

Wastewater Treatment Capacity Strategy to Meet Projected Growth

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Hillsborough County (county) is located on the west coast of Florida in the central portion of the state, as shown in Figure 1. According to the U.S. Census Bureau, the county has a total area of 1,266 sq mi, is the fourth-most-populous county in Florida, and the most-populous county outside the Miami metropolitan area. The Hillsborough County Public Utilities Department (PUD) provides drinking water treatment, wastewater treatment, and re-

claimed water service to unincorporated parts of the county. The county's PUD service areas are divided into the northwest service area and the south-central service area, which include four water treatment plants, six wastewater treatment plants, and a biosolids facility between the two service areas.

To meet anticipated demands for new water and wastewater service, the PUD's planning department continuously reviews population and growth projections to plan for new infrastructure and treatment facilities. Planning, however, comes with challenges. Economic variability can make predicting the size and timing for new utility infrastructure difficult. Table 1 presents the population growth and projected growth data from the county's 2018 Annual Economic Development Indicators Report, which shows a 15.09 percent growth rate between the years 2010-2018. In comparison, the county's 2015 Annual Economic Development Indicators Report showed a much lower 6.43 percent growth rate. To further illustrate the long-term variability of the county's population growth, Figure 2 presents the year-to-year percent change from 1970-2017. The average annual percent change for the overall 48-year period is also illustrated in this figure to provide a benchmark for gauging periods of relatively

Table 1. Hillsborough County population and project growth projections.

2018 Population Growth and Project Growth					
Location	2010	2018	2023	2010-2018	2018-2023
Hillsborough	1,233,849	1,420,088	1,505,121	15.09%	5.99%
Florida	2,788,854	3,109,347	3,264,960	11.49%	5.00%
Florida	18,801,310	21,166,515	22,227,106	12.58%	5.01%
2015 Population Growth and Project Growth					
Location	2010	2015	2020	2010-2015	2015-2020
Hillsborough	1,229,226	1,308,304	1,395,620	6.43%	6.67%
Tampa MSA ¹	2,783,243	2,893,923	3,027,024	3.98%	4.60%
Florida	18,801,310	19,603,934	20,654,191	4.27%	5.36%

(Source: EMSI)

¹ The Tampa-St. Petersburg-Clearwater Metropolitan Statistical Area (MSA) is comprised of Hernando, Hillsborough, Pasco, and Pinellas counties.



Figure 1. Location of Hillsborough County within the state of Florida (in red).



Figure 2. Hillsborough County's year-to-year population growth from 1970-2017.

high—and relatively low—growth against the backdrop of the long-term average.

The highest rate of new growth is currently occurring within the south-central service area, and this article focuses more specifically on the planning for wastewater treatment capacity within this service area.

For strategic planning, the county's goals include maximizing the use of existing infrastructure, ensuring the right capacity is in place at the right time, and selecting growth alternatives that provide the highest return on investment.

To meet the anticipated wastewater capacity needs for a planning period through the year 2040, the county engaged CDM Smith to evaluate the following three strategies:

1. Maximizing treatment capacities at the existing advanced wastewater treatment plants (AWTPs) through the potential use of alternative treatment technologies.
2. Modification or addition of conveyance system pump stations to allow the redirection of wastewater flows between the south-central service area AWTPs.
3. Construction of an additional AWTP within this service area.

Existing System

The county's south-central service area includes the following three existing AWTPs:

- ◆ Falkenburg AWTP - permitted for 12 mil gal per day (mgd) annual average daily flow (AADF)
- ◆ South County AWTP - permitted for 10 mgd AADF
- ◆ Valrico AWTP - permitted for 12 mgd AADF

The location and service areas for the three south-central AWTPs are presented in Figure 3.

Population and Capacity Projections

The county utilizes population projections provided by the Southwest Florida Water Management District (SWFMWD) based on the Florida Bureau of Economic and Business Research (BEBR) data. "The Geospatial Small-Area Population Forecasting (GSAPF) Model Methodology Used by the Southwest Florida Water Management District" (January 24, 2018), prepared by GIS Associates Inc., documents the process of converting the BEBR 2017 medium population projections by county (available in five-year increments from 2020 to 2045) into parcel-level projections that are then summarized by water utility service area boundaries.

