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TECHNICAL MEMORANDUM

TO:	Ron Patel, P.E., Hernando County
FROM:	Mitch Chiavaroli, P.E., McKim & Creed
CC:	Gordon Onderdonk, Hernando County Jeff Trommer, WSP
DATE:	~~March 22, 2025~~ Revised October 1, 2025
RE:	Hernando County Water Master Plan Update - Hydraulic Modeling

Executive Summary

In accordance with Task 6 - Hydraulic Modeling, of the Potable Water Master Plan (WMP) Update scope of services, McKim & Creed (M&C) has prepared this Technical Memorandum (TM) to summarize the hydraulic modeling efforts performed and the recommended improvements to the County's water supply and distribution infrastructure. This TM discusses the condition of the potable hydraulic model as received from Hernando County (County), identifies changes made to the hydraulic model, describes the assumptions made and incorporated into the hydraulic model, and summarizes the hydraulic modeling criteria used in the analysis. The results from the hydraulic modeling for planning period were used to determine the recommended improvements to address observed limitations within the County's potable water distribution system.

As part of the 2021 WMP, McKim & Creed combined the County's hydraulic models into a single hydraulic model covering all service areas: the West Hernando, Seville, East Hernando, Royal Oaks, Dogwood Estates, and Cedar Lane service areas. McKim & Creed also updated and calibrated the model and created model scenarios with recommended improvements based on the demand projections through 2040. As part of the current WMP update, the County provided McKim & Creed with the current version of the model, which includes changes made since 2021.

Updated water demand projections used for these hydraulic modeling efforts are explained in the 2024 Demand Projections Technical Memorandum. The hydraulic model was loaded with updated projected water demands through 2045. Using the 2021 WMP recommendations as a starting point, McKim & Creed modeled scenarios in five-year increments from 2025 through 2045. The purpose was to identify capital improvement program (CIP) recommendations for addressing system growth and potential hydraulic deficiencies.

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Abbreviations and Acronyms

AB	Antelope-Barrow
AC	Asbestos Cement
AM	Ante Meridiem (Before Midday)
AP	Airport
Avg	Average
AWWA	American Water Works Association
Blvd	Boulevard
BPS	Booster Pump Station
BW	Braewood
C	Hazen-Williams Friction Factor
CI	Cast Iron
CIP	Capital Improvements Program
CK	Cartee-Keysville
County	Hernando County
Ct	Court
D	Diameter
DI	Ductile Iron
Dr	Drive
e.g.	Exempli Gratia (For Example)
EL	Eldridge
EL.	Elevation
EST	Elevated Storage Tank
FF	Fire Flow
fps	Feet Per Second
ft	Feet
ft^2	Square Feet
FY	Fiscal Year
Gals	Gallons
GIS	Geographic Information System
gpm	Gallons Per Minute
GR	Gretna
GST	Ground Storage Tank
HCUD	Hernando County Utilities Department
HD	Hill-n-Dale
HDPE	High-Density Polyethylene
h_f	Headloss Due to Friction
HGL	Hydraulic Grade Line
HR	Hexam Rd
HSP	High Service Pump
Hydro	Hydropneumatic Storage Tank
i.e.	Id Est (That Is)
in.	Inches
JA	Jamaica-Apricot

KI	Mariner-Killian
L	Length
LA	Lakeside Acres
LD	Linden-Deer
LF	Linear Feet
LR	Lockhart Rd
M&C	McKim & Creed
mgd	Million Gallons Per Day
MMAD	Maximum Month Average Day
MSBU	Municipal Service Benefit Unit
N/A	Not Applicable
NFPA	National Fire Protection Association
No.	Number
Oct	October
PDD	Peak Day Demand
PM	Post Merīdiem (After Midday)
psi	Pounds Per Square Inch
PVC	Polyvinyl Chloride
Q	Flow
R^2	Regression Coefficient of Determination
RA	Rolling Acres
Rd	Road
RH	Royal Highlands
RMN	Ridge Manor North
RMS	Ridge Manor South
RMW	Ridge Manor West
SCADA	Supervisory Control and Data Acquisition
SP	Springwood Estates
St	Street
STL	Steel
SVL	Seville
SWH	Southwest Hernando
TP	Timber Pines
TM	Technical Memorandum
VFD	Variable Frequency Drive
WH	West Hernando
WTP	Water Treatment Plant
WUP	Water Use Permit
WWW WTP-1	Weeki Wachee Woodlands No. 1
WWW WTP-2	Weeki Wachee Woodlands No. 2

1 Introduction

In 2024, the County delivered on average, approximately 21.77 million gallons per day (mgd) of potable water to a functional population of approximately 145,000 in the County's service area. The County uses groundwater wells to supply source water to its seventeen (17) water treatment plants (WTPs), which are distributed amongst its six (6) water supply systems. The County does not import water from external sources and relies exclusively on its WTP-based well systems.

Of the six (6) water supply systems, the West Hernando System is the largest and serves the Spring Hill community in southwest Hernando County. The East Hernando System is the second largest and it serves the eastern areas of the County. The Seville System is considerably smaller and is located in the northwest part of the County. The three remaining systems are small and essentially serve the communities of Royal Oaks, Dogwood Estates, and Cedar Lane, which are centrally located. Altogether, the HCUD water supply systems have a total permitted annual average capacity of 24.36 mgd.

2 Existing Hydraulic Model

During project scope development, the County provided McKim & Creed with their latest Bentley WaterCAD/GEMS hydraulic model covering six (6) service areas:

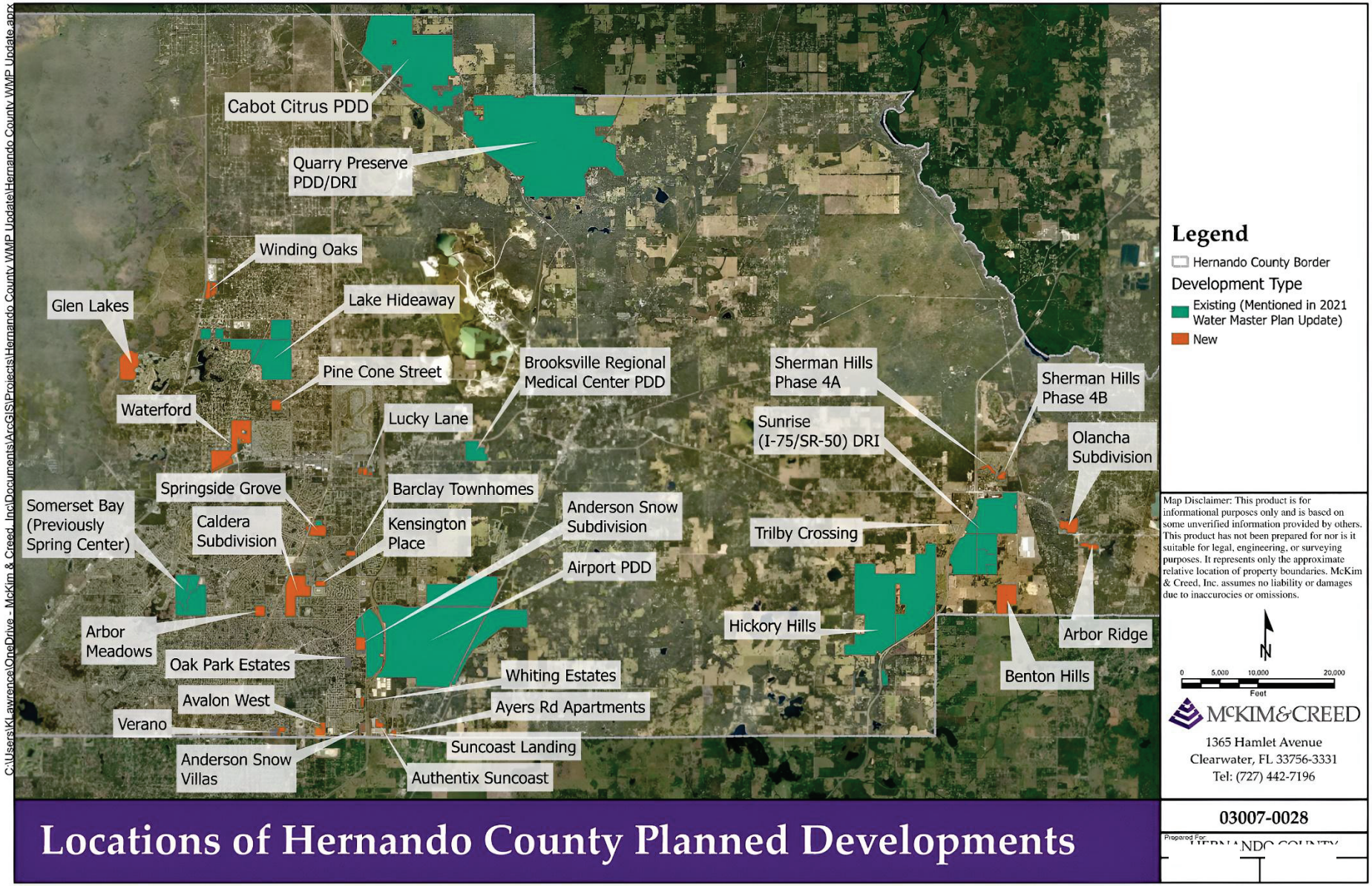
- West Hernando
- Seville
- East Hernando
- Royal Oaks
- Dogwood Estates
- Cedar Lane

The County provided model was used for this planning analysis.

3 Physical Model Updates

Starting with the year 2025, projected demands outlined in the 2024 Demand Projections Technical Memorandum (2024 Demand TM) were loaded in the model. In particular, junctions associated with each new development were chosen. In cases where junctions or pipes did not exist to supply a planned development, they were added. The locations of the planned developments are shown in **Figure 3-1**. (Note that **Figure 3-1** is intended to show the approximate location of the majority of the larger planned developments that were identified by the County during the demand development phase of the project. The demand development takes into account projected countywide population growth information obtained from SWFWMD, BEBR, and Hernando County, which accounts for the smaller developments and infill.)

Figure 3-1. Locations of Planned Developments in the HCUD Service Areas



3.1 Pipe Sizes and Geometry

No updates were made to the size and geometry of existing transmission mains pipes except as detailed under the suggested improvements sections for each scenario.

3.2 Pipe Materials and Physical Properties

No updates were made to the pipe materials. In order to prevent reverse flow issues in the model, check valves were added to pipes downstream of WTP pumps. New piping associated with the Wiscon WTP, which is currently in design, was also added.

3.3 Junctions and Hydrants

No updates were made to the junctions beyond changes made for the purpose of assigning demand for new developments.

3.4 Storage and Tanks

No updates were made to storage tanks in the model aside from removing those which were decommissioned and adding the planned Wiscon GST. The storage tanks included in the model are shown in **Table 3-1** through **Table 3-4.**

Table 3-1. West Hernando Ground Storage Tanks

Facility Name	Tank No.	GST Ground EL. (ft)	Volume (gal)
Antelope Barrow[(1)]	1	60	1,000,000
Cartee Keysville	1	35	1,000,000
Eldridge	1	39	2,000,000
Gretna	1	69	2,000,000
Hexam Rd	1	42	2,000,000
Jamaica Apricot	1	37	500,000
Linden-Deer	1	39	2,000,000
Mariner Killian	1	76	2,000,000
Royal Highlands	1	19	500,000
Southwest Hernando	1	80	2,000,000
Southwest Hernando	2	80	2,000,000
Timber Pines[(1)]	1	62	500,000
West Hernando	1	19	850,000
Wiscon[(2)]	1	80	2,000,000

[(1)] It is understood that the existing well pumps cannot be pulled from these wells and replacement wells is not feasible. Facility planned to be decommissioned after 2030

[(2)] Proposed for 2025

Table 3-2. East Hernando Hydropneumatic and GST Tanks

Facility Name	Tank No.	Hydro Ground EL. (ft)	Volume (gal)
Hill 'n Dale	1	104	10,000
Lockhart Rd	1	138	30,000[1]
Lockhart Rd (GST)	1	140	2,000,000[1]
Ridge Manor South	1	70	5,000
Ridge Manor West	1	70	20,000
Rolling Acres	1	110	5,000

[1] GST planned to replace the hydropneumatic tank in 2025

Table 3-3. East Hernando Elevated Storage Tanks

Facility Name	Tank No.	Volume (gal)
Ridge Manor	1	500,000[1]

[1] Planned to be decommissioned after 2030

Table 3-4. Smaller System Storage Tanks

Facility Name	Tank No.	Volume (gal)
Seville (GST)	1	750,000
Seville (Hydro)	1	10,000
Royal Oaks (Hydro)	1	10,000
Dogwood Estates (Hydro)	1	10,000
Dogwood Estates (Hydro)	2	10,000
Cedar Lane (Hydro)	1	15,000
Cedar Lane (Hydro)	2	15,000
Landfill (Hydro)[2]	1	7,500

[2] Serves landfill and FDOT toll plaza only

3.5 High-Service Pump Curves

Pump curves for the high service pump stations utilized in the model are the same as the pump curves that were included in the 2021 WMP, with the following exceptions.

