



# GOMESA PHASE II PROJECT FUNDING

## Request for Funding FY2026

Submission ID: #202509301377

### PROJECT SUMMARY

#### 1. Title of Project

North and South Gulfport WWTPs Improvements

#### 2. Location of Project

North Gulfport WWTP: 30°26'18"N 89°03'33"W Northeast of the intersection between Seaway Road and Larkin Smith Drive in Gulfport, MS South Gulfport WWTP: 30°25'17"N 89°03'43"W Northeast of the intersection between Washington Avenue and Rippy Road in Gulfpo

#### 3. Requesting Organization:

Harrison County Utility Authority (HCUA)

#### 4. Requesting Agency Representative

a. Name:

John Wilson, P.E.

b. Phone:

228-868-8752

d. Email:

JWilson@HCUA-MS.US

c. Address:

10271 Express Drive

Gulfport Mississippi

#### 5. Funding Requested:

\$1800000

#### 6. Have any other State or Federal funding sources been identified for the project?

No

#### 7. If yes, enter amount and source of additional funds:

\$

#### Source of Additional Funds:

#### 8. Total Project Funds



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\$1800000

### 9. Provide Brief Project Description/Overview:

This Utility Authority has a need for advanced biological process modeling of its North Gulfport WWTP to support long-term consolidation of the City's wastewater system. Currently, the City operates two WWTPs (North and South), both of which are nearing operational and regulatory limits, particularly during wet weather events. The South Plant lacks the spatial capabilities for long-term expansion and will be transitioned into a pump station, with its influent redirected to the North Plant for treatment.

A Phase II Master Plan was developed for the Harrison County Utility Authority with recommendation to absorb the South Plant into the North Plant to operate as a singular, modernized facility. The City of Gulfport and Harrison County Utility Authority are currently investing more than \$30 million dollars into the North Gulfport WWTP to construct additional treatment capacity through a new filter basin and headworks to accommodate the combined system flow from the South Plant. However, significant process modifications are still required to ensure reliable treatment, nutrient removal, and compliance with increasingly stringent discharge requirements. This project will consist of advanced BioWin modeling, supported by industry-leading expert resources and trained staff, to develop a comprehensive plan for upgrading the North Plant.

By consolidating treatment into a single, modernized facility, the project will improve efficiency and reliability, reduce operational costs, protect Bayou Bernard and its adjacent wetlands from nutrient and solids pollution, and expand the City's capacity to serve residents and support sustainable development through 2045.

### 10. LIST Project Goals/Objectives:

1. Develop a comprehensive process model of the North WWTP using BioWin software, providing a clear technical road map for system consolidation and long-term upgrades.
2. Evaluate and design biological process improvements that incorporate modern nutrient removal strategies (nitrogen and phosphorous) to ensure compliance with current and future regulatory requirements, while reducing environmental impacts to Bayou Bernard and adjacent wetlands by improving effluent water quality and protecting sensitive habitats.
3. Plan the transition of the South Plant into a pump station, optimizing the current setup and eliminating the need for costly expansions at multiple sites.
4. Lower operational and maintenance costs by consolidating facilities, modernizing treatment processes, and reducing operator burden.
5. Strengthen resiliency and reliability of the City's wastewater treatment system, reducing risks of permit violations and sanitary sewer overflows into sensitive surrounding areas.
6. Promote growth and economic development by ensuring wastewater infrastructure can accommodate future flows.

### 11. Which of the following authorized uses set forth in the GOMESA Act does this project fall under? Explain SPECIFICALLY and in detail how the project meets the required criteria. Check all that apply - At least one must be checked.

(A) Projects and activities for the purposes of coastal protection, including conservation, coastal restoration, hurricane protection, and infrastructure directly affected by coastal wetland losses

While this project is primarily focused on wastewater treatment modeling, it directly supports long-term infrastructure improvements that protect adjacent wetlands and coastal ecosystems. By creating a road map to modernize biological



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treatment and reduce harmful nutrient discharges, the project addresses and sets forth improvements to the effluent water quality (a primary driver of wetland degradation) of two wastewater treatment plants that drain to Bernard Bayou.

**(B) Mitigation of damage to fish, wildlife, or natural resources.**

This project directly supports the protection of fish, wildlife, and natural resources by planning for significant improvements in effluent water quality, by setting forth a road map to eliminate the need for the South Plant NPDES and strengthening the biological processes for the North Plant. Both existing plants have become outdated and are increasingly at risk for overflows, leading to excess nitrogen and phosphorous entering Bayou Bernard. This nutrient loading threatens aquatic life and degrades habitats. By modeling advanced biological nutrient removal and consolidating treatment into a single modernized facility, the project provides the technical foundation to mitigate impacts to sensitive aquatic ecosystems and wildlife.

**(C) Implementation of a federally-approved marine, coastal, or conservation management plan**

**(D) Mitigation of the impact of Outer Continental Shelf activities through funding of onshore infrastructure projects.**



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### 12. Project Timetable/Milestones:

Begin BioWin model for consolidation of South and North Plant - July 2026

Finalize BioWin model of the North Plant - December 2026

Deliver Final Report and Engineer Recommendations - April 2027

### 13. Project Timing

Short-term (3 year or less)



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### APPLICATION SUMMARY QUESTIONNAIRE

**14. Current status of architectural/engineering plans & specifications for this project (if applicable):**

**Group 1:**

In Progress

**Group 2:**

Funds not budgeted

**15. In what way does this project meet the goals and objectives of the Department of Marine Resources, which includes enhancing, protecting and conserving the marine interest of Mississippi for present and future generations.?**

The project directly supports the goals and objectives of the Mississippi Department of Marine Resources by protecting the State's aquatic environments by ensuring cleaner, healthier water reaches our coastal and wetland ecosystem. The City's two wastewater treatment plants are aging and no longer equipped with the biological processes needed to remove nutrients and pollutants, in the form of nitrogen and phosphorous, to modern standards. As a result, the risk of overflows and discharge of effluent detrimental to the aquatic life continues to rise, putting stress on the long-term resilience of these vital habitats.

By funding advanced biological modeling of the City's wastewater treatment system, the project lays the foundation for consolidating two outdated plants into a single modernized facility capable of nutrient removal. This planning effort is the crucial first step toward upgrades that will significantly reduce nitrogen, phosphorous, and solids discharges into Bayou Bernard and its connecting wetlands, pollutants that drive algal blooms and habitat/fish population decline.

While this application funds the planning stage, it is a necessary first step in delivering the infrastructure upgrades that will preserve water quality, protect sensitive habitats, and reduce the risk of ecological degradation, while also ensuring marine and coastal resources are protected not only for current residents, but for future generations as well.

**16. Estimated number of years to completion:**

1

**17. Estimated Completion Date:**

April 2027

**18. Prioritize if your agency has submitted multiple projects:**

3



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### BUDGET

Category	Total
Salaries	
Travel	
Architecture & Engineering	1800000
Legal	
Consulting	
Construction	13900000
Site Work	
Equipment	
Indirects	
Other	
Total	15700000

#### Attachments

1. pages-from-gomesa-form-fy2026\_improvements.pdf

I hereby certify under penalty of perjury that all information contained in this application packet is true and correct. I have not knowingly or intentionally provided any false information. I understand that a false statement on this application may be grounds for rejection of my application or termination of the award. In addition, a false statement may be punishable under applicable state or federal laws, which may also result in a fine and/or imprisonment.

I certify that the above referenced agency / entity has given me the authority to submit this application.

Name

Phone

Date

Nathan Long

2253474419

09/30/2025

**Table ES3-3. Long Beach – Pass Christian WWTF Opinion of Estimated Project Cost**

Long Beach – Pass Christian WWTF Improvement Description		Capital Cost	Non-Construction Cost	Total Project Cost
<b>Year 0-5</b>		<b>\$15,780,000</b>	<b>\$3,160,000</b>	<b>\$18,940,000</b>
Headworks	\$15,190,000			
Flow Measurement	\$50,000			
Chlorine Contact Basins	\$540,000			
<b>Year 5 to 10</b>		<b>\$3,790,000</b>	<b>\$760,000</b>	<b>\$4,550,000</b>
Influent Pump Station	\$350,000			
Oxidation Ditches	\$470,000			
RAS/WAS Pump Station	\$410,000			
Gravity Belt Thickeners	\$750,000			
Aerobic Digesters	\$1,360,000			
Electrical/PLC Control System	\$450,000			
<b>Year 10 to 20</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
	\$0			
<b>Total</b>				<b>\$23,490,000</b>

WAS = waste activated sludge

#### ES3.4 North Gulfport Wastewater Treatment Facility Assessment

Assessment of the North Gulfport WWTF was conducted through a site visit, evaluation of the historical influent and effluent data, flow projections, and steady-state biological process modeling. The flow projections indicate the North Gulfport WWTF will exceed average design capacity and permitted capacity by 2045, which necessitates a plant expansion within the planning years. Review of the effluent data also showed the North Gulfport WWTF exceeded its effluent biological oxygen demand (BOD) monthly average permit limit in April and December of 2015, and effluent total nitrogen limits in August 2016 and most of the summer months of 2017.

A proposed plant expansion and modification was developed for efficient treatment of current and future influent flows and loads to meet current and future permit limits. The expansion and process modifications recommended at the North Gulfport WWTF include installing a new headworks, replacing tertiary filters and ultraviolet (UV) system, installing new equalization basins, expanding and modifying the oxidation ditches into a Bardenpho biological nutrient removal process, constructing a new blower building, expanding the secondary clarification process, expanding the aerobic digester process, and installing new dewatering facilities. Details of the assessment are presented in the North Gulfport WWTF Assessment TM included in Appendix E of this Master Plan.

The headworks, tertiary filters, and UV disinfection improvement needs should be completed within year 0-5 of the planning period. The remaining improvements should be implemented within year 5-10 of the planning period. An opinion of estimated project cost including associated non-construction cost was developed. Non-construction costs can include cost associated with land acquisition, geotechnical investigation, legal services, design, and construction administrative services. The estimated total project cost for the recommended improvements at the North Gulfport WWTF is \$91,140,000. Table ES3-4 provides a summary of the estimated project cost.

**Table ES3-4. North Gulfport WWTF Opinion of Estimated Project Cost**

North Gulfport Improvement Description		Capital Cost	Non-Construction Cost	Total Project Cost
<b>Year 0-5</b>		<b>\$21,990,000</b>	<b>\$4,398,000</b>	<b>\$26,388,000</b>
Headworks	\$9,500,000			
Tertiary Filters	\$9,180,000			
UV Disinfection	\$3,310,000			
<b>Year 5 to 10</b>		<b>\$53,960,000</b>	<b>\$10,792,000</b>	<b>\$64,752,000</b>
New Equalization Basins	\$2,570,000			
Oxidation Ditches	\$20,370,000			
Secondary Clarifiers	\$8,910,000			
RAS/WAS Pump Station	\$6,390,000			
Solids Thickening and Dewatering	\$6,700,000			
Aerobic Digesters	\$9,020,000			
<b>Year 10 to 20</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
	\$0			
<b>Total</b>				<b>\$91,140,000</b>

**ES3.5 South Gulfport Wastewater Treatment Facility Assessment**

Assessment of the South Gulfport WWTF was conducted through a site visit, evaluation of the historical influent and effluent data, flow projections, and steady-state biological process modeling. The flow projections indicated that the South Gulfport WWTF will be operating at 64 percent of its average design capacity. However, the plant has high peaking factor (~8.6), which is likely due to inflow and infiltration (I&I) issues associated with the collection system connected to the Gulfport WWTFs. The causes of the high peaking factor need to be further evaluated and addressed.

Review of the effluent data showed the South Gulfport WWTF exceeded its effluent summer (May to October) maximum weekly BOD permit limit and the combined (with North Gulfport) effluent total nitrogen limits in August 2016 and most of the summer months of 2017.

