City of Apopka

Wastewater Treatment Plan

Wekiva and Rock Spring BMAP and Upper Ocklawaha BMAP

Prepared by:

City of Apopka Public Services Department

748 E Cleveland St.

Apopka Fl, 32703

407-703-1731

2023

1. Facility's Permitted Capacity: 8.0 MGD annual average daily flow treatment, 19.40 MGD annual average daily flow to Public Access Reuse
2. Facility's Permitted TN and TP Effluent limits
    a. TN: 10.0 mg/L
    b. TP: Report only
3. The annual TN and TP loads discharged from the facility over the past five years
    a. 2019: TN annual average 6.46mg/L, Annual Average daily Public Access Reuse flow 7.20MGD, Total Nitrogen average daily load 387.9lbs.
    b. 2019: TP annual average 2.73mg/L, Annual Average daily Public Access Reuse flow 7.20MGD, Total Phosphorus average daily load 163.9lbs.
    c. 2020: TN annual average 5.30mg/L, Annual Average daily Public Access Reuse flow 8.012MGD, Total Nitrogen average daily load 354.1lbs.
    d. 2020: TP annual average 3.29mg/L, Annual Average daily Public Access Reuse flow 8.012MGD, Total Phosphorus average daily load 219.8lbs.
    e. 2021: TN annual average 3.48mg/L, Annual Average daily Public Access Reuse flow 8.363MGD, Total Nitrogen average daily load 242.7lbs.
    f. 2021: TP annual average 2.97mg/L, Annual Average daily Public Access Reuse flow 8.363MGD, Total Phosphorus average daily load 207.1lbs.
    g. 2022: TN annual average 4.31mg/L, Annual Average daily Public Access Reuse flow 8.694MGD, Total Nitrogen average daily load 312.5lbs.
    h. 2022: TP annual average 3.04mg/L, Annual Average daily Public Access Reuse flow 8.694MGD, Total Phosphorus average daily load 220.4lbs.
    i. 2023: TN annual average 3.60mg/L, Annual Average daily Public Access Reuse flow 8.177MGD, Total Nitrogen average daily load 245.5lbs.
    j. 2023: TP annual average 3.20mg/L, Annual Average daily Public Access Reuse flow 8.177MGD, Total Phosphorus average daily load 218.23lbs.
4. A capacity analysis for the facility, considering future growth over the next 20 years: Please see attached analysis from Tetra Tech, completed in 2023. (Appendix 1 and 2)
5. A list and ranking of facility construction, expansion, or upgrades to meet applicable nutrient water quality requirements and estimated costs of these improvements. Please see attached (Appendix 1 and 2)
6. A projected timeline of the dates by which the construction of the projects listed in item 5 will be completed and the date by which operation of the improved facility will begin. Please See Attached (appendix 1 and 2)

Appendix 1

FLOW PROJECTIONS

Three (3) different methodologies were evaluated to project future wastewater and reclaimed water flows. This Section intends to select one (1) source of the three (3) flow projection approaches for each wastewater and reclaimed water, and thereby establish future flows which will be used in the WRF future capacity analysis from this Report and other evaluations the City will conduct in the near future. The different projection sources evaluated in this Report are summarized in **Table 5-1**.

Table 5-1. Flow Projection Source Summary

Flow Projection Source	Wastewater	Reclaimed Water
Utility Master Plan (Wright-Pierce, 2019)	X	X
Flow projections developed by the City	X	X
Flow projections developed in this Report (linear growth and percent increase)	X	
Reuse Water Balance Modeling Report (LSG, 2023)		X

MASTER PLAN FLOW PROJECTIONS

Based on a cursory review of the latest City's Wastewater and Reclaimed Water Master Plans (Wright-Pierce, 2019), the Master Plans were developed based on (1) historical wastewater / reclaimed water flows, (2) Bureau of Economics and Business Research (BEBR) population projections, (3) "fill-in" wastewater / reclaimed water demand, and (4) projected flow from planned developments. "Fill-in" projections refer to additional flows projected from existing developed areas which will expand to fill-in any available properties in the existing service area. **Table 5-2** provides a summary of the wastewater and reclaimed water flow projections as developed on their respective master plans.

The Wastewater Master Plan (Wright-Pierce, 2019) is provided in **Appendix E** and the Reclaimed Water Master Plan (Wright-Pierce, 2019) is provided in **Appendix F**.

