

Town of Palm Beach Water Feasibility Study

TOWN OF PALM BEACH
PUBLIC WORKS



APRIL 2022

Prepared By:

Kimley»»Horn

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1 Introduction.....	7
1.1 Background.....	7
1.2 Approach.....	7
1.3 Purpose.....	10
2 Available Information	11
3 Evaluation of Existing System	12
3.1 Description of Existing System.....	12
3.2 Historical Water Demand.....	12
3.3 Per Capita Water Use.....	14
3.4 Existing Condition of Infrastructure	15
3.4.1 <i>Franchise Agreement</i>	15
3.4.2 <i>Inventory of City Facilities</i>	15
3.4.3 <i>2015 Utility Master Plan</i>	16
3.4.4 <i>Existing Infrastructure Condition Summary</i>	18
3.5 Existing Hydraulic Model.....	18
3.5.1 <i>Model Results</i>	19
4 Overview of Potential Alternative Potable Water Service and Utility Providers.....	25
4.1 Identification of Potable Water Service and Utility Providers.....	25
4.1.1 <i>Coordination Meetings</i>	26
4.2 Municipal Water Suppliers	27
4.2.1 <i>City of West Palm Beach Public Utilities</i>	27
4.2.2 <i>Palm Beach County Water Utilities Department</i>	28
4.2.3 <i>City of Riviera Beach</i>	30
4.2.4 <i>City of Lake Worth Beach</i>	31
4.2.5 <i>Town of Manalapan</i>	33
4.2.6 <i>Municipal Water Supplier Summary</i>	34
4.3 Golf Course Water Suppliers	35
4.4 Private Utility Provider	37
4.4.1 <i>Contract Operations and Maintenance</i>	37
4.4.2 <i>Design Build Finance Operate (DBFO) Concessions</i>	38
4.4.3 <i>Private Ownership of Asset</i>	38

4.4.4	<i>Initial Investigation of Private Utility Providers</i>	39
4.4.5	<i>FGUA</i>	40
4.4.6	<i>Corix/Utilites Inc.</i>	40
4.4.7	<i>Private Utility Provider Summary</i>	35
4.5	Phase 1 Summary and Conclusions	35
4.6	Preliminary Screening of Water Supply Alternatives to be Further Evaluated In Phase 236	
5	Evaluation of Alternatives	38
5.1	Approach.....	38
5.2	Alternative 1 – Renew Current Franchise Agreement with the City of West Palm Beach	41
5.2.1	<i>System Improvements</i>	42
5.2.2	<i>Pipeline Replacement Needs as Identified in Franchise Agreement</i>	42
5.2.3	<i>Critical Pipeline Improvements as Identified in Master Plan</i>	44
5.2.4	<i>Water Quality</i>	45
5.2.5	<i>Capital Costs</i>	45
5.2.6	<i>Alternative 1 Summary</i>	45
5.3	Alternative 2 – Town Owned Water Supply	47
5.3.1	<i>Water Treatment Site Options</i>	48
5.3.2	<i>Water Supply and Treatment</i>	49
5.3.3	<i>Water Distribution System Improvements</i>	51
5.3.4	<i>Capital Costs</i>	57
5.3.5	<i>Alternative 2 Summary</i>	58
5.4	Alternative 3 – Palm Beach County.....	62
5.4.1	<i>System Improvements</i>	63
5.4.2	<i>Existing Town Distribution System Required Improvements</i>	67
5.4.3	<i>Improvements Resulting from PBCWUD interconnections</i>	67
5.4.4	<i>Capital Costs</i>	68
5.4.5	<i>Alternative 3 Summary and Evaluation</i>	69
5.5	Alternative 4 – City of Lake Worth Beach	72
5.5.1	<i>System Improvements</i>	72
5.5.2	<i>Existing Town Distribution System Required Improvements</i>	76
5.5.3	<i>Capital Costs</i>	78
5.5.4	<i>Alternative 4 Summary and Evaluation</i>	79
5.6	Phase 2 Summary and Conclusions	82
6	Detailed Investigations of Selected Alternatives	86

6.1	Evaluation of Desalination Facility at Phipps Park Site	86
6.1.1	Raw Water Well Sizing and Siting	87
6.1.2	Phipps Park Desalination Water Treatment Facility	91
6.1.3	Potable Water Storage Requirements	94
6.1.4	Concentrate Management.....	94
6.1.5	Potable Water Distribution System Upgrades	95
6.1.6	Impact Analysis.....	97
6.2	Membrane Treatment Facility at Quadrille Site.....	102
6.2.1	Conveying Treated Water from the City's WTP to the Quadrille Site	103
6.2.2	Treatment Facility Components and Siting	106
6.2.3	Concentrate Management.....	109
6.2.4	Potable Water Distribution System Upgrades	109
6.2.5	Impact Analysis.....	111
6.2.6	Economic Evaluation.....	112
6.3	Upgrade City of WPB Treatment Plant.....	116
6.3.1	Water Supply	116
6.3.2	Potable Water System Upgrades	116
6.3.3	Impact Analysis.....	118
6.3.4	Economic Evaluation.....	119
6.4	Evaluation of Alternatives	123

LIST OF TABLES

Table 1: Existing System LOS	1
Table 2: Alternative Overview	3
Table 3: Alternative Overview	3
Table 4: Summary of Capital Costs and Utility Formation Costs	4
Table 5: Summary of Cost to Produce 1,000 Gallons	5
Table 6: Existing Annual Average Day Demand Summary Comparison.....	12
Table 7: Summary of Per Capita Water Usage.....	14
Table 8: Water Distribution Main Candidate Project's Details	16
Table 9: Hydraulic Model Town System Pipe Summary	19
Table 10: Hydraulic Model Existing Demand Summary	20

Table 11: Existing Annual Average Day Demand - Summary Comparison.....	20
Table 12: Existing Water Source Summary	21
Table 13: Existing System Max Day Model Results Summary	23
Table 14: Existing System LOS.....	23
Table 15: City of West Palm Beach Public Utilities Water Use Summary	27
Table 16: PBCWUD’s Water Treatment Plants.....	29
Table 17: Palm Beach County Water Utilities Department Water Use Summary.....	29
Table 18: City of Riviera Beach Water Use Summary.....	30
Table 19: City of Lake Worth Beach Water Use Summary.....	32
Table 20: Town of Manalapan Water Use Summary	33
Table 21: Potential Municipal Water Service Supplier Summary.....	34
Table 22: Scenario 1 – Potential Surplus Allocation (Floridan, Surficial and Surface Water)	36
Table 23: Scenario 2 – Potential Surplus Allocation (Floridan and Surficial Aquifers Only).....	36
Table 24: Phase 1 Potable Water Supplier Evaluation Matrix	36
Table 25: Alternative 1 City of West Palm Beach System Operating Condition	42
Table 26: Pipeline Replacement Status – Franchise Agreement.....	44
Table 27: 2015 Critical Pipeline Replacement Per 2015 Master Plan.....	44
Table 28: Alternative 1 Conceptual Order of Magnitude Opinion of Capital Costs	45
Table 29: Alternative 1 Construction Complexity	46
Table 30: Alternative 2A and 2B Water Treatment Recovery Rates.....	49
Table 31: Well Capacities and Finished Water Yield	50
Table 32: Alternative 2A and 2B Operating Conditions	52
Table 33: Alternative 2A and 2B System Improvements within the Town	56
Table 34: Alternative 2 Pipeline Replacement Needs - Franchise Agreement.....	56
Table 35: Alternative 3 Critical Pipeline Replacement Per 2015 Master Plan.....	57
Table 36: Alternative 2A Conceptual Order of Magnitude Capital Costs	58
Table 37: Alternative 2B Conceptual Order of Magnitude Capital Costs	58
Table 38: Alternative 2A Construction Complexity	61
Table 39: Alternative 2B Construction Complexity.....	61
Table 40: Alternative 3 PBCWUD Operating Conditions	65