The SWFMWD projections are refined by the county and are allocated to the parcel level to

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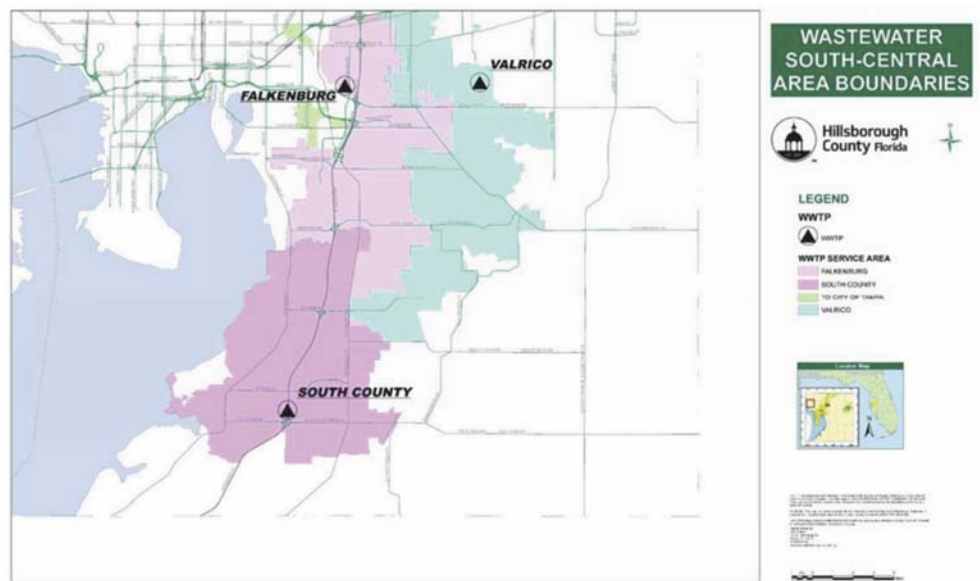


Figure 3. Location and service areas for South County, Falkenburg, and Valrico advanced wastewater treatment plants.

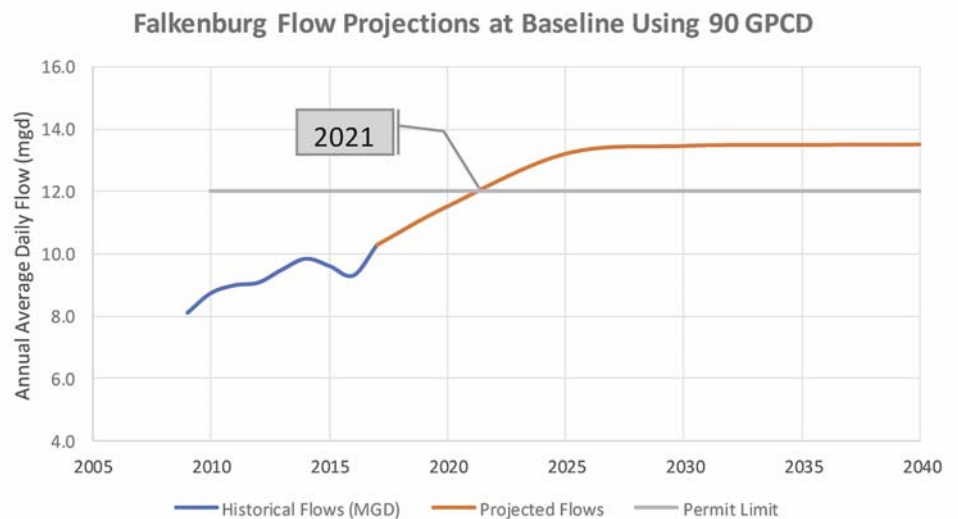


Figure 4. Falkenburg advanced wastewater treatment plant flow projections and permitted capacity at 90 gpcd.