- Killian WTP high service pump curves were updated for the current design.
- Lockhart WTP high service pump curves were updated for the current design.
- Wiscon WTP high service pump curves were included for the current design.

A pump curve summary table is included in **Appendix A**.

3.6 Facility Controls

No changes were made to existing facility controls in the hydraulic model. For the proposed Wiscon wells, the well pumps were programmed in the model to turn on when the GST falls below 50% full, and off above 98% full.

The hydraulic model already included Lockhart Rd WTP coming online in 2025, so no changes were made to that facility and its controls in the model.

Facilities which have been decommissioned were deleted from the model. Settings for these facilities are summarized in **Table 3-5** through **Table 3-10**. Updates per the 2021 WMP recommendations are noted.

Table 3-5. West Hernando Facility Pressure Settings

Facility Name	Acronym	Pressure (psi)
Antelope-Barrow WTP(1)	AB WTP	76
Cartee-Keysville WTP	CK WTP	75-80
Eldridge WTP	EL WTP	71
Gretna WTP	GR WTP	73
Hexam Rd WTP	HR WTP	73
Jamaica-Apricot WTP	JA WTP	76
Linden-Deer WTP	LD WTP	73
Mariner-Killian WTP	KI WTP	55
Royal Highlands WTP	RH WTP	80
Southwest Hernando WTP	SW WTP	56(2)
Timber Pines BPS(1)	TP BPS	57
West Hernando WTP	WH WTP	71

(1) Facility planned to be decommissioned after 2030

(2) Pressure setting should be increased to 60 psi in 2030 and increased again to 70 psi in 2045 to meet increased demands

Table 3-6. East Hernando Facility Pressure Settings

Facility Name	Acronym	Pressure (psi)
Hill-n-Dale WTP	HD WTP	62
Lockhart Rd WTP	LR WTP	29-50
Ridge Manor South WTP	RMS WTP	57-76
Ridge Manor West WTP	RMW WTP	73
Rolling Acres WTP	RA WTP	48-68

Table 3-7. Seville Facility Pressure Settings

Facility Name	Acronym	Pressure (psi)
Seville WTP	SVL	71-74

Table 3-8. West Hernando High Service Pumps

Facility Name	HSP No.	HSP Ground Elev. (ft)	Pump Status		Time Setting
			On (psi)	Off (psi)	On/Off
Antelope-Barrow WTP[1]	AB-1	68	--	CS	-
	AB-2	68	76	VFD	8 PM – 8 AM
	AB-3	68	76	VFD	8 PM – 8 AM
Cartee-Keysville WTP	CK-1	35	75	VFD	-
	CK-2	35	75	VFD	
Eldridge WTP	EL-1	39	71	VFD	-
	EL-2	39	71	VFD	
	EL-3	39	71	VFD	
	EL-4	39	71	VFD	
	EL-5	39	71	VFD	
Gretna WTP	GR-1	69	73	VFD	-
	GR-2	69	73	VFD	
	GR-3	69	73	VFD	
	GR-4	69	73	VFD	
	GR-5	69	73	VFD	
Hexam Rd WTP	HR-1	42	73	VFD	-
	HR-2	42	73	VFD	
	HR-3	42	73	VFD	
Jamaica-Apricot WTP	JA-1	37	76	VFD	5 AM – 8 AM, 7 PM – 10 PM
Linden-Deer WTP	LD-1	39	73	VFD	-
	LD-2	39	73	VFD	
	LD-3	39	73	VFD	
	LD-4	39	73	VFD	
	LD-5	39	73	VFD	
Mariner-Killian WTP	KI-1	76	55	VFD	-
	KI-2	76	55	VFD	
	KI-3	76	55	VFD	
Royal Highlands WTP	RH-1	23	80	VFD	-
	RH-2	23	80	VFD	
Southwest Hernando WTP	SW-1	80	54	VFD	-
	SW-2	80	54	VFD	
	SW-3	80	54	VFD	
	SW-4	80	54	VFD	

Facility Name	HSP No.	HSP Ground Elev. (ft)	Pump Status		Time Setting
			On (psi)	Off (psi)	On/Off
	SW-5	80	54	VFD	
	SW-6	80	54	VFD	
West Hernando WTP	WH-1	23	71	VFD	-
	WH-2	23	71	VFD	
	WH-3	23	71	VFD	
	WH-4	23	71	VFD	

(1) WTP planned to be decommissioned after 2030

Table 3-9. Seville High Service Pumps

Facility Name	HSP No.	HSP Ground Elev. (ft)	Pump Status		Time Setting
			On (psi)	Off (psi)	On/Off
Seville WTP	SVL-1	54	71	74	-
Seville WTP	SVL-2	54	71	74	-

Table 3-10: West Hernando Booster Pump Stations

Facility Name	Booster Pump No.	Booster Ground Elev. (ft)	Pump Status		Time Setting	
			On (psi)	Off (psi)	On	Off
Timber Pines BPS(1)	TP-1	55	40	57	6 AM – 9 AM	
	TP-2	55	40	57	-	

(1) Facility planned to be decommissioned after 2030

Well pumps operate in the model at treatment plants either feeding a hydropneumatic tank or feeding a ground storage tank. Controls were updated as necessary to avoid tanks from draining.

Table 3-11: West Hernando Well Pumps

Facility Name	Well No.	Well Ground Elev. (ft)	Tank Level	
			On (ft)	Off (ft)
Antelope-Barrow WTP[1]	AB-1	60	-	20
Antelope-Barrow WTP[1]	AB-2	60	-	20
Cartee-Keysville WTP	CK-1	35	22	25
Cartee-Keysville WTP	CK-2	35	22	25
Cartee-Keysville WTP	CK-3	36	22	25
Eldridge WTP	EL-1	32	26	30
Eldridge WTP	EL-2	32	26	30
Gretna WTP	GR-1	68	28.5	30
Gretna WTP	GR-2	64	28.5	30
Gretna WTP	GR-3	60	28.5	30
Hexam Rd WTP	HR-1	40	28	30
Hexam Rd WTP	HR-2	40	28	30
Jamaica-Apricot WTP	JA-1	37	14	16
Jamaica-Apricot WTP	JA-2	32	14	16
Linden-Deer WTP	LD-1	36	28	30
Linden-Deer WTP	LD-2	36	28	30
Linden-Deer WTP	LD-3	36	28	30
Mariner-Killian WTP	KI-3	76	30.5	31
Mariner-Killian WTP	KI-4	83	30	31
Mariner-Killian WTP	KI-5[2]	83	-	-
Royal Highlands WTP	RH-1	27	12	15
Southwest Hernando WTP	SW-1	86	26	26.5
Southwest Hernando WTP	SW-2	87	26	26.5
Southwest Hernando WTP	SW-3	86	25.5	26.5
Southwest Hernando WTP	SW-4	70	25.5	26.5
Southwest Hernando WTP	SW-5	60	25.5	26.5
Southwest Hernando WTP	SW-6	60	25	26.5
Southwest Hernando WTP	SW-7	60	25	26.5
West Hernando WTP	WH-1	60	12.5	20
West Hernando WTP	WH-2	65	12.5	20
West Hernando WTP	WH-3	22	-	-
West Hernando WTP	WH-4	32	-	-
West Hernando WTP	WH-5	37	12.5	20

[1] Wells planned to be decommissioned after 2030

[2] Currently not in service.

Table 3-12: East Hernando Well Pumps

Facility Name	Well No.	Well Ground Elev. (ft)	Tank HGL[1]	
			On (ft)	Off (ft)
Hill-n-Dale WTP	HD-1	104	219.5	254
Hill-n-Dale WTP	HD-2	104	219.5	254
Lockhart Rd WTP	LR-1	138	155	170
Lockhart Rd WTP	LR-2	138	155	170
Lockhart Rd WTP	LR-3	138	155	170
Ridge Manor South WTP	RMS-1	70	202	246
Ridge Manor West WTP	RMW-1	63	220	230
Rolling Acres WTP	RA-1	110	222.5	267

(1) On-site hydropneumatic or ground storage tank unless otherwise noted

Table 3-13: Small System Well Pumps

Facility Name	Well No.	Well Ground Elev. (ft)	Tank Level	
			On (ft)	Off (ft)
Seville WTP	SVL-1	53	63	67
Seville WTP	SVL-2	53	63	67
Royal Oaks WTP	RO-1	160	264	302
Dogwood Estates WTP	DE-1	105	215	262
Dogwood Estates WTP	DE-2	105	215	262
Cedar Lane WTP	CL-1(1)	130	Off	Off
Cedar Lane WTP	CL-2	130	235	281

(1) Model indicates one well is a standby

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4 Potable Water Demand

Demand projections are defined in the January 2024 Water Demand Projections Technical Memorandum, a copy of which is included as **Appendix B**.

4.1 Diurnal Demand Patterns

The diurnal demand patterns from the 2021 WMP, i.e., the average diurnal curve developed for the Eldridge WTP using WTP's normalized flow data from four (4) days between April 2017 and May 2019, were used for this hydraulic modeling effort. Developments were assigned the "residential" demand pattern.

Subsequent to performing the hydraulic modeling, the County and M&C met to discuss concerns the County has pertaining to low system pressures predicted in the model during the peak demand hours of the peak demand days. The diurnal curve from the 2021 WMP has a "peaking factor" of approximately 1.747 that occurs in the 8:00 p.m. hour. The County believes the peaking factor of the diurnal curve overestimates the peak hourly usage demand and asked M&C to reevaluate the peak factor using more recent flow data.

The County provided flow data for the calendar years of 2022 and 2023 for 5 water treatment plants; Linden-Deer, Eldridge, Hexam, Southwest, and Killian WTPs. When analyzing the data for diurnal patterns, M&C observed that Southwest and Killian WTPs did not have typical diurnal patterns, and therefore the data for these two WTPs was not used in the analysis. The analysis is summarized in the March 2025 Diurnal Curve Determination Memorandum submitted to the County, a copy of which is include in Appendix C. This analysis resulted in "combined" diurnal peaking factors ranging from 1.42 to 1.67. ("Combined" looks at the average hourly peaking factor of the Linden-Deer, Eldridge, Hexam WTPs.)

After presenting this information to the County, it was agreed to keep the diurnal curve pattern in the existing hydraulic model the same with the exception of "flattening" the evening diurnal peak between the hours of 7:00 and 9:00 p.m. to a maximum 1.60.

4.2 Scenario Development

The scenarios analyzed for planning periods and alternatives are the following:

- Average day demand
- Peak day demand (average day demand times a peaking factor), across 24-hours
- Peak day demand plus fire flow, steady state (i.e., a snapshot in time)

The peak day peaking factors used for the 2021 WMP were also used for this hydraulic modelling effort:

- 1.7 for the West Hernando Service Area
- 1.8 for the East Hernando Service Area
- 2.5 for the Seville Service Area
- 3.0 for the Cedar Lane, Dogwood Estates, and Royal Oaks Service Areas

Note that at the County's direction, water usage data from January 2019 through October 2024 was analyzed to determine more current peaking factors for the East and West Hernando Service Areas. During this period, the average day to peak day peaking factors for the East Hernando Service Area ranged from 1.40 to 1.73; with the peaking factor above 1.7 for three of the six years. As such, M&C recommends the continued use of the 1.8 peaking factor for the East Hernando Service Area. The average day to peak day peaking factors for the West Hernando Service Area ranged from 1.34 to 1.55. While lower than the 1.7 peaking factor currently used in the model for the West Hernando Service Area, M&C would not recommend using a peaking factor less than 1.6 for the West Hernando Service Area.

These more recent peaking factors were discussed with the County on January 24, 2025, and it was agreed to keep the peaking factors of 1.8 (East Hernando) and 1.7 (West Hernando) in the hydraulic model. However, this discussion lead to further evaluation of the diurnal curve used in the model. (See previous Section 4.1.)

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5 Hydraulic Modeling Criteria

The hydraulic modeling criteria used with the 2021 WMP were used for this hydraulic modeling effort. The criteria used is summarized as follows.

5.1 Minimum and Maximum Pressures

Junctions were analyzed for minimum and maximum pressure under peak day demand (PDD) scenarios. Typical guidelines for distribution system pressures under normal operating conditions are 40 to 90 psi. Operating in this range typically provides for satisfactory pressure for customers while minimizing system leakage and pipeline breaks associated with high pressures. Pressures exceeding 100 psi are allowable in transmission mains but should be avoided in distribution lines. Minimum pressures of 20 psi must be maintained under all conditions. The American Water Works Association states that typical pressure design criteria are as follows:

- 90 – 100 psi during minimum demands
- 60 – 90 psi during average demands
- 35 – 50 psi during peak hour demand
- 20 psi minimum during peak day demand plus fire flow

Typical system values the County has noted range from 50 psi in the Spring Hill area to 90 psi in Hernando Beach. (The 2021 WMP recommended installation of pressure relief valves (PRV's) on the two water mains that feed Hernando Beach. These PRV's are "installed" in the hydraulic model.) The County has experienced a number of breaks both on the mains and on the customer service lines. While some level of breaks is unavoidable, the County wishes to operate at 70 psi or lower as much as possible. As noted in Table 3-5 through Table 3-7, there are pumps in the system typically delivering at or higher than 70 psi at this time. A target of 45 psi sustained minimum on the peak day is desirable to limit customer complaints.