Table 41: Alternative 3 System Improvements within the Town	67
Table 42: Franchise Agreement Pipeline Replacements	68
Table 43: Alternative 3 Critical Pipeline Replacement Per 2015 Master Plan	68
Table 44: Alternative 3 Conceptual Order of Magnitude Capital Costs	69
Table 45: Alternative 3 Construction Complexity	71
Table 46: Alternative 4 LWB System Improvements and Operating Conditions.....	75
Table 47: Alternative 4 System Improvements within the Town	77
Table 48: Alternative 4 Pipeline Replacement Needs, Franchise Agreement.....	78
Table 49: Alternative 4 2015 Critical Pipeline Replacement Per 2015 Master Plan	78
Table 50: Alternative 4 Conceptual Order of Magnitude Capital Costs	79
Table 51: Alternative 4 Construction Complexity	81
Table 52: Phase 2 Alternative Overview.....	83
Table 53: Phase 2 Alternative Overview.....	83
Table 54: Phipps Park Desalination Water Treatment Facility.....	91
Table 55: Phipps Park Zoning.....	93
Table 56: Distribution System Improvements to Maintain System Pressure	95
Table 57: Distribution System Improvements to Replace Aged Infrastructure	95
Table 58: Distribution System Improvements to Replace Critical Pipelines	97
Table 59: Phipps Park Opinion of Probable Construction Cost	99
Table 60: Capital and Utility Startup Cost Summary	100
Table 61: Summary of Operation and Maintenance Costs.....	101
Table 62: Summary of Assets Replacement Costs.....	101
Table 63: Summary of Desalination Facility at Phipps Park Cost per 1,000 Gallons.....	102
Table 64: Quadrille Membrane Treatment Facility	106
Table 65: Proposed Flagler Drive Distribution Piping.....	109
Table 66: Distribution System Improvements to Replace Aged Infrastructure	110
Table 67: Water Distribution Main Candidate Project's Details.....	111
Table 68: Quadrille Site Opinion of Probable Construction Costs	113
Table 69: Capital Utility Startup Cost Summary.....	113
Table 70: Summary of Operation and Maintenance Costs.....	114

Table 71: Summary of Asset Replacement Costs.....	115
Table 72: Summary of Membrane Facility at Quadrille Cost per 1,000 Gallons	115
Table 73: Distribution System Improvements to Replace Aged Infrastructure	117
Table 74: Water Distribution Candidate Project's Details	118
Table 75: Upgrade City Water Treatment Plant	120
Table 76: Capital and Utility Startup Cost Summary	120
Table 77: Capital Cost Summary	121
Table 78: Summary of Asset Replacement Costs.....	122
Table 79: Summary of City of West Palm Beach WTP Upgrade Cost per 1,000 Gallons.....	122
Table 80: Summary of Capital Costs and Utility Formation Costs	123
Table 81: Summary of Cost to Produce 1,000 Gallons	124

LIST OF FIGURES

Figure 1: Estimated Completion Durations of Selected Alternatives.....	6
Figure 2: Study Area Location Map.....	9
Figure 3: Existing Potable Water System	13
Figure 4: Water Distribution Main - Candidate Project Areas	17
Figure 5: Existing Hydraulic Model.....	18
Figure 6: Pipeline Crossings	22
Figure 7: Palm Beach County utility service areas, from 2018 LEC Water Supply Plan Update by SFWMD.	25
Figure 8: City of West Palm Beach Water Treatment Plant.....	27
Figure 9: PBCWUD Water Treatment Plants.....	28
Figure 10: City of Riviera Beach Water Treatment Plant.....	30
Figure 11: City of Lake Worth Beach WTP	31
Figure 12:Town of Manalapan Water Treatment Plant.....	33
Figure 13: Palm Beach Golf Course Water Suppliers	35
Figure 14: Contract Operations and Maintenance	38
Figure 15: Concession Contract.....	38
Figure 16: Private Ownership of Asset	39
Figure 17: Alternative 1 West Palm Beach	43

Figure 18: Alternative 2A Town Owned Floridan Aquifer Source.....	53
Figure 19: Alternative 2B Town Owned Seawater Source	54
Figure 20: Alternative 3 Palm Beach County	64
Figure 21: Existing LWB Water Treatment Plant to be Expanded in Capacity	74
Figure 22: Desalination Facility at Phipps Park Site Overview	88
Figure 23: Desalination Facility at Phipps Park WTP Site Plan	89
Figure 24: Par 3 Well Site Plan	90
Figure 25: Phipps Park Desalination Water Treatment Facility Building Layout.....	92
Figure 26: Class 1 Injection Well.....	94
Figure 27: Phipps Park Distribution Improvements	96
Figure 28: Membrane Treatment Facility at Quadrille Conceptual Layout	104
Figure 29: Piping Route from WPB WTP to Quadrille Site	105
Figure 30: Membrane Treatment Facility at Quadrille Site Plan	107
Figure 31: Membrane Treatment Facility at Quadrille Building Layout	108
Figure 32: Conceptual Implementation Schedule	126

APPENDICES

Appendix A – 1999 Franchise Agreement

Appendix B – Data Collection Summary

Appendix C – Select Tables from Inventory of City Facilities within the Town by Erdman Anthony, dated July 25, 2014

Appendix D – Select Figures and Tables from 2014 Brown and Caldwell Technical Memorandum

Appendix E – Correspondence and Meetings with Water Suppliers and Providers

EXECUTIVE SUMMARY

The Town is interested in exploring alternate options for providing potable water to the residents and business owners of the Town upon expiration of the current Retail Water Service and Franchise Agreement with the City of West Palm Beach, which will expire in 2029. Kimley-Horn was retained to perform a conceptual review of potential water supply options for both potable water and irrigation purposes. Water Supply options that were identified and explored include the following:

- Continue with a Retail Agreement with the City of West Palm Beach.
- Negotiate a Wholesale Agreement with the City of West Palm Beach.
- Negotiate a Wholesale Agreement with an alternative public water supplier.
- Develop a Town-owned water supply source.
- Enter into a Public-Private-Partnership with a private utility provider.
- Consider a combination of the above-mentioned water supply options as potential additional alternatives.

An approach was developed to perform the study in three phases.

Phase 1: Identification and Overview of Potential Alternative Potable Water Service and Utility Providers (Sections 3 & 4)

The first phase focused on data collection, establishing the hydraulic baseline to define the Town's existing level of service, and identification of potential water suppliers. A review of the City of West Palm Beach's hydraulic model was performed, and the Town's current level of service (LOS) is provided in **Table 1** below and defined based on the existing model results.

Parameter	Existing System
Maximum Day Demand (MDD) Model Output	6,900 gpm (approx.) 9.93 MGD
Town of Palm Beach Average Pressure	72 psi

The list of potential municipal water suppliers initially evaluated included:

1. City of West Palm Beach
2. Palm Beach County Water Utilities Department
3. City of Riviera Beach
4. City of Lake Worth Beach
5. Town of Manalapan

The current Agreement with the City can be defined as a Retail Service Agreement. In a Retail Service Agreement, the water supplier is responsible for operations, maintenance, and administration functions of the utility, including the distribution systems for which they serve. This means that the water customers in the Town are direct customers of the City of West Palm Beach. For all alternative municipal water supply options we evaluated, except the City of West Palm Beach, the Town would be required to enter into a bulk customer agreement for the Town's residents and business owners to receive potable and irrigation water. If the Town were to execute an alternative agreement to the current Franchise Agreement with the City, the

potable water assets (i.e., the distribution system infrastructure) within the Town would be conveyed to the Town and the Town would own these assets. Under any scenario other than the City of West Palm Beach and City of Lake Worth Beach, decisions would need to be made regarding how the Town would provide operations, maintenance, and administration services needed to operate and maintain the potable water distribution system, including customer service and billing.

In lieu of establishing a Town potable water utility, there are utility provider opportunities that the Town would be able to access when considering Public Private Partnership (P3). A P3 is a feasible solution for public municipalities to access the benefits of the water system operation and maintenance from a private provider with varying amounts of ownership, financing, and risk factors. The P3 model has several types of agreements including:

Contract Operations and Maintenance

Design Build Finance Operate (DBFO) Concessions

Private Ownership of Asset

Phase 1 of the study provided an overview of the various P3 options to consider, if the Town were to move forward with any of the bulk supply alternatives. We met with three private utility companies and found each were most interested in assisting the Town with setting up a utility if they were to decide to enter into a bulk agreement or decide to build their own water supply. There was no private utility nearby that had the ability to provide water similar to the local municipal water suppliers. The conclusion to the first phase included a review meeting with Town staff and a short list of water supply alternatives to evaluate further in the second phase the study.

Considerations for preliminary screening include the complexity and regional impact associated with modifying the potable water allocation to serve the Town. Additionally, alternative water suppliers that do not appear to have the ability to satisfy 100% of the Town's requirements were not further evaluated as these options would pose additional complexities to the process and will create an environment where multiple providers with different service arrangements and rates would need to be established for various geographic areas in Town.

