North Florida Regional Water Supply Plan Project Conceptualization Partnership

JANUARY 2025

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Executive Summary

Introduction

The Partnership:	**Partnership Members:**
The North Florida Regional Water Supply Plan Project Conceptualization (NFRWSPPC) Partnership is a voluntary collaborative effort between four water supply utilities and three state agencies. The utilities are the largest four utilities located within the North Florida Regional Water Supply Planning Area and collectively serve over 1.3 million residents of north Florida.	▪ Clay County Utility Authority (**CCUA**) ▪ Gainesville Regional Utilities (**GRU**) ▪ **JEA** ▪ St. Johns County Utility Department (**SJCUD**) ▪ St. Johns River Water Management District (**SJRWMD**) ▪ Suwannee River Water Management District (**SRWMD**) ▪ Florida Department of Environmental Protection (**FDEP**)
The Mission:	**Project Goals:**
The purpose of the Partnership is to identify potential large-scale groundwater recharge projects that can work in conjunction with conservation and other projects to meet minimum flows and levels (MFLs) requirements for the Lower Santa Fe and Ichetucknee Rivers (LSFIR). This effort builds upon the North Florida Regional Water Supply Plan and other water supply planning efforts with the goal of restoring and protecting these valuable natural resources while ensuring adequate water supply for the region. The goal of the Partnership is to address the impacts from all water users, including utilities.	▪ Perform a comprehensive identification and screening of potential alternatives to increase aquifer recharge to offset impacts of current and future pumping to meet proposed LSFIR MFLs ▪ Identify a short-list of potential alternatives for further evaluation ▪ Develop order-of-magnitude costs ▪ Identify next steps needed to further vet potential alternatives and implement final alternative(s)

Background

SRWMD and FDEP are developing LSFIR MFLs to protect these resources from significant harm due to reduction in spring and river flow resulting from current and future groundwater withdrawals. **Table ES.1** summarizes the proposed recovery and prevention goals at the most critical flow monitoring points for the LSFIR. The recovery goals are based on current pumping, and the prevention goals are based on projected future pumping through 2045. A recovery and prevention plan to meet these goals must accompany the MFL upon adoption. The water management districts and FDEP have engaged stakeholders throughout the water supply planning and MFL development process to develop projects and approaches to meet the proposed MFLs. However, the Partnership recognized that efforts to date have not identified projects that fully meet the recovery and prevention goals. The Partnership initiated efforts to identify and screen potential large-scale projects that could work in concert with conservation efforts and other locally implemented projects to meet the MFL goals in an environmentally sustainable manner.

Table ES.1 Proposed Lower Santa Fe and Ichetucknee Rivers MFL Recovery and Prevention Goals

	Recovery Goal (cfs)	Prevention Goal (cfs)	Total Goal (cfs)
Santa Fe MFL Goals (measured at streamflow gage at Hwy 441)	1.0	16.3	17.3
Ichetucknee MFL Goals (measured at streamflow gage at Hwy 27)	6.3	6.9	13.2

Project Screening Process

The conceptual evaluation integrated a range of alternative water sources, recharge approaches, and treatment technologies (**Figure ES.1**). Utility integrated water resources plans, and the North Florida Regional Water Supply Plan identified these potential source waters.

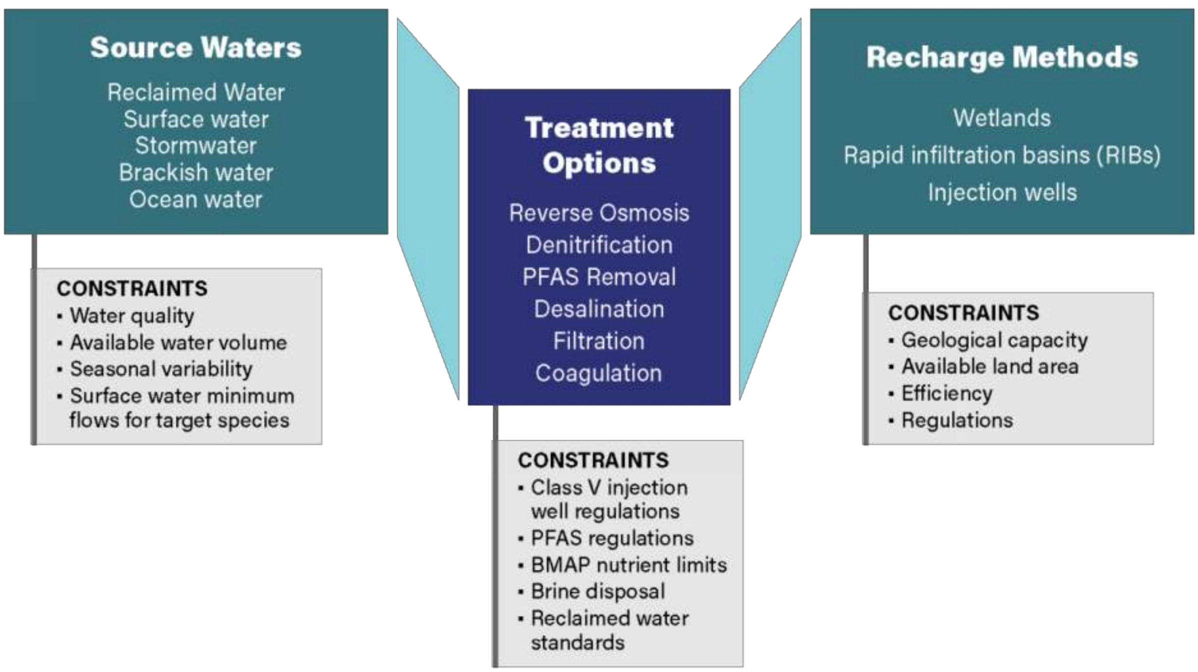


Figure ES.1 Source Water, Treatment, and Recharge Constraints

Combining various source water, treatment and recharge technologies resulted in several hundred potential alternatives. Participating members met for six interactive workshops to develop a framework and screen conceptual alternatives to develop a short-list of potential alternatives for further consideration. Criteria used for this screening included:

- Estimated Capital and Operation and Maintenance Costs
- Implementation Difficulty
- Potential Environmental Impacts
- Operational Complexity
- Project Development Time
- Source Water Reliability
- Potential for Regional Benefits
- Ancillary Benefits

The Partnership conducted an extensive review and compiled cost data from previous projects to develop estimated costs. The effort considered permitting and environmental issues such as nutrients, emerging contaminants, and other issues at a very high level. However, the Partnership recognizes the need for a more detailed evaluation of short-listed alternatives in the next phase to ensure these considerations are fully addressed before a project can be implemented.

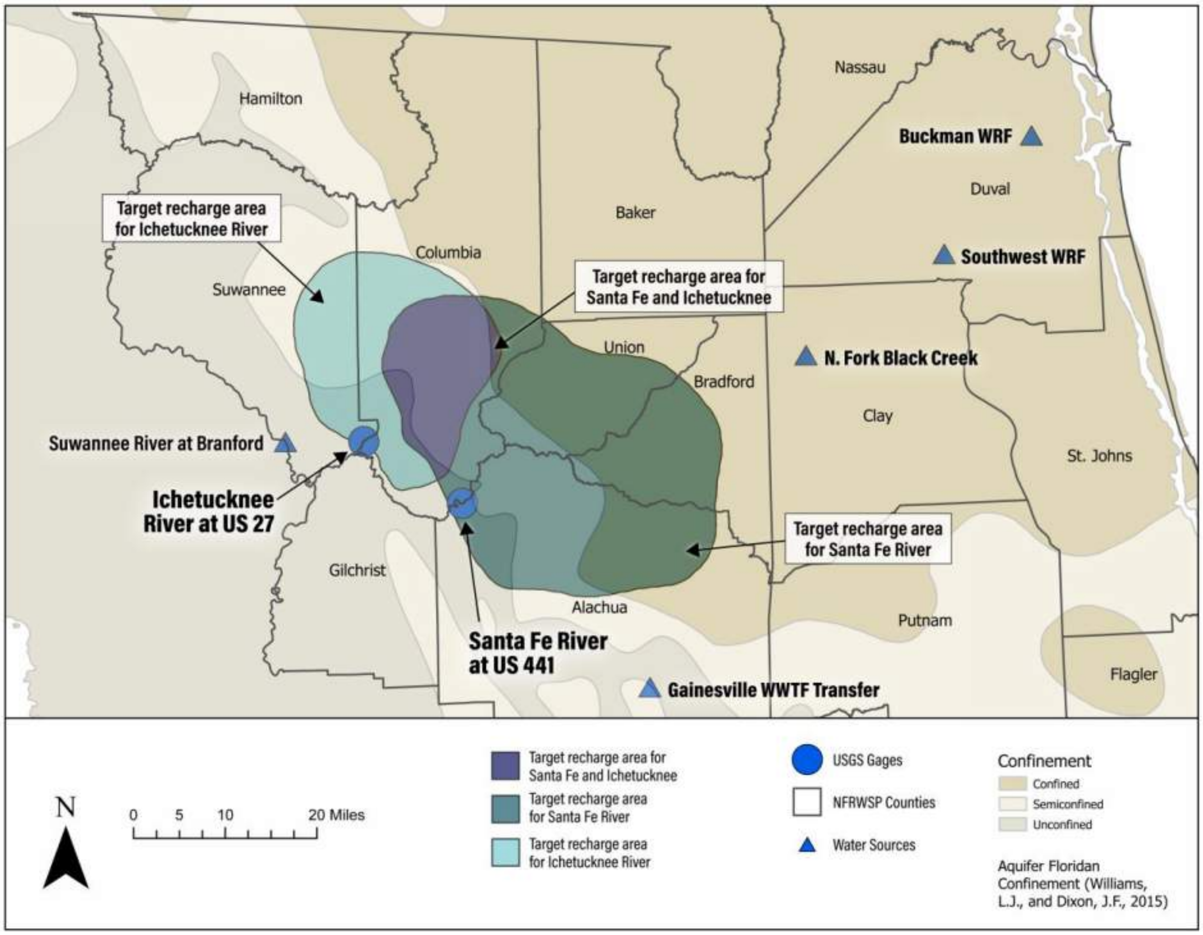


Figure ES.2 Conceptual Recharge Area

The evaluation identified a conceptual recharge area shown in **Figure ES.2** based on preliminary estimates of recharge benefits using the North Florida Southeast Georgia (NFSEG) regional groundwater model. While the conceptual areas in Figure ES.2 adjoin the Santa Fe and Ichetucknee Rivers, actual recharge locations will need to be sufficiently far away from the rivers to ensure regional benefit. The Partnership recognizes a more detailed hydrogeological and engineering analysis, beyond the scope of this effort, will be needed to identify specific recharge locations to ensure all environmental goals are met and that there are no adverse environmental impacts.

Short-Listed Alternatives

While the evaluation process identified more than 800 alternatives, **Table ES.2** summarizes a short-list of potential alternatives identified through sequential, data-driven screening, workshop dialogue, and consideration of both individual and collective value. Table ES.2 includes reclaimed water sources, surface water sources, and seawater.

Table ES.2 Summary of Short-Listed Alternatives

Source	Volume (MGD)	Santa Fe Benefit (cfs)[3]	Ichetucknee Benefit (cfs)[3]	Capital Cost Estimate ($M)	Full MFL Goals?
JEA Reclaimed Water from Buckman and Southwest WRFs	40	17	14	830	Yes[2]
GRU Reclaimed Water	3	1.1	0.9	90	No
North Fork Black Creek	4.2 avg	2.0	1.6	210	No
Lower Suwannee/ Branford	8.9 avg	4.1	3.4	340	No
Desal – Coquina[1]	40	19	15	2,800	Yes[2]
Desal – Gulf[1]	40	19	15	3,000	Yes[2]
Pumping Replacement[1]	182	20.6	4.7	12,000	No

1 Desalination options are shown for comparative purposes, but not recommended for further study at this time.
2. Full MFL goals could be met based on current modeling and careful selection/design of recharge sites and methods.
3. MFL benefits for JEA Reclaimed Water from Buckman and Southwest WRFs assume a 90 percent recharge efficiency for RIBs. MFL benefits for GRU Reclaimed Water assume an 80 percent recharge efficiency for recharge wetlands. MFL benefits for the remaining alternatives assume a 100 percent recharge efficiency for recharge wells.

The MFL benefits were estimated based on the volume of water from each source and preliminary recharge benefits based on the conceptual recharge area. The following section provides a summary of each alternative:

- **JEA Reclaimed Water**: Includes reclaimed water from JEA Buckman and Southwest water reclamation facilities totaling 40 million gallons per day (MGD). The preliminary project concept is based on operation of a treatment wetland upstream of the recharge location. At 40 MGD, this alternative could address the full LSFIR MFL needs if recharged in a strategic location. The project would also assist JEA meet Senate Bill 64 non-beneficial surface water discharge elimination requirements.
- **GRU Reclaimed Water**: Up to approximately 3 MGD of reclaimed water flow for aquifer recharge could be obtained by shifting flow between GRU water reclamation facilities. This alternative's volume is not large enough to meet MFL targets by itself, but may be beneficial in concert with the JEA alternative and/or other alternatives.
- **North Fork Black Creek**: Surface water would periodically be withdrawn from the north fork of Black Creek and beneficially recharged. Preliminary analysis suggests that withdrawal of 5.2 MGD could potentially be available approximately 80 percent of the time while meeting ecological flow needs. More detailed hydrological analysis would be required to ensure source water availability.
- **Lower Suwannee River**: Surface water would periodically be withdrawn downstream of the Branford Gage and beneficially recharged. Preliminary analysis suggests that withdrawal of 20 MGD could potentially be available approximately 45 percent of the time while meeting ecological flow needs. More detailed analysis would be required to ensure compliance with Suwannee River MFLs and no other adverse environmental impacts.

- **Desalination (for comparative reference- not recommended for further study):** Several desalination alternatives were considered in the evaluation. Table ES.2 presents three desalination alternatives for comparison with the other water sources: Desal-Coquina would desalinate ocean water from the east coast in the Jacksonville area and pump it to the conceptual recharge area (Figure ES.2). Desal-Gulf would desalinate water from a location on the west coast and pump it to the recharge area. Pumping Replacement would desalinate saltwater from the Jacksonville area and would replace groundwater as a water supply for all four utilities. The desalination alternatives are not recommended for further evaluation because of: 1) High capital and operation and maintenance cost, 2) Brine disposal, 3) Replacement of all four participating utility pumping with desalinated seawater would not meet the full MFL requirements, and 4) Ocean desalination does not address the requirements of Senate Bill 64 to put reclaimed water to beneficial use.

Next Steps

Through the comprehensive and collaborative process documented in this report, the Partnership identified four alternatives for further study. Further evaluation of these alternatives will be required to ensure technical feasibility, meet environmental and regulatory constraints, refine costs, and develop plans for implementation and long-term management. Items that will need to be addressed include the following::

- **Technical Feasibility Studies of Selected Alternatives.** Technical feasibility studies should include evaluation of treatment technologies needed to make source water suitable for the recharge options selected and site-specific hydro-geological evaluations of the recharge sites.
- **Governance and Cooperative Agreements.** Initiate development of agreements for operation, future rehabilitation and replacement, and governance of potential projects. Develop a framework on how offset benefits are distributed to users.
- **Project Funding.** Identify and pursue options for project funding.

1.0 Drivers and Goals for This Evaluation

In 2017, the governing boards of the St. Johns River Water Management District (SJRWMD) and Suwannee River Water Management District (SRWMD) approved the North Florida Regional Water Supply Plan (NFRWSP). The NFRWSP encompasses 14 counties: Alachua, Baker, Bradford, Clay, Columbia, Duval, Flagler, Gilchrist, Hamilton, Nassau, Putnam, St. Johns, Suwannee, and Union. The purpose of the plan is to protect natural resources and water supplies in north Florida. The water management districts have updated the plan, in accordance with Section 373.709 of the Florida Statutes, which requires the districts reevaluate their determinations concerning the need for a water supply plan at least every five years. The NFRWSP identified impacts to the Lower Santa Fe and Ichetucknee Rivers (LSFIR) as water resource constraints and efforts are now underway to identify large-scale groundwater recharge projects that work in conjunction with conservation and other projects to recover the LSFIR to their previous levels. The Florida Department of Environmental Protection (FDEP) and SRWMD are developing proposed MFLs for the LSFIR which are expected to be adopted in 2026. The MFLs must be accompanied by a recovery and prevention plan to achieve compliance with the proposed targets.

The four public utilities—JEA, Gainesville Regional Utilities (GRU), St. Johns County Utility Department (SJCUD), and the Clay County Utility Authority (CCUA)—have developed independent Integrated Water Resource Plans (IWRPs). These public utilities developed their IWRPs with planning horizons tied to projected population growth and capital infrastructure investment. The public utilities want their respective IWRPs to integrate with regional water supply development projects to protect vital environmental resources and sustainably manage the region's water resources in perpetuity.

The water management districts, and the public utilities understand that to address the long-term sustainability of important water resources (such as the Lower Santa Fe, Ichetucknee, and Suwannee Rivers) large-scale cross-district and cross-utility projects will likely be necessary. To address this need, the FDEP, water management districts, and public utilities agreed to work together to develop this NFRWSP Projects Conceptualization Partnership.

Ultimately, the principal goal of this Partnership is to provide full recovery and prevention flow benefits to the Lower Santa Fe and Ichetucknee Rivers, thereby addressing the impacts from all water users, including utilities.

The MFLs for these rivers use streamflow gauges as measurements of improvement, and as proxies for restoration of flow in upstream aquifer-fed springs.

The MFLs established for both the Santa Fe and Ichetucknee Rivers have two components:

- Recovery target represents the amount of flow that needs to be restored for the river based on impacts of baseline average groundwater pumping from 2014–2018.
- Prevention target represents the amount of flow that must be provided to offset the anticipated reductions in flow due to projected impacts of anticipated groundwater withdrawls in the northern Florida region from 2019–2045.

The recovery and prevention targets are shown in **Table 1.1**; and represent the total MFL goal for flow improvement. The Partnership considered both sets of targets during the evaluation of project alternatives for this effort. The goal was to identify alternatives that could meet all the MFL recovery and prevention needs.

Table 1.1 Proposed Ichetucknee and Lower Santa Fe Rivers MFL Recovery and Prevention Goals

	Recovery Goal (cfs)	Prevention Goal (cfs)	Total Goal (cfs)
Ichetucknee MFL Goals (measured at streamflow gage at Hwy 27)	6.3	6.9	13.2
Santa Fe MFL Goals (measured at streamflow gage at Hwy 441)	1.0	16.3	17.3

As an important first step in identifying a strategy to address the full needs for the LSFIR MFLs, this phase of work accomplished the following initial steps:

1. Performed a comprehensive identification and screening of over 800 alternative ways to increase aquifer recharge to offset impacts of current and future pumping to meet proposed LSFIR MFLs
2. Identified a short-list of potential alternatives for further evaluation.
3. Developed order-of-magnitude costs for comparative purposes.
4. Identified next steps needed to further vet potential alternatives, refine cost estimates, better understand regulatory requirements, and examine recharge projects with more specificity.

2.0 Process and Methodology Overview

To identify and evaluate alternatives that would accomplish the MFL goals, the Partnership formed a working group that met monthly for facilitated workshops to conceptualize, evaluate, and screen project ideas. This group was supplemented by a technical committee that met weekly to discuss technical evaluation and provide feedback to the larger Partnership.

The conceptual evaluation integrated a range of alternative water sources, recharge approaches, and treatment technologies (**Figure 2.1**). The Partnership identified available water sources based on integrated water resources planning conducted by the utilities as well as the NFRWSP.