Under fire flow conditions, the minimum pressure allowed was 20 psi to conform to National Fire Protection Association (NFPA) regulations. Pressures outside of these values on the discharge side of pumps and throughout the distribution system were considered deficiencies.

5.2 Maximum Velocities

The model was used to evaluate pipe conditions with respect to the calculated maximum velocities, particularly under PDD scenarios. When high velocities are experienced, there is increased potential for hydraulic transients (i.e., water hammer) in a distribution system. Additionally, since the pressure loss in the system is roughly proportional to the square of the velocity, energy requirements increase considerably with velocity. As noted in the 2021 WMP, a velocity of 4 – 6 fps during normal operations is a typical target, with a limit of 10 fps during fire flow. Dead-end 6-inch mains cannot meet a 10 fps limit for fire flow requirements of 1000 gpm and higher if a velocity limit is imposed for fire flows. The minimum recommended size for dead-end mains is 8-inch for fire protection with 6-inch mains capable of providing protection if looped.

As noted in the 2021 WMP, suction and discharge piping can have higher velocities than the distribution system.

The maximum velocity allowed during normal conditions in the distribution system model was 8 fps. This was viewed as a practical recommendation for the County's system. Because the County does not have long transmission mains, booster pumps, steep changes in elevation, drastic changes in pressure, or pumps turning on and off repeatedly, the risk of hydraulic transient issues is minimalized. Additionally, the County operates at relatively low pressures, which increases the available surge allowance should transient conditions occur.

5.3 Maximum Headloss Gradients

The headloss gradient along a pipe is a measure of how much energy is lost per unit length of pipe. Typical guidelines allow for an upper limit of 10 ft/1000 ft (0.01) for distribution piping and an upper limit of 3 ft/1000 ft (0.003) for transmission mains. As noted in the 2021 WMP, typical design criteria are 5 – 7 ft/1000 ft for small pipe diameters (less than 16-inch) and 2 – 3 ft/1000 ft for large pipe diameters (16-inch or greater).

An upper limit on headloss gradient was not set for this analysis. However, a high headloss gradient was used to identify hydraulic bottlenecks. Additionally, pipes with a high headloss gradient should be priority candidates for upsizing as part of any rehabilitation and replacement program.

5.4 System-Wide Fire Flow Availability

The County abides by the Florida Fire Prevention Code, which in turn generally relies on NFPA's Fire Code for fire flow requirements. One- and two-family dwellings that are 5,000 square feet (ft^2) and smaller have a minimum fire flow requirement of 1,000 gpm for one (1) hour. Allowances can be made for automatic sprinkler systems, building separation, and other factors. These were not analyzed on a case-by-case basis, and 1,000 gpm was set as the fire flow requirement for typical residential dwellings.

Fire flow requirements for non-residential buildings require additional evaluation. Required flow and duration range from 1,500 gpm over two (2) hours to 8,000 gpm over four (4) hours depending on area and type of construction. Reductions in required flow can be made for building isolation, automatic sprinkler systems, and other factors for non-residential buildings. Adding to the complexity is that fire flow provided for large buildings is often from multiple hydrants. The NFPA fire code aggregates the capacity of hydrants within 1,000 ft of a building but typically limits the contribution of any single hydrant to 1,500 gpm. Because the non-residential fire flow requirements can vary for each property and building, a target of 1,500 gpm was typically used for non-residential properties.

Parcels with the following future land use descriptions were assigned a 1,500 gpm fire flow requirement:

- Commercial
- Educational
- Industrial
- Multi-family Residential
- Mixed-use

- Planned Development District
- Public Facility

Similar to the 2021 WMP, each parcel was assigned to the nearest fire hydrant. The highest fire flow assigned to a hydrant dictated the fire flow requirement for each particular hydrant. For future conditions, junctions were used to represent fire flow locations (e.g., line extensions to future developments where hydrant locations are unknown).

Under any fire flow conditions, the minimum flow requirement had to be met while maintaining a minimum of 20 psi residual pressure in the system.

5.5 Summary of Hydraulic Criteria

While other parameters were analyzed, the definition of a hydraulic deficiency during model analysis was identified as any of the following:

- Pressure above 100 psi at any time during PDD conditions but preferably 70 psi and lower.
- Pressure below 40 psi at any time during PDD conditions on the discharge-side of the HSPSs but preferably 45 psi and higher. In several cases, short durations where pressures dropped below 40 psi during PDD were allowed on a case-by-case basis.
- Pressure below 20 psi at any hydrant location during PDD plus fire flow conditions.
- Velocity exceeding 8 fps during PDD conditions in transmission and distribution mains.

5.6 Modeling Scenarios

The modeling effort examined impacts of projected system growth, various alternative conditions, and changes in operation on the system hydraulics. For each model scenario, typically three (3) run types were analyzed, average daily demand (ADD), peak day demand (PDD), and peak day demand plus fire flow (PDD+FF).

ADD was simulated over a 24-hour period, i.e., an extended-period simulation (EPS). The focus of ADD model runs was generally to cross-check model output at WTPs with permitted capacity and not to identify system deficiencies or recommended improvements.

PDD was generated by scaling the ADD to account for possible PDD conditions. The peaking factors used were 1.7 for West, 1.8 for East, 2.5 for Seville, and 3.0 for the remaining smaller systems. This demand scenario was run as a 24-hour EPS. The focus of PDD model runs for this project was to identify projected hydraulic deficiencies and recommend improvements.

Under PDD+FF, each demand node was analyzed under PDD with an additional demand range to determine the available fire flow. This demand scenario was simulated under steady-state conditions (i.e., a snapshot in time). The focus of PDD+FF model runs for this project was to highlight areas where fire flow availability may not meet current standards under PDD conditions, which represent a near worst-case scenario for the fully functioning water system. The ability to meet fire flow demand would be expected to be greater throughout the rest of the year.

Table 5-1 summarizes the current well capacity in each service area and the projected ADD (MGD) values. Values in bold indicate projected demands that exceed current well capacity. With the increased demands, additional source water will be required. The County is actively pursuing new source water through expansion of existing wellfields (Gretna, Ridge Manor West), new wellfields (Centralia) and collaborative efforts with developers (Sunrise).

The modeling effort is focused on the distribution system and, as such, it is assumed that sufficient source water will be available for each service area through the aforementioned additional water sources. Therefore, the source water availability was not a restriction to running the model.

Table 5-1: Well Capacity versus ADD

Service Area	Well Capacity (MGD)	Projected ADD by Year (MGD)				
		2025[1]	2030	2035	2040	2045
West Hernando	21.16	20.91	21.75	**22.36**	**23.75**	**24.90**
East	2.54	1.17	1.91	**2.90**	**3.47**	**4.05**
Seville	0.49	0.04	**0.57**	**1.52**	**2.04**	**2.56**
Cedar Lane	0.04	0.02	0.04	0.04	0.04	0.04
Dogwood Estates	0.11	0.09	0.10	0.10	0.11	0.11
Royal Oaks	0.02	0.02	0.02	0.02	0.02	0.02
Total	**24.36**	**22.25**	**24.39**	**26.95**	**29.43**	**31.68**

[1] 2025 projected water demands are based on actual 2024 annual average day metered flows with a 2% increase for 2025.

5.6.1 Small Systems

The small systems of Cedar Lane, Dogwood Estates, and Royal Oaks are essentially built-out and the updated demand projections are similar to those in the 2021 WMP. Therefore these were not analyzed.

5.6.2 Seville

Seville was analyzed under the 2025, 2030, 2035, 2040, and 2045 demand year conditions. Improvements recommended in the 2021 WMP Update are used as the initial modeling scenario for each planning period. The following assumptions were made:

- Proposed Quarry Preserve wells and WTP online by 2035. Actual timeframe for this facility is dependent on the development's schedule as at least one well and WTP is required to provide water to the Quarry Preserve Development.

5.6.3 East Hernando

East Hernando was modeled under the 2025, 2030, 2035, 2040, and 2045 demand year conditions. Improvements recommended in the 2021 WMP Update are used as the initial modeling scenario for each planning period. The following assumptions were made:

- The expanded Lockhart Road WTP will be online in 2025.

- The Trilby Crossing transmission main and the Cortez Blvd water main projects identified in the 2021 WMP are complete.
- The Ridge Manor EST would be offline prior to 2035. (Proposed 12" transmission main crossing I-75 needs to be in service before EST can be removed from service.)
- The model includes three active pressure reducing valves installed near the Lockhart WTP, one on Lockhart Rd, one on Old Trilby Road, and the third on a future parallel east-west water main. The pressure setting in the model for each valve is 65 psi.

5.6.4 West Hernando

West Hernando was modeled under the 2025, 2030, 2035, 2040, and 2045 demand year conditions. Improvements recommended in the 2021 WMP Update are used as the initial modeling scenario for each planning period. The following assumptions were made:

- The Timber Pines GST and BPS will be decommissioned after 2030.
- The Antelope-Barrow WTP will be decommissioned after 2030.
- Killian WTP improvements in service in 2025.
- Pressure reducing valves installed on the water mains to the Hernando Beach area in 2025.
- Wiscon WTP in service after 2025.
- The water main associated with the County Line Road to Ayers Road transportation project in service by 2025.
- Water mains associated with airport and US 41 FDOT projects are constructed and in service prior to 2030.
- The Gretna WTP permitted well capacity increase of 0.65 MGD was maintained.

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6 CAPITAL IMPROVEMENTS PROJECTS

Improvements to the County's water systems to meet the projected 2045 water demands were identified using the data obtained from the water demand projections, water supply source evaluation, and hydraulic modeling performed for the County's water distribution system. Improvements to the County's water supply, water treatment, and water distribution systems identified previously in the 2021 WMP are still recommended, however the year to complete several of these improvements may have changed as noted in the subsequent project descriptions. Projects that were identified as underway in the 2021 WMP were included in the hydraulic model as being in service for the 2025 analysis.

6.1 SMALL SYSTEMS

The small systems of Cedar Lane, Dogwood Estates, and Royal Oaks are essentially built-out and the updated water demand projections are similar to those in the 2021 WMP. Therefore, further analysis of these small systems was not performed. The findings from the 2021 Water Master Plan for these small systems, i.e., improvements necessary to address low pressures under fire flow conditions are still applicable. The following paragraphs summarize the results of the previous hydraulic modeling. With similar demand projections, the results will be the same.

6.1.1 Cedar Lane System

The Cedar Lane population projections utilized as the basis of the average day demand project an increase from 302 people in 2021 to 318 people in 2045. No modeled hydraulic deficiencies were identified for the Cedar Lane system. Per HCUD, the hydropneumatic tanks are scheduled to be replaced (size for size) in 2025. No other capital improvement projects were identified for the planning period.

6.1.2 Dogwood Estates System

The Dogwood Estates population projections utilized as the basis of the average day demand project an increase from 750 people in 2021 to 839 people in 2045. Per HCUD, one hydropneumatic tank is scheduled to be replaced (size for size) in 2025. Two deficiencies were identified from the previous hydraulic modeling, low minimum pressures in the northeast corner of the system and fire flows that are below 1000 gpm with a 20 psi residual pressure.

The low minimum pressures in the northeast corner of the system are attributed to the significant grade differences within the system - a low of 64 ft to a high of 146 ft. Adjusting the low pressure setting on the hydropneumatics tank will raise the low minimum pressure.

Regarding fire flows, per HCUD, there is an existing MSBU for fire flow at 500 gpm.

6.1.3 Royal Oaks System

The Royal Oaks population projections utilized as the basis of the average day demand project an increase from 161 people in 2021 to 168 people in 2045. Only one deficiency was identified from the previous hydraulic modeling, fire flows that are below 1000 gpm with a 20 psi residual pressure. However, per HCUD, there is an existing MSBU for fire flow at 500 gpm.

6.2 Seville Service Area

The Seville, or North Service Area sees the largest percentage increase in water demand, over 500% increase, between today and 2045. This is the result of two identified developments, Cabot Citrus and Quarry Preserve. Without the demand from these two developments, the existing wells and Seville WTP would have sufficient capacity to meet the projected Seville Service Area demand. However, the water demand from the Cabot Citrus and Quarry Preserve developments will require both new source water (Quarry Preserve wells QP-1 and QP-2) and a new Quarry Preserve WTP.

The recommended improvements for Seville Service Area for the 20-year planning period total $29,125,400 in 2025 dollars and include the following projects identified in 5-year increments. Note that for all identified projects, the estimated project cost includes 30% construction contingency plus 12% for engineering and project administration.

It is noted that per the Cabot Citrus Water and Sewer Agreement, the first phase of the development requires approximately 190,000 GPD of water service. This demand will be met by a well and treatment system constructed by the developer. Connection to the County's system is conditioned on availability (system in right of way abutting their site boundary). Once considered available, the developer has 1 year to connect. These conditions will affect when the flows need to be added to the model.

Year 2030

- Quarry Preserve Wells (two) and WTP – Construction of two 16" diameter wells, each equipped with a 1 mgd well pump; 2 MG GST; HSPS with a 2,700 gpm pumping capacity; and disinfection system.
  - Estimated project cost = $13,494,300. This project is developer driven; developers will be required to share in the cost of the project and deed land to the County for the wells and WTP.