Phase 2: Evaluation of Alternatives (Section 5)

The following alternatives were identified to further evaluate as part of the second phase of the study:

Alternative 1 - City of West Palm Beach Utilities

Alternative 2A and 2B - Town of Palm Beach developed and owned water supply system

Alternative 3 - Palm Beach County Water Utilities

Alternative 4 - City of Lake Worth Beach Utilities

Each of the four alternatives were evaluated to meet the Town's existing level of service. Each alternative included an evaluation of system improvements and capital costs that would be required to provide service to the Town. Additionally, each alternative included a qualitative evaluation of water supply security, water supply permitting complexity, construction complexity, operational complexity, system reliability, land acquisition requirements, permitting complexity, and stakeholder considerations. Following the evaluation each of the four alternatives were found to be viable water suppliers and with the improvements identified in the study each can supply potable water while maintaining the current level of service within the Town.

An overview of each of the Alternatives is provided in **Tables 2 and 3**.

Table 2: Alternative Overview						
Alternative	Description	Capital Costs ¹ Pipeline Replacements ²	Capital Costs ¹ Interconnects and Town Distribution Improvements	Capital Costs ¹ Water Treatment Improvements	Connection Fees	Total
1	City of West Palm Beach	\$47M – \$70M	\$0	\$0	\$0	\$47M – \$70M
2A	Town Owned Supply - Groundwater	\$22M – \$32M	\$101M to \$151M	\$188M – \$281M	\$0	\$311M – \$464M
2B	Town Owned Supply - Seawater	\$22M – \$32M	\$96M to \$144M	\$198M – \$298M	\$0	\$316M – \$474M
3	Palm Beach County	\$22M – \$32M	\$135M - \$202M	\$0	\$209M ³	\$366M – \$443M
4	City of Lake Worth Beach	\$21M – \$32M	\$111M to \$166M	\$131M – \$197M	\$0 ⁴	\$263M – \$395M

1. Class 5 “Order of Magnitude” conceptual opinion of probable costs.
2. Pipeline Improvement per Franchise Agreement and Critical Pipeline Improvements per the Master Plan
3. Connection/Capacity Fees based on the Town’s water use converted to an equivalent residential unit consumption.
4. The capital cost for the treatment improvement was used in lieu of the Lake Worth Beach connection /capacity fees.

Table 3: Alternative Overview									
Alt	Desc	Town Developed Utility Required	Water Supply Security	Water Supply Permitting Complexity	Construction Complexity	Operational Complexity and System Reliability	Land Acquisition	Permitting Complexity	Stakeholder Coordination
1	City of West Palm Beach	Retail – No Bulk - Yes	Moderate	None – Already Permitted	Low	Low / High	Low	Low	Low
2A	Town Owned Supply - Groundwater	Yes	High	High	High	High / High	Moderate	High	Moderate
2B	Town Owned Supply - Seawater	Yes	High	High	High	High / High	Moderate	High	Moderate
3	Palm Beach County	Yes	Moderate - High	Moderate	High	High / Moderate	High	High	High
4	City of Lake Worth Beach	Retail – No Bulk - Yes	Moderate - High	High	High	Low / Moderate	High	High	High

Building upon the Phase 2 findings, the Town requested that a third Phase of the analysis be performed to continue assisting the Town through the decision-making process as they consider the results of the study.

Phase 3: Further Evaluation of Alternatives (Section 6)

Additional detailed investigations were performed as Phase 3 of this study. The following three select alternatives were further developed to gain a deeper understanding of the project components and the associated impacts if implemented:

- **Evaluation of Desalination Facility at Phipps Park Detailed Site Evaluation (Section 6.1).**
- **Evaluation of Membrane Treatment Facility at Quadrille Site Evaluation (Section 6.2)**
- **Partnership with the City of West Palm Beach to Phase in Membrane Treatment (Section 6.3)**

The purpose of the Phase 3 additional detailed investigations is to support an economic evaluation of select alternatives. The economic evaluation considers costs associated with capital infrastructure improvements including raw water supply, treatment, and distribution system improvements. For some of the alternatives, utility formation costs are also considered, as the Town will be required to establish a water utility for two of the options discussed below. Additional costs to be considered in the economic analysis include operation, maintenance, and administration associated with the raw water, potable treatment, and distribution systems. Additional costs considered in the economic evaluation include costs associated with an asset renewal program, which would provide replacement costs associated with renewal of the existing pipelines and proposed treatment facility assets.

For the alternative where bulk water is purchased from the City, costs associated with the purchase of the water were assumed and included.

	10 MGD Desalination Treatment Facility at Phipps Park		10 MGD Membrane Treatment Facility at Quadrille		47 MGD City of West Palm Beach Upgrade	
	Low	High	Low	High	Low	High
Capital Cost	\$351M	\$526M	\$268M	\$402M	\$547M	\$821M
Utility Formation	\$1M	\$3M	\$1M	\$3M	NA	NA
Subtotal Capital Cost and Utility Formation	\$352M	\$529M	\$269M	\$405M	\$547M	\$821M

Table 5: Summary of Cost to Produce 1,000 Gallons								
	10 MGD Desalination Treatment Facility at Phipps Park		10 MGD Membrane Treatment Facility at Quadrille		47 MGD City of West Palm Beach Phased Upgrade		47 MGD City of West Palm Beach One Program Upgrade	
	Low	High	Low	High	Low	High	Low	High
Capital Cost	\$5.34	\$8.03	\$4.08	\$6.14	\$2.96	\$4.43	\$2.02	\$3.02
Plant O&M	\$3.78	\$3.78	\$2.32	\$2.32	\$5.73	\$5.73	\$5.73	\$5.73
Distribution O&M	\$0.50	\$0.50	\$0.55	\$0.55				
Pipeline Renewal Program- 75-years	\$2.29	\$2.29	\$2.78	\$2.78	\$2.25	\$2.25	\$2.25	\$2.25
Treatment Plant Renewal Program- 50-years	\$1.60	\$1.60	\$1.03	\$1.03	\$0.93	\$0.93	\$0.93	\$0.93
Bulk Water Purchase	NA	NA	\$3.81	\$3.81	NA	NA	NA	NA
Total \$/ 1,000 gal	\$13.50	\$16.20	\$14.58	\$16.64	\$11.87	\$13.35	\$10.93	\$11.93

The Town’s current franchise agreement expires in 2029, and it is important to understand the timeframes required to implement these three options. An evaluation of a conceptual implementation schedule of the **Section 6** alternatives is provided in **Figure 1** below.

Alternate	Task/Activity	Duration (Months)	Duration (Quarters)	2023				2024				2025				2026				2027				2028				2029				2030				2031			
				1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
General	Preliminary Design and Field Investigations	12	4	■	■	■	■																																
	Consumptive Use and Wellhead Permitting	12	4			■	■	■	■																														
	Deep Injection Well Design and Permitting	12	4					■	■	■	■																												
	Membrane Water Treatment Facility Design and Permitting	15	5					■	■	■	■	■																											
	Water Distribution System Design and Permitting	24	8					■	■	■	■	■	■	■																									
Seawater Supply at Phipps Park	Seawater Wellfield Development	42	14			■	■	■	■	■	■	■	■	■																									
	Seawater RO Water Treatment Facility Construction	36	12					■	■	■	■	■	■	■																									
	Town Water Distribution System Construction	72	24									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
	Deep Injection Well Construction	30	10									■	■	■	■	■	■	■	■	■	■	■																	
WPB Supply Re-Treat at Quadri	Quadri Membrane Water Treatment Facility Construction	42	14									■	■	■	■	■	■	■	■	■	■	■																	
	West Palm Beach Water Distribution System Construction	60	20									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
	Deep Injection Well Construction	30	10									■	■	■	■	■	■	■	■	■	■	■																	
Upgrade WPB WTP Treatment	West Palm WTP Membrane Water Treatment Facility Construction	36	12					■	■	■	■	■	■	■																									
	Deep Injection Well Construction	30	10									■	■	■	■	■	■	■	■	■	■	■																	

Figure 1: Estimated Completion Durations of Selected Alternatives

Each of the alternatives were developed to meet the Town’s existing level of service for water supply. Each alternative included system improvements and capital costs that would be required to provide water service to residents of the Town. An economic evaluation was completed to further evaluate the alternatives in terms of cost to produce 1,000 gallons of water to allow each alternative to be compared to each other. Additionally, each alternative included an analysis of near-term and long-term impacts to the community. Following the evaluation, each of the three alternatives were found to be viable water supply options that can supply potable water while maintaining the current level of service within the Town. The estimated construction duration for each of the three alternatives indicates the Desalination Water Plant at Phipps Park and the Membrane Treatment Plant at Quadri could require an extension of the current franchise agreement with the City. Each of the alternatives is technically possible and the relevant regulations allow permits to be issued for their construction. Each of the alternatives offer somewhat different benefits to the Town.