Table 5-2. Projected Wastewater and Reclaimed Water Flow (Master Plan)

Year	Projected Wastewater Flow, MGD	Projected Reclaimed Water Flow, MGD
2017	3.37	6.51
2020	3.80	7.58
2025	4.75	9.92
2030	5.31	11.4
2035	5.75	12.5

CITY-DEVELOPED FLOW PROJECTIONS

To predict future wastewater flow, the City used recorded historical flow data for the time period between the years 2017 and 2022, as recorded by the influent flow meter, and known annual population for each year to estimate the average daily wastewater flow per person expressed as gallons per capita per day (gpcd). The average daily wastewater flow based on historical information was determined to be 84 gpcd and a projected annual increase of 1,137 residential units, based on BEBR's database, was used to predict the future wastewater production.

A similar concept was used to predict future reclaimed water flow; however, there are two main differences in the development of reclaimed water flow projections:

1. Reclaimed water consumption was projected separately for residential and commercial users, and the total reclaimed water was assumed to be the sum of the two sources.
2. Historical reclaimed water flow data was measured based off the billed gallons for each customer type (i.e., residential vs commercial).

Between 2017 and 2022, the average daily reclaimed water flow for residential customers was determined to be 191 gpcd and for commercial customers was determined to be 6,576 gallons per commercial unit

A copy of the City-developed wastewater and reclaimed water flow projections is provided in **Appendix G** and **Appendix H**, respectively.

Table 5-3 provides a summary of the wastewater and reclaimed water flow projections through the year 2045, as developed by the City, presented in 5-year increments.

Table 5-3. Projected Wastewater and Reclaimed Water Flow (City)

Year [1]	Projected Wastewater Flow, MGD	Projected Reclaimed Water Flow, MGD
2017	3.37	5.23
2018	3.37	5.27
2019	2.90	5.63
2020	2.96	6.10
2021	3.07	5.94
2022	3.20	5.91
2027	4.90	9.79
2032	6.20	12.9
2037	7.49	16.0
2042	8.79	19.2
2045	9.57	21.1

Notes:

[1] Data between 2017 and 2022 is actual recorded data. Data presented for future years is projected data.

WASTEWATER FLOW PROJECTIONS

Historical wastewater flow information as obtained from the DMRs was used to project future flows following the extrapolation estimation method. Historical data was used to assume an existing trend and predict future flows by extending the known series beyond the historical flows. **Table 5-4** summarizes the City's wastewater historical data as recorded in the DMRs between years 2012 and 2022.

Table 5-4. Historical Wastewater Flow

Year	Operating Plant	Flow Rate, MGD
2012	West Plant	2.63
2013	West Plant	2.79
2014	West Plant	2.95
2015	West Plant	3.11
2016	West Plant	3.22
2017	West Plant	3.37
2018	West Plant thru Oct.	3.50 [1]
2019	East Plant	2.90
2020	East Plant	2.96
2021	East Plant	3.08
2022	East Plant	3.20
2023	East Plant	3.25 [2]

Notes:

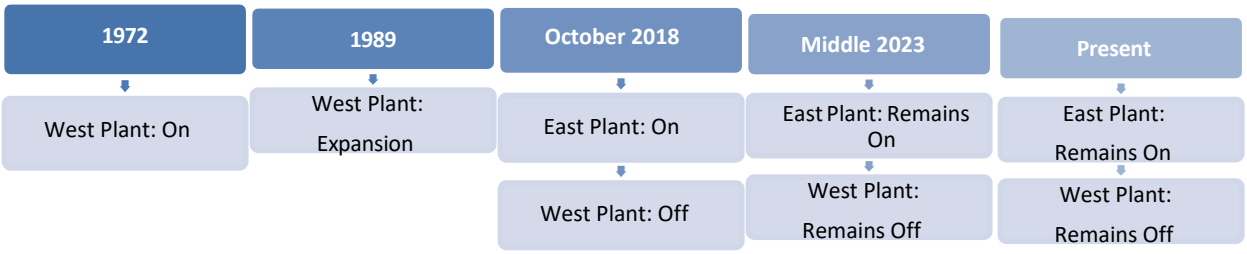
[1] Operations from the West Plant were transitioned to the East Plant in October 2018. Annual average flow for year 2018 excludes recorded data for November and December to avoid introducing a source of error from flow readings of two different flow meters.

[2] Includes flow data from January 2023 through August 2023, as available at the time of development of this Report.