A proposed plant expansion and modification was developed for efficient treatment of current and future influent flows and loads at South Gulfport WWTF to meet current and future permit limits. The expansion and process modifications recommended at the South Gulfport WWTF include installing new headworks, retrofitting the first-stage trickling filters into equalization basins, retrofitting the existing primary clarification process into a chemically enhanced primary treatment, constructing a new biological nutrient removal system using integrated fixed film activated sludge technology (IFAS), constructing a new blower building, constructing anaerobic digesters, expanding the solids dewatering process, and expanding the chlorine contact basins. Details of the assessment are presented in the South Gulfport WWTF Assessment TM included in Appendix F of this Master Plan.

All the recommended improvements for the South Gulfport WWTF should be implemented within year 0-5 of the planning period. An opinion of estimated project cost including associated non-construction cost was developed. Non-construction costs can include costs associated with land acquisition, geotechnical investigation, legal services, design, and construction administrative services. The estimated total project cost for the recommended

improvements at the South Gulfport WWTF is \$75,444,000. Table ES3-5 provides a summary of the estimated project cost.

**Table ES3-5. South Gulfport WWTF Opinion of Estimated Project Cost**

South Gulfport Improvement Description		Capital Cost	Non-Construction Cost	Total Project Cost
<b>Year 0-5</b>		<b>\$62,870,000</b>	<b>\$12,574,000</b>	<b>\$75,444,000</b>
Influent Pump Station	\$2,220,000			
Headworks	\$13,400,000			
Primary Clarifiers	\$3,940,000			
New IFAS System	\$17,610,000			
RAS/WAS Pump Station	\$2,200,000			
Chlorine Disinfection	\$1,420,000			
Solids Thickening and Dewatering	\$7,420,000			
Anaerobic Digesters	\$14,660,000			
<b>Year 5 to 10</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
	\$0			
<b>Year 10 to 20</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
	\$0			
<b>Total</b>				<b>\$75,444,000</b>

**ES3.6 North and South Gulfport Wastewater Treatment Facility Alternative Analysis**

A conceptual alternative analysis was conducted to determine the best possible treatment option to address the modification and expansion needs of the Gulfport WWTFs to treat projected 2045 flows and loads. The projected flows and loads for the North and South Gulfport WWTFs are presented in the North and South Gulfport WWTF TMs included in Appendixes E and F of this Master Plan. The alternative analysis included three conceptual alternatives to treat the wastewater from the Gulfport area considering the existing conditions of North and South Gulfport WWTF and the combined nutrient limits for the two facilities.

The three alternatives evaluated were:

- 1) Conversion of South Gulfport WWTF into a pump station with expansion and modification of the North Gulfport WWTF (Alternative 1)
- 2) Expansion and modification of the secondary treatment at North Gulfport WWTF to receive primary effluent and sludge from South Gulfport WWTF (Alternative 2)
- 3) Expansion and modification of North and South Gulfport WWTFs as separate facilities (Alternative 3)

Details of the three alternatives are presented in the North and South Gulfport WWTF Alternative Analysis Assessment TM included in Appendix G of this Master Plan. Alternative 3, which had an estimated total capital cost of \$166,584,000, was the most cost-effective alternative and was recommended to address projected future flows and loads at the Gulfport WWTFs. Table ES3-4 and ES3-5, presented previously, provides a summary of the estimated project cost.

**Appendix E**  
**North Gulfport Wastewater Treatment Facility Assessment**  
**Technical Memorandum**

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<b>Subject</b>	<b>North Gulfport WWTF Assessment</b>	<b>Project Name</b>	Harrison County Utility Authority (HCUA) Water & Sewer Resources Plan Phase II
<b>Attention</b>	John L. Wilson, P.E Executive Director, HCUA	<b>Project No.</b>	D3113002
<b>From</b>	Jacobs Engineering Group Inc. (Jacobs)		
<b>Date</b>	April 1, 2020		

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## 1. Introduction

The North Gulfport Wastewater Treatment Facility (WWTF) is located north of Bernard Bayou and south of Interstate 10. North Gulfport WWTF was built in 1998. The facility consists of a septage receiving station, a filtrate/septage pump station, screenings, two grit removal systems, two oxidation ditches, two secondary clarifiers, effluent filtration, ultraviolet (UV) disinfection, a re-aeration basin, and a gravity effluent structure. The treated water discharges into a nearby ditch that continues to flow into Bernard Bayou. The facility utilizes two aerobic digesters and a sludge processing building consisting of two belt filter presses (BFPs) to process the waste sludge collected. The process flow diagram and site plan for the North Gulfport WWTF are displayed in Attachment 1.

The facility's record drawings show the North Gulfport WWTF had an original average design capacity of 5.5 million gallons per day (MGD) and peak capacity of 22.8 MGD. According to a 2010 compliance study report by Volkert Inc. (Volkert 2010), the aeration capacity in the oxidation ditches was increased to expand the average treatment capacity of the North Gulfport WWTF from 5.5 MGD to 7.75 MGD. The facility has a permitted flow capacity of 7.75 MGD based on monthly average flow. HCUA has considered the idea of expanding North Gulfport WWTF to take all flow from the South Gulfport WWTF and potentially convert the South Gulfport facility into a lift station.

## 2. Influent

### 2.1 Overview

The North Gulfport WWTF receives flow mainly from the Airport pump station located at the south end of Klein road. There are about 17 other pump stations that also convey flow to the North Gulfport WWTF. The flow from all the pump stations combine in one 36-inch pipe at the influent station. There is a 20-inch magnetic influent flowmeter at the plant for influent flow measurement. However, the magnetic flowmeter was not functional at the time of visit.

The influent station is located at the headworks where three pipes convey flow to the headwork screens. The three pipes consist of the 36-inch influent force main, a 14-inch pipe conveying filtrate and septage flow, and a 12-inch pipe carrying the plant drain from filter backwash.

The average and peak daily flow recorded at the North Gulfport WWTF during the last 5-year period from January 2014 and December 2018 was 6.32 MGD and 25.99 MGD, respectively. Plant staff also indicated that peak hourly flow as high as 50 MGD is recorded at the plant during wet weather conditions.

Figure 2-1 shows the historical monthly average flows received at the North Gulfport WWTF between January 2014 and December 2018. The historical data indicate the monthly average influent flow has exceeded the facility's average design capacity and permitted flow capacity (7.75 MGD) on several occasions.

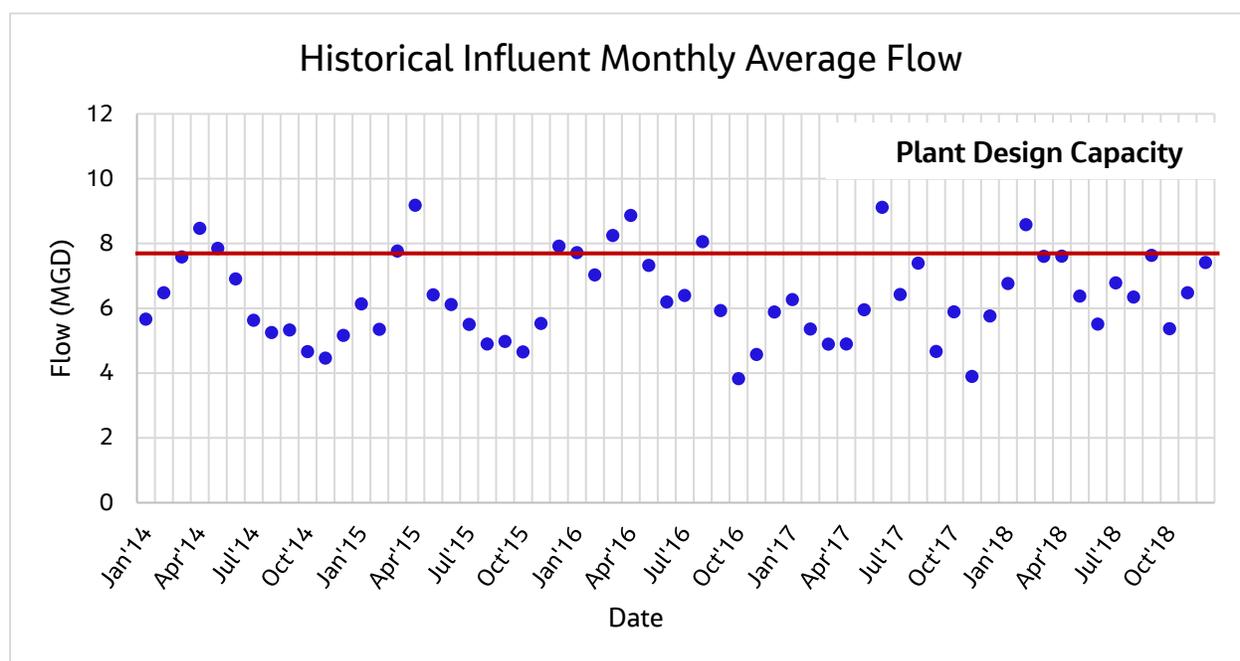


Figure 2-1. Historical Monthly Average Flow

## 2.2 Influent Flow Projections

The North Gulfport WWTF treats wastewater from North Gulfport and East Gulfport sub areas situated in the Gulfport service area that is expected to experience population growth and development in the future. According to the HCUA 2015 Phase 1 Master Plan by Brown, Mitchell & Alexander, Inc. (BMA 2015), the North Gulfport service area is projected to experience an annual population growth rate of 0.79 percent between 2015 and 2040. Additionally, an employment increase of 22.1 percent (0.88 percent per annum) is expected for the North Gulfport service area within that same period.

The influent flow projections for the next 25 years (i.e., 2020 to 2045) for the North Gulfport WWTF was estimated using the Phase 1 population growth factors as well as the historical influent flow information obtained for 2015 to 2018. An average flow contribution per capita was calculated using the annual average monthly flow and estimated population for 2015 (49,340) to 2018 (50,554). An average flow per capita was estimated as 128.2 gallons per day per capita and was assumed to remain the same throughout the planning years. The projected average flow for the North WWTF in 2045 is expected to be 8.07 MGD, a 30 percent increase from 2015, indicating the North Gulfport WWTF will exceed average design capacity and permitted capacity by 4 percent. As a result, the North Gulfport WWTF will need expansion and

increased permitted capacity to handle the future flows. The influent 5-day biochemical oxygen demand (BOD<sub>5</sub>) is expected to be 14,683 pounds per day (lbs/d), which is equivalent to an increase of 26 percent from 2015. The projected influent flows and BOD<sub>5</sub> loadings are shown on Figure 2-2 and in Table 2-1.