1 INTRODUCTION

1.1 BACKGROUND

The Town of Palm Beach (Town) receives potable water service from the City of West Palm Beach (City), who currently owns and operates a potable water supply system which supplies water to the City and South Palm Beach. Potable water service is provided to the Town and its residents by the City pursuant to a 30-year Franchise Agreement executed in 1999 (**Appendix A**). The general location map is provided in **Figure 2**. According to this agreement, the City owns and maintains all the water infrastructure facilities throughout the Town. The Town is interested in exploring alternate options for providing potable water to the residents of the Town upon expiration of the current Retail Water Service and Franchise Agreement with the City, which will expire in 2029.

Kimley-Horn was retained to perform a conceptual review of potential water supply options currently being considered by the Town for potable water purposes, which includes both potable water and irrigation use. The Town of Palm Beach desires to receive their potable water supply from a single supplier, as opposed to obtaining multiple water supply agreements. Potential water supply options currently being considered include the following:

1. Continue with a Retail Agreement with the City of West Palm Beach.
2. Negotiate a Wholesale Agreement with the City of West Palm Beach.
3. Negotiate a Wholesale Agreement with an alternative public water supplier.
4. Develop a Town-owned water supply source.
5. Enter into a Public-Private-Partnership with a private utility provider.

1.2 APPROACH

This study was performed in three (3) phases as follows:

Phase 1: Identification and Overview of Potential Alternative Potable Water Service and Utility Providers (Section 4)

1. The collection of data necessary to perform analysis.
2. The establishment of the hydraulic baseline for evaluation of the Town's potable water system and potential potable water supply alternatives.
3. The identification of several potential water supply alternatives.
4. The preliminary screening and identification of four (4) potable water supply alternatives to be evaluated in Phase 2.

Phase 2: Evaluation of Alternatives (Section 5)

Upon completion of the first phase, a meeting was held with Town staff to discuss the preliminary identification of potable alternatives and a shortlist of four (4) alternatives was identified to further screen as part of Phase 2 of this study. The Phase 2 effort includes evaluation of technical feasibility of each alternative. Phase 2 comprised of the following efforts:

1. Development of planning scenarios for each alternative and performing a hydraulic analysis to determine required improvements, such as water main upgrades, storage requirements, and re-pumping facilities that would be required for each alternative.

2. Development of Class 5 “Order of Magnitude” opinion of probable costs for the water system modifications required for each alternative.
3. Identification of advantages and disadvantages of each alternative.
4. Presentation of findings to Town staff.

Phase 3: Further Evaluation of Alternatives (Section 6)

Upon completion of the second phase, a meeting was held with Town staff to discuss the evaluation of four (4) alternatives. The City then requested Kimley-Horn to expand the scope of the analysis to further refine one of the previously identified potential water supply options, review the feasibility of two additional water supply options, and perform a cost analysis that provides a comparative basis in terms of cost per 1,000 gallons of water treated.

Town of Palm Beach Water Supply Assessment

Study Area Map

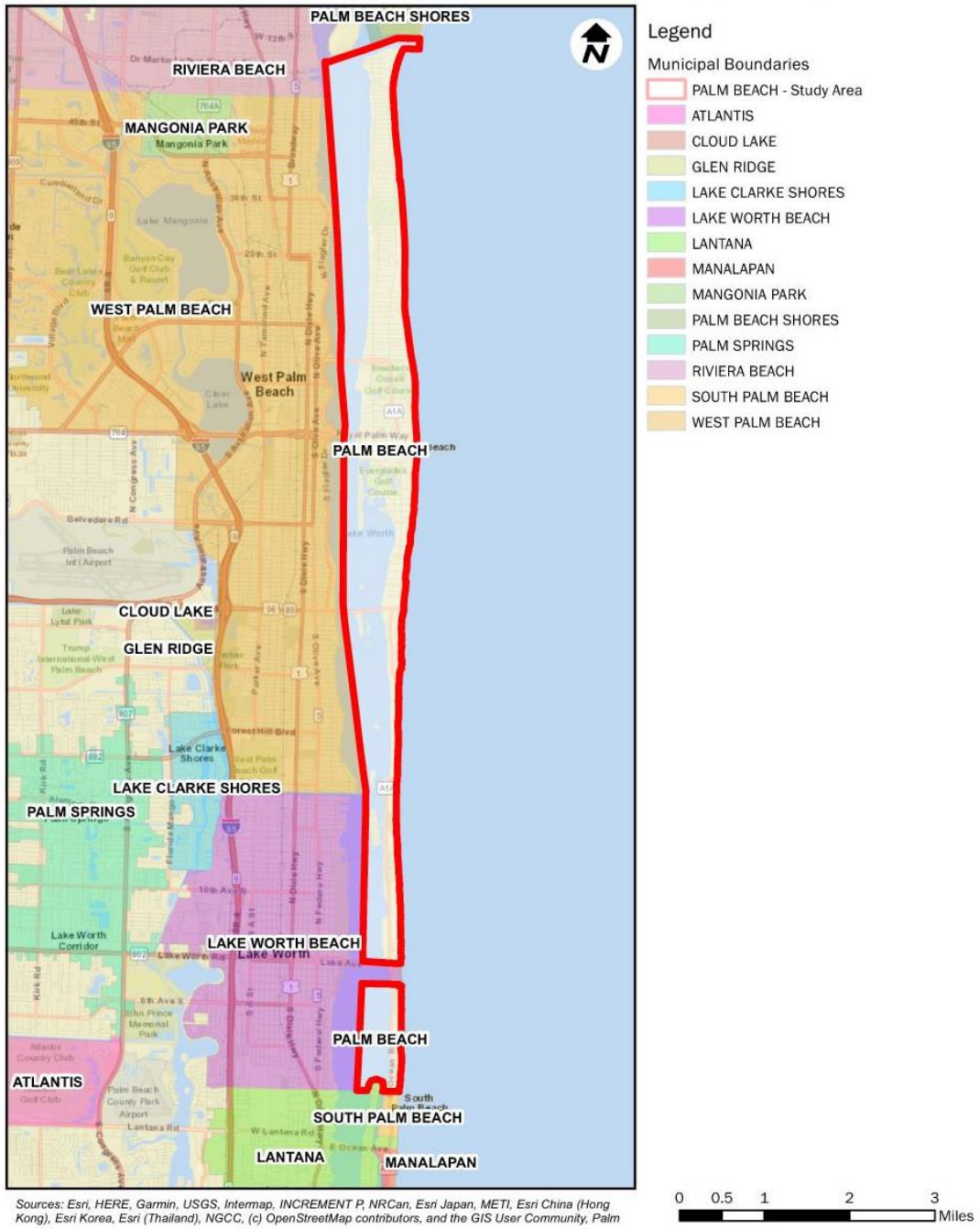


Figure 2: Study Area Location Map

1.3 PURPOSE

The purpose of this report is to provide a summary of Phase one and Phase two efforts associated with this study including a summary of each of the alternatives evaluated, advantages, disadvantages, the capital improvements required to implement each alternative and the Class 5 “Order of Magnitude” cost estimate for each alternative.

The objective of this study is to identify feasible alternative water supply options and identify the Class 5 “Order of Magnitude” costs associated with each alternative. This study does not address operational, maintenance, and administration costs for each alternative. Additionally, this study does not determine the impact that each alternative has on the customers, in terms of retail or bulk rates. Should the Town determine to proceed with further investigation of any or all of the alternatives discussed herein, additional analysis and discussions will need to be had with the corresponding water providers to determine the impact that any alternative has on the rate payer and a formal rate study will likely be required.