Historical wastewater data recorded in the City's monitoring reports show a decrease in flow when operations were transitioned from the West Plant to the East Plant. With this change, a new influent flow meter was used to record influent wastewater flow, which is assumed to be the cause for the difference in flow before and after the East Plant was placed into operation.

Further, it was recognized in mid-2023 that the East Plant influent flow meter had an average deficit of approximately
0.80 MGD that resulted from signal issues in sending correct data to SCADA. Since then, the City has replaced the signal wire and fixed the scale as a corrective measure. However, historical data gathered at the East Plant before the influent meter was repaired is assumed to have a +0.80 MGD margin of error. It is assumed that signal issues caused erroneous influent flow readings at the East Plant from its startup in October 2018 through its repair in mid- 2023.

Figure 5-1. Timeline for the WRF operational timeline, inclusive of upgrades and expansions to the WRF.



Scenario 1: Uses a percent increase in flow developed based on *actual* historical wastewater flow.

Scenario 2: Uses a linear regression equation developed based on *adjusted* historical wastewater flow.

Scenario 1: Average Percent Increase

Scenario 1 was developed based on actual recorded historical data between years 2012 and 2022, and is intended to project future flows without modifying historical data to accommodate additional calibration flows. Historical data was used to determine the annual percent increase in flow by first obtaining the difference in flow between two consecutive years and then using that difference to calculate the percent increase compared to the second year. The percent change in flow from 2018 to 2019, the time the new influent flow meter was placed into service, was omitted in the percent increase analysis. **Table 5-5** summarizes the calculations completed to obtain the average annual percent increase in wastewater flow which will be used to project future flows under Scenario 1.

Year	Historical AADF, MGD	Flow Difference between 2-Consecutive Years, MGD	Annual Percent Increase, %
2012	2.63	--	--
2013	2.79	0.16	5.81%
2014	2.95	0.15	5.12%
2015	3.11	0.16	5.22%
2016	3.22	0.12	3.63%
2017	3.37	0.14	4.25%
2018	3.50 [1]	0.13	3.76%
2019	2.90	-- [2]	-- [2]
2020	2.96	0.06	1.94%
2021	3.08	0.12	3.88%
2022	3.20	0.12	3.76%
2023	3.25 [3]	0.05	1.58%
Average % Increase			4.15%

Notes:

[1] Excludes flow data from November and December 2018.

[2] Flow difference between 2018 and 2019 was not considered due to now recognized signal errors in the East Plant influent flow meter. It is assumed that the signal errors remained consistent through the flow meter repair in 2023 (i.e., 0.8 MGD); therefore, the annual increase in flow between 2019 and 2023 is assumed to be accurate.

[2] Includes flow data from January 2023 through August 2023, as available at the time of development of this Report.

Scenario 2: Linear Regression

Scenario 2 was developed based on adjusted historical data to account for additional flows that are assumed to be "unread" as a result of signal issues at the East Plant influent flow meter. Erroneous flow readings are assumed to have occurred between 2019 and 2023; consequently, flow data adjustment was only completed for that time period. **Table 5-6** presents the historical recorded wastewater flow data between 2012 and 2018 and the adjusted flow data between 2019 and 2023.

Table 5-6. Scenario 2 – Historical Adjusted Wastewater Flow

Year	Recorded Wastewater Flow	Additional Calibration Flow	Adjusted Wastewater Flow
2012	2.63	--	2.63
2013	2.79	--	2.79
2014	2.95	--	2.95
2015	3.11	--	3.11
2016	3.22	--	3.22
2017	3.37	--	3.37
2018	3.50 [1]	--	3.50
2019	2.90	0.80	3.70
2020	2.96	0.80	3.76
2021	3.08	0.80	3.88
2022	3.20	0.80	4.00
2023	3.25 [2]	0.80	4.15

Notes:

[1] Excludes flow data from November and December 2018.

[2] Includes flow data from January 2023 through August 2023, as available at the time of development of this Report.

Figure 5-2. Historical wastewater flow data adjusted where needed. Scenario 2 uses the linear regression equation provided in **Figure 5-2** to project future flows.