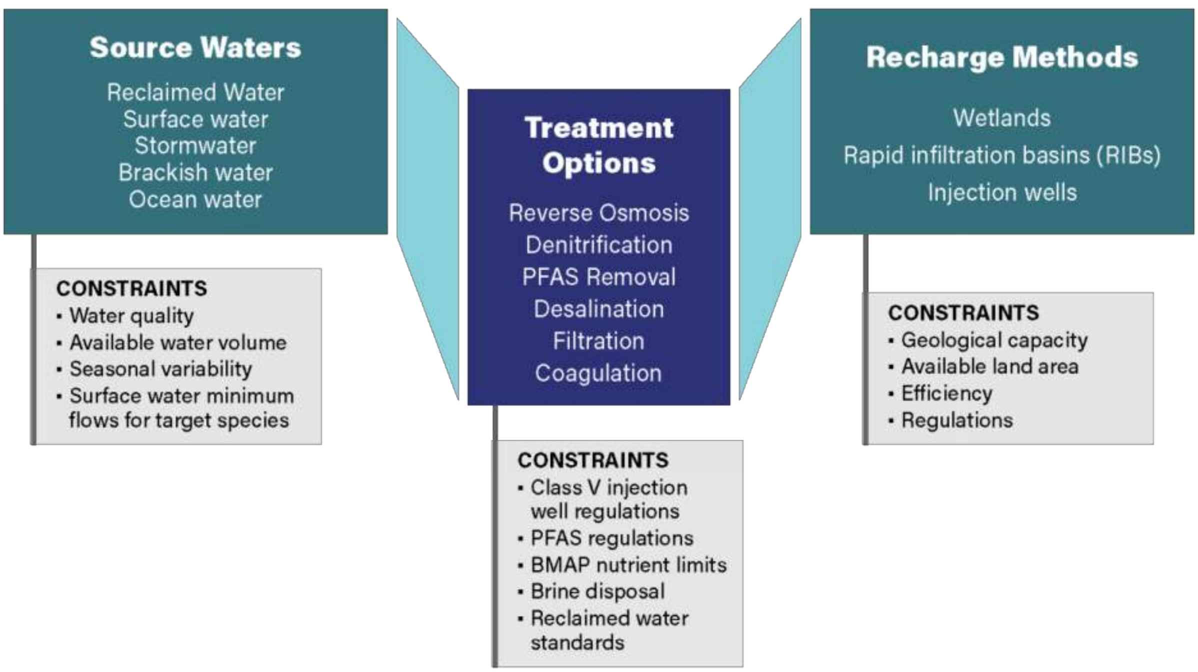


Figure 2.1 Source Water, Treatment, and Recharge Constraints

Project alternatives were defined as shown in **Figure 2.1**, and then evaluated based on the cost of implementing the infrastructure needs versus the potential recharge benefits they could offer. The combining of various source water, treatment and recharge technologies resulted in several hundred potential alternatives. A three-tiered evaluation process was employed to progressively screen the alternative list based on successively refined criteria, as shown in **Figure 2.2** and summarized below.

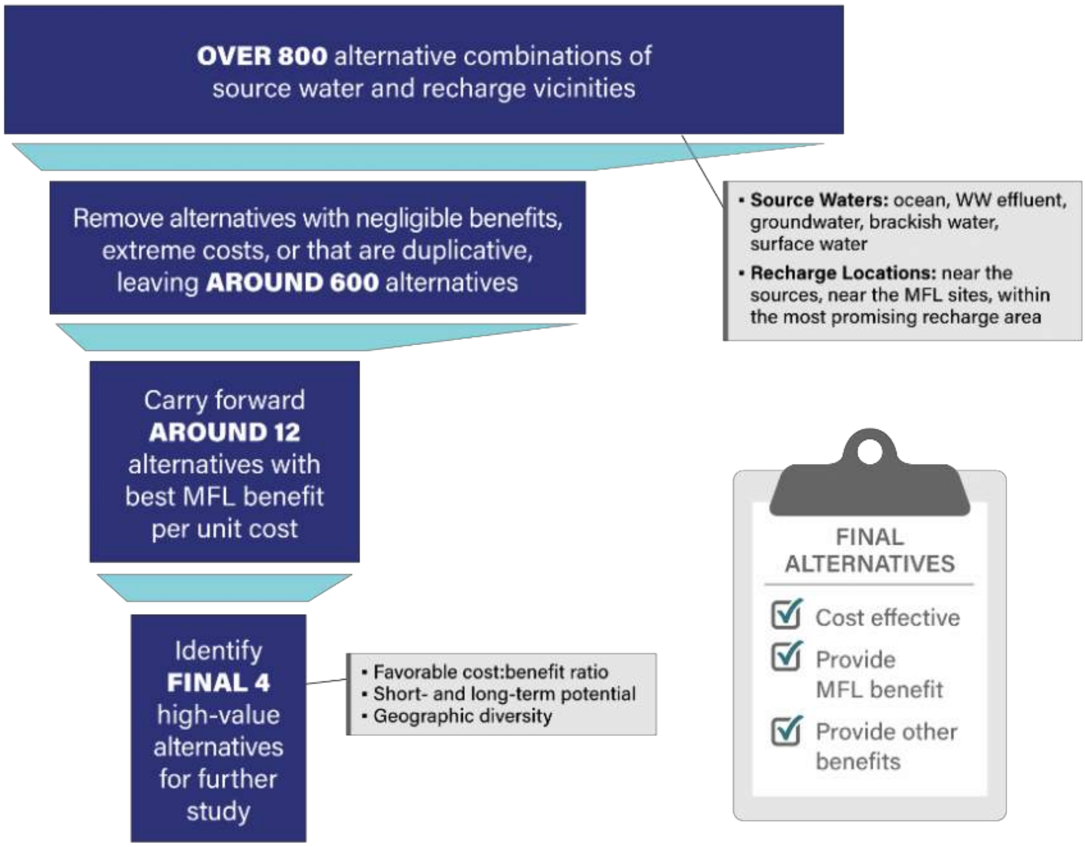


Figure 2.2 Three Tiered Screening Process for Alternative Recharge Concepts

Tier 1: In the first tier, the Partnership considered the identified candidate water sources with variations in pathways into the MFL recharge area. Project alternatives that provided less than three MGD or that exhibited significantly higher unit conveyance costs than other alternatives were removed from consideration. The Partnership also identified sources that were either technically or institutionally infeasible.

Tier 2: The Partnership evaluated the remaining alternatives for conceptual costs and potential benefits. Conceptual costs included source development, treatment, conveyance, and recharge. Benefits were estimated based on *the expected combined flow benefit* at the two MFL sites, based on the volume of water expected to reach the sites from a target recharge area (see **Section 4.0**). Alternatives were sorted based on the capital cost to MFL benefit ratio. From this list, approximately ten alternatives were chosen based on their value, and with careful consideration for maintaining a broad array of source waters.

Tier 3: These ten short-listed projects were compared using a multi-criteria scorecard that combined both quantitative and qualitative features of each alternative. In this phase, conceptual cost estimates were further refined, MFL benefits were reported individually for the two sites, and a broad array of qualitative characteristics were examined (e.g., ancillary benefits, implementation ease, development time, operational complexity, reliability of source water, and potential for benefit to additional MFL water bodies). The project alternatives were discussed in their totality; through facilitated discussion, and the Partnership identified four projects to advance for more detailed feasibility assessments.

Decision-makers from the Partnership used a series of facilitated workshops to discuss the technical outcomes at each step of the process (**Table 2.1**). Through progressive, data-driven screening, workshop dialogue, and consideration of both individual and collective value of alternatives, the Partnership was able to move from over 800 initial alternatives to the four alternatives identified for additional study.

Table 2.1 Workshops with Sponsor Organizations

Workshop	Date	Theme
1	Jan 2024	Intro and Development of Scorecard Criteria
2	Mar 2024	Sample of Initial Project Concepts
3	Apr 2024	Tier 1 Screening: Fatal Flaws and Clear Low Value
4	Jun 2024	Tier 2 Methods: Conceptual Costs and Benefits
5	Jul 2024	Tier 2 Results – High Performing Projects
6	Sep 2024	Scorecard Evaluation: Recommended Projects for Feasibility Assessment

3.0 Candidate Water Sources

The initial list of alternatives included potential sources from rivers, groundwater, reclaimed water, seawater, stormwater, and brackish water in both the St. Johns and Suwannee River Basins. **Table 3.1** lists the initial array of candidate water sources, largely identified by IWRPs, the 2023 NFRWSP, and facilitated discussions with the project sponsors. While treated reclaimed water and desalination have defined volumes for source water, surface waters and stormwater would require additional analysis to determine the amount of water available without impacting the source water bodies. **Figure 3.1** maps these sources.

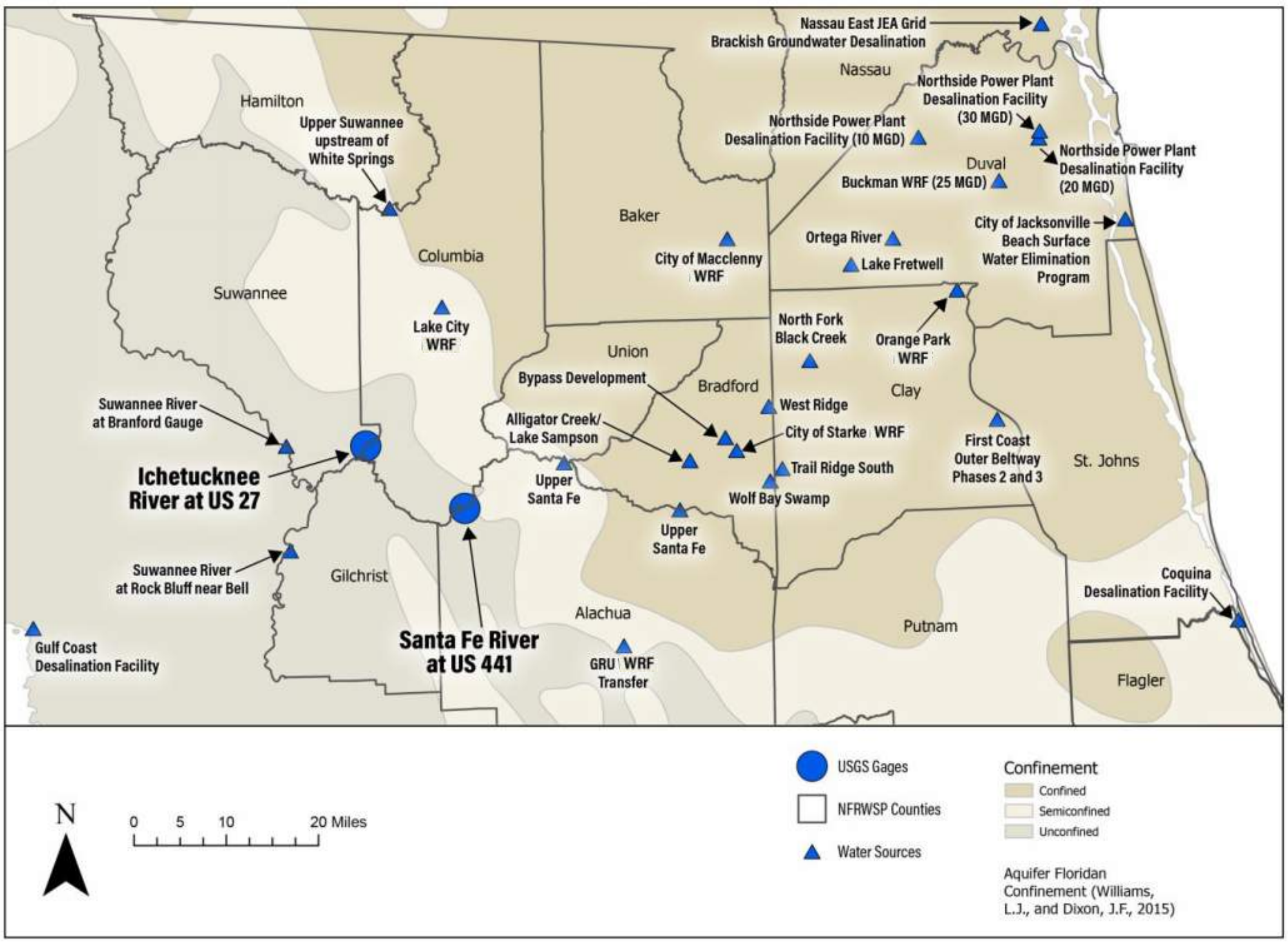


Figure 3.1 All Water Sources Considered

Table 3.1 Original List of Candidate Sources of Recharge Water

Source ID	Source Type	Target Flow (MGD)
Alligator Creek	Surface Water	Undefined
Buckman + Southwest WRF	Reclaimed Water	40
Coquina Coast Desal	Desalinated Water	40
First Coast Outer Beltway Phase 2	Stormwater	2.6
GRU WRF Transfer	Reclaimed Water	3
Gulf Coast Desal	Desalination	40
Jacksonville Beach Surface Water Elimination	Surface Water	2.3
Lake City WRF	Reclaimed Water	0.2
Lake Fretwell	Stormwater	Undefined
MacClenny WRF	Reclaimed Water	0.7
Nassau East Brackish	Brackish Groundwater	4
North Fork Black Creek	Surface Water	5.2
North Brackish	Brackish Groundwater	9
Northside Power Desal	Brackish Surface Water	10 - 30
Orange Park WRF	Reclaimed Water	0.79
Ortega River	Surface Water	1.8
SRWMD West Interconnection	Groundwater	Undefined
Starke 301 Bypass Development	Stormwater	Undefined
Starke WRF	Reclaimed Water	0.54
Suwannee Bell	Surface Water	20
Suwannee Branford	Surface Water	20
Trail Ridge South	Stormwater	Undefined
Trout River	Surface Water	2.4
Upper Santa Fe	Surface Water	0.9
Upper Suwannee	Surface Water	10
West Ridge	Stormwater	Undefined
Wolf Bay Swamp	Stormwater	Undefined

4.0 Candidate Recharge Areas and Methods

4.1 Target Recharge Area

The further away from the MFL water bodies, the less "influence" recharge may have on augmenting the flows in the LSFIR. The ability for water reaching the Upper Floridan Aquifer (UFA) to contribute to flows in the MFL water bodies was evaluated by the water management districts using the North Florida/Southeast Georgia (NFSEG) groundwater model. Results were provided by the SRWMD in the form of "influence factor" maps (**Figure 4.1**), which could be used to estimate the ratio of augmented flow at the MFL target locations based on the full volume applied to the UFA at a given recharge site. Influence Factors are ratios ranging from 0 to 1, with 1 representing 100 percent of the applied UFA flow reaching the MFL site, and 0 representing none of the applied UFA flow reaching the site. The figures illustrate that proximity to the MFL water bodies is essential to optimizing MFL benefits.

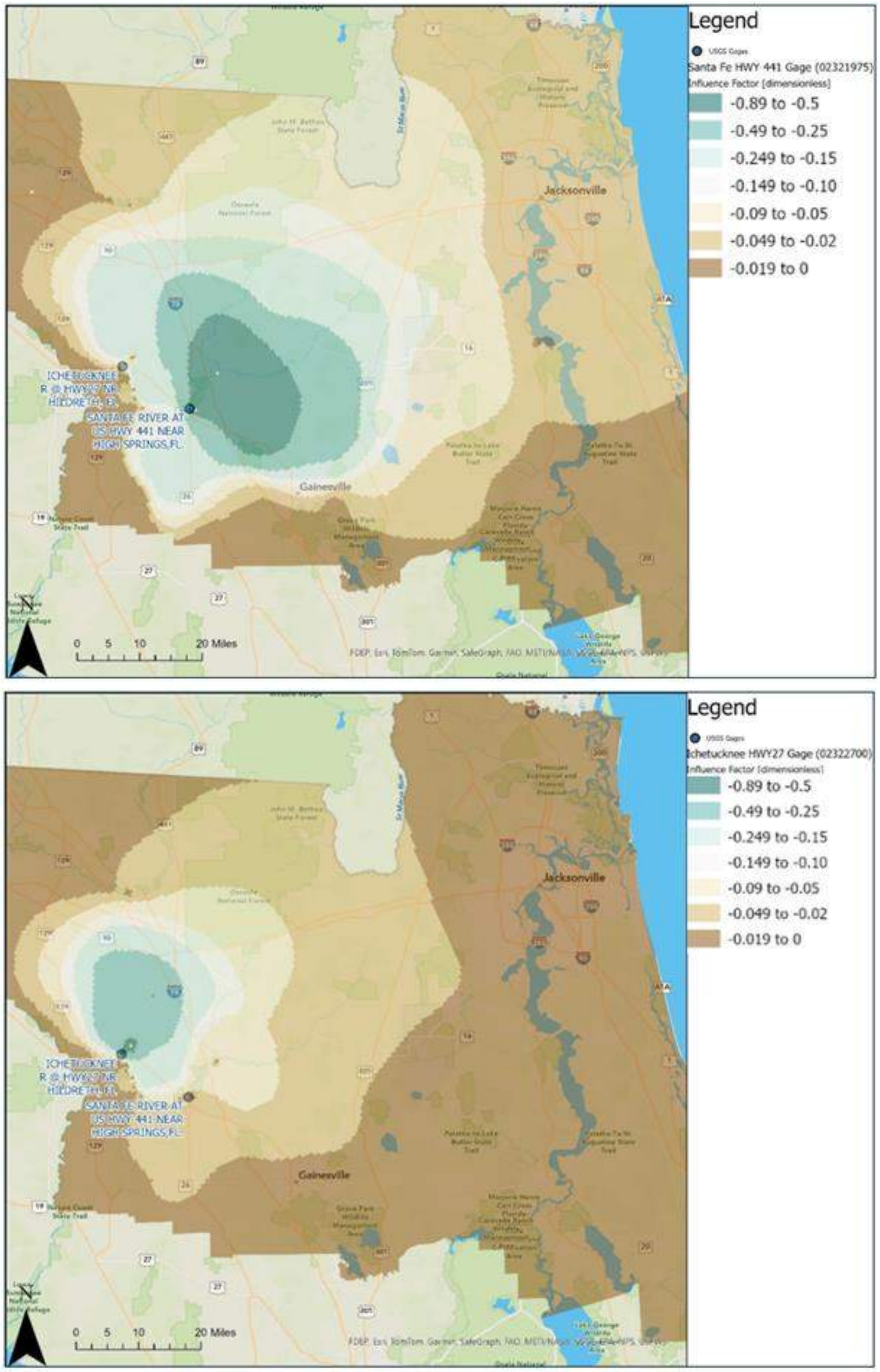
Other considerations:

- **Mutual Benefits**: While some areas predominantly benefit the Santa Fe system, others predominantly benefit the Ichetucknee. **Figure 4.2** illustrates where these influential areas overlap.

  Recharge at the scale proposed is likely to require more than one site. Multiple sites would provide the opportunity to maximize benefit to each site individually or to supplement individually beneficial sites with some mutually beneficial sites within the overlap area.

For comparative purposes during this phase of study, the Partnership designated representative influence factor values within the target recharge area to be used for all candidate alternatives. Though the values within this target recharge area can vary on a site-specific basis, the representative influence factor values provide a reasonable expectation of the benefits expected at each of the two sites.

- **Hydrogeologic Confinement**: The two MFL sites are situated near the Cody Escarpment, a transitional geologic feature that divides a highly impervious soil column to the east from a highly pervious soil column to the west. Land to the east is characterized by a confining, or restricting, clay layer between surficial aquifers and the deeper UFA. Land to the west is unconfined, meaning that water discharged to the surface can infiltrate more freely downward at higher rates. A narrow band of transitional land is marked by intermittent confining layers and is characterized as "semi-confined." Figure 4.2 illustrates that the target recharge area is located principally in the semi-confined area. This suggests that future phases of work should examine site-specific soil features and permeability to identify effective recharge locations and methods.