2 AVAILABLE INFORMATION

Historically, the Town has given great consideration to water supply alternatives and options. In the past, numerous reports, studies, data collection efforts, etc. have been undertaken to evaluate the issue of water supply. To the extent possible, this evaluation has incorporated the information available from those past efforts, which has been reviewed and/or updated for current-day conditions. A summary of the information made available by the Town is presented in **Appendix B**. In addition, the following documents were obtained from various sources and reviewed by Kimley-Horn as part of this analysis:

1. West Palm Beach Franchise Agreement
2. South Florida Water Management District (SFWMD) Water Use Permits (WUP) for the following entities:
 - a. City of West Palm Beach
 - b. Palm Beach County Water Utilities Department
 - c. City of Riviera Beach
 - d. City of Lake Worth Beach
 - e. Town of Manalapan
 - f. The Breakers Palm Beach (Golf Course)
 - g. Palm Beach Country Club (Golf Course)
 - h. Palm Beach Par 3 (Golf Course)
 - i. The Everglades Club (Golf Course)
3. 2019 Water Quality Report, City of West Palm Beach
4. Applicable Florida Department of Environmental Protection Permit (FDEP) documentation for neighboring utilities.
5. Applicable FDEP permitting requirements.
6. Applicable Chapters of the Florida Administrative Code and Sections of the Florida Statutes.
7. Applicable/available data related to private utility providers

Additionally, several meetings and correspondence with potential alternative water suppliers were held. Detailed discussions of these meetings are provided in **Section 4** of this Technical Memorandum. Information provided by alternative water suppliers to support this evaluation include the following:

- City of Riviera Beach Water System GIS files
- City of Lake Worth Water System GIS files

3 EVALUATION OF EXISTING SYSTEM

3.1 DESCRIPTION OF EXISTING SYSTEM

The Town has an estimated average population of approximately 8,800 residents; however, seasonal populations can be as high as 25,000 residents (inclusive of permanent residents). The Town spans approximately 8 miles, north to south, and is primarily less than ¼ - mile wide (east to west) with a few areas of exception.

Residents receive water supply through the aforementioned Franchise Agreement with the City. There are approximately 3,411 total water accounts in the City’s system attributed to Town residents (including 290 dedicated irrigation accounts). There are an additional 52 total water accounts attributed to the Town of South Palm Beach (including 3 dedicated irrigation accounts).

According to the 2014, “Inventory of City of West Palm Beach Water Facilities in the Town of Palm Beach” prepared by Erdman Anthony, the City’s water supply infrastructure is comprised of approximately 384,000 linear feet (72 miles) of distribution pipelines of varying diameters and material. Additionally, the Town’s potable water distribution system contains a Booster Pumping Station at Phipps Ocean Park and a 1.0 million-gallon (MG) ground storage tank and repump station located at the corner of Slope Trail and Country Club Road.

The City provides potable water to the Town through five (5) pipeline crossings of the Intracoastal Waterway. The City also serves the community of South Palm Beach which is conveyed through the infrastructure located within in the Town prior to entering the South Palm Beach service area. The City’s water distribution system and the limits of the Town study area is shown on **Figure 3**.

3.2 HISTORICAL WATER DEMAND

Two sources were evaluated to identify the Town’s historical water usage including:

- 2017 – 2019 customer billing data provided by the City
- 2015 City of West Palm Beach Water and Wastewater Master Plan (2015 Master Plan)

These annual average demands are listed in **Table 6** below.

Demand Source	Total Demand (Million Gallons per Day (MGD))	Town of Palm Beach Demand (MGD)	Town of South Palm Beach Demand (MGD)
Billing Data (Average 2017-2019)	7.87	7.53	0.34
2015 Master Plan – 2020 Projection*	8.45	8.13	0.32

*calculation for 2020 from the projection of 2015 and 2025 demands

Town of Palm Beach
Water Supply Assessment

Water Distribution Map

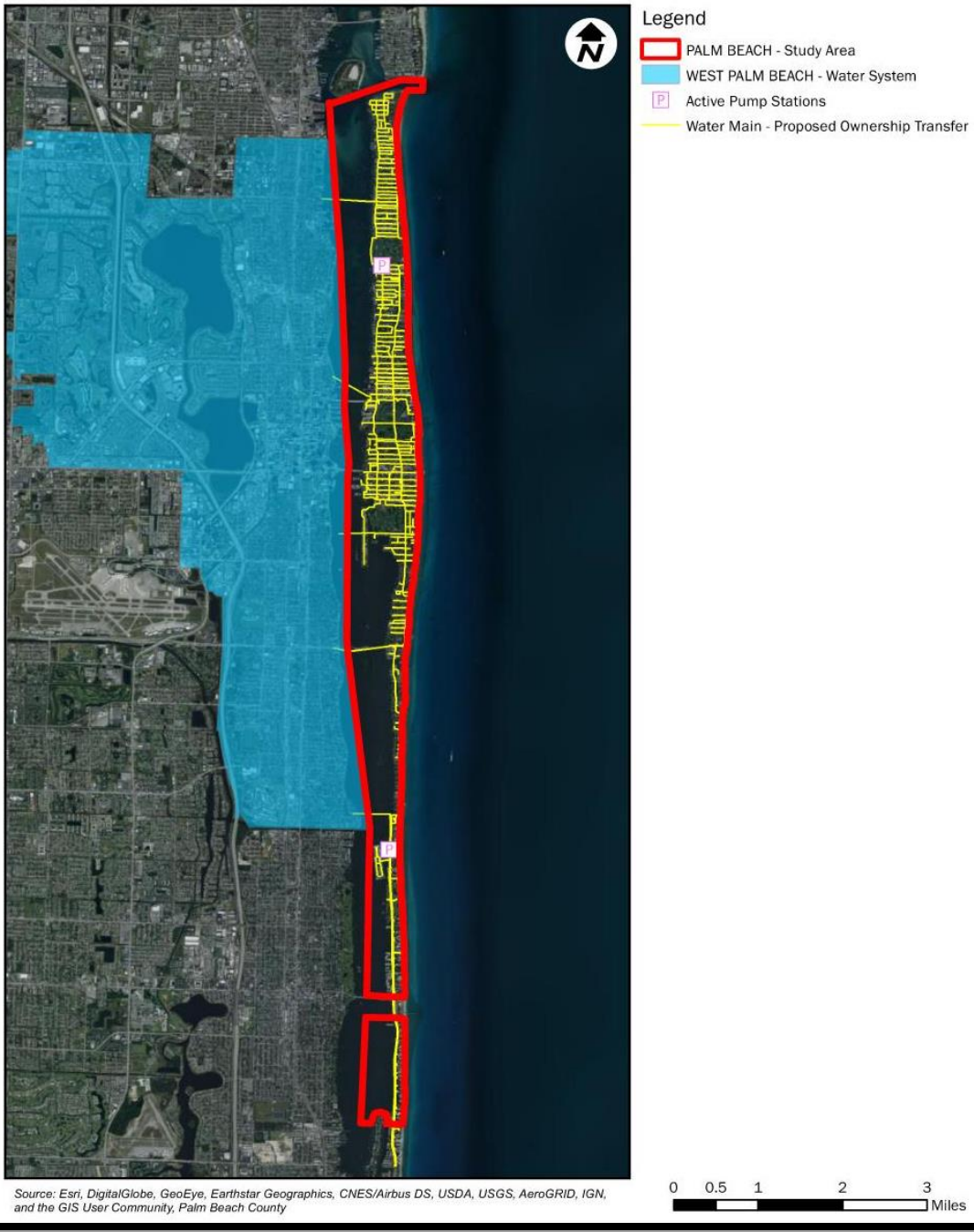


Figure 3: Existing Potable Water System

Historical billing data suggest that the average day demand for the Town for the period 2017 to 2019 is reported to be 7.53 MGD. The 2015 Master Plan projected the 2020 average day demand to be 8.45 MGD. For the purpose of this evaluation, our analysis will assume the existing condition and baseline annual average day demand is 8.45 MGD in accordance with the City’s 2015 Master Plan. This is slightly higher than the billing data suggests; however, if utilized for planning purposes, it provides a conservative approach to evaluating future alternatives.

3.3 PER CAPITA WATER USE

A summary of the estimated per capita water use in gallons per capita per day (gpcd) for the customers within the Town was identified within the 2015 Master Plan, as well as the Water Use Permit (WUP 50-00615). A summary of the estimated per capita use is provided below in **Table 7**.

