

Hazen *Technical Memorandum*

May 23, 2022

To: Peace River Manasota Regional Water Supply Authority

From: Briana Parbus, Hazen and Sawyer
Stephanie Ishii, Hazen and Sawyer
Andre Dieffenthaler, Hazen and Sawyer

cc: Thomas Wilson, Wade Trim
Nita Naik, Wade Trim
Dale Pearson, Ardurra

Regional Integrated Loop Phase 3C Pipeline: Water Quality Considerations

FINAL

This Technical Memorandum serves as supplemental information to the Regional Integrated Loop Phase 3C Pipeline Feasibility and Routing Study (March 2022). Water age and associated water quality implications of the preferred pipeline alternative are presented here. The potential need for confirmation of operational protocols and additional water quality analyses is also discussed.

Table of Contents

1. Introduction	3
2. Approach	6
2.1 Description of Model	6
2.2 Modeled Scenarios	8
3. Results.....	9
4. Discussion	14

List of Figures

Figure 1-1: Phase 1 and Phase 2 Route Alternatives	5
Figure 2-1: WaterGEMs Model Layout and POCs.....	7
Figure 3-1: 2025 Demand Water Age Without Phase 3C.....	9
Figure 3-2: 2025 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 2 days.....	10
Figure 3-3: 2025 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 4 days.....	11
Figure 3-4: 2025 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 7 days.....	12
Figure A-1: 2025 Demand Water Age Without Phase 3C.....	A-1
Figure A-2: 2040 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 2 days.....	A-2
Figure A-3: 2040 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 4 days.....	A-3
Figure A-4: 2040 Demand Water Age With Phase 3C - Target Manatee County POC Water Age is 7 day	A-4

1. Introduction

Regional Integrated Loop Phase 3 of the Regional Interconnect System extends the Peace River Manasota Regional Water Supply Authority's (Authority's) transmission system from the Carlton Water Treatment Plant to Manatee County. Phase 3 is divided into three phases 3A, 3B and 3C:

- Phase 3A:
 - Completed in 2011.
 - Comprised of a 48-inch diameter transmission main from the Carlton Water Treatment Plant to the Preymore/State Road 681 Interconnect.
 - Delivers Regional water to a Sarasota County Point of Connection (POC) located west of the Central County Solid Waste Disposal Complex.
- Phase 3B:
 - Completed in 2020
 - Comprised of 48-inch and 36-inch diameter transmission mains from the Authority's transmission system north to State Road 72 (Clark Road) near Cow Pen Slough just west of the Sarasota National Cemetery.
 - Delivers Regional water to another Sarasota County POC that serves a 30" County distribution line to the west along Clark Rd
- Phase 3C:
 - Comprised of two phases, herein referred to as:
 - Phase 1: Extends the transmission system north to State Road 780, better known as Fruitville Road. Supplies a new Sarasota County POC located near the terminus of Phase 3C near the intersection of Fruitville Rd and Lorraine Rd. Includes a pumping facility site with storage and chemical feed capability for water quality enhancement
 - Phase 2: Will be constructed from the Phase 1 Fruitville Road facilities north to Manatee County at a later date.

Phase 1 is the higher priority project due to anticipated demands from Sarasota County. The Regional Integrated Loop Phase 3C Pipeline Feasibility and Routing Study (March 2022) documents the route development, evaluation, and ranking process for both Phase 1 and Phase 2. A single recommended route was identified for Phase 1, and three shortlisted routes were identified for Phase 2. Only one route was used for this water quality analysis.

It was recommended that the Authority proceed with construction of the Phase 1 facilities, including a pumping station, 5 million gallons (MG) of ground storage, and 41,306 linear feet (LF) of 42-inch transmission main that follows Route B1 (Figure 1-1). Phase 1 includes the transmission main from the pump station to the Sarasota County's distribution system POC. If the POC is moved near to the intersection of Lorraine Road and Blue Lake Road, an additional 8,150 LF of 42-inch water transmission main will be required. Phase 2 recommended either Route A2 or Route B2 of 42-inch and 36-inch water transmission main to the Manatee County POC at University Parkway and Lakewood Ranch Boulevard. Route B2 was used for water quality modeling purposes for Phase 2.