Negative Values are for modeling purposes only – influence factors are the positive of the above
[Source: SRWMD from North Florida/Southeast Georgia NFSEG model]

Figure 4.1 Influence of Recharge on the Santa Fe (Upper) and Ichetucknee (Lower) MFL Gauges

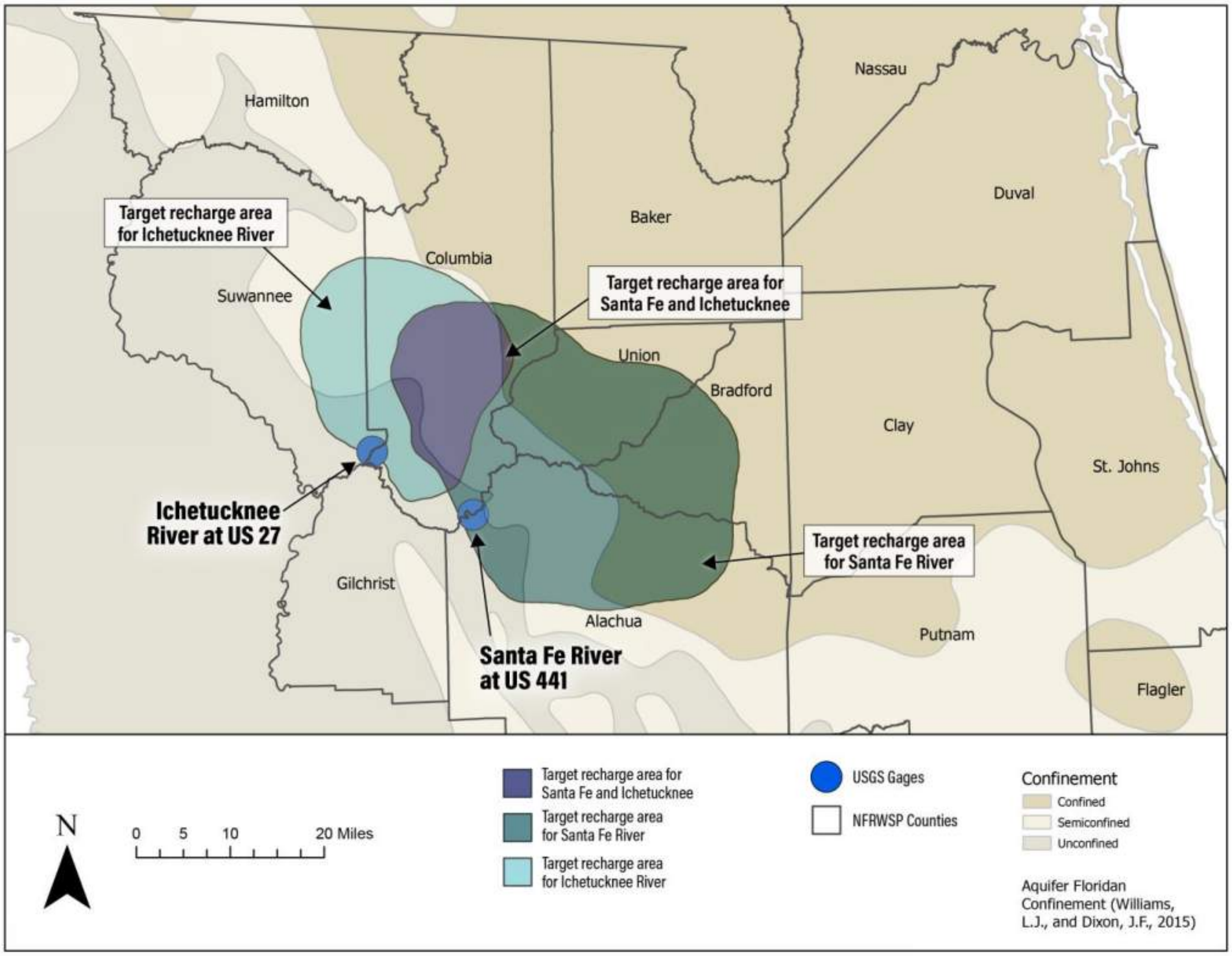


Figure 4.2 Conceptual Recharge Areas

4.2 Available Recharge Methods

Three methods of recharge into the UFA are available: (1) Natural or constructed wetlands, (2) rapid infiltration basins (RIBs), and (3) recharge wells. All three methods have been used in Florida. The Partnership discussed all three methods and evaluated capacity and conceptual cost based on desktop analysis. Detailed, site-specific investigation of land availability, soils, and location analyses are recommended for future phases of work to match appropriate recharge methods with specific recharge sites. For informational purposes, each method is detailed below.

Wetlands: Placing reclaimed water in wetlands (for effluent disposal/reuse) has occurred for 40 to 45 years. Use of existing natural wetlands is regulated under Chapter 62-611, FAC Wetlands Application; however, constructed wetlands are also used for reuse and disposal, and are addressed by the same rule. The value of wetlands is that they provide some nutrient removal through uptake in vegetation, thereby satisfying some treatment needs through natural processes.

An example of a constructed wetlands system used to recharge both reclaimed water and stormwater is the Ocala Wetland Recharge Park. This 60-acre project recharges approximately three MGD to the Floridan aquifer. The use of wetlands for high-rate recharge could be problematic, depending on the substrate (soil) on which it is constructed. Wetlands perform better with some degree of organic content in the soil, and the soil and the vegetation root systems can impede the downward flow of water. Maintaining design recharge rates could require ongoing maintenance to ensure recharge flow pathways remain open and effective.

RIBs: The next method of aquifer recharge, RIBs, has been used in Florida since the late 1970s. Most RIBs are used for effluent disposal and recharge and are most effective in upland areas with thick surficial deposits and deep water tables, such as in Florida's sand ridges and adjoining uplands (e.g., Lake Wales Ridge, Mt. Dora Ridge, etc.). For deeper recharge to be effective, the regional confining unit (Hawthorn Group sediments) are usually thin or missing altogether. RIBs permitted as high-rate-land application systems typically adhere to Reuse of Reclaimed Water regulations (Chapter 62-610, FAC Part IV).

There are many RIB systems used for reclaimed water disposal throughout Florida. RIBs are initially permitted to process as much as three inches per day (1.9 gallons per day per square foot [gpd/ft^2] of RIB bottom area). When the RIBs have been operated for a sufficient period of time to collect data, they can be re-rated and re-permitted for up to nine inches per day (5.6 gpd/ft^2).

In addition to groundwater recharge (Chapter 62-610, FAC Part V), RIBs can also be used for indirect potable reuse projects when in proximity to potable supply wells (Chapter 62-565, FAC). RIBs located in areas with Basin Management Action Plans (BMAPs) for established Total Maximum Daily Loads (TMDLs) for nutrients may also require high level of treatment for the source water. Denitrification is also a primary concern for RIBs located in proximity to springs with excessive nitrate levels. Further evaluation of treatment processes to achieve allowable nitrate levels may result in treatment needs greater than biological denitrification processes alone can achieve.

Recharge Wells: The third method of aquifer recharge is direct recharge to the target aquifer using a Class V injection well. Class V wells, as defined in Chapter 62-528, FAC Underground Injection Control, are those which inject water into the Underground Source of Drinking Water (USDW). The USDW is defined as groundwater that contains a TDS of less than 10,000 milligrams per liter (mg/L). Rule 62-610.563, FAC (Waste Treatment and Disinfection) defines two distinct levels of treatment, depending on TDS concentrations of the receiving aquifer. Full treatment must be provided if the TDS of the groundwater in the receiving aquifer is less than 3,000 mg/L and principal treatment is allowed for groundwaters with a TDS between 3,000 and 10,000 mg/L. It is anticipated that recharge wells located within the preliminary target recharge area would have to meet the full treatment requirements, including reducing the amount of organic carbon present. Treatment for direct recharge is more expensive than for wetlands or RIBs. There are several planned aquifer recharge wells and indirect potable recharge wells planned for Florida. There is one permitted and operational aquifer recharge project in west central Florida—the South Hillsborough Aquifer Recharge Project, which is a salinity barrier system permitted under Rule 62 610.662, FAC and under Chapter 62-528, FAC, and uses reclaimed water from the Falkenburg and Valrico WRF as the injectate. The recharge wells are permitted as Class V, Group 2 wells, which are classified by FDEP for aquifer recharge purposes. Direct injection into an aquifer (for aquifer recharge purposes) is the most effective method of recharge, but treatment can be the most complicated and costly of the alternatives. Operationally, however, recharge wells are less complex to operate and maintain than RIBs.

Several assumptions were made during the sequential tiers of screening. While the Partnership did not select specific recharge methods for each project, they did conceptually evaluate each method to demonstrate that none of the three should be excluded from further site-specific evaluation due to cost or infeasibility. For this comparative assessment, the following assumptions were made about recharge efficiency of each method:

- For cost and benefit evaluations, recharge efficiency of wetlands was assumed to be 80 percent, but initial hydrogeologic investigation within the overlapping recharge area suggests that higher values are likely attainable.
- Recharge efficiency of RIBs was assumed to be 90 percent, but also assumed to have higher potential when sites are investigated specifically for area and permeability.
- Recharge efficiency of recharge wells is 100 percent.

4.3 Conceptual Routing to Recharge Sites

Each alternative includes a conceptual transmission route from the water source to the target recharge area using state and federal highway rights-of-way. Routes were developed based on a desktop analysis for the sole purpose of estimating conveyance distances for the initial cost estimates used for screening. For cost comparisons, representative locations within the target recharge area (Figure 4.2) were selected to establish transmission distances.

5.0 Screening Processes and Results

The Partnership applied three rounds of screening to the alternatives, each progressively refined in technical detail. Throughout the process, any alternative deemed to be infeasible was removed from further consideration by the group.

5.1 Tier One Screening: Low Value or Excessive Cost

Because so many candidate source waters are long distances from the effective recharge areas, conveyance costs were used in the first round of screening to help reduce the permutations of sources and routes into the recharge area. The Partnership utilized two independent tools to estimate conveyance costs for combinations of flow volumes and distances. One tool had been previously developed by CDM Smith and employed for CCUA for conveyance planning. The other tool was a planning-level cost estimator developed by SJRWMD and used for the NFRWSP. Both tools were used to evaluate the relationship between flow rate (MGD) and the cost per MGD for various conveyance distances. Both tools clearly demonstrated a very consistent pattern. For flows less than three MGD, unit costs are very sensitive and escalate very rapidly (**Figure 5.1**) regardless of the distance traveled. Therefore, the first screening criterion for the initial list of alternatives was that available source water flow should equal or exceed three MGD. Stormwater project concepts were screened out during this phase because volumes were anticipated to be below the threshold of three MGD, availability was likely to be extremely intermittent, and because highly uncertain treatment requirements were yet to be developed. Other than stormwater, no other source candidates were removed from further consideration during this tier of screening.

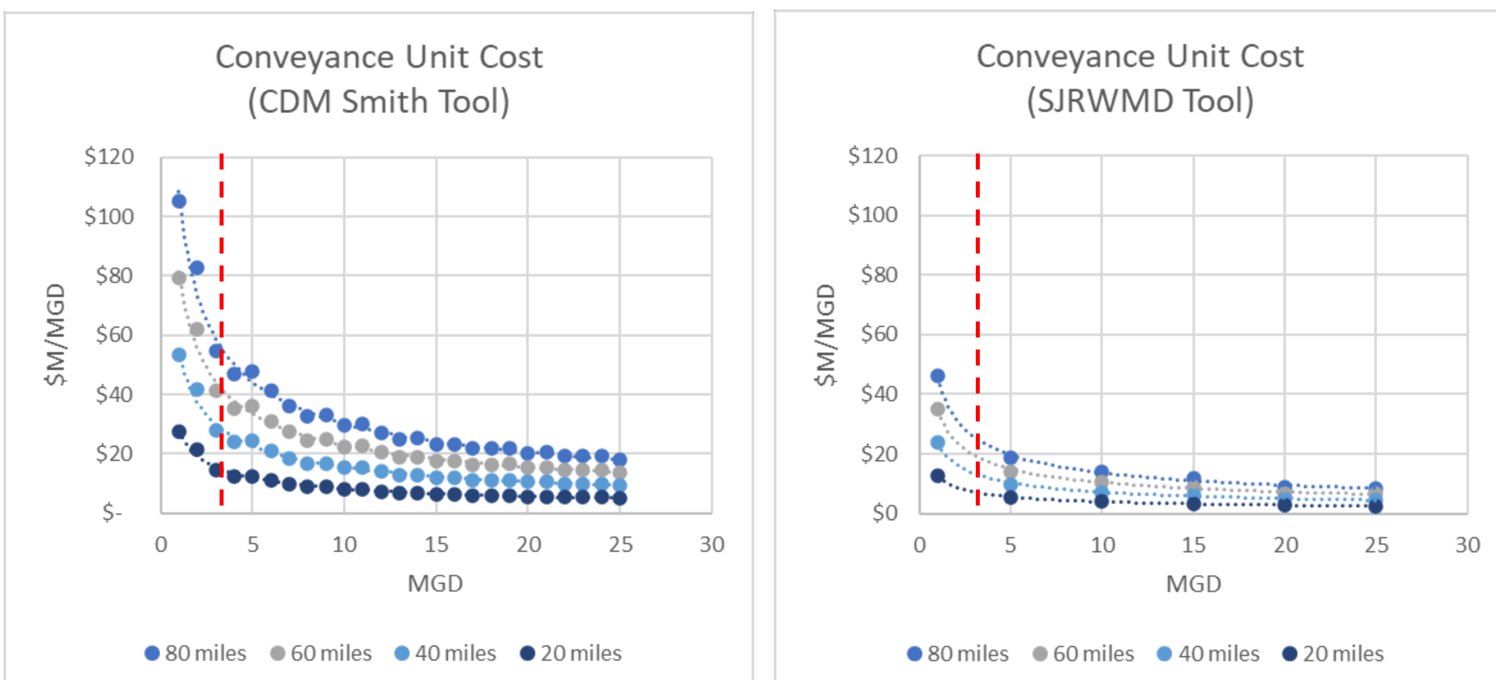
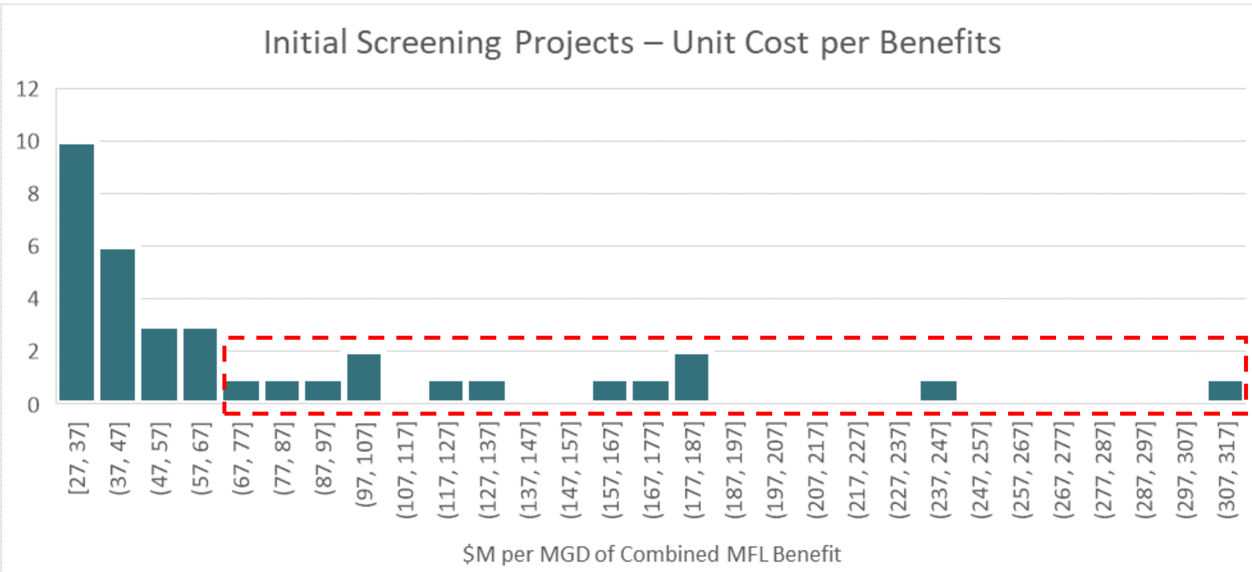


Figure 5.1 Unit Conveyance Cost Screening Factor

Next, a representative subset of the initial sources and conveyance pathways was screened for cost-effectiveness based on conveyance cost per MGD of combined MFL benefit, using estimated MFL benefits from the target recharge area. **Figure 5.2** is a histogram showing nearly two-thirds of the evaluated alternatives exhibit comparatively low unit cost per benefit, and one-third of alternatives exhibit substantially higher unit cost per benefit, including some clear outliers. Therefore, the second screening criterion for the initial list of alternatives was that unit conveyance cost per MFL benefit must be less than $80M per MGD. Any more than $80M per MGD of benefit would exceed $1 billion (B) for conveyance alone.



CDM Smith conveyance tool used for estimates. Project concepts selected are a representative subset of the full array of concepts.

Figure 5.2 Histogram of 32 Representative Alternatives Based on $M per MGD of MFL Benefit

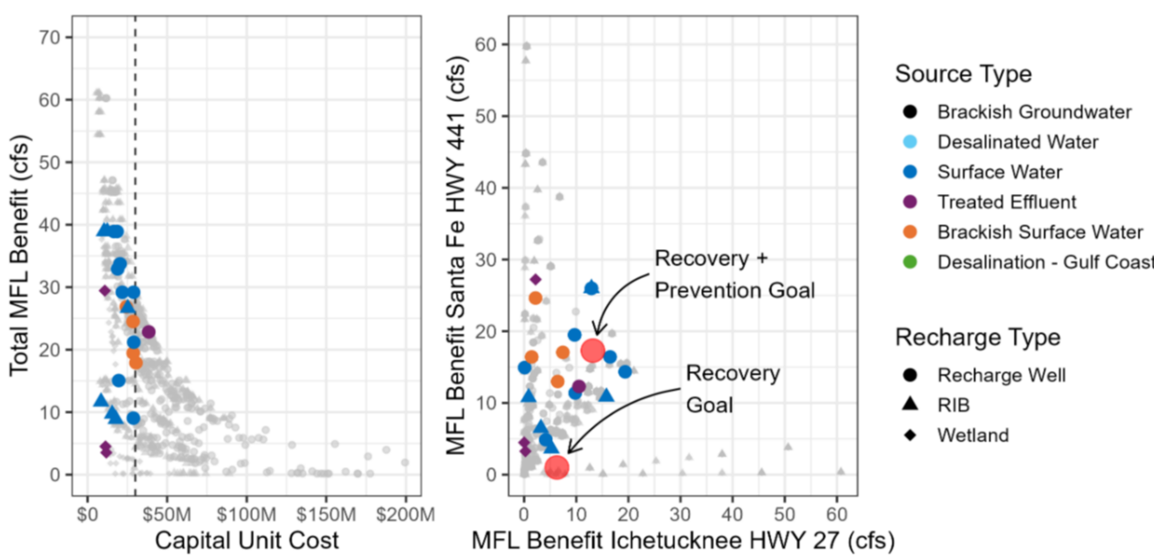
5.2 Tier Two Screening: Capital Cost and MFL Benefit

The goal of the second tier of screening was to identify a short list of alternatives that met the following criteria:

- Demonstrable cost-effectiveness with more defined capital cost estimates.
- Comparatively high MFL benefit to one or both MFL sites.
- Ability as a collective to fully address both MFLs.
- Breadth as a collective to retain multiple source types and locations.

This second tier of screening required cost estimates for most aspects of each project, including supply development for natural waters, treatment, conveyance, and recharge. For consistency and comprehensiveness, the Partnership utilized the SJRWMD cost estimation spreadsheet (SJRWMD "Updated Cost Equation for April 2024.xlsx") to the extent possible. For per- and polyfluoroalkyl substances (PFAS) treatment and various nitrogen reduction treatment processes, CDM Smith used generalized cost curves extrapolated from work with JEA and other clients. For the construction of wetlands, actual realized costs from GRU were used and scaled according to flow needs. Denitrification filter costs were developed based on previous project cost estimates escalated to 2024 dollars. Low-pressure reverse osmosis plus ultraviolet advanced oxidation process (RO+UV-AOP) costs were based on CDM Smith and JEA pilot study work.

The remaining alternatives were evaluated for cost-effectiveness based on MFL benefit unit cost ($M/cfs), considering capital costs only. Rather than selecting the most cost-effective projects by rank, the Partnership members used cost-effectiveness as a guide to develop a well-rounded and flexible list of promising alternatives. While recharge methods are not selected in this phase of work, representative methods were associated with various alternatives to provide cost ranges and demonstrate that all three methods are conceptually viable in this framework. The initial list of alternatives in this tier exhibited a relatively consistent value of $20M to $30M per cfs of MFL benefit; as shown in **Figure 5.3**, and while this was not used as a strict threshold, it was useful guidance for comparative purposes. Also notable in Figure 5.3 is that many of these promising projects offer benefits to both MFL sites, and toward both recovery and prevention targets.