- Ponce de Leon Blvd Transmission Main - This project includes 18,000 LF of 12-inch pipe along Ponce de Leon Blvd from Suncoast Parkway to Quarry Preserve and 5,400 LF of 20-inch pipe from QP WTP to Quarry Preserve. This transmission main connects existing Seville distribution system with the Quarry Preserve WTP and serves to provide water to the planned Cabot Citrus development. Note that the actual length of 20-inch pipe depends on how and where the Quarry Preserve water distribution infrastructure is designed. For purposes of this planning effort, the entire Quarry Preserve demand was set at one node in the hydraulic model. Also included in this project is the installation of

a pressure reducing valve (65 psi) between Quarry Preserve and Cabot Citrus (needed during ADD due to the significant change in elevation).

- Estimated project cost = $15,390,800. This project is developer driven; developers will be required to share in the cost of the project.

Year 2040

- Quarry Preserve HSPS Improvements – Expand the capacity of the HSPS by adding a third duty pump (2,700 gpm capacity).
  - Estimated project cost = $240,300.

6.3 East Hernando Service Area

The 2045 projected average day water demand in the East Hernando Service Area is 4.05 mgd, an increase of 2.27 mgd over the projected 2025 average day demand of 1.78 mgd, or an increase of over 200%. (Note that the 2021 WMP also included most of the planned developments used in current demand projection, however the 2021 WMP assumed only partial buildout of the larger developments over the 20-year planning period. As noted in the February 2024 Water Demands TM, the current demand projections assume full buildout of the identified developments by the year 2045.)

With the increased water demand projected for the East Hernando Service Area, the current source water capacity is insufficient. Additional well construction is required. New well construction for the Lockhart WTP has recently been completed, and the expansion of the Lockhart WTP is scheduled to be completed in 2025. The remaining source water deficit will be addressed with the construction of the Sunrise wells, SR-1 and SR-2. The other recommended source water improvement is the completion of a second well at the Ridge Manor West WTP (RM-W2R) as a backup water supply source for this facility.

The recommended improvements for East Hernando Service Area for the 20-year planning period total $44,105,800 in 2025 dollars and include the following projects identified in 5-year increments. Note that for all identified projects, the estimated project cost includes 30% construction contingency plus 12% for engineering and project administration.

Year: 2025

- I-75 Crossing - Trilby to Kettering Rd Transmission Main – I-75 crossing and extensions to Kettering Road to eliminate the Ridge Manor EST and north to Cracker Crossing for looping, totaling 10,800 LF of 12" water main. (It is understood that this project may be pushed out beyond 2025, however for planning purposes, completion is shown prior to implementing the identified 2030 improvements.)
  - Estimated project cost = $6,235,400. This project is developer driven and will be completed under a Developer's Agreement at no cost to the County. Per the County, the Developers' Agreement identifies the proposed transmission main crossing I-75 to be a 16" main.

- Ridge Manor West WTP Improvements - Complete Well RM-W2R as a back-up well for the WTP, including 350 gpm well pump, and 2nd hydropneumatic tank. Pump control panel should include receptacle for portable generator.
  - Estimated project cost = $1,502,400
- Three projects upsizing existing water mains to provide full fire flow protection under peak day plus fire flow demands (PDD+FF). **Note that if there are MSBU's to provide 500 gpm fire flow for these areas, like other locations within the County, the need to upsize the pipe will not be required**.

  Fort Dade Park Community – Upsize approximately 10,600 LF of 6" water main to 8" pipe (2,900 LF) and 10" pipe (7,700 LF) to improve fire flow protection.
  - Estimated project cost = $4,419,000

  Tree Lane – Install approximately 1,900 LF of 8" water main along Tree Lane from Cortez Blvd to Ridge Manor Blvd, then along Ridge Manor Blvd to Boxtree Court to improve fire flow protection.
  - Estimated project cost = $438,200

  Westlake – Upsize approximately 2,900 LF of 6" water main to 8" pipe to improve fire flow protection.
  - Estimated project cost = $1,049,200

Year 2030

- I-75/SR 50 PDD Looping – Includes 13,800 LF of 16" water main
  - Estimated project cost = $8,759,600. This project is developer driven; developer will be required to share in the project cost. Per the County, a segment of the 16" water main on Kettering has been installed as part of the Benton Hills Development.
- River Crossing Transmission Main – River crossing redundancy consisting of 17,600 LF of 12" water main
  - Estimated project cost = $9,808,000
- Sunrise WTP – Construction of a 1 mgd WTP including two 16" diameter wells each with a 350 gpm well pump, hydropneumatic tanks, chemical feed system for disinfection, site work, electrical and instrumentation systems, and yard piping. Location of the Sunrise WTP will need to be coordinated with the proposed Sunrise Development. For planning purposes, it is assumed that the facility will be constructed on the west side of the development, just east of I-75.

  - Estimated project cost = $5,911,400. This project is developer driven; developer will be required to share in the cost of the project and sell land to the County for the wells and WTP.

Year 2035

- Lockhart Rd Transmission Main South – Transmission main south down Lockhart Rd consisting of 10,600 LF of 12" water main

- Estimated project cost = $5,982,600.

6.4 West Hernando Water Service Area

The 2045 projected average day water demand in the West Hernando Service Area is 24.90 mgd, an increase of 5.68 mgd over the projected 2025 average day demand of 19.42 mgd, or an increase of approximately 28%. Note that like the East Hernando Service Area, the 2021 WMP also included many of the planned developments used in current demand projection, however the 2021 WMP assumed only partial buildout of the larger developments over the 20-year planning period. As noted in the February 2024 Water Demands TM, the current demand projections assume full buildout of the identified developments by the year 2045, unless information was available from either the developer or the County indicating otherwise.

Like the East Hernando Service Area, the constructed well capacity will not be sufficient to meet projected water demand when considering the need to remove from service the wells and WTP at Jamaica and Antelope and/or wells at Southwest. To account for the loss of these wells, construction of new water supply sources is recommended. One of these new sources, the two (2) proposed wells, WI-1 and WI-2, are already under contract for construction. The other new water supply sources proposed include one additional well at the Gretna WTP (GR-4) and four additional wells along Centralia, CW-1 through CW-4.

With the addition of a new well at the Gretna WTP, construction of a second 2 MG GST is also recommended. Upgrades to the existing HSPS at Gretna are not required as the HSPS was originally constructed to account for this future expansion of the WTP. The proposed Centralia wells will supply additional raw water to the Hexam WTP, which will be expanded with a second GST.

As noted, the two wells WI-1 and WI-2 are already under contract to be constructed; with construction scheduled to be complete early in 2025. The Wiscon WTP, a new facility, planned for construction in 2025 will be located on County property adjacent to the Wiscon Operations Facility. This new WTP includes a 2 MG GST, HSPS, and standby generator. Initially, this WTP will be connect to the existing 12" transmission main on Wiscon Rd. As the demand on this WTP increases, the 12" transmission main will need to be upsized to 24" or a parallel 12" transmission will need to be installed from the Wiscon WTP to Mariner Blvd.

The remainder of the recommended improvements are transmission main improvements. The recommended improvements for West Hernando Water Service Area for the 20-year planning period total $117,681,000 in 2025 dollars and include the following projects identified in 5-year increments. Note that for all identified projects, the estimated project cost includes 30% construction contingency plus 12% for engineering and project administration.

Year: 2025

- Gretna WTP – WTP improvements consisting of one 2 MG GST and one new 16" diameter well and one 1 mgd well pump
  - Estimated project cost = $5,532,200

- Summer Set Bay Improvements – Water main improvements consisting of 2,500 LF of 8" water main, 6,000 LF of 12" water main, and 11,700 LF of 16" water main to extend service into this planned development
  - Estimated project cost = $11,323,600. This project is developer driven. Per the County, the developer is installing these water mains.
- Gretna to Spring Hill Drive Transmission Main – Transmission main from Gretna WTP to Spring Hill Drive consisting of 1,400 LF of 20" water main and 9,000 LF of 16" water main
  - Estimated project cost = $7,148,300
- Royal Highlands WTP – Increase the pressure setting to 80 psi to improve the ability of this facility to meet PDD+FF.
  - Estimated project cost = No cost
- Woodland Waters Blvd – While the hydraulic modelling shows a need to upsize approximately 3,400 LF of 8" water main to 10" pipe to improve fire flow protection, it is understood that the Lake Hideaway Phase 2 will be required to connect to the water main at the end of Woodland Waters Blvd. This will provide a back feed into the subdivision via a planned 16-inch trunk main from Hexam Road south through the project.

Year: 2030

- Airport Area South Improvements – Consisting of 9,900 LF of 12" water main
  - Estimated project cost = $5,585,600 This project is developer driven; developer will be required to share in the project cost.
- Airport Area North Improvements – Consisting of 3,500 LF of 12" water main and 4,100 LF of 16" water main
  - Estimated project cost = $4,631,000
- Coronado Drive Transmission Main – Includes 4,100 LF of 16" and 3,500 LF of 12" transmission main. Upsizing transmission main east out of Gretna WTP.
  - Estimated project cost = $4,570,000
- Deltona Blvd 12" Water Main – Includes 5,000 LF of 12" transmission main along Deltona Blvd from Spring Hill Drive to Belen Avenue and across to Terrace View Lane
  - Estimated project cost = $2,765,100
- Tracy Street 8" Water Main – Includes 500 LF of 8" transmission main along Tracy Street to connect a 16" main with a low-pressure area near Mariner Blvd
  - Estimated project cost = $188,500
- Centralia Wells – Construction of four new 16" diameter wells, each with a 1,000 gpm well pump, and approximately 36,500 LF of 16" and 20" raw water transmission main from the Centralia wellfield to the Hexam WTP (project schedule is dependent on the Lake Hideaway developer's schedule.
  - Estimated project cost = $43,049,200

Year: 2035

- Hexam WTP Expansion – Expansion of existing WTP including a second 2 MG GST to provide redundancy and additional treated water storage capacity. With the planned development in the immediate vicinity of the Hexam WTP, should this facility need to be taken off-line for repair of maintenance, the water distribution system will not meet minimum target pressures. The facility already has a redundant high service pump. Adding the second ground storage tank provides the redundancy and flexibility needed to periodically take the existing tank out of service for inspection and maintenance. (**Expansion of the Hexam WTP is dependent on the developer's timeline for the buildout of the Lake Hideaway development, the construction of the Centralia wellfield, and associated raw water transmission main.**)
  - Estimated project cost = $3,920,500
- Barclay Avenue Transmission Main – Includes 6,000 LF of 16" transmission main along Barclay Ave from Highgrove to Astaire with 300 LF of 8" at Silverthorn Ave (addresses low pressures in the Mariner Blvd area)
  - Estimated project cost = $3,966,200
- Mariner Blvd 16" Transmission Main – Includes 8,800 LF of 16" transmission main along Mariner Blvd from Killian to Cortez (addresses low pressures in the Mariner Blvd area)
  - Estimated project cost = $5,640,400
- County Line Rd Water Main – Includes 10,000 LF of 10" and 14,700 12" transmission mains along County Line Rd from Preston Hollow to Fargo
  - Estimated project cost = $13,824,500
- Suncoast Blvd 12" Water Main – Includes 7,000 LF of 12" transmission main along Suncoast Blvd from County Line Rd to Eldridge Rd. (Per HCUD, a portion of this project is currently being designed by a private subdivision developer. If built, it would complete the segment from County Line Road to Fairbanks Road connecting through their subdivision's road right of way. HCUD plans to participate in water main oversizing from 8-inch to 12-inch. Note that the estimated project cost below does not account for this.)
  - Estimated project cost = $3,978,300

It should be noted that with the decommissioning of the Antelope Barrow WTP and the Timber Pines GST and BPS following the 2030 planning period, the hydraulic modeling predicts that starting with planning year 2040, the southeast area of the West Hernando Service Area will experience of low pressures (defined as less than 40 psi) during a few hours of the PDD. Upgrades to the transmission system to resolve these low pressures were considered, but did not show any significant improvement. As the low pressures occurred only during a 4-hour window during the peak day demand in the planning year, it is the Consultants recommendation that the County continue to monitor pressures in this area as demands increase to confirm potential low pressure predictions.