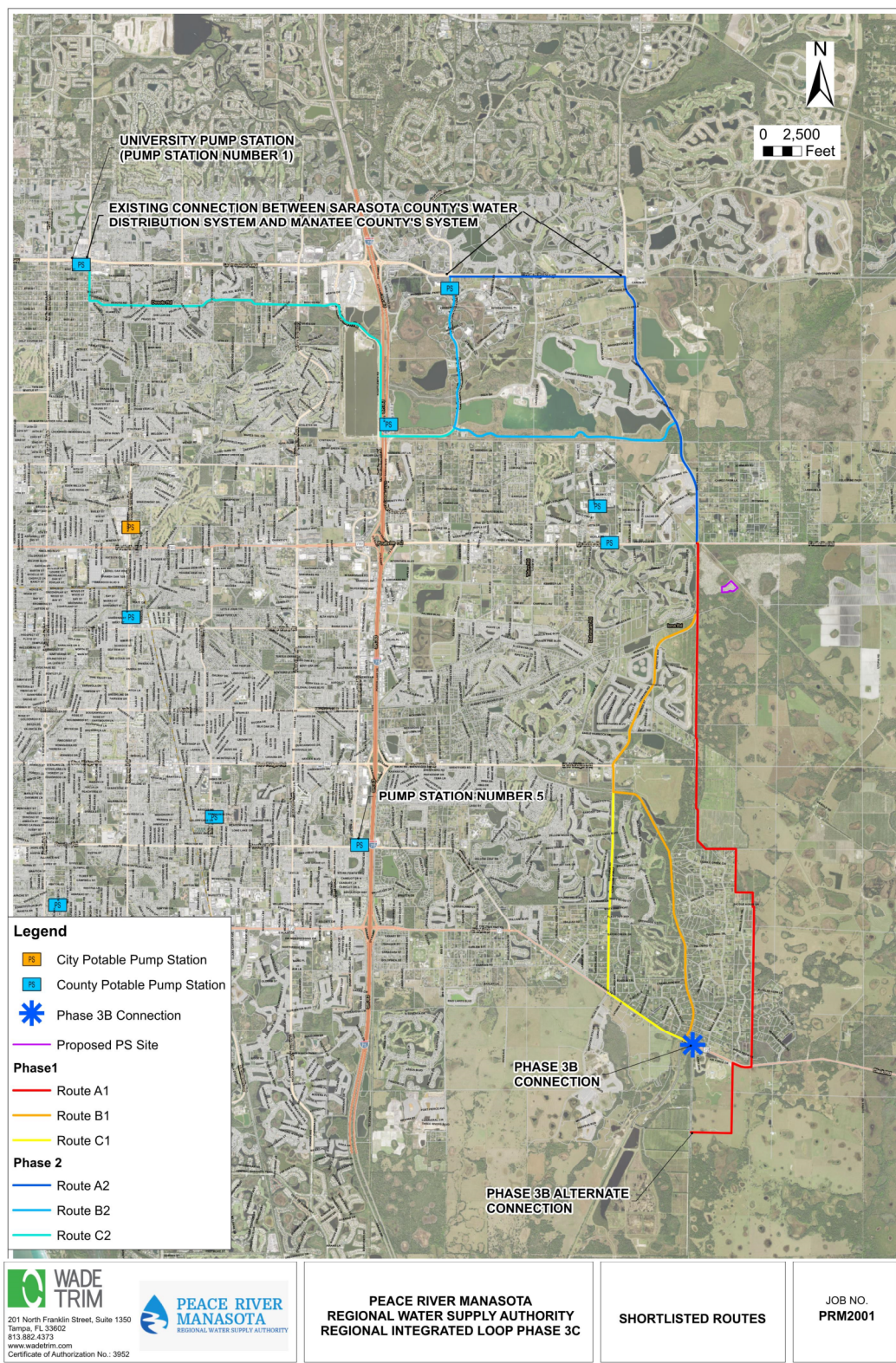


Figure 1-1: Phase 1 and Phase 2 Route Alternatives

This Technical Memorandum serves as supplemental information to the Regional Integrated Loop Phase 3C Pipeline Feasibility and Routing Study (March 2022), herein referred to as the March 2022 Routing Study. Water age and associated water quality implications of the preferred pipeline alternative are presented here. The potential need for confirmation of operational protocols and additional water quality analyses are also discussed.

2. Approach

Hazen was tasked with the assessment of the water age and quality at Sarasota and Manatee County's POCs north of Clark Road, through the use of the regional hydraulic model. Water age analysis was assessed using a 30-day water age simulation in Bentley WaterGEMs hydraulic modeling software. Water quality blending was not able to be performed with the model provided.

2.1 Description of Model

No additional modeling calibration or development was completed as part of this task. Hazen used the WaterGEMs model received from Ardurra, which included the proposed transmission main route. Hazen also received from Ardurra and HDR the water distribution network for Manatee County, Sarasota County, and Charlotte County. Accurate water age and blending modeling of distribution systems requires detailed controls that reflect accurate pumping set points and tank cycling times, as these greatly affect water age results. Unfortunately, the regional water model did not include controls with the level of detail necessary for the water age and blending analysis of the complete system. In order to simplify the analysis to the regional system, only the areas up to the POCs (see Figure 2-1) were activated in the model. Water quality blending within Manatee County and Sarasota County was not able to be determined due to this simplification.