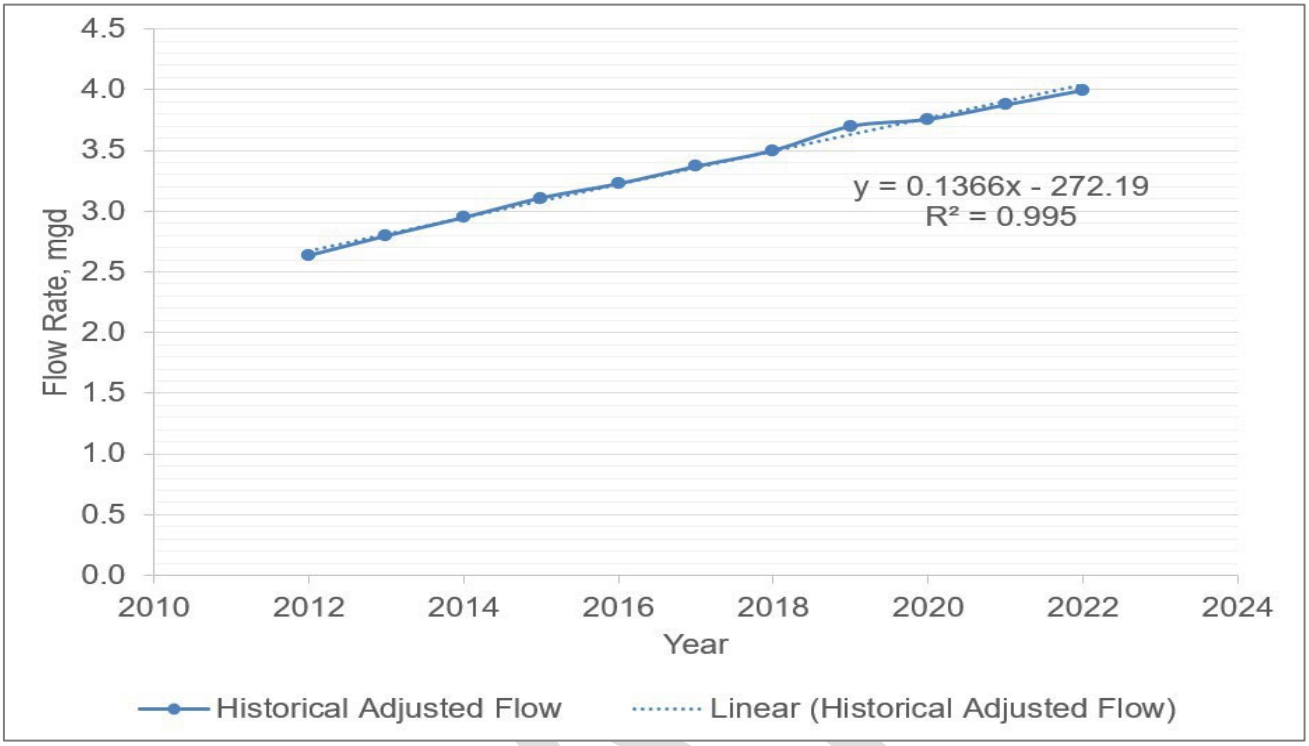


Figure 5-2. Historical Adjusted Wastewater Flow

Extrapolation Analysis Summary

Table 5-7 summarizes the wastewater flow projections developed for Scenarios 1 and 2.

Table 5-7. Projected Wastewater and Reclaimed Water Flow (Extrapolation Analysis)

Year [1]	Scenario 1	Scenario 2
2012	2.63	2.63
2013	2.79	2.79
2014	2.95	2.95
2015	3.11	3.11
2016	3.22	3.22
2017	3.37	3.37
2018	3.50 [2]	3.50 [2]
2019	2.90	3.70
2020	2.96	3.76
2021	3.08	3.88
2022	3.20	4.00
2023	3.25 [3]	4.15 [3]
2024	3.37	4.29
2025	3.50	4.43
2030	4.24	5.11
2035	5.13	5.79
2040	6.21	6.47
2045	7.52	7.16

Notes:

[1] Data between years 2017 and 2023 is actual recorded data. Data presented for future years is projected data.

[2] Excludes flow data from November and December 2018.

[3] Includes flow data from January 2023 through August 2023, as available at the time of development of this Report.

REUSE WATER BALANCE MODELING REPORT FLOW PROJECTIONS

Tetra Tech's subconsultant Liquid Solutions Group (LSG) used a predictive reuse water balance model to project future reclaimed water flows under a separate report. A copy of the Reuse Water Balance Modeling Report as completed by LSG is provided in **Appendix I**.

The predictive model was developed using historical Apopka WRF treated wastewater flow and supplemental water flows from the different sources the City uses to augment its reuse water supply, including Sunshine Water, Altamonte Springs, and Orange County Utilities, and reclaimed water flows that the City provides to other sources for their use, including Mount Dora. The model

also considered tank and pond storage in the offsite reuse facilities and seasonal and climatological factors.