7 References

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APPENDIX A

Pump Summary

Appendix A: Pump Curve Summary

Facility Name	Pump #	Motor Make	Motor HP	Pump Make	Pump Model #	Pump Serial #
Cartee-Keysville WTP	CK-1	GE	50	PEERLESS	4AD14	409554
Cartee-Keysville WTP	CK-2	EMERSON	60	PEERLESS	4AD14	409554
Eldridge WTP	EL-1	RELIANCE	125	PATTERSON	8X6MI	SC-C070250-001
Eldridge WTP	EL-2	RELIANCE	125	PATTERSON	8X6MI	SC-C070250-002
Eldridge WTP	EL-3	RELIANCE	125	PATTERSON	8X6MI	SC-0070250-003
Eldridge WTP	EL-4	RELIANCE	125	PATTERSON	8X6MI	SC-0070250-004
Eldridge WTP	EL-5	RELIANCE	125	PATTERSON	8X6MI	SC-0070250-005
Gretna WTP	GR-1	RELIANCE	125	PATTERSON	8X6MI	SC-C070251-001
Gretna WTP	GR-2	RELIANCE	125	PATTERSON	8X6MI	SC-C070251-002
Gretna WTP	GR-3	RELIANCE	125	PATTERSON	8X6MI	SC-C070251-003
Gretna WTP	GR-4	RELIANCE	125	PATTERSON	8X6MI	SC-C07025-004
Gretna WTP	GR-5	RELIANCE	125	PATTERSON	8X6MI	SC-C07025-005
Hexam Rd WTP	HR-1	BALDOR	75	PEERLESS	6AE16G	9927005966-10-A
Hexam Rd WTP	HR-2	BALDOR	75	PEERLESS	6AE16G	9927005966-10-C
Hexam Rd WTP	HR-3	BALDOR	75	PEERLESS	6AE16G	9927005966-10-B
Jamaica-Apricot WTP	JA-1	US MOTOR	75	GOULDS	3410	8274C326
Linden-Deer WTP	LD-1	RELIANCE	100	PATTERSON	8X6MI	SC-C070252-001
Linden-Deer WTP	LD-2	RELIANCE	100	PATTERSON	8X6MI	SC-C070252-002
Linden-Deer WTP	LD-3	RELIANCE	100	PATTERSON	8X6MI	SC-C070252-003
Linden-Deer WTP	LD-4	RELIANCE	100	PATTERSON	8X6MI	SC-C070252-004
Linden-Deer WTP	LD-5	RELIANCE	100	PATTERSON	8X6MI	SC-C070252-005
Mariner-Killian WTP	KI-1	TECO WESTINGHOUSE	100	GOULDS	3180	254C912
Mariner-Killian WTP	KI-2	TECO WESTINGHOUSE	100	GOULDS	3180	253C748
Mariner-Killian WTP	KI-3	TECO WESTINGHOUSE	100	GOULDS	3180	Unknown

Facility Name	Pump #	Motor Make	Motor HP	Pump Make	Pump Model #	Pump Serial #
Mariner-Killian WTP	High Service Pumps	N/A	100	Patterson	8x6 MI-I	N/A – Not installed yet
Royal Highlands WTP	RH-1	EMERSON	60	STERLING	C-1440	543878B
Royal Highlands WTP	RH-2	EMERSON	60	STERLING	C-1440	543878A
Seville WTP	SVL-1	US MOTOR	75	PENTAIR	411LFC	15-2432602-3
Seville WTP	SVL-2	US MOTOR	75	PENTAIR	411LFC	15-2432602-1
Southwest Hernando WTP	SW-1	US MOTOR	75	ITT	1150	1-64486-01-3
Southwest Hernando WTP	SW-2	US MOTOR	75	ITT	1150	1-64486-01-1
Southwest Hernando WTP	SW-3	US MOTOR	75	ITT	1150	1-64486-01-2
Southwest Hernando WTP	SW-4	US MOTOR	75	ITT	1150	1-64486-01-4
Southwest Hernando WTP	SW-5	WEG	75	PEERLESS	6AE14	Unknown
Southwest Hernando WTP	SW-6	US MOTOR	75	PEERLESS	6AE14	Unknown
West Hernando WTP	WH-1	EMERSON	50	GOULDS	3410	A262C832-1
West Hernando WTP	WH-2	EMERSON	50	GOULDS	3410	A262C832-2
West Hernando WTP	WH-3	EMERSON	50	GOULDS	3410	A261C691-2
West Hernando WTP	WH-4	EMERSON	50	GOULDS	3410	A261C691-1
Wiscon WTP	Well Pumps	USEM	40	PEERLESS	12MB/MC	N/A – Not installed yet
Wiscon WTP	High Service Pumps	N/A	50	PATTERSON	5x4M	N/A – Not installed yet

APPENDIX B

Water Demand Projections
Technical Memorandum

1365 HAMLET AVENUE, CLEARWATER, FL 33756
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TECHNICAL MEMORANDUM

TO:	Ron Patel, P.E., Hernando County
FROM:	Mitch Chiavaroli, P.E., McKim & Creed
CC:	Jeff Trommer, WSP
DATE:	~~January 14, 2024~~ Revised July 22, 2025
RE:	Water Demand Projections Technical Memorandum

Executive Summary

In accordance with Task 3, Water Demand Projections, McKim & Creed reviewed data from several sources to project the future potable water demands for the Hernando County Utilities Department potable water service area, including:

A. 2022 Southwest Florida Water Management District (SWFWMD) Functional Population Projections (updated version published in 2023)
B. Geographical information system (GIS) and spreadsheet data obtained from SWFWMD with population projections detailed to the parcel level.
C. University of Florida's Bureau of Economic and Business Research (BEBR)
D. Information obtained from the Hernando County website showing approved developments within the County's potable water service area along with associated development orders.
E. Historical gross water usage for Hernando County Utilities Department customers
F. Hernando County's 2040 Comprehensive Plan
G. Hernando County's Reclaimed Water Master Plan

Based on the analysis of this data, McKim & Creed recommends planning for a 2045 average day demand of 32.69 million gallons per day (MGD) and an annual average per capita demand of 130 gallons (gpcd). It should be noted that the 2040 average demand of 30.24 MGD exceeds the permitted quantity of 23.29 MGD in the current water use permit (WUP) compared to the 2021 level of 24.36 MGD.

Mitch Chiavaroli, PE
FL Professional Engineer No. 56335
McKim & Creed, Inc.
1365 Hamlet Avenue
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Introduction

McKim & Creed (M&C) and WSP completed a Potable Water Master Plan (Master Plan or WMP) for Hernando County (County) in July 2021. The Master Plan used population projections, as well as date pertaining to identified and potential planned developments to determine water demands for the 20-year planning period through 2040 in 5-year increments. Since the completion of the Master Plan, several new planned developments, plus modifications to known planned developments, have been introduced. As such, the County requested the Master Plan be updated to reflect changes to the projected water demands and extend the projections through year 2045.

Using the information from the 2021 Master Plan, recent planning data received from the Hernando County Utilities Department (HCUD), and population projections obtained from the Southwest Florida Water Management District (SWFWMD) and the University of Florida's Bureau of Economic and Business Research (BEBR), revised water demands were developed.

The future demand projections were developed for 20 years (2025 through 2045) in five (5)-year increments and are summarized in this Water Demand Technical Memorandum.

Population Projections

Population projections obtained from SWFWMD and BEBR were analyzed. The SWFWMD projections are detailed to the parcel level and particularly useful for allocating population projections to HCUD's service areas.

SWFWMD PROJECTIONS

The SWFWMD population projections for the HCUD service area from 2022 are shown in **Table 1**. These values represent the adjusted total functional population. The total functional population is the sum of the functionalized seasonal population and the permanent residential population. The functionalized seasonal population is the peak seasonal resident population reduced to account for the percentage of the year seasonal residents typically reside elsewhere, which in turn, results in a subsequent reduction in potable water use during that time[1].

Table 1: Base Population Projections from SWFWMD[2]

HCUD Service Area	2021	2025	2030	2035	2040	2045
Functional Population	151,827	157,869	163,752	167,844	170,901	173,585

M&C obtained GIS shapefiles from SWFWMD and compared the information with the 2022 SWFWMD projections (updated version published in 2023). The files used included:

[1] The Geospatial Small-Area Population Forecasting (GSAPF) Model Methodology used by the Southwest Florida Water Management District, GIS Associates, Inc., 2021

[2] Section C, Population Projections — Utility and Parcel Layers, SWFWMD, https://www.swfwmd.state.fl.us/sites/default/files/medias/documents/Adjusted_SWFWMD_2022_PS_Projection_Summaries_17APR2023.xlsx, April 27, 2023

- Shapefiles from SWFWMD GIS portal:
  - *Hernando Population Projection Points*. This file includes population projection points for the County within the SWFWMD area. File created March 21, 2022, and updated February 1, 2023[3]
  - *Public Supply Service Areas*. This file includes polygons of all public supply service areas in the SWFWMD area, including the County's service area. Data updated on November 17, 2021[4]
- Excel spreadsheet via SWFWMD: *Population Projections calculated using the latest GIS Associates, Inc. 's (GISA) population projection model data and the PS_SERVICEAREAS GIS layer (dated: 17APR2023). (2022 GISA Projections Adjusted using 2021 PSARs)*[2]

Items of note include:

- The SWFWMD projections considered some of the County's approved developments as large planned developments but treated others as ordinary parcels of undeveloped land. This approach results in underestimating future population projections. Adding the latest development information obtained from the County may help to address this.
- Some of HCUD's potable water lines and current customers extend outside of the HCUD service boundary shapefile. An example of this condition is shown in **Figure 1**. This was also noted in the 2021 Potable Water Master Plan.

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[3] Hernando Population Projection Points Zip File, SWFWMD Online Mapping and Data, SWFWMD, https://swfwmd.maps.arcgis.com/home/item.html?id=ece6c97b9abf4853b87ec75380de0004#overview, February 1, 2023

[4] Public Supply Service Areas, Southwest Florida Water Management District Geospatial Open Data Portal, SWFWMD, https://data-swfwmd.opendata.arcgis.com/datasets/swfwmd::public-supply-service-areas/explore?location=28.078608%2C-82.078950%2C8.00, November 17, 2021

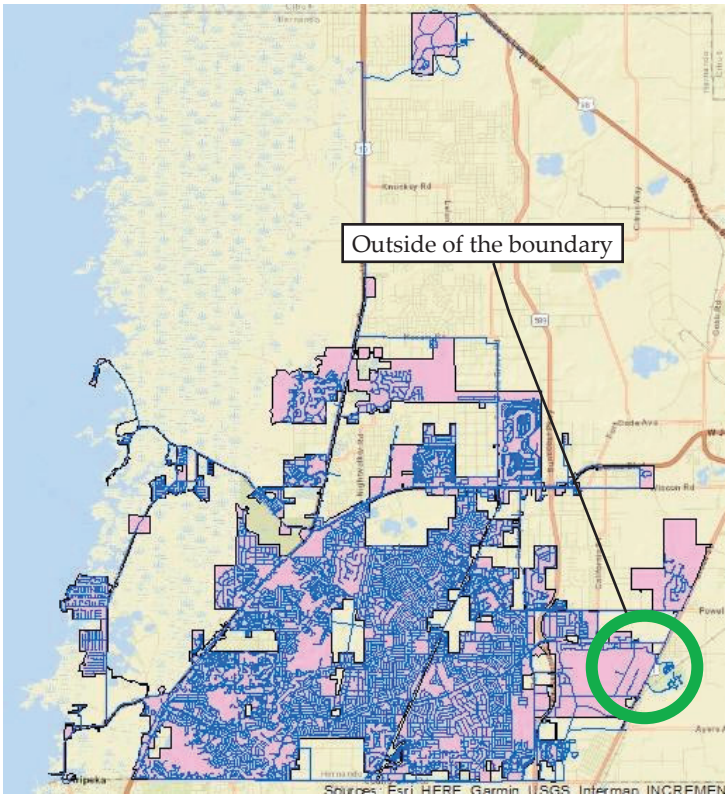

Figure 1 West Hernando Service Area

Pink shading = service area from SWFWMD, blue lines = potable water lines from County

- The SWFWMD population projections included in the parcels within the HCUD service area shapefile boundary did not match SWFWMD published population projections. For example, based on the GIS data the total functional population for 2021 is 131,655. That is 13% lower than the adjusted value of 151,827 from the April 2023 SWFWMD spreadsheet. Upon contacting SWFWMD, they explained that the "differences between the raw GISA projections and the summary file stem from the adjustments made to the base year. Before publishing the projections, SWFWMD compares the base year of the deliverable to the latest population served on the Public Supply Annual Report (PSAR). If there is a difference greater than 5 percent, SWFWMD utilizes the PSAR population and applies the GISA growth rates to extend out to 2050. For the latest deliverable, the 2021 PSAR population was 151,827, and the 2025-2050 populations were subsequently revised upward. The same process was conducted for the 2017 deliverable."

BEBR PROJECTIONS

The BEBR population projections are countywide and do not restrict the population projections to only areas served by the municipal or private utility services. As such, the BEBR population projections will be higher than the SWFWMD projections previously discussed. **Table 2** lists the latest BEBR medium-growth population projections through 2045.

Table 2: BEBR Medium-Growth Populations Projections

Hernando County Population	2021	2025	2030	2035	2040	2045
2022 BEBR Medium - Growth Population	199,207	206,800	217,500	226,400	233,500	239,300

The BEBR projections also show greater population growth than the SWFWMD projections. **Table 3** compares the 2022 SWFWMD population projections to the BEBR medium-growth population projections.

Table 3: Comparison of BEBR and SWFWMD Population Projections

Hernando County Population	2021	2025	2030	2035	2040	2045
SWFWMD Functional Population	151,827	157,869	163,752	167,844	170,901	173,585
2022 BEBR Medium-Growth Population	199,207	206,800	217,500	226,400	233,500	239,300
Difference	47,380	48,931	53,748	58,556	62,599	65,715
Percent Difference	23.8%	23.7%	24.7%	25.9%	26.8%	27.5%
Percentage of County served by HCUD (calculated)	76.2%	76.3%	75.3%	74.1%	73.2%	72.5%

Based on the SWFWMD and BEBR population estimates, approximately 76% of the County population was served by HCUD in 2021. SWFWMD estimates of growth from 2025–2045 compared to the BEBR estimates project that an average of 74% of County residents will be served by HCUD within the 2025–2045 timeframe, with the greatest service area population being 76% in 2025.