Gray projects were not selected. Recharge method only used for cost estimation purposes and well-rounded alternatives.

Figure 5.3 High Value Projects

This initial list of projects with high favorability based on the relationship between total capital cost estimates and potential MFL benefits was further refined through facilitated discussions with the Partnership, resulting in a list of ten alternatives listed in **Table 5.1**. This list was based on the Partnership's desire to retain diversity in the source water options by including more breadth in the categories of source water, as well as surface water sources in both districts. Additionally, although the comparative value was low in both Tier 1 and Tier 2 relative to other alternatives, ocean desalination from both coasts was carried forward in the short list to fully understand the comparative value in the more comprehensive Tier 3 assessment. These alternatives were evaluated within a comprehensive framework of quantitative and qualitative factors in Tier 3.

Table 5.1 Candidate Projects from Tier 2 Screening

Source	Volume (MGD)	Estimated Capital Cost ($M)[1]	Estimated MFL Benefit Ichetucknee (cfs)	Estimated MFL Benefit Santa Fe (cfs)
Reclaimed Water from Buckman & Southwest WRFs	40	830	14	17
Reclaimed Water from GRU	3	90	0.9	1.1
Suwannee Bell	20 Target (8.6 Avg)	390	3.3[2]	4.0[2]
Suwannee Branford	20 Target (8.9 Avg)	340	3.4[2]	4.1[2]
Upper Suwannee	10[3]	260	3.9	4.6
NF Black Creek	5.2 Target (4.2 Avg)	210	1.6[2]	2.0[2]
Northside Power Desal	20	560	7.7	9.3
Gulf Coast Desal	40	2,800	15	19
Coquina Coast Desal	40	3,000	15	19
Desal Replacement Pumping (JEA, SJCUD, CCUA, and GRU) - Coquina Coast	182	12,000	4.7	21

1. Ranges of costs were evaluated based on uncertainties in source water quality, treatment needs, and recharge locations and methods. Presented in this table are the final values of the high range of costs (developed in subsequent Tier 3 analysis).
2. Estimated MFL benefits are based on annual average flows rather than target instantaneous flows
3. Upper Suwannee water availability was determined to be too low to provide consistent and reliable value. They were not assessed further.

5.3 Tier Three Screening

The Partnership compared multiple factors for each short-list alternative and made a consensus-based decision about which concepts to recommend for more detailed and site-specific feasibility assessment (see **Section 6.0**). The Tier 3 evaluation included both quantitative factors, such as cost and MFL benefits, as well as an array of qualitative factors pertaining to implementation feasibility and additional benefits to the region. The alternatives were not ranked or scored against each other; instead, each was evaluated for its own merits using a consistent scorecard approach. Alternatives were evaluated both as individual projects and a collective of ideas that could provide opportunities for portfolios to address both recovery targets and prevention targets for the two MFLs.

5.3.1 Additional Technical Analysis

Three additional technical assessments were performed to refine understanding of the recharge potential, limitations, and treatment needs of the short-listed alternatives:

- Hydrogeology of each candidate recharge site was evaluated to refine estimates of recharge efficiency based on soil properties.
- Intermittency of water availability from surface water bodies was estimated using ecologically based flow targets, precedents from prior projects, and regulatory guidelines.
- Source water quality was examined to better provide a range of potential treatment needs and potential costs based on conservative and optimistic interpretations of regulatory guidelines.

5.3.1.1 Hydrogeology of Recharge Sites

The Partnership conducted an evaluation of the soil characteristics in the target recharge area to better understand permeability within the predominantly semi-confined region. The assessment revealed that much of the area is more characteristic of confined aquifers than unconfined, though there are select areas in which high permeability would allow RIBs or wetlands to be effective recharge means. Additional site-specific analysis will be needed during further phases of work, but these findings highlight two important considerations:

- Much of the beneficial recharge area is likely to be characterized by confined aquifers and soils with low permeability, suitable for recharge wells but not necessarily RIBs or wetlands.
- There are select areas within the target recharge area that exhibit the likelihood of high permeability, and which may therefore be amenable to RIBs or wetlands.

5.3.1.2 Surface Water Reliability

To effectively address low flows during dry periods, source waters must be available when the Santa Fe and Ichetucknee Rivers are in need. For reclaimed water, the source water is almost always available at a constant rate, resulting in a near continuously available flow. Surface water diversion, on the other hand, is dependent on natural variability in river flows, regulatory flow requirements, and climatic conditions for the availability of water, making them a less reliable source. One surface water project in each district from the short list was examined for “reliability,” or frequency of availability for withdrawal. The Partnership evaluated intermittent flow availability to calculate an annual average volume of water that could be considered available for potential recharge. More detailed investigations will be needed, but this analysis helped the Partnership understand some of the vulnerabilities of surface water sources.

The North Fork Black Creek source was evaluated in the SJRWMD, and the Lower Suwannee at Branford Source was evaluated in the SRWMD. Different regulatory standards and precedents were applied based on recent examples and discussions with district staff. Because of potential trends in flows, only the past 30 years of gauge flow were used in the analysis.

Lower Suwannee at Branford: Flow availability for this alternative was based on three ecological flow targets on the Suwannee River:

- Critical flow at Branford, to support the sturgeon population, is 3,190 cfs.
- Critical flow at the Wilcox gauge, to provide low salinities to support submerged aquatic vegetation is 6,600 cfs from May to October
- Critical flow at the Wilcox gauge, to support manatee access at the mouth, is 7,600 cfs November to April.

Analysis over the 30-year period of record revealed that a target withdrawal of up to 20 MGD could be available up to 45 percent of the time, resulting in an annual average withdrawal of approximately nine MGD. Results are shown in **Figure 5.4**. It is important to note that there are periods of up to 365 days in which flow criteria are not met, and no source water would be available for the two MFL sites.

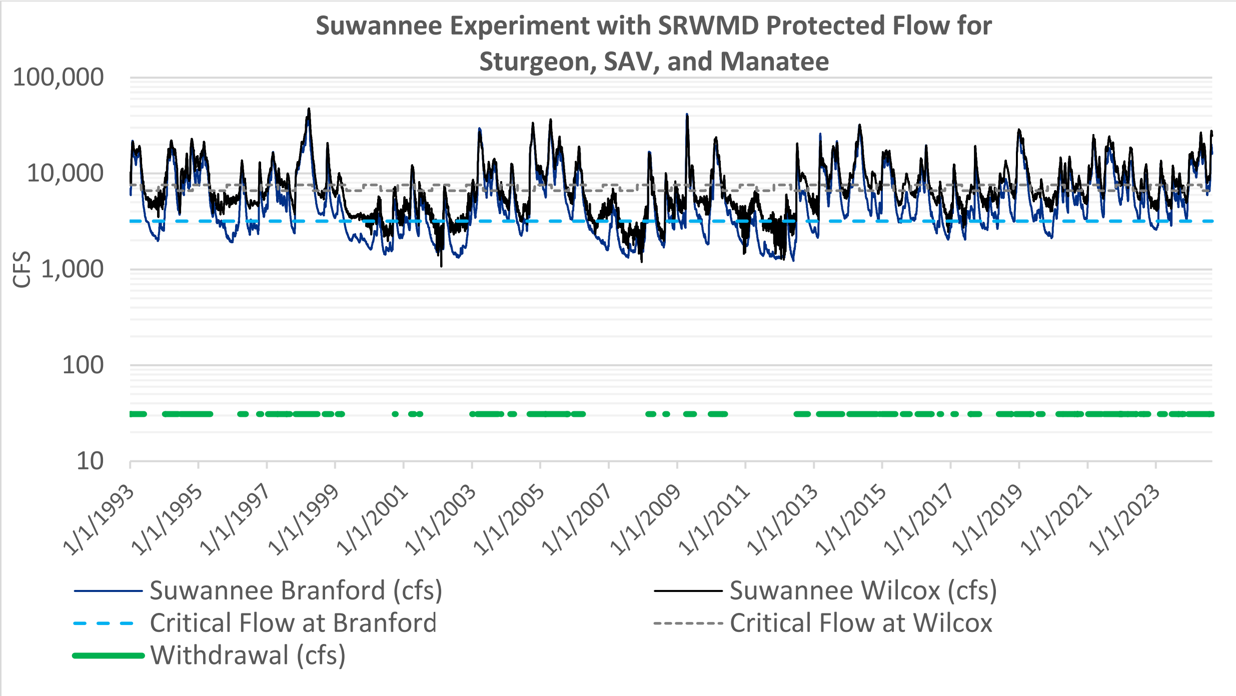


Figure 5.4 Flow Availability from Lower Suwannee at Branford

North Fork Black Creek: Flow availability for this alternative was based on the precedent established on the south fork of Black Creek for similar withdrawals intended for groundwater recharge to restore other MFLs. Within the south fork, a low flow threshold was established based on preserving a 15th percentile flow (flow with 85 percent exceedance frequency) in the river. Based on the 30-year period of record, this equates to 26 cfs. **Figure 5.5** depicts the historic flows in the north fork of Black Creek and the 15th percentile flow threshold. The analysis indicated that a target withdrawal of 5.2 MGD would be available approximately 80 percent of the time, resulting in a long-term average of 4.2 MGD.

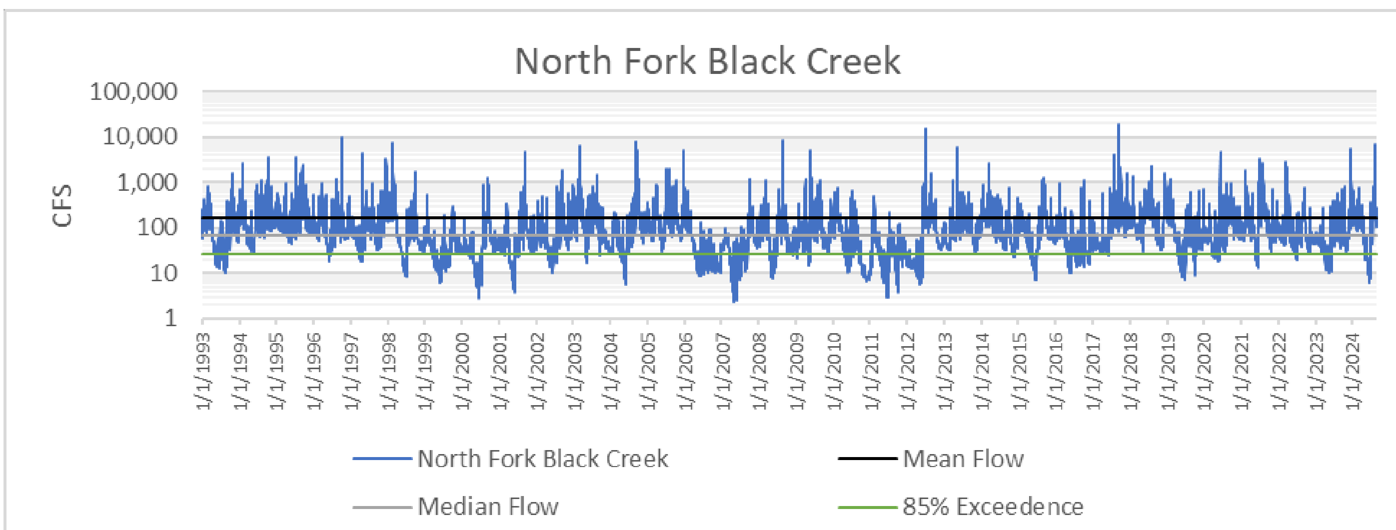


Figure 5.5 Flow Availability from North Fork Black Creek

5.3.1.3 Treatment Requirements

Source water quality will vary for many of the sources, and the regulations that govern recharge using these source waters are still in development. For these reasons, treatment process requirements and associated cost estimates were developed as a range for each of the ten short-listed alternatives, based on conservative and optimistic outlooks on treatment needs and anticipated regulations.

Three governing concerns defined the levels of treatment necessary for selected source waters:

- Water that is injected via recharge wells directly into the USDW will need to meet drinking water standards.
- Because all recharge areas are in the Suwannee River BMAP or Suwannee River BMAP area, total nitrogen will need to be reduced to at least 3.0 mg/L before leaving the recharge site. BMAP requirements should be reviewed in detail. Meeting the target treatment concentration of 3.0 mg/l may not be sufficient. Some BMAPs do not allow addition of any nitrogen in the BMAP area, and it could become necessary to remove an amount of nitrogen equal to the amount added by the recharge activities. This will be determined through further study beyond this phase.
- An additional consideration is treatment of PFAS. At minimum, source waters will be treated for PFAS if levels are above the recently promulgated U.S. Environmental Protection Agency standards. Future levels of PFAS in source waters are unknown. As more PFAS-bearing products are removed from the marketplace, the presence of PFAS in reclaimed water may also decrease. PFAS removal is considered a variable in the range of required treatment and associated costs.

Table 5.2 summarizes the ranges of assumptions for high-cost and low-cost treatment requirements based on uncertainties in source water quality and future regulatory standards. The methods and cost assumptions are outlined further in **Table 5.3**.

Table 5.2 Treatment Process Assumptions for Best Case and Worst Case Scenarios

Source Category	Recharge Type	Cost Bracket	Surface Water Treatment	Reverse Osmosis Treatment				Total Nitrogen Reduction	
				Brackish Water	Desalination	PFAS Removal	RO+ UV-AOP	Wetlands	Denitrification Filters
Brackish Desalinated Water	Well Injection	High		●					
	Well Injection	Low		●					
Ocean Desalinated Water	Well Injection	High			●				
	Well Injection	Low			●				
Surface Water	RIB	High	●			●			●
	RIB	Low	●						
Surface Water	Well Injection	High	●			●			●
	Well Injection	Low	●						
Reclaimed Water	Wetland	High				●		●	●
	Wetland	Low						●	
Reclaimed Water	Well Injection	High					●		
	Well Injection	Low					●		
Reclaimed Water	RIB	High				●		●	●
	RIB	Low						●	

Table 5.3 Treatment Method Details

Treatment Process	General Process Description	Cost Basis
Conventional Surface Water Treatment	Standard drinking water treatment without PFAS: Includes Equalization tank, high-rate flocculation and clarification, deep bed filter, chemical feed, and residuals handling	SJRWMD Cost Estimator
Brackish Water Treatment	Traditional reverse osmosis for brackish water – would likely also remove PFAS	SJRWMD Cost Estimator
Reverse Osmosis for Desalination	Reverse osmosis using semi-permeable membranes to remove salts and impurities. This process is capable of meeting drinking water standards	SJRWMD Cost Estimator and estimates from recent participant experience
Reverse Osmosis for PFAS Removal	Reverse osmosis or nanofiltration using coarser membranes than those used for desalination	CDM Smith Estimates
Natural Wetland Filtration	Denitrification via natural wetlands processes	GRU Realized Costs
Denitrification Filters	Traditional deep-bed, down-flow media filter to reduce particulates and remove total nitrogen.	Previous Project Cost Estimates Escalated to 2024 dollars
Low-Pressure Reverse Osmosis plus Ultraviolet Advanced Oxidation Process (RO + UV-AOP)	Low-pressure reverse osmosis membranes remove nutrients and contaminants, such as PFAS. Ultraviolet light and an oxidant are used to break down additional harmful chemicals and provide disinfection. These processes are capable of meeting drinking water standards.	CDM Smith / JEA Pilot Work

5.3.2 Scorecard Evaluation

The final tier of screening evaluated the ten short-listed alternatives with a series of predetermined criteria from earlier workshops. This included refinement of cost and benefits from earlier phases, and evaluation of more subjective characteristics of each alternative. The alternatives were not ranked but compared for individual and collective merits toward the goal of achieving overall recovery and prevention goals. The Partnership members recognized that ultimately, the most effective strategy may be one large project, or a phased portfolio of several projects.

Table 5.4 describes the criteria that were developed and employed by the Partnership to compare and contrast the short-listed alternatives to identify a suite of projects recommended for further feasibility assessments, either on individual merits or on their potential value in tandem with another project on the final recommended list.

Table 5.4 Scorecard Criteria (*Interpretation of Scorecard Columns*)

<table>
<tr><td rowspan="7">PROJECT DEFINITIONS</td><td colspan="2">Source</td><td colspan="3">Origination of water supply</td></tr>
<tr><td colspan="2">Volume (MGD)</td><td colspan="3">Average annual available water for recharge</td></tr>
<tr><td colspan="2">MFL Benefits</td><td colspan="3">Expected CFS at the Ichetucknee and Santa Fe Gages</td></tr>
<tr><td rowspan="4">Total Cost</td><td>Capital Cost High ($M)</td><td colspan="3" rowspan="2">Costs associated with most aggressive treatment
(given uncertainty in regulatory environment)</td></tr>
<tr><td>O&M Cost High ($M/yr)</td></tr>
<tr><td>Capital Cost Low ($M)</td><td colspan="3" rowspan="2">Costs associated with most optimistic treatment
(given uncertainty in regulatory environment)</td></tr>
<tr><td>O&M Cost Low ($M/yr)</td></tr>
<tr><td rowspan="4">QUALITATIVE FACTORS</td><td colspan="2">Ancillary Benefits:
- SB-64
- WQ/BMAP
- Recreation
- Ecosystem Restoration</td><td>SB-64, WQ, +</td><td>SB-64 or WQ</td><td>No Ancillary Benefits Identified</td></tr>
<tr><td colspan="2">Implementation Ease:
- Permitting Complexity
-Political/Public Opinion
- Land Acquisition
- Conveyance Obstacles</td><td>Low to Moderate in all categories</td><td>Moderate in most categories</td><td>Moderate to High in all categories (known obstacles or significant unknowns)</td></tr>
<tr><td colspan="2">Project Development Time</td><td>Up to 10 Years</td><td>10–20 Years</td><td>20+ Years</td></tr>
<tr><td colspan="2">Operational Flexibility:
- Governance
- Level of Monitoring
- Level of Training</td><td>Low to Moderate in all categories</td><td>Moderate in most (acceptable risk)</td><td>Moderate to High in all (known obstacles or significant unknowns)</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Source Water Reliability</td><td>90%–100%</td><td>80%–90%</td><td>< 80%</td></tr>
<tr><td colspan="2">Potential for Regional Benefit as estimated at the Ellaville gage on the Suwannee River (cfs)</td><td>> 1.0 cfs</td><td>0.5-1.0 cfs</td><td>< 0.5 cfs</td></tr>
</table>

The full scorecard for the Tier 3 projects is provided in **Figure 5.6**. Recommendations from the scorecard analysis are presented in **Section 6.0**.

North Florida Regional Water Supply Plan

ALTERNATIVES SCORECARD

NOTE: This information is not used for ranking. The alternatives are not listed in any preferred sequence.