Table 5-8 Projected public access demand developed by LSG.

Table 5-8. Projected Reclaimed Water Flow (LSG, 2023)

Year [1]	Projected Reclaimed Water Flow, MGD
2017	5.23
2018	5.27
2019	5.63
2020	6.10
2021	5.94
2022	5.91
2027	9.79
2032	12.9
2037	16.0
2042	19.2
2045	21.1

Notes:

[1] Historical data through 2022 is actual recorded data at the City's WRF 18- and 20-inch reuse meters. Data presented for future years is projected data.

FLOW PROJECTIONS SUMMARY

Wastewater Flow

Figure 5-3. Wastewater Flow Projections

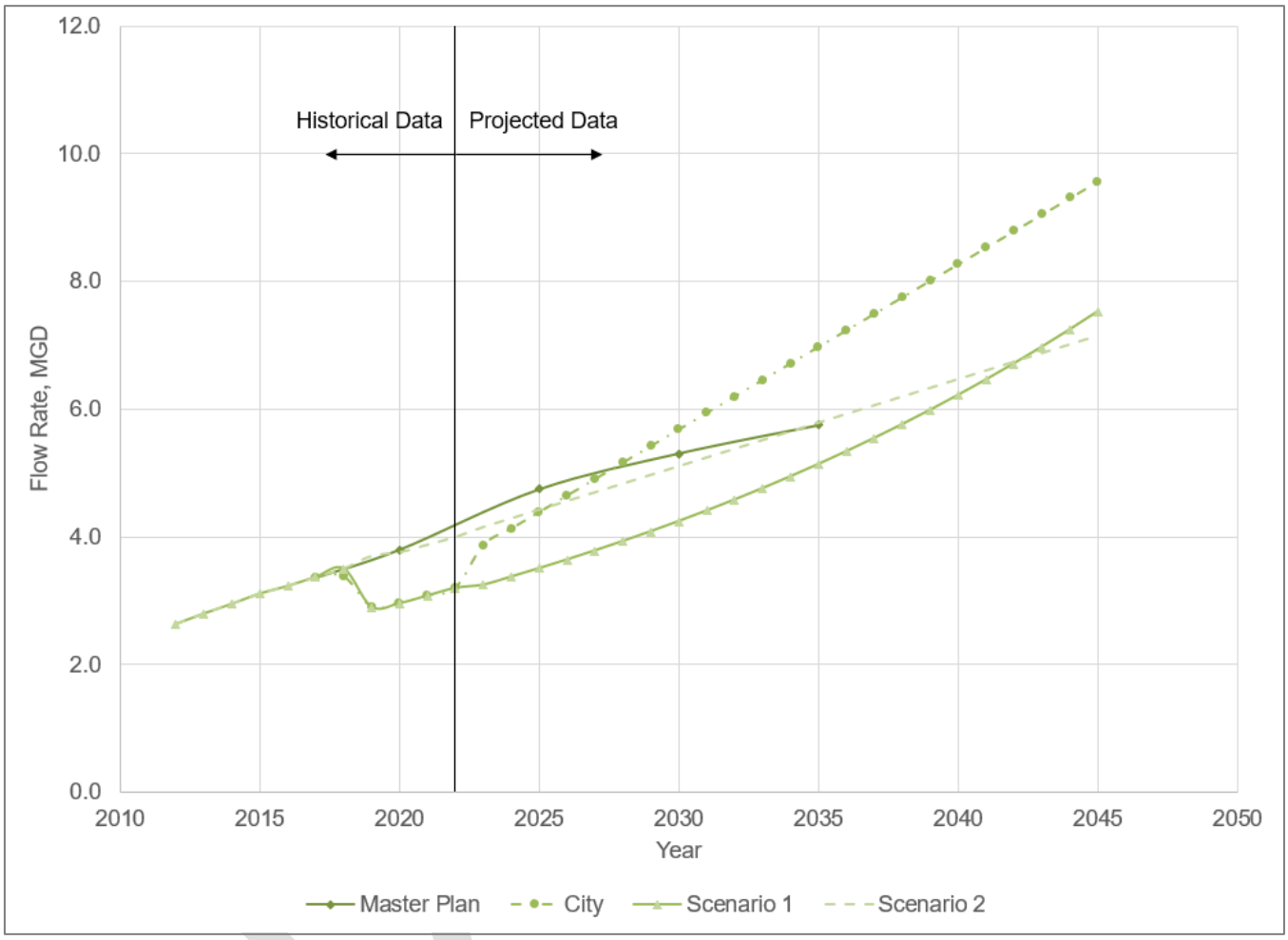


Figure 5-3 provides a graphical representation of the flow projections developed in the Master Plan, by the City, and in this Report. The Master Plan and City projections consider flows beginning in year 2017 while Tetra Tech's projections consider flows beginning in year 2012.

