withdrawals. Additional surface water and groundwater modeling will be completed in 2023 that may show additional benefits at Indian Lake from the Tiger Bay Weir (constructed in 2016) and the Bennett Swamp rehydration project. This information will be included in the next CSEC RWSP five-year update.

Scoggin Lake

Scoggin Lake MFLs will be achieved at 2040 with 1.0 ft of freeboard through implementation of water conservation measures and additional reclaimed water utilization within the model domain. Similar to Indian Lake, this analysis assumed that nearby utilities would continue to adhere to their wellfield management plans throughout the planning horizon.

Shaw Lake

Implementation of water conservation measures is sufficient to ensure Shaw Lake MFLs are met at the planning horizon, although results show negligible remaining freeboard. Currently, a single consumptive use permit utilizes surface water withdrawals from Shaw Lake for crop freeze protection. Additional UFA freeboard may be achievable through a permit modification that authorizes an alternative source for freeze protection. SJRWMD regulatory staff have been notified of the Shaw Lake MFL status, which will assist in future consumptive use permit application review.

Blue Spring

Implementation of the water conservation, alternative water supply, reclaimed water expansion, and recharge projects identified in this plan will ensure achievement of the final Blue Spring MFL (157 cfs) at 2040 projected water demand with approximately 0.8 cfs of remaining freeboard.

Water Quality

Eleven percent of the analyzed DOWN wells, 12 percent of the analyzed public supply wells, and one of the two analyzed agricultural wells in Volusia County displayed increasing chloride concentrations at the high or medium rate of change. These increasing trends may be the result of localized upconing in response to groundwater withdrawals, which can often be mitigated through enhanced wellfield management strategies or well modifications. Although the projects in Chapter 6 did not directly address potential water quality issues resulting from possible upconing, several

projects will reduce groundwater pumping in vulnerable areas. Wellfield management plans that move withdrawals outside the Blue Spring springshed and the further development of alternative water supplies such as reclaimed water and surface water have the potential to reduce upconing impacts in the St. Johns River valley. In the coastal areas where only select wells within a wellfield appear to be affected by upconing, public supply utilities can investigate the modification of wells or operation strategies to reduce water quality changes. When viewed in total, the primary conclusion of this analysis is that groundwater quality may constrain the availability of fresh groundwater in a limited area within Volusia County, specifically along the coast and near the St. Johns River. However, through the implementation of proposed projects and enhanced management strategies, it may be possible to reduce or reverse increasing chloride concentration trends in impacted areas. The SJRWMD Regulatory Program will continue to evaluate the potential for harmful upconing and lateral intrusion during consumptive use permit application review to ensure all permitting criteria are met prior to permit issuance. In addition, SJRWMD will investigate instances of unforeseen harmful water quality impacts potentially resulting from consumptive uses of water, and if verified, will require mitigation by the responsible permittee(s).

It should be noted that the major public supply utilities in coastal Volusia County have developed additional wellfields further inland. New wellfields were necessary to avoid water quality degradation in the thin freshwater lens of the Upper Floridan aquifer near the coast while meeting increased demand of growing populations. The continued shift of withdrawals to the west may be of concern in the future as municipalities in western Volusia County are shifting withdrawals east to mitigate impacts to MFL water bodies. Additional alternative water supplies may be necessary in the future as utilities continue to shift withdrawals toward central Volusia County to reduce water resource impacts.

Wetlands

Since the potential for adverse change does not necessarily correspond to realized adverse change (see Chapter 4), water supply and water resource project development did not focus on reducing the 4,553 acres of wetlands identified as having the potential for adverse change. However, implementation of the projects specified in the CSEC RWSP will reduce the acreage of potentially impacted wetlands, although these benefits were not quantified as a part of this plan. Furthermore, through the continued use of the enhanced wetland assessment protocol in conjunction with the spatial review of wetland acreage identified in the CSEC RWSP (see Chapter 4), SJRWMD regulatory staff will ensure the protection of wetland acreage within Volusia County by preventing, or requiring mitigation for, adverse impacts to wetlands from both individual and cumulative permit-related groundwater withdrawals.

Water Resource Caution Area

The 2013 Volusia Strategy identified MFL constraints in Volusia County that were reaffirmed in the 2018 Volusia Strategy Assessment and the 2020 Lake Butler Strategy.

Currently, four water bodies in Volusia County are listed as being in prevention with respect to their MFLs and one is in recovery. Projects identified in the strategies have been incorporated into the CSEC RWSP, as they are necessary to ensure achievement of the MFLs at 2040 projected water demand. The CSEC RWSP, along with the 2013 Volusia Strategy, the 2018 Volusia Strategy Assessment, and the 2020 Lake Butler Strategy, constrain the availability of groundwater throughout Volusia County and provide a technical basis for the constraint. As a result of these constraints, the Volusia County portion of the CSEC RWSP area is proposed for inclusion in the CSEC WRCA.

Chapter 6: Project Options for Volusia County

Water Resource Development Project Options

A summary of water resource development project options for Volusia County is shown in Table A1-9. Upon implementation, these projects would provide 16.6 mgd of water for aquifer recharge. Additional project details can be found in Appendix I.

Table A1-9: Summary of Water Resource Development Project Options in Volusia County

Type	Number of Projects	Quantity Water Produced (mgd)	Estimated Construction Cost (Million dollars)
Multi-source[1]	4	7.6	$20.7
Stormwater	1	3.0	$0.3
Reclaimed water	1	6.0	$5.3
Total	**6**	**16.6**	**$26.3**

Note: mgd = million gallons per day
[1] Combined source that can include reclaimed water, surface water, and stormwater.

Water Supply Development Project Options

A summary of water supply development options is shown in Table A1-10. Together, these projects provide 33.6 mgd of water in Volusia County. Since several of the projects increase reclaimed water availability due to storage expansion or supplementation with surface water, it is estimated that 15.4 mgd of reclaimed water will be available for additional future projects. These unspecified reclaimed water projects were considered in the sufficiency analysis presented in Chapter 5. Additional project details can be found in Appendix J.

Table A1-10: Summary of Water Supply Development Project Options in Volusia County

Type	Number of Projects	Quantity Water Produced (mgd)	Estimated Construction Cost (Million dollars)
Groundwater	2	8.0	$81.6
Multi-source[1]	2	12.1	$11.6
Reclaimed Water	20	13.5	$65.2
Total	**24**	**33.6**	**$158.4**

Note: mgd = million gallons per day
[1] Combined source that can include reclaimed water, surface water, and stormwater.

Water Conservation Project Options

Estimates for Volusia County show the water conservation potential at 9.8 mgd (high estimate) at 2040 at a cost of approximately $14.5 million. Eight water conservation projects are completed or currently underway in Volusia County with an estimated savings of 0.4 mgd of water for $1.3 million (Appendix K). Remaining conservation potential is

estimated at 9.4 mgd and can be realized through the implementation of the various types of water conservation projects listed in the CSEC RWSP.

Summary of SJRWMD Project Funding in Volusia County

From fiscal year (FY) 2014 through FY 2020, the SJRWMD cost-share program has awarded Volusia County cooperators approximately $43.5 million in total funds, with $22.3 million awarded specifically for water supply, natural systems, and water conservation projects (Appendix L). Once fully implemented, these projects will provide approximately 19.2 mgd of alternative water supplies and 0.4 mgd in water savings, with 1.0 mgd providing a natural systems benefit.

Chapter 7: Conclusions

The CSEC RWSP was developed consistent with the water supply planning requirements of Chapter 373, F.S. The CSEC RWSP concludes that the current and future water demands of Volusia County can be met through the 2040 planning horizon while sustaining the water resources and related natural systems through water conservation, management measures, and implementation of the water resource and water supply development projects identified in Chapter 6.

Total water demands by all water use categories in Volusia County are projected to increase from a current use in 2015 of 88.4 mgd to approximately 109.6 mgd in 2040. SJRWMD has determined that fresh groundwater alone cannot supply the projected 21.3 mgd increase in water demand without causing unacceptable impacts to water resources.

Primary solutions identified for meeting the future water demands in Volusia County while protecting the environment include enhanced water conservation, wellfield management, aquifer recharge, additional use and implementation of reclaimed water, and surface water and stormwater projects. With all of these options, SJRWMD and local stakeholders have identified up to 75.4 mgd of projects potentially available to offset the projected increase in water demand at 2040 under average (21.3 mgd) and 1-in-10 year drought conditions (32.5 mgd).

Chapter 8: References

Boniol, D. 2002. *Evaluation of Upper Floridan Aquifer Water Quality to Design a Monitoring Network in the St. Johns River Water Management District*. SJRWMD Technical Publication SJ2002-1.

Central Florida Water Initiative (CFWI). 2015. *Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP): Volume I – Planning Document*. Available from: http://cfwiwater.com/

CFWI. 2018. *Central Florida Water Initiative (CFWI); Minimum Standards for Water Resource Data Collection, Site Establishment, and Field Data Collection Protocols*. Available from: https://cfwiwater.com/pdfs/DMIT-MinStandards-2018.pdf

FDACS. 2017. *Florida Statewide Agricultural Irrigation Demand.* Prepared by The Balmoral Group. FDACS, Tallahassee, FL.

SJRWMD. 2013. *Prevention/Recovery Strategy for Implementation of Minimum Flows and Levels for Volusia Blue Spring and Big, Daugharty, Helen, Hires, Indian, and Three Island Lakes.* SJRWMD, Palatka, FL. Available from: www.sjrwmd.com/static/mfls/gb1311_005.pdf

SJRWMD. 2019. *2018 Five-Year Strategy Assessment for the Implementation of Minimum Flow and Levels for Volusia Blue Spring and Big, Daugharty, Helen, Hires, Indian, and Three Island Lakes*. SJRWMD, Palatka, FL. Available from: www.sjrwmd.com/static/mfls/Volusia_5year_assessment_2019.pdf

SJRWMD. 2020. *Prevention Strategy for the Implementation of Lake Butler Minimum Levels*. SJRWMD, Palatka, FL. Available from: www.sjrwmd.com/static/mfls/MFL-Lake-Butler/Butler_Strategy.pdf

Williams, S.A. 2006. *Simulation of the effects of groundwater withdrawals from the Floridan aquifer system in Volusia County and vicinity*. SJRWMD Technical Publication SJ2006-4.

A2: Regional Water Supply Plan Components for Marion and North Lake Counties

Chapter 1: Introduction to Marion and North Lake Counties

Population

The estimated population in Marion and North Lake[1] counties during the base year, 2015, was just under 0.43 million.

Primary Surface Water Basins

The primary surface water basins located within Marion and North Lake counties include portions of the Ocklawaha River, Middle St. Johns River, and Lake George basins.

Springs

There are three Outstanding Florida Springs (OFS) in Marion and North Lake counties, pursuant to subsection (ss.) 373.802(4), *Florida Statutes* (F.S.); Alexander (North Lake), Silver Glen (Marion), and Silver (Marion) springs. These three OFS are classified as first-magnitude springs, defined as having flows of at least 100 cubic feet per second (cfs). There are also seven second-magnitude springs in this region, defined as having flows between 10 and 100 cfs; Bugg, Messant, and Seminole springs in North Lake County and Fern Hammock, Juniper, Salt, and Sweetwater springs in Marion County.

[1] North Lake County is defined throughout the CSEC RWSP as that portion of Lake County that is not located in the Central Florida Water Initiative planning region.

Chapter 2: Water Demand, Reclaimed Water and Water Conservation Projections for Marion and North Lake Counties

Population

Total population for Marion and North Lake counties is expected to increase by 126,000 people (30% to approximately 554,000 people) by 2040 (Figure A2-1). For a breakdown of population by type (public supply versus domestic self-supply served) and by county, see Appendix B.

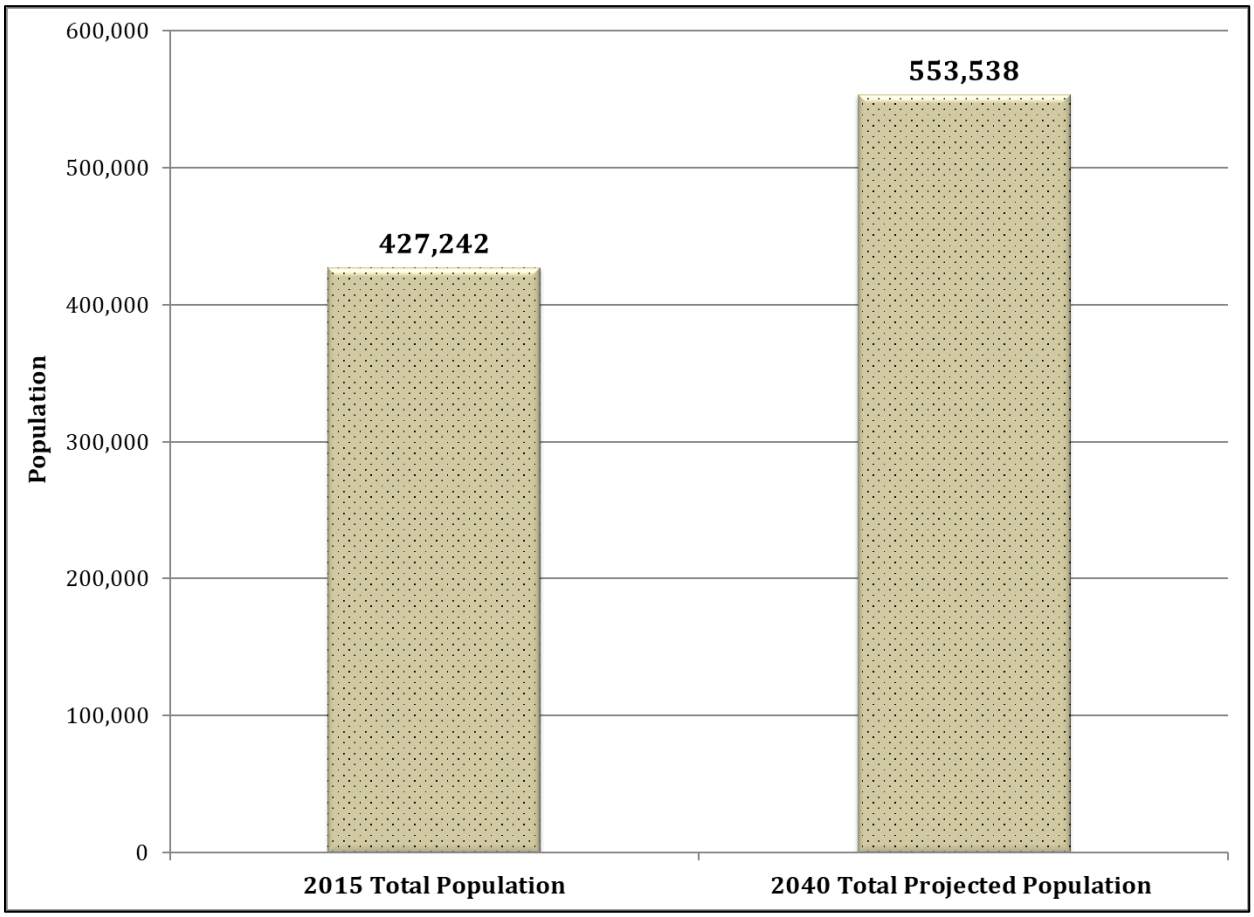


Figure A2-1: 2015 Population Estimate and 2040 Population Projection in Marion and North Lake Counties

Water Demand

Total water demand in Marion and North Lake counties is anticipated to increase from 96.4 million gallons per day (mgd) in 2015 to 126.4 mgd in 2040 (31%). Public supply represents the largest demand in Marion and North Lake counties (48%), followed by agriculture (20%), and domestic self-supply (DSS)(16%), as shown in Figure A2-2. It is estimated that 2040 total water demand could increase by an additional 14 percent (17.3 mgd) if a 1-in-10 year drought occurred.

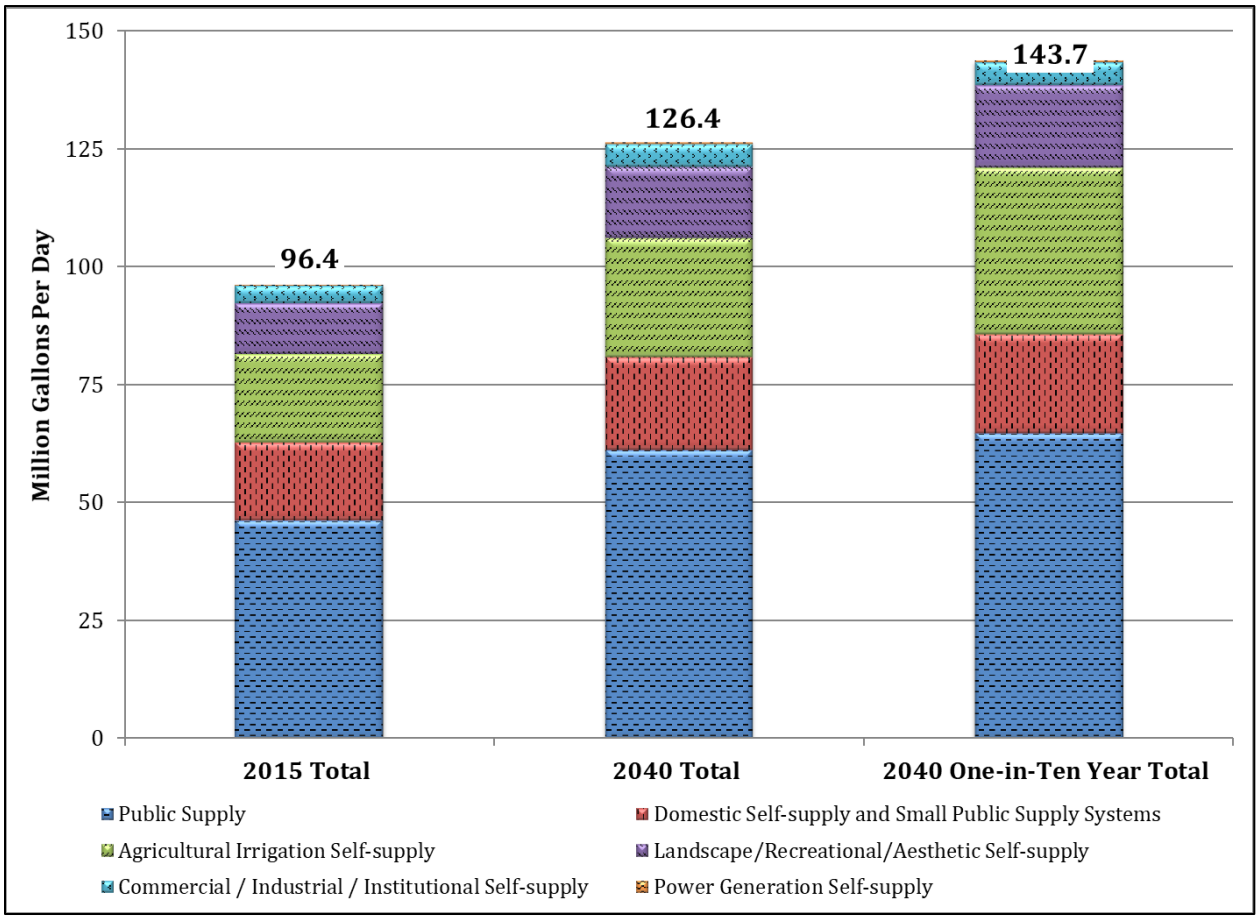


Figure A2-2: 2015 Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Public Supply Demand

Total public supply water demand for Marion and North Lake counties is expected to increase by 14.8 mgd (32% to approximately 61.1 mgd) by 2040 (Figure A2-3). Public supply represents 48 percent of the 2040 projected water demand in Marion and North Lake counties. Of note, public supply also represents 50 percent of the total increase in water demand in Marion and North Lake counties. It is estimated that 2040 public supply water demand could increase by an additional 6 percent (3.6 mgd) if a 1-in-10 year drought occurred.

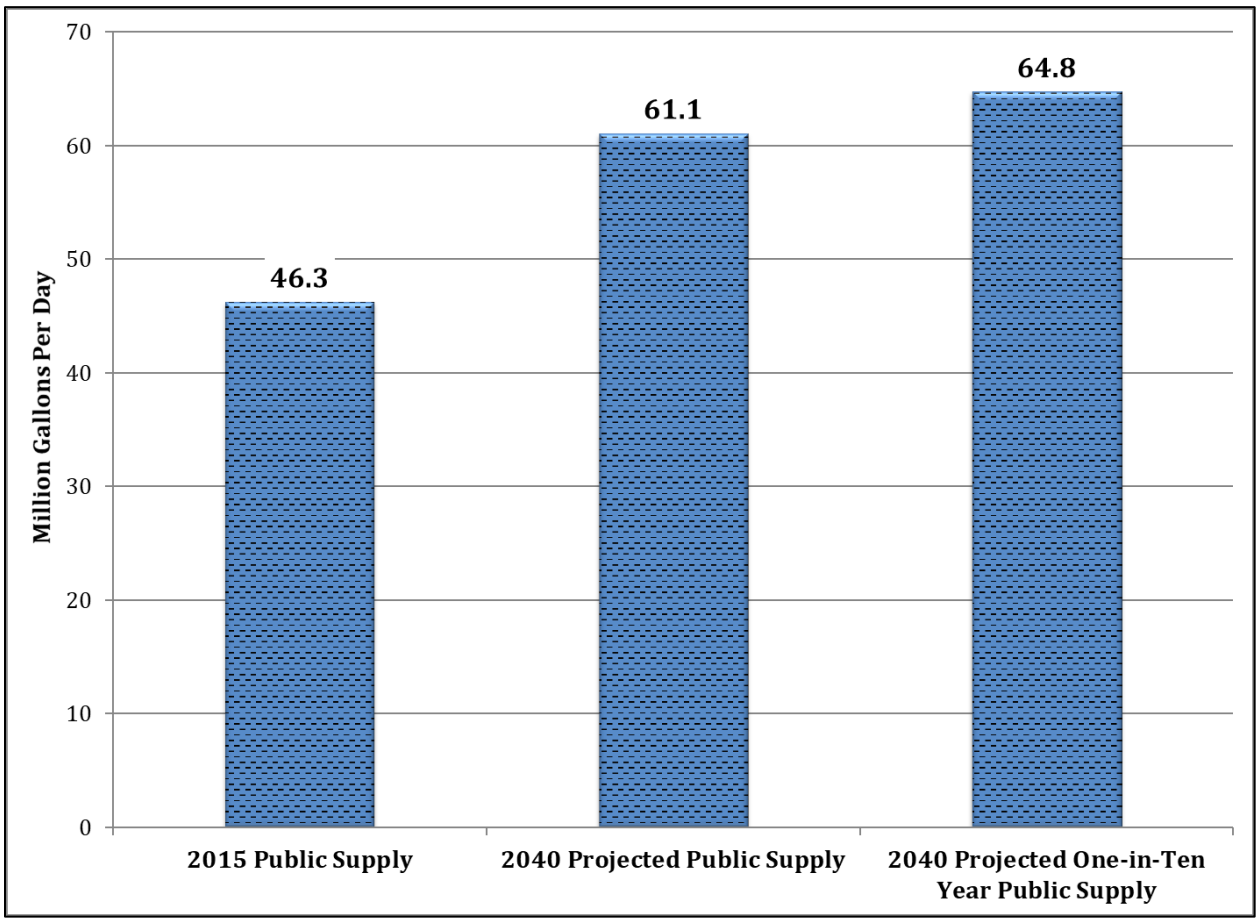


Figure A2-3: 2015 Public Supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Domestic Self-Supply Demand

In Marion and North Lake counties, total combined DSS water demand, which includes small public supply systems as defined in Appendix B, is expected to increase by 3.1 mgd (19% to 19.8 mgd) by 2040 (Figure A2-4). Of the 2040-combined DSS water demand, DSS wells represent 83 percent of the projected water demand (with small public supply systems representing the remaining 17%). It is estimated that 2040 DSS water demand could increase by an additional 6 percent (1.2 mgd) if a 1-in-10 year drought occurred.