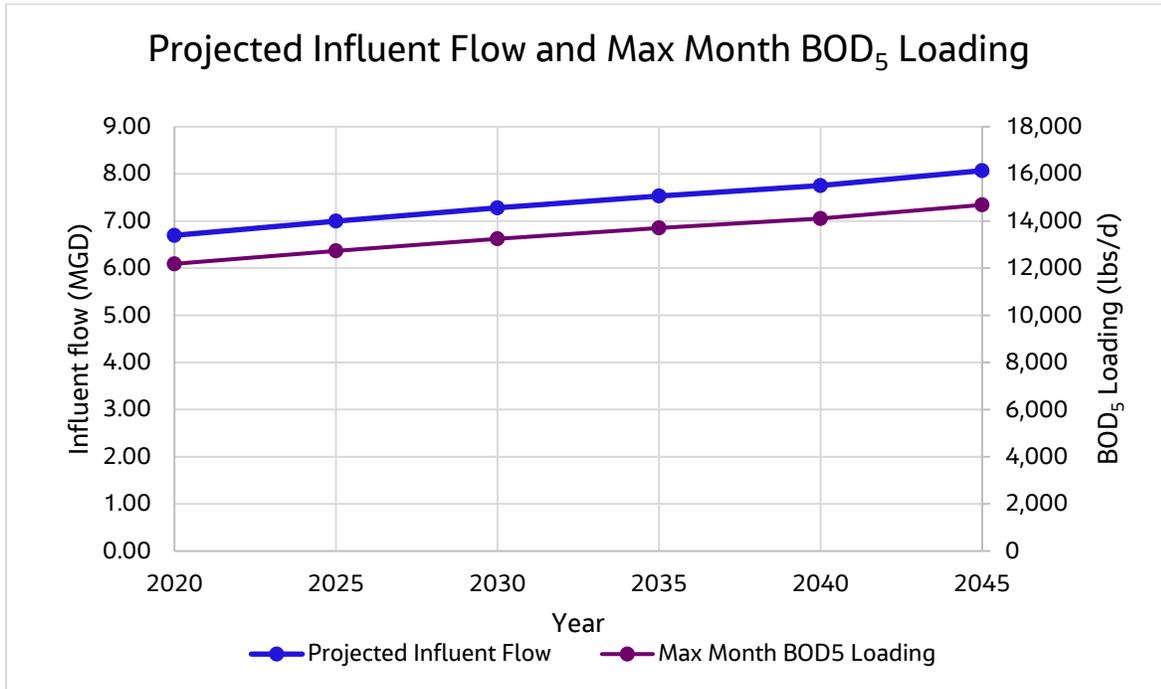


Figure 2-2. Projected Average Influent Flow and Max Month BOD<sub>5</sub> Loading

Table 2-1. Projected Influent Wastewater Flow and Loads

Parameter	Unit	2045 Max Month Flow and Loads
Flow	MGD	10.64
BOD <sub>5</sub>	lbs/d	14,683
Ammonia (NH <sub>3</sub> -N)	lbs/d	1,433
Total Suspended Solids (TSS)	lbs/d	16,156
Total Phosphorous (TP)*	lbs/d	710

\* Estimated 2045 TP loading

### 2.3 Recommended Improvements

The flow projections indicate the North Gulfport WWTF will exceed average design capacity and permitted capacity by 4 percent by 2045, which necessitates a plant expansion by 2045. The flow projections presented here do not account for possible inflow and infiltration (I&I) because it is expected that the flow increases will be connected through new extension systems that will have minimal I&I.

The existing 20-inch magnetic influent flowmeter at the plant was not functional at the time of visit.

The following improvements are recommended for the North Gulfport WWTF:

- Consider an expansion of the North Gulfport WWTF to accommodate future influent flows by 2045.
- Install new magnetic flowmeter for flow measurement.

### 3. Headworks

#### 3.1 Overview

The headworks structure includes an influent station where three pipes consisting of the 36-inch influent force main, a 14-inch pipe conveying filtrate and septage flow, and a 12-inch pipe carrying the plant drain from filter backwash are connected. The headworks consists of two mechanical screens, a manual bar screen, and grit removal system. There is also an automatic influent sampler located at the headworks for taking influent samples to determine the characteristics of the influent flow. There is a 20-inch magnetic influent flowmeter at the plant for influent flow measurement. However, the magnetic flowmeter was not functional at the time of visit.

#### 3.2 Headworks Screens

The treatment process begins with screening of the influent to remove coarse debris to protect downstream processes and equipment. There are two Parksons Aquaguard mechanical screens of 6-millimeter openings that are used to screen the wastewater. The screens are equipped with screening wash press and stainless-steel covers. The screenings are disposed into a dumpster. The mechanical screens were replaced in 2005 after Hurricane Katrina; however, the screens currently have some missing teeth (as shown on Figure 3-1) and ineffective side seals. The North Gulfport WWTF receives high flows above 25 MGD, particularly during wet weather conditions, however the two mechanical screens do not have capacity to handle such peak flows. As a result, flows above 25 MGD bypass the mechanical screens and creates ragging problems at the return activated sludge (RAS) pumps downstream. In addition to the mechanical screens, there is one manual bar screen located between the two mechanical screens to supplement the screening process. Figure 3-1 shows the two mechanical screens system used at the North Gulfport WWTF.



Figure 3-1. Mechanical Screens (left) with broken teeth (right) at North Gulfport WWTF

### 3.3 Grit Removal

Screened influent is conveyed to two Smith and Loveless vortex grit removal systems where grit is removed to prevent grit buildup in downstream units. The grit removal system consists of two 12-foot-diameter vortex grit collectors, two 250-gallon per minute (gpm) grit pumps, two grit concentrators, and two classifiers. The grit collector settles out the grit from the screened flow and the settled grit is pumped into grit cyclones and screw classifiers for dewatering and disposal. Although the grit removal system works, plant staff mentioned there is frequent clogging in the 4-inch grit pipe, which requires continuous flushing with water. Figure 3-2. Shows the grit removal systems at North Gulfport WWTF.



Figure 3-2. Grit Removal Systems at North Gulfport WWTF

### 3.4 Splitter Box

The screened wastewater from the headworks flows through a 42-inch pipe to a 21-foot-long and 13-foot-wide splitter box. The splitter box has adjustable weirs and sluice gates to split the screened influent into two oxidation ditches.

### 3.5 Recommended Improvement

The headworks screens and grit system at the North Gulfport WWTF have reached the end of their useful life and do not have capacity to handle current peak flows above 25 MGD. As a result, flows above 25 MGD bypass the mechanical screens and create ragging problems at the RAS pumps downstream. The mechanical screens also have some missing teeth and ineffective side seals, which also contribute to the ragging issues at the RAS pumps.

The following near-term (0-5 years) improvement is recommended for the North Gulfport WWTF:

- Repair the ineffective side seals of the mechanical screens to reduce ragging issues downstream.

The following future expansion and modification needs, and improvements are recommended for North Gulfport WWTF:

- Replace the entire headworks structure at the North Gulfport WWTF. The new headworks structure should have three new 6-mm perforated mechanical screens of 16 MGD capacity each. Each of the new mechanical screens should have stainless-steel covers and screen-washing presses .

- The new headworks structure should have two new vortex grit removal systems of 24 MGD capacity each at the new headworks structure. The grit system should include three (2+1) grit pumps of 200-gpm capacity each.
- The new headworks structure should have all channels covered and the channel air should be routed to a new biofilter odor control system.
- Construct two equalization basins downstream of the headworks to control peak conditions without overburdening the downstream biological unit process. Each equalization basin should be circular and should be 3 million gallons (MG) in volume.

## 4. Oxidation Ditch

### 4.1 Overview

The preliminary treated flow moves from the splitter box into two 2-stage oxidation ditches for biological treatment. Each oxidation ditch is approximately 1.8 MG in volume and has a side water depth of approximately 15 feet. Each oxidation ditch is also partitioned into an aerobic zone equipped with one surface aerator to supply oxygen and an anoxic zone equipped with one mixer to maintain channel velocity. The anoxic zones precede the aerobic zones and receive the influent flow and returned activated sludge. The configuration of the oxidation ditches also allows mixed liquor return/recirculation to aid denitrification. According to plant staff, the surface aerators in the aerobic zones are sometimes turned off to settle sludge to prevent overloading the downstream secondary clarifiers.

Currently, there are no probes installed in the oxidation ditch for dissolved oxygen (DO) measurement. As a result, plant staff manually measure the DO in the oxidation ditch with handheld equipment. Installing DO probes as well as oxidation-reduction potential (ORP) probes in the oxidation ditch will enhance DO control and help ensure aeration cycles necessary for BOD and nutrient removal. Plant staff also mentioned there is no lightning at the oxidation ditches. As shown on Figure 4-1, the covers over the surface aerators in the oxidation ditches were damaged during Hurricane Katrina and have since not been replaced. Figure 4-1 shows the oxidation ditches at the North Gulfport WWTF.



Figure 4-1. Covers over aerator (left) and Aerobic Zone (right) of the Oxidation Ditches at North Gulfport WWTF

### 4.2 Equipment

Each aeration zone in the oxidation ditch was originally equipped with a 150-horsepower (hp) surface aerators. However, according to a 2010 compliance study report by Volkert Inc. (Volkert 2010), the

original aerators were replaced with 200-hp aerators with the intention of increasing the treatment capacity from 5.5 MGD to 7.75 MGD. The mixers in the anoxic zones are four-blade propeller mixers equipped with 15-hp motors. The surface aerators and the mixers were functional at the time of visit.

### 4.3 Splitter Box

The flow from the two aeration basins combine in one 42-inch pipe and discharge the biologically treated wastewater into a 25-foot-long and 13-foot-wide splitter box where weirs and sluice gates are used to split the flow between two secondary clarifiers.

### 4.4 Capacity, Reliability, and Performance Assessment

The capacity of the oxidation ditches was evaluated based on the current maximum monthly influent loadings and the projected 2045 max month loading. The 2014-2018 historical monthly operational data was reviewed to compare the current maximum month influent loadings to the capacity of the oxidation ditches.

A steady-state model of the North Gulfport WWTF was developed in Pro2D2 to approximate the capacity of the secondary treatment process using the historical data provided in the monthly operating reports. Assuming a minimum solids retention time (SRT) of 12 days with the two oxidation ditches and current treatment process, the oxidation ditches at North Gulfport WWTF have capacity to achieve some nitrification at current max month influent BOD loading of 10,974 lbs/d and ammonia-N loading of 1,140 lbs/d. The existing two 200-hp aerators do not have capacity to provide the 416 hp needed to treat current max month influent loadings, and the 660-hp aeration needed for current peak day influent loadings. The model results also showed the North Gulfport WWTF will be operating at near capacity for its permitted nutrient limits.

A review of historical performance of the North Gulfport WWTF showed a minimum of 97 percent BOD removal has been achieved for a 5-year period between 2014 and 2018, which is compliant with the minimum 85 percent Mississippi Department of Environmental Quality (MDEQ) requirement. Over the 5-year period, the effluent ammonia-N discharged between January 2014 and December 2018 has remained within the MDEQ's permitted limits, except in December 2015 where maximum weekly average was above the weekly permit as shown in Table 4-1. Additionally, the North Gulfport WWTF exceeded its BOD permit limit of 259 lbs/d in April 2015 and December 2015 by discharging 284 lbs/d and 355 lbs/d, respectively.

The North and South Gulfport plants have a combined nutrient permit. The latest permit, MS0051756, was issued on March 16, 2020, and expires on February 28, 2025. This new permit has the same nutrient requirement as the recently expired permit and requires a maximum monthly average (North and South Gulfport WWTFs) effluent total nitrogen (TN) loading limit of 1,141.1 lbs/d and 3,109.3 lbs/d for summer months (May-October) and winter months (November-April), respectively. The permit also includes a combined TP effluent limit of 972 lbs/d and 1,431 lbs/d for summer months and winter months, respectively. It should be noted that the current combined permit does not include a restriction on effluent nutrient concentrations so long as the effluent loading is within the permit limit.

The historical performance data provided by HCUA also showed the biological units and processes at the Gulfport WWTFs have mostly been able to meet these total nutrient limits between 2014 and 2018, except in August 2016 and most of the summer months in 2017 where TN limits were violated as shown on Figure 4-2. The effluent TN from North Gulfport WWTF ranged from 62.9 to 354 lbs/d in the 5-year review period, whereas higher loads were contributed from South Gulfport WWTF (71 to 1,213 lbs/d) which resulted in the permit violation. According to the permit violations report, HCUA associated the 2016 and 2017 nutrient violations with extreme rain events, which amounted to about 14.2 and 10 inches

of rain (in a month), respectively. The performance of the oxidation ditches at the North Gulfport WWTF is shown in Table 4-1 and on Figures 4-2 and 4-3.