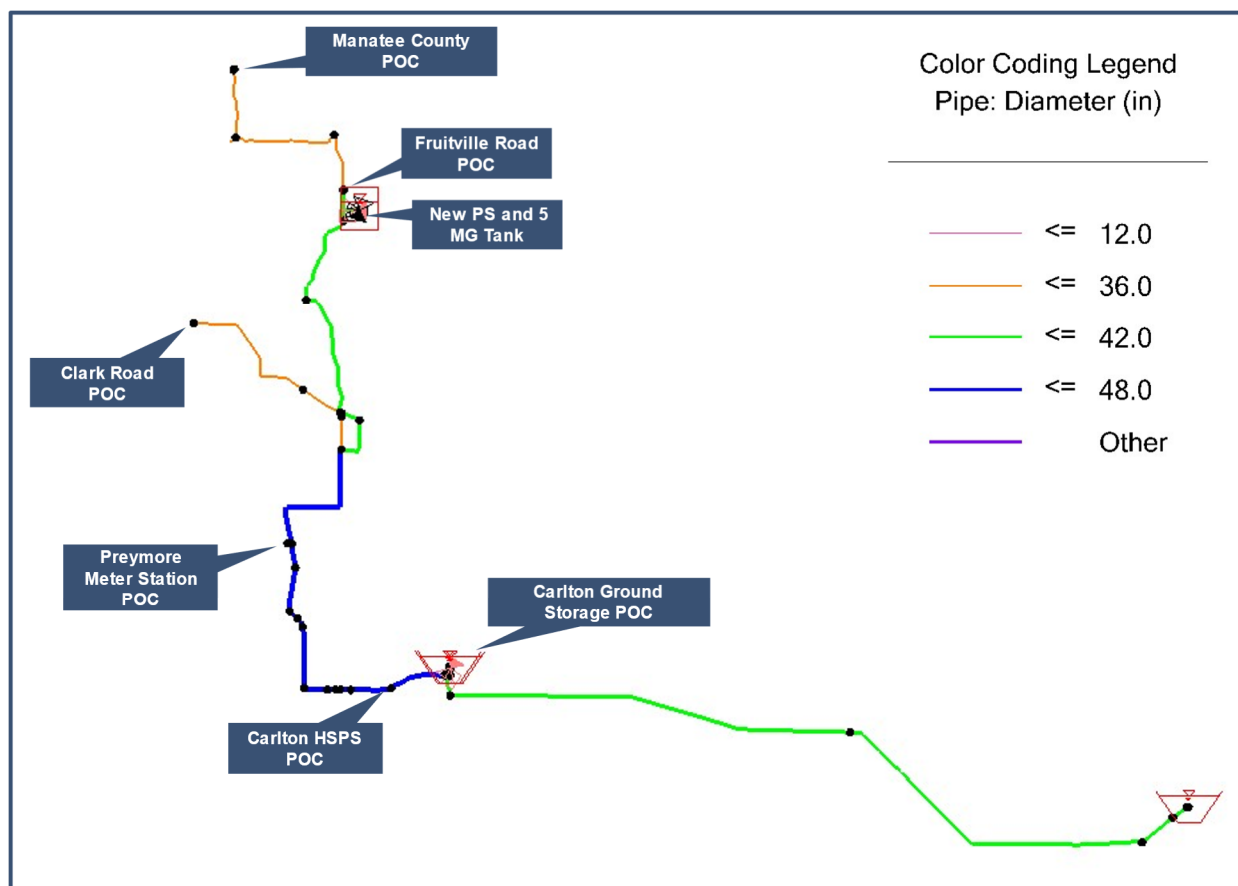


Figure 2-1: WaterGEMs Model Layout and POCs

Average day demands were applied at the POCs. Max day requirements were taken from the March 2022 Routing Study. Average day demands were determined by dividing the max day requirement by the peaking factor of 1.3. Note that Carlton High Service Pump Station flows do not use the peaking factor and instead take the remaining Carlton Ground Storage Tank flow after all other demands have been met. Per the March 2022 Routing Study “Sarasota County did not indicate a flow requirement for the 2025 condition but included 6.0 MGD as required in 2040. It is understood that the County and Authority’s intent would be to provide that flow upon completion of the Phase 3C project (as simulated by the 2025 Max Day Scenario), at which time flows to other delivery points would be reduced accordingly.” To create the worst-case scenario for water age, Hazen assumed that the flow at Preymore Meter Station would be reduced in 2025 if demand is being delivered at Fruitville Road. The average day demands used in the model are listed in Table 2-1.

Table 2-1: POC Demand Requirements

POC Name	2025 Max Day (MGD)	2025 Average Day (MGD)	2040 Max Day (MGD)	2040 Average Day (MGD)
Peace River Supply to Carlton Ground Storage**	21.1	16.2	26.6	20.5
Carlton High Service Pump Station***	4.9	3.8	3.0	2.4
Preymore Meter Station (aka 681)	11.3 (3.0*)	2.3	3.0	2.3
Clark Road	7.2	5.5	14.6	11.2
Fruitville Road	0.0 (6.0*)	4.6	6.0	4.6

* Sarasota County does not require the 6 MGD by 2025, but it is assumed that they will accept the 6 MGD whenever Phase 1 is completed and reduce demand at Preymore Meter Station, therefore the model assumes a max day flow of 6 MGD at the Fruitville Road POC and 3.0 MGD at Preymore Meter Station.

**Peace River Supply to Carlton Ground Storage equals the sum of Carlton High Service Pump Station, Preymore Meter Station, Clark Road, and Fruitville Road.

***Carlton High Service Pump Station flows are calculated from the remaining flows to Peace River Supply to Carlton Ground Storage after the other three POC demands have been met.

The proposed Phase 3C pump station on Lorraine Road was modeled as a single pump with a 5 MGD tank. A flow control valve was set to match the flow demanded downstream of the tank to maintain the tank level at approximately 95 percent full.

2.2 Modeled Scenarios

For comparison purposes, water age was run without Phase 3C first. In order to facilitate planning for future controls, scenarios were run to determine the approximate daily flow from the Authority to Manatee County to maintain a target water age at the delivery point. Since disinfection is provided by chloramines, the maximum target water age is 7-days, though it is advisable to aim for a shorter water age to account for time within the Manatee County distribution system. The following eight scenarios were modeled:

1. **2025** AADF without Phase 3C
2. **2040** AADF without Phase 3C
3. **2025** AADF with Phase 3C – maintaining 2-day water age
4. **2025** AADF with Phase 3C – maintaining 4-day water age
5. **2025** AADF with Phase 3C – maintaining 7-day water age
6. **2040** AADF with Phase 3C – maintaining 2-day water age
7. **2040** AADF with Phase 3C – maintaining 4-day water age
8. **2040** AADF with Phase 3C – maintaining 7-day water age

Demands at the POCs were applied as listed in Section 2.1. Demand at the Manatee County POC was adjusted until the target water age was reached.

3. Results

Overall, the results show that under AADF for 2025 and 2040, the water age between the Carlton Water Storage Tanks and the end of the Phase 3B transmission main is less than 36 hours without Phase 3C. See Figure 3-1 for the 2025 AADF water age results prior to Phase 3C installation. Results for 2025 demand are considered worst-case scenario and will be used for the remainder of this section. Appendix A includes results for 2040 AADF.