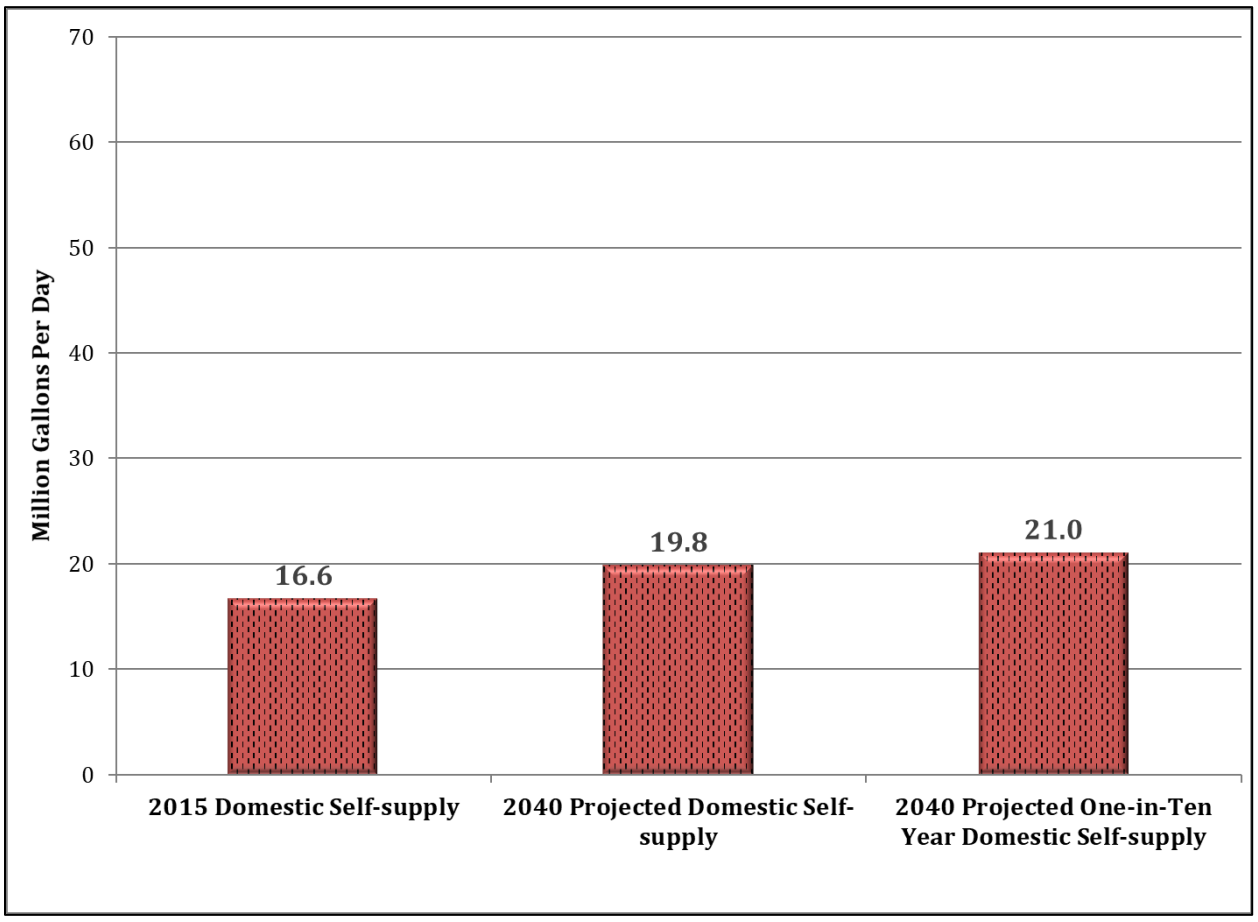


Figure A2-4: 2015 Combined Domestic Self-supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Agriculture Acreage and Demand

Total agricultural water demand for Marion and North Lake counties is expected to increase by 6.6 mgd (35% to approximately 25.3 mgd) by 2040 and acreage is expected to increase by 3,600 acres (22% to approximately 20,000 acres)(Figures A2-5 and A2-6). Florida Department of Agriculture and Consumer Services' (FDACS) Florida Statewide Agricultural Irrigation Demand (FSAID) IV estimates that 2040 agricultural water demand (which was based on a 5-in-10 year, or average, drought condition) could increase by an additional 40 percent (10.0 mgd) if a 1-in-10 year drought occurred (FDACS 2017).

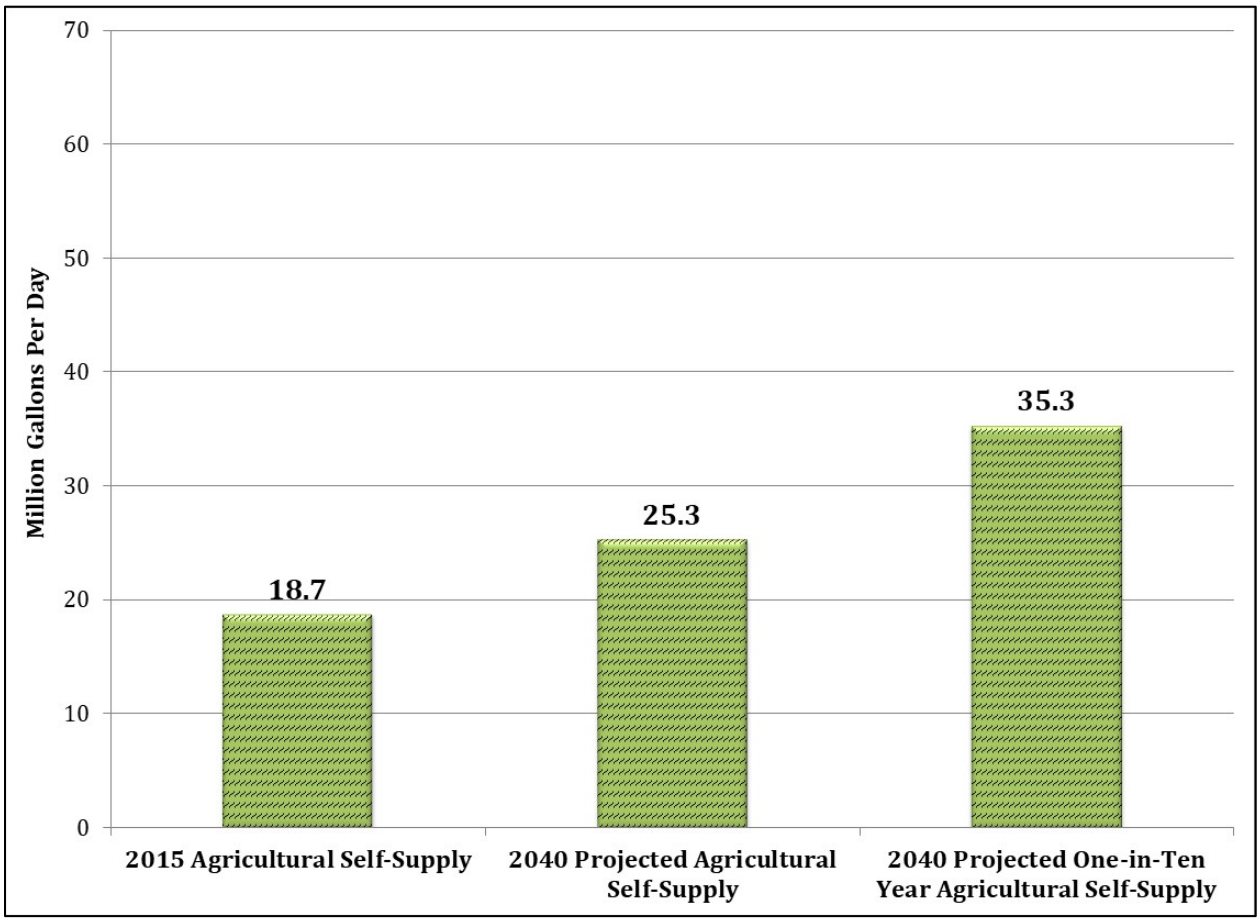


Figure A2-5: 2015 Agriculture Self-supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties (FDACS 2017)

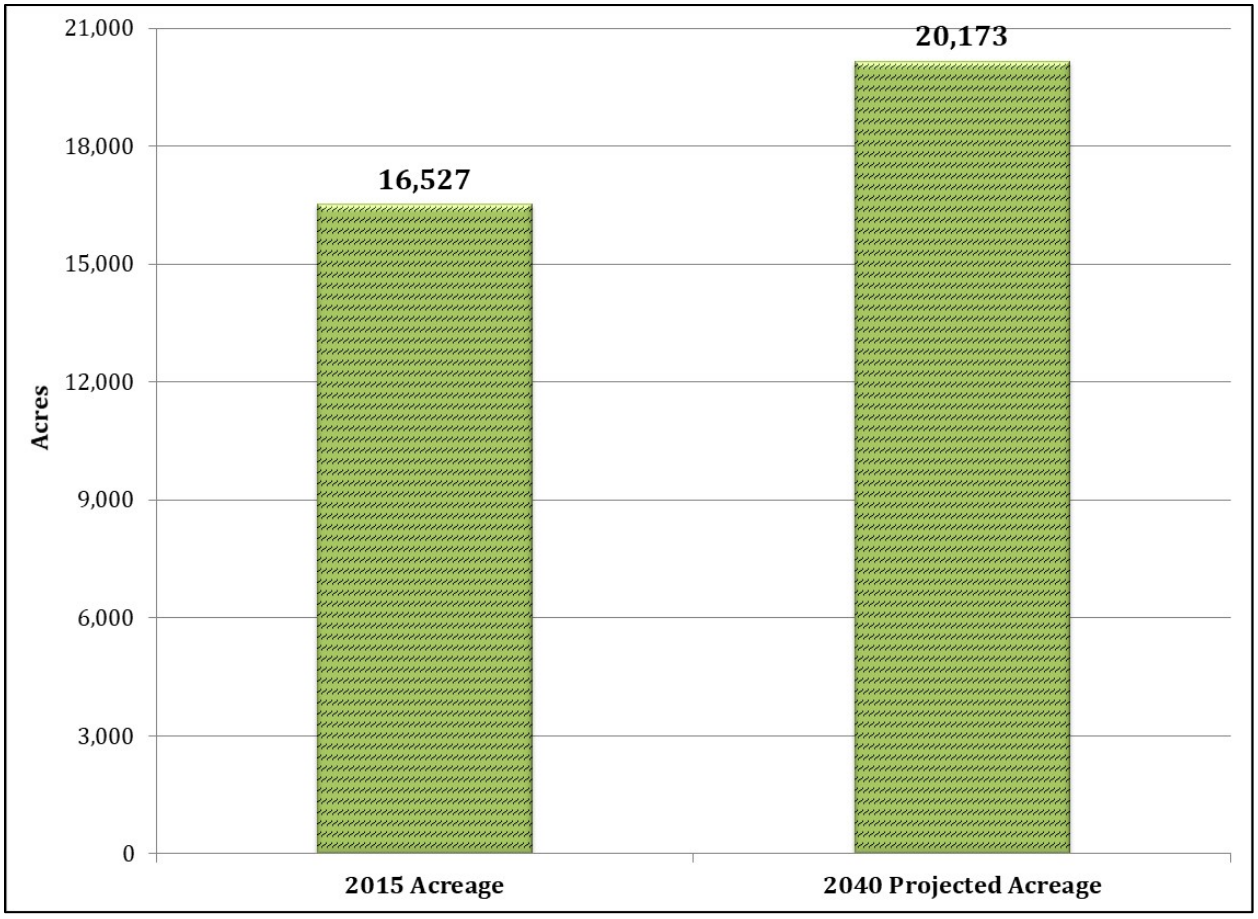


Figure A2-6: 2015 Agriculture Self-supply Acreage Estimates and 2040 Acreage Projections in Marion and North Lake Counties (FDACS 2017)

Commercial/Industrial/Institutional and Mining/Dewatering Demand

Total combined commercial/industrial/institutional and mining/dewatering water demand for Marion and North Lake counties is expected to increase by 1.0 mgd (28% to approximately 4.8 mgd) by 2040 (Figure A2-7).

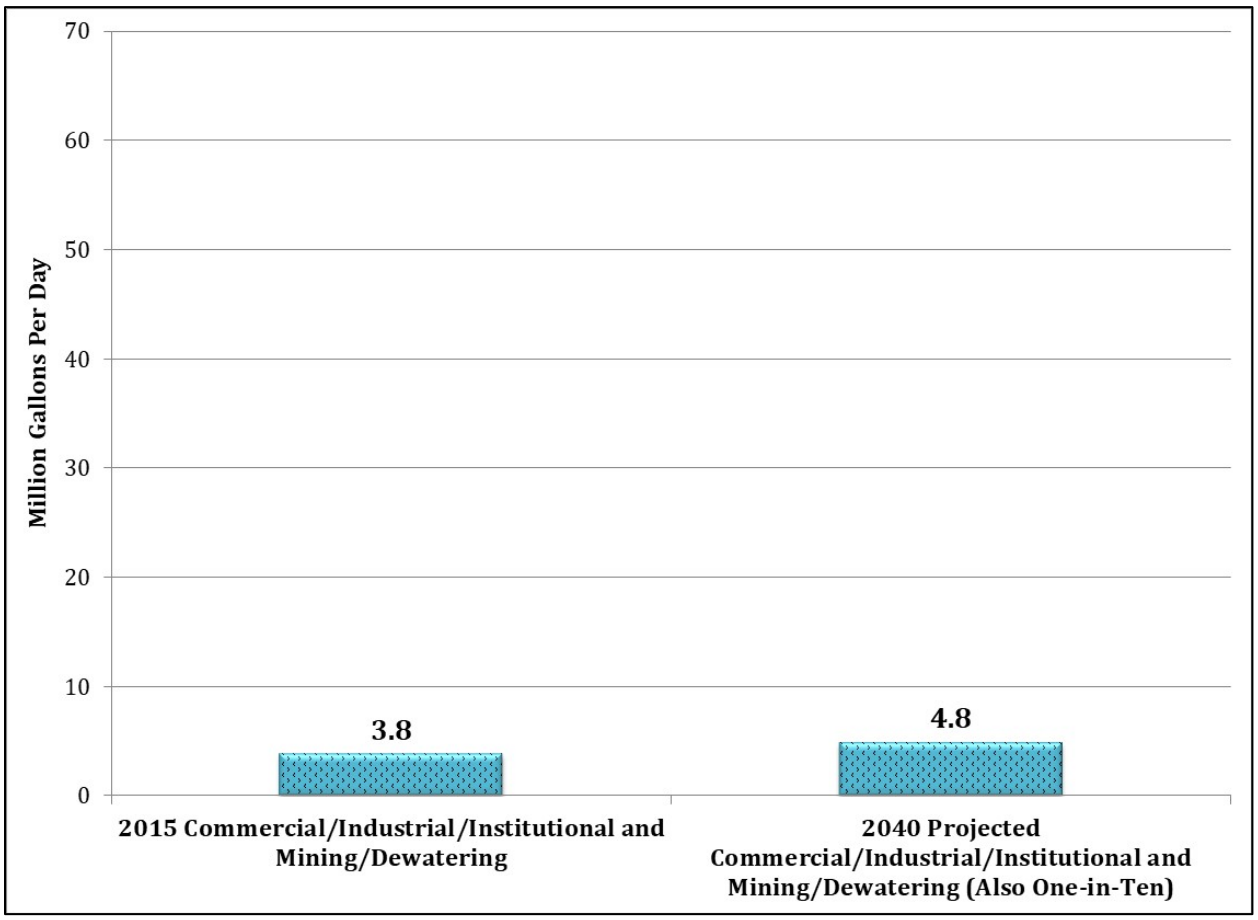


Figure A2-7: 2015 Commercial/Industrial/Institutional and Mining/Dewatering Self-supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Landscape/Recreation/Aesthetic Demand

Total landscape/recreation/aesthetic (LRA) water demand for Marion and North Lake counties is expected to increase by 4.2 mgd (39% to 15.0 mgd) by 2040 (Figure A2-8). It is estimated that 2040 LRA water demand could increase by an additional 17 percent (2.6 mgd) if a 1-in-10 year drought occurred.

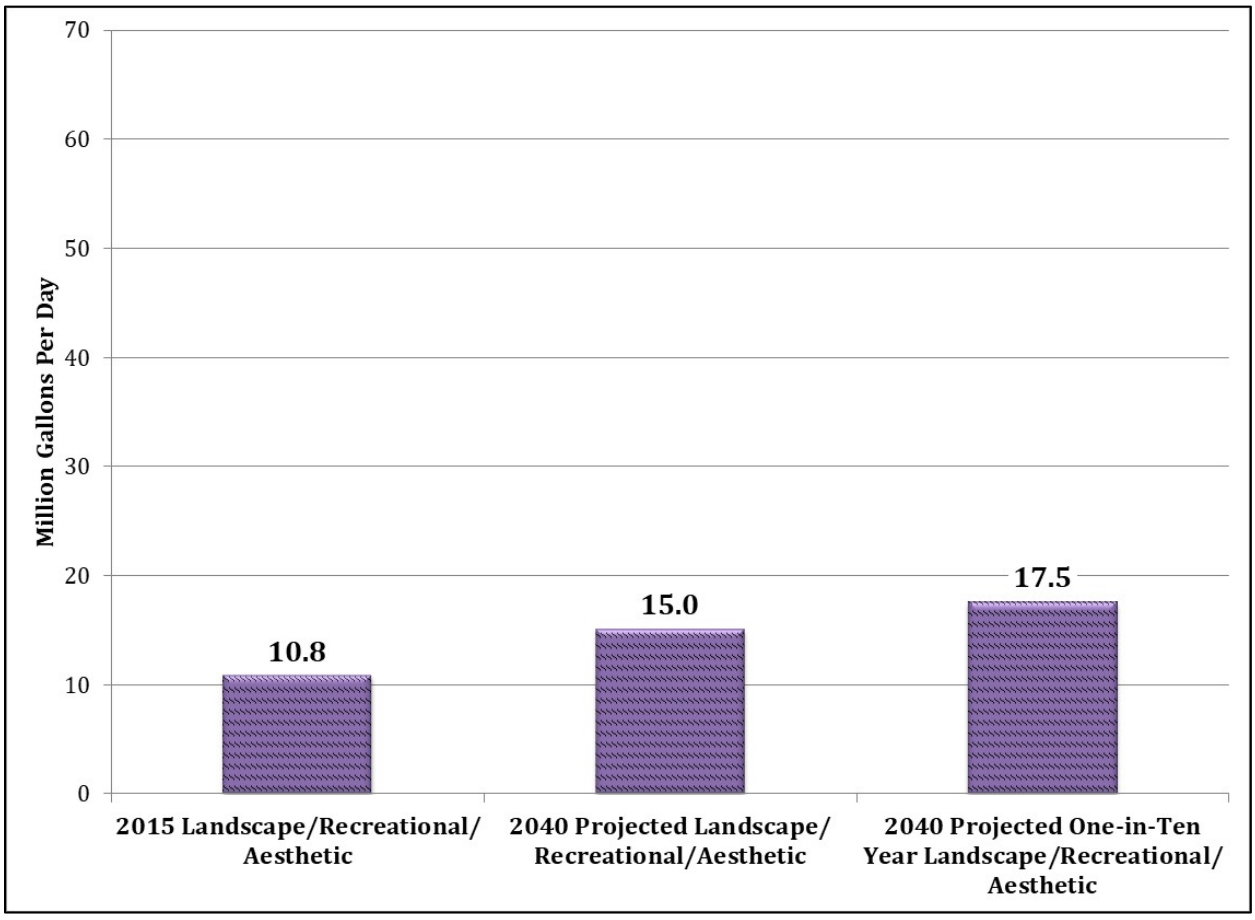


Figure A2-8: 2015 Landscape/Recreational/Aesthetic Self-supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Power Generation Demand

Total power generation water demand in Marion and North Lake counties is expected to increase by 0.1 mgd (39% to approximately 0.3 mgd) by 2040 (Figure A2-9).