Historical data used in the City's and Tetra Tech's Scenario 1 flow projections show a "*drop*" in wastewater flow where an upward trend is observed until year 2019 when wastewater flow decreases prior to commencing a new upward trend. This *drop-in* flow is assumed to be caused by the transition of operations from the West Plant to the East Plant.

The City's projection anticipates the current permitted WRF capacity of 8.0 MGD to be exceeded in year 2039. Both of Tetra Tech's projections are reaching the current permitted capacity by year 2045. The Master Plan projection does not appear to be approximate to the City's permitted capacity; however, the Master Plan flow projections were completed through year 2035.

Based on discussions with City Staff, Tetra Tech's Scenario 2 was selected as the flow projection source for future wastewater planning, primarily on the basis that the other sources investigated were not applicable or sufficient for this project per the following:

5 The Master Plan assumes higher flows for short-term planning than anticipated based on current flow conditions. In addition, the Master Plan provides a shorter projection of future flows compared to the other alternatives. Consequently, the Master Plan was removed from consideration.

6 The City's flow projections assume a rapid development in the future which is not consistent with historical trends. It was concluded that this scenario is unlikely to occur and was therefore removed from consideration.

7 Tetra Tech's Scenario 1 projections are reasonable if the influent flows prior to 2019 are accurate. However, both of Tetra Tech's scenarios (1 and 2) converge over time. It was determined that without determining the cause of the *drop* in flows after the new flow meter was installed, using the lower flow data could result in underestimating the short-term capacity needs of the WRF. For this reason, this source was also removed from consideration.