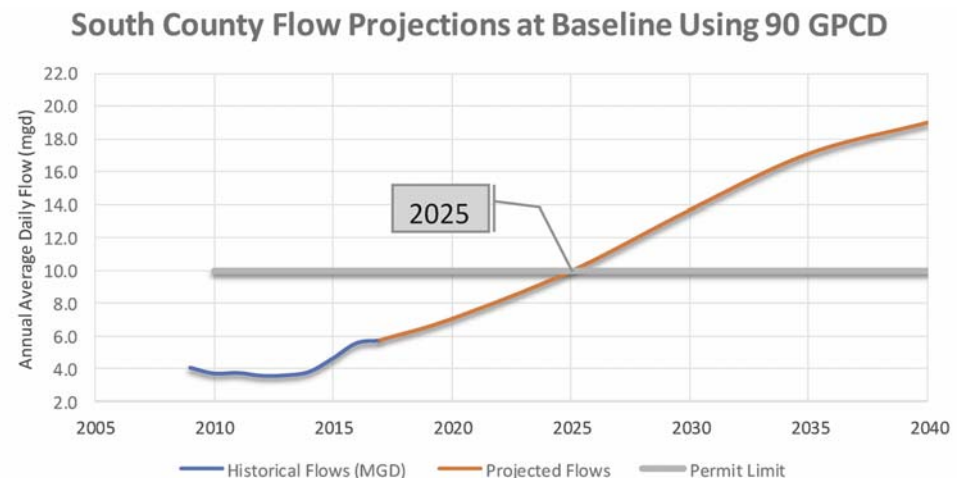


Figure 5. South County advanced wastewater treatment plant flow projections and permitted capacity at 90 gpcd.

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identify population by “sewer sheds” based on topography and location of county pump stations. The population by sewer sheds is then aggregated into the three AWTP service areas. Thus, the

BEBR population projections at five-year intervals starting in 2020 were converted into population projections at five-year intervals for the three AWTP service areas.

Wastewater Treatment Flow Projections

The population projections were multiplied by a value of 90 gal per capita per day (gpcd), which is the planning-level value provided in the county’s comprehensive plan. The resulting flow projections and permitted capacity for each of the south-central service area AWTPs are presented in Figures 4 through 6.

Historical Flows and Projections

The historical population and annual average influent flow data for each AWTP service area were provided by the county for the years 2014 through 2017. A historical look back was conducted to calculate the actual gpcd per year at each AWTP, with results presented in Table 2.

The calculated gpcd results are all lower than the 90-gpcd value utilized during for planning purposes. The highest differences were noted for the South County AWTP and the Valrico AWTP service areas, showing reductions of 38 gpcd (90-52) and 29 gpcd (90-61) respectively.

There are multiple factors that can impact flows within a service area:

1. Older service areas tend to have aging infrastructure, and flow may increase due to groundwater infiltration into leaky pipes and inflow of stormwater during heavy rain events. Comparison of flow contribution during wet and dry periods can be utilized to further evaluate actual gpcd flows to those predicted.
2. Areas of new construction require connection to wastewater service, leading to higher flow rates on a per capita basis. Service areas that encompass older developments include residences on private septic tank services, which can account for lower-than-anticipated per capita flow contributions.
3. The mix of commercial, industrial, and residential services and occupancy rates within the wastewater contribution area can also impact flow contributions within a service area. Assigning various gpcd flow projections based on the type of wastewater contribution may allow for a refined prediction of flows during planning phases.

The difference in actual gpcd flows into the three south-central service area wastewater treatment plants are noted in Table 2. As the factors stated previously can change over time, it’s essential to review historical flow data and continuously refine flow projections. The Falkenburg AWTP had a notably higher gpcd flow, which may be due to infiltration and inflow (I&I). The county has an active project to evaluate I&I; if I&I were

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Valrico Flow Projections at Baseline Using 90 GPCD

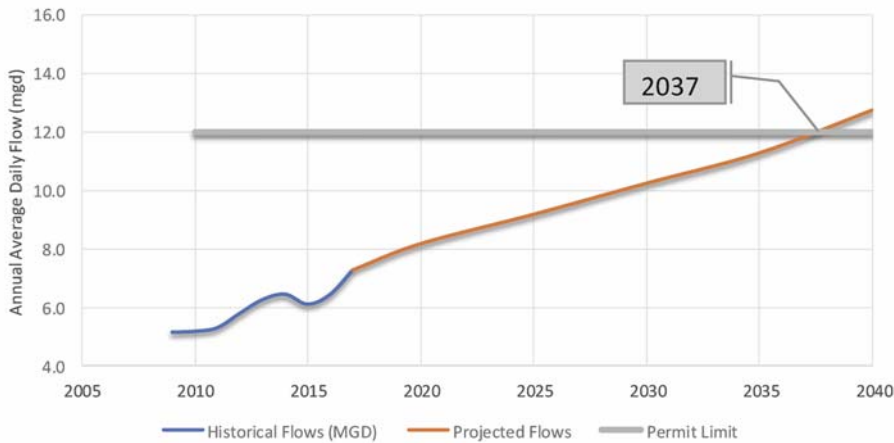


Figure 6. Valrico advanced wastewater treatment plant flow projections and permitted capacity at 90 gpcd.