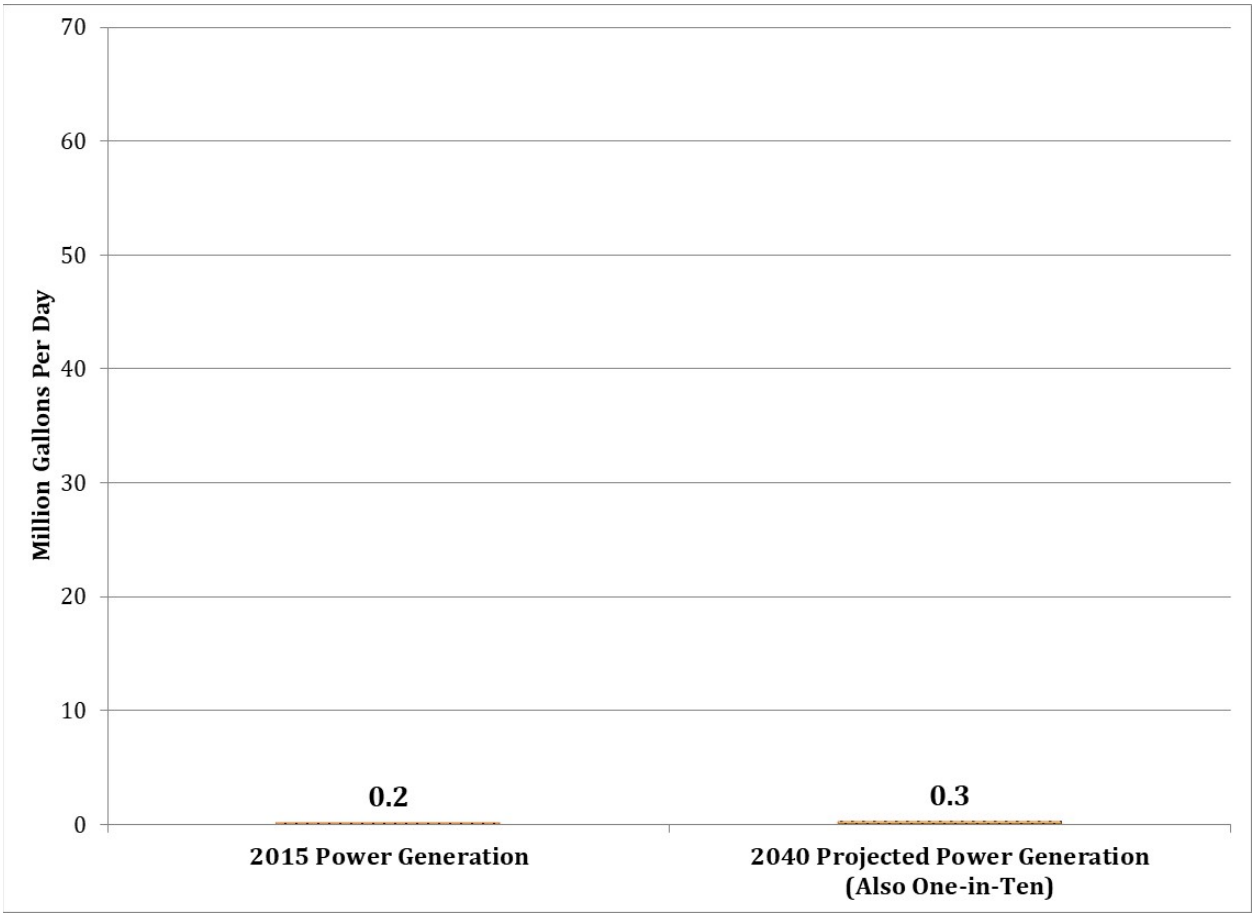


Figure A2-9: 2015 Power Generation Self-supply Water Use Estimates and 2040 Water Demand Projections in Marion and North Lake Counties

Reclaimed Water Projections

Existing Flows

Figure A2-10 displays 2015 reclaimed water flows, both beneficial and disposal, in Marion and North Lake counties. The relative size of the pie charts represents the magnitude of total flow. The yellow shading represents disposal, and the purple shading represents the beneficial use of reclaimed water. The values utilized for Figure A2-10 are provided in Table A2-1. Approximately 62 percent (10.1 mgd) of 2015 treated wastewater flows was used beneficially in Marion and North Lake counties, while the remaining 38 percent (6.1 mgd) was considered disposal. Recognizing the potential for increased beneficial reuse of existing flows, the St. Johns River Water Management District (SJRWMD) estimated that between 2.4 mgd and 4.5 mgd of the existing disposal flows could reasonably be utilized beneficially going forward.

Future Flows

SJRWMD estimated that increased future reclaimed water flows of approximately 3.7 mgd to 5.2 mgd could be used for beneficial purposes. When considered together with existing disposal flow that could be utilized beneficially, between 6.1 mgd and 9.7 mgd of total potential reclaimed water for reuse will be available by 2040 to potentially offset withdrawals from traditional water sources and predicted impacts within Marion and North Lake counties.

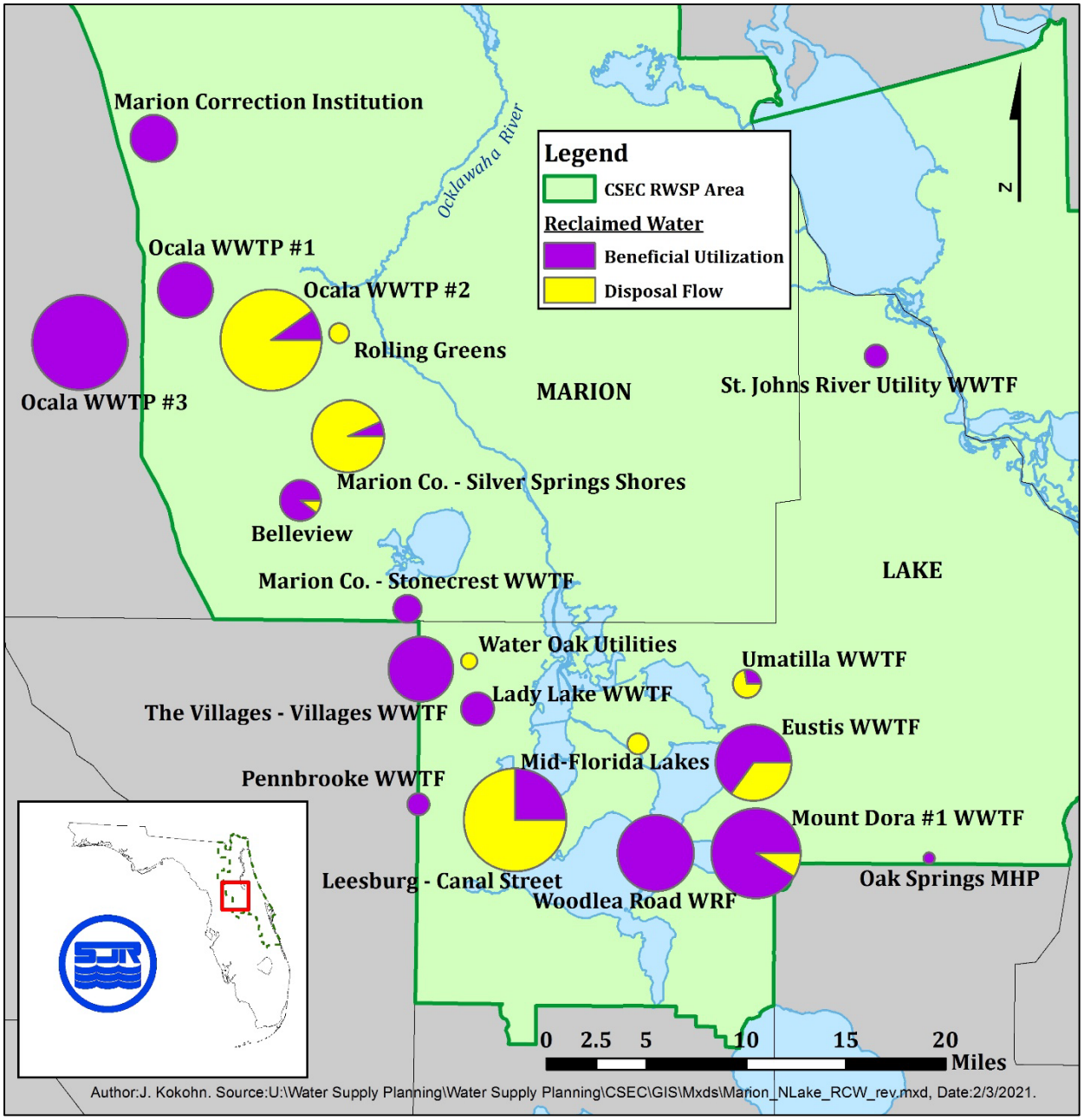


Figure A2-10: Summary of 2015 Reclaimed Water Flows in Marion and North Lake Counties

Table A2-1: Detailed Summary of 2015 Reclaimed Water Flows in Marion and North Lake Counties

Facility	2015 Total Treated Flow (mgd)[1]	Beneficial Utilization (mgd)	Disposal (mgd)
Belleview	0.4	0.3	<0.1
Eustis WWTF	1.3	0.9	0.5
Lady Lake WWTF	0.3	0.3	0.0
Leesburg – Canal Street	2.4	0.6	1.8
Marion Correctional Institution	0.5	0.5	0.0
Marion Co. – Silver Springs Shores	1.2	0.1	1.1
Marion Co. – Stonecrest WWTF	0.2	0.2	0.0
Mid-Florida Lakes	0.1	0.0	0.1
Mount Dora #1 WWTF	1.8	1.7	0.2
Oak Springs MHP	<0.1	<0.1	0.0
Ocala WRF #1	0.7	0.7	0.0
Ocala WRF #2	2.3	0.2	2.1
Ocala WRF #3[2]	2.1	2.1	0.0
Pennbrooke WWTF	0.1	0.1	0.0
Rolling Greens	0.1	0.0	0.1
St. Johns River Utility WWTF	0.1	0.1	0.0
Woodlea Road WRF	1.3	1.3	0.0
Umatilla WWTF	0.2	0.1	0.1
The Villages – Villages WWTF	1.0	1.0	0.0
Water Oak Utilities	0.1	0.0	0.1
Total[1]	**16.1**	**10.1**	**6.1**

Note: mgd = million gallons per day; WWTF = wastewater treatment facility; MHP = mobile home park; WRF = water reclamation facility

[1] Totals may be slightly different due to rounding of individual values.

[2] Although the Ocala WRF #3 is not located within SJRWMD, the City of Ocala's potable wells are located entirely within SJRWMD and any reclaimed water offsets would potentially reduce groundwater withdrawals within the SJRWMD portion of Marion County.

Water Conservation and Irrigation Efficiency

For the first scenario of water conservation and irrigation efficiency [using the CFWI Regional Water Supply Plan (RWSP) method (CFWI 2015) and FDACS' FSAID IV (FDACS 2017)], it is estimated that approximately 7.1 mgd of the projected demand for 2040 could be reduced by water conservation (Table A2-2).

For the second scenario, using the average 2011–2015 gross per capita rate for Marion and North Lake counties for public supply and applying the same percent reduction to DSS, it is estimated that water conservation could be increased by 3.1 mgd, potentially offsetting some future demand (Table A2-2).

Table A2-2: 2040 Water Conservation and Irrigation Efficiency Potential in Marion and North Lake Counties

Category	**2040 Low Conservation Potential (mgd)**	**2040 High Conservation Potential (mgd)**
Public Supply	2.5	5.1
Domestic Self-supply	0.8	1.3
Agriculture	3.3	3.3
Landscape/Recreation/Aesthetic Self-supply	0.4	0.4
Commercial/Industrial/Institutional Self-supply	0.1	0.1
Power Generation Self-supply	< 0.1	< 0.1
Total	**7.1**	**10.2**

Note: mgd = million gallons per day

Chapter 3: Assessment of Groundwater Conditions Associated with Future Water Demand Projections for Marion and North Lake Counties (Northern District Regional Groundwater Flow Model Modeling Simulations)

Northern District Groundwater Flow Model Overview

The Northern District Model Version 5 (NDMv5) was developed collaboratively with the Southwest Florida Water Management District (SWFWMD) in 2016, with the intent of both water management districts using the same model for resource assessments in Marion County (HGL et al. 2016). NDMv5 is a fully-three-dimensional model that uses a public domain version of the MODFLOW-SURFACT code. The model grid includes 275 rows and 212 columns, with a uniform grid spacing of 2,500 ft. The grid is aligned east-west/north-south with extents from Keystone Heights in the north, Tampa Bay to the south, the St. Johns River in Lake, Marion and Putnam counties along the eastern boundary, and the Gulf of Mexico on the west side of the model (Figure A2-11). NDMv5 includes seven layers, which represent the surficial, intermediate, Upper and Lower Floridan aquifers and their respective semi-confining units.

The model was calibrated to steady-state conditions representing hydrologic stresses for the year 1995. In addition, a transient model was developed that represented monthly hydrologic stresses for 1996 through 2006. NDMv5 was subsequently updated and the calibration verified using 2010 hydrologic conditions. All simulations performed in support of the Central Springs/East Coast (CSEC) RWSP utilized the 2010 boundary conditions with various water use stresses as determined by the specific analysis.

SJRWMD is working collaboratively with SWFWMD and other stakeholders to develop a new groundwater flow model with expanded boundaries that will replace NDMv5 and the Volusia model (utilized in the water resource assessment in Volusia County) This new model, named the Central Springs Model, will be utilized in future CSEC RWSP updates upon its completion.

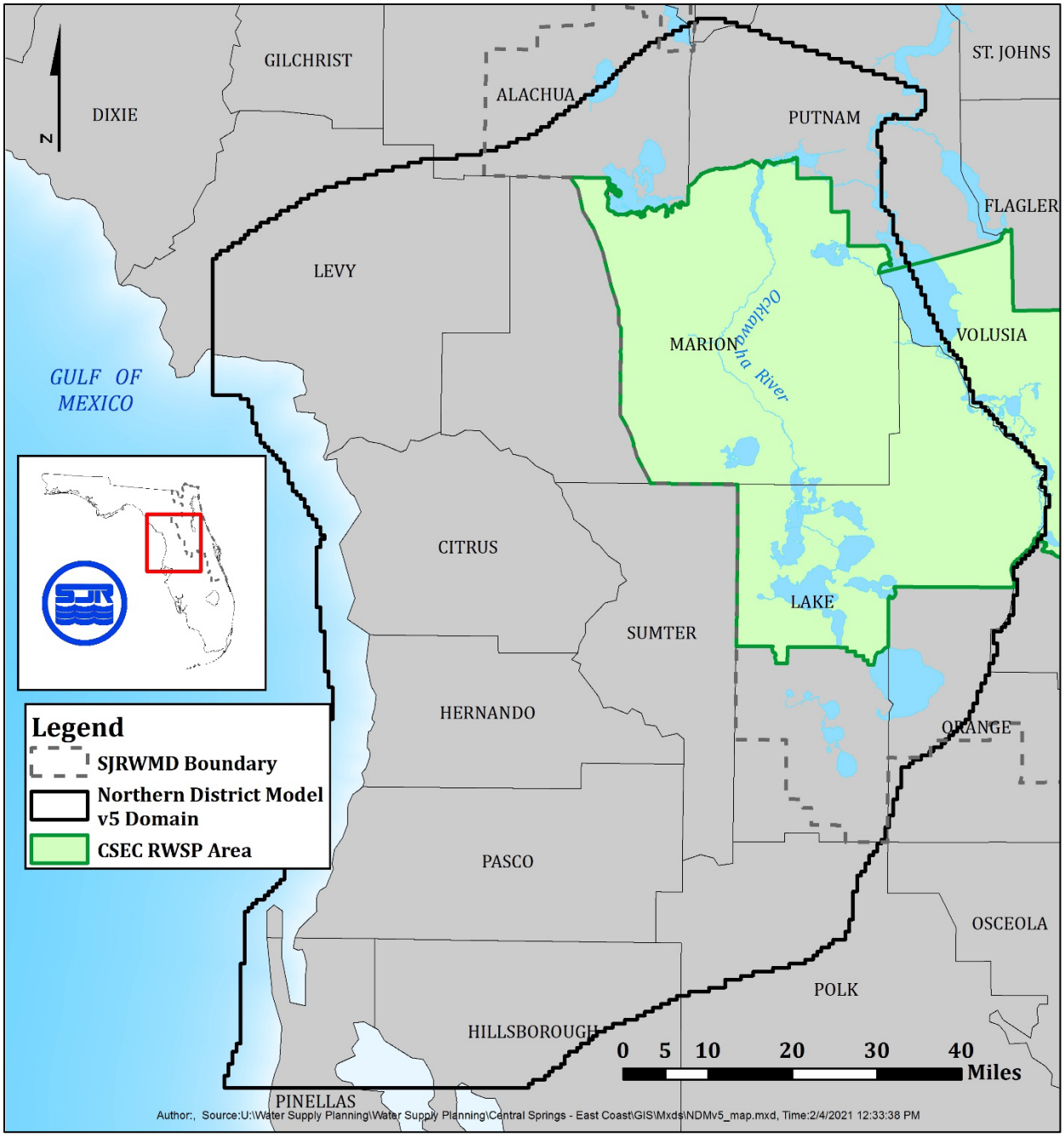


Figure A2-11: Northern District Model Version 5 Domain

Methodology

SJRWMD completed a water resource assessment using the NDMv5 to estimate the potential impacts through the planning horizon. The assessments addressed the potential impacts of groundwater withdrawals with respect to adopted minimum flow and minimum levels (MFLs) and wetlands within Marion and North Lake counties.

Four modeling scenarios and three comparisons, listed below, were performed as part of the Marion and North Lake counties water resource assessment and to predict the benefits of water supply and water resource development projects. Modeling of additional water use scenarios was performed to determine current (2015) MFL status and is described in Appendix C.

Scenarios

- Scenario 1: 2010 water use (verified baseline condition)
- Scenario 2: 2015 water use
- Scenario 3: 2040 projected water demand[2]
- Scenario 4: Scenario 3 with water supply and water resource development projects included

Comparisons

Comparison 1 was utilized to bring forward the 2010 freeboard values for the MFL springs to 2015, or current, water use conditions. Comparison 2 was performed to assess potential water resource impacts due to increases in groundwater withdrawals from 2015 to 2040 (see footnote [1]) within the NDMv5 groundwater model domain. Lastly, comparison 3 demonstrated the effectiveness of the water supply and water resource development projects summarized in Chapter 6.

Results of these comparisons are described in Chapters 4 and 5.

- Comparison 1: Updating 2010 freeboard flows for MFL springs (Scenario 2 minus Scenario 1)
- Comparison 2: MFL water bodies and wetland assessment (Scenario 3 minus Scenario 2)
- Comparison 3: Benefits of water supply and water resource development projects (Scenario 4 minus Scenario 3)

[2] Water use projections for 2040 were not available from all water management districts at the time of analysis, therefore, Scenario 3 contains 2040 projections for SJRWMD and Suwanee River Water Management District and 2035 projections for SWFWMD and South Florida Water Management District.

Chapter 4: Evaluation of Potential Effects of Projected Water Demand on Water Resources within Marion and North Lake Counties (Water Resource Assessment)

Water Resource Assessment Results

A water resource assessment was performed for Marion and North Lake counties at 2040 projected water demand. The results for the MFL, groundwater quality, and wetlands analyses are provided below along with a list of approved MFL prevention/recovery strategies applicable to the area.

MFLs

The MFL analysis results are summarized in Table A2-3 and then discussed by water type below. Additional details regarding the analysis are provided in Appendix F.

Table A2-3: Status of Assessed MFL Water Bodies within Marion and North Lake Counties

Type	Name	County	MFLs Status at 2040
Lake	Bowers	Marion	Met
Lake	Halfmoon	Marion	Met
Lake	Hopkins Prairie	Marion	Met
Lake	Kerr	Marion	Met
Lake	Nicotoon	Marion	Met
Lake	Smith	Marion	Met
Spring	Alexander	Lake	Met
Spring	Silver	Marion	Prevention
Spring	Silver Glen	Marion	Met

Lakes with MFLs

Results of the MFL lake analyses indicate that all six evaluated lakes in Marion and North Lake counties are meeting their MFLs under current conditions and are projected to meet their MFLs throughout the 2040 planning horizon.

Springs with MFLs

Results of the MFL springs analyses show that Alexander and Silver Glen springs are meeting their MFLs under current conditions and will continue to meet their MFLs throughout the planning horizon.

Based on a status evaluation of the Silver Springs MFLs, the MFLs were achieved at the 2010 baseline condition with 17 cubic feet per second (cfs) of available flow (freeboard) for consumptive uses of water (Table A2-4). In 2015, an overall county-wide decrease in withdrawals in Marion County resulted in an additional 2.2 cfs of freeboard, for a total of 19.2 cfs. At 2040 water use conditions, there is a deficit flow of -3.6 cfs indicating that the MFLs will not be met. Since the MFLs are currently being achieved but will not be achieved in 2040, Silver Springs will continue to be classified as being in prevention with respect to its MFLs.

Table A2-4: Silver Springs Predicted Freeboard/Deficit under 2010 (Baseline), 2015 (Current), and 2040 Projected Conditions

Year	Modeled Flow (cfs)	Freeboard/Deficit (cfs)	SJRWMD-Marion Withdrawals (mgd)
2010 (Baseline)	708.8	17	43.0
2015 (Current)	711.0	19.2	37.9
2040	688.3	-3.6	55.5

Note: cfs = cubic feet per second; mgd = million gallons per day

MFL Prevention and Recovery Strategies

The 2017 Prevention Strategy for the Implementation of Silver Springs Minimum Flows and Levels (Silver Springs Prevention Strategy; SJRWMD 2017) was approved by the SJRWMD Governing Board on April 11, 2017 and is included in Appendix G. New regulatory measures affecting water use permit holders in Marion County were included in the Silver Springs Prevention Strategy, which required ratification by the Florida Legislature. A bill ratifying the regulatory measures was signed by the Governor on March 19, 2018, with the regulatory measures becoming effective on this date.

Groundwater Quality (Saltwater Intrusion)

Lateral saltwater intrusion is not a significant problem in Marion and North Lake counties; therefore, permittees are not typically required to monitor water quality. All the analyzed wells in Marion and North Lake counties were district observation well network (DOWN) wells within the Upper Floridan aquifer (UFA).

Of the 32 DOWN wells evaluated, none had chloride concentrations increasing at a high (≥ 3 milligrams per liter per year (mg/L/yr)) or a medium (within the range ≥ 1 and < 3 mg/L/yr) rate of change. One evaluated DOWN well in North Lake County showed a decreasing chloride trend (Figure A2-12). Although not shown on Figure A2-12 since neither showed a statistically significant rate of change in chloride concentration, two wells in North Lake County had chloride concentrations currently exceeding the chloride secondary drinking water standard. Both wells are located in a groundwater discharge area near the St. Johns River where there is naturally occurring upwelling of relict sea water from the Lower Floridan aquifer.