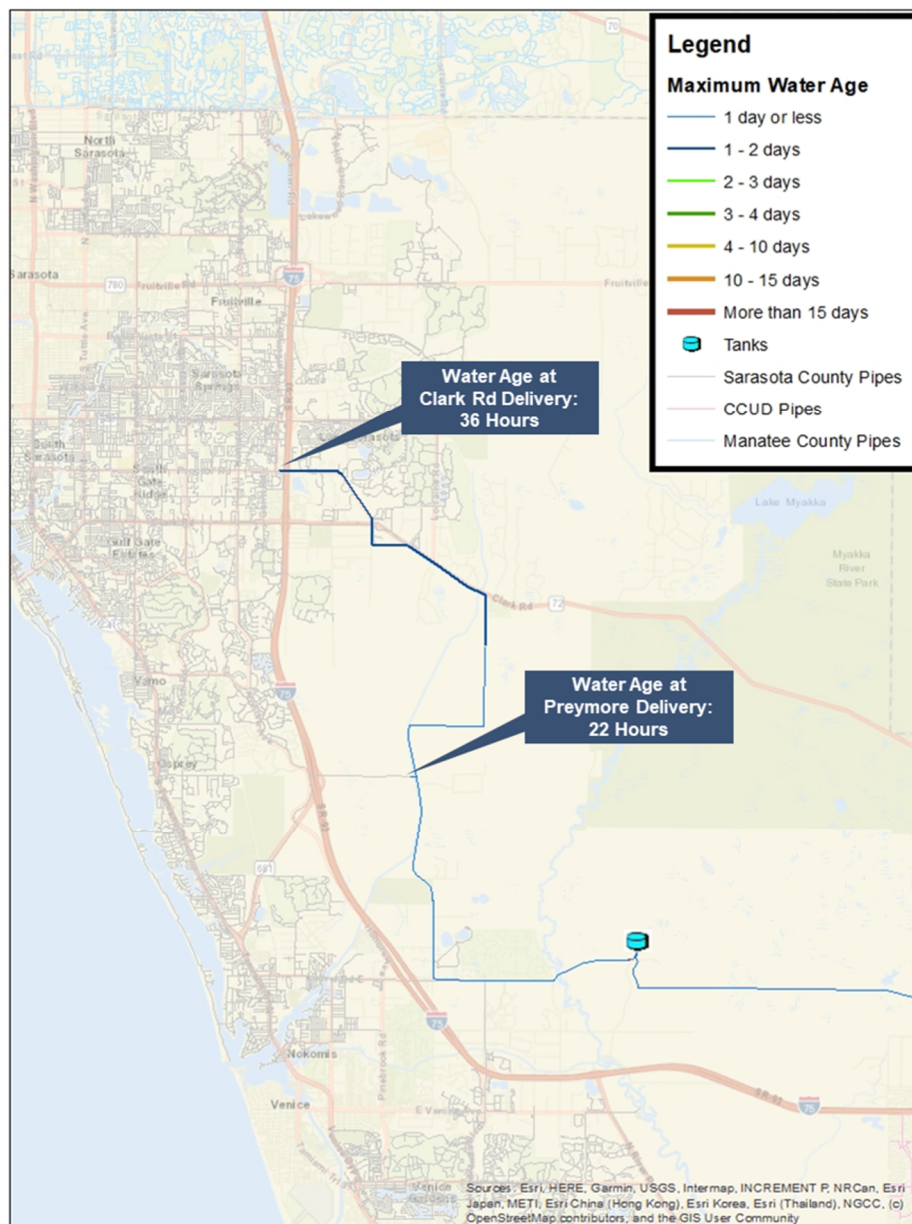


Figure 3-1: 2025 Demand Water Age Without Phase 3C

For Phase 3C, the demand at the Fruitville and Lorraine POC generally maintains the water age in the 5 MG storage tank at the new pump station, therefore the water age in the remaining section of pipe is heavily dependent on the quantity of water Manatee County is prepared to accept from the Authority. Figure 3-2 through Figure 3-4 show the water age across the distribution system when various target water ages are being met at the Manatee County POC under 2025 AADF conditions.

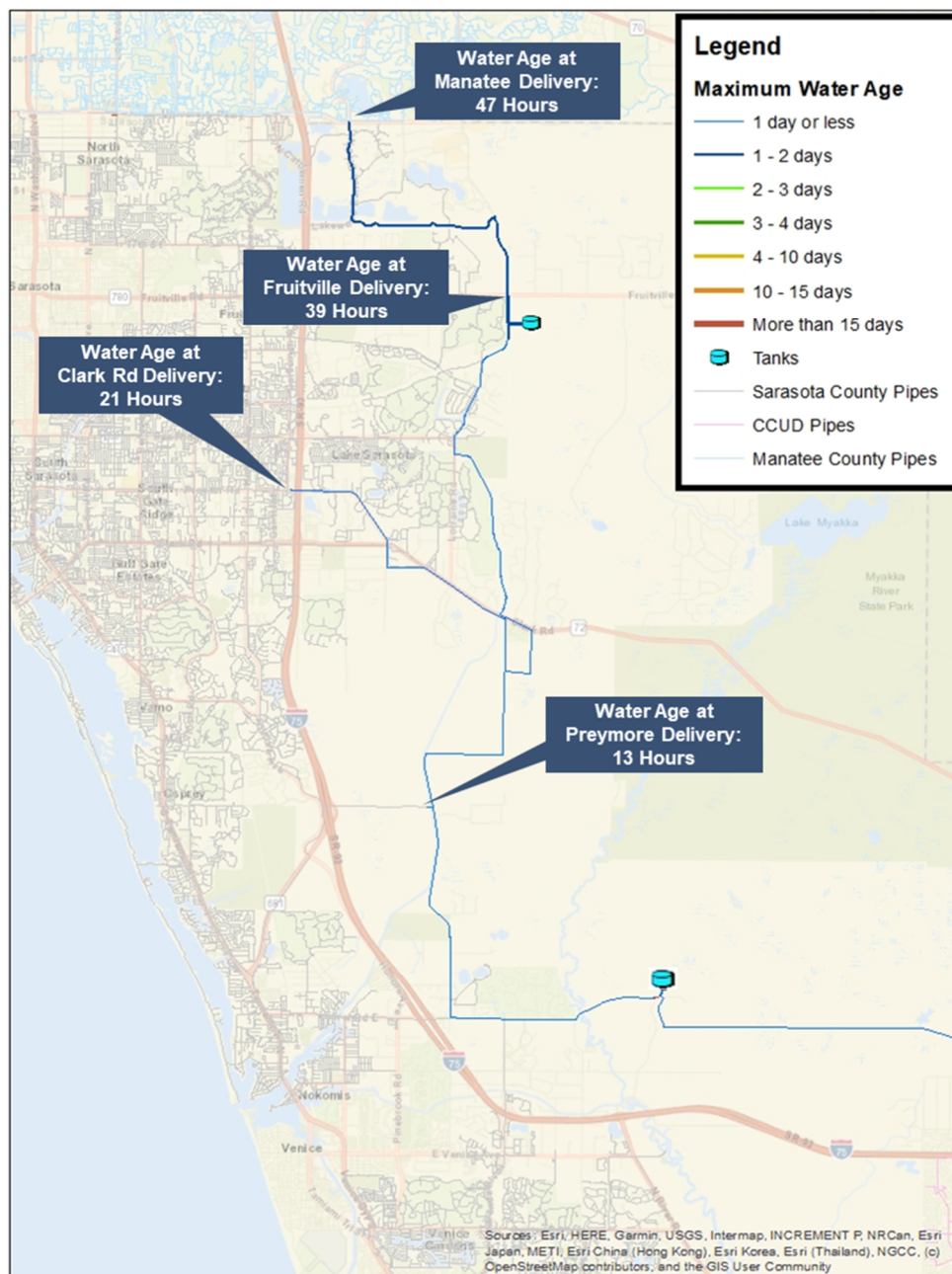
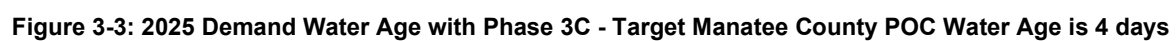