Source Document	Water Service Area	Per Capita Demand (gpcd)
2015 Master Plan Average Day Per Capita Demand Rates	West of the Turnpike	144
	I-95 to Turnpike	182
	East of I-95	176
	Town of Palm Beach	899
	Town of South Palm Beach	252
	Composite for Water Service Area	229
WUP 50-00615-W Average Day Per Capita Demand Rates	City of West Palm Beach and Unincorporated Palm Beach County	185
	Town of South Palm Beach	285
	Town of Palm Beach	997
	City of West Palm Beach Public Utilities Average	272

The per capita water usage for the Town residents is reported in the 2015 Master Plan and is estimated to be 899 gpcd. The per capita water usage, as reported in the City’s Water Use Permit, is 997 gpcd. The Water Use Permit estimate accounts for water use, as well as non-revenue generating activities, such as water loss and hydrant flushing.

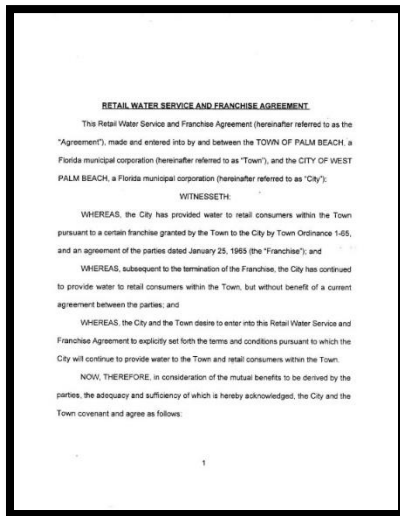
In both cases, the Town’s per capita water usage is significantly higher than the City’s remaining service area. The City’s composite potable water demand (including customers within the town) is 229 gpcd. The Town’s water use has historically been higher due to irrigation needs and property size. Irrigation demands are met with the potable water provided by the City. Irrigation wells within the Town are not feasible.

3.4 EXISTING CONDITION OF INFRASTRUCTURE

The following reports were reviewed, as they provide historical documentation of the condition of the City's potable water system, including the Town's system.

- Retail Water Service and Franchise Agreement Between the Town and the City, June 23, 1999
- Inventory of City facilities within the Town by Erdman Anthony, July 25, 2014
- City's Utility Master Plan Water Distribution System Criticality Assessment Technical Memorandum by Brown and Caldwell, May 8, 2014

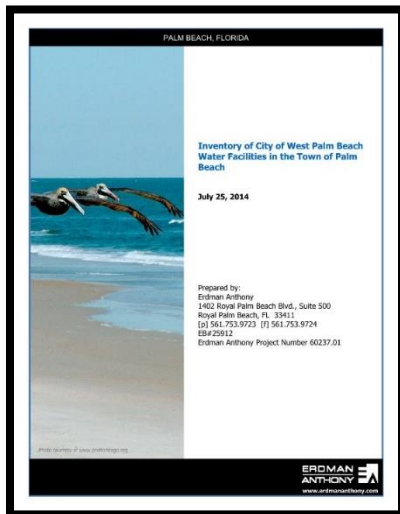
3.4.1 FRANCHISE AGREEMENT



The 1999 Franchise Agreement between the Town and the City listed 84 projects to be completed by the City by 2004. These projects address the needs of the aging infrastructure. The Franchise Agreement states the projects total approximately 102,640 linear feet of pipe and funding for these projects was capped at \$18,000,000 (in 1999).

The Franchise Agreement also requires that the Town provide written notice of the Town's intent to extend the terms of the agreement or any renewal term, at least two years prior to the expiration of the initial term. Therefore, notification to the City regarding the Town's intent to renew, alter, or terminate the agreement is required by October 1, 2027.

3.4.2 INVENTORY OF CITY FACILITIES



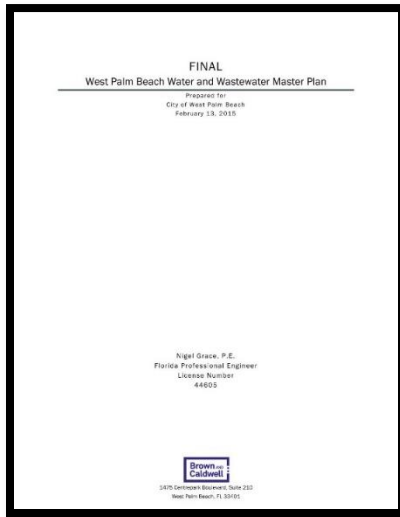
In 2014, the Town commissioned a report to provide an inventory of the water facilities within the Town and a priority listing of water projects that should be undertaken. The study, *Inventory of City of West Palm Beach Water Facilities in The Town of Palm Beach* by Erdman Anthony was completed as a draft in July 25, 2014. The report found that the Town has approximately 384,000 linear feet of pipe, which was evaluated based on size, age, and material.

The tables of the report detail the findings as it relates to the progress of the 1999 Franchise Agreement projects and additional projects prioritized based on condition and location to Capital Improvement Program (CIP) roadway projects. See **Appendix C** for select tables from the report.

The report determined the approximate 67% of the Franchise Agreement projects were completed at the time of the study. Of the remaining approximately 37,000 linear feet of pipeline improvements, the report indicated that the City had plans for approximately 15,000 of pipeline improvements to be completed by 2016.

Additional water distribution improvement projects that have been completed within the limits of the Town include the rehabilitation of the two pump stations. The Phipps Booster Pump Station was improved in 2011 and the Palm Beach Repump station was improved in 2015.

3.4.3 2015 UTILITY MASTER PLAN



The City completed a Utility Master Plan in 2015. The Utility Master Plan included a criticality assessment for all infrastructure within the City’s potable water system, including the Town. The full assessment is detailed in the City of West Palm Beach Utility Master Plan Water Distribution System Criticality Assessment Technical Memorandum by Brown and Caldwell, January 12, 2015. See **Appendix D** for select figures and tables from the Technical Memorandum. The criticality assessment identified an overall criticality score based on likelihood of failure and consequence of failure to the system’s water system piping. From this scoring, the Master Plan identified six critical pipelines within the Town including four water mains crossing the Intracoastal Waterway to the Town. These critical pipeline segments are identified by GIS water main asset ID and corresponding project areas that are comprised of one or more water main assets are illustrated in **Figure 4**. The specific details of the pipelines, including length of pipe, pipe material, and

likelihood of failure score are listed in **Table 8**.

Project Area	GIS Water Main Asset ID	Linear Feet (LF)	Likelihood of Failure Score	Total Risk Score	Pipe Diameter (inches)	Pipe Material	Install Date
WM4	WSP24790	859	195	35,490	16	CAS	1964
WM4	WSP24791	1462	215	32,680	16	CICL	1967
WM5	WSP30096	962	220	24,640	12	CAS	1950
WM7	WSP12603	6	215	21,070	8	AC	1972
WM7	WSP31599	25	215	21,070	8	AC	1972
WM7	WSP32451	3063	190	18,620	8	CICL	1972
WM12	WSP23657	3374	180	20,160	16	DIP	1950

After review of this information, it appears that the analysis performed as part of the 2015 Master Plan should be further validated. For example, one of the pipelines identified as critical and to be considered for replacement includes WM5, a 12-inch diameter water main referenced to be installed in 1950. This water main appears to be the same water main located on Country Club Road. Kimley-Horn designed the replacement of this line and it was constructed in 2004.