Additional detailed information about individual wells is provided in Appendix D.

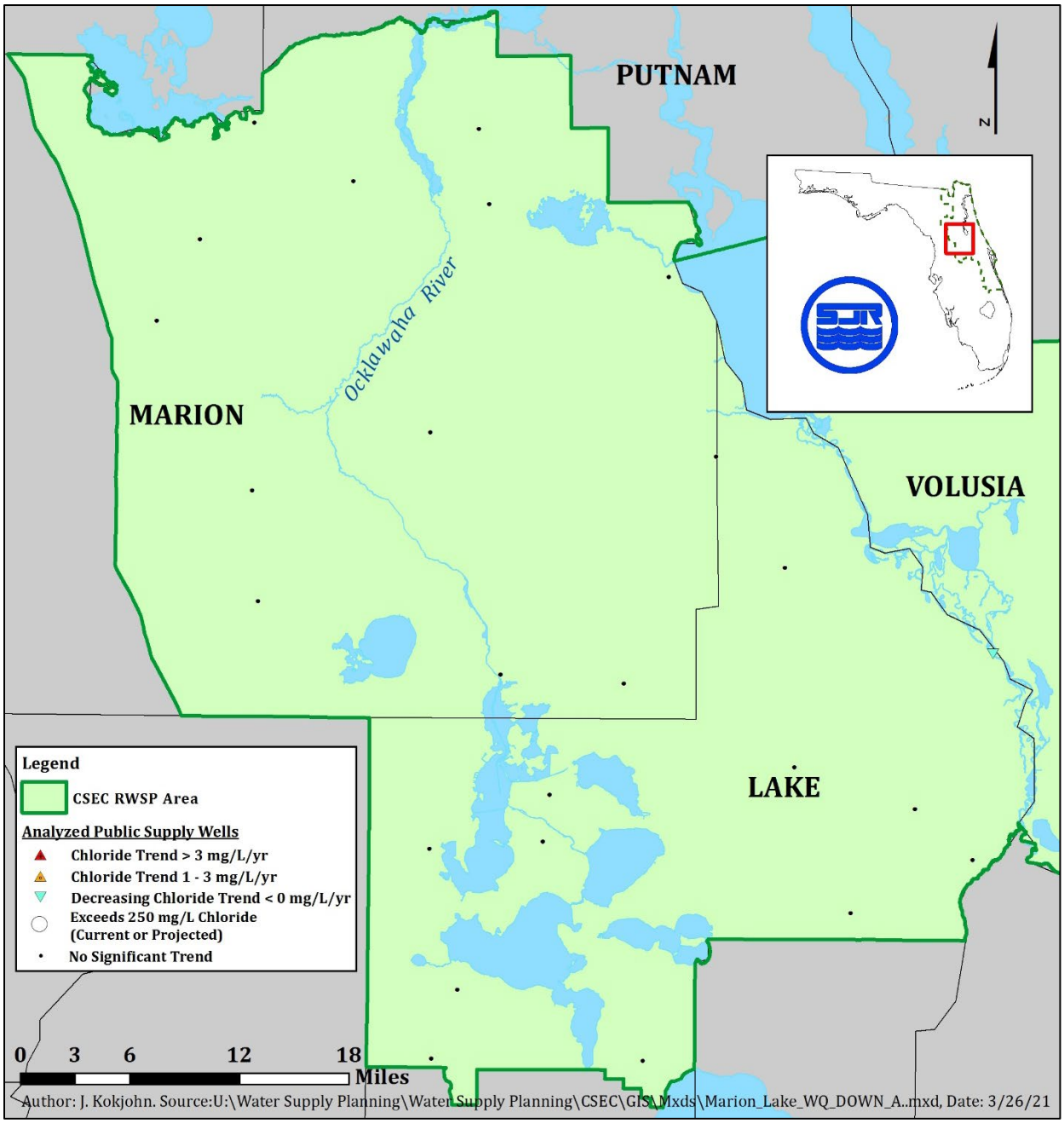


Figure A2-12: Spatial Summary of UFA Public Supply Well Chloride Trend Analysis in Marion and North Lake Counties

Wetlands

The wetland assessment identified 29,190 acres in Marion and North Lake counties that have a moderate or high potential for adverse change based on 2040 conditions within the NDMv5 domain (Table A2-5; Figure A2-13). The potential for adverse change does not necessarily correspond to realized adverse change due to the uncertainty with the analysis. As a result, field verification and monitoring, typically carried out for the SJRWMD regulatory program, is required when it is determined to be necessary to ensure the prevention of impacts from groundwater pumping. In 2015, the SJRWMD regulatory program implemented an enhanced wetland monitoring protocol that was developed and approved by stakeholders during the CFWI planning process (CFWI 2018). This new protocol results in a more comprehensive and defensible strategy to monitor for and prevent adverse change to wetlands resulting from groundwater withdrawals. The CSEC wetland assessment is not a replacement for the analysis of the specific potential of a proposed consumptive use to individually or cumulatively impact wetland systems, however, the spatial coverage of wetland acreage identified as being at risk for change can be utilized by regulatory staff for use as a screening tool to locate general areas where potential wetland impacts are more likely to occur.

Additional detailed information regarding the wetland assessment methodology is included in Appendix H.

Table A2-5: Wetland Acreage Identified as Having a Moderate or High Potential for Adverse Change to Wetland Function in Marion and North Lake Counties

County	**Potential Wetland Adverse Change at 2040 (acres)**
Marion	4,686
North Lake	24,504
Total	**29,190**

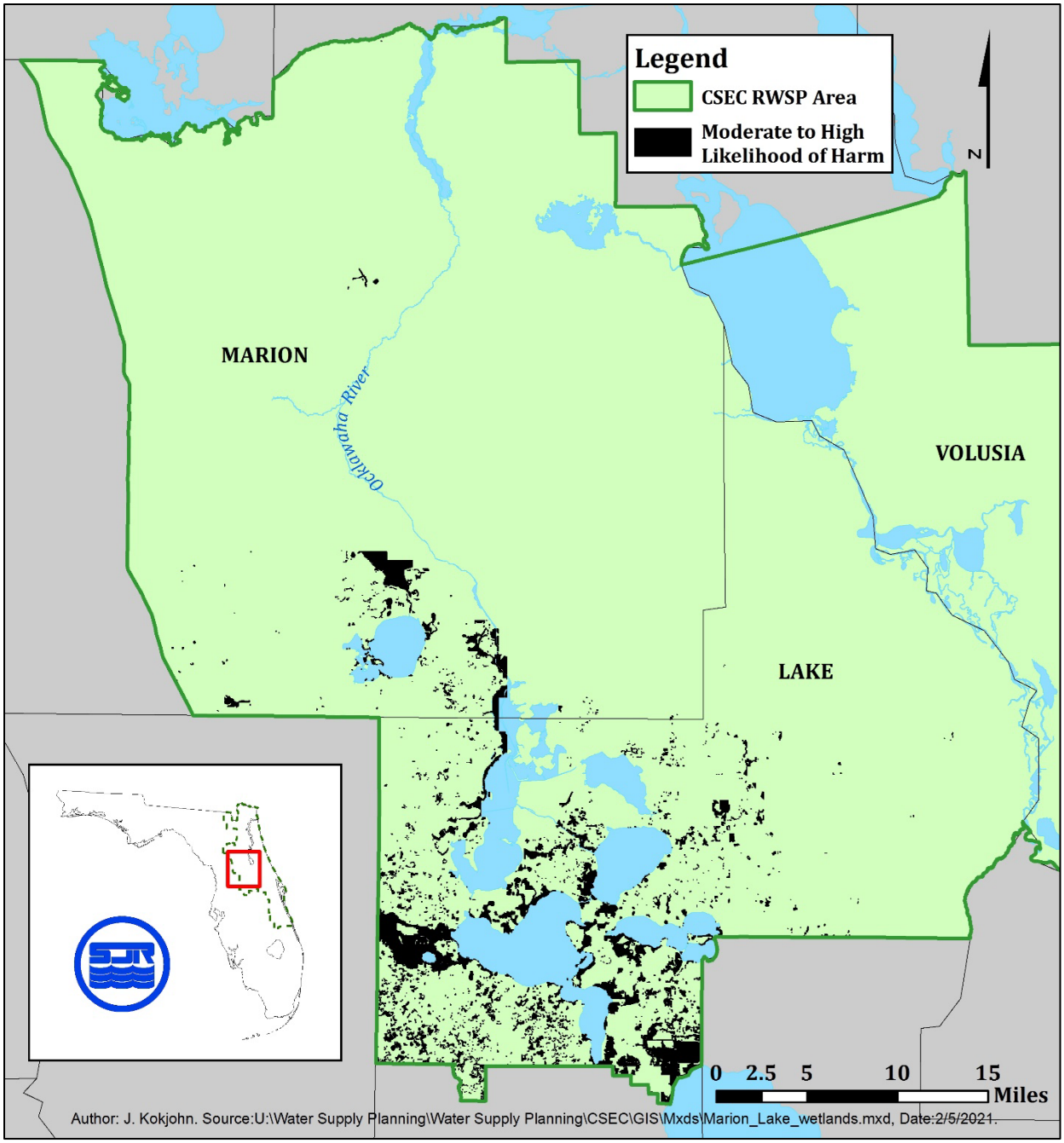


Figure A2-13: Wetlands at Risk of Adverse Change in Marion and North Lake Counties Due to 2040 Projected Withdrawals within the NDMv5 Domain

Chapter 5: Alternative Water Supply Needs Assessment and Delineation of Water Resource Caution Area for Marion and North Lake Counties (Sufficiency Analysis)

Sufficiency Analysis

Within Marion and North Lake counties, results of the MFLs and wetlands analyses demonstrate the potential water resource impacts associated with 30 mgd of future demand at 2040. Since the wetland analysis is a screening tool with monitoring and verification of impacts performed through the regulatory program, the focus of the suite of projects in Chapter 6 is to address potential impacts to MFL water bodies, specifically Silver Springs, which was identified as being in prevention.

As required by Chapter 373.709, F.S., SJRWMD has included the Silver Springs Prevention Strategy in the CSEC RWSP (Appendix G). By incorporating specific projects identified in the Silver Springs Prevention Strategy, along with new proposed projects, the CSEC RWSP provides assurance that the future water needs of Marion and North Lake counties will be met while sustaining water resources and related natural systems.

Using the NDMv5 model, SJRWMD assessed the effects of 36.7 mgd of water savings potential and water supply and water resource development projects. The modeling results demonstrated that implementation of the suite of projects is sufficient to provide the increase in spring flow required to ensure achievement of MFLs at 2040 demand. Seven listed projects are complete or in progress, with several projects currently under development.

MFL Water Bodies in Prevention

As mentioned previously, implementation of water conservation projects that meet the low potential as described in Chapter 2 along with the water supply and water resource development projects summarized in Chapter 6 is sufficient to ensure achievement of Marion and North Lake counties MFLs in 2040. Specific details regarding the MFL water body identified as being in prevention are provided below.

Silver Springs

Implementation of all projects identified within Chapter 6 will ensure achievement of the Silver Springs MFLs at 2040 projected demand with approximately 19 cfs of remaining freeboard. This excess benefit allows water users flexibility in selecting which projects to implement.

Water Quality

The water quality analysis results for Marion and North Lake counties indicate that water quality constraints due to lateral saltwater intrusion or upconing are not

projected for this area. Lateral saltwater intrusion is unlikely in the central part of Florida, which is farther from coastal areas and closer to groundwater recharge areas.

Wetlands

Since the potential for adverse change does not necessarily correspond to realized adverse change (see Chapter 4), water supply and water resource project development did not focus on reducing the 29,190 acres of wetlands identified as having the potential for adverse change. However, implementation of the projects specified in the CSEC RWSP will reduce the acreage of potentially impacted wetlands, although these benefits were not quantified as a part of this plan. Furthermore, through the continued use of the enhanced wetland assessment protocol in conjunction with the spatial review of wetland acreage identified in the CSEC RWSP (see Chapter 4), SJRWMD regulatory staff will ensure the protection of wetland acreage within Marion and North Lake counties by preventing, or requiring mitigation for, adverse impacts to wetlands from both individual and cumulative permit-related groundwater withdrawals.

Water Resource Caution Area

Analyses performed as part of the CSEC RWSP effort support the 2017 designation of Silver Springs as being in prevention with regard to its MFLs. Projects identified in the Silver Springs Prevention Strategy have been incorporated into the CSEC RWSP, as they are necessary to ensure achievement of the Silver Springs MFLs at 2040 projected water demand. The CSEC RWSP, along with the Silver Springs Prevention Strategy, constrain the availability of traditional groundwater sources throughout Marion County and provide a technical basis for the constraint. Although current data suggests that MFLs will be achieved in North Lake County through the planning horizon, it is important to recognize the presence of water resource constraints to the north (Marion County) and to the south (southern Lake County in the CFWI). Groundwater withdrawals in North Lake County impact MFL water bodies across political boundaries and therefore should be considered in addressing regional MFL impacts. As such, the Marion and North Lake counties portion of the CSEC RWSP area is proposed for inclusion in the CSEC WRCA.

Chapter 6: Project Options for Marion and North Lake Counties

Water Resource Development Project Options

There is one water resource development project proposed within the Marion and North Lake subregion. The Ocala Wetland Groundwater Recharge Park, located in Marion County, consists of a wetland treatment and groundwater recharge project on a 33-acre site. The project will provide up to 5 mgd of beneficial recharge to the UFA and will cost $9.3 million to construct with operating and maintenance expenses estimated at $100,000 per year. Project details are provided in Appendix I.

Water Supply Development Project Options

A summary of water supply development options is shown in Table A2-6. Together, these projects provide 24.7 mgd of water in Marion and North Lake counties. Since several of the projects increase reclaimed water availability resulting from facility expansion and septic to sewer conversion, it is estimated that 8.1 mgd of reclaimed water will be available for additional future projects. These unspecified reclaimed water projects were considered in the sufficiency analysis presented in Chapter 5. Additional project details can be found in Appendix J.

Table A2-6: Summary of Water Supply Development Project Options in Marion and North Lake Counties

Type	Number of Projects	Quantity Water Produced (mgd)	Estimated Construction Cost (Million dollars)
Groundwater	5	19.1	$60.8
Reclaimed Water	8	5.6	$40.1
Total	**13**	**24.7**	**$100.9**

Note: mgd = million gallons per day

Water Conservation Project Options

Estimates for Marion and North Lake counties show the water conservation potential at 10.4 mgd (high estimate) at 2040 at a cost of approximately $15.8 million. Seventeen water conservation projects are completed or currently underway in Marion and North Lake counties with an estimated savings of 1.6 mgd of water for $2.6 million (Appendix K). Remaining conservation potential is estimated at 8.8 mgd and can be realized through the implementation of the various types of water conservation projects listed in the CSEC RWSP.

Summary of SJRWMD Project Funding in Marion and North Lake Counties

From fiscal year (FY) 2014 through FY 2020, the SJRWMD cost-share program has awarded Marion and North Lake cooperators approximately $33.6 million in total funds, with $13.5 million awarded specifically for water supply, natural systems, and water conservation

projects (Appendix L). Once fully implemented, these projects will provide approximately 20.4 mgd of alternative water supplies and 1.8 mgd of water savings, with 4.4 mgd providing a natural systems benefit.

Chapter 7: Conclusions

The CSEC RWSP was developed consistent with the water supply planning requirements of Chapter 373, F.S. The CSEC RWSP concludes that the current and future water demands of Marion and North Lake counties can be met through the 2040 planning horizon while sustaining the water resources and related natural systems, through water conservation, management measures, and implementation of water resource and water supply development projects identified in Chapter 6.

Total water demands by all water use categories in Marion and North Lake counties are projected to increase from an estimated current use in 2015 of 96.4 mgd to approximately 126.4 mgd in 2040. SJRWMD has determined that fresh groundwater alone cannot supply the projected 30.0 mgd increase in water demand without causing unacceptable impacts to water resources.

Primary solutions identified for meeting the future water demands in Marion and North Lake counties while protecting the environment include enhanced water conservation, wellfield management, aquifer recharge, and alternative water supply projects. With all these options, SJRWMD and local stakeholders have identified up to 48.2 mgd of projects potentially available to offset the projected increase in water demand at 2040 under average (30.0 mgd) and 1-in-10 year drought conditions (47.3 mgd).

References

Central Florida Water Initiative (CFWI). 2015. *Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP): Volume I – Planning Document*. Available from: http://cfwiwater.com/

CFWI. 2018. *Central Florida Water Initiative (CFWI); Minimum Standards for Water Resource Data Collection, Site Establishment, and Field Data Collection Protocols*. Available from: https://cfwiwater.com/pdfs/DMIT-MinStandards-2018.pdf

FDACS. 2017. *Florida Statewide Agricultural Irrigation Demand.* Prepared by The Balmoral Group. FDACS, Tallahassee, FL.

HydroGeoLogic, Inc. (HGL) and Dynamic Solutions, LLC. 2016*. Northern District Groundwater Flow Model Version 5.0*. Prepared for SJRWMD and SWFWMD.

SJRWMD. 2017. *Prevention Strategy for the Implementation of Silver Springs Minimum Flows and Levels*. SJRWMD, Palatka, FL. Available from: www.sjrwmd.com/static/mfls/ssmfl/Silver-Springs-Prevention-Strategy.pdf

A3: Regional Water Supply Plan Components for Brevard, Indian River and Okeechobee Counties

Chapter 1: Introduction to Brevard, Indian River, and Okeechobee Counties

Population

The estimated population in Brevard, Indian River, and Okeechobee counties during the base year, 2015, was just over 0.55 million. This does not include population from the City of Cocoa service area, which is included in the Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP).

Primary Surface Water Basins

The primary surface water basins located within Brevard, Indian River, and Okeechobee counties include portions of the Upper St. Johns River and Indian River Lagoon basins.

Springs

There are no documented first- or second-magnitude springs in the Brevard, Indian River, or Okeechobee portion of the Central Springs/East Coast (CSEC) RWSP area.

Chapter 2: Water Demand, Reclaimed Water and Water Conservation Projections for Brevard, Indian River, and Okeechobee Counties[1]

Population

Total population for Brevard, Indian River, and Okeechobee counties is expected to increase by 187,000 people (34% to approximately 740,000 people) by 2040 (Figure A3-1). For a breakdown of population by type (public supply versus domestic self-supply served) and by county, see Appendix B.

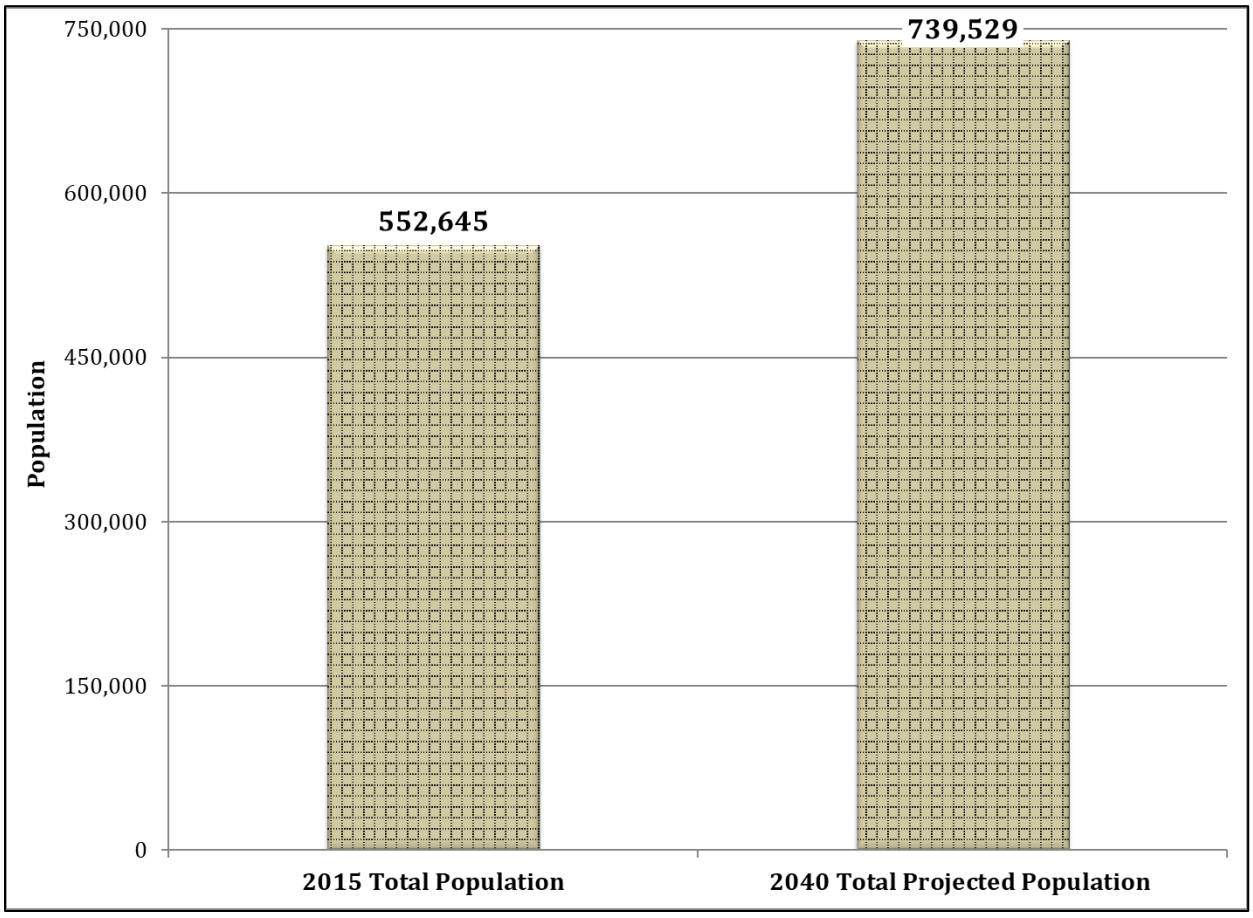


Figure A3-1: 2015 Population Estimate and 2040 Population Projection in Brevard, Indian River, and Okeechobee Counties

[1] Population and water use estimates and projections do not include the City of Cocoa service area, which is included in the Central Florida Water Initiative.