Ancillary Benefits	Implementation Ease	Alternative Development Time	Operational Complexity	Source Water Reliability	Potential For Regional Benefits (CFS)
SB-64, WQ, +	Low-Mod in all	Up to 10 Years	Low-Mod in all	90-100%	> 1 cfs
SB-64 or WQ	Mod in most	10-20 Years	Moderate in most (acceptable risk)	80-90%	0.5 - 1 cfs
No Goals	"Mod-High in all (Known obstacles or significant unknowns)"	20+ Years	"Mod-High in all (Known obstacles or significant unknowns)"	< 80%	< 0.5 cfs

DEFINITIONS OF ALTERNATIVES					PRINCIPAL QUANTITATIVE FACTORS				QUALITATIVE FACTORS			OTHER QUANTITATIVE FACTORS			
					Recovery + Prevention Target; Recovery Target; Alternative Performance Estimate		TOTAL COST (Source Development, Treatment, Conveyance, Recharge)								
ID#	Source	Volume (MGD)	MFL Benefit Ichetucknee (CFS)	MFL Benefit Sante Fe (CFS)	MFL Benefit Ichetucknee (CFS)	MFL Benefit Sante Fe (CFS)	Capital Cost Low-High	O&M Cost Low-High Annual	Ancillary Benefits	Implementation Ease	Alternative Development Time	Operational Complexity	Source Water Reliability	Potential For Regional Benefits (CFS)	Other Considerations
1	Buckman + Southwest	40	14	17			$690M – $830M	$6M – $16M	• SB 64 • Recreation • Ecosystem restoration • Water quality improvement	• Permitting (H) • Public/political (L) • Land acquisition (H) • Conveyance (H)	10-20 Years	• Governance (H) • Monitoring (H) • Training (M)	100%	1.2	Treatment wetland option is based on JEA Peterson Tract (1200 acres). Due to the large volume of water, multiple recharge sites and methods my be required. Treatment method would be highly dependent on recharge method.
2	GRU WWTF Transfer	3	0.9	1.1			$60M – $90M	$0M – $3M	• Recreation • Ecosystem restoration • Water quality improvement	• Permitting (M) • Public/political (L) • Land acquisition (M) • Conveyance (M)	Up to 10 Years	• Governance (M) • Monitoring (M) • Training (L)	100%	0.1	Locations exist within the target recharge area that have more favorable influence on the MFL sites, and because the volume is low, there shoud be many available sites.
3	Suwannee River – Suwannee Bell	8.6 Avg (20 Max)	3.3	4.0			$290M – $390M	$5M – $11M	None	• Permitting (H) • Public/political (H) • Land acquisition (M) • Conveyance (L)	10-20 Years	• Governance (M) • Monitoring (H) • Training (M)	Able to withdraw **40%** of time while meeting ecological flow needs	0.3	Reflects maintenance of instream flows to protect sturgeon and manatee populations. More detailed hydrologic and ecological evaluation will be required.
4	Suwannee River – Suwannee Branford	8.9 Avg (20 Max)	3.4	4.1			$250M – $340M	$5M – $11M	None	• Permitting (H) • Public/political (H) • Land acquisition (M) • Conveyance (L)	10-20 Years	• Governance (M) • Monitoring (H) • Training (M)	Able to withdraw **45%** of time while meeting ecological flow needs	0.3	
5	Suwannee River – Upper Suwannee	10	3.9	4.6			$180M – $260M	$3M – $7M	None	• Permitting (H) • Public/political (H) • Land acquisition (H) • Conveyance (L)	10-20 Years	• Governance (M) • Monitoring (H) • Training (M)	Flow values too low to offer consistent and reliable value - not analyzed further.	0.5	Upper Suwannee withdrawls could have substantial impacts on flow rregimes even above low flows. For this reason, Upper Suwannee alternatives were not considered further.
6	NF Black Creek	4.2 Avg (5.2 Max)	1.6	2.0			$170M – $210M	$2M – $5M	None	• Permitting (M) • Public/political (M) • Land acquisition (L) • Conveyance (M)	10-20 Years	• Governance (M) • Monitoring (H) • Training (H)	Able to withdraw **80%** of time while meeting ecological flow needs	0.2	
7	Northside Power Desal	20	7.7	9.3			$560M	$14M	• SB 64	• Permitting (L) • Public/political (L) • Land acquisition (L) • Conveyance (H)	20+ Years	• Governance (H) • Monitoring (H) • Training (H)	50%	1.0	The future of this source water is uncertain and may not be available as a viable consistent source water under future conditions.
8	Gulf Coast Desal	40	15	19			$1,400M – $2,800M	$61M	None	• Permitting (H) • Public/political (M) • Land acquisition (L) • Conveyance (L)	20+ Years	• Governance (M) • Monitoring (M) • Training (H)	100%	2.0	
9	Coquina Coast Desal	40	15	19			$1,500M – $3,000M	$61M	None	• Permitting (H) • Public/political (M) • Land acquisition (L) • Conveyance (H)	20+ Years	• Governance (M) • Monitoring (M) • Training (H)	100%	2.0	
10	Desal Replacement Pumping (JEA, SJCUD, CCUA, and GRU) - Coquina Coast	181.9	4.7	21			$3,800M – $12,000M	$250M	None	• Permitting (H) • Public/political (M) • Land acquisition (L) • Conveyance (H)	20+ Years	• Governance (H) • Monitoring (H) • Training (H)	100%	Would require modeling of no pumping at all four utilities and impact at Ellaville.	

Note: MFL benefits for line 1 assume a 90% recharge efficiency for RIBs. MFL benefits for line 2 assume an 80% recharge efficiency for recharge wetlands. MFL benefits for lines 3-10 assume a 100% recharge efficiency for recharge wells.

6.0 Recommendations

6.1 Recommended Projects for further Feasibility Assessment

Through facilitated deliberation, the Partnership recommended that the alternatives in **Table 6.1** and **Figure 6.1** be carried forward for detailed feasibility assessment, including site-specific recharge potential, permitting, definitive treatment needs and methods, etc. Detailed project fact sheets are provided for each recommended project at the end of this section.

For comparative purposes, **Table 6.2** demonstrates the comparative value of the ocean desalination projects that were carried forward to this stage. Summary observations follow both tables.

Table 6.1 Alternatives Recommended for Further Study

Source	Volume (MGD)	Ichetucknee Benefit (cfs)[2]	Santa Fe Benefit (cfs)[2]	Capital Cost Estimate ($M)	Full MFL Goals?
JEA Reclaimed Water from Buckman and Southwest WRFs	40	14	17	830	Yes[1]
GRU Reclaimed Water	3	0.9	1.1	90	No
North Fork Black Creek	4.2 avg	1.6	2.0	210	No
Lower Suwannee/ Branford	8.9 avg	3.4	4.1	340	No

1. Full MFL goals could be met based on current modeling and careful selection/design of recharge sites and methods.
2. MFL benefits for JEA Reclaimed Water from Buckman and Southwest WRFs assume a 90% recharge efficiency for RIBs. MFL benefits for GRU Reclaimed Water assume an 80% recharge efficiency for recharge wetlands. MFL benefits for the remaining alternatives assume a 100% recharge efficiency for recharge wells.

Table 6.2 Comparative Results for Ocean Desalination Alternatives

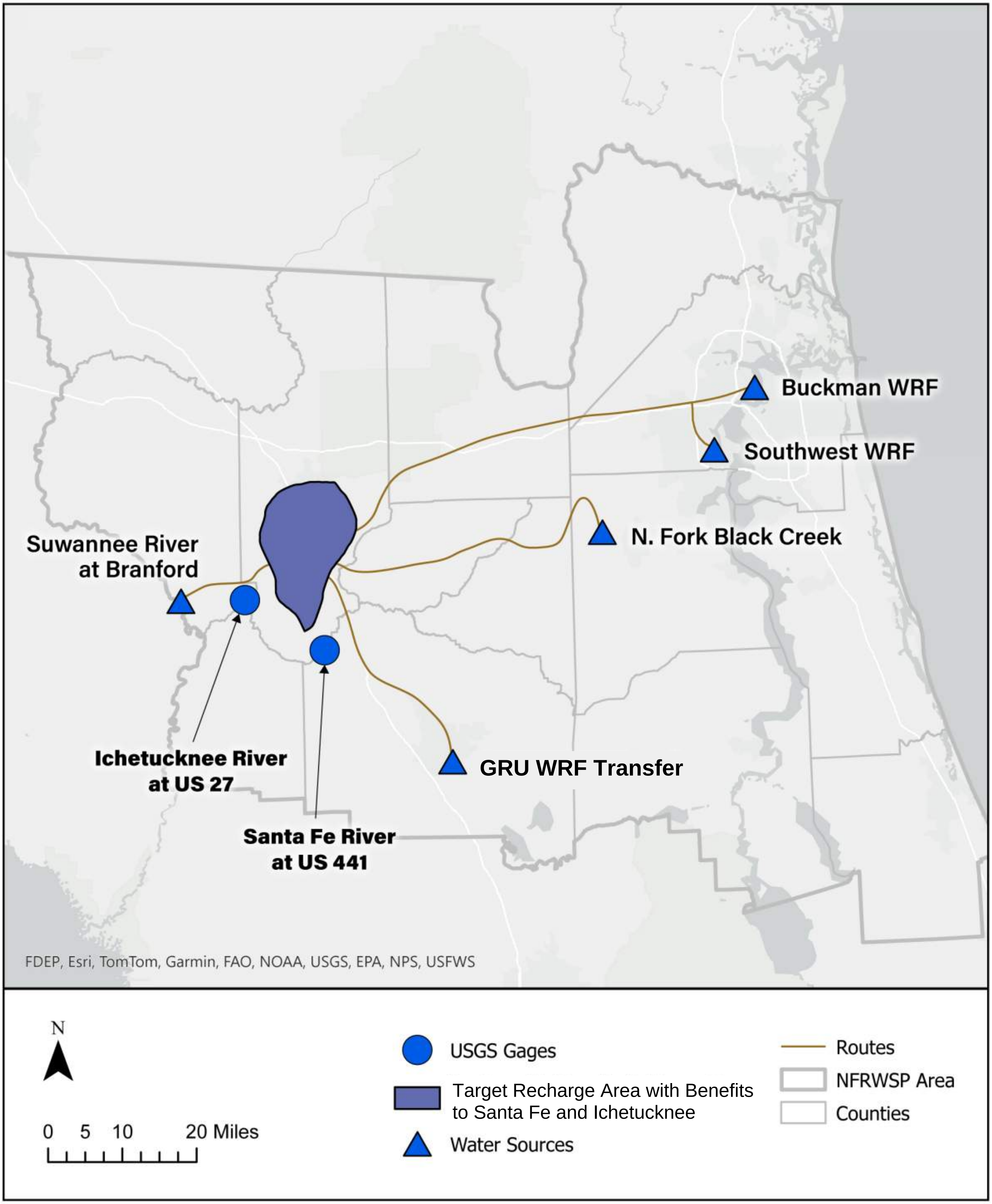
Source	Volume (MGD)	Ichetucknee Benefit (cfs)[3]	Santa Fe Benefit (cfs)[3]	Capital Cost Estimate ($M)	Full MFL Goals?
Desalination -Coquina[1]	40	15	19	2,800	Yes[2]
Desalination – Gulf Coast[1]	40	15	19	3,000	Yes[2]
Pumping Replacement[1]	182	4.7	20.6	12,000	No

1. Desalination alternatives are shown for comparative purposes, but not recommended for further study at this time.
2. Full MFL goals could be met based on current modeling and careful selection/design of recharge sites and methods.
3. MFL benefits for ocean desalination projects assume a 100% recharge efficiency for recharge wells.

6.2 Descriptions and Summary Assessments of Projects Recommended for Further Study

6.2.1 Description of Final Alternatives

- **JEA Reclaimed Water**: This alternative includes reclaimed water from JEA Buckman (25 MGD) and Southwest (15 MGD) water reclamation facilities totaling 40 MGD. The alternative concept is based on operation of a treatment wetland upstream of the recharge location. At 40 MGD, this alternative could address the full LSFIR MFL needs if recharged in a strategic location or distributed over multiple locations. The project would also assist JEA meet Senate Bill 64 (SB-64, 2021) non-beneficial surface water discharge elimination requirements.



This diagram illustrates schematic connectivity of sources to the overlapping area of effective recharge, though further study may suggest that recharge sites outside this area are more favorable for other reasons.

Figure 6.1 Four Alternatives Recommended for Further Study

- **GRU Reclaimed Water**: Up to approximately three MGD of reclaimed water flow for aquifer recharge could be obtained by shifting flow between GRU water reclamation facilities. GRU is located closer to the effective recharge area than JEA resulting in lower transmission costs. However, the alternative offers smaller recharge benefit due to less water availability. This alternative may be beneficial in concert with the JEA alternative and/or other alternatives, and it could offer near-term benefits to the region.
- **North Fork Black Creek**: Surface water would periodically be withdrawn from the north fork of Black Creek and beneficially recharged. Preliminary analysis suggests that withdrawal of 5.2 MGD could potentially be available approximately 80 percent of the time while meeting ecological flow needs. More detailed hydrological analysis would be required to ensure source water availability. Guidance from the ongoing project on the south fork Black Creek may be beneficial with permitting and scheduling.
- **Lower Suwannee River**: Surface water would periodically be withdrawn downstream of the Branford Gage and beneficially recharged. Preliminary analysis suggests that withdrawal of 20 MGD could potentially be available approximately 45 percent of the time while meeting ecological flow needs. More detailed analysis would be required to ensure compliance with Suwannee River MFLs and no other adverse environmental impacts.

6.2.2 Observations and Discussion

- **Desalination (for comparative reference- not recommended for further study):** Several desalination alternatives were considered in the evaluation. Desalination at Coquina would desalinate ocean water from the east coast in the Jacksonville area and pump it to the conceptual recharge area. Desalination at the Gulf Coast would desalinate water from a location on the west coast and pump it to the recharge area. The Pumping Replacement alternative would desalinate saltwater from the Jacksonville area and replace groundwater as a water supply for all four participating utilities. The desalination alternatives are not recommended for further evaluation because of: 1) High capital and operation and maintenance cost, partly due to the treatment process itself, and partly due to the high cost of brine disposal, 2) Managing brine disposal incurs significant technical and regulatory challenges, 3) Replacement of all four participating utility groundwater pumping with desalinated seawater would not meet the full MFL requirements, and 4) Ocean desalination does not address the requirements of Senate Bill 64 to put reclaimed water to beneficial use.
- **Full MFL Compliance with JEA Reclaimed Water**: The concept of JEA's reclaimed water from both Buckman and Southwest WRFs yields the potential to fully satisfy both MFL recovery and prevention targets with careful selection and possible distribution of recharge sites. It is far more cost-effective than the ocean desalination projects of similar scale. This alternative would involve lengthy development time and numerous regulatory, logistical, and operational hurdles, but it could be strategically phased over time. It may need supplemental projects to meet near-term recovery targets.
- **Compliance with Senate Bill 64:** The inclusion of reclaimed water from the JEA facilities in the recharge strategy helps to address the Senate Bill 64, which requires "certain domestic

wastewater utilities to submit to the Department of Environmental Protection by a specified date a plan for eliminating nonbeneficial surface water discharge within a specified timeframe."

- **Phasing and Near-Term Benefits:** Combined into strategic portfolios, some of the recommended alternatives offer the potential for implementation to address recovery targets within 20 years of the effective date of the rule while longer-term projects are further developed to address prevention targets.
- **Geographic Diversity:** Collectively, the recommended projects include potential water sources from both water management districts, and to the north, south, east, and west of the MFL water bodies.
- **Surface Water Evaluation Needs:** The surface water alternatives (North Fork Black Creek and Lower Suwannee) could be considered as supplemental projects but would not be viable as a primary mechanism to meet the MFLs. These alternatives would need to be evaluated in more detail to develop operational guidelines to protect the ecology and water quality of the source water body. Furthermore, water from these sources, particularly the Lower Suwannee, would likely not be available during the most critical dry periods. The balance between recharge location, aquifer storage capacity, residence time, and influence on the MFL flows would require detailed analysis to evaluate long-term effectiveness through drier periods.

6.3 Next Steps

Through the comprehensive and collaborative process documented in this report, four alternatives have been identified for further study. The development of these alternatives is a complex undertaking involving technical, financial, environmental, hydrologic and governance issues, among others. Therefore, to provide for a path forward in the development of these alternatives, several actions are recommended for future work efforts as follows:

Technical feasibility studies of selected alternatives

Technical feasibility studies should include the following key considerations:

- Water quality requirements and potential treatment technologies,
- Intake, transmission and pumping requirements, including potential routes for future consideration,
- Source availability, which includes both reclaimed water sources and natural sources,
- Recharge technology requirements to encompass the potential for RIBs, treatment wetlands or recharge wells,
- Modular, phased, spatially distributed, or hybrid project designs to maximize flexibility and cost efficiency, and
- Potential project design, permitting and construction schedules that would allow for the MFLs to be met as soon as feasible and within 20 years.

Comprehensive evaluation of potential recharge sites

Evaluation of recharge sites should include the following actions:

- Conduct a hydrogeological evaluation considering potential recharge rates, travel times to springs, and potential for impacts such as sinkholes. Estimate residence times in the Upper Floridan aquifer for alternatives with less than continuous availability of water at the source.
- Conduct hydrogeological studies to identify optimal recharge sites throughout the delineated recharge vicinity, and to refine estimates of recharge efficiency and limitations for RIBs and wetland recharge approaches.
- Identify land area requirements for various recharge technologies considering hydrogeologic conditions and recharge flow rates.
- Confirm that benefits to the MFL, currently calculated using the NFSEG model and averaged over effective recharge areas for this study, are accurate and appropriate.
- Estimate the potential benefits of recharge on the proposed Upper and Middle Suwannee River MFLs.
- Determine necessary parcel size(s) for recharge projects from three to 40 MGD using recharge wells, RIBs, and wetlands, with the understanding that these may vary based on soil permeability.
- Consider current and historic land uses, land ownership, and potential acquisition costs.
- Identify restricted areas within the delineated area based on ownership, land use or designation, hydrogeologic connectivity, or other factors.

Environmental and permitting considerations

Evaluate the existing and proposed regulatory requirements associated with each water source, recharge location, and recharge technology, including:

- FDEP requirements for reclaimed water recharge, including aquifer water quality, BMAPs, nutrients, and potential emerging contaminants.
- Regulations and guidelines applicable to withdrawals from natural water bodies to prevent harm to the river or otherwise impact MFLs.
- Confirm that the recharge does not create other issues, such as flooding.

Refinement of potential project costs

Perform additional refinement of cost estimates for each alternative, including:

- Pipeline and pump system concepts, pipeline routes, peaking needs, advanced treatment options, recharge site development, land acquisition, permitting, outreach, etc.
- Consider modular, phased, spatially distributed, or hybrid designs to maximize flexibility and cost efficiency.

Initiate discussions regarding governance options and cooperative agreements

The identified alternatives cross multiple geographic and jurisdictional boundaries. The construction and long-term operation could require interagency agreements for both governance and cost-sharing.

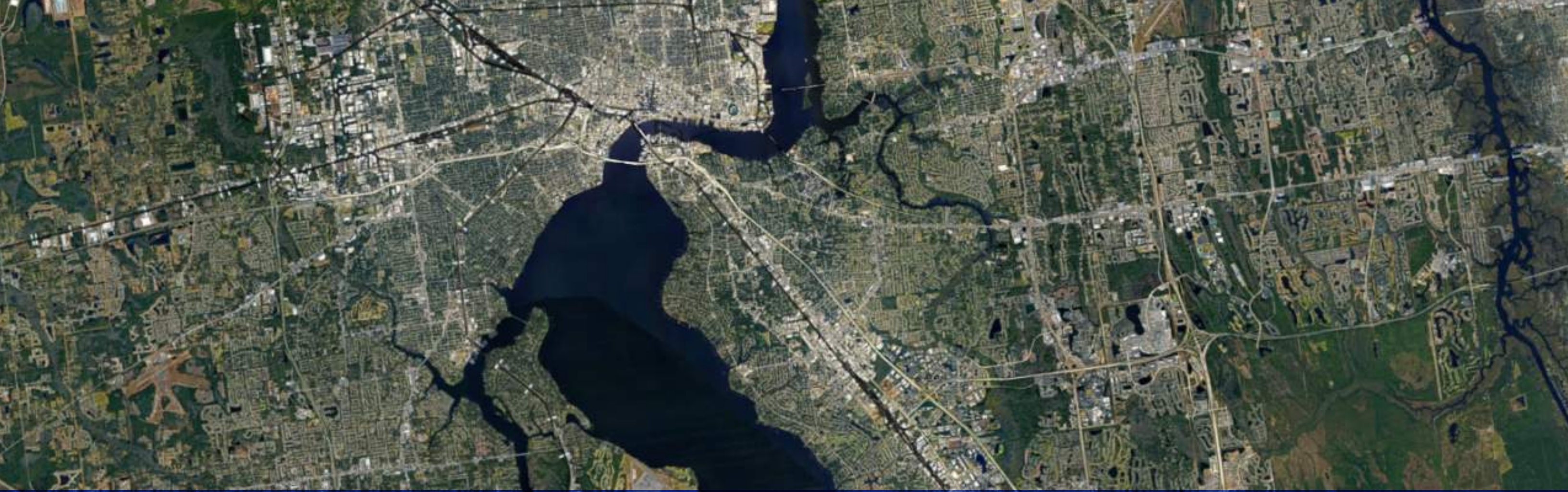
- Develop governance frameworks for multi-jurisdictional project implementation and operations.
- Determine how credits for MFL benefits will be assigned.
- Plan for long-term funding of O&M and replacement and renewal costs. Consider potential governance frameworks for multi-jurisdictional project implementation and operations, including regulatory considerations, ownership options, and agreements needed for project development.
- Determine how the project benefits will be apportioned in a fair and equitable manner and that provides regulatory confidence in consideration of the significant costs identified.
- Evaluate flexible options for project operations once constructed.