Figure 3-2: 2025 Demand Water Age with Phase 3C - Target Manatee County POC Water Age is 2 days



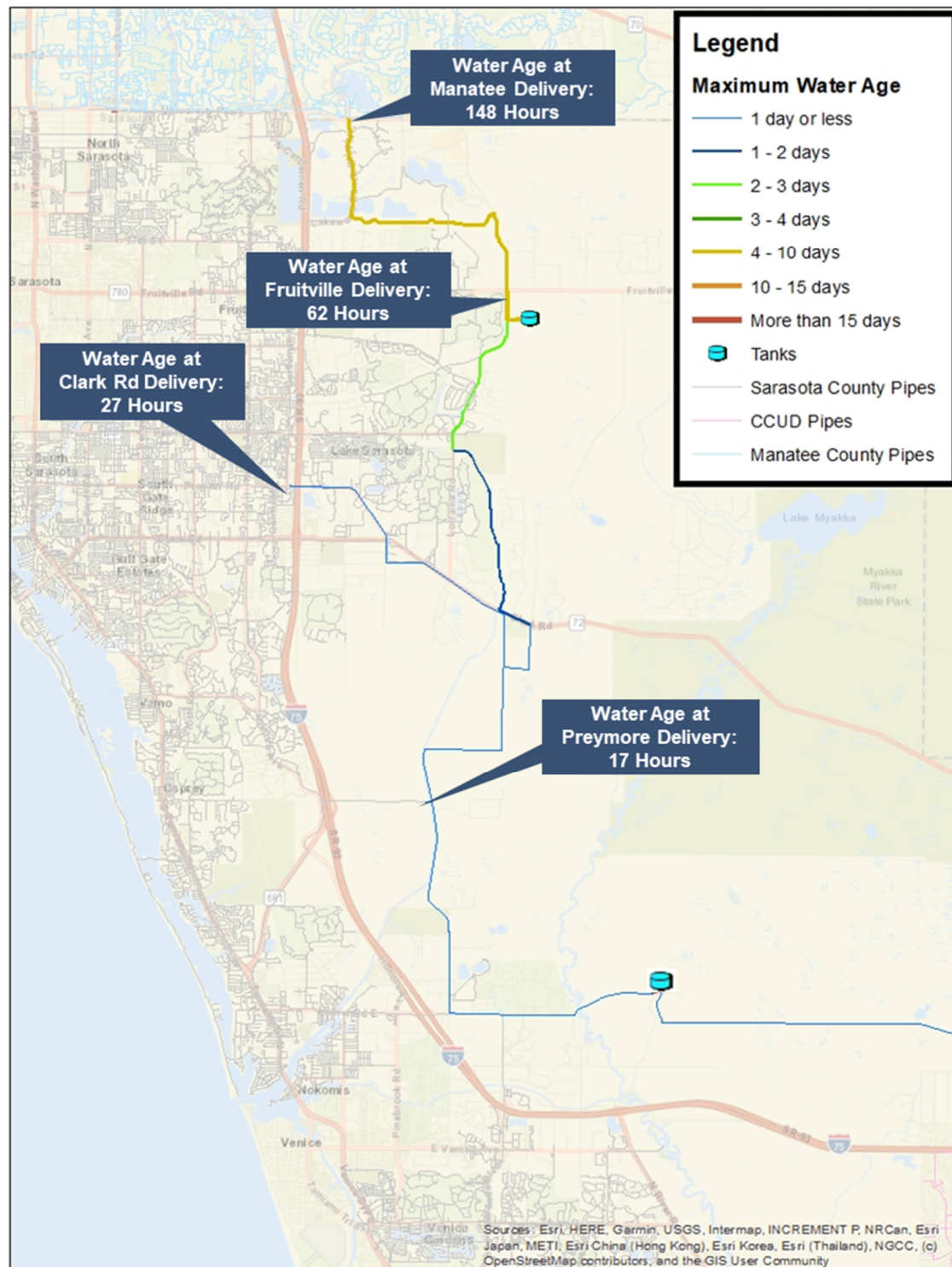


Figure 3-4: 2025 Demand Water Age with Phase 3C - Target Manatee County POC Water Age is 7 days

Table 3-1 summarizes the approximate flow rates required to be accepted by Manatee County to maintain various water age goals at the POC. These values are based on the assumption that the new tank operates up to 95% full and that all treatment occurs at the Carlton Water Treatment Plant. It should also be noted that the amount of water accepted by Manatee County also effects the water age of the water supplied to Sarasota County at the Fruitville Road POC.

Table 3-1: Summary of Manatee County POC Required Flow Acceptance for Target Water Age Rates

Condition	2- Day Water Age Flow (MGD)	4- Day Water Age Flow (MGD)	7- Day Water Age Flow (MGD)
2025 AADF Demands	5.0	1.1	.5
2040 AADF Demands	4.5	1.1	.4

Table 3-2 summarizes the water age at the previously listed POCs under 2025 and 2040 demand conditions.