Table 2. Calculated gpcd values for the south-central service area.

Historical Year Evaluated	Falkenburg AWTP GPCD	South County AWTP GPCD	Valrico AWTP GPCD
2014	84	45	63
2015	80	52	57
2016	75	57	59
2017	79	54	64
Average	80	52	61

South County Flow Projections at Baseline Using 62 GPCD

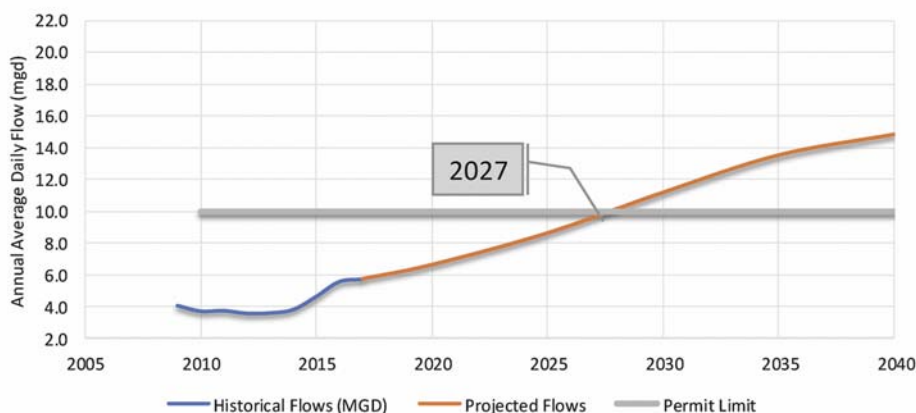


Figure 7. South County advanced wastewater treatment plant flow projections using 62 gpcd (historical 52 gpcd plus 10 gpcd).

Valrico Flow Projections at Baseline Using 71 GPCD

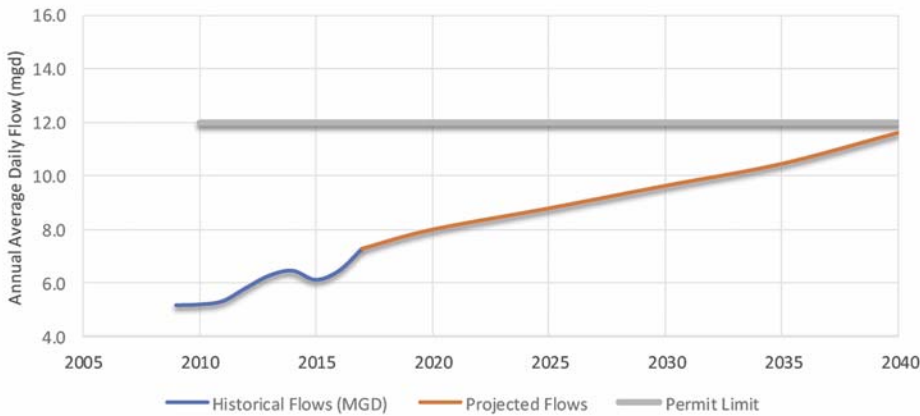


Figure 8. Valrico advanced wastewater treatment plant flow projections using 71 gpcd (historical 61 gpcd plus 10 gpcd).

Table 3. Potential increased wastewater treatment plant capacities.