**Table 4-1. Performance Evaluation of Oxidation Ditches at North Gulfport WWTF**

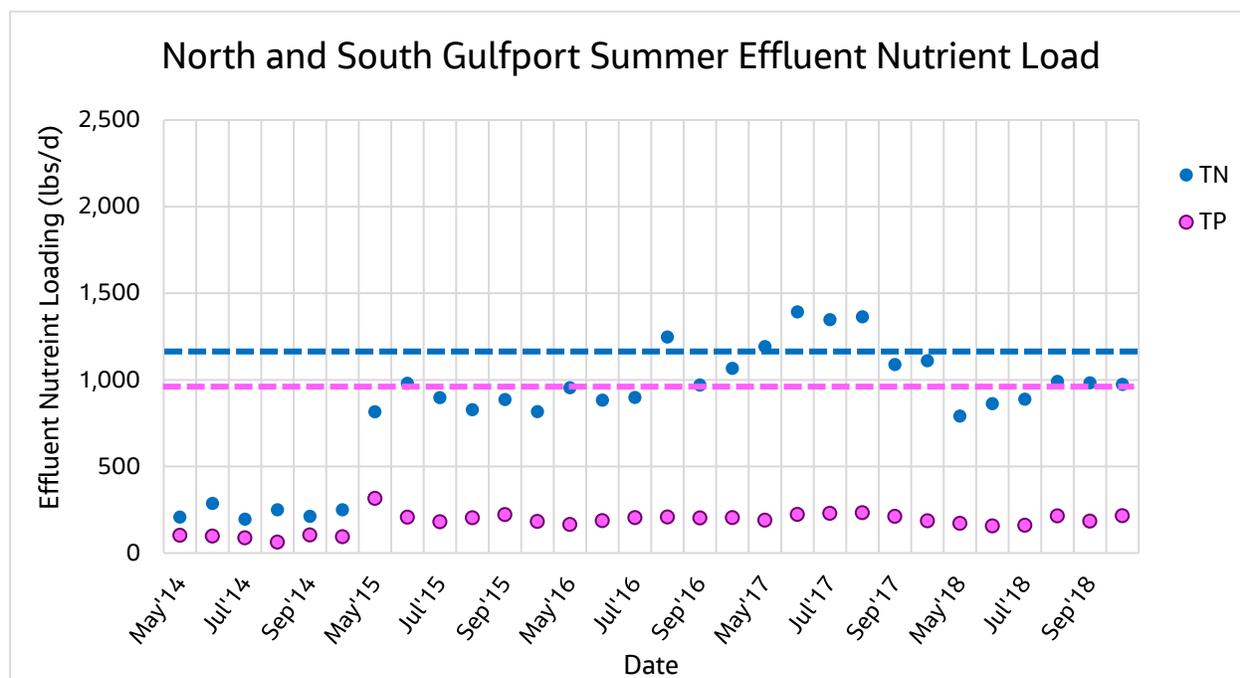
Performance Evaluation				
Effluent Parameter	Permit Limit (Monthly Average)	2014-2018 (Maximum Monthly Average)	Permit Limit (Maximum Weekly Average)	2014-2018 (Maximum Weekly Average)
BOD (lbs/d)	259	355	388	838
NH <sub>3</sub> -N (lbs/d)	65	53.98	97	162.6
TN (lbs/d) <sup>a</sup>	1,141.1	1,391.8*	-	-
TN (lbs/d) <sup>b</sup>	3,109.3	1,492.4*	-	-
TP (lbs/d) <sup>a</sup>	972	315.2*	-	-
TP (lbs/d) <sup>b</sup>	1,431	1,077.6	-	-

NH<sub>3</sub>-N = Ammonia-nitrogen

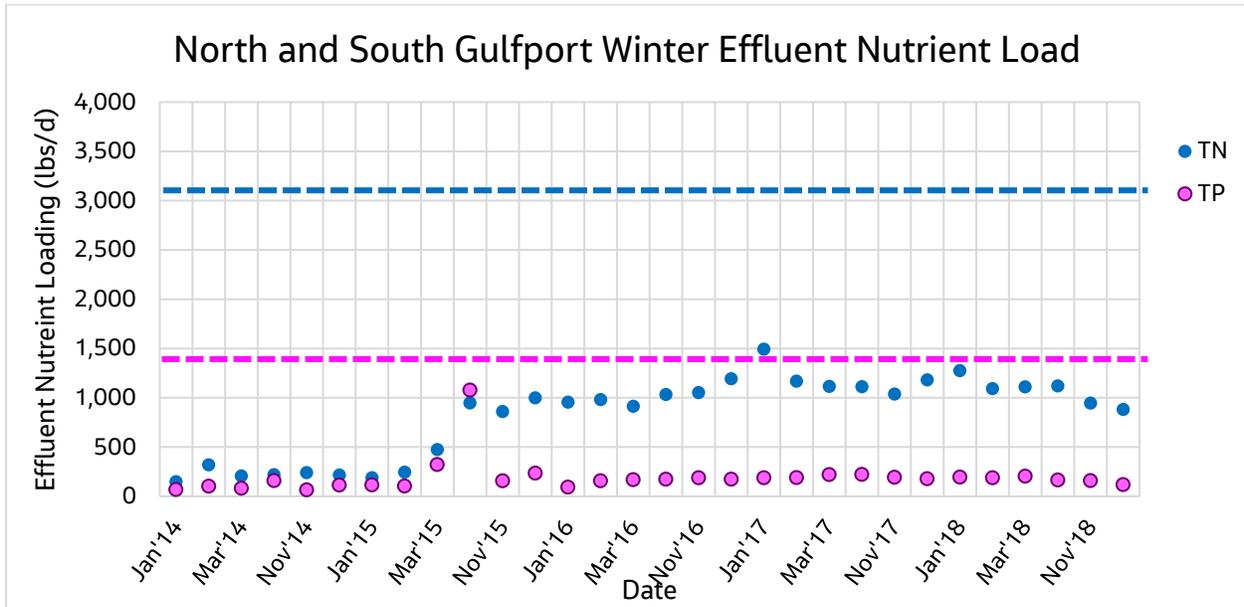
<sup>a</sup> May to October combined permit limit for both North and South Gulfport WWTF.

<sup>b</sup> November to April combined permit limit for both North and South Gulfport WWTF.

\* Combined effluent load for both North and South Gulfport WWTF.



**Figure 4-2. Historical Summer Month Effluent Nutrient Load for North and South Gulfport WWTF**



**Figure 4-3. Historical Winter Month Effluent Nutrient Loading for North and South Gulfport WWTFs**

### 4.5 Recommended Improvement

The oxidation ditches at the North Gulfport WWTF are equipped with one surface aerator and one mixer each, with no room for redundancy. Additionally, the surface aerators are turned off during high flows to settle sludge in the oxidation ditches, which is intended to avoid overloading the downstream secondary clarifiers. Settling sludge in the oxidation ditches can result in ammonia spikes and affect the biological population in the oxidation ditches.

Consistent biological treatment requires consistent DO in the aeration basins for effective treatment. Continuous monitoring of DO and aerators equipped with variable frequency drives (VFDs) are needed to control DO for effective biological treatment process. The oxidation ditches at the North Gulfport facility are not equipped with DO probes and manual measurements of DO are taken once a day. Moreover, the surface aerators are not equipped with VFDs that will help maintaining a set DO in the oxidation ditches. Keeping DO concentrations consistent throughout the day leads to more consistent effluent quality and more stable biological populations. In addition, maintaining a set DO with VFDs will avoid overaeration and reduce energy costs.

The biological treatment at the North Gulfport WWTF has resulted in exceeding some parameters of its permit limit. Projected 2045 flows and loads indicate an expansion and modification are needed to help North Gulfport meet treatment and permit requirements.

The following future expansion and modification needs, and improvement is recommended for the North Gulfport WWTF:

- Jacobs recommends an expansion and modification of the existing two oxidation ditches at the North Gulfport WWTF into three trains of 5-stage Bardenpho biological nutrient removal process. The 5-stage Bardenpho process involves a first anaerobic stage, which receives both RAS from the clarifiers and preliminary treated wastewater from the headworks. The anaerobic stage promotes the growth of phosphorous accumulating organisms for biological phosphorous removal and creates better settleable sludge for enhanced clarification downstream. The second stage is an anoxic zone where denitrification (conversion of nitrate-N to nitrogen gas) occurs. The third stage of the

Bardenpho process is an aerobic zone where nitrification (conversion of ammonia-N to nitrates) occurs. The fourth stage is a post-anoxic zone for further removal of any residual nitrate-N. The fifth stage is a post-aerobic stage for removing residual ammonia-N before secondary clarification, as well as, enhancing settleability of the sludge by degassing any trapped nitrogen gas which was created by denitrification process in post-anoxic zone.

To enhance the nitrogen removal, nitrified mixed liquor is recycled from the aerobic zone in the third stage to the anoxic zone at the second stage of the Bardenpho process. The existing oxidation ditches at North Gulfport have manually controlled gates for the internal recycle channels, which allows this nitrified recycling without pumps. Automatic controls should be installed to optimally control the nitrified recycle rates to enhance nitrogen removal.

The two existing 2-stage (anoxic-aerobic) oxidation ditches should be expanded into 5-stage Bardenpho reactors by adding new 0.13-MG anaerobic selectors upstream, and new 0.39-MG post-anoxic and 0.26-MG post-aerobic zones downstream. In addition to the expansion of the existing two trains, a new 2.56-MG 5-stage Bardenpho should be constructed to bring the total bioreactor volume at North Gulfport to 7.7 MG to handle projected flows and loads. The three trains of the 5-stage Bardenpho process will enhance the capacity of the biological treatment for nutrient removal, produce better settling sludge and also allow for redundancy in the event that one train needs to be taken offline. Figure 4-4 shows the proposed layout for the North Gulfport WWTF.

- Replace the surface aerators in the aerobic zones of the existing oxidation ditches with fine bubble diffusers for more efficient oxygen transfer, and a blower system equipped with VFDs. In addition, the aerobic zones in the new 5-stage bioreactor should be equipped with fine bubble diffusers and a blower system. There should be four total blowers (3 on-duty + 1 standby) with each having a capacity of 4,800 standard cubic feet per minute (scfm).
- Construct a new blower building to accommodate the four blowers.
- Install two DO probes in each of the aerobic zones and one DO probe in each of the post-aerobic zones in each train.
- Install one ORP probe in each of the new anaerobic selectors to monitor anaerobic conditions.
- Install one 7.5-hp mixer in each of the non-aerobic zones (i.e., anaerobic zone, anoxic and post-anoxic zones) in each train.

Figure 4-4 shows the proposed site layout for the North Gulfport WWTF. Table 4-2 presents the Pro2D2 model design criteria and the expected effluent quality based on the proposed biological treatment configuration for the projected 2045 flow and influent loads. As described in Section 2.3, the 2045 flow and influent loads were estimated based on historical (2015-2018) monthly average flow and annual maximum month influent loads. As shown in Table 4-2, the Pro2D2 model projected good effluent quality that will meet MDEQ's combined permit requirement for the North and South Gulfport WWTFs.

It should be noted that the Pro2D2 model projected effluent gives a reasonable assessment of the proposed aeration basin configuration and estimates for the mechanical equipment needed for planning purposes. However, the solution described below is a reference solution. A more detailed assessment should be conducted in a predesign analysis to confirm that this solution is the best path forward for HCUA before commencing design for the upgrades at the North Gulfport WWTF.