Identify and pursue options for project funding

Identify funding for both feasibility studies and implementation of alternative components.

6.4 Project Fact Sheets

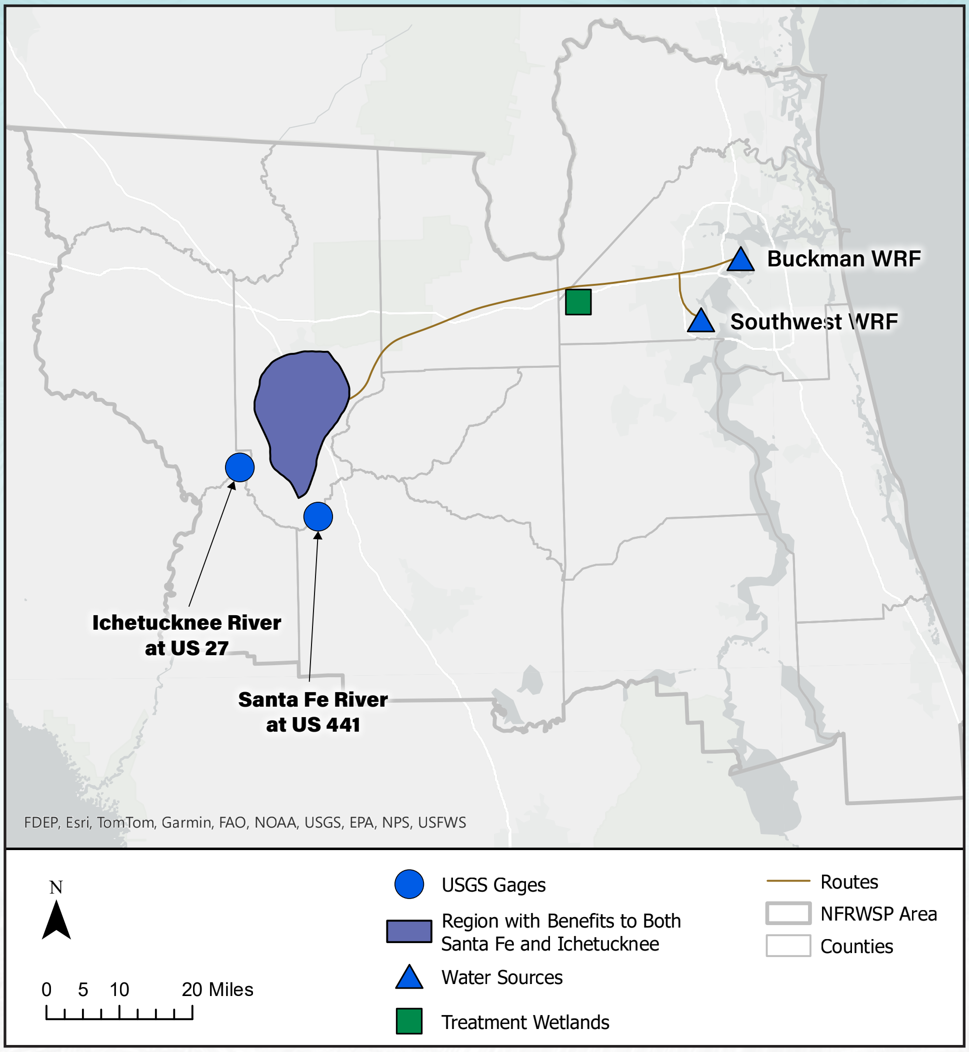
This section provides detailed fact sheets for each alternative recommended for further feasibility assessment.



JEA BUCKMAN AND SOUTHWEST WRF RECLAIMED WATER

Project Description

This project includes reclaimed water from the Buckman Water Reclamation Facility (WRF) (25 MGD) and Southwest WRF (15 MGD) to a common treatment wetland located on a JEA-owned property near the western edge of Duval County. Following wetland treatment to address nutrients (TN and TP), the reclaimed water will be pumped overland to a recharge location closer to the MFLs. Recharge options for this project range from rapid infiltration basins (RIBs) to direct injection using recharge wells.



SOURCE WATER
Buckman WRF (25 MGD) + Southwest WRF (15 MGD)

TREATMENT METHOD(S)
Upper Range – Purification

Lower Range – Treatment Wetlands

RECHARGE METHOD(S)
RIBs and Recharge Wells

Facilities Description

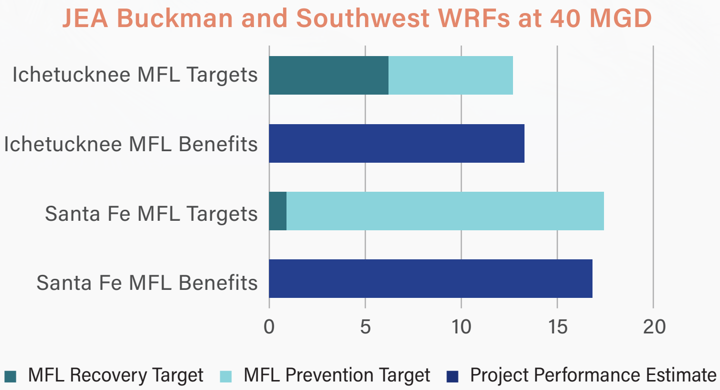
The following facilities have been identified as part of this project:

- For the higher range treatment scenario, purification facilities would be required to treat reclaimed water to drinking water standards. For the lower range treatment scenario, only pumping facilities will be provided at the WRFs to transport reclaimed water to the next stage of the process.
- Provide transmission mains from the Buckman and Southwest WRFs to the north side of the JEA-owned Peterson tract. Booster pump stations would be provided as necessary to convey flow the 25 miles from Buckman WRF to the Peterson tract and 20 miles from Southwest WRF to the Peterson tract.
- Provide a flow through treatment wetland on the Peterson tract. The terminal end of the wetland will be provided with a reservoir and pumping facility to transmit the reclaimed water to the next stage of the process.
- Provide transmission mains and booster pump stations as necessary to convey flow approximately 40 miles from the Peterson tract to selected recharge locations.
- Depending on selected recharge location geotechnical characteristics and land availability, RIBs, recharge wells, or a combination of both would be used to introduce reclaimed water to recharge the aquifer.

Project Benefits to the LSFIR MFLS

The benefits calculated for this project are based on representative NFSEG influence factors for the Ichetucknee and Santa Fe River gages within the target recharge area. A recharge efficiency of 90% was assumed for this project based on use of RIBs.

The graph below demonstrates the project's ability to address MFLs at the Santa Fe River US Highway 441 gage near High Springs and the Ichetucknee River gage near Highway 27 in Hildreth.



	Ichetucknee River US Highway 27	Santa Fe River US Highway 441
Influence Factors	0.25	0.30
Recovery Target (cfs)	6.3	1.0
Prevention Target (cfs)	13.2	17.3
MFL Benefit Provided (cfs)	14	17

Notes:
Careful selection of recharge site(s) and methods could result in satisfaction of full MFL targets based on current WMD modeling.

Ancillary Benefits

- This project will assist JEA in meeting the intent of Florida SB64 to beneficially use reclaimed water.
- Utilization of the treatment wetland to lower nutrient concentrations prior to discharge addresses concerns for impaired water bodies near the discharge location. The Santa Fe River has an adopted Basin Management Action Plan (BMAP) for total nitrogen and dissolved oxygen, therefore the addition of high-quality water to the aquifer and ultimately Ichetucknee Springs and Santa Fe River will improve water quality for the impaired water body.
- The construction of treatment wetlands on the Peterson Tract could provide the opportunity for co-location of recreational benefits and/or environmental enhancements that could be utilized by the surrounding residents and native flora and fauna.

Potential for Regional Benefits

In recognition that there are additional MFLs under development in the same geographic area as the Ichetucknee and Santa Fe, the project was evaluated for potential to positively impact surrounding water bodies. Implementation of the project resulted in an average increase of approximately 1.2 cfs at the Suwannee River Ellaville gage.

Source Water Reliability

Source water for this project is categorized as fully reliable with minimal seasonal variations.

Planning Level Project Cost Estimating

Transmission Costs: The SJRWMD costing tool for rural pipeline projects was used to estimate the transmission costs for water from the WRF to the treatment wetland and from the treatment wetlands to a representative recharge location within the target recharge area. Total distance estimated for costing is 85 miles and utilizes public rights-of-way. The transmission cost estimate includes pipeline costs but does not include transmission pump stations. Pipeline costs are the dominant factor in calculating transmission costs.

Treatment Costs: The selected treatment method is highly dependent on the recharge method selected, which in turn is dependent upon specific site geology and the area of land available. Two treatment scenarios were costed to provide a range of treatment costs. The upper range scenario is based on the use of recharge wells, which would require treatment to drinking water standards using reverse osmosis (RO) with ultraviolet advanced oxidation procedures (UV-AOP). Alternatively, the lower range scenario is based on the use of RIBs and could allow for treatment using natural system wetlands. The upper range treatment costs are based on CDM Smith's reverse osmosis cost curves. The lower range treatment costs are based on natural wetland removal of TN only. Costs for this option are based on wetland information provided by the SJRWMD costing tool.

Recharge Costs: This project provides the flexibility to recharge through multiple methods. For costing, two recharge scenarios were costed. The upper range scenario is based on the use of recharge wells. The lower range scenario is based on the use of RIBs. The SJRWMD costing tool was used to develop costs for both RIBs and recharge wells.

The tables below provide estimated capital and O&M costs for the two scenarios. No land acquisition costs are included in the above cost estimates.

Option	Transmission Cost ($M)	Treatment Costs ($M)	Recharge Costs ($M)	Total Capital Costs ($M)	O&M Costs ($M)	Annualized Cost ($M/yr)
Upper Range (Recharge Well)	340	430	60	830	16	57
Lower Range (Treatment Wetland)	340	165	185	690	6	41

Notes:
1. These are high level planning costs, developed by noted references and citations at the back of this fact sheet and do not include potential costs for potential unknows related to Environmental Remediation, Real Estate, Permitting, Engineering.
2. O&M costs represent both variable O&M costs like electricity and process chemicals as well as fixed O&M costs incurred each year.
3. Annualized costs are based on capital costs annualized over a 30-year project life plus annual O&M costs.

Project Schedule

October 2024 - October 2027	July 2025 - July 2026	January 2026 - January 2031	January 2026 - January 2029	July 2026 - July 2029	July 2029 - January 2045
Wetland Pilot (Ongoing) Demonstration	Feasibility Study	Land Acquisition	Permitting	Design	Construction

Implementation Ease

Permitting: For both treatment scenarios, it is anticipated that pilot studies will be required to further define treatment capabilities. In the case of the treatment wetland, additional study is needed to determine wetland treatment capabilities related to nutrient reduction and PFAS removal.

Political/Public Opinion: It is anticipated that public opinion will be favorable related to establishing wetland treatment and RIB sites that could potentially enhance recreation or environmental conditions in the surrounding areas.

Land Acquisition: The use of RIBs will require significant land for implementation and requires favorable underlying geological conditions to achieve the desired recharge efficiency. The availability of land within the target recharge area may necessitate multiple recharge sites utilizing varied recharge methods.

Conveyance Obstacles: The conveyance distance for this project is more than 80 miles and will require significant coordination for several large pipelines. The urban portion of the route from the WRF to the treatment wetland includes congested urban ROWs.

Operational Complexity

Governance: This project will require multiple agencies to form a cooperative agreement to provide the resources for ongoing operation, maintenance, and monitoring of the proposed facilities. It is anticipated the JEA will provide operational oversight of treatment facilities at their WRFs and at the JEA-owned treatment wetland.

Monitoring: Ground water recharge wells will require monitoring of water quality prior to discharge (Chapter 62-610, FAC Part V). For recharge scenarios using treatment wetlands, monitoring may be required within the wetland to confirm water quality treatment meets AWT standards prior to discharge to RIBs.

Training and Operations: The lower treatment scenario relies on passive treatment processes which will require minimal operator training. The higher treatment scenario employs a number of processes that require significant operator training and staffing.

Key Assumptions

- Treatment cost lower value is based on the assumption that the wetlands would provide the required nutrient reduction and PFAS removal.
- The wetland treatment site is assumed to be owned by JEA. No land acquisition costs are included in the above cost estimates.

Key Questions to be Answered by Further Study

Treatment:

- Define treatment wetland capabilities with regard to nutrient reduction and PFAS removal based on JEA pilot wetland study results and define necessary acres of treatment wetland to achieve required performance
- Evaluate nutrient removal treatment options (denitrification filters versus ozone treatment)

Conveyance:

- Perform a route study to identify major potential conflicts

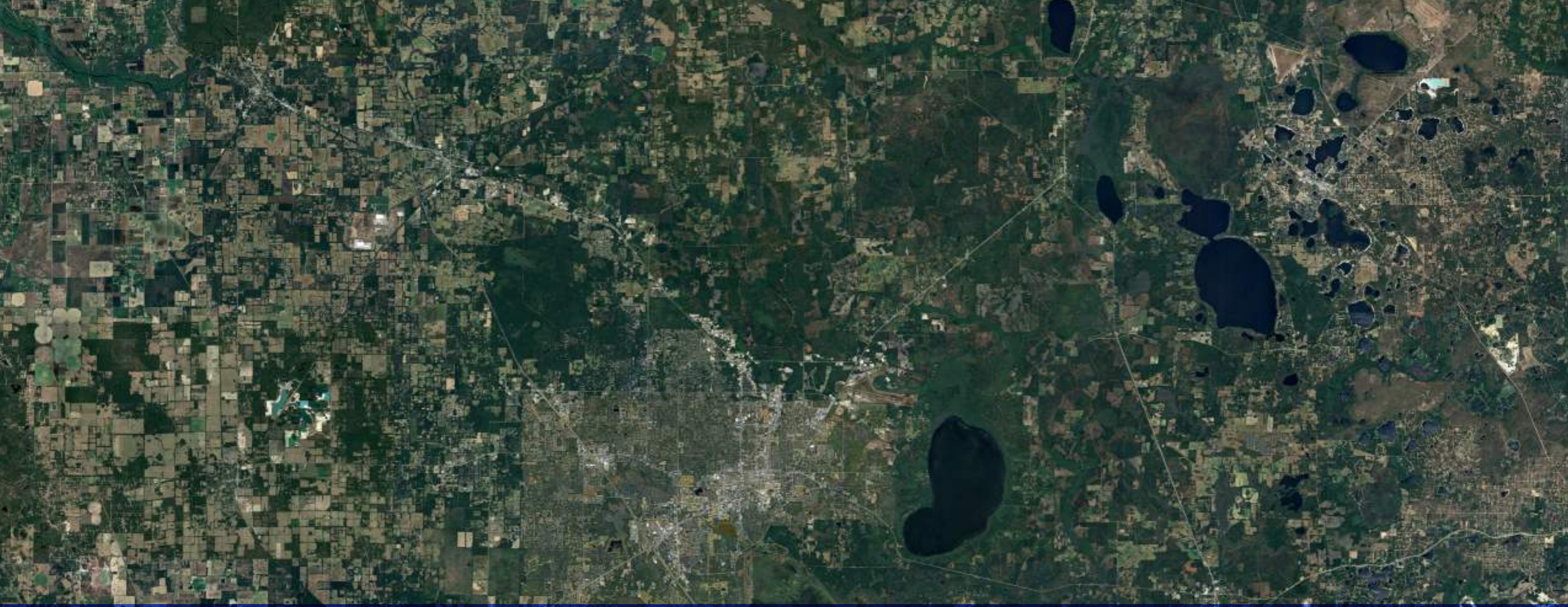
Recharge:

- Determine required acres of RIBs and recharge wells based on site specific geotechnical characteristics
- Study the distribution of 40 MGD to multiple sites given the complexity of recharging the full volume at a single location

References

Saint Johns River Water Management District (2023) "Updated Cost Equation for Apr 2023" SJRWMD. Provided April 2024.

Gainesville Regional Utilities (No Date) "GRU_SWNP_ROM_jd_21_9". Provided May 2024.



GRU WETLAND RECHARGE

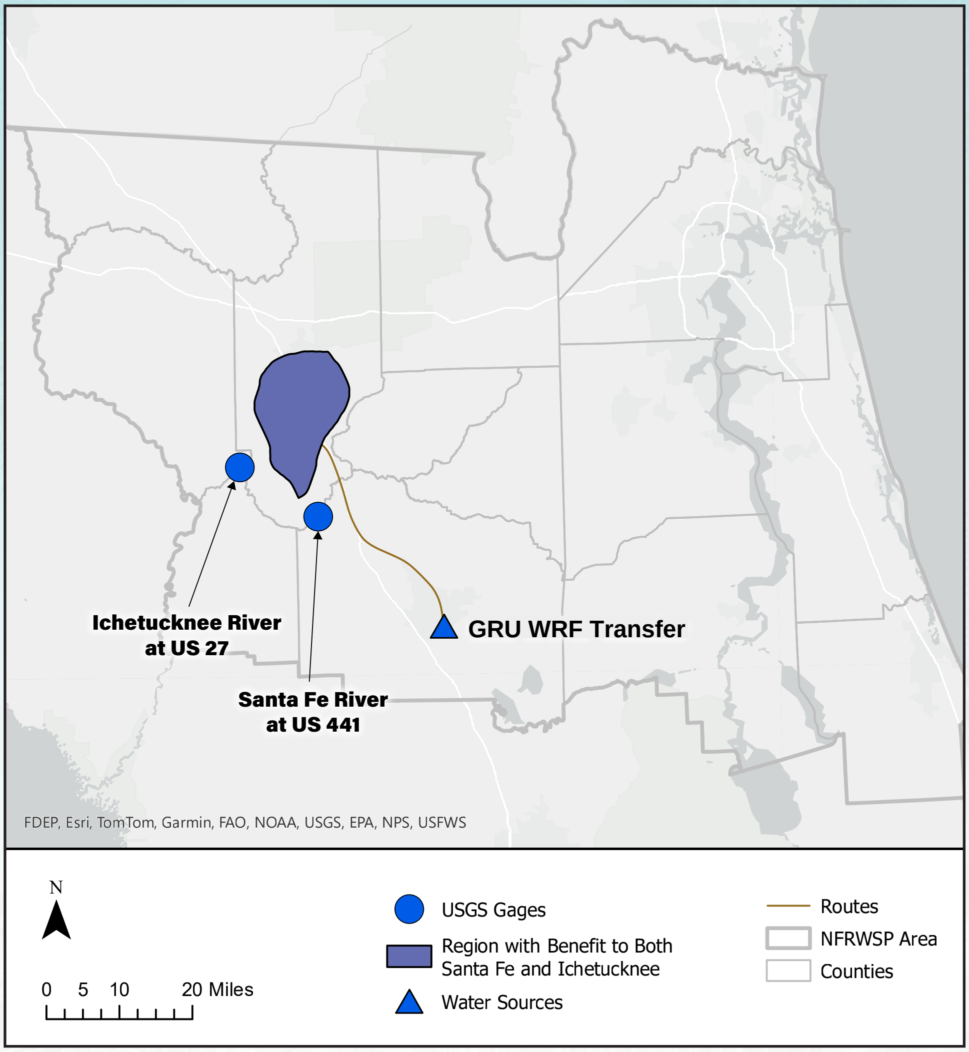
Project Description

This project includes 3 MGD of reclaimed water from the Gainesville Regional Utilities Main Street WRF or Kanapaha WRF discharged to a wetland for treatment and aquifer recharge.