Using 76% of the BEBR population projection within the HCUD service area, the BEBR population projections would need to be adjusted as shown in **Table 4**. These population projections were distributed proportionally across each HCUD service area, in proportion to their distribution in the SWFWMD GIS layer for the year 2021.

Table 4: HCUD Service Area Population Estimates

HCUD Service Area	2021	2025	2030	2035	2040	2045
SWFWMD Functional Population	151,827	157,869	163,752	167,844	170,901	173,585
Adjusted BEBR Population w/in HCUD service area	151,397	157,168	165,300	172,064	177,460	181,868

Population estimates as the service area level were developed by using the relative proportion of people in each service area from the SWFWMD GIS layer in 2021. This value was then applied to the 'BEBR Population w/in HCUD service area' numbers to create Adjusted BEBR estimates. These form the foundation of the population projections.

APPROVED DEVELOPMENTS

Hernando County has several approved developments that will become HCUD customers when constructed. Some are classified as planned development districts (PDDs) while others are developments of regional interest (DRIs). The SWFWMD and BEBR population projections look at historical regional growth and do not account for the rapid growth and more dense population associated with these new developments. Therefore, SWFWMD and BEBR population projections are going to be lower than population projections that include these developments.

The following is a summary of the approved developments. This list is based on the Hernando 2040 County Comprehensive Plan Section B. Future Land Use Map Series, and the 2021 Master Plan.

West Hernando:

- Airport – Projected buildout population of 3,533.[5]
- Brooksville Regional Medical Center (West) – 200 hospital beds, 50-bed assisted-living facility.[5]
- Somerset Bay (formerly Spring Center) – Maximum 3,000 residential units.[5]
- Lake Hideaway - Up to 2,400 single family units, up to 1,300 multifamily units[6], up to 50,000 SF of retail commercial, up to 150,000 SF of office (2,862,000 GPD max average daily flow for multi-family residential but shows zero demand for commercial[7]). Phase 1 will contain 211 single-family units.[8] As noted above, this development is already accounted for in the GIS projections, so it was not double counted.
- Lucky Lane (Kensington Woods) – up to 139 single-family residential units (108,420 GPD total maximum daily flow for residential).[9]
- Anderson Snow Villas – 128 residential units. The project will be constructed in two phases. Phase One will consist of 92 lots and Phase two will contain the remaining 36 lots. (99,840 GPD maximum daily flow for residential).[10]
- Anderson Snow Road Subdivision – up to 174 residential lots (60,900 GPD for residential).[11]

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[5] Information from 2019 Population and Demand Projections Report, Name change 2025
[6] 2008 Lake Hideaway Development Order
[7] Lake Hideaway Phase 1 (Pods A and B) Conditional Plat Capacity Analysis, Coastal Engineering Associates (CEA), 2021
[8] Lake Hideaway Phase 1 (Pods A and B) Conditional Plat – Narrative, CEA, July 9, 2021
[9] Lucky Lane Capacity Analysis, CEA, 2022
[10] Anderson Snow Villas Basis of Design Engineering Report, CEA, 2021
[11] Anderson Snow Road Subdivision Capacity Analysis, CEA, April 5, 2022

- Arbor Meadows Development: Rainbow Glen – 153 residential units (117,000 GPD maximum daily flow for residential).[12]
- Barclay Townhomes – Up to 172 residential townhomes (60,200 GPD average daily flow for residential).[13]
- Caldera at Sterling Hill – up to 814 single-family residential units. Phase 1 – up to 121 single -family lots, (42,350 GPD average daily flow for residential for Phase 1, 284,900 GPD average daily flow for residential upon completion).[14] [15] [16] [17]
- Waterford (previously called Cortez Oaks) – up to 919 single-family units (321,650 GPD for residential).[18]
- Glen Lakes Phase II-13AB – up to 188 single-family units (47,000 GPD residential for Phase 1 & 2, 117,000 GPD residential for total project). In total Glen Lakes Phase Two A & B will have up to 332 single-family residential units, up to 24 multi-family residential units.[19]
- Pine Cone Street – up to 215 single-family residential units.[20]
- Somerset Bay Phase 1 – up to 400 single-family residential lots (312,000 GPD total maximum daily flow for residential)[21]. Somerset Bay is planned to have 2,125 single-family homes, 250,00 SF of commercial, 150,000 SF of office, and 100,000 SF of gov/institutional upon completion per the Zoning Capacity Calculations, however only Phase 1 seems to be approved at this time. For planning purposes, the larger value is used.
- Springside Grove – up to 230 residential lots (89,700 GPD total average daily flow for residential).[22]
- Winding Oaks – up to 241 single family residential units (187,980 GPD total maximum daily flow for residential).[23] [24]
- Kensington Place – up to 81 single-family residential lots. No potable water demand provided.[25]
- Ayers Road – up to 200 apartment units.[26]

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[12] Arbor Meadows Utility System Analysis Report, CEA, April 2022
[13] Utility System Analysis Report for Barclay Townhomes, CEA, August 2022
[14] Basis of Design Engineering Report for Caldera Subdivision Phase 1, CEA, November 2022
[15] P&Z comments, HCUD, April 2022
[16] Utility System Analysis Report for Caldera at Sterling Hill, CEA, June 2022
[17] Project Narrative – Pulte - Caldera at Sterling Hill, CEA, December 28, 2022
[18] Utility System Analysis Report for Waterford Development, CEA, January 2023
[19] Glen Lakes Phase Two – Parcel 13 A & B Conditional Plat Application, ACDG, July 14, 2021
[20] Oak Development Group – Pine Cone (Key #344648, #344746) Conditional Plat Application, Langan, March 9, 2022
[21] Utility System Analysis Report for Somerset Bay, CEA, May 2021
[22] Capacity Analysis for Springside Grove, CEA, April 2022
[23] Winding Oaks Construction Drawings Subdivision Review Application, Garden Street Communities Southeast, LLC, October 20, 2021
[24] Basis of Design Engineering Report for Winding Oaks, CEA, November 2021
[25] Kensington Place Construction Drawings, Wert, Christopher S, July 22, 2022
[26] Ayers Road Apartment Construction Drawings, CEA, January 24, 2022

- Whiting Estates Phase II – up to 29 single-family lots. No potable water demand provided.[27]
- Oak Park Estates – up to 86 single-family residential lots (67,080 GPD peak hour flow for residential).[28] [29]
- Authentix Suncoast – up to 264 multifamily residential units, up to 2,795 SF of clubhouse/pool, and up to 1 maintenance building/car wash (207,480 GPD for all buildings).[30]
- Suncoast Landing – up to 118 residential units, up to 12 commercial units (645,900 GPD).[31] [32]
- Verano (Kaimakliotis) – up to 219 single family residential units (170,820 GPD peak flow for residential)[33]. The anticipated completion date is November 2023.[34]

East Hernando:

- Hickory Hill - Up to 1,750 dwelling units, up to 50,000 SF of neighborhood commercial, and up to 54 golf holes and ancillary facilities (700,000 GPD for residential, 62,000 GPD for non-residential).[35]
- Sunrise (I-75/SR-50) - Up to 4,200 single family units, up to 600 multifamily units, up to 75 motel units, up to 325,000 SF of commercial, up to 50,000 SF of office, up to 40,000 SF of mini warehouse (1,680,000 GPD for residential, 88,200 GPD for nonresidential).[36]
- Arbor Ridge – up to 184 residential lots (119 mobile home lots, 65 RV lots) (46,313 GPD for residential)[37].
- Avalon West Phase 1 – up to 198 single-family residential lots, up to 100,000 SF of commercial, and up to 20,000 SF of fraternal lodge (Elks Lodge) (124,800 GPD maximum average daily flow for residential for Phase 1)[38].
- Benton Hills Phase 1 – up to 659 single-family lots. Phase 1 will consist of up to 183 single-family lots, Phase 2 – 190 up to single-family lots, and Phase 3 – up to 278 single family lots (230,650 GPD average daily flow for residential)[39].

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[27] Whiting Estates Phase 2 Construction Drawings, Landmark Engineering & Surveying Corporation, January 12, 2023

[28] Oak Park Estates Capacity Analysis, Langan, July 8, 2021

[29] Oak Park Estates Construction Drawings, Langan, September 8, 2021

[30] Authentix Suncoast Water Capacity Analysis, Madden Moorhead & Stokes, LLC, October 5, 2021

[31] Suncoast Landing Water & Sewer Capacity Analysis, Florida Land Design & Permitting, November 16, 2020

[32] Construction Drawing Subdivision Review Application for Suncoast Landing, Suncoast Investment Group of Hernando County, LLC, September 4, 2020

[33] Verano Water Capacity Analysis, Clearview Land Design, P.L., June 22, 2021

[34] Verano Approved Construction Drawings 11-02-21, Clearview Land Design, P.L.

[35] Development Order - Hickory Hill Development of Regional Impact, Hernando County, Florida, April 26, 2007

[36] Development Agreement - Sunrise (Combined-Planned Development Project), June 13, 2023

[37] Arbor Ridge Construction Drawings Sheet No. 10, ProCivil 360, October 27, 2022

[38] Basis of Design Engineering Report for Avalon West, CEA, February 2021

[39] Basis of Design Engineering Report for Benton Hills Subdivision, CEA, August 2022

- Olancha Subdivision – up to 226 single-family lots and 66,000 SF of commercial space (79,100 GPD average daily flow for single-family and 11,880 GPD average daily flow for commercial)[40].
- Sherman Hills Phase 4A – up to 81 single-family residential lots (56,700 GPD total average daily flow for residential)[41]. Estimated construction completion date is June 2023.[42]
- Sherman Hills Phase 4B – up to 85 single-family residential lots (59,500 GPD total average daily flow for residential)[43]. Estimate construction completion date is June 2023.[44]
- Trilby Crossing – up to 400 single family residential lots.[45]

Seville:

- Seville Phase 1A – up to 208 units.[46]
- Quarry Preserve – Up to 5,800 dwelling units with maximum of 4,600 single family units and a minimum of 1,200 multifamily units, up to 200 hotel/motel units, up to two golf courses totaling 36 holes, 850,000 SF of business park, 545,000 SF of commercial uses, and a school site. Requires water supply. The development order states 2.03 million gallons per day (MGD) for residential and 0.173 MGD for non-residential. [5]
- Cabot Citrus (formerly World Woods) – Buildout population of 3,687. [5]

Other (to connect to Seville and possibly West Hernando):

- Shady Oaks North – no information provided about the number of units or lots.

Several differences between the above list of developments compared to those identified in the 2021 Master Plan include:

- New developments not accounted for in the 2021 Master Plan, including Lucky Lane and Arbor Ridge
- The 2021 Master Plan included demands for developments around the airport, Brooksville Regional Medical Center, Somerset Bay (formerly Spring Center), Quarry Preserve, and Cabot Citrus (formerly World Woods). However, the development information received from the County for this project did not include information about these developments. Still, as these developments were noted as significant in the 2021 Master Plan, the previous development information was used in when calculating updated population projections.

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[40] Olancha Subdivision Capacity Analysis, CEA, June 2022

[41] Utility System Analysis Report Sherman Hills Phase 4A & 4B, Commercial Site Solutions (CSS), October 11, 2022

[42] Sherman Hills PH 4A Narrative - Preliminary Engineering Analysis for Sherman Hills Phase 4A, CSS, June 10, 2022

[43] Utility System Analysis Report Sherman Hills Phase 4A & 4B, CSS, October 11, 2022

[44] Preliminary Engineering Analysis for Sherman Hills Phase 4B, CSS, June 22, 2022

[45] Trilby Crossing Conditional Plat Approval Letter, HCUD, December 10, 2018

[46] Construction Plans for Seville Phase 1 A, CEA, December 21, 2006

CONSOLIDATING DEVELOPMENT DATA AND GIS DATA

Some planned developments were already identified in the SWFWMD GIS layer as a planned development. These were noted under the GIS attribute "DEVELOPMEN". To avoid double counting the population (and related water demands) associated with each of these areas, the population increase between 2021 and 2045 reflected in the SWFWMD GIS layer was subtracted from the calculated build-out populations of these planned developments to determine the projected 2045 populations used in the water demand calculations. The process used to reconcile the planned development data with the GIS data is described below.

- If a planned development is identified in the population projection GIS layer (SWFWMD GIS layer), the 2045 projected population within the GIS layer boundary equals the build-out population increase from the development minus the 2021 to 2045 population increase projected by SWFWMD;
- If a planned development is outside of the HCUD Public Service Area GIS boundary or if a planned development is not identified in the SWFWMD GIS layer, the 2045 projected population within the GIS layer boundary equals the BEBR Adjusted projected population plus the total population increase from the development
- If there is no planned development within the SWFWMD GIS layer, the projected populations within the GIS layer boundary equals the BEBR Adjusted projected populations.