Expansion Alternative	Additional AADF Capacity	Expanded AADF Capacity
Falkenburg AWTP Expansion Alternatives		
5 th Bioreactor	1.5 MGD	13.5 MGD
IFAS	2.0 MGD	14.0 MGD
BioMag	5.0 MGD	17.0 MGD
South County AWTP Expansion Alternatives		
5 th Bioreactor	3.4 MGD	13.4 MGD
IFAS	4.4 MGD	14.4 MGD
BioMag	8.0 MGD	18.0 MGD

Falkenburg Flow Projections at Baseline Using 90 GPCD with Treatment Alternatives

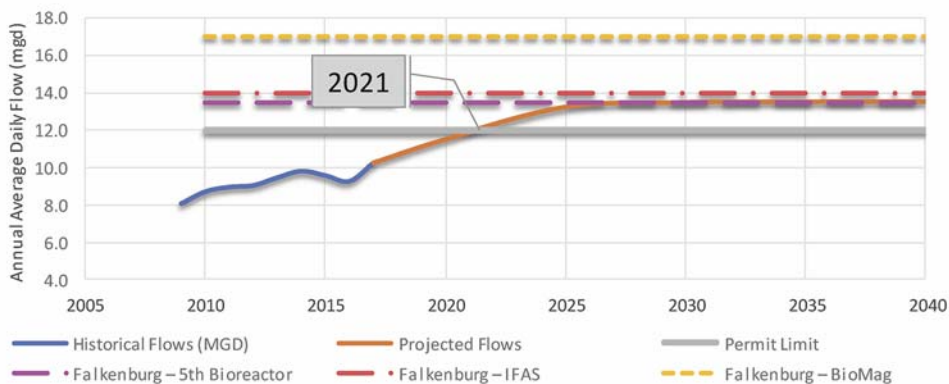


Figure 9. Falkenburg advanced wastewater treatment plant flow projections at 90 gpcd with treatment alternatives.

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significantly reduced, the project could extend the available capacity at the Falkenburg AWTP.

The 90-gpcd value is appropriate for planning and is used in the evaluations provided in subsequent subsections. In order to visualize the future capacity impacts using the historical gpcd values, flow projection graphs were created using the 2014-2017 average gpcd values (Table 2), plus a buffer of 10 gpcd. The historical gpcd and the 10-gpcd buffer graphs for the South County and Valrico AWTPs are presented as Figures 7 and 8, respectively. Because the Falkenburg AWTP historical-calculated gpcd is at 80 gpcd, no additional graph was provided for the Falkenburg AWTP.

Utilizing a projection of 62 gpcd for the South County AWTP results in a shift of two years (from 2025 to 2027), when this facility is projected to meet capacity. Utilizing a projection of 71 gpcd for the Valrico AWTP shifts the date, when this facility would be projected to exceed capacity past the end of the 2040 study period.

Project Alternatives to Meet Wastewater Capacity Needs

Three strategies were evaluated to provide additional/new wastewater treatment capacity:

1. Maximizing treatment capacities at the existing AWTPs through the potential use of alternative treatment technologies.
2. Modification or addition of conveyance system pump stations to allow the redirection of wastewater flows between the south-central service area AWTPs.
3. Construction of an additional AWTP within this service area.

Alternate Treatment Technologies at Existing Wastewater Treatment Plants

As part of the south and central area wastewater expansion study, the following three expansion alternatives identified by the county's PUD were reviewed and evaluated to increase the capacity of the Falkenburg and South County AWTPs:

1. Addition of a fifth biological nutrient removal (BNR) bioreactor.
2. Incorporating integrated fixed-film activated sludge (IFAS) in the existing BNR bioreactors.
3. Incorporating magnetite-ballasted activated sludge (BioMag®) in the existing BNR bioreactors.

The evaluation resulted in potential increased capacities at the Falkenburg and South County AWTPs, as shown in Table 3. Since the Valrico AWTP had the greatest remaining ca-

capacity over the study period, alternative treatment technologies were not evaluated for this facility.

To show the potential impacts to the wastewater treatment plant capacity projections, the 90-gpcd flow projection graphics presented as Figures 4 and 5 were updated to include the potential gained capacities, as noted in Table 3. The updated graphics for the Falkenburg and South County AWTPs are presented as Figures 9 and 10.

For the Falkenburg AWTP, Figure 9 indicates that implementing one of the proposed treatment alternatives has the potential to extend the available treatment capacity beyond the 2040 study period; however, this is not the case for the South County AWTP. Figure 10 indicates that, even with implementing one of the proposed treatment alternatives, the South County AWTP still exceeds the available treatment capacity within the 2040 study period.