**Table 4-2. Pro2D2 Model Design Criteria and Projected Effluent Quality for North Gulfport WWTF**

Parameter	Unit	Design Criteria	Comment
<b>Input Influent Characteristics for Pro2D2 model</b>			
Flow	MGD	10.64	Projected 2045 Max Month flow
BOD <sub>5</sub>	lbs/d	14,683	Projected 2045 Max Month BOD <sub>5</sub> loading
NH <sub>3</sub> -N	lbs/d	1,433	Projected 2045 Max Month ammonia-N loading
TSS	lbs/d	16,156	Projected 2045 Max Month TSS loading
<b>Design Criteria</b>			
Aerobic SRT	days	8	To ensure adequate nitrification at winter month temperatures
Total SRT	days	13	For adequate nitrification and denitrification during winter months
Temperature	°C	15	Winter month temperature typical for the Biloxi area was chosen for conservative reasons
<b>Projected Effluent Quality from Pro2D2 model</b>			
Ammonia-Nitrogen (NH <sub>3</sub> )	mg/L	0.6	
Ammonia-Nitrogen (NH <sub>3</sub> )	lbs/d	54	
Nitrate (NO <sub>3</sub> )	mg/L	1.23	
TN	mg/L	2.91	
TN	lbs/d	264	23% of combined permit limit
TP	mg/L	3.06	
TP	lbs/d	279	29% of combined permit limit
Orthophosphate (OP)	mg/L	2.94	

°C = degree(s) Celsius

mg/L = milligram(s) per liter



Figure 4-4. Proposed Site Layout for North Gulfport WWTF

## 5. Secondary Clarifiers

### 5.1 Overview

The effluent from the oxidation ditch splitter box discharges into two 125-foot secondary clarifiers via 42-inch pipes. In the secondary clarifiers, the wastewater is held quiescent to settle activated sludge for downstream treatment. The effluent from the clarifiers is conveyed in 36-inch pipes to effluent filters for additional solids removal. The clarifiers are equipped with scum removal systems which remove and convey scum to the scum pump station via an 8-inch pipe. Part of the settled sludge is conveyed in a 20-inch RAS pipe to the RAS pump station while the remaining sludge is conveyed to the waste activated sludge (WAS) pump station. Figure 5-1 shows one of the two clarifiers at the North Gulfport WWTF.



**Figure 5-1. Secondary Clarifiers at North Gulfport WWTF**

### 5.2 Capacity, Reliability, and Performance Assessment

The two secondary clarifiers at the North Gulfport WWTF have a combined surface overflow rate of 929 gallons per day per square foot (gpd/sf) at design peak daily flow of 22.8 MGD as shown in Table 5-1. At current peak daily flow of 25.99 MGD, the two clarifiers have capacity to treat the wastewater at a surface overflow rate at approximately 1,059 gpd/sf.

A state point analysis (SPA) was conducted to evaluate the capacity of the secondary clarifiers with respect to the current peak daily flow (25.99 MGD) and design peak daily flow (22.8 MGD) based on other operational conditions at the North Gulfport WWTF. The performance of the secondary clarifiers is affected by the sludge settleability or sludge volume index (SVI) of the feed solids, as well as the concentration of the mixed liquor suspended solids (MLSS). In the SPA analysis, SVI was calculated from the sludge 30 minutes settleability and MLSS data provided by HCUA. The SVI data included monthly minimum and maximum 30 minutes settleability values from January 2017 to December 2018. For conservative reasons, the average of the maximum monthly SVI values (90 milliliters per gram [mL/g]), which is estimated to correspond to the 90th percentile of daily or monthly average values was used in the

SPA. It should be noted that the SVI values from the historical data were lower than expected. An underflow rate of 8.2 MGD was used for the analysis based on the RAS pumping capacity at the North Gulfport WWTF. The capacity of the clarifiers was estimated at 85 percent of the calculated limiting mass flux.

The SPA of the secondary clarifiers determined that at current SVI condition of 90 mL/g, the two secondary clarifiers can handle the design peak flow of 22.8 MGD with maximum MLSS concentration of 3,450 mg/L, which is a little below the historical average MLSS concentration of 3,566 mg/L. The SPA results also showed that 75 percent of the design peak flow (17.1 MGD) can be handled by one clarifier at a maximum MLSS of 3,000 when one clarifier is taken out of service.

At current peak daily flow (25.99 MGD) and SVI conditions of 90 mL/g, the two secondary clarifiers can handle the flow at a maximum MLSS concentration of 3,120 mg/L. At the same conditions, one clarifier can handle 75 percent of the current peak daily flow (19.5 MGD) at a maximum MLSS concentration of 2,720 mg/L. According to plant staff, the North Gulfport WWTF receives peak hour flow as high as 50 MGD during wet weather conditions. At 50 MGD, the two clarifiers can handle maximum MLSS concentration of 1,850 mg/L. A review of the historical data from January 2017 to December 2018 shows MLSS concentrations at North Gulfport WWTF range from 3,043 to 4,069 mg/L with an average of 3,566 mg/L.

An assessment of the historical effluent data between 2014 and 2018 indicated the secondary clarifiers have achieved a maximum monthly average effluent TSS concentration of 480 lbs/d, which is below permitted discharge limits of 1,939 lbs/d. The clarifier capacity, reliability, and performance information are shown in Table 5-1.

**Table 5-1 Capacity, Reliability, and Performance Assessment of Secondary Clarifiers at North Gulfport WWTF**

Parameter	Design Criteria	Capacity Assessment	Reliability
<b>Capacity and Reliability</b>			
Number of units	2	The two clarifiers have capacity to handle current peak daily flow of 25.99 MGD at MLSS concentration of 3,120 mg/L.	Criteriaa: 75% capacity with largest unit offline. One clarifier can handle 75% of current peak daily flow at maximum MLSS of 2,720 mg/L.
Total Surface Area, Total (sf)	24,544		
Surface Overflow rate at Peak flow of 22.8 MGD (gpd/sf)	929		
Effluent Parameter	Permit Limit (Monthly Average)	2014-2018 (Maximum Monthly Average)	
<b>Performance Evaluation</b>			
TSS (lbs/d)	1,939	480	

<sup>a</sup> U.S. Environmental Protection Agency (EPA) Class Reliability Criteria (EPA 1999)

### 5.3 Recommended Improvement

The secondary clarifiers were evaluated under current and the design peak conditions and the SPA results indicated that at the same SVI conditions of 90 mL/g, the two secondary clarifiers have capacity to handle the design peak flow of 22.8 MGD at a maximum MLSS concentration of 3,450 mg/L. A review of the North Gulfport WWTF historical data shows the average MLSS concentration between January 2017 and December 2018 was 3,566 mg/L. The historical average MLSS concentration of 3,566 mg/L exceeds the

MLSS limit of 3,120 mg/L determined from the SPA analysis under current peak conditions of 25.99 MGD, indicating the clarifiers will be having settling issues at such flows. Moreover, MLSS concentrations at the North Gulfport WWTF during wet weather months can be as high as 4,070 mg/L (December 2018). To accommodate the current and future peak conditions under high MLSS concentrations, additional clarifier area will be required to prevent overloading the existing clarifiers and exceeding TSS permit limits. The following improvements are recommended for the secondary treatment process at the North Gulfport WWTF.

- Construct two new 125-foot diameter secondary clarifiers to expand the secondary clarification process to meet current and future peak conditions at the North Gulfport WWTF.
- Increase the RAS pumping capacity so that the clarification capacity of the clarifiers is not restricted by the RAS pumping rate. This recommendation is further discussed in Section 6.6.

## 6. Return Activated Sludge/Waste Activated Sludge and Scum Pump Station

### 6.1 Return Activated Sludge Pump Station

#### 6.1.1 Overview

The RAS pump station at the North Gulfport WWTF (Figure 6-1) consists of three RAS pumps that convey settled activated sludge from the secondary clarifiers to the splitter box upstream of the oxidation ditches. According to plant staff, RAS is pumped at a flow rate of 3.4 MGD during average flows. At high flows above 25 MGD, the RAS pumps are clogged with rags due to screens being bypassed at such high flows.



Figure 6-1. RAS/WAS and Scum pump station at North Gulfport WWTF

#### 6.1.2 Equipment

Each of the three RAS pumps is a 1,900-gpm centrifugal non-clog pumps that are equipped with 20-hp motors. According to plant staff, the RAS pumps are mostly run at 35 Hertz and go up to a maximum of 52 Hertz. The existing RAS pumps are near the end of their useful life and will only provide 32 percent of the maximum needed RAS pumping rate for future expansion.

## 6.2 Waste Activated Sludge Pump Station

### 6.2.1 Overview

The WAS pump station consists of two WAS pumps that transfer activated sludge to the gravity belt thickener (GBT) via an 8-inch pipe for thickening. The WAS pumps can also pump directly to the aerobic digesters via a 6-inch pipe.

### 6.2.2 Equipment

The WAS pumps are 600-gpm non-clog centrifugal pumps that are driven by 10-hp motors. The pumps were functioning at the time of visit.

## 6.3 Scum Pump Station

### 6.3.1 Overview

The scum pump station consists of two scum pumps that transfer scum from the secondary clarifiers to the aerobic digesters via 6-inch pipes.

### 6.3.2 Equipment

The scum pumps are 150-gpm non-clog submersible pumps that are driven by 3-hp motors. The scum pumps were functioning at the time of visit.

## 6.4 Recommended Improvement

The projected 2045 flow at the North Gulfport WWTF indicate the facility will be operating beyond capacity, which requires an expansion. Evaluation of the secondary clarifiers indicated that two additional secondary clarifiers will be needed to meet future clarification needs. The RAS pumps at the North Gulfport WWTF have a total capacity of 5,700 gpm, which is about 65 percent of the maximum needed RAS rate for current conditions. Moreover, the existing RAS pumps are near the end of their useful life and will only provide 32 percent of the maximum needed RAS pumping rate for future expansion. The following improvement is recommended for the North Gulfport WWTF:

- Replace the existing RAS pumps by installing RAS pumping system with a firm capacity of 17,000 gpm to aid settling in the clarifiers. These RAS pumps should be equipped with VFDs, flowmeter, and controller to adjust flow automatically based upon flow from the influent pump station. The proposed new headworks structure should eliminate any ragging issues at the RAS pumps. However, if the headworks is not upgraded, the RAS pumps should be replaced with chopper pumps to avoid clogging from rags.

## 7. Filtration

### 7.1 Overview

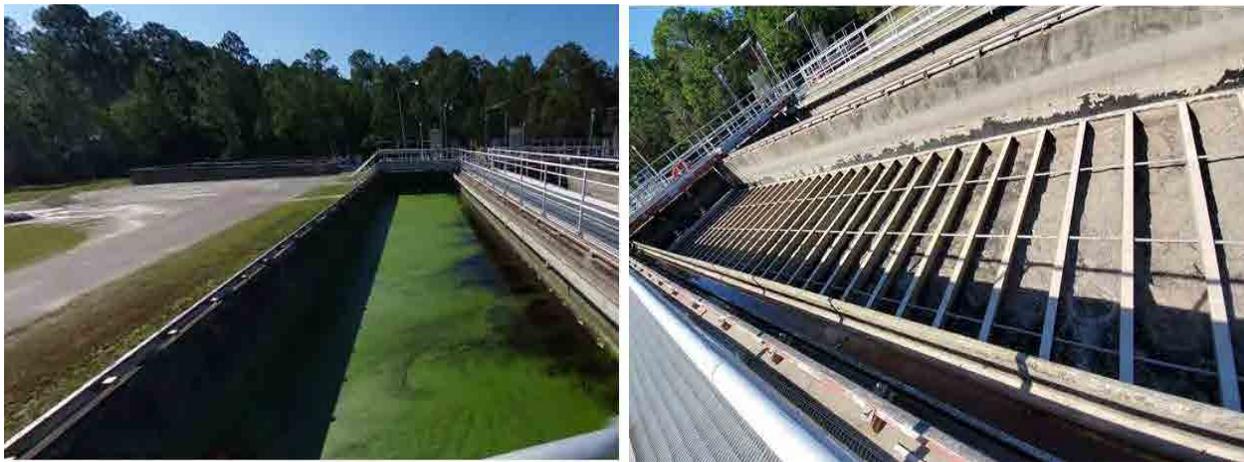
The effluent from the secondary clarifiers is conveyed to EIMCO traveling bridge filters for additional solids removal. The additional solids removal helps protect the downstream UV disinfection system and helps prevent effluent TSS permit violations. There are four 16-foot-wide filters with approximately 32 basins each. The filter media consists of sand and anthracite. The filters are equipped with individual backwash pumps, carriage drive units, and filter hood lifts. According to a 2019 HCUCA Filtration and Disinfection Assessment Report by Neel-Schaffer Inc., (Neel-Schaffer 2019) each filter at the North Gulfport WWTF is designed to handle 1.38 MGD during average flow and 7.6 MGD at peak flows. At higher

flows of about 11 MGD, the filters are bypassed with a 36-inch bypass line, which transfers secondary effluent directly to the disinfection systems.