Table 3-2: Summary of Water Age at POCs under various Flow Rates at Manatee County POC

Condition	POC Name	2- Day Water Age at Manatee (hr)	4- Day Water Age at Manatee (hr)	7- Day Water Age at Manatee (hr)
2025 AADF Demands	Carlton High Service Pump Station	8	8	8
	Preymore Meter Station (aka 681)	13	15	17
	Clark Road	21	24	27
	Fruitville Road	39	57	62
2040 AADF Demands	Carlton High Service Pump Station	8	8	8
	Preymore Meter Station (aka 681)	13	14	14
	Clark Road	18	19	19
	Fruitville Road	38	53	58

4. Discussion

The results presented herein were developed by adjusting the demand at the Manatee County POC as an independent variable to achieve preferred water age in the Authority's distribution system. For these results to be realized in practice, Manatee County must commit to a schedule of demands at the proposed POC that aligns with that described in Section 3. Manatee County also has the ability to exchange water back to Sarasota County at an existing pump station at University Parkway and Lockwood Ridge Road in order to improve water age conditions within their system. As Manatee County and Sarasota County gain more insight into future control strategies for these changes to their water supply, the water age model should be run in more detail to determine the associated water age implications in the Authority's distribution system and at Manatee and Sarasota County's POCs. Disinfectant decay tests and simulated distribution system tests should be performed to predict disinfectant residual and disinfection byproduct concentrations at anticipated water ages throughout the system.

Manatee and Sarasota County's anticipated demands and operational protocols must be incorporated into the model to characterize the blending of different finished water supplies and water age in the distribution system up- and downstream of the POCs under various conditions. As previously noted, areas within the distribution system with extended water age are important because these may become areas that require chemical additions and/or flushing to maintain target disinfectant residual and disinfection byproduct concentrations. Furthermore, the extent and variability of water supply blending within the distribution system over time as demands, source waters, and infrastructure change are important because of compatibility considerations. For example, Table 4-1 summarizes the corrosion control strategies practiced by the Authority, Manatee County, and Sarasota County. The mixing of waters with different corrosion control strategies or changing the corrosion control strategy within an area that is acclimated to a different corrosion control strategy may pose a challenge to lead and copper requirements.

Future evaluations of the need, siting, and sizing of chemical addition points should include updated water age and associated water quality analyses for model runs at low flow, average, and max day conditions with refined Manatee County demands and operational protocols.

Table 4-1: Corrosion Control Strategies Practiced by Supplies with Potential Blending in the Phase 3C Pipeline

Utility	Corrosion Control Strategy
Peace River Manasota Regional Water Supply Authority	Target pH of 8.1 - 8.2
Manatee County	1.8 mg/L zinc metaphosphate, target pH of 7.0 - 8.0
Sarasota County	2 mg/L liquid ortho-polyphosphate, target pH of 7.3 - 8.0