Water Demand

Total water demand in Brevard, Indian River, and Okeechobee counties is anticipated to increase from 168.4 million gallons per day (mgd) in 2015 to 191.9 mgd in 2040 (14%). Unlike the other two subregions of the CSEC RWSP area, agriculture represents the largest demand in Brevard, Indian River, and Okeechobee counties (40%), followed by public supply (33%), and landscape/recreation/aesthetic (LRA)(16%) (Figure A3-2). It is estimated that 2040 total water demand could increase by an additional 27 percent (52.1 mgd) if a 1-in-10 year drought occurred.

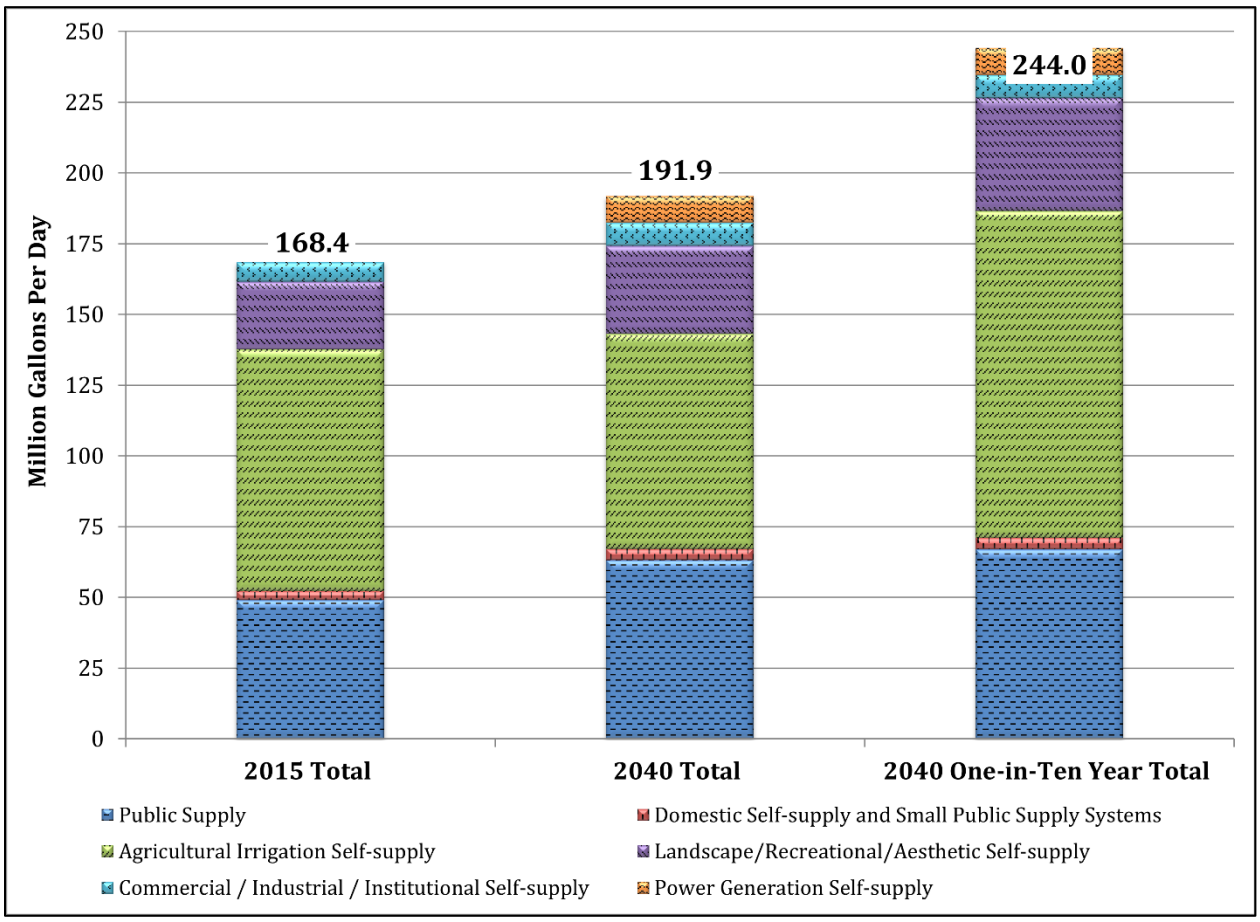


Figure A3-2: 2015 Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties by Category

Public Supply Demand

Total public supply water demand for Brevard, Indian River, and Okeechobee counties is expected to increase by 14.2 mgd (29% to approximately 63.1 mgd) by 2040 (Figure A3-3). Public supply represents 33 percent of the 2040 projected water demand in Brevard, Indian River, and Okeechobee counties. Of note, public supply also represents 61 percent of the total increase in water demand in Brevard, Indian River, and Okeechobee counties. It is estimated that 2040 public supply water demand could increase by an additional 6 percent (4 mgd) if a 1-in-10 year drought occurred.

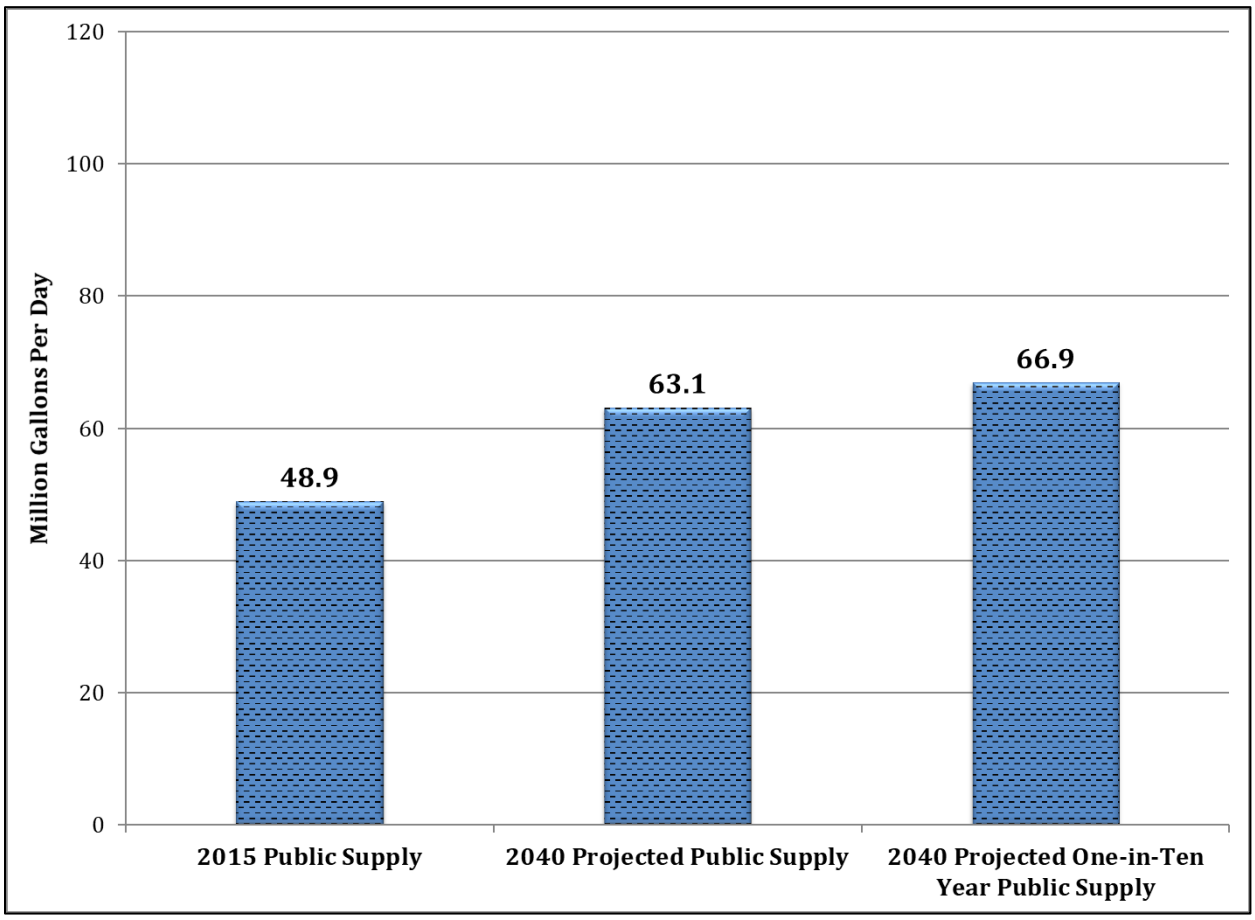


Figure A3-3: 2015 Public Supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties

Domestic Self-Supply Demand

In Brevard, Indian River, and Okeechobee counties, total combined DSS water demand, which includes small public supply systems as defined in Chapter 3, is expected to increase by 0.6 mgd (15% to approximately 3.8 mgd) by 2040 (Figure A3-4). Of the 2040-combined DSS water demand, DSS wells represent 95 percent of the projected water demand (with small public supply systems representing the remaining 5%). It is estimated that 2040-combined DSS water demand could increase by an additional 6 percent (0.2 mgd) if a 1-in-10 year drought occurred.

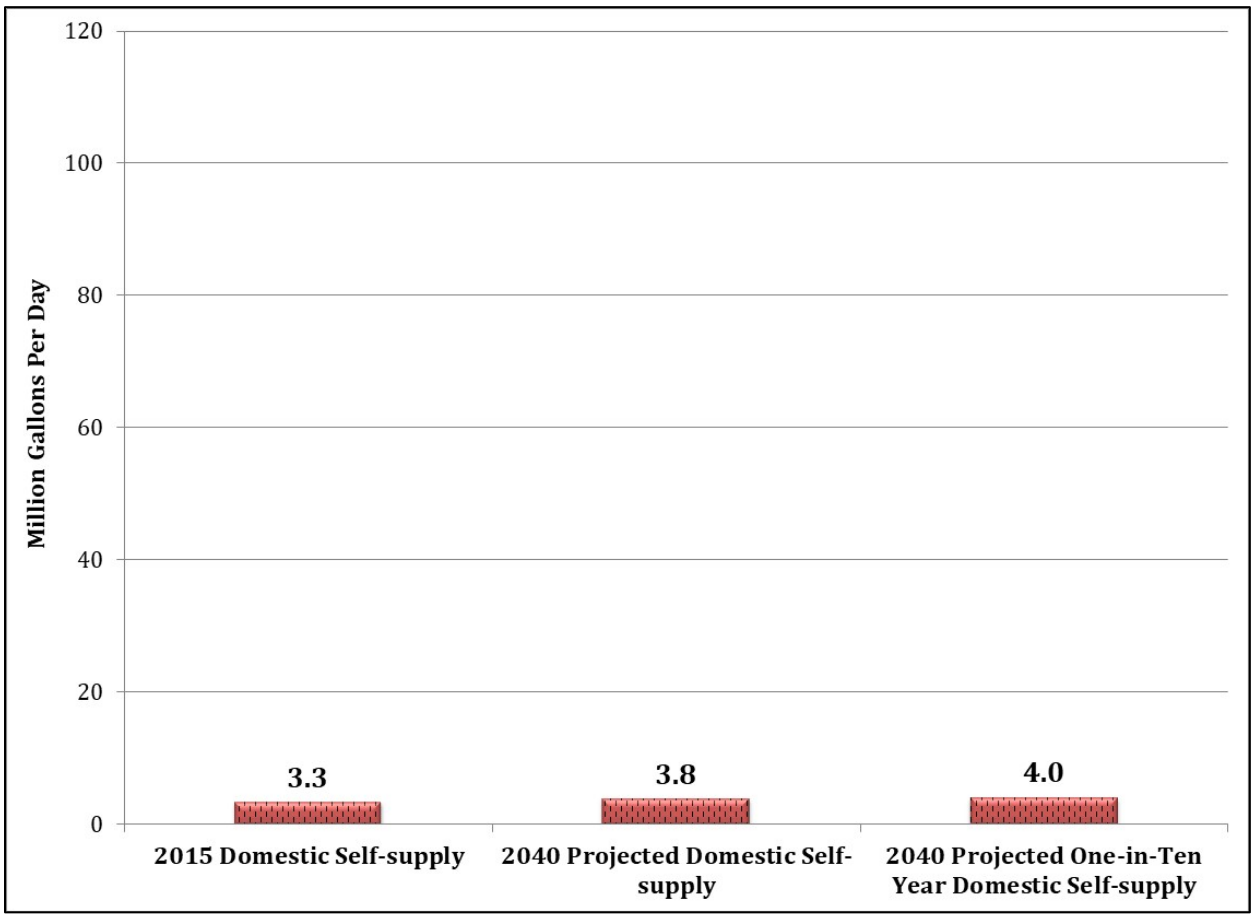


Figure A3-4: 2015 Combined Domestic Self-supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties

Agriculture Acreage and Demand

Total agricultural water demand for Brevard, Indian River, and Okeechobee counties is expected to decrease by 9.2 mgd (11% to approximately 76.1 mgd) by 2040 and acreage is expected to decrease by 7,800 acres (16% to approximately 66,000 acres) (Figures A3-5 and A3-6). Florida Department of Agriculture and Consumer Services' (FDACS) Florida Statewide Agricultural Irrigation Demand (FSAID) IV estimates that 2040 agricultural water demand (which was based on a 5-in-10 year, or average, drought condition) could increase by an additional 52 percent (39.4 mgd) if a 1-in-10 year drought occurred (FDACS 2017).

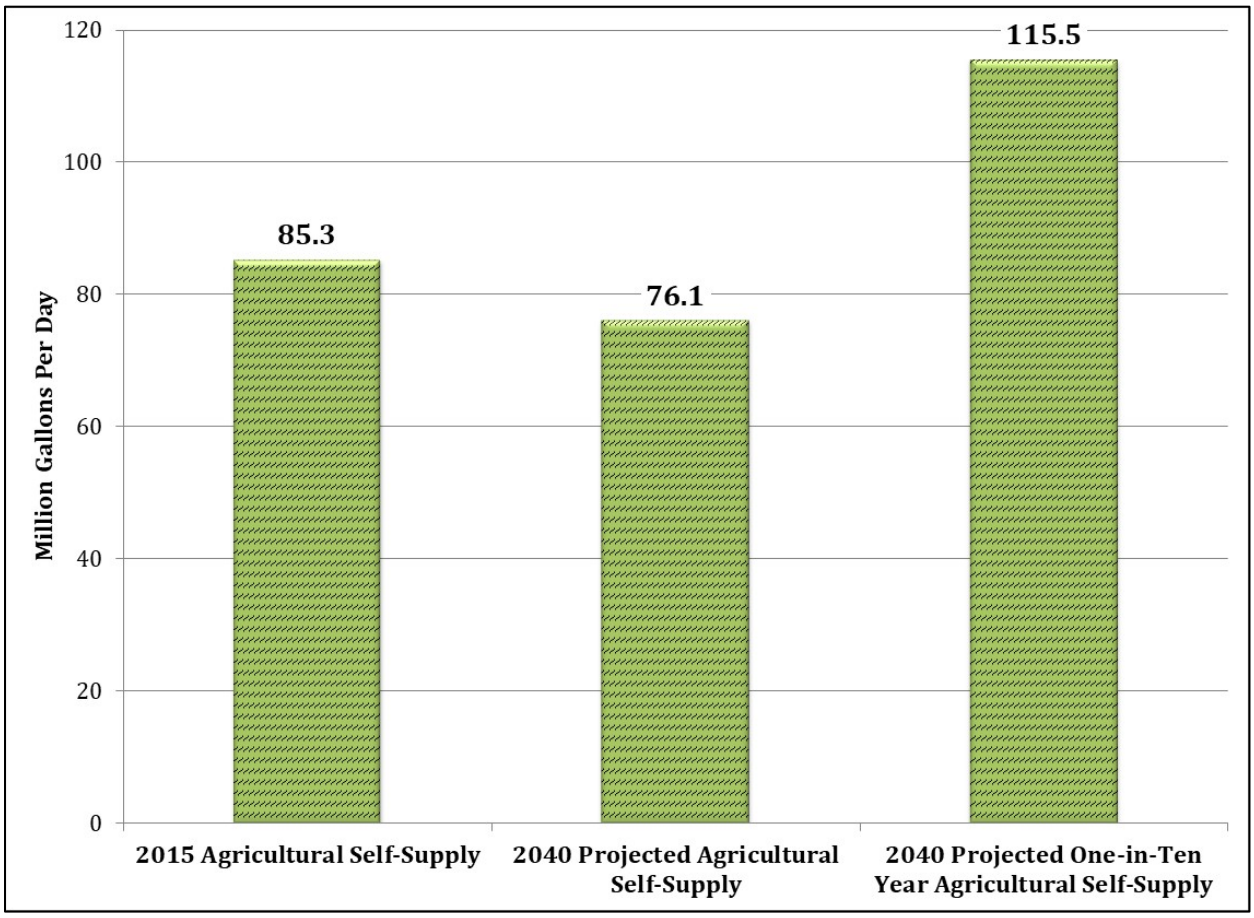


Figure A3-5: 2015 Agriculture Self-supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties (FDACS 2017)

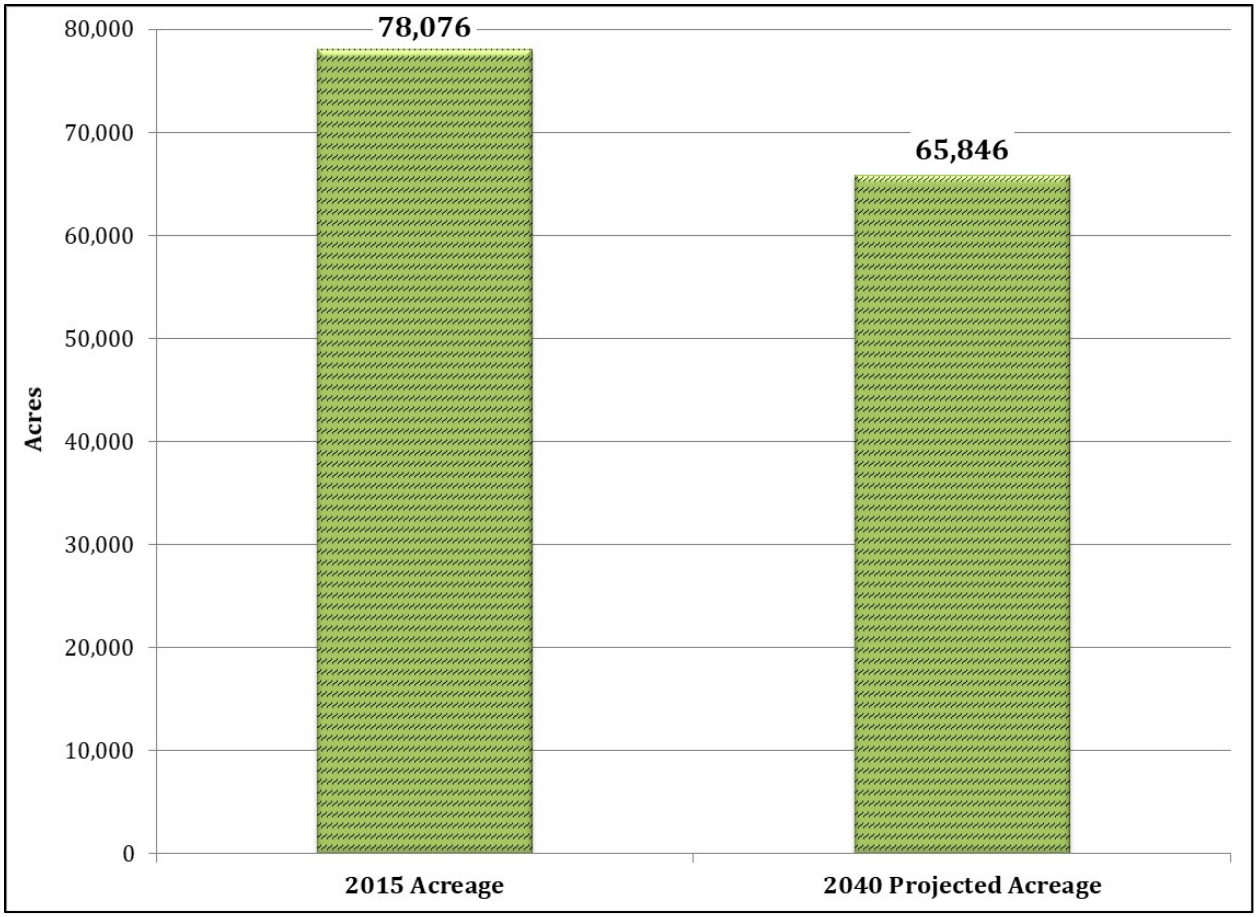


Figure A3-6: 2015 Agriculture Self-supply Acreage Estimates and 2040 Acreage Projections in Brevard, Indian River, and Okeechobee Counties (FDACS 2017)

Commercial/Industrial/Institutional and Mining/Dewatering Demand

Total combined commercial/industrial/institutional and mining/dewatering water demand for Brevard, Indian River, and Okeechobee counties is expected to increase by 1.3 mgd (20% to approximately 8.2 mgd) by 2040 (Figure A3-7).