The alternative treatment technologies indicate that additional investigations would be required to confirm the anticipated additional treatment capacities.

Flow Transfer Alternatives Within the Conveyance System

As part of the south and central area wastewater expansion study, six flow transfer alternatives were reviewed and evaluated. The county has expressed interest in further pursuing Flow Diversion Alternative 6, which includes the construction of a new Valrico East Master Pump Station.

Flow Diversion Alternative 6 would divert portions of the Valrico east service area away from the Nature's Way Master Pump Station via a new Valrico East Master Pump Station and new force mains. The diversion of flow away from the Nature's Way Master Pump Station would allow that station to be utilized to divert flow from the Falkenburg AWTP service area to the Valrico AWTP, without the need to upgrade that station. The estimated potential AADF diversion for Alternative 6 was 1.23 mgd, which would be diverted from the Falkenburg AWTP to the Valrico AWTP.

To show potential impacts to the wastewater treatment plant capacity projections, the 90-gpcd flow projection graphics (presented as Figures 4 through 6) were updated to include the potential transferred AADF of 1.23 mgd. To allow time for design and construction, it was assumed that the flow transfer would begin in 2021. The updated graphics for the Falkenburg and Valrico AWTPs are presented as Figures 11 and 12.

The transfer of 1.23 mgd AADF delays the potential permitted capacity exceedance for the

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South County Flow Projections at Baseline Using 90 GPCD with Treatment Alternatives

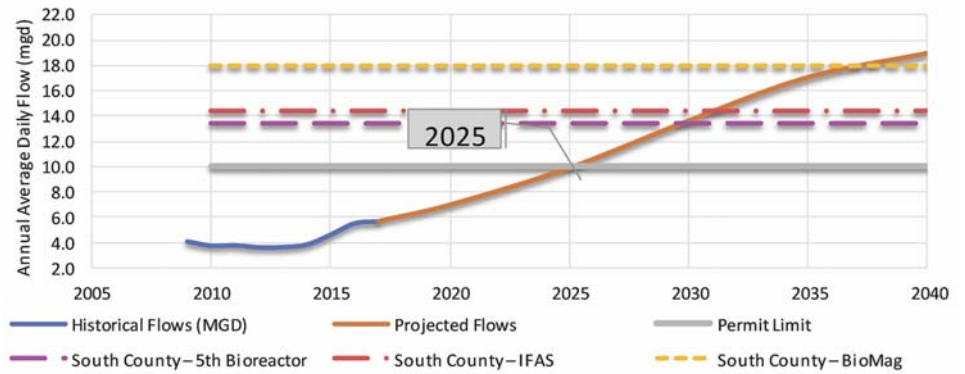


Figure 10. South County advanced wastewater treatment plant flow projections at 90 gpcd with treatment alternatives.

Falkenburg Flow Projections at 90 GPCD with Flow Diversion Alternative #6

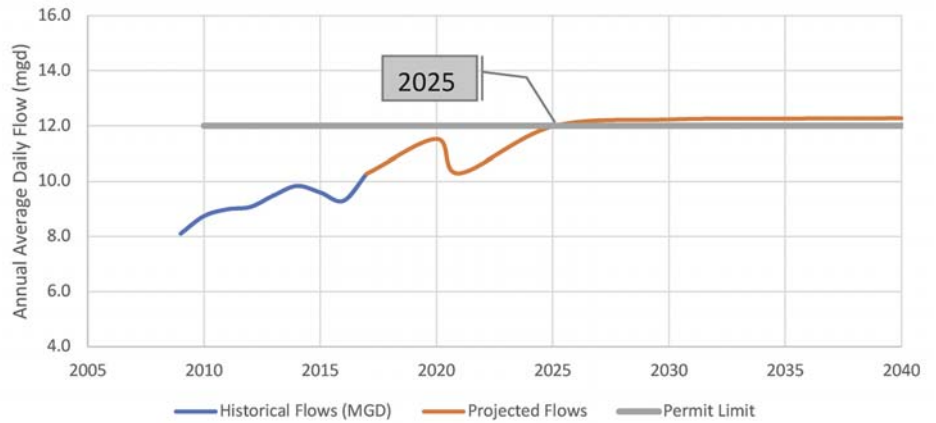


Figure 11. Falkenburg advanced wastewater treatment plant flow projections at 90 gpcd with Flow Diversion Alternative 6.