SOURCE WATER
Main Street or Kanapaha WRF (3MGD)

TREATMENT METHOD
Upper Range – Treatment wetland paired with denitrification and LPRO
Lower Range – Treatment wetland

RECHARGE METHOD(S)
Wetland



Facilities Description

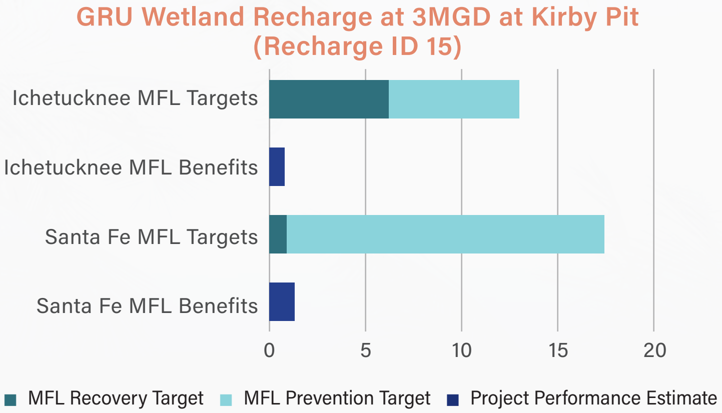
The following facilities have been identified as part of this project:

- For the higher treatment option, requiring denitrification filters and PFAS removal, treatment facilities will be located onsite at the WRF. Following treatment, on-site pumping facilities will transport reclaimed water from the WRF to the recharge site.
- For the low treatment option, only pumping facilities will be provided at the WRF to transport reclaimed water to the next stage of the process.
- Provide transmission mains from the Main Street WRF to the recharge site. Booster pump stations will be provided as necessary to convey flow to the target recharge area.
- Provide approximately 40-60 acres of flow through treatment/recharge wetland.

Project Benefits to the LSFIR MFLS

The benefits calculated for this project are based on representative NFSEG influence factors for the Ichetucknee and Santa Fe River gages within the target recharge area. A recharge efficiency of 80% was assumed for this project based on use of wetlands.

The graph below demonstrates the project's ability to address MFLs at the Santa Fe River US Highway 441 gage near High Springs and the Ichetucknee River gage near Highway 27 in Hildreth.



	Ichetucknee River US Highway 27	Santa Fe River US Highway 441
Influence Factors	0.25	0.30
Recovery Target (cfs)	6.3	1.0
Prevention Target (cfs)	13.2	17.3
MFL Benefit Provided (cfs)	0.9	1.1

Ancillary Benefits

- Utilization of either the denitrification filters or the recharge wetland to lower nutrient concentrations prior to discharge addresses concerns for impaired water bodies near the discharge location. The Santa Fe River has an adopted Basin Management Action Plan (BMAP) which sets a 3 mg/l total nitrogen limit for wastewater discharges within the BMAP area. The addition of high-quality water to the aquifer will improve water quality for the impaired water body.
- The wetland recharge site will provide wildlife habitat and can be configured as a public park which will provide recreational and economic benefits from tourism to the region. The GRU Sweetwater Wetlands Park is an example of a similar facility which has resulted in habitat for species such as the endangered Cape Sable Seaside Sparrow and Snail Kite as well as providing more than 3.5 miles of recreational trails.
- With a relatively short implementation timeline, this project could provide an opportunity to demonstrate progress toward meeting recovery targets within 10 years.

Potential for Regional Benefits

In recognition that there are additional MFLs under development in the same geographic area as the Ichetucknee and Santa Fe, the project was evaluated for potential to positively impact surrounding water bodies. Implementation of the project resulted in an average increase of approximately 0.1 cfs at the Suwannee River Ellaville gage.

Source Water Reliability

Source water for this project is categorized as fully reliable with minimal seasonal variations.

Project Costs

Transmission Costs: The SJRWMD costing tool for rural pipeline projects was used to estimate the transmission costs for water from the Main Street WRF to a representative recharge site within the target recharge area. Total distance estimated for costing is 25-30 miles and utilizes public rights-of-way. The transmission cost estimate includes pipeline costs, but does not include transmission pump stations. Pipeline costs are the dominant factor in calculating transmission costs.

Treatment Costs: Based on uncertainty around regulatory acceptance of treatment wetlands to meet nutrient removal requirements as well as PFAS removal requirements, two treatment scenarios were costed to provide a range of treatment costs. The upper range scenario is based on denitrification filters for a portion of the flow coupled with low pressure reverse osmosis for PFAS removal. PFAS removal costs were based on low pressure RO with deep well injection of the concentrate. Costs for denitrification options are based on utilizing quotes from equipment vendors and comparison against costs for similar projects within the last 3 years. Costs for treatment capacity and raw wastewater transfer upgrades are not included in this screening level estimate but will need to be evaluated in future more detailed analyses. The treatment cost lower range scenario is based on natural wetland removal of TN. Cost for this alternative is included in the recharge cost since the same wetland is providing both functions.

Recharge Costs: Treatment wetland costs were developed using the SJRWMD costing tool and refined based on GRU's Sweetwater Wetland construction and O&M experience. No land acquisition costs were included in this estimate.

The tables below provide estimated capital and O&M costs for the two scenarios. No land acquisition costs are included in the above cost estimates.

Option	Transmission Cost ($M)	Treatment Costs ($M)	Recharge Costs ($M)	Total Capital Costs ($M)	O&M Costs ($M)	Annualized Cost ($M/yr)
Upper Range (LPRO and denitrification)	50	30	10	90	3	7
Lower Range (Treatment Wetland)	50	0	10	60	0.3	3

Notes:
1. These are high level planning costs, developed by noted references and citations at the back of this fact sheet and do not include potential costs for potential unknows related to Environmental Remediation, Real Estate, Permitting, Engineering.
2. O&M costs represent both variable O&M costs like electricity and process chemicals as well as fixed O&M costs incurred each year.
3. Annualized costs are based on capital costs annualized over a 30-year project life plus annual O&M costs.

Project Schedule

July 2025 - July 2026	January 2026 - January 2029	July 2026 - July 2031	January 2027 - January 2030	January 2030 - January 2045
Feasibilty Study	Permitting	Land Acquisition	Design	Construction

Implementation Ease

Permitting: No pilot studies are anticipated for this project based on the successful implementation of similar projects by GRU.

Political/Public Opinion: It is anticipated that public opinion will be favorable related to establishing wetland recharge sites that could potentially enhance recreation or environmental conditions in the surrounding areas. However, the project will divert flow that would otherwise be going to Sweetwater Wetlands Park. Therefore, the effects of the project on Sweetwater Wetlands and Paynes Prairie will need to be evaluated to ensure that there is no negative ecological impact.

Land Acquisition: The project is anticipated to require 50-60 acres that have favorable underlying geological conditions to achieve the desired recharge efficiency.

Conveyance Obstacles: Few or no conveyance obstacles were identified for this project. Most transmission is through non-congested public rights-of-way.

Operational Complexity

Governance: This project will require multiple agencies to form a cooperative agreement to provide the resources for ongoing operation, maintenance, and monitoring of the proposed facilities. It is anticipated the GRU will maintain operations over treatment facilities located at the WRF, while the SRWMD will lead operations at the recharge wetland.

Monitoring: Monitoring will likely be required within the wetland to confirm water quality treatment meets AWT standards prior to discharge to the environment.

Training and Operations: If the lower treatment scenario is implemented, most of the treatment processes are passive and will require minimal operator training. If the higher treatment scenario is implemented, the addition of LPRO will require additional operator training.

Key Assumptions

- Since the geology of the area does not accommodate deep well injection, additional evaluation of PFAS removal alternatives and byproduct disposal will be required in future analyses.
- Costs for treatment capacity and raw wastewater transfer upgrades are not included in this screening level estimate but will need to be evaluated in future analyses.

Key Questions to be Answered by Further Study

Treatment:

- Identify and develop costs for required raw wastewater transmission and treatment plant capacity upgrades.
- Define treatment wetland capabilities with regard to nutrient reduction and PFAS removal to determine treatment needs.
- Identify viable treatment methodology for PFAS removal including any byproduct disposal.

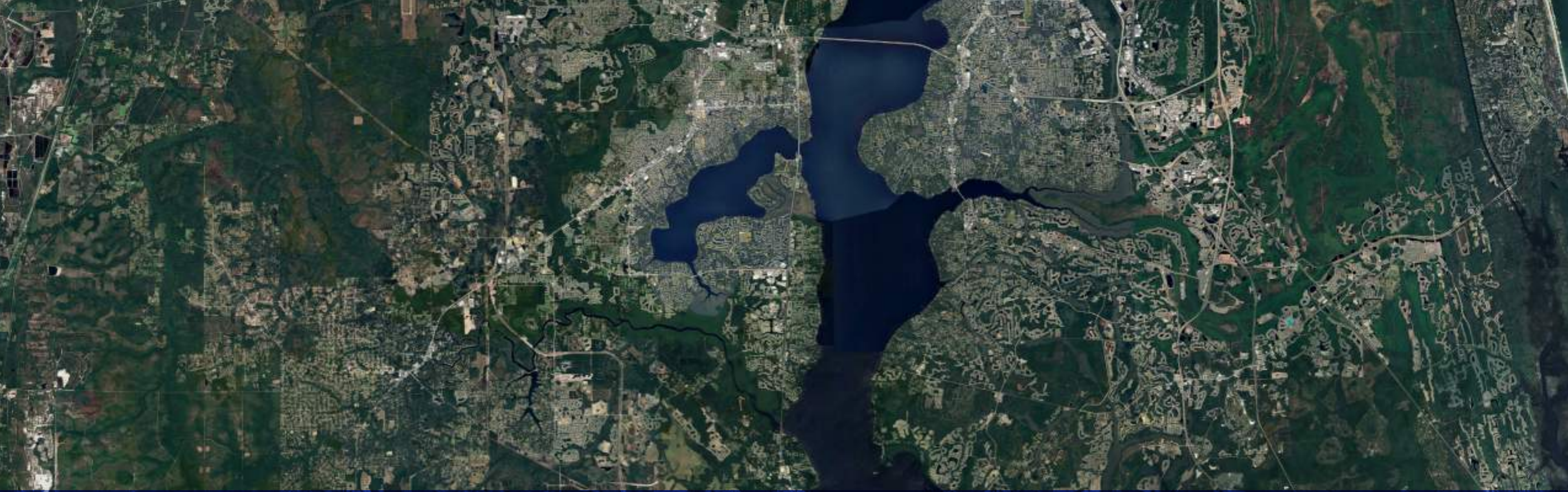
Recharge:

- Identify likely locations for construction of recharge wetlands. Based on specific site characteristics, determine needed size of recharge wetlands.

References

Saint Johns River Water Management District (2023) "Updated Cost Equation for Apr 2023" SJRWMD. Provided April 2024.

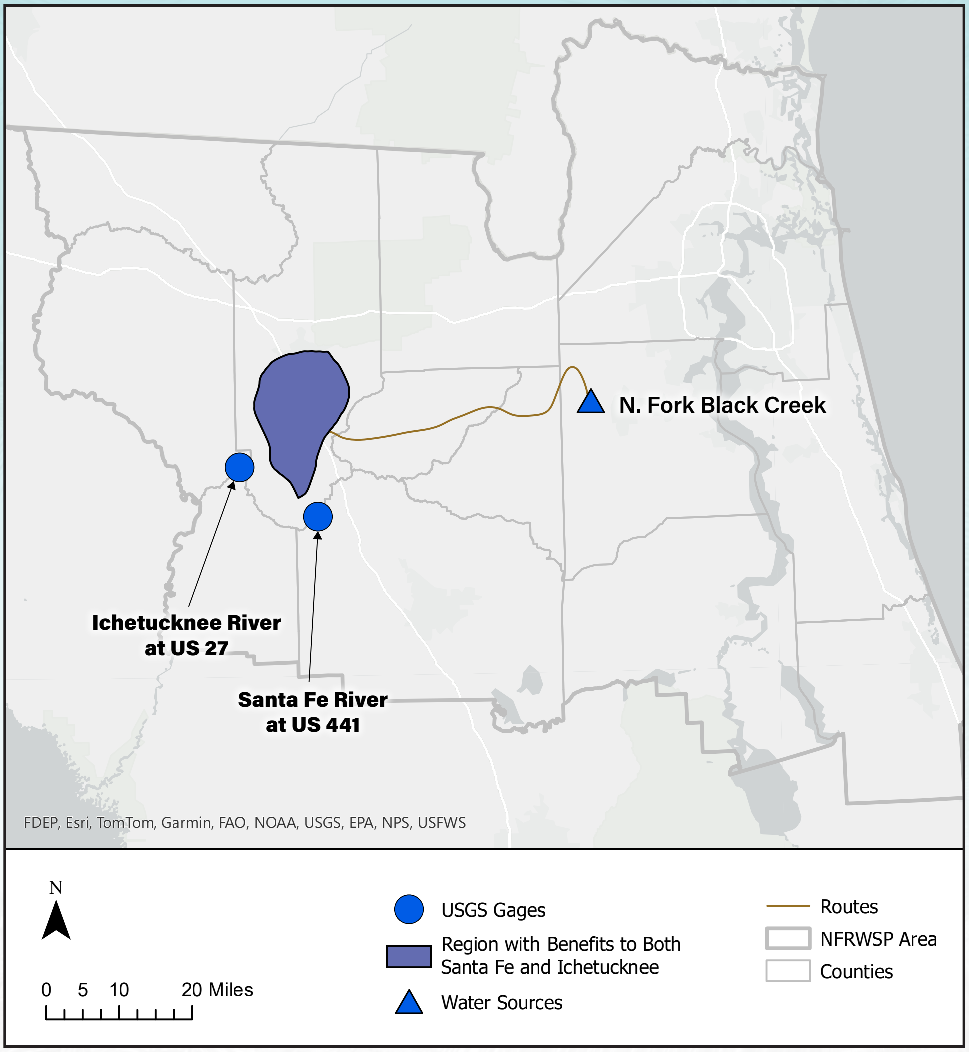
Gainesville Regional Utilities (No Date) "GRU_SWNP_ROM_jd_21_9". Provided May 2024.



NORTH FORK OF BLACK CREEK SURFACE WATER DIVERSION

Project Description

This project includes harvesting water from the north fork of Black Creek during environmentally sustainable higher flow periods and injecting the harvested water into the Upper Floridan aquifer for longer-term storage and migration to the MFL sites. Based on analysis of a 30-year period of record for Black Creek, it is anticipated that up to 5.2 MGD of water may be available during periods of high flow. The frequency of availability is discussed in detail later in this fact sheet.



SOURCE WATER
North Fork Black Creek (5.2 MGD)

TREATMENT METHOD
Upper Range - Surface water treatment paired with denitrification and LPRO
Lower Range - Surface water treatment

RECHARGE METHOD(S)
Recharge Well

Facilities Description

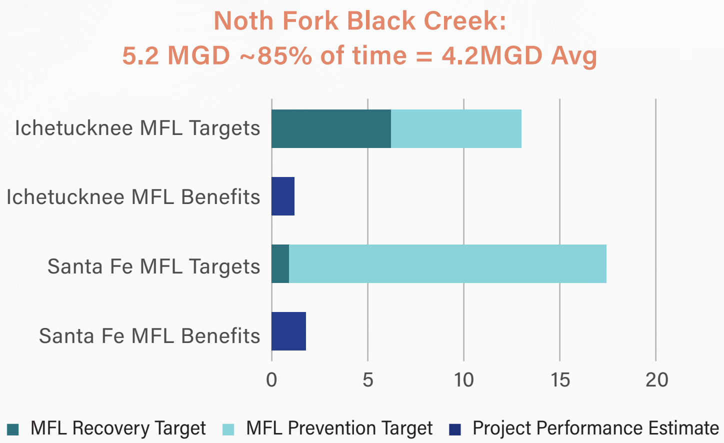
The following facilities have been identified as part of this project:

- Provide a pump station with intake structure at the North Fork of Black Creek. Treatment facilities for nutrients and PFAS could be co-located with the pump station to treat water prior to transmission.
- Provide transmission mains from the pump station at the north fork of Black Creek to target recharge area.
- Provide recharge wells at the selected recharge site.

Project Benefits to the LSFIR MFLS

The benefits calculated for this project are based on representative NFSEG influence factors for the Ichetucknee and Santa Fe River gages within the target recharge area. A recharge efficiency of 100% was assumed for this project based on using recharge wells discharging directly to the Upper Floridan Aquifer.

The graph below demonstrates the project's ability to address MFLs at the Santa Fe River US Highway 441 gage near High Springs and the Ichetucknee River gage near Highway 27 in Hildreth.



	Ichetucknee River US Highway 27	Santa Fe River US Highway 441
Influence Factors	0.25	0.30
Recovery Target (cfs)	6.3	1.0
Prevention Target (cfs)	13.2	17.3
MFL Benefit Provided (cfs)	1.6	2.0

Ancillary Benefits

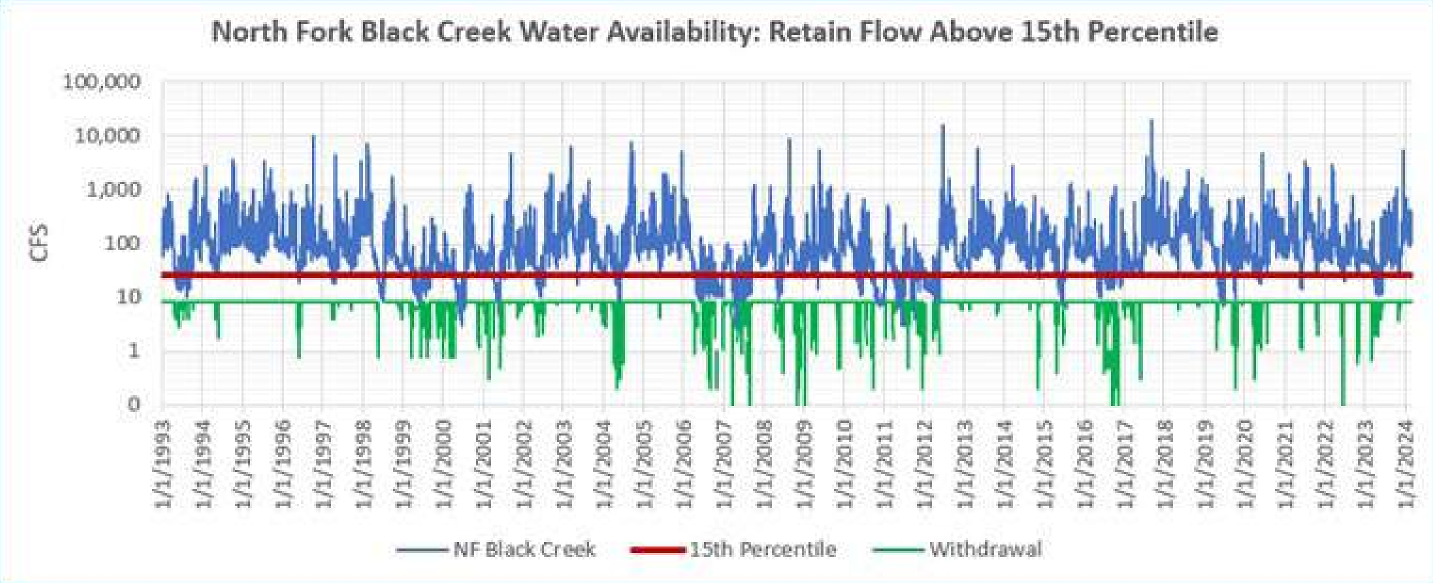
- This project could be used in conjunction with other projects to provide additional benefits at either or both MFL sites.

Potential for Regional Benefits

In recognition that there are additional MFLs under development in the same geographic area as the Ichetucknee and Santa Fe, the project was evaluated for potential to positively impact surrounding water bodies. Implementation of the project resulted in an average increase of approximately 0.21 cfs at the Suwannee River Ellaville gage.

Source Water Reliability

Unlike effluent from wastewater sources, this project is targeted at capturing a portion of the North Fork of Black Creek during periods of environmentally sustainable higher discharge. Based on withdrawal procedures established for the South Fork of Black Creek, a minimum flow threshold was established to protect base flows in the creek. A 30-year period of record for the North Fork of Black Creek is shown overlaid with the low flow criteria. Over the period of record, flows exceeded the minimum flow thresholds a total of 85% of the time. When minimum flow thresholds are met, peak discharges are sufficient to supply an average of 5.2 MGD for recharge. It is important to note that there were some extended periods in which minimum flow thresholds were not met. To function as a reliable source water for MFL recovery, this project will benefit from being paired with a more continuous water source or used in conjunction with other project efforts.