The filtrate from the four filters combine in a 36-inch pipe and flow to the disinfection units downstream. Filter backwash flows through a 14-inch pipe to the filter backwash pump station.

The plant experiences algae issues particularly during the summer. The algae growth is curtailed intermittently by covering the filters to avoid sunlight supply to the algae.

The filters at North Gulfport WWTF are near the end of their useful life and were generally in poor condition at the time of visit as shown on Figure 7-1.



**Figure 7-1. Tertiary Filters at North Gulfport WWTF**

### **7.2 Filter Backwash Pump Station**

The filter backwash pump station consists of two 1,500-gpm non-clog submersible pumps, which convey the filter backwash water to the headworks via 12-inch pipe.

### **7.3 Recommended Improvement**

The existing tertiary filters at the North Gulfport WWTF are in poor condition and appear to have reached the end of their useful life. The following improvement is recommended for the North Gulfport WWTF:

- Replace the existing granular filters with four new cloth disc filters with a total area of 3,700 sf. The new filters should have a width of 8 feet and length of approximately 116 feet.

## **8. Ultraviolet Disinfection**

### **8.1 Overview**

The filtered effluent flows to a UV disinfection system for pathogen inactivation. The disinfected effluent flows through a 36-inch pipe to a splitter box where the flow is split between the plant water system and the post-aeration basin. The UV system at North Gulfport WWTF is in poor condition and the 2019 asset management report shows that there have been multiple failures during operation (Utility Partners ,2019). Figure 8-1 shows the UV disinfection system at the North Gulfport WWTF.



**Figure 8-1. UV Disinfection System at North Gulfport WWTF**

## 8.2 Equipment

The UV system is a single train, TrojanUV4000 medium-pressure disinfection system consisting of two banks and were installed over 20 years ago. Each of the banks contains 36 bulbs that are 3.2 kilowatts each. According to a Neel-Shaffer 2019 disinfection assessment report, the Trojan UV4000 at North Gulfport WWTF is outdated and needs to be replaced. The report also indicated that the UV system at the North Gulfport WWTF has automation issues and can operate at full capacity, which results in high energy costs.

## 8.3 Recommended Improvement

The TrojanUV4000 disinfection system at North Gulfport WWTF is an outdated medium-pressure system, which is poor condition and results in higher energy costs compared to newer low-pressure UV systems. Additionally, the UV system can only run at full capacity due to automation issues, which results in high energy consumption. The following improvement is recommended for the North Gulfport WWTF:

- Replace the existing UV system with a new Trojan UV Signa low-pressure high-output system in a new structure consisting of four channels. Each channel should be 16 feet long, 3.6 feet wide and 7.8 feet deep. Each of the channels should consist of two banks of Trojan UV Signa system and each bank should contain 14 UV lamps.

## 9. Post-aeration and Effluent Discharge

### 9.1 Overview

The effluent from the disinfection system flows by gravity to two post-aeration basins where the effluent is re-aerated before final discharge. There are sluice gates for isolating the post-aeration basins. Each post-aeration basin is sectioned into two sub chambers, which are each equipped with two aerators. Typically, one aerator in each post-aeration basin is run at a time. A review of the historical data showed the post-aeration system at the North Gulfport WWTF has been effective in producing a minimum of 6 mg/L DO is the effluent as required by the permit.

### 9.2 Equipment

There is a total of four surface aerators in the post-aeration basins. Each surface aerator is driven by 20- hp motors.

### 9.3 Effluent

The aerated effluent from the post-aeration basins flows through a 48-inch pipe into a ditch that flows to Bernard Bayou. The North Gulfport has an effluent flow discharge permit limit of 7.75 MGD on a monthly average basis. A review of monthly operational data from 2014 to 2018 showed the effluent flow from North Gulfport has exceeded the permitted discharge limit on several occasions as shown on Figure 9-1. According to the permit violations report, HCUA indicated the violations were as a result of I&I problems and excessive (typically >13 inches) rain events.

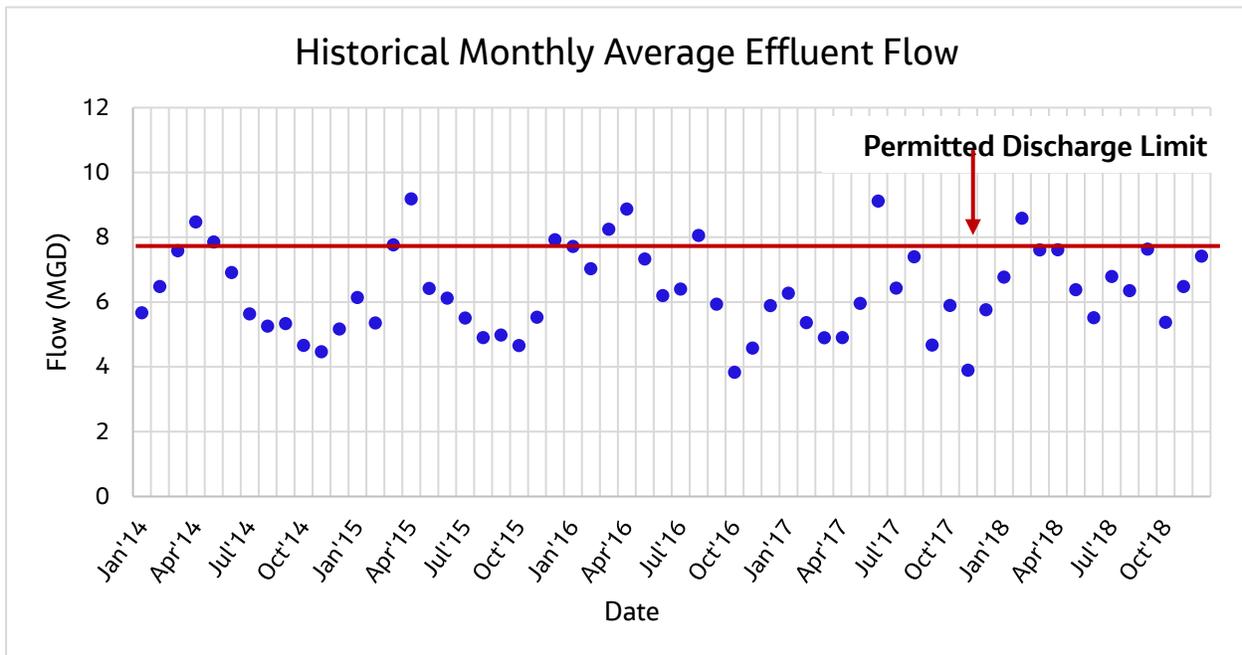


Figure 9-1. Historical Monthly Average Effluent Flow at North Gulfport WWTF

### 9.4 Recommended Improvement

A review of monthly operational data from 2014 to 2018 showed the effluent flow from North Gulfport has exceeded the permitted discharge limit on several occasions as a result of I&I problems and excessive (typically >13-inches) rain events. The following improvement is recommended for the North Gulfport WWTF:

- Coordinate with City of Gulfport to conduct a sanitary sewer evaluation survey to address the I&I issues. TVing of the sewers, smoke testing, and flow measurement should be included.
- Communicate with MDEQ to increase the effluent discharge permit limit.

## 10. Effluent Flushing Water

### 10.1 Overview

Some of the disinfected and re-aerated water is returned to the plant water system for reuse by effluent flushing water (EFW) pumps. There are three vertical turbine pumps that convey the EFW via a 6-inch pipe to the solids processing units. Two of the pumps are equipped with 10-hp motors and have capacity to discharge flow at 100 gpm while the third pump is a 320-gpm pump driven by a 25-hp motor.

### 10.2 Recommended Improvement

There are no recommended improvements to the EFW at this time.

## 11. Biosolids Handling and Reuse

### 11.1 Sludge Thickening

The WAS from the secondary clarifiers is pumped to one 2-meter Ashbrook GBT, which thickens the sludge to about 4 percent solids concentration. The thickened sludge is conveyed to the aerobic digesters for volatile solids destruction. The 2-meter GBTs are typically rated to process 500 kilograms per meter per hour (kg/m/hr) up to 1.5 percent solids. The Pro2D model shows the projected 2045 loads will require solids thickening capacity of 344 kg/m/hr at 1 percent solids, which indicates that the existing GBT will likely have capacity. However, the GBT at the North Gulfport WWTF has been in operation for over 20 years and is reaching its end of useful life. Figure 11-1 shows the GBT at the North Gulfport WWTF.



Figure 11-1. Gravity Belt Thickener at North Gulfport WWTF

### 11.2 Aerobic Digesters

#### 11.2.1 Overview

The thickened biosolids from the GBT is sent to two aerobic digesters via a 6-inch pipe. Each aerobic digester is 70-foot in diameter and has a side water depth of 14 feet. Thickened sludge is stabilized in the aerobic digesters by means of constant aeration. According to plant staff, the SRT in the aerobic digesters is normally 20 days and about 30 percent volatile solids reduction is achieved after the digestion process. The steady-state Pro2D model was used to approximate the capacity of the aerobic digesters at the North Gulfport WWTF at current and projected 2045 max month conditions. Using solids concentration of

4 percent (based on information from plant staff), the model results indicated that at current max month and projected 2045 conditions, approximately 28-day SRT is maintained in the existing digesters, which is inadequate to meet the 40-day SRT at 20°C or the 60-day SRT at 15°C requirement for Class B. Digested sludge from the aerobic digesters is conveyed to the digested sludge pumping station. Figure 11-2 shows the aerobic digester at North Gulfport WWTF.



**Figure 11-2. Aerobic Digester at North Gulfport WWTF**

### 11.2.2 Equipment

Each aerobic digester is equipped with a 100-hp surface aerator that supply oxygen for sludge stabilization. The aerators were functional at the time of visit.

### 11.3 Digested Sludge Pumping

Digested sludge is conveyed in 6-inch pipes from the aerobic digesters to the BFP by two 150-gpm duplex plunger pumps driven by 7.5-hp motors. The plant staff reported that the air release valves do not function properly creating issues for the feed pumps.

### 11.4 Dewatering

Digested sludge from the two aerobic digesters is pumped to one 2-meter Ashbrook BFP for dewatering. Polymer is added to the sludge to aid the dewatering process and 15 percent solids sludge cake is normally produced. Following the dewatering process, filtrate flows through an 8-inch pipe to the filtrate and septage pump station to be pumped back to the headworks. The dewatered sludge is conveyed in a covered screw conveyor into a provided truck under a canopy. The 2-meter BFP at North Gulfport WWTF is rated to process approximately 250 kg/m/hr. The Pro2D model shows the projected 2045 loads will require capacity of 658 kg/m/hr, which indicates that the existing BFP will not have capacity for future solids loading. Moreover, the BFP has been in operation for over 20 years and is reaching its end of useful life. Figure 11-3 shows the BFP at North Gulfport WWTF.