Town of Palm Beach
2015 Master Plan Water Distribution Areas

Water Distribution Map

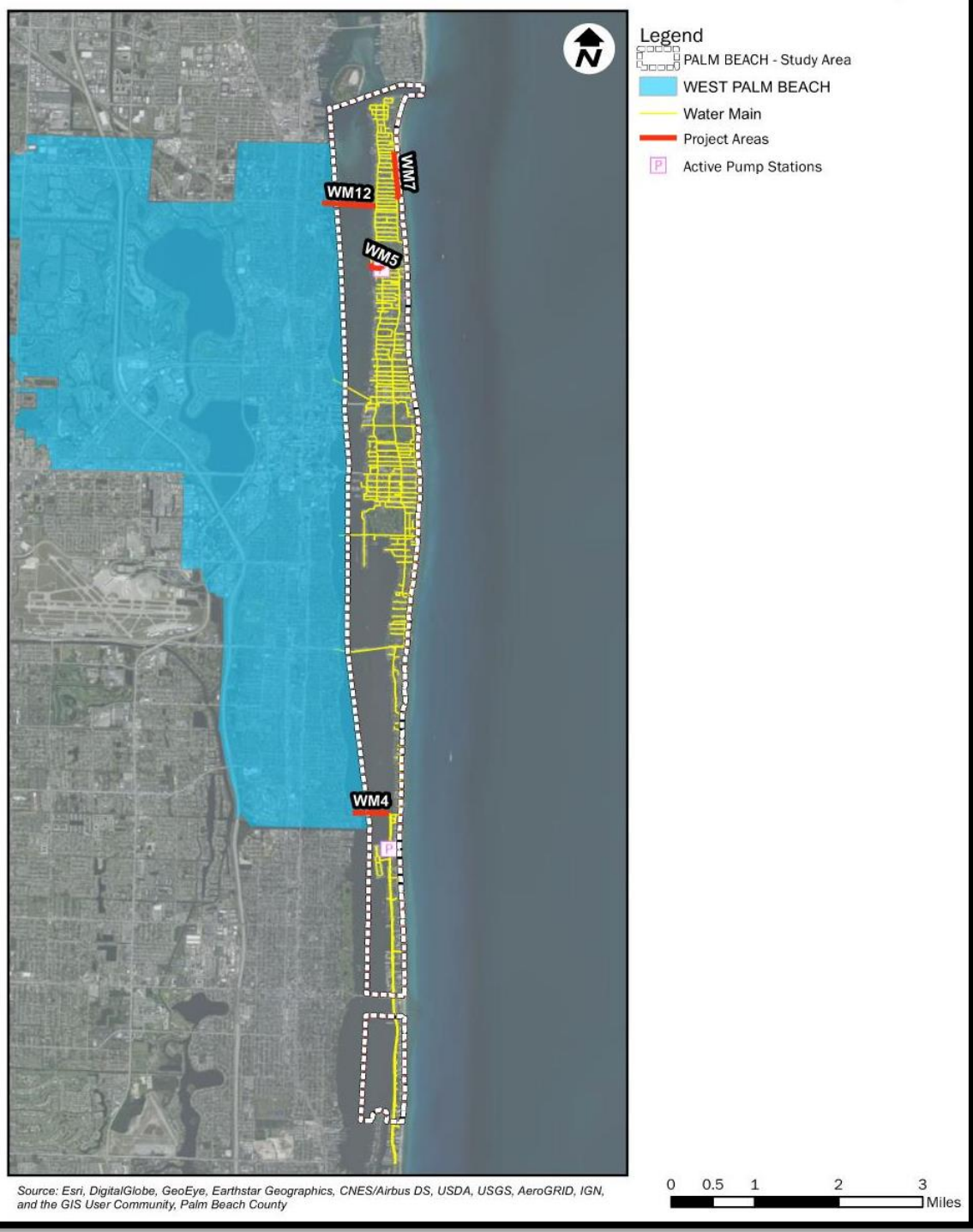


Figure 4: Water Distribution Main - Candidate Project Areas

3.4.4 EXISTING INFRASTRUCTURE CONDITION SUMMARY

A review of the available information on the condition of the existing infrastructure suggests that there are still pipelines within the Town that may be in need of repair and/or improvements since the establishment of the 1999 Franchise Agreement. However, the City has invested in improving several of the identified deficiencies since 1999 including rehabilitation of the two pump stations.

In addition to the overall maintenance needs, in the 2015 Master Plan, through a risk-based analysis, the City identified seven critical pipeline segments associated with four specific pipeline replacement projects that have high criticality score based on likelihood of failure and consequence of failure to the system's water system piping.

Each alternative evaluated considers the required rehabilitation/replacement needs for the water distributions system within the Town limits as well as any critical infrastructure identified in the 2015 Master Plan. An updated "Order of Magnitude" opinion of probable cost for the remaining pipeline replacements associated with the Franchise Agreement was developed for each alternative and is presented in **Section 5.2.2** of this report. Additionally, the potential cost related to the necessary pipeline replacement based on pipeline segment useful life and criticality will be evaluated. This cost will be relevant to maintaining a reliable system, regardless of what alternative water supply strategy is evaluated.

3.5 EXISTING HYDRAULIC MODEL

The existing potable water system serving the Town is included within the City's overall hydraulic model. The City provided their hydraulic model for use in this evaluation. The City's overall hydraulic model also includes the system serving the Town of South Palm Beach. For the purposes of this analysis the hydraulic model was reviewed from the Town's points of connection to the City's system. A review and summary of the portion of the existing hydraulic model serving the Town is provided herein. The data extracted from the existing system hydraulic model was compared to known operating data to validate that the hydraulic model is representative of the system serving the Town and can be used to evaluate alternative water supplies.

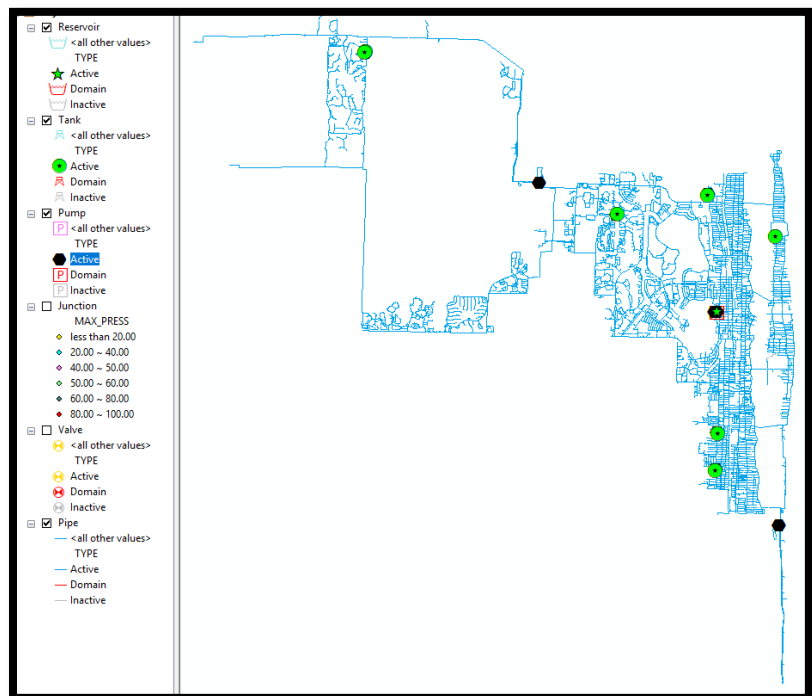


Figure 5: Existing Hydraulic Model

The existing hydraulic model for the Town's system includes:

- Water mains 2-inch diameter and greater;
- Five intracoastal pipeline crossings;
- Palm Beach Repump Station (2 pumps) and 1 MG storage;
- Phipps Ocean Park Booster Pump Station (2 pumps).

A snapshot of the entire existing hydraulic model is shown in **Figure 5** and **Table 9** provides a summary of the pipe inventory within the hydraulic model. The remainder of the hydraulic model discussion will focus on the Town's system for the purposes of this review and will terminate at the point of connection of the five intracoastal crossings on the mainland.

Table 9: Hydraulic Model Town System Pipe Summary	
Diameter (inches)	Length (LF)
2	1,518
2.5	10
3	294
4	23,034
6	79,156
8	138,471
10	6,057
12	96,945
16	35,168
20	13,770
24	3,782
Total	398,207

3.5.1 MODEL RESULTS

The model results provide a basis to compare existing water use information to determine if the model is reflective of existing conditions and if the model is a viable tool that can be used to evaluate alternative water supply strategies. Once the model is confirmed to be an accurate representation of existing conditions, additional model results can be extracted to determine the operating conditions the Town requires to maintain its existing level of service.

A multi-step process was utilized to validate the model including:

Demand - First, the demand for the Town was compared to existing demand data to validate the model to existing conditions.

Operating Pressure - The model results for flows and pressures were summarized as a range to determine the range of operating conditions of flow and pressure that the Town requires in a max day scenario.

Demand

The model demand results were extracted for the Town of Palm Beach and Town of South Palm Beach, this demand collectively represents the water that is delivered from the City through the intracoastal waterway pipeline crossings. The demands, as contained within the hydraulic model, for average day, max day, and peak hour for each of the Towns and the total of the Towns' demand that flows through the crossings are listed in **Table 10**.

Table 10: Hydraulic Model Existing Demand Summary				
Demand Type	Peak Factor	Total Demand (MGD)	Town of Palm Beach Demand (MGD)	Town of South Palm Beach Demand (MGD)
Average Day	-	8.34	8.07	0.27
Max Day	1.19	9.93	9.61	0.32
Peak Hour	1.73	14.43	13.93	0.50

A review of the model information in comparison with the 2015 Master Plan and 2017-2019 billing information is provide below in **Table 11**.