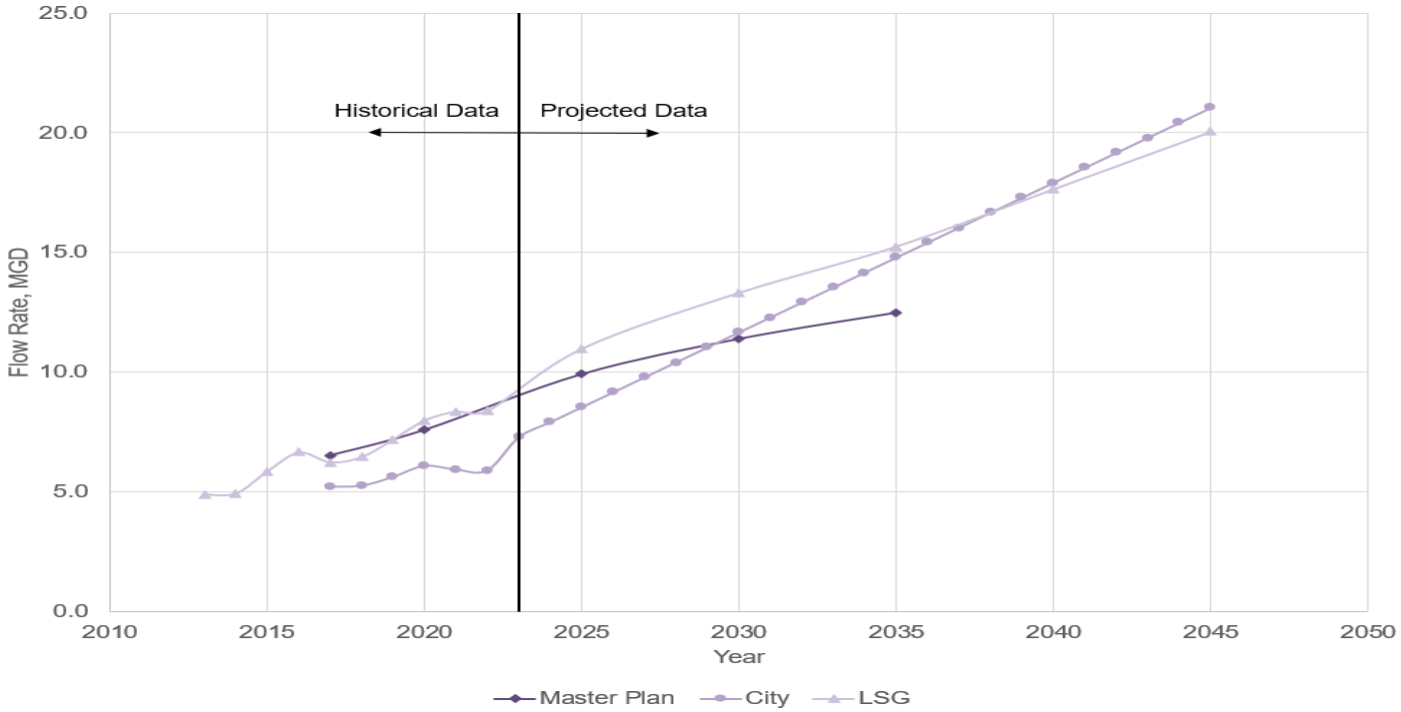
5.5.2 Reclaimed Water Demand

Similarly, reclaimed water demand projections as developed in the Master Plan, by the City, and by LSG as provided in **Figure 5-4**. The Master Plan and City's projections consider historical flow beginning in year 2017; LSG's projections consider flow beginning in year 2013.

Historical data summarized by LSG and the City have different values which is assumed to be due to the different sources used for data collection. Historical reuse flow used in LSG's report was based on measurements recorded at the flow meters before exiting the WRF. The City, on the other hand, used historical flow measurements recorded at the customers' reclaimed water meters, including residential and commercial customers. The main difference between the two approaches is that flow recorded at the WRF is inclusive of reuse water that is stored at City's offsite reuse storage facilities and reuse water that is sent to Mount Dora to supplement their reclaimed water system.

Based on discussions with City Staff, LSG's flow projections were selected as the source to be used for any future planning of reclaimed water projects. This selection was based on the idea that LSG provides a more conservative projection of flow for short-term planning. In addition, LSG developed their flow projections with the use of a model that accounted for reclaimed water facilities as a complete system and is therefore assumed to provide a more accurate prediction of future flows.

Figure 5-4. Reclaimed Water Demand Projections



GENERAL REQUIREMENTS EVALUATION

GENERAL

The existing WRF capacity was evaluated to determine capacity limitations resulting from future regulatory requirements, future wastewater flows, and existing West Plant operations. This Section provides a conceptual analysis for the future capacity of the WRF and upgrades required to meet future regulatory water quality.

CAPACITY ANALYSIS

FDEP requires municipalities to conduct a Capacity Analysis Report (CAR) when the three-month average daily flow exceeds 50% of the permitted capacity of the treatment plant or reuse and disposal systems. The CAR is intended to establish a mechanism for assessing operations and physical capabilities of wastewater treatment facilities. The City submitted a preliminary CAR to FDEP in January 2022 indicating compliance with the 50% capacity requirement, based on an average three-month average daily influent flow of 3.037 MGD and a permitted WRF capacity of 8.0 MGD.

In accordance with Rule 62-600.45, FAC, if the initial CAR report or an update of the CAR documents that the permitted capacity will be equaled or exceeded within the next ten (10) years, an updated CAR needs to be submitted to FDEP annually. FDEP requires documentation of timely planning, design, and construction of needed expansions according to the following schedule:

1. Begin planning and preliminary design of the necessary expansion if the permitted capacity will be equaled or exceeded within the next five (5) years,

2. Begin design of plans and specifications for the necessary expansion if the permitted capacity will be equaled or exceeded within the next four (4) years,
3. Submit a complete permit application for the necessary expansion if the permitted capacity will be equaled or exceeded within the next three (3) years.

Flow projections established in **Section 5.5** predict that future flows will be under the WRF permitted capacity through year 2045. However, currently the West Plant is not in operation and the City would need to invest significantly to rehabilitate and replace equipment to treat wastewater and future flows are anticipated to near the East Plant's permitted capacity of 5.0 MGD by year 2030. Based on (1) current operations of the WRF where only the East Plant is in operation and (2) flow projections of influent wastewater to the WRF, it is recommended that the City begins planning for additional future capacity either by repairing, rehabilitating, and recommissioning the West Plant or by expanding the East Plant.