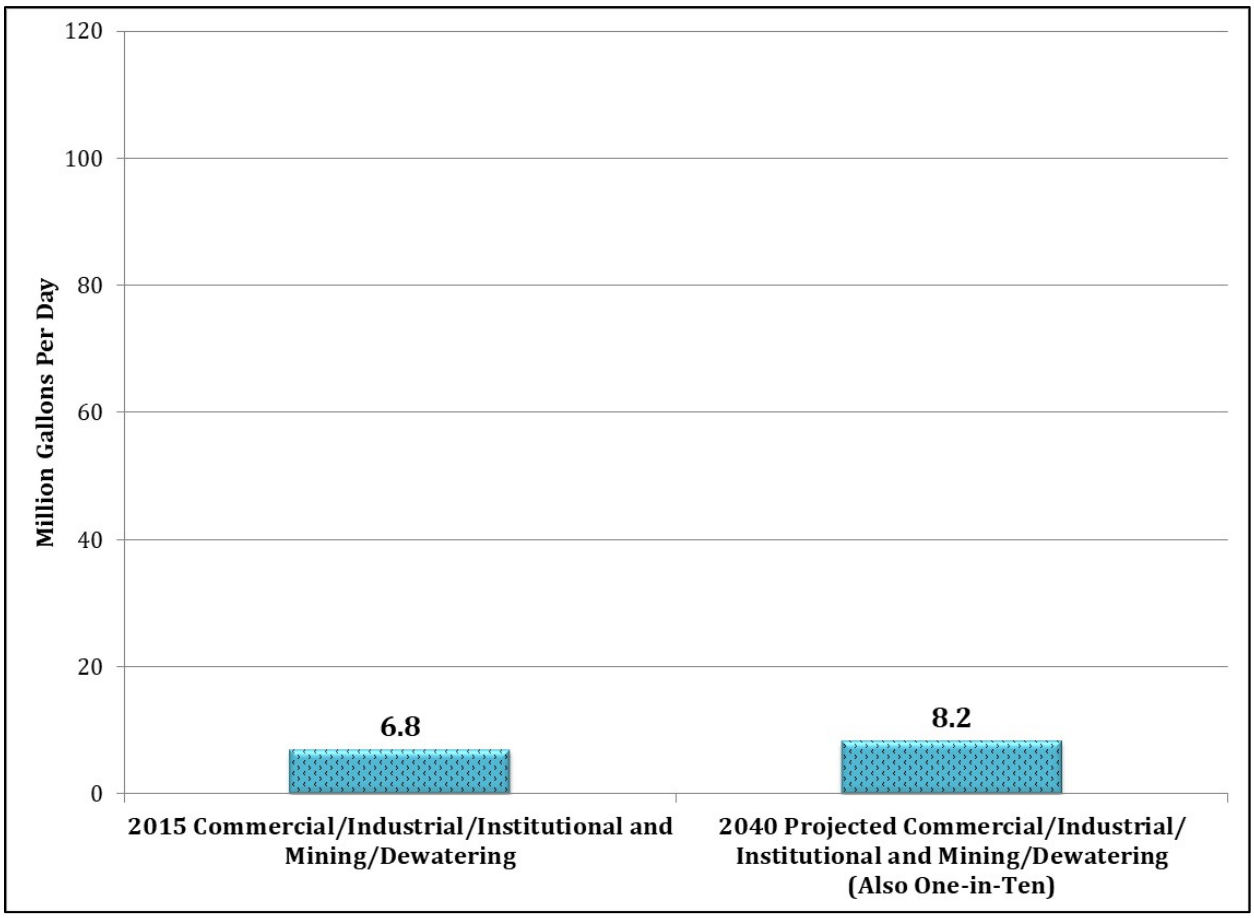


Figure A3-7: 2015 Commercial/Industrial/Institutional and Mining/Dewatering Self-supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties

Landscape/Recreation/Aesthetic Demand

Total LRA water demand for Brevard, Indian River, and Okeechobee counties is expected to increase by 7.2 mgd (30% to approximately 31.2 mgd) by 2040 (Figure A3-8). It is estimated that 2040 LRA water demand could increase by an additional 28 percent (8.6 mgd) if a 1-in-10 year drought occurred.

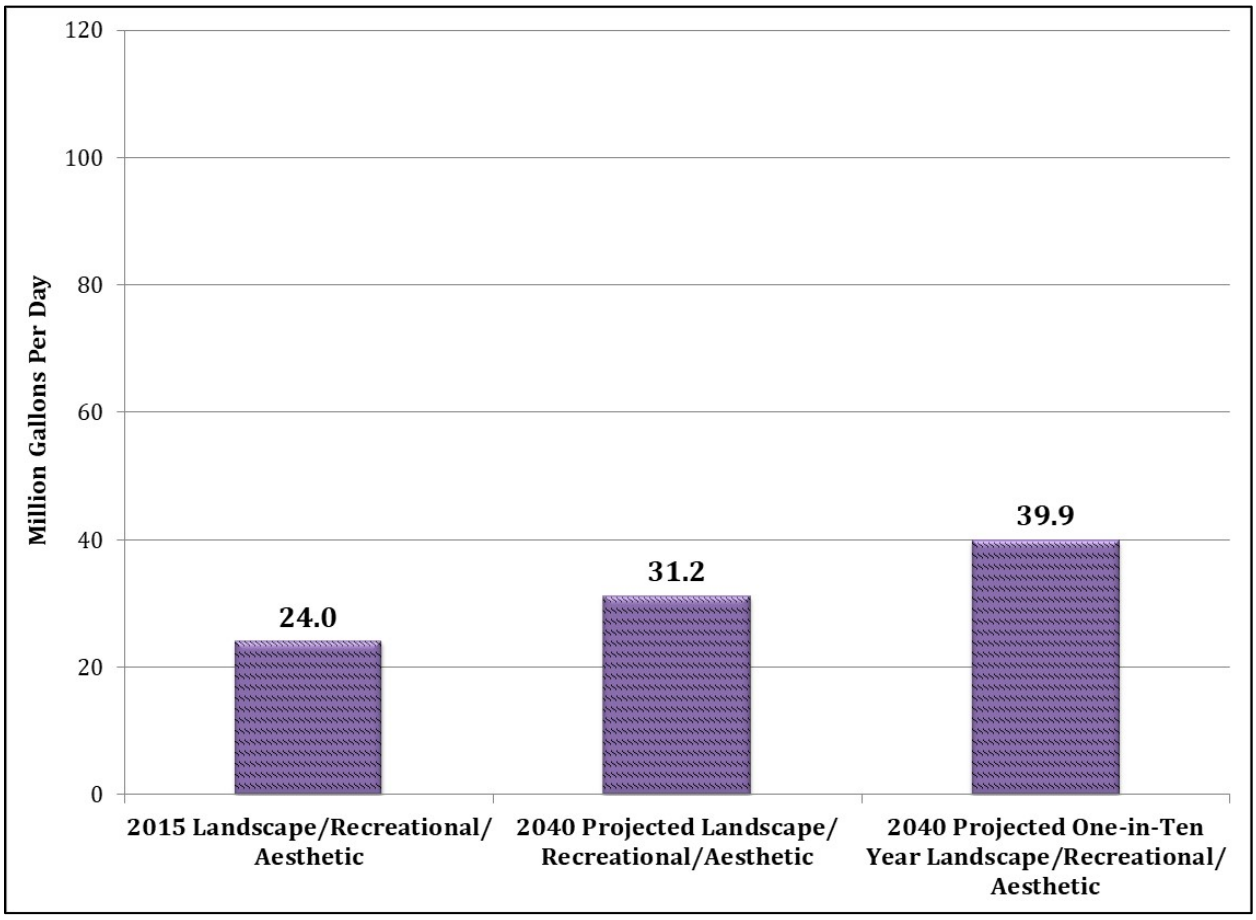


Figure A3-8: 2015 Landscape/Recreational/Aesthetic Self-supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties

Power Generation Demand

Total power generation water demand for Brevard, Indian River, and Okeechobee counties is expected to increase by over 9 mgd (to approximately 9.5 mgd) by 2040 (Figure A3-9). This increase is due to a new power generation facility located in Okeechobee County (Florida Power & Light – Okeechobee Clean Energy Plant).

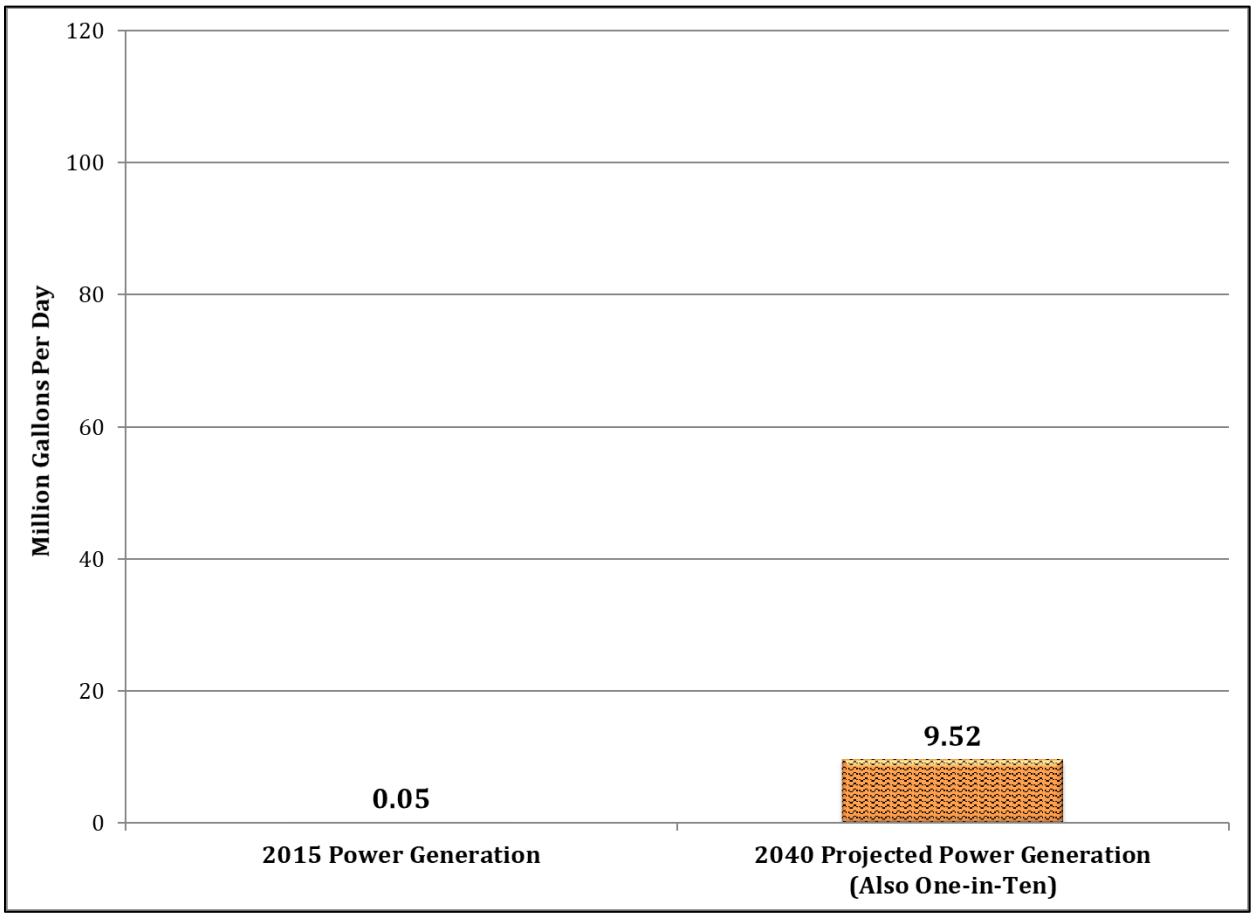


Figure A3-9: 2015 Power Generation Self-supply Water Use Estimates and 2040 Water Demand Projections in Brevard, Indian River, and Okeechobee Counties

Reclaimed Water Projections

Existing Flows

Figure A3-10 displays 2015 reclaimed water flows, both beneficial and disposal. The relative size of the pie charts represents the magnitude of total flow. The yellow shading represents disposal, and the purple shading represents the beneficial use of reclaimed water. The values utilized for Figure A3-10 are provided in Table A3-1. Approximately 48 percent (15.3 mgd) of 2015 treated wastewater flows was used beneficially in Brevard and Indian River counties, while the remaining 52 percent (16.7 mgd) was considered disposal. Recognizing the potential for increased beneficial reuse of existing flows, the St. Johns River Water Management District (SJRWMD) estimated that between 6.4 mgd and 12.6 mgd of the existing disposal flows could reasonably be utilized beneficially going forward. Of note, there are no wastewater treatment facilities located in the small section of Okeechobee County that fall within SJRWMD jurisdiction.

Table A3-1: Detailed Summary of 2015 Reclaimed Water Flows in Brevard, Indian River, and Okeechobee Counties

Facility[1]	**2015 Total Treated Flow (mgd)**	**Beneficial Utilization (mgd)**	**Disposal (mgd)**
Brevard Co. Utility Dept. (BCUD) – Barefoot Bay	0.5	0.5	0.1
BCUD – North Brevard Regional WWTF	0.3	0.2	0.1
BCUD – South Beaches WWTF	6.5	1.4	5.1
Indian River Co. Utility Dept. – West Regional WWTF	4.8	3.1	1.8
Melbourne – David B. Lee WWTF	7.2	2.2	5.0
Palm Bay	2.2	0.5	1.6
Ray Bullard WRF (West Melbourne)	1.6	0.8	0.8
Titusville WRF	5.2	3.7	1.5
Vero Beach WWTF	3.8	3.0	0.8
Total[2]	**32.1**	**15.3**	**16.7**

Note: mgd = million gallons per day; WWTF = wastewater treatment facility; WRF = water reclamation facility

[1] Wastewater treatment facilities that serve the City of Cocoa public supply service area are not included in the CSEC RWSP since the City of Cocoa service area is included in the CFWI.

[2] Total may be slightly different due to rounding of individual values.

Future Flows

SJRWMD estimated that increased future reclaimed water flows between 6.3 mgd and 10.1 mgd could be used for beneficial purposes. When considered together with existing disposal flow that could be utilized beneficially, between 12.6 mgd and 22.6 mgd of total potential reclaimed water for reuse will be available in 2040 to potentially

offset withdrawals from traditional water sources and predicted impacts within Brevard, Indian River, and Okeechobee counties.

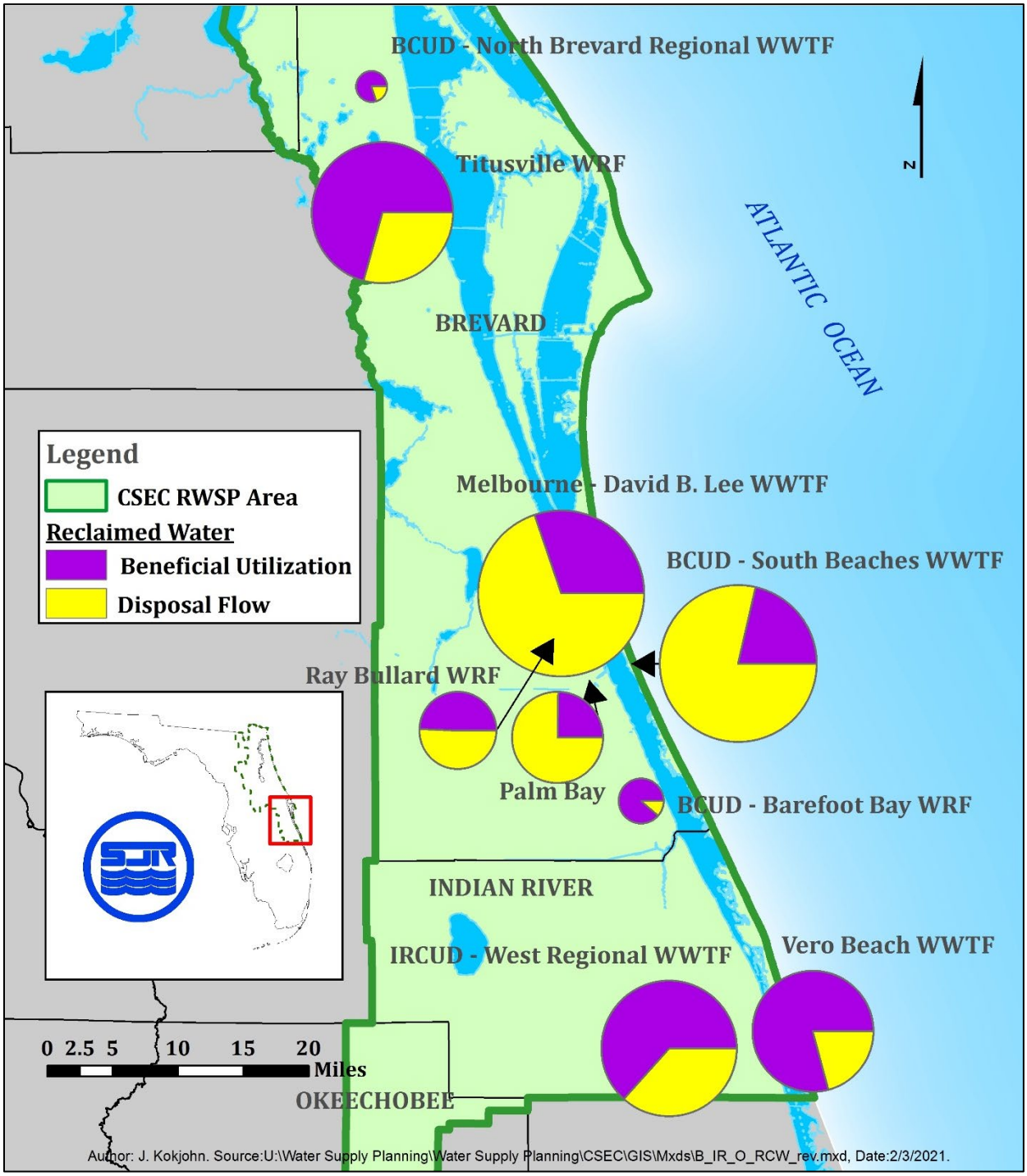


Figure A3-10: Summary of 2015 Reclaimed Water Flows in Brevard, Indian River, and Okeechobee Counties

Water Conservation and Irrigation Efficiency

For the first scenario of water conservation and irrigation efficiency (using the CFWI RWSP method (CFWI 2015) and FDACS' FSAID IV (FDACS 2017)), it is estimated that approximately 13.8 mgd of the projected demand for 2040 could be reduced by water conservation (Table A3-2).

For the second scenario, using the average 2011-2015 gross per capita rate Brevard, Indian River, and Okeechobee counties for public supply and applying the same percent reduction to DSS, it is estimated that water conservation could be increased by 4.5 mgd, potentially offsetting some future demand (Table A3-2).

Table A3-2: 2040 Water Conservation and Irrigation Efficiency Potential in Brevard, Indian River, and Okeechobee Counties

Category	**2040 Low Conservation Potential (mgd)**	**2040 High Conservation Potential (mgd)**
Public Supply	2.6	6.9
Domestic Self-supply	0.2	0.4
Agriculture	9.9	9.9
Landscape/Recreation/Aesthetic Self-supply	0.9	0.9
Commercial/Industrial/Institutional Self-supply	0.1	0.1
Power Generation Self-supply	0.1	0.1
Total	**13.8**	**18.3**

Note: mgd = million gallons per day

Chapter 3: Assessment of Groundwater Conditions Associated with Future Water Demand Projections for Brevard, Indian River, and Okeechobee Counties (East-Central Florida Transient Expanded Regional Groundwater Flow Modeling Simulations)

East-Central Florida Transient Expanded Model Overview

The East-Central Florida Transient Expanded Model (ECFTX) is the newest of the three models utilized for the CSEC RWSP effort (Figure A3-11). It was developed through a collaborative process between South Florida Water Management District, SJRWMD, and Southwest Florida Water Management District (CFWI 2020b). It is fully-three dimensional, United States Geologic Survey MODFLOW code based, with a model cell size/spacing of 1,250 ft using 603 rows and 704 columns. The model grid is aligned east-west/north-south, with Daytona Beach at its northern limit and extending south to the Charlotte-Desoto county line. The east and west limits of the model are the Atlantic Ocean and Gulf of Mexico, respectively. Freshwater aquifers systems and semi-confining layers within the central portion of the Florida peninsula are represented in the model by a total of 11 layers.

The model calibration was conducted in two phases. The first phase consisted of a steady-state simulation representing hydrologic conditions for calendar year 2003 (including groundwater withdrawals, return flows from irrigation and rapid infiltration basins, rainfall, evapotranspiration, spring flows, and baseflows to river systems). The final phase of the model calibration provided for an 11-year simulation, representing monthly hydrologic stresses for the period from 2004 through 2014.

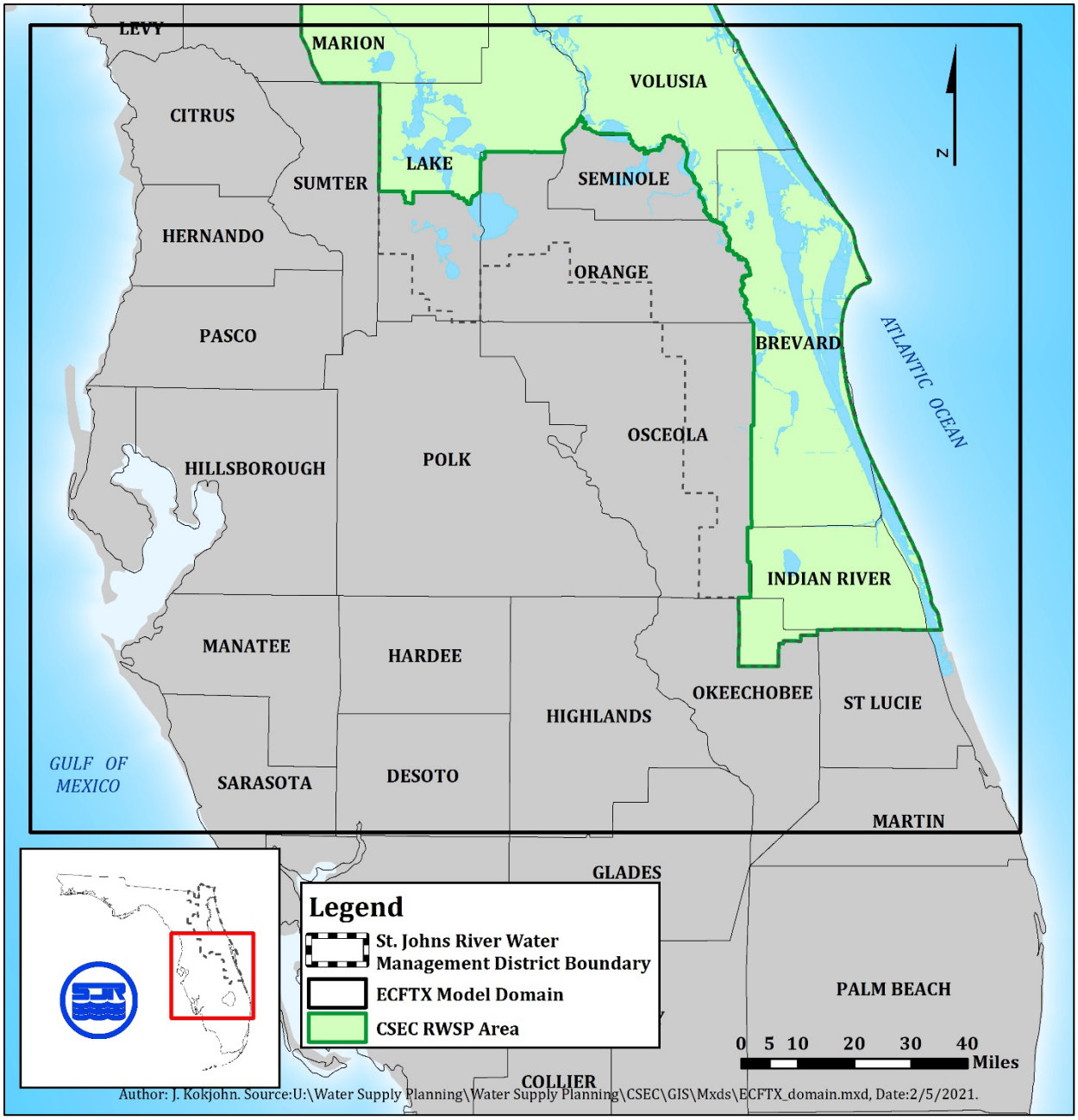


Figure A3-11: East-Central Florida Transient Extended Model Domain

Methodology

SJRWMD completed a water resource assessment using the ECFTX to estimate the potential impacts through the 2040 planning horizon. The assessments addressed the potential impacts of groundwater withdrawals with respect to adopted MFL water bodies and wetlands in Brevard, Indian River, and Okeechobee counties.