Valrico Flow Projections at 90 GPCD with Flow Diversion Alternative #6

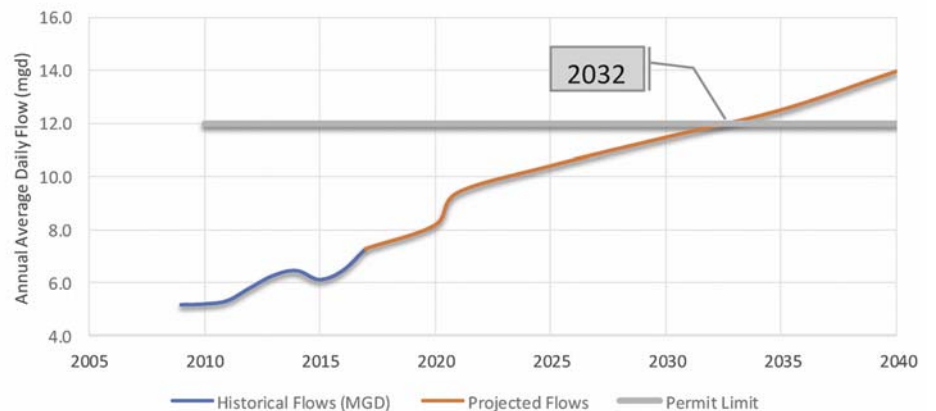


Figure 12. Valrico advanced wastewater treatment plant flow projections at 90 gpcd with Flow Diversion Alternative 6.

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Falkenburg AWTP by four years, shifting from 2021 to 2025; however, it accelerates the potential capacity exceedance at the Valrico AWTP forward by five years, moving from 2037 to 2032. The transfer of flow does provide additional time for the county to implement longer-term solutions to meet the anticipated treatment requirements for future wastewater flows.

Additional confirmations for the quantity of flow that may be diverted, and impacts within the

existing conveyance system, will require further evaluation.

New South-Central Regional Wastewater Treatment Facility

As part of the south and central area wastewater expansion study, the implementation of a new South-Central Regional Water Reclamation Facility (SCRWRF) was reviewed and evaluated. This facility would eventually replace the South

County AWTP, while also treating the excess flows from the Falkenburg and Valrico AWTPs once flows exceed their permitted treatment capacity. A two-phase construction schedule was envisioned for the SCRWRF, with the construction of a new AWTP starting in 2025 and an additional expansion to follow.

A holistic approach to allow flow diversions between the south-central service area AWTPs and create operational flexibility should be taken under consideration. Flow distribution allocations for the diversions from the three existing south-central service area AWTPs could be adjusted based on realized flows and adjusted projections. Should the county proceed with the implementation of Flow Diversion Alternative 6, additional flow may be diverted from the Valrico AWTP. A new SCRWRF would allow the county to optimize flow diversions based on the capacities and operations at the Falkenburg, South County, and Valrico AWTPs.

Summary

The county has taken a proactive approach to plan for the future wastewater treatment capacities that will be required, based on current population and flow projections.

The flow diversion alternatives looked at ways to optimize the distribution of flows between the south-central service areas three existing AWTPs. Flow transfer alternatives present opportunities to maximize the use of existing infrastructure and present short-term solutions to treatment capacity challenges. The treatment alternatives presented a potential long-term solution for the Falkenburg AWTP, but did not offer a long-term solution for the South County AWTP. A new south-central regional AWTP provides for a long-term solution and offers operational flexibility.

The options evaluated are not mutually exclusive, and the county may opt to implement one or more strategies. When evaluating strategies, numerous factors must be considered, including:

- ◆ Short-term strategies
- ◆ Long-term strategies
- ◆ Cost-to-benefit ratios
- ◆ Operational challenges
- ◆ Operation and maintenance costs
- ◆ Mutual benefits that may be realized
- ◆ Systemwide operational flexibility
- ◆ Reliability
- ◆ Environmental impacts

Strategies may develop over time. Flow projections rely on the best available information at the time of the evaluation. Projections should be continuously reviewed and updated to allow for adjustments to occur when feasible. ◊