WATER QUALITY ANALYSIS

As noted in the current operating permit, by July 1, 2028, the WRF needs to comply with the latest Wekiva BMAP which establishes a lower total nitrogen level (3.0 mg/L) in the effluent than the current permitted level (10.0 mg/L). Planning for improved treatment needs to consider influent wastewater characteristics. **Table 6-1** provides a summary of the average influent wastewater quality data between 2019 and 2023, as well as the design values used for the planning of the WRF expansion completed in 2019.

Table 6-1. Influent Wastewater Characteristics

Parameter	2019 WRF Expansion Basis of Design, mg/L	Historical Average
BOD_5, mg/L	260	237
TSS, mg/L	225	265
TKN, mg/L	48	49

Historical data between 2019 and 2023 closely aligns to the basis of design values used for the 2019 WRF expansion. Therefore, this evaluation is based on the same design criteria as the 2019 expansion. The following provides recommendations to comply with the lower total nitrogen level in the effluent.

The East Plant is designed to achieve an effluent TN of 3.0 mg/L at 5.0 MGD. Therefore, no process treatment upgrades are required to comply with the more stringent water quality requirement in the forthcoming permit renewal. However, the West Plant was designed to achieve an effluent of 10.0 mg/L TN in accordance with the current permit requirement. The West Plant will require upgrades to its biological nutrient removal process to achieve an effluent water quality of 3.0 mg/L.

EAST PLANT EXPANSION

The East Plant was designed and constructed as a 4-Stage Bardenpho system. Therefore, expansion to the East Plant for additional flows and compliance with the lower nitrogen effluent requirements can be accomplished by adding a second treatment train identical to the existing at the

East Plant. The new train would also be rated for 5.0 MGD, for a total WRF treatment capacity of 10.0 MGD. The WRF would need to be re-rated with FDEP for the increased treatment capacity.

The existing headworks and EQB are sized for a flow of 8.0 MGD AADF, consistent with the current WRF treatment capacity. However, similar to the West Plant Upgrade alternative a new EQB is recommended be constructed equal in size to the existing EQB to provide better flow attenuation and provide a more consistent nutrient loading to the biological treatment process.

In addition, the overall capacity of the WRF can be increased 10.0 MGD with construction of a new headworks structure.

It is not anticipated that additional upgrades are required for the biosolids management facility. The proposed changes, however, will have an impact on the biosolids management operations. The existing digesters are designed to store thickened sludge for approximately 20 days based on an average flow of 8.0 MGD. With an increased flow of 10.0 MGD, the storage time at the digesters will be reduced to 16 days. The belt filter presses (BFP) used to dewater solids are anticipated to operate for an extended period of time due to the reduced digester holding time. The BFPs were designed to operate 8 hours a day, 5 days a week. At the increased flow, the BFPs would need to either operate 10 hours a day, 5 days a week or operate approximately 8.5 hours a day, 6 days a week.

Table 7-2. Preliminary EOPCC – East Plant Expansion

Description	Cost		
	3 MGD/8 MGD Total	5 MGD/10 MGD Total w/o Biosolids	5 MGD/10 MGD Total w/o Biosolids
Second Headworks	--	$9,000,000	$9,000,000
Second Flow Equalization Basin	$12,000,000 [1]	$12,000,000	$12,000,000
Liquid Stream Unit Processes	$66,000,000	$66,000,000	$66,000,000
Solids Handling Expansion (w/o Sludge Drying)	--	--	$13,000,000
Subtotal	$77,000,000	$87,000,000	$100,000,000
Contingency (35%)	$27,000,000	$30,000,000	$35,000,000
Total	$104,000,000	$117,000,000	$135,000,000

Notes:

[1] Recommended for this alternative but not required.

7.2.2 Recommended Schedule

Currently, the West Plant is not in operation and flows are approaching the East Plant's permitted capacity of 5.0 MGD. Additionally, the effluent water quality will be required to meet an effluent TN of 3.0 mg/L prior to July 1, 2028. **Table 7-3** provides a recommended schedule for planning and construction of the selected alternative to meet the regulatory requirements.

Table 7-3. Planning and Construction Recommended Schedule

Description	Date
Advertise Request for Qualifications	June 1, 2024
Award and NTP	September 1, 2024
Preliminary Design	February 28, 2025
Permitting	April 30, 2025
Final Design	November 30, 2025
Advertise for Bid	January 2, 2025
Award	April 1, 2025
Begin Construction	July 1, 2025
Complete Construction	December 30, 2027
WRF Compliance with TN limit 3.0 mg/L	June 30, 2028

Appendix 2: WRF Future Capacity Evaluation (Separate document submitted with this report)