Appendix A: Water Age Results

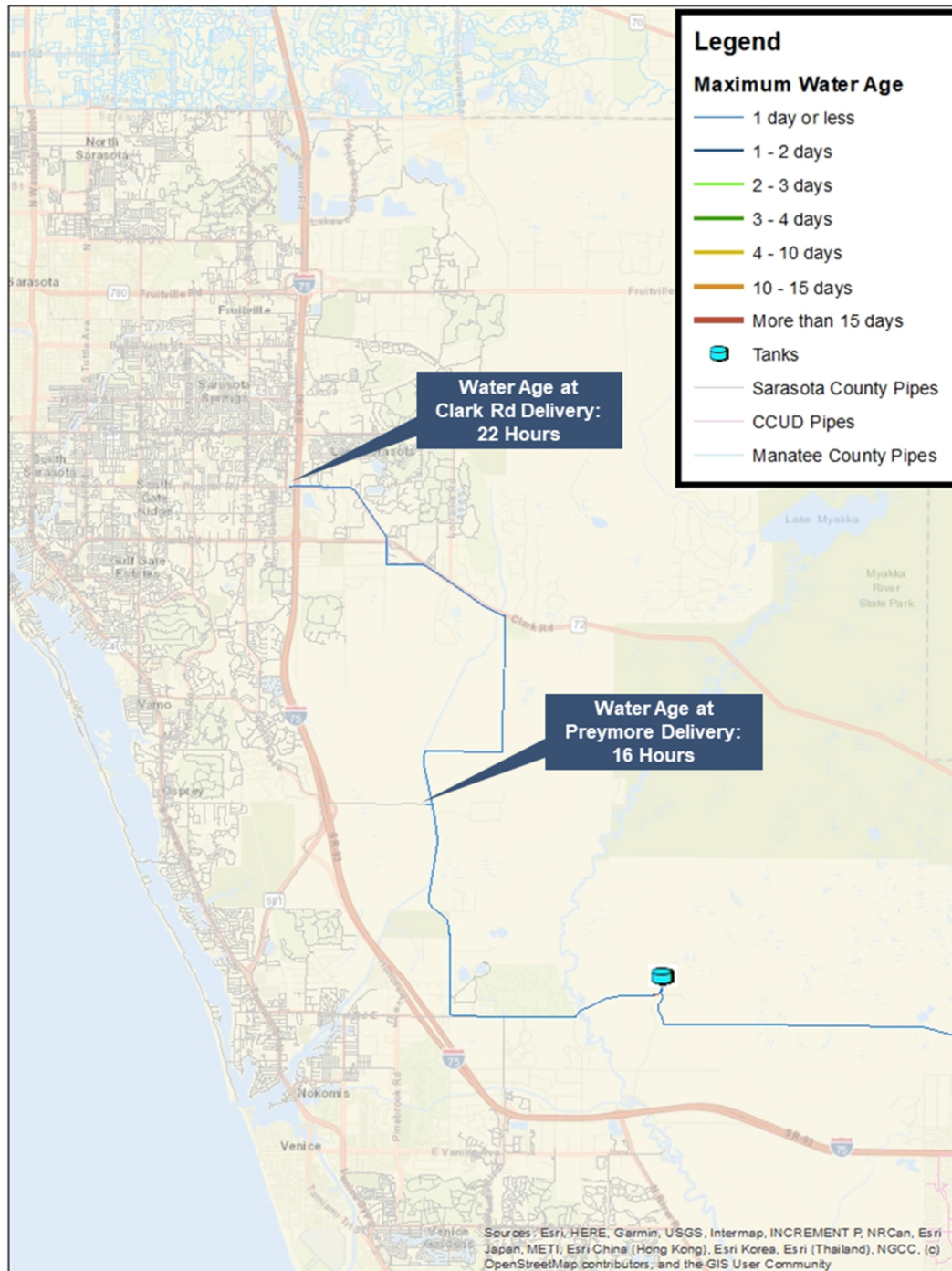


Figure A-1: 2025 Demand Water Age Without Phase 3C

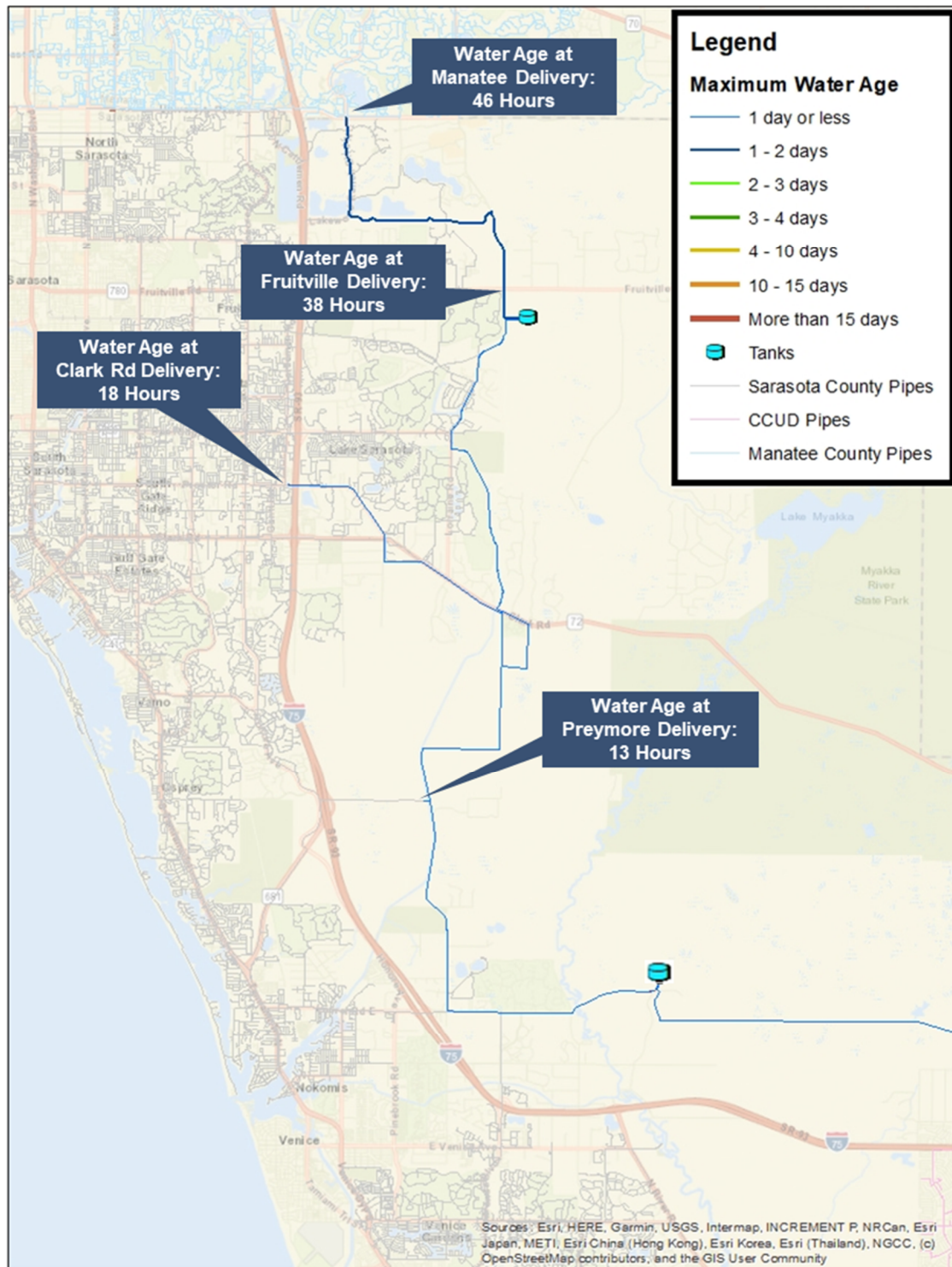


Figure A-2: 2040 Demand Water Age with Phase 3C - Target Manatee County POC Water Age is 2 days