**Figure 11-3. Belt Filter Press at North Gulfport WWTF**

### 11.5 Reuse

Dewatered biosolids produced at the North Gulfport plant are conveyed to a truck provided by Breaux Brothers. The biosolids are then hauled off by Breaux Brothers for land application on farms belonging to the Breaux Brothers.

### 11.6 Recommended Improvement

The aerobic digesters at the North Gulfport WWTF will not have capacity to handle current and future maximum month solids at the 40-day SRT at 20°C or the 60-day SRT at 15°C requirement for Class B. The GBT and BFP at North Gulfport WWTF have been in operation for over 20 years and are reaching the end of their useful life. Additionally, the BFP does not have capacity for future solids loading. The following future expansion needs are recommended for the solids processing units at the North Gulfport WWTF:

- Replace the existing thickener with two new 2-meter GBTs and should be placed in the existing solids processing building. Construct a new solids processing building and place three (2+1) new 2-meter BFPs.
- Construct two additional 70-foot diameter aerobic digesters. The new aerobic digesters should be equipped with coarse bubble diffusers and blower system to provide aeration.
- Install two new sludge transfer pumps to help transfer sludge between the digesters. The transfer pumps should be rotary lobe pumps with a firm capacity of 2,300 gpm.
- Install two new dewatering feed pumps to convey digested sludge to the dewatering units. Each of the dewatering feed pumps should have a capacity of 180 gpm.

## 12. Septage Receiving

### 12.1 Overview

There is a concrete septage receiving station at the plant where septage is offloaded onto a concrete containment equipped with 1/2-inch bar screens. The bar screen is not effective and coarse debris sometimes goes through the screens to causing problems at the filtrate pump station. The septage flows to

the filtrate pump station and the combined flow is conveyed to the plant influent station via a 14-inch pipe. According to plant staff, the quantity (in gallons) of septage received is unknown because the flow is not measured. Figure 12-1 shows the septage receiving station at North Gulfport WWTF.



**Figure 12-1. Septage Receiving Station at North Gulfport WWTF**

### 12.2 Recommended Improvement

The septage receiving station at the North Gulfport WWTF is a concrete containment with a 1/2-inch bar screen, which is not effective and creating problems at the filtrate pump station. The following improvement is recommended for the North Gulfport WWTF:

- Replace the existing septage receiving station with a packaged septage (e.g., Huber Sludge Acceptance Plant) receiving station, which includes an integrated screening and dewatering system.

## 13. Summary of Recommended Improvements

Unit Process	Recommendation Number	Description
Future Expansion	1	<p><i>The projected influent flows of 8.07 MGD indicates the North Gulfport WWTF will exceed its design capacity of 7.75 MGD by 2045.</i></p> <ul style="list-style-type: none"> <li>▪ Consider expansion of the North Gulfport WWTF before 2045.</li> <li>▪ Install new magnetic flowmeter for flow measurement.</li> </ul>
Headworks	2	<p><i>The existing mechanical screens have missing teeth and ineffective side seals and are unable to handle peak flows above 25 MGD. Moreover, the screens and the grit removal systems are nearing their end of useful life and need to be replaced.</i></p> <ul style="list-style-type: none"> <li>▪ Replace the entire headworks structure. The new headworks structure should have three new 6-mm mechanical screens with 48 MGD total capacity (16 MGD capacity each). Each of the new mechanical screens should have stainless-steel covers and screen-washing press.</li> <li>▪ The new headworks structure should have two new vortex grit removal systems of 24 MGD capacity each. The grit system should include three (2+1) grit pumps of 200 gpm capacity. The new headworks structure should have all channels covered and the channel air should be routed to a new biofilter odor control system.</li> </ul>

Unit Process	Recommendation Number	Description
New Equalization Basins	3	<p><i>Current and future instantaneous high flows at the North Gulfport WWTF can overburn the secondary treatment system.</i></p> <ul style="list-style-type: none"> <li>▪ Construct two new equalization basins at the immediate downstream of the headworks to control peak conditions. Each equalization basin should be circular 3 MG in volume.</li> </ul>
Oxidation Ditches	4	<p><i>The existing oxidation ditches are equipped with one surface aerator and one mixer each with no redundancy. Moreover, the biological treatment at North Gulfport has resulted in some permit violations of parameters such as BOD, ammonia-Nitrogen and TN. There is no available data on the variability of DO concentration in the oxidation ditches.</i></p> <ul style="list-style-type: none"> <li>▪ Expand and modify the two existing oxidation ditches into 5-stage Bardenpho reactors by adding 0.13-MG anaerobic selectors upstream and new 0.39-MG post-anoxic and 0.26-MG post-aerobic zones downstream.</li> </ul> <p>In addition to expansion and modification of the existing oxidation ditches, add a new 2.56-MG 5-stage Bardenpho bioreactor to bring the total bioreactor volume at North Gulfport WWTF to 7.7 MG.</p> <ul style="list-style-type: none"> <li>▪ Replace the surface aerators in the aerobic zones of the existing oxidation ditches with fine bubble diffusers and a blower system equipped with VFDs. In addition, the aerobic zones in the new 5-stage bioreactor should be equipped with fine bubble diffusers and a blower system. There should be four total blowers (3 on-duty + 1 standby) with each having a capacity of 4,800 scfm. The blowers should be placed in a new blower building.</li> <li>▪ Install two DO probes in each of the aerobic zones and one DO probe in each of the post-aerobic zones in each train.</li> <li>▪ Install one ORP probe in each of the new anaerobic selectors to monitor anaerobic conditions.</li> <li>▪ Install one 7.5-hp mixer in each of the non-aerobic zones (i.e., anaerobic zone, anoxic and post-anoxic zones) in each train.</li> </ul>
Secondary Clarifiers	5	<p><i>The existing two secondary clarifiers have limited capacity for current and future peak conditions under high MLSS concentrations.</i></p> <ul style="list-style-type: none"> <li>▪ Construct two new 125-foot diameter secondary clarifiers to expand the secondary clarification process for future peak conditions.</li> </ul>
RAS/WAS Pumping	6	<p><i>The existing RAS pumps are near end of their useful life and will only be 32 percent of the maximum needed RAS pumping rate for future expansion with two new additional clarifiers in service.</i></p> <ul style="list-style-type: none"> <li>▪ Replace the existing RAS pumps by installing RAS pumping system with a firm capacity of 17,000 gpm to aid settling in the clarifiers. These RAS pumps should be equipped with VFDs, flowmeter, and controller to adjust flow automatically based upon flow from the influent pump station. If the headworks is not upgraded to eliminate ragging downstream, the RAS pumps should be replaced with chopper pumps to avoid clogging from rags.</li> </ul>

Unit Process	Recommendation Number	Description
Tertiary Filters	7	<p><i>The existing tertiary filters at the North Gulfport WWTF are not in good condition and appear to have reached the end of their useful life.</i></p> <ul style="list-style-type: none"> <li>Replace the existing granular filters with four new cloth disc filters with a total area of 3,700 sf. The new filters should have a width of 8 feet and length of approximately 116 feet.</li> </ul>
UV Disinfection	8	<p><i>The TrojanUV4000 disinfection system at North Gulfport WWTF is an outdated medium-pressure system, which results in higher energy costs compared to newer low-pressure UV systems. Additionally, the UV system can only run at full capacity due to automation issues, which results in high energy consumption</i></p> <ul style="list-style-type: none"> <li>Replace the existing UV system with a new Trojan UV Signa low-pressure high-output system in a new structure consisting of four channels. Each channel should be 16 feet long, 3.6 feet wide and 7.8 feet deep. Each of the channels should consist of two banks of Trojan UV Signa system and each bank should contain 14 UV lamps</li> </ul>
Effluent Discharge	9	<p><i>Effluent flow from North Gulfport has exceeded the permitted discharge limit on several occasions as a result of I&amp;I problems and excessive (typically &gt;13-inches) rain events</i></p> <ul style="list-style-type: none"> <li>Coordinate with City of Gulfport to conduct a sanitary sewer evaluation survey to address the I&amp;I issues. TVing of the sewers, smoke testing, and flow measurement should be included.</li> <li>Communicate with MDEQ to increase the effluent discharge permit limit.</li> </ul>
Solids Thickening and Dewatering	10	<p><i>The GBT and BFP have reached the end of useful life and future flow conditions necessitates an expansion of the thickening and dewatering system.</i></p> <ul style="list-style-type: none"> <li>Construct a new solids processing building and replace the existing thickener and dewatering units with two new 2-meter GBTs and two new 2-meter BFPs.</li> </ul>
Aerobic Digesters	11	<p><i>The existing two aerobic digesters have limited capacity for projected future flows and loads.</i></p> <ul style="list-style-type: none"> <li>Construct two additional 70-foot diameter aerobic digesters similar to the existing digesters. The new aerobic digesters should be equipped with coarse bubble diffusers and blower system to provide aeration.</li> <li>Install two new sludge transfer pumps to help transfer sludge between the digesters. The transfer pumps should be rotary lobe pumps with a firm capacity of 2,300 gpm.</li> <li>Install two new dewatering feed pumps to convey digested sludge to the dewatering units. Each of the dewatering feed pumps should have a capacity of 180 gpm.</li> </ul>
Septage Receiving Station	12	<p><i>The septage receiving station at the North Gulfport WWTF is a concrete containment with a 1/2-inch bar screen, which is not effective and sometimes creates problems at the filtrate pump station.</i></p> <ul style="list-style-type: none"> <li>Replace the existing septage receiving station with a packaged septage (e.g., Huber Sludge Acceptance Plant) receiving station, which includes an integrated screening and degritting system.</li> </ul>

**14. Cost Estimates**

In the cost estimates analysis, the CH2M HILL, Inc. Parametric Cost Estimating System (CPES), a proprietary cost estimating and design tool, was used to determine the capital cost estimates for the North Gulfport WWTF. In the CPES model, the percentages used for the general project costs, contractor markups, and non-construction costs are shown in Table 14-1. The itemized cost for North Gulfport WWTF were then rounded up and is shown in Table 14-2. The estimated total project cost for the recommended improvements at the North Gulfport WWTF is \$91,140,000.

**Table 14-1. Percentages Used in the Cost Estimates for North Gulfport WWTF**

Category	Percent (%)
<b>General Project Cost</b>	
Demolition	1.5
Overall sitework	4
Plant Computer System	1.5
Yard Piping	5
Electrical	6
<b>Contractor Markups</b>	
Overhead	12
Profit	10
Mob/Bond/Insurance	3
Contingency	30
<b>Non-construction</b>	
Engineering	8
Permitting	2
Services During Construction	8
Commissioning 2	2

**Table 14-2. Itemized Cost Estimates for North Gulfport WWTF based on Alternative 3**

North Gulfport Improvement Description		Capital Cost	Non-Construction Cost	Total Project Cost
<b>Year 0 to 5</b>		<b>\$21,990,000</b>	<b>\$4,398,000</b>	<b>\$26,388,000</b>
Headworks	\$9,500,000			
Tertiary Filters	\$9,180,000			
UV Disinfection	\$3,310,000			
<b>Year 5 to 10</b>		<b>\$53,960,000</b>	<b>\$10,792,000</b>	<b>\$64,752,000</b>
New Equalization Basins	\$2,570,000			
Oxidation Ditches	\$20,370,000			
Secondary Clarifiers	\$8,910,000			
RAS/WAS Pump Station	\$6,390,000			
Solids Thickening and Dewatering	\$6,700,000			
Aerobic Digesters	\$9,020,000			
<b>Year 10 to 20</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
	\$0			
<b>Total</b>				<b>\$91,140,000</b>

## 15. References

Brown, Mitchell & Alexander, Inc. (BMA). 2015. *Harrison County Utility Authority's (HCUA's) 2015 Phase 1 Master Plan*.