Project Costs

Transmission Costs: The SJRWMD costing tool for rural pipeline projects was used to estimate the transmission costs for water from the North Fork of Black Creek to a representative recharge location within the target recharge area. Total distance estimated for costing is 50 miles and utilizes public rights-of-way. The transmission cost estimate includes pipeline costs but does not include transmission pump stations. Pipeline costs are the dominant factor in calculating transmission costs.

Treatment Costs: Based on uncertainty around treatment requirements for PFAS and nutrients, two treatment scenarios were costed to provide a range of treatment costs. The upper range scenario is based on conventional surface water treatment, reverse osmosis for PFAS removal, and denitrification filters for nutrient reduction. Alternatively, the lower range scenario is based solely on conventional surface water treatment. Surface water treatment costs were estimated using the SJRWMD cost tool, reverse osmosis costs are based on CDM Smith cost curves, and denitrification costs are based on vendor estimates.

Recharge Costs: Costs associated with recharge wells were estimated using the SJRWMD cost tool. No land acquisition costs were included in this estimate.

The tables below provide estimated capital and O&M costs for the two scenarios. No land acquisition costs are included in the above cost estimates.

Option	Transmission Cost ($M)	Treatment Costs ($M)	Recharge Costs ($M)	Total Capital Costs ($M)	O&M Costs ($M)	Annualized Cost ($M/yr)
Upper Range (LPRO and denitrification)	100	90	20	210	5	16
Lower Range (Conventional treatment)	100	50	20	170	2	11

Notes:
1. These are high level planning costs, developed by noted references and citations at the back of this fact sheet and do not include potential costs for potential unknows related to Environmental Remediation, Real Estate, Permitting, Engineering.
2. Transmission costs includes $27M in source development costs
3. O&M costs represent both variable O&M costs like electricity and process chemicals as well as fixed O&M costs incurred each year
4. Annualized costs are based on capital costs annualized over a 30-year project life plus annual O&M costs.

Project Schedule

July 2025 - July 2026	January 2026 - January 2031	January 2026 - January 2029	July 2026 - July 2029	July 2029 - January 2045
SJRWMD Feasibilty Study	Permitting	Land Acquisition	Design	Construction

Implementation Ease

Permitting: Permitting for this project would include an intrabasin transfer and further hydrogeological and engineering analysis to ensure all environmental goals are met and that there are no adverse environmental or flooding impacts.

Political/Public Opinion: Public opinion will be favorable related to protecting flows for the creek.

Land Acquisition: This project will not require significant land acquisition.

Conveyance Obstacles: Few or no conveyance obstacles were identified for this project. Most transmission is through non-congested public rights-of-way.

Operational Complexity

Governance: This project could be executed by the SJRWMD and SRWMD, requiring a cooperative agreement between the two Districts.

Monitoring: Ground water recharge wells will require monitoring of water quality prior to discharge (Chapter 62-610, FAC Part V).

Training and Operations: Some operational training will be required to operate and maintain a large pump station and recharge wells.

Key Assumptions

- The low flow threshold for this project was established to maintain a 15th percentile flow (26.2 cfs) in the creek. This precedent was established for the South Fork of Black Creek.

Key Questions to be Answered by Further Study

Treatment:

- Refine low flow (protective flow) thresholds to better estimate availability of water defined as environmentally sustainable peak discharges.
- Determine specific treatment components for conventional surface water treatment and lead removal.

Conveyance:

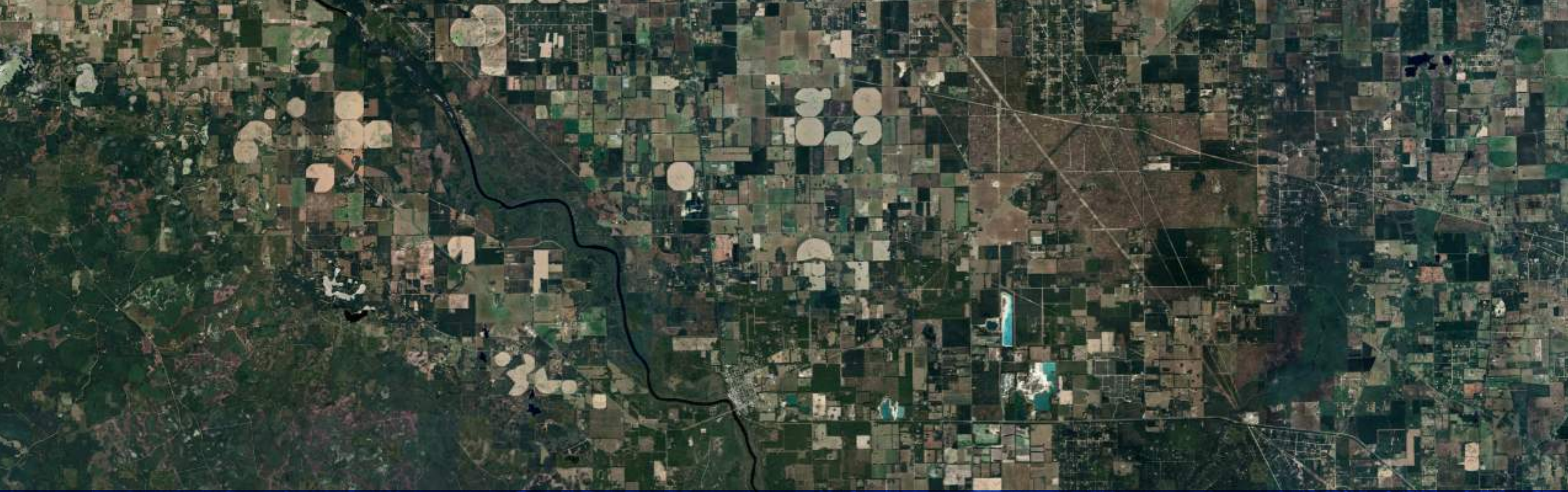
- Perform route analysis.
- Identify number and location of booster pump stations.

Recharge:

- Determine best recharge site to facilitate longer storage of water in the aquifer.
- Determine number of recharge wells needed to inject up to 5.2MGD of flow.

References

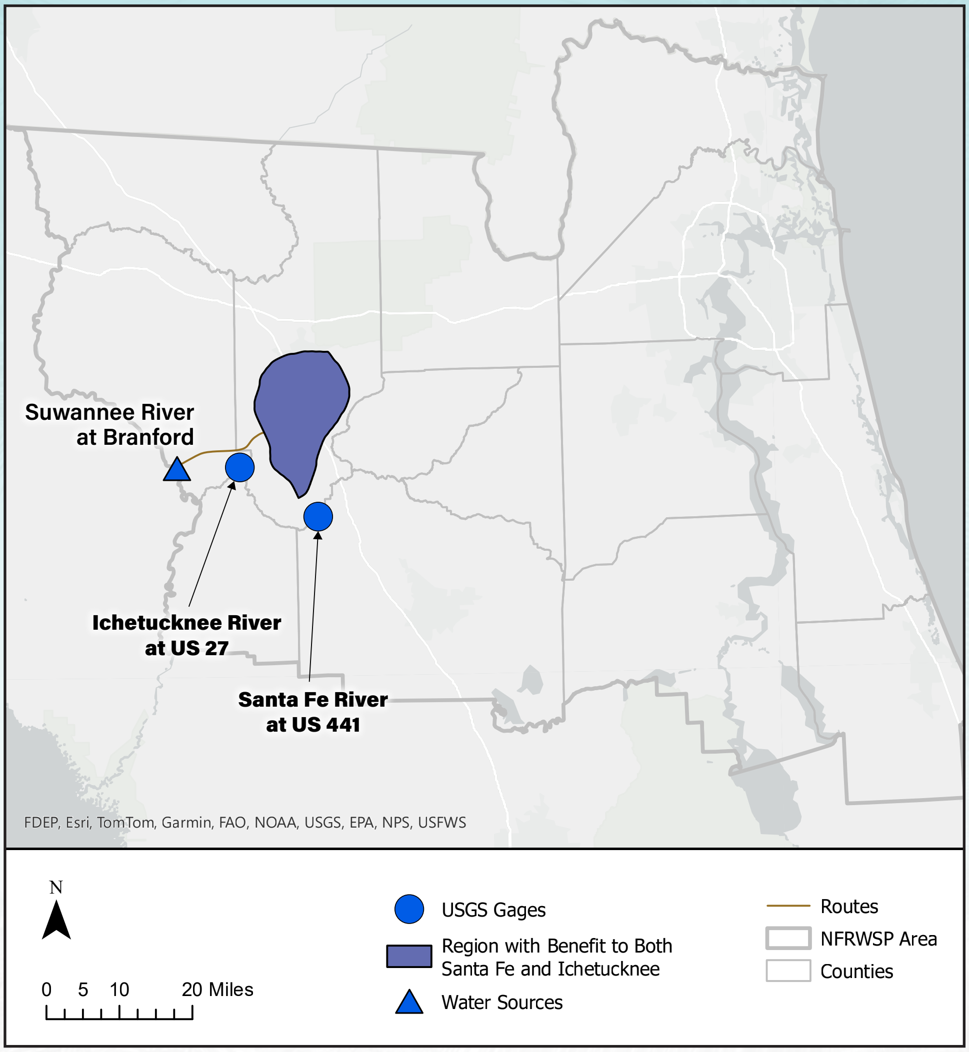
Saint Johns River Water Management District (2023) "Updated Cost Equation for Apr 2023" SJRWMD. Provided April 2024.



SUWANNEE RIVER SURFACE WATER DIVERSION

Project Description

This project includes diverting discharges from the Suwannee River during period of high flow and injecting the diverted water into the semi-confined aquifer for longer-term storage and migration to the MFL sites. Based on analysis of 30-year period of record for the Suwannee River, it is anticipated that up to 20 MGD of water may be available during periods of high flow. Over the 30-year period of record recharge flows of 20 MGD were available 45% of the time. A detailed discussion on the frequency of availability is presented later in this fact sheet.



SOURCE WATER

Lower Suwannee River near Branford (20 MGD)

TREATMENT METHOD

Upper Range - Surface water treatment denitrification and LPRO

Lower Range - Surface water treatment

RECHARGE METHOD(S)

Recharge Well

Facilities Description

The following facilities have been identified as part of this project:

- Provide a pump station with intake structure at the Suwannee River near Branford. Treatment facilities for the surface water withdrawals could be co-located with the pump station to treat water prior to transmission.
- Provide transmission mains from the pump station at Branford to the target recharge area.
- Provide recharge wells at the recharge site.

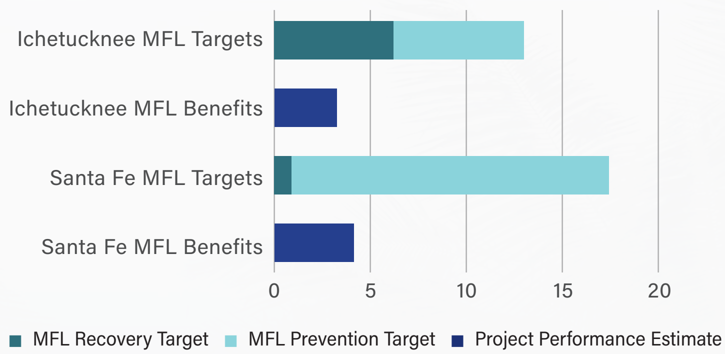
Project Benefits to the LSFIR MFLS

The benefits calculated for this project are based on representative NFSEG influence factors for the Ichetucknee and Santa Fe River gages within the target recharge area. A recharge efficiency of 100% was assumed for this project based on using recharge wells discharging directly to the Upper Floridan Aquifer.

The graph below demonstrates the project's ability to address MFLs at the Santa Fe River US Highway 441 gage near High Springs and the Ichetucknee River gage near Highway 27 in Hildreth.

	Ichetucknee River US Highway 27	Santa Fe River US Highway 441
Influence Factors	0.25	0.30
Recovery Target (cfs)	6.3	1.0
Prevention Target (cfs)	13.2	17.3
MFL Benefit Provided (cfs)	3.4	4.1

Lower Suwannee at Branford:
20MGD ~45% of time = 8.9MGD Avg



Ancillary Benefits

- This project could be used in conjunction with other projects to provide additional benefits at either or both MFL sites.

Potential for Regional Benefits

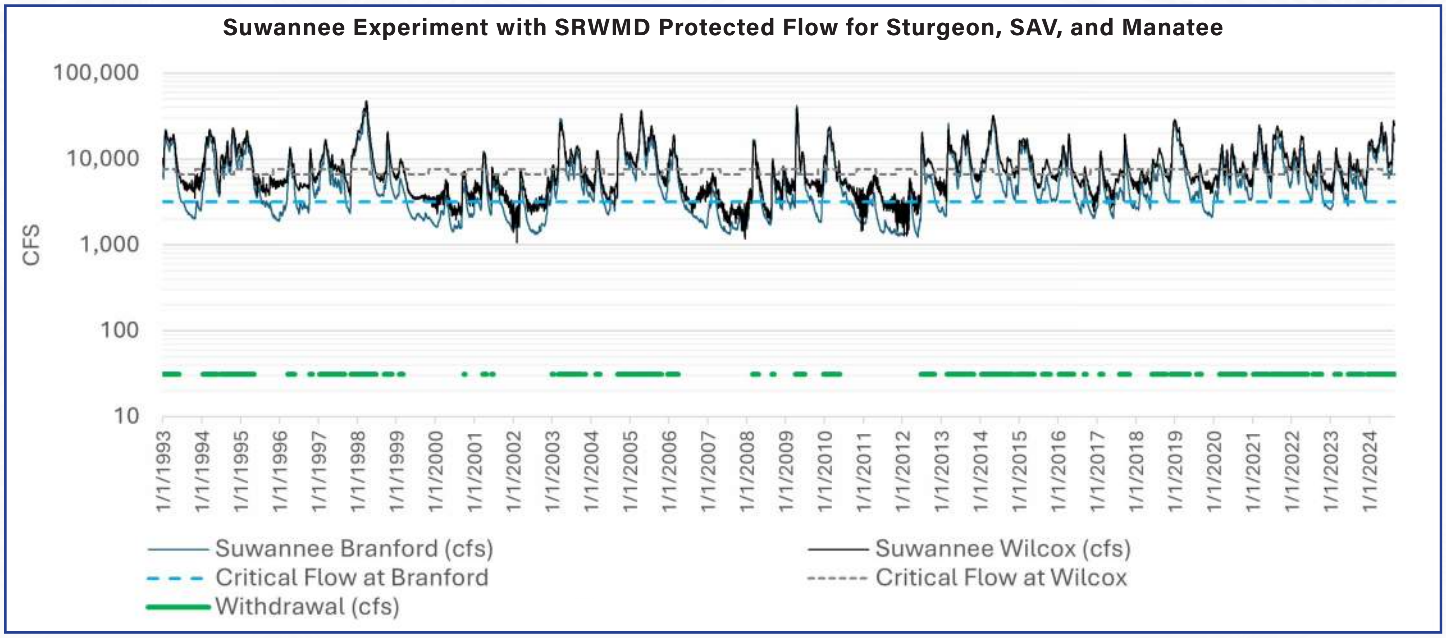
In recognition that there are additional MFLs under development in the same geographic area as the Ichetucknee and Santa Fe, the project was evaluated for potential to positively impact surrounding water bodies. Implementation of the project resulted in an average increase of approximately 0.3 cfs at the Suwannee River Ellaville gage.

Source Water Reliability

Unlike reclaimed water sources, this project is targeted at capturing a portion of the Lower Suwanee River flow during periods of peak discharge. In conjunction with the SRWMD, three minimum flow thresholds were established. These thresholds are outlined below.

- A minimum of 3,190 cfs at Branford to provide access to shoals for sturgeon
- A minimum of 6,600 cfs at Wilcox between May-Oct to maintain low salinities for submerged aquatic vegetation (SAV)
- A minimum of 7,600 cfs at Wilcox Nov-Apr for manatee access

A 30-year period of record for Suwannee River flows was analyzed to see how often peak flows exceeded these minimum flow thresholds, and could therefore be available for diversion to MFL recharge sites. Over the period of record, flows exceeded the minimum flow thresholds approximately 45% of the time. When minimum flow thresholds are met, peak discharges are sufficient to supply up to 20 MGD flow. Over the 30-year period of record recharge flows of up to 20 MGD were available 45% of the time. It is important to note that there were stretches as long as 365 days in which minimum flow thresholds were not met. To function as a reliable source water for MFL recovery, this project will benefit from being paired with a more continuous water source or used in conjunction with other project efforts.



Planning Level Project Cost Estimating

Transmission Costs: The SJRWMD costing tool for rural pipeline projects was used to estimate the transmission costs for water from the Branford area to a representative recharge location within the target recharge area. Total distance estimated for costing is 20 miles and utilizes public rights-of-way. The transmission cost estimate includes pipeline costs but does not include transmission pump stations. Pipeline costs are the dominant factor in calculating transmission costs.

Treatment Costs: Based on uncertainty around treatment requirements for PFAS and nutrients, two treatment scenarios were costed to provide a range of treatment costs. The upper range scenario is based on conventional surface water treatment, reverse osmosis for PFAS removal, and denitrification filters for nutrient reduction. Alternatively, the lower range scenario is based solely on conventional surface water treatment. Surface water treatment costs were estimated using the SJRWMD cost tool, reverse osmosis costs are based on CDM Smith cost curves, and denitrification costs are based on vendor estimates.

Recharge Costs: Costs associated with recharge wells were estimated using the SJRWMD cost tool. No land acquisition costs were included in this estimate.

Option	Transmission Cost ($M)	Treatment Costs ($M)	Recharge Costs ($M)	Total Capital Costs ($M)	O&M Costs ($M)	Annualized Cost ($M/yr)
Upper Range (LPRO and denitrification)	120	185	36	340	11	28
Lower Range (Conventional treatment)	120	95	36	250	5	17

Notes:

1. These are high level planning costs, developed by noted references and citations at the back of this fact sheet and do not include potential costs for potential unknows related to Environmental Remediation, Real Estate, Permitting, Engineering.
2. Transmission costs includes $72M in source development costs
3. O&M costs represent both variable O&M costs like electricity and process chemicals as well as fixed O&M costs incurred each year
4. Annualized costs are based on capital costs annualized over a 30-year project life plus annual O&M costs.

Project Schedule

July 2025 - July 2026	January 2026 - January 2029	July 2026 - July 2031	January 2027 - January 2030	January 2030 - January 2045
Feasibilty Study	Permitting	Land Acquisition	Design	Construction

Implementation Ease

Permitting: Permitting for this project would include an intrabasin transfer and further hydrogeological and engineering analysis to ensure all environmental goals are met and that there are no adverse environmental or flooding impacts. Anticipated permitting includes NPDES, Clean Water Act Section 404, Potable Water Production, Class V Well Discharge, Sovereign Submerged Lands, and ROW permits.

Political/Public Opinion: It is anticipated that here will be strong public opposition to withdrawing water from the Suwannee River. There is hope that establishing low flow thresholds protective of the plants and wildlife in the river will alleviate some concerns.

Land Acquisition: This project will require some land acquisition for treatment facilities, but does not include the large land area for constructed wetlands or RIBs.

Conveyance Obstacles: Few or no conveyance obstacles were identified for this project. Most transmission is through non-congested public rights-of-way.

Operational Complexity

Governance: This project could be executed by a single implementing agency.

Monitoring: Ground water recharge wells will require monitoring of water quality prior to discharge (Chapter 62-610, FAC Part V).

Training and Operations: Some operational training will be required to operate and maintain a large pump station and recharge wells.

Key Assumptions

- Water availability is based on maintaining three key flows to protect plants and wildlife in the Lower Suwannee River.

Key Questions to be Answered by Further Study

Treatment:

- Refine low flow (protective flow) thresholds to better estimate availability of water defined as peak discharges. Consider additional impacts to wetlands, spring recharge, and recreational use.
- Determine specific treatment components for conventional surface water treatment and nutrient removal.

Recharge:

- Determine best recharge site to facilitate longer storage of water in the aquifer.
- Determine the number and spacing of recharge wells based on site specific characteristics.

Conveyance:

- Perform route analysis.
- Identify number and location of booster pump stations.

References

Saint Johns River Water Management District (2023) "Updated Cost Equation for Apr 2023" SJRWMD. Provided April 2024.