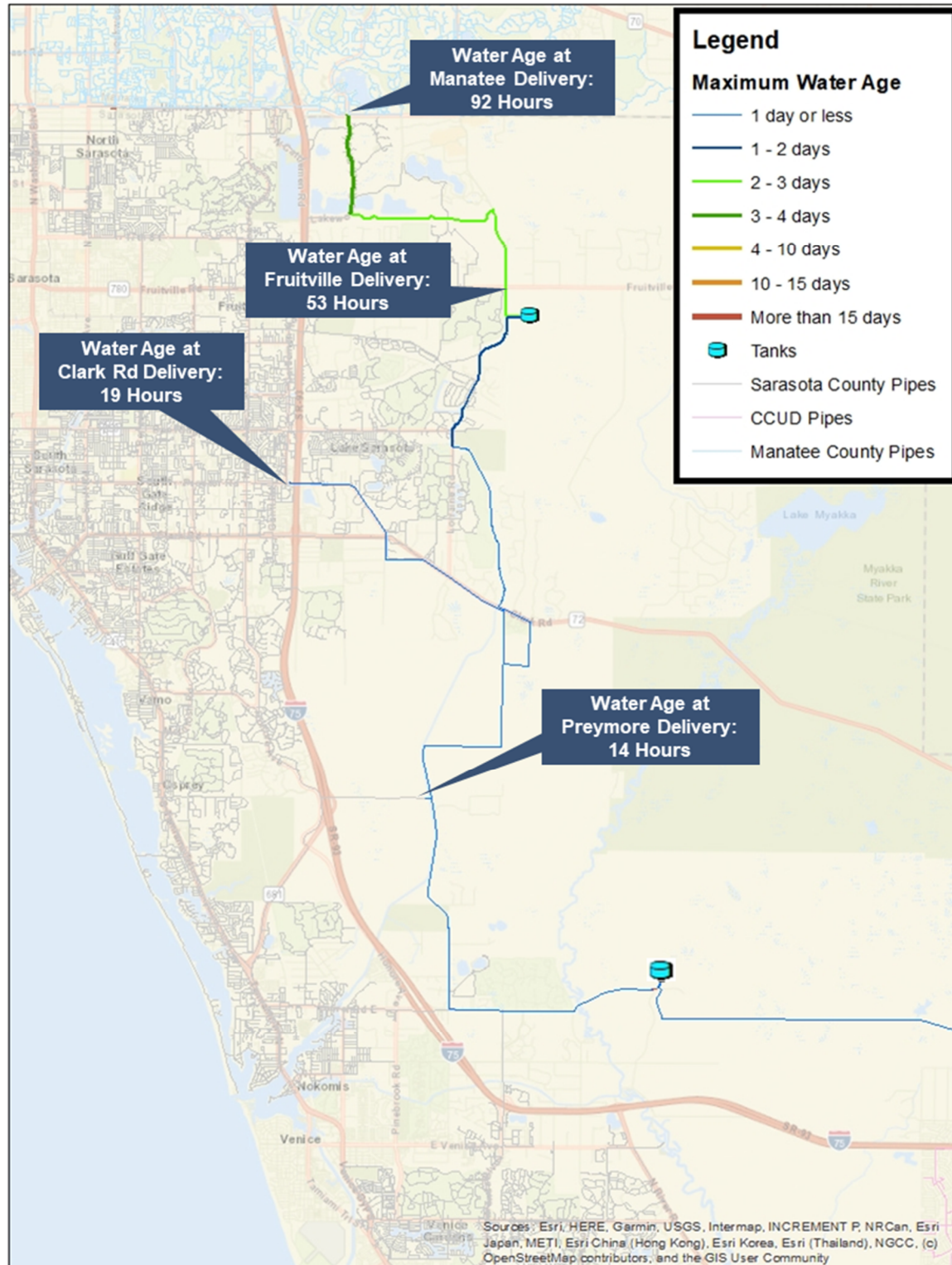


Figure A-3: 2040 Demand Water Age with Phase 3C - Target Manatee County POC Water Age is 4 days

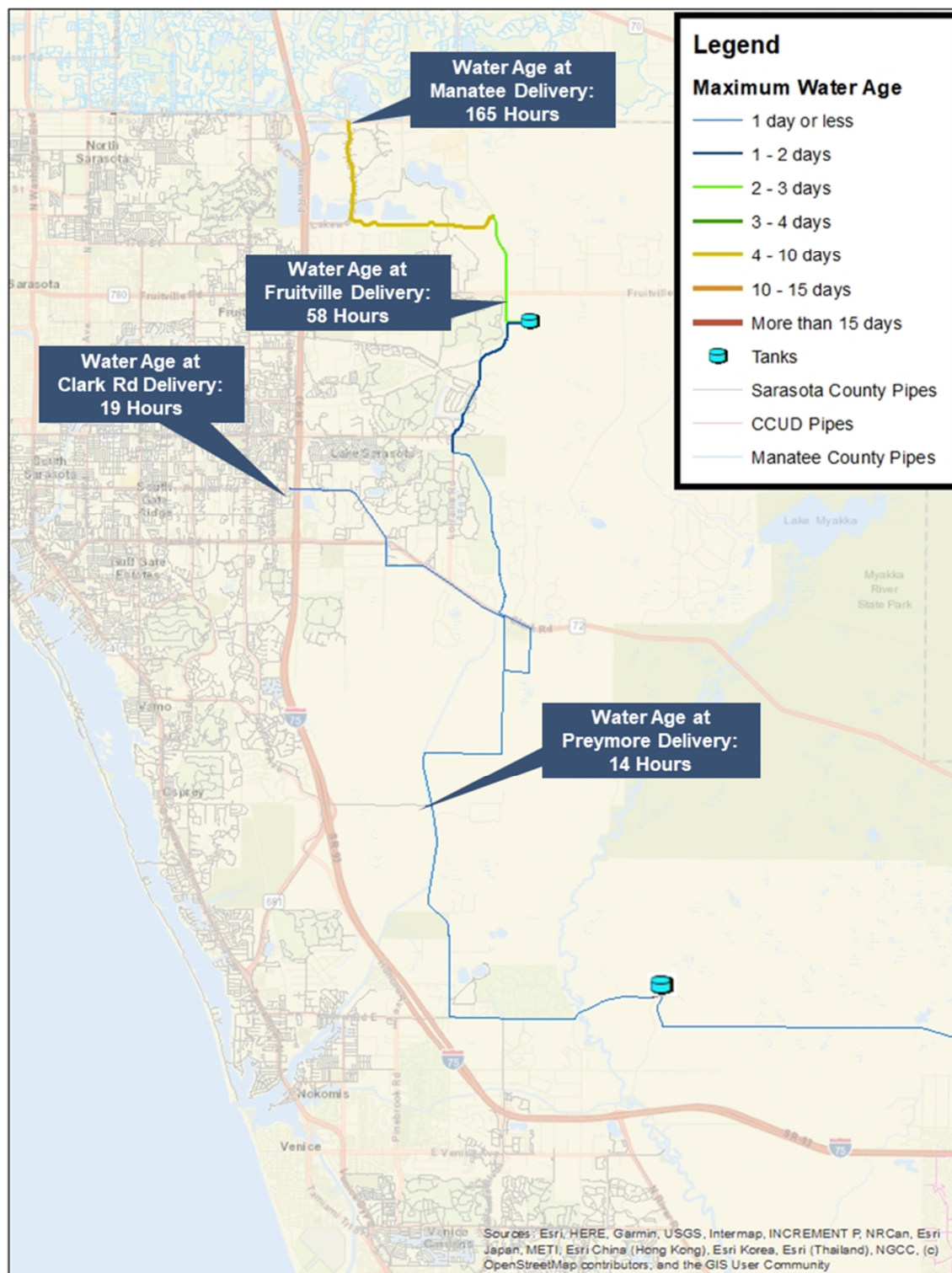


Figure A-4: 2040 Demand Water Age with Phase 3C - Target Manatee County POC Water Age is 7 days