In both cases where a planned development is within the SWFWMD GIS layer boundary, we assumed full build-out of the planned development by the year 2045.

POPULATION SUMMARY

McKim & Creed used the adjusted BEBR medium-growth populations (BEBR Adjusted) to account for the populations within HCUD's service area (as shown in Table 4) plus the additional population increases from the approved developments to calculate the water demand. For Cedar Lane, Dogwood Estates, and Royal Oaks, McKim & Creed assumed the SWFWMD population projections were adequate as these areas are essentially built out. The distribution of projections is shown in **Table 5**.

Table 5: Allocated and Total HCUD Service Area Population Estimates

Service Area	2021	2025	2030	2035	2040	2045
West	140,587	149,397	162,205	176,662	188,858	199,286
East	9,526	13,662	17,880	22,294	26,727	31,136
North/Northwest/Seville	71	3,639	7,663	11,706	15,713	19,680
Cedar Lane	302	302	303	307	313	318
Dogwood Estates	750	750	763	788	815	839
Royal Oaks	161	161	161	163	166	168
Total	**151,397**	**167,911**	**188,975**	**211,921**	**232,593**	**251,428**

DEMAND PROJECTIONS

The process to convert the population to water demands is multi-step. First, a per capita water use demand needs to be defined. Second, non-residential water use usage such as commercial, industrial, and institutional needs to be defined for non-residential areas. Finally, water loss needs to be defined.

The County's 2040 Comprehensive Plan identifies the water demand for one equivalent residential unit (ERU) to be 350 GPD. Per the US Census Bureau, the average household population is estimated to be 2.44[47]; which equates to 146 GPD per capita (gpcd). As shown in **Table 6**, HCUD's service area usage – including non-residential usage – is historically much lower than 146 gpcd.

Table 6: HCUD Historical per Capita Water Use Based on SWFWMD PSARs

	2018	2019	2020	2021	2022
Annual Average Per Capita Water Use (gpcd)	123	126	129	131	130
Water Loss (annual average MGD)	1.59	1.83	1.81	1.93	1.88
Water Loss as Percent of Gross Use	8.94	9.92	9.45	9.72	9.34

For consistency with the 2021 Master Plan and the per capital water usage identified in **Table 7**, the following calculation was used to estimate the average daily demands for single-family and multi-family developments:

$$Total\ average\ day\ demand = \#\ of\ dwellings\ \times 2.44\ \frac{people}{ERU} \times \mathbf{130\ gpcd}$$

Phasing information was available for several planned developments and was used to distribute the associated population and demand across the years 2025 through 2045. For all other developments, build-out was assumed in the year 2045 and the population and demand were distributed evenly across the 20-year planning period from 2025 to 2045.

Some of the planned developments also include commercial space, provided in square feet (SF). The annual average per capita water use accounts for both residential and non-residential use. Therefore, no additional calculations for commercial use associated with these developments.

Using above information, average daily water demands were calculated as shown in **Table 7**.

[47] QuickFacts Hernando County, Florida, United States Census Bureau, https://www.census.gov/quickfacts/fact/table/hernandocountyflorida, 2022

Table 7: Average Day Demand (MGD) Projections

Service Area	2025	2030	2035	2040	2045
West	19.42	21.09	22.97	24.55	25.91
East	1.78	2.32	2.90	3.47	4.05
North/Northwest/Seville	0.47	1.00	1.52	2.04	2.56
Cedar Lane	0.04	0.04	0.04	0.04	0.04
Dogwood Estates	0.10	0.10	0.10	0.11	0.11
Royal Oaks	0.02	0.02	0.02	0.02	0.02
Total	**21.83**	**24.57**	**27.55**	**30.24**	**32.69**

Summary

McKim & Creed evaluated data from SWFWMD, BEBR, and HCUD to estimate and allocate population projections and associated potable water demand projections. Based on the analysis of this data, McKim & Creed recommends planning for a 2045 average day demand of 32.69 MGD.

APPENDIX C

Diurnal Curve Determination Memorandum

McKIM&CREED

1365 HAMLET AVENUE, CLEARWATER, FL 33756
TEL (727) 442-7196 ● FAX (727) 461-3827

MEMORANDUM

TO:	Ron Patel, P.E., Hernando County
FROM:	Mitch Chiavaroli, P.E., Omar Mulla-Saleh, E.I.T., McKim & Creed
CC:	Gordon Onderdonk, Hernando County
	Jeff Trommer, WSP
DATE:	March 5, 2025
RE:	Hernando County Water Master Plan Update - Diurnal Curve Determination

A meeting was held with Hernando County Utilities (County), McKim & Creed (M&C), and WSP on February 26, 2025 to discuss modifying the diurnal curve used in the hydraulic model for the County's potable water distribution system. The diurnal curve serves to reflect the 24-hour flow pattern for extended period simulations (EPS).

The current hydraulic model uses the same diurnal curve used in the preparation of the 2021 Water Master Plan, i.e., the average diurnal curve developed for the Eldridge WTP using WTP's normalized flow data from four (4) days between April 2017 and May 2019. This diurnal curve has a "peaking factor" of approximately 1.747 that occurs in the 8:00 p.m. hour. The County believes the peaking factor of the diurnal curve overestimates the peak hourly usage demand and asked M&C to reevaluate the peak factor using more recent flow data.

The County provided flow data for the calendar years of 2022 and 2023 for 5 water treatment plants; Linden-Deer, Eldridge, Hexam, Southwest, and Killian WTPs. When analyzing the data for diurnal patterns, M&C observed that Southwest and Killian WTPs did not have typical diurnal patterns. The Southwest WTP exhibited both a diurnal pattern and a flat steady flow at different times of the year. When the flow data for the Southwest WTP did show a diurnal pattern, the pattern did not reflect the early morning or late afternoon peaks consistent with the other County WTPs and typical diurnal curves. Flow data from the Southwest WTP was also missing hourly data on numerous days, making the data inconsistent. The missing data is visualized in the Southwest WTP curve by dropping down to 0 before jumping back up to the measured flow at the next reading. The Killian WTP was observed to have days with diurnal patterns and days with flat steady flows. For these reasons, the flow data from the Southwest and Killian WTPs was not used in determining a representative diurnal curve.

As done for the 2021 Master Plan, flows from four (4) days were selected, two representing the wet season and two representing the dry season. The selected days were April 21, 2022; August 16, 2022; May 9, 2023; and September 13, 2023. Diurnal patterns for all 5 plants were compared and an average of the combined Lindeen-Deer, Eldrige, and Hexam plants was created. (Again, the flow data from the Southwest and Killian WTPs was not used for the combined curve for the reasons previously discussed.) The combined for each day was compared to the previous curve labeled as Eldrige Avg. 2017-2019 data.

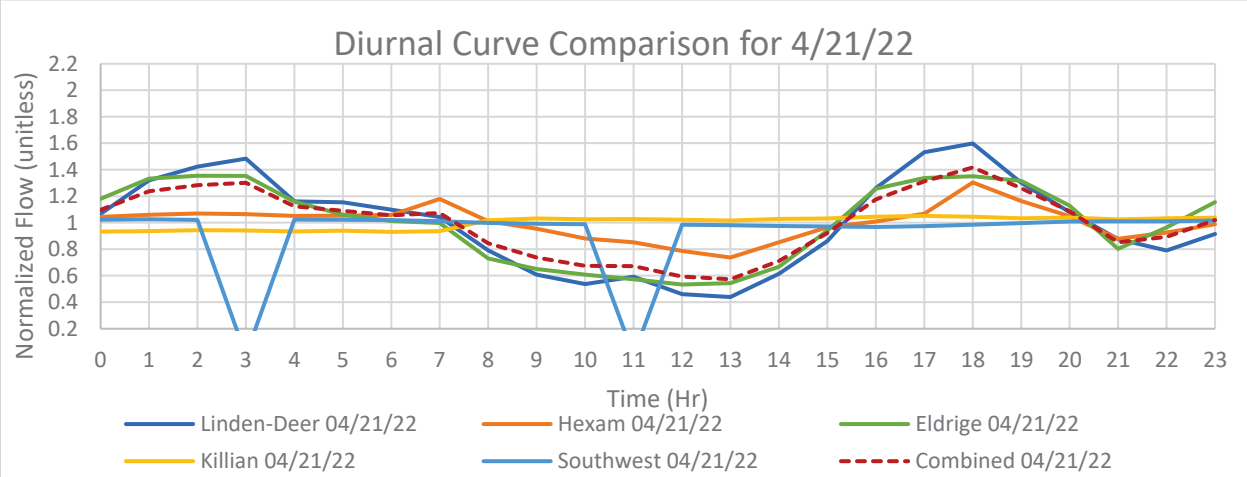

Figure 1: Comparison of diurnal curves for 5 WTPs and a combined average for Linden-Deer, Hexam, and Eldrige WTPs on 4/21/22.

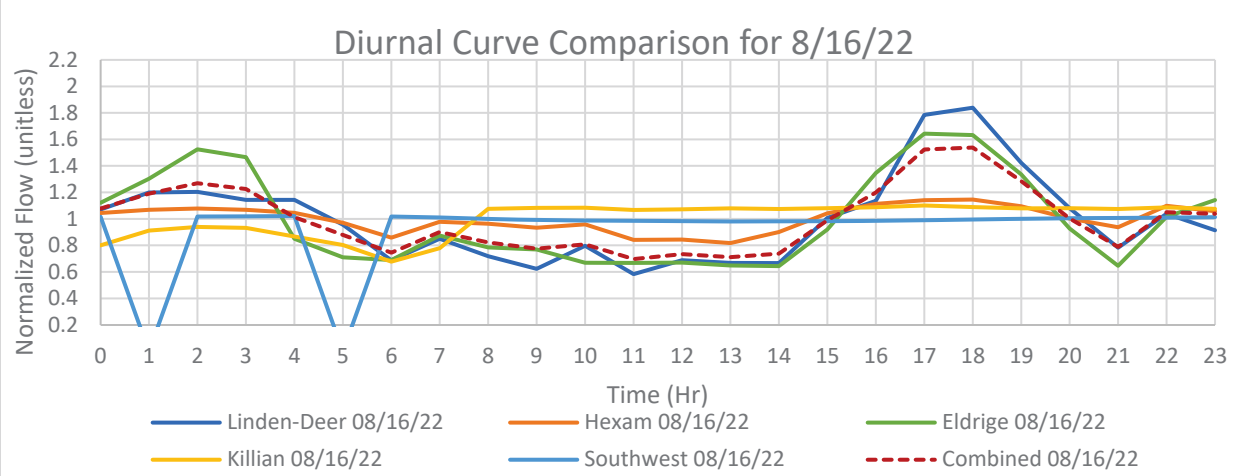

Figure 2: Comparison of diurnal curves for 5 WTPs and a combined average for Linden-Deer, Hexam, and Eldrige WTPs on 8/16/22.

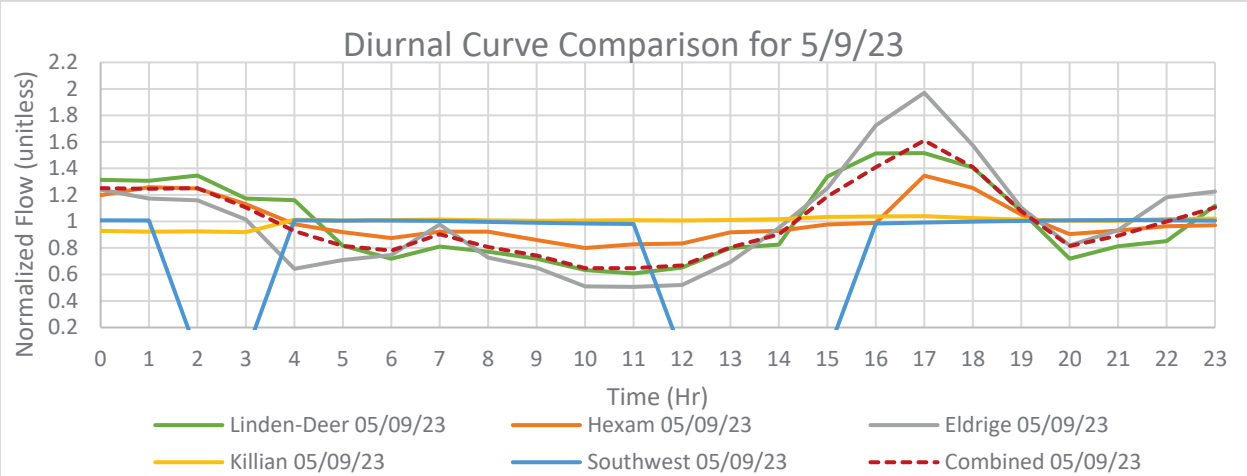

Figure 3: Comparison of diurnal curves for 5 WTPs and a combined average for Linden-Deer, Hexam, and Eldrige WTPs on 5/9/23.