Two transient model scenarios and one comparison, listed below, were performed as part of the Brevard, Indian River, and Okeechobee counties water resource assessment. Since

the estimated water conservation potential and reclaimed water availability at 2040 was greater than the projected increase in water demand at 2040 in Brevard, Indian River, and Okeechobee counties, a modeling scenario to evaluate the benefits of water supply and water resource development projects was not required.

Scenarios

- Scenario 1: 2014 reference condition
- Scenario 2: 2040 projected water demand

Comparison

The results from the two simulations were compared (Scenario 2 minus Scenario 1) to assess potential impacts to wetlands and MFL water bodies due to projected increases in groundwater withdrawals within Brevard, Indian River, and Okeechobee counties, a subset of the ECFTX domain. Results of this comparison are described in Chapters 4 and 5.

Chapter 4: Evaluation of Potential Effects of Projected Water Demand on Water Resources within Brevard, Indian River, and Okeechobee Counties (Water Resource Assessment)

Water Resource Assessment Results

A water resource assessment was performed for Brevard, Indian River, and Okeechobee counties at 2040 projected water demand. The results for the MFL, groundwater quality, and wetlands analyses are provided below. There are no approved MFL prevention or recovery strategies applicable to this area.

MFLs

Results of the MFLs analysis is summarized in Table A3-3 and discussed by water type below. Additional information regarding the MFLs analyses is included in Appendix F.

Table A3-3: Status of Assessed MFL Water Bodies in Brevard, Indian River, and Okeechobee Counties

Type	Name	County	MFLs Status at 2040
Lake	Fox	Brevard	Met
Lake	South	Brevard	Met
River	St. Johns downstream of Lake Washington weir	Brevard	Met

Lakes with MFLs

Results of the MFL lake analysis indicate that both evaluated lakes in the Brevard, Indian River, and Okeechobee portion of the CSEC RWSP area are meeting their MFLs under current conditions and are projected to meet their MFLs throughout the 2040 planning horizon. It is worth noting that both lakes are located in an area of Brevard County with minimal UFA withdrawals.

Rivers with MFLs

The MFL status assessment for the St. Johns River downstream of the Lake Washington weir revealed that the MFLs are met under current and 2040 projected water use conditions.

Groundwater Quality (Saltwater Intrusion)

The results from the water quality analysis for Brevard and Indian River counties are summarized below. There were no DOWN wells or monitored public supply or

agricultural wells in the limited portion of Okeechobee County that is under the jurisdiction of SJRWMD. Additional information regarding the water quality analysis, including data for specific wells, can be found in Appendix D.

District Observation Well Network Wells

Of the 22 UFA District Observation Well Network (DOWN) wells evaluated in Brevard and Indian River counties, six showed increasing chloride concentrations at rates ≥ 3 mg/L/yr (high rate of change), and one showed increasing chloride concentrations at a rate within the range ≥ 1 and < 3 mg/L/yr (medium rate of change)(Table A3-3). Two of these wells are located on the Atlantic coast, four just west of the Indian River Lagoon, and one in central Indian River County (Figure A3-12). These seven trending wells do not meet the chloride secondary drinking water standard (SDWS) as the UFA is mostly brackish (>250 mg/L chlorides) in the region. Water quality changes in four of the seven DOWN wells with high and medium rates of chloride change may be indicative of lateral saltwater intrusion as they are located near the Atlantic coast or Indian River Lagoon in areas without significant quantities of UFA withdrawals. Water quality changes in the remaining three DOWN wells with high and medium rates of chloride increase may be the result of upconing from the influence of nearby production wells.

Finally, one DOWN well showed a statistically significant decreasing rate of change and has a current chloride concentration that exceeds the SDWS.

Although there was insufficient data to perform a statistical analysis on the SAS DOWN wells in this area, it is worth noting that six of the 18 actively monitored SAS DOWN wells in Brevard and Indian River counties currently exceed the chloride SDWS and one well shows a maximum concentration just below the SDWS.

Table A3-4: Analyzed UFA DOWN Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Brevard and Indian River Counties

Chloride Trend Category	Number of Wells Currently Exceeding 250 mg/L	Number of Additional Wells Projected to Exceed 250 mg/L by 2040
High Rate of Change (6 wells)	6	---
Medium Rate of Change (1 well)	1	---
Decreasing Rate of Change (1 well)	1	NA

Note: mg/L = milligrams per liter

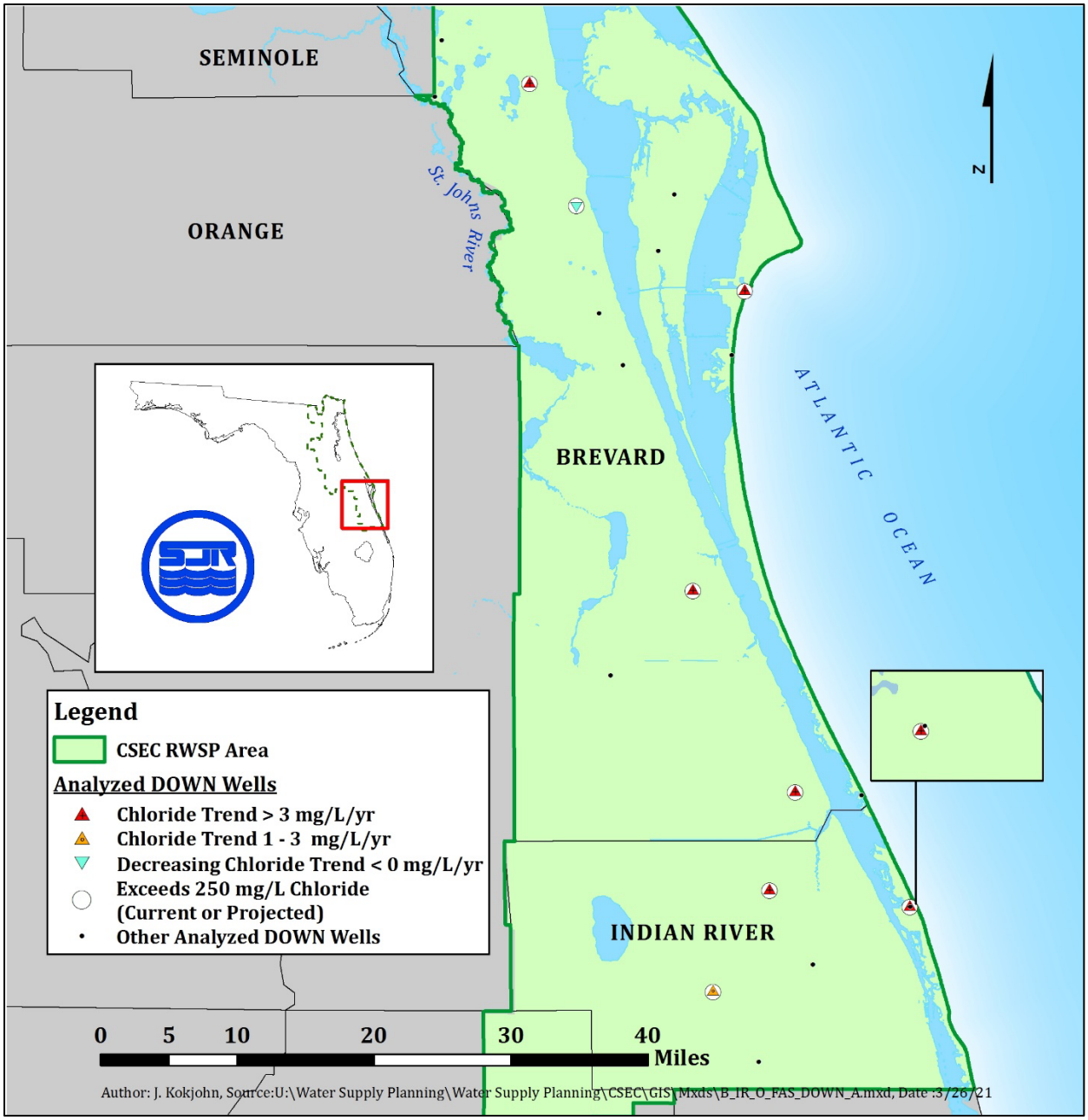


Figure A3-12: Spatial Summary of UFA DOWN Well Chloride Trend Analysis in Brevard and Indian River Counties

Public Supply Wells (Upper Floridan Aquifer)

Of the 35 UFA public supply wells evaluated in Brevard and Indian River counties, 15 showed increasing chloride concentrations at rates ≥ 3 mg/L/yr (high rate of change) (Table A3-5). Each of these 15 wells currently exceeds the chloride SDWS and is generally located along the Indian River Lagoon or Atlantic coastline (Figure A3-13). Most of these wells are located in clusters (i.e., within a wellfield), with some wells showing increasing trends while others in the cluster did not. Therefore,

it is possible that water quality changes in these wells are from upconing resulting from individual or cumulative groundwater withdrawals. Public supply utilities that currently utilize reverse osmosis (RO) for treatment of brackish UFA water, generally, would not be impacted by increasing chloride concentrations. However, in this region, agricultural users rely, in part, on the UFA for irrigation. Increasing chloride concentrations could potentially impact agricultural operations in the area if levels exceed the tolerance of historically grown crops.

None of the UFA public supply wells showed increasing chloride concentrations at a rate within the range ≥ 1 and < 3 mg/L/yr (medium rate of change). Finally, of the five public supply wells that showed a statistically significant decreasing rate of change, one currently exceeds the chloride SWDS.

Table A3-5: Analyzed UFA Public Supply Wells with Statistically Significant High, Medium, or Increasing Trends in Chloride Concentration in Brevard and Indian River Counties

Chloride Trend Category	**Number of Wells Currently Exceeding 250 mg/L**	**Number of Additional Wells Projected to Exceed 250 mg/L by 2040**
High Rate of Change (15 UFA wells)	15	---
Medium Rate of Change (0 UFA wells)	---	---
Decreasing Rate of Change (5 UFA wells)	1	NA

Note: mg/L = milligrams per liter

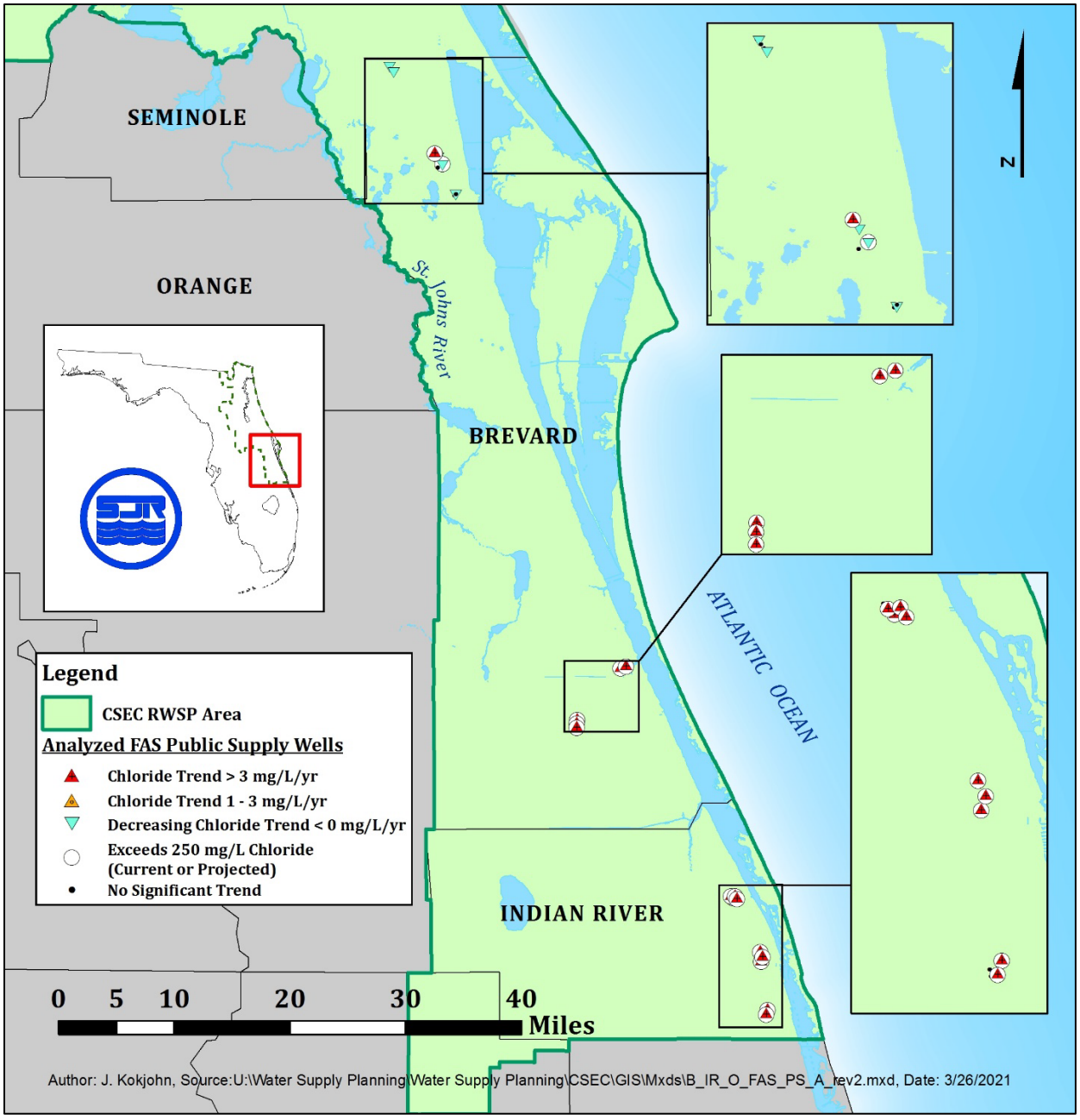


Figure A3-13: Spatial Summary of UFA Public Supply Well Chloride Trend Analysis in Brevard and Indian River Counties

Public Supply Wells (Surficial Aquifer System)

SJRWMD evaluated 101 Surficial Aquifer System (SAS) public supply wells in Brevard and Indian River counties. Twenty-two wells showed an increasing chloride rate change of ≥ 3 mg/L/yr (high rate of change) and nine wells showed an increasing chloride rate within the range ≥ 1 and < 3 mg/L/yr (medium rate of change)(Table A3-6). Of the 31 wells showing a high or medium rate of change, eight currently exceed the chloride SDWS, and 13 additional wells are projected to exceed

the SDWS by 2040. All 31 wells are located just west of the Indian River Lagoon with the majority occurring in Brevard County (Figure A3-14).

Water quality degradation in the SAS tends to be an issue for communities near the Atlantic coast. Utilities that have historically relied on the SAS have needed to replace SAS withdrawals with an alternate source, often of a lower quality, to halt impacts. Although surficial aquifer withdrawals have generally decreased over the years, additional water quality impacts are projected based on current withdrawals. It is estimated that approximately 70 percent of the 2040 projected domestic self-supply demand in Brevard and Indian River counties will come from the SAS (CFWI 2020a). Although there have been no known complaints thus far regarding impacted DSS wells, increasing chloride concentrations beyond the SDWS would present a financial hardship to DSS users if additional treatment is needed to render the water potable. Adherence to surficial aquifer wellfield management plans by utilities can help to lessen the chloride trend increases in some cases, as evidenced by the 34 SAS production wells that showed a decreasing trend. However, where there is a significant cluster of wells with current and projected impacts, additional strategies may be required.

Table A3-6: Analyzed SAS Public Supply Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Brevard and Indian River Counties

Chloride Trend Category	Number of SAS Wells Currently Exceeding 250 mg/L	Number of Additional SAS Wells Projected to Exceed 250 mg/L by 2040
High Rate of Change (22 SAS wells)	8	12
Medium Rate of Change (9 SAS wells)	0	1
Decreasing Rate of Change (34 SAS wells)	4	NA

Note: mg/L = milligrams per liter

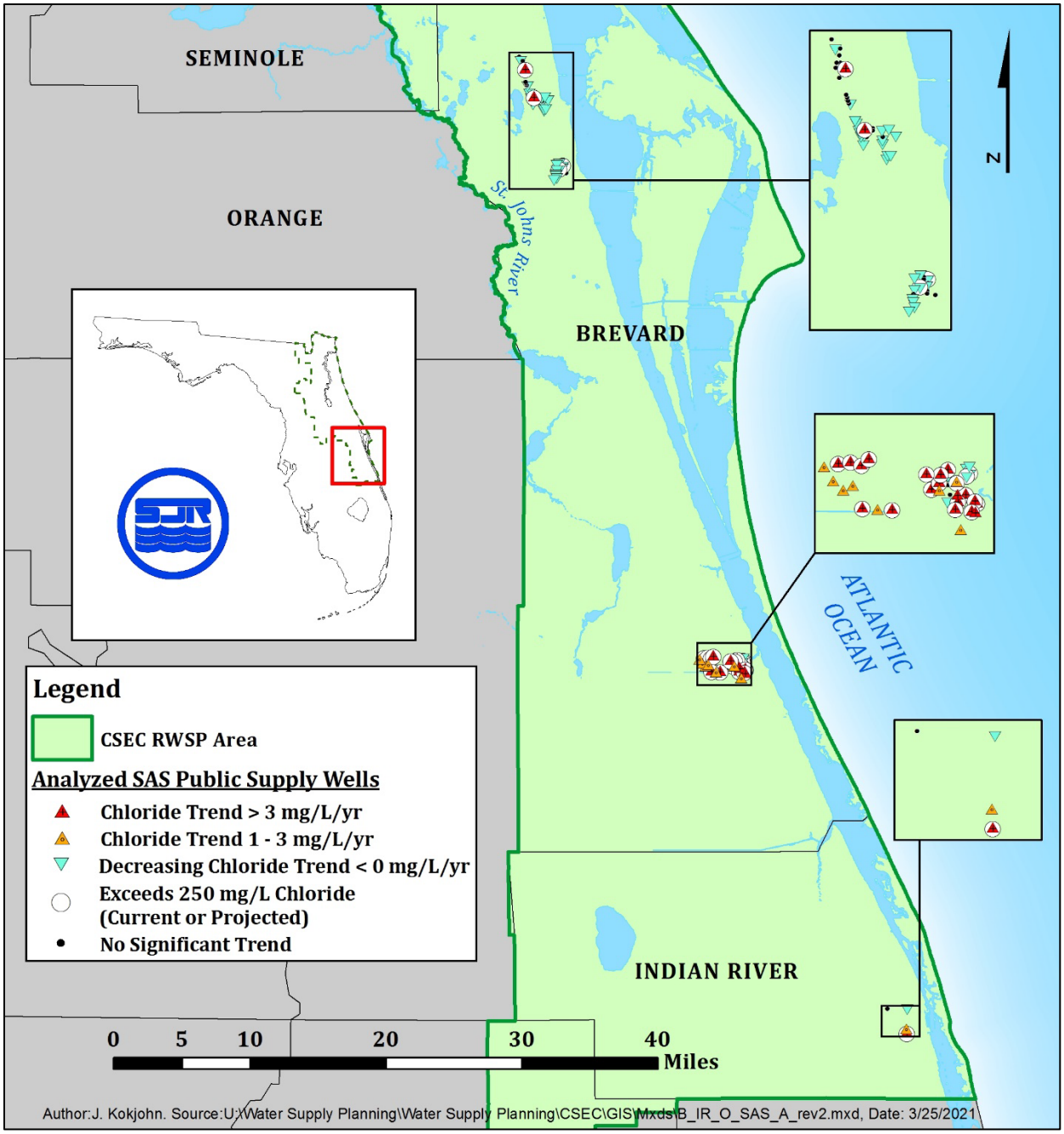


Figure A3-14: Spatial Summary of SAS Public Supply Well Chloride Trend Analysis in Brevard and Indian River Counties

Agricultural Wells

None of the 18 agricultural wells evaluated in Brevard and Indian River counties (all constructed into the UFA) showed a statistically significant increasing trend in chloride concentration (Table A3-7). Water quality data was limited to wells from four farming operations in Brevard County and one in Indian River County. Although the data does not show increasing trends, anecdotal descriptions from the

farming community indicate historical increases in chlorides. Two wells associated with a single agricultural operation in central Indian River County showed a decreasing chloride trend (Figure A3-15). Both wells currently exceed the chloride SDWS. It is possible that the decreasing chloride trends are the result of implementation of additional water conservation measures and expansion of alternative water supplies by the permittee. SJRWMD will consider adding additional agricultural wells to the groundwater quality assessment performed for the five-year update of the CSEC RSWP.