Table 11: Existing Annual Average Day Demand - Summary Comparison			
Demand Source	Total Demand (MGD)	Town of Palm Beach Demand (MGD)	Town of South Palm Beach Demand (MGD)
Hydraulic Model	8.34	8.07	0.27
Billing Data (Average 2017-2019)	7.87	7.53	0.34
2015 Master Plan – 2020 Projection*	8.45	8.13	0.32

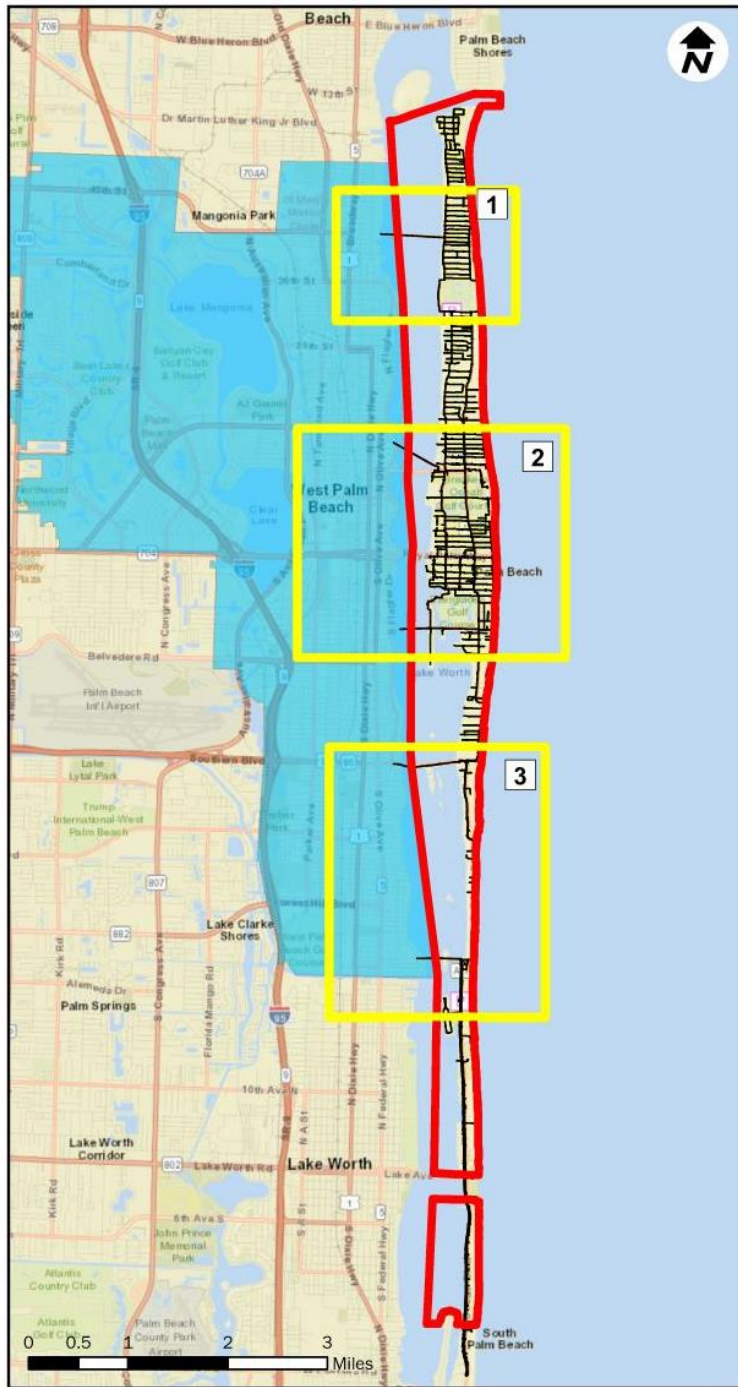
Operating Condition at Intracoastal Waterway Pipeline Crossings

The existing water source for the Town are the pipeline crossings that transmit water from the City's mainland system to the Town. There are five pipeline crossings varying in pipe size from 16-inch to 24-inch and pipe material, see **Table 12** for a detailed list of crossing location, diameter, and material. **Figure 6** shows the pipeline crossing locations within the existing system.

Table 12: Existing Water Source Summary				
Pipeline Crossing	Road Name	Pipe Diameter	Pipe Material*	Installation Year*
Crossing 1	Getter Park to N. Lake Way and Orange Grove Road	16"	DIP	1967
Crossing 2	1015 N. Flagler Dr. to Bradley Park	24"	HDPE	2011
Crossing 3	Barcelona Rd. to Island Rd. at Everglades Island	20"	CSU	1937
Crossing 4	Southern Blvd. (SR98/CR80) crosses along the Marjorie Merriweather Post Memorial Causeway between the City and TOPB	16"	HDPE/DIP	2017
Crossing 5	7619 S Flagler Drive to S. Ocean Blvd.	16"	CAS/CICL	1967
*Data source is City of West Palm Beach geodatabase				

Town of Palm Beach Water Supply Assessment

Water Distribution Water Crossings Map



- Legend**
- PALM BEACH - Study Area
 - WEST PALM BEACH
 - Active Pump Stations
 - Water Main - Proposed Ownership Transfer
- Water Main - Pipe Size**
- < 2"
 - 2 - 4"
 - 6 - 8"
 - 10 - 16"
 - > 20"



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Figure 6: Pipeline Crossings

For the purpose of gathering information about the existing water supply needs of the Town, the crossings are considered to be the boundary condition of the City’s potable water source. The model results, for the flow through and pressure within these crossings at the mainland connection point, was extracted from the model and is presented in **Table 13**.

Table 13: Existing System Max Day Model Results Summary						
Pipeline Crossing	Max Day Flow (gallons per minute (gpm))			Max Day Pressure (psi)		
	Avg.	Min.	Max.	Avg.	Min.	Max.
Crossing 1	1,139	3	2,004	77	59	91
Crossing 2	1,543	1,188	2,061	84	69	95
Crossing 3	2,121	1,595	3,388	81	66	94
Crossing 4	536	2	1,638	77	63	91
Crossing 5	1,558	1,017	2,498	76	62	91
Total Flow (gpm)	6,897		11,589			
System Operating Range (psi)				59-95 psi		

The model results provide a range of demand flows through each crossing and pressure at the point these crossing connect to the City’s mainland system. The maximum flow through each crossing creates velocity ranging from 1.5 feet per second (fps) in Crossing 2 to 4.0 fps in Crossing 5. The minimum pressure provided is 59 psi at Crossing 1 and the maximum pressure provided is 95 psi at Crossing 2.

Level of Service (LOS) – For the purposes of evaluating alternative water supply options, the current level of service is defined as the ability to provide the maximum day demand while maintaining the average system pressure across the Town as represented within the existing conditions model. **Table 14** provides a summary of the existing LOS. A hydraulic evaluation of each alternative was performed to determine system improvement needs required to maintain the existing level of service.

Table 14: Existing System LOS	
Parameter	Existing System
Maximum Day Demand (MDD)	6,900 gpm (approx.)
Model Output	9.93 MGD
Town of Palm Beach Average Pressure	72 psi

Fire Flow – The hydraulic model of the existing system within the Town also provides confirmation of the system’s ability to meet the MDD and fire flow requirements of 1,000 gpm. Under this scenario, the existing model results indicate that the Town’s distribution system not fall below a residual pressure of 20 psi under the fire flow scenario. For each alternative evaluated as a part of this study, fire flow scenario will be evaluated. For each alternative to be considered feasible, the scenario must meet or exceed the 20 psi residual pressure under a fire flow scenario.

Modeling Conclusions and Results

The basis of evaluation of water supply alternatives is the ability for a potential provider to deliver, at a minimum:

- Average Day Demand of 6,900 gpm (approximately)
- Peak Hour Demand 10,000 gpm (approximately)
- Operating Ranges 59-95 psi at 5 different crossings
- Average system pressure of 72 psi within the TOPB potable water system

Once potential alternative scenarios are identified, the model will be utilized to evaluate each alternative and potential improvements necessary, such as additional storage and booster pumping needs.

For each alternative water supply strategy evaluated, the hydraulic model will be used to determine the extent of infrastructure improvements required. Additional consideration may be required to address the demand distribution between the Town of Palm Beach and the Town of South Palm Beach within the model.