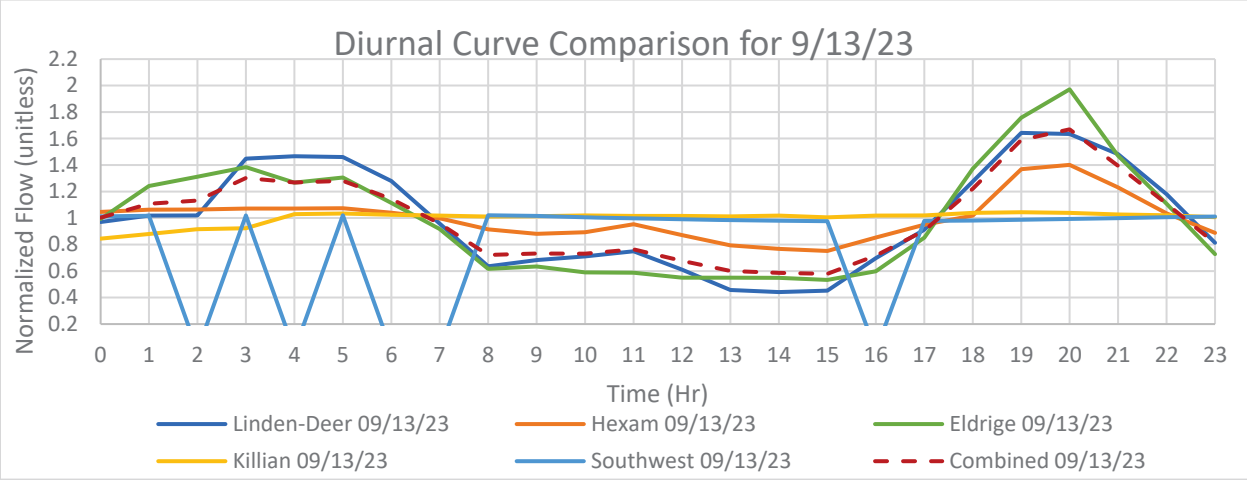

Figure 4: Comparison of diurnal curves for 5 WTPs and a combined average for Linden-Deer, Hexam, and Eldrige WTPs on 9/13/23

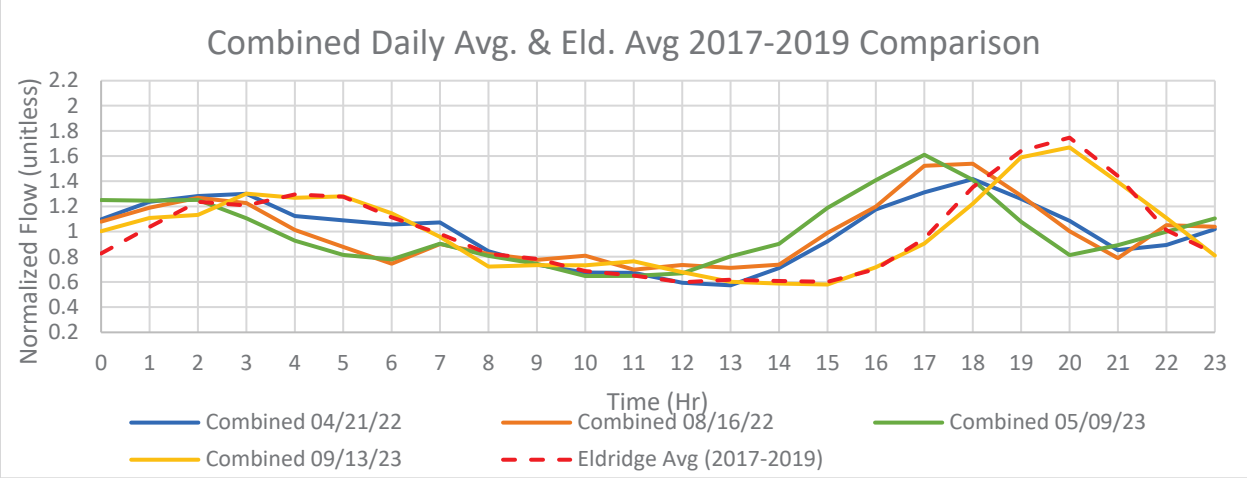

Figure 5: Comparison of diurnal curves combined average for Linden-Deer, Hexam, and Eldrige WTPs on 4/21/22, 8/16/22, 5/9/23, and 9/13/23 and Eldridge average previously used for modeling. The peak hour for 4/21/22, 8/16/22, and 5/9/23 occur earlier in the day than peak hour for Eldridge avg. 2017-2019 and 9/13/23

The peak hours in the diurnal curve appear to shift between 2017 to 2023. The peak hours during 2022 and early 2023 were approximately 2 hours earlier than the peaks in 2017-2019. Data in the latter half of 2023 was also observed to have a horizontal shift with peak hours occurring approximately 2 hours later compared to data from 2022 and first half of 2023. It is assumed some sort of time stamp shift occurred between 2019 to 2022 and another shift occurred in 2023. The 2023 shift brought peak hours more in line with what was previously observed during 2017-2019. Further research is required to determine the causes for the odd behaviors exhibited in the data which were not within the scope of this meeting.

The highest peaking factor for the combined data was generally lower than the previous highest peaking factor value of 1.747. This is not unexpected as the previous diurnal curve represents the flows from one WTP, i.e., the Eldrige WTP, while this new diurnal curve averages three WTPs,

the Linden-Deer, Eldrige, and Hexam WTPs. The Hexam WTP provides water to an area that is not fully developed and has a lower customer base.

Table 1: Summary of Peaking Factors

Date	Weekday	Highest Individual WTP Peaking Factor	Combined WTP's Peaking Factor
04/21/2022	Thursday	1.598	1.418
08/16/2022	Tuesday	1.839	1.539
05/09/2023	Tuesday	1.971	1.611
09/13/2023	Wednesday	1.972	1.669
Eldridge Ave. 2017-2019		1.747	1.747

After presenting the data to the County, it was agreed that the flow data from the Southwest and Killian WTPs would not be used for the diurnal curves. It was observed that the data on April 21, 2022 was considerably lower than the other three (3) days despite being a dry season day and removed from determining the diurnal peaking factor. The remaining three (3) days peaking factors were averaged and determined to have a peaking factor of 1.606. This new peaking factor represents an approximate 8% decline from the previous factor of 1.747. The new peaking factor aims to capture the current demand from fully developed areas using flow data for the Eldrige and Linden-Deer WTPs and the lower demand from developing areas using flow data from the Hexam WTP.

With the horizontal shift occurring, averaging the diurnal charts across the 3 selected days was not recommended as it would artificially flatten the curves and not be representative of the hourly demands. The County and M&C agreed to move forward expecting to keep the diurnal curve pattern in the existing hydraulic model the same with the exception of "flattening" the evening diurnal peak between the hours of 7:00 and 9:00 p.m. to a maximum 1.60.

Below are the individual WTP diurnal curves for the dates selected. Linden-Deer, Eldridge, and Hexam exhibit the expected diurnal pattern and the 2 hour shift.

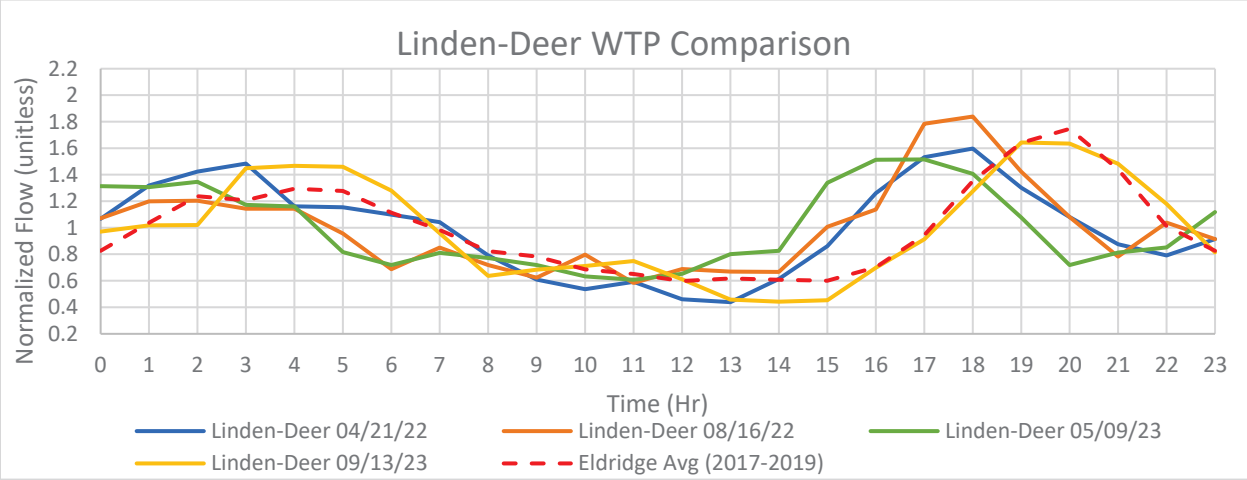

Figure 6: Lind-Deer WTP Diurnal Data for the selected dates compared with the previous Eldridge Avg. used. Similar diurnal pattern when accounting for the 2-hour shift.

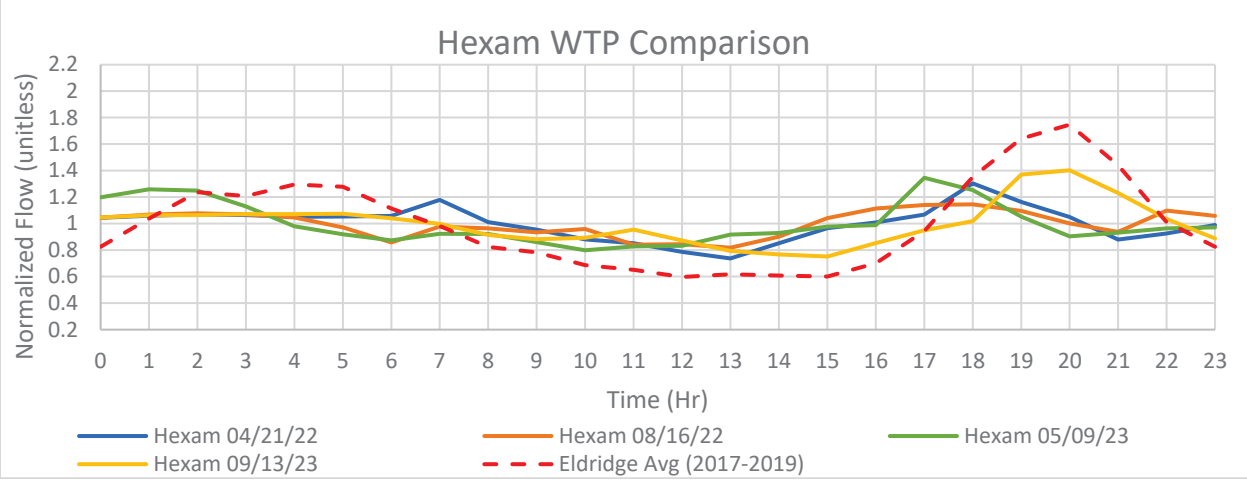

Figure 7: Hexam WTP Diurnal Data for the selected dates compared with the previous Eldridge Avg. used. Similar diurnal pattern but lower peaks than previous Avg. when accounting for the 2-hour shift.

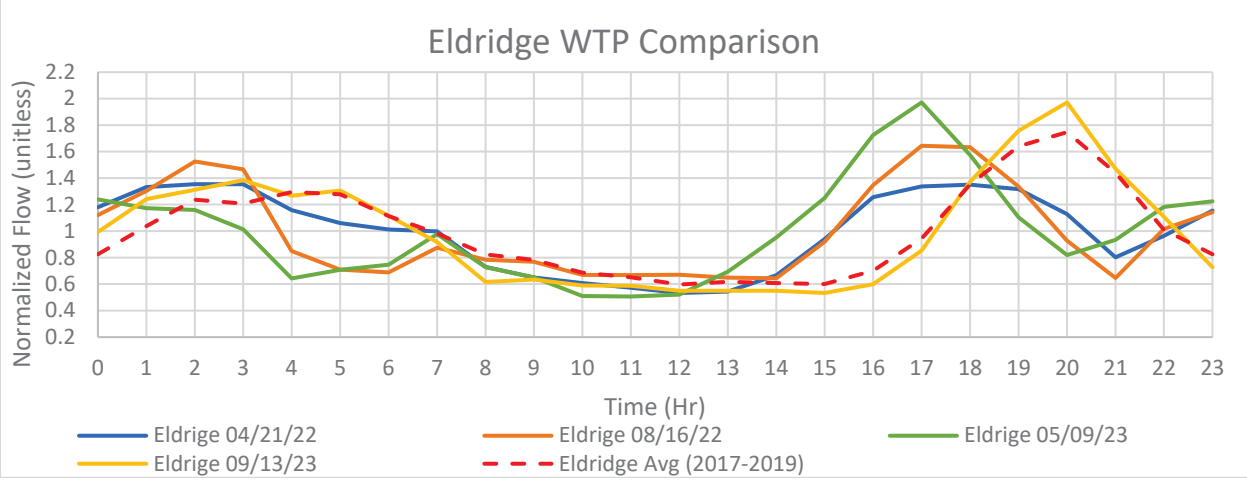

Figure 8: Lind-Deer WTP Diurnal Data for the selected dates compared with the previous Eldridge Avg. used. Similar diurnal pattern when accounting for the 2-hour shift.