Table A3-7: Analyzed UFA Agricultural Wells with Statistically Significant High, Medium, or Decreasing Trends in Chloride Concentration in Brevard and Indian River Counties

Chloride Trend Category	**Number of Wells Currently Exceeding 250 mg/L**	**Number of Additional Wells Projected to Exceed 250 mg/L by 2040**
High Rate of Change (0 wells)	---	---
Medium Rate of Change (0 wells)	---	---
Decreasing Rate of Change (2 wells)	2	NA

Note: mg/L = milligrams per liter

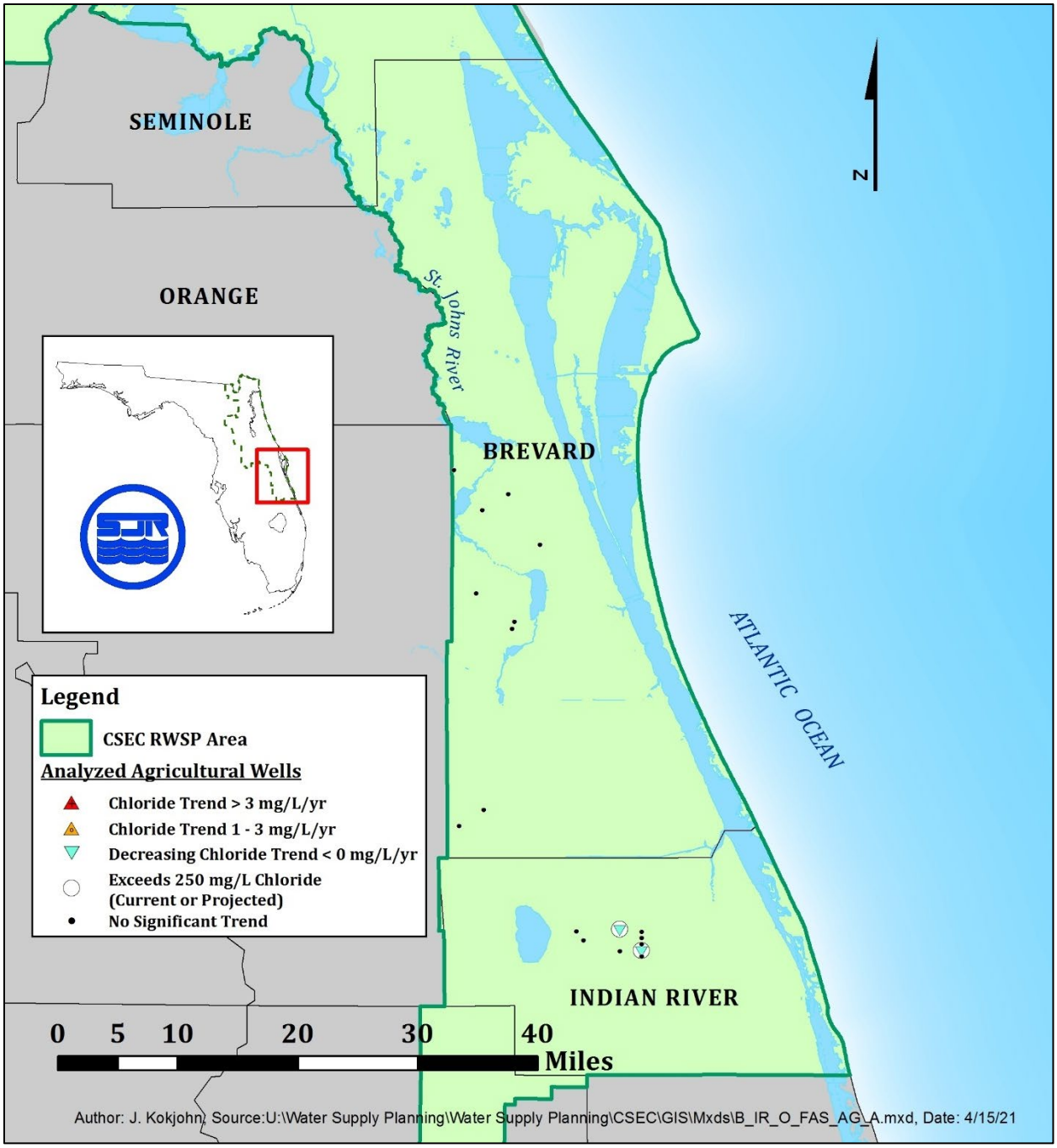


Figure A3-15: Spatial Summary of UFA Agricultural Well Chloride Trend Analysis in Brevard and Indian River Counties

Wetlands

The wetland assessment identified 373 acres that have a moderate or high potential for adverse change based on 2040 conditions within the Brevard, Indian River, and Okeechobee portion of the CSEC RWSP area (Table A3-8; Figure A3-16). The potential for adverse change does not necessarily correspond to realized adverse change due to

the uncertainty with the analysis. As a result, field verification and monitoring, typically carried out for the SJRWMD regulatory program, is required when it is determined to be necessary to ensure the prevention of impacts from groundwater pumping. In 2015, the SJRWMD regulatory program implemented an enhanced wetland monitoring protocol that was developed and approved by stakeholders during the CFWI planning process (CFWI 2018). This new protocol results in a more comprehensive and defensible strategy to monitor for and prevent adverse change to wetlands resulting from groundwater withdrawals. The CSEC wetland assessment is not a replacement for the analysis of the specific potential of a proposed consumptive use to individually or cumulatively impact wetland systems, however, the spatial coverage of wetland acreage identified as being at risk for change can be utilized by regulatory staff for use as a screening tool to locate general areas where potential wetland impacts are more likely to occur.

Additional detailed information regarding the wetland assessment methodology is included in Appendix H.

Table A3-8: Wetland Acreage Identified as Having a Moderate or High Potential for Adverse Change to Wetland Function in Brevard, Indian River, and Okeechobee Counties

County	**Potential Wetland Adverse Change at 2040 (acres)**
Brevard	327
Indian River	7
Okeechobee	10
Total	**343** [1]

[1] Total may be slightly different due to rounding of county values.

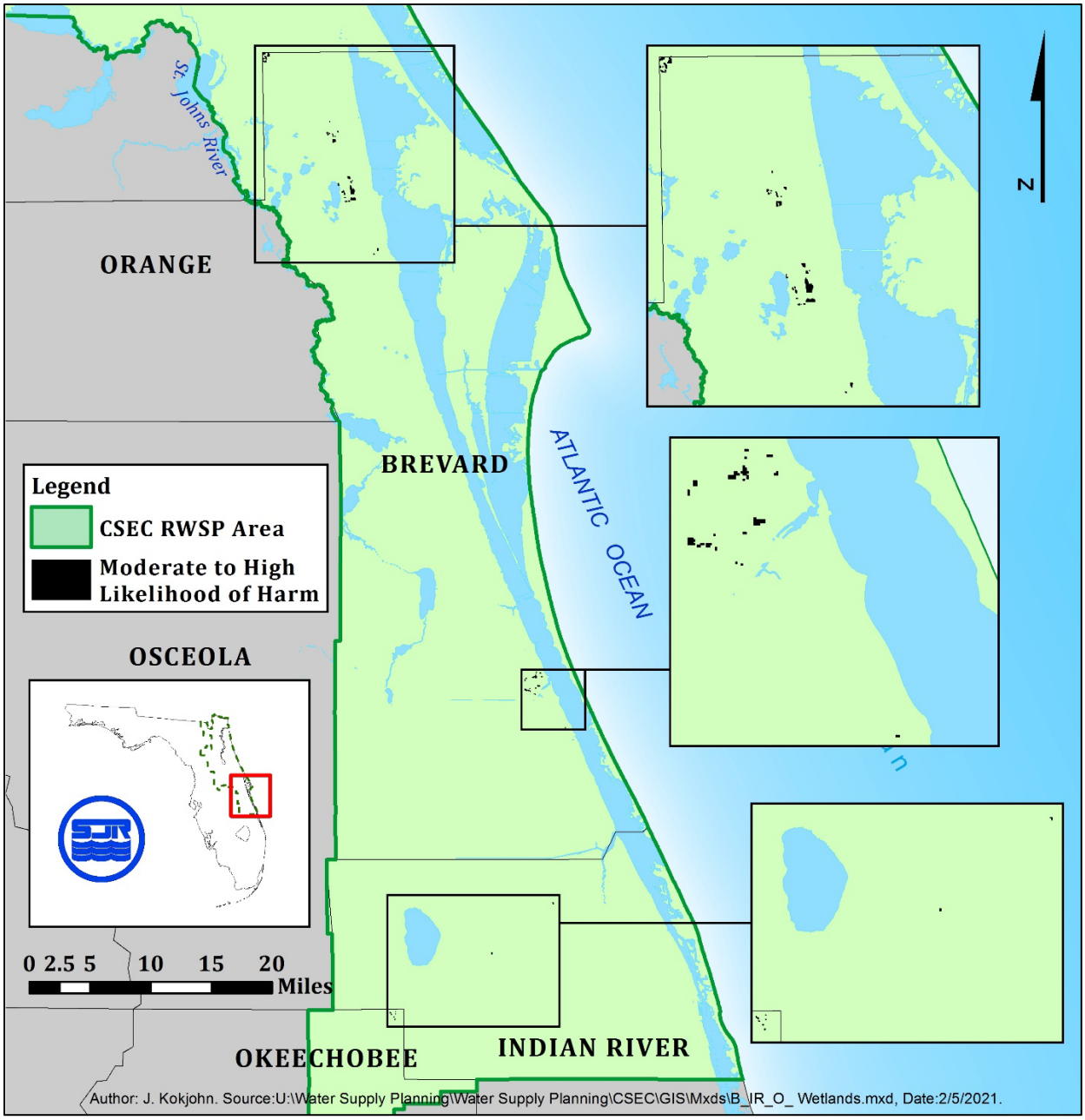


Figure A3-16: Wetlands at Risk of Adverse Change in Brevard, Indian River and Okeechobee Counties Due to 2040 Projected Withdrawals within the ECFTX Domain

Chapter 5: Alternative Water Supply Needs Assessment and Delineation of Water Resource Caution Area for Brevard, Indian River and Okeechobee Counties (Sufficiency Analysis)

Sufficiency Analysis

There are no projected MFL constraints within Brevard, Indian River, and Okeechobee counties. However, results of the water quality assessment demonstrate the potential for water resource impacts associated with 23.5 mgd of future demand at 2040. Since this increase in demand can be met through the implementation of water conservation strategies (low estimate of 13.8 mgd) and the provision of additional available reclaimed water (low estimate of 12.6 mgd), a project modeling scenario was not necessary to determine the sufficiency of projects. Although water quality issues related to saltwater intrusion are typically managed via the SJRWMD regulatory program, it is important to recognize the possibility of potential regional water quality impacts that may influence the future availability of water from traditional sources.

Water Resource Caution Area

SJRWMD evaluated the results of the water resource assessment to determine whether constraints exist to justify the inclusion of Brevard, Indian River, and Okeechobee counties in the CSEC water resource caution area (WRCA). As stated previously there are no MFL concerns associated with 2040 water demand in this area, however, projected water quality impacts may limit future groundwater withdrawals from current sources.

Water Quality

Thirty-two percent of the analyzed DOWN wells and 43 percent of the analyzed UFA public supply wells in Brevard and Indian River counties displayed increasing chloride concentrations at the high or medium rate of change. A spatial evaluation of the trending wells appears to suggest that upconing may be the cause of increasing chlorides in most cases. However, increasing chloride trends in two DOWN wells located on coastal barrier islands may be indicative of lateral saltwater intrusion. Many public supply utilities currently rely on alternative water supplies in this region, mostly brackish UFA and some surface water. Therefore, increased chloride levels should not impact their current treatment processes. However, since water quality data shows increasing chloride concentrations in over one-third of the analyzed UFA DOWN and public supply wells, consideration of potential impacts to other water users is warranted.

Groundwater withdrawals are projected to increase by 18.4 mgd through 2040 in Brevard, Indian River, and Okeechobee counties. Increased UFA groundwater withdrawals may exacerbate saltwater intrusion if not managed properly. Many agricultural operations in this region rely on the UFA to meet a portion of their irrigation needs, and increased chlorides in groundwater could result in farmers having

to invest in alternate, less productive crops with a higher chloride tolerance. The agricultural community has expressed concerns regarding anecdotal increases in chloride concentrations within their UFA wells; however, none of the 18 analyzed agricultural wells in Brevard and Indian River counties showed increasing chloride trends. This may be the result of the limited number and spatial coverage of the analyzed wells or it may be related to recent land use changes and implementation of water conservation and water resource development projects.

By 2040, public supply water demand is projected to increase by 29 percent, while agricultural demand is projected to decrease by 11 percent. Conversion of agricultural land to developed parcels is occurring throughout the region and is projected to continue. Increased chlorides are not anticipated to impact the utilities utilizing RO treatment technologies to provide water to new developments, and a reduction in the number of farms may translate to a reduced concern for raw UFA water quality. A recent investigation by SJRWMD regulatory staff has revealed many farms in Indian River County no longer in operation or operating at a reduced capacity, which further supports projections of agricultural decline in the region.

In addition, the SJRWMD abandoned artesian well plugging program has been very successful in Brevard and Indian River counties. Both counties contribute funds on an annual basis to cost share on the proper abandonment (i.e., plugging) of free-flowing wells within their boundaries. During the last three-year contract cycle, 17 wells were plugged in Indian River County having a combined flow of 9 mgd. In Brevard County, 19 wells with flows totaling 1.5 mgd were plugged in the first year of the three-year contract. Continuation of these programs will further reduce unnecessary flow from the UFA and may help to lessen or reverse increasing chloride trends.

Thirty-one percent of public supply SAS production wells showed increasing rates of chloride concentration in the high and medium category with 21 currently exceeding, or projected by 2040 to exceed, the chloride SDWS. Since approximately 70 percent of domestic supply-wells in Brevard and Indian River counties rely on the surficial aquifer, increasing chloride levels may be a potential concern. Chloride levels beyond the SDWS can render DSS wells non-potable forcing homeowners to invest in expensive treatment systems. Through the careful managing of withdrawals, coastal utilities who rely on the surficial aquifer can often avoid water quality degradation. Based on communications with SJRWMD regulatory staff, deviations to established wellfield management plans likely contributed to the increasing chloride trends in many impacted wells. Strict adherence to existing or enhanced wellfield management plans can lessen or reverse increasing chloride trends in some of the wells. However, where the majority of wells within a wellfield show signs of degradation, reducing the strain on the surficial aquifer by decreasing withdrawals may be necessary. In the case of the impacted SAS wellfield in Brevard County, the utility is implementing projects that will almost double their RO treatment capacity within the next 10 years and provide additional reclaimed water for reuse (Appendix J). Project implementation will result in decreased withdrawals from the surficial aquifer and will allow chloride concentrations to potentially stabilize or improve.

Results of the water quality analysis show that UFA saltwater intrusion in Brevard and Indian River counties may be a result of upconing in response to groundwater withdrawals from a single well and/or combined withdrawals. However, water quality changes in two DOWN UFA wells may be the result of lateral saltwater intrusion. In addition, the water quality analysis demonstrates current and projected impacts to the surficial aquifer indicative of a potentially strained and limited freshwater supply. When viewed together, the conclusion is that groundwater quality may constrain the availability of groundwater sources in Brevard and Indian River counties. The SJRWMD Regulatory Program will continue to evaluate the potential for harmful upconing and lateral intrusion during consumptive use permit (CUP) application review to ensure all permitting criteria are met prior to permit issuance. In addition, SJRWMD will investigate instances of unforeseen harmful water quality impacts potentially resulting from consumptive uses of water, and if verified, will require mitigation by the responsible permittee(s).

Based on the above water quality constraints, the Brevard, Indian River, and Okeechobee portion of the CSEC RWSP area is proposed for inclusion in the CSEC WRCA.

Additional Water Resource Concerns

There are additional water resource concerns in this sub-region that, although are not quantifiable at this time, are worth including in the CSEC RWSP. The South Florida Water Management District (SFWMD) implemented a restricted allocation area (RAA) that includes St. Lucie County, which borders Indian River County to the south (SFWMD 2016). The RAA in St. Lucie County restricts the use of well pumps within the Upper Permeable Zone (UPZ) of the UFA. Agricultural users in this area rely on the UPZ as a backup irrigation source, as surface water within the canals is not sufficient to meet irrigation demand in certain drought scenarios. Since the potentiometric surface of the UPZ is above land surface, these UPZ wells flow without pumps. The RAA helps to prevent a decline in the potentiometric surface that would result in loss of artesian flow for agricultural irrigation. Although SJRWMD has only received one complaint regarding the loss of artesian flow in this region, which has been mitigated by the responsible party, increased water demand resulting from growth has the potential to impact additional wells. The SJRWMD Regulatory program will continue to evaluate the potential for interference to existing legal users during CUP application review to ensure all permitting criteria are met prior to permit issuance. If unforeseen interference does occur subsequent to permit issuance, SJRWMD will require mitigation by the responsible permittee(s).

The South Florida Water Management District has also raised concerns regarding potential impacts to water quality within the UPZ. The current water quality supports the existing crops being propagated; however, declining water quality may necessitate a change to a more salt tolerant crop. Groundwater modeling performed by SFWMD shows areas within Indian River County that have the potential to contribute to cumulative potentiometric surface declines and water quality changes in St. Lucie County (SFWMD 2016). SJRWMD will continue to coordinate with SFWMD regarding use of the UPZ in Indian River and St. Lucie counties.

In addition, this portion of the CSEC RWSP area is bordered by two WRCAs: the CFWI, verified as a WRCA in 2020 (CFWI 2020a); and the Upper East Coast region of the SFWMD, designated a WRCA in 2014 via an amendment to the 2011 Upper East Coast Water Supply Plan update (SFWMD 2014). Furthermore, to the north, Volusia County UFA withdrawals are constrained by MFL water bodies. Groundwater withdrawals from Brevard, Indian River, and Okeechobee counties have the potential to contribute to cumulative water resource impacts in neighboring counties with water resource constraints.

Chapter 6: Project Options for Brevard, Indian River, and Okeechobee Counties

Water Resource Development Project Options

A summary of water resource development project options for Brevard, Indian River, and Okeechobee counties is shown in Table A3-9. Additional project details can be found in Appendix I.

Table A3-9: Summary of Water Resource Development Project Options in Brevard, Indian River, and Okeechobee Counties

Type	Number of Projects	Quantity Water Produced (mgd)	Estimated Construction Cost (Million dollars)
Surface Water	2	14.9	$38.7
Groundwater (brackish)	3	22.5	$0.3
Total	**5**	**37.4**	**$39.0**

Note: mgd = million gallons per day

Water Supply Development Project Options

A summary of water supply development options is shown in Table A3-10. Together, these projects provide 29.2 mgd of alternative water supplies in Brevard, Indian River, and Okeechobee counties. Since two projects increase reclaimed water availability due to storage expansion, it is estimated that 21.2 mgd of reclaimed water will be available for additional future projects. Additional project details can be found in Appendix J.

Table A3-10: Summary of Water Supply Development Project Options in Brevard, Indian River, and Okeechobee counties

Type	Number of Projects	Quantity Water Produced (mgd)	Estimated Construction Cost (Million dollars)
Groundwater (brackish)	7	18.2	$107.7
Surface Water	3	3.6	$10.5
Reclaimed Water	6	7.3	$67.1
Total	**16**	**29.2**	**$185.3**

Note: mgd = million gallons per day

Water Conservation Project Options

Estimates for Brevard, Indian River, and Okeechobee counties indicate a potential water conservation of 18.2 mgd (high estimate) by 2040 at a cost of approximately $32.7 million. Sixteen water conservation projects have been completed or are currently underway in Brevard, Indian River, and Okeechobee counties with an estimated water savings of 1.4 mgd of water for $2.8 million (Appendix K). Remaining conservation potential is estimated at 16.8 mgd and can be realized through the implementation of the various types of water conservation projects listed in the CSEC RWSP.

Summary of SJRWMD Project Funding in Brevard, Indian River, and Okeechobee Counties

From fiscal year (FY) 2014 through FY 2020, the SJRWMD cost-share program has awarded Brevard, Indian River, and Okeechobee cooperators approximately $12.9 million in total construction funds, with $3.8 million awarded specifically for water supply and water conservation projects (Appendix L). Once fully implemented, these projects will provide approximately 2.9 mgd of alternative water supplies and 4.1 mgd of water savings.

Chapter 7: Conclusions

The CSEC RWSP was developed consistent with the water supply planning requirements of Chapter 373, F.S. The CSEC RWSP concludes that the current and future water demands of Brevard, Indian River, and Okeechobee counties can be met through the 2040 planning horizon while sustaining the water resources and related natural systems, through water conservation, management measures, and implementation of water resource and water supply development projects identified in Chapter 6.

Total water demands by all water use categories in Brevard, Indian River, and Okeechobee counties are projected to increase from an estimated current use in 2015 of 168.4 mgd to approximately 191.9 mgd in 2040. SJRWMD has determined that current groundwater sources may not be able to supply the projected 23.5 mgd increase in water demand without causing unacceptable impacts to water resources.

Primary solutions identified for meeting the future water demands in Brevard, Indian River, and Okeechobee counties while protecting the environment include enhanced water conservation, wellfield management, and water resource development and alternative water supply projects. With all these options, SJRWMD and local stakeholders have identified up to 105.1 mgd of projects potentially available to offset the projected increase in water demand at 2040 under average (23.5 mgd) and 1-in-10 year drought conditions (75.6 mgd).

References

Central Florida Water Initiative (CFWI). 2015. *Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP): Volume I – Planning Document*. Available from: http://cfwiwater.com/

CFWI. 2018. *Central Florida Water Initiative (CFWI); Minimum Standards for Water Resource Data Collection, Site Establishment, and Field Data Collection Protocols*. Available from: https://cfwiwater.com/pdfs/DMIT-MinStandards-2018.pdf

CFWI. 2020a. *Central Florida Water Initiative; Regional Water Supply Plan 2020, Planning Document*. Available from https://cfwiwater.com/planning.html

CFWI. 2020b. *Model Documentation Report East-Central Florida Transient Expanded (ECFTX) Model*. Prepared by the CFWI Hydrologic Analysis Team. Available from https://cfwiwater.com/pdfs/ECFTX_Model_Final_Report_Feb_2020.pdf

FDACS. 2017. *Florida Statewide Agricultural Irrigation Demand.* Prepared by The Balmoral Group. FDACS, Tallahassee, FL.

SFWMD. 2014. Final Order on the 2014 Amendment to the 2011 Upper East Coast Water Supply Plan Update. Order No.: 2014-022-DAO-WS. SFWMD, West Palm Beach, FL.

SFWMD. 2016. *Upper East Coast Water Supply Plan Update; Planning Document*. SFWMD, West Palm Beach, FL.