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Neel-Schaffer Inc. 2019. *HCUCA Filtration and Disinfection Assessment Report*.

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Utility Partners, LLC. 2019. *North Gulfport 2019 Asset Management Executive Summary*.

Volkert, Inc. 2010. *HCUA Phase II Compliance Study: Gulfport North WWTP and South WWTP*.

**Appendix G**  
**North and South Gulfport Wastewater Treatment Facility Alternative**  
**Analysis Technical Memorandum**

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<b>Subject</b>	<b>North and South Gulfport WWTFs Alternative Analysis</b>	<b>Project Name</b>	Harrison County Utility Authority (HCUA) Water & Sewer Resources Plan Phase II
<b>Attention</b>	John L. Wilson, P.E, Executive Director, HCUA	<b>Project No.</b>	D3113002
<b>From</b>	Jacobs Engineering Group Inc. (Jacobs)		
<b>Date</b>	December 16, 2020		

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## 1. Introduction

The HCUA owns the North and South Gulfport wastewater treatment facilities (WWTFs) located in the Gulfport area. The two treatment facilities have a combined nutrient permit (MS0051756), which was recently modified on March 16, 2020, and expires on February 28, 2025. As shown in the North and South Gulfport technical memorandums (TMs), the two Gulfport plants have significant expansion and modification needs to be able to handle future flows and loads to meet the nutrient limits.

This TM summarizes the proposed conceptual alternative analysis to address the modification and expansion needs of the Gulfport WWTFs.

## 2. Conceptual Alternatives for North and South Gulfport WWTFs

Jacobs conducted a conceptual alternative analysis to determine the best possible treatment option to address the modification and expansion needs of the Gulfport WWTFs to treat projected 2045 flows and loads. The projected flows and loads for the North and South Gulfport WWTFs are presented in the North and South Gulfport WWTF TMs, respectively. The alternative analysis included three conceptual alternatives to treat the wastewater from the Gulfport area considering the existing conditions of the North and South Gulfport WWTFs and the combined nutrient limits for the two facilities.

### 2.1 Conversion of South Gulfport WWTF into a Pump Station with Expansion and Modification of the North Gulfport WWTF (Alternative 1)

The first alternative (Alternative 1) include converting the South Gulfport WWTF to a pump station with expansion and modification of the North Gulfport WWTF to receive and treat the total flow from South Gulfport WWTF. Under this alternative, the raw wastewater is preliminary treated in a new headworks structure for screening and grit removal at the South Gulfport WWTF. Following the preliminary treatment, the wastewater is then conveyed from South Gulfport across the Bayou Bernard to the North Gulfport WWTF. Alternative 1 includes the following process modification at the North Gulfport WWTF:

- Construction of four 110-foot-diameter primary clarifiers.
- Replacement of the existing aerobic digesters with two 85-foot-diameter anaerobic digesters for solids stabilization downstream.

- Expansion and modification of the existing two trains of 2-stage (anoxic-aerobic) oxidation ditches at the North Gulfport WWTF into three trains of 5-stage (anaerobic-anoxic-aerobic-post anoxic-post aerobic) Bardenpho biological nutrient removal process.
- Expansion of the secondary clarification process to include six 160-foot-diameter secondary clarifiers in addition to the existing two 125-foot-diameter secondary clarifiers.

The proposed layout for the North and South Gulfport WWTF in Alternative 1 is shown on Figures 2-1 and 2-2.

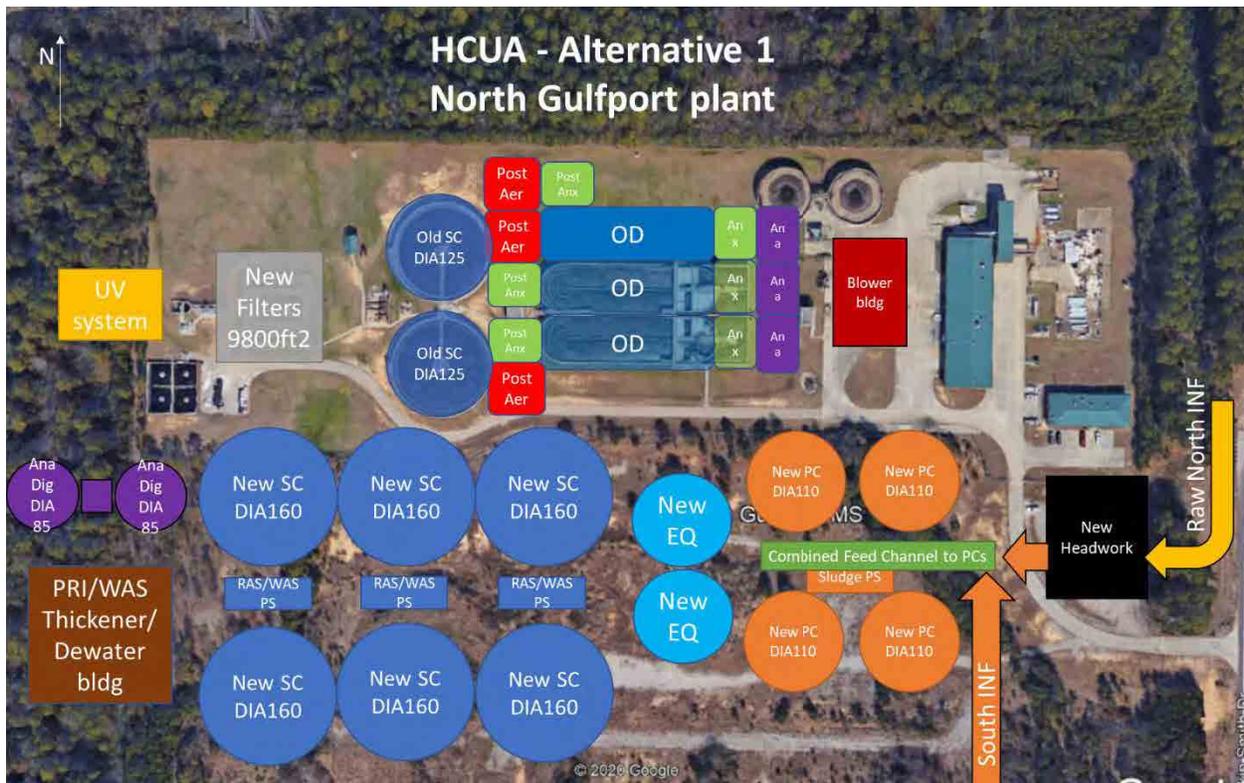


Figure 2-1. Proposed Layout for North Gulfport WWTF in Alternative 1

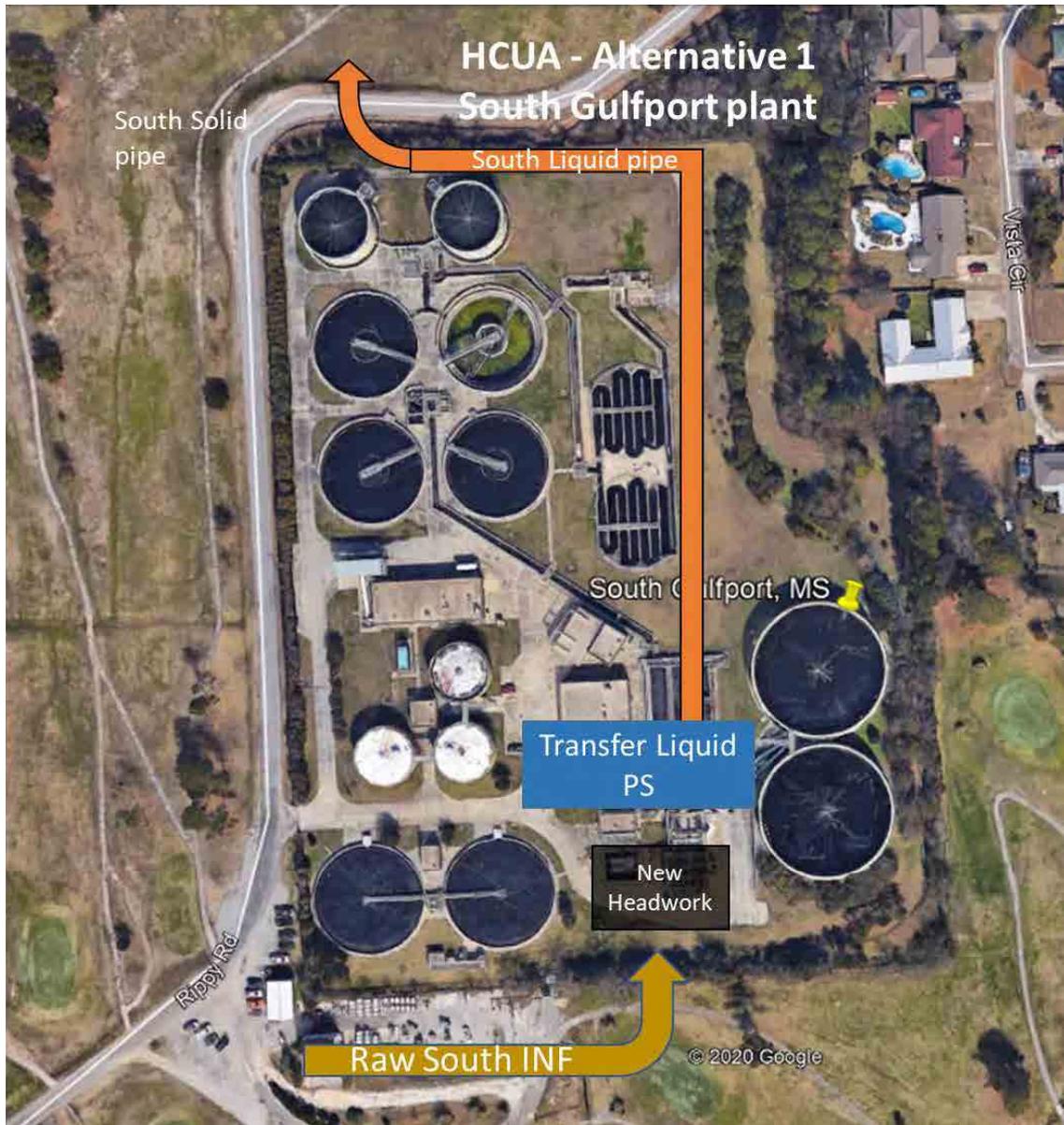


Figure 2-2. Proposed Layout for South Gulfport WWTF in Alternative 1

### 2.2 Expansion and Modification of the Secondary Treatment at North Gulfport WWTF to Receive Primary Effluent and Sludge from South Gulfport WWTF (Alternative 2)

Alternative 2 involves an expansion and modification of the secondary treatment at the North Gulfport WWTF to receive preliminary- and primary-treated effluent and primary sludge from South Gulfport WWTF. This alternative includes construction of a new headworks at the South Gulfport WWTF, utilization of the existing two primary clarifiers, and modification of one of the existing secondary clarifiers as a primary clarifier for expanded primary treatment at the South Gulfport WWTF. Alternative 2 includes two additional options (Alternatives 2A and 2B) for additional treatment before conveying flow to the North Gulfport WWTF.

In Alternative 2A, the first-stage trickling filters are retrofitted into two equalization basins to control the flow pumped to the North Gulfport WWTF for treatment via a Liquid Transfer Station. In Alternative 2B, the existing first-stage trickling filters are used to achieve some partial secondary treatment before the flow is conveyed to the North Gulfport WWTF for further treatment; and the existing second stage trickling filters are converted into two equalization basins. In both Alternative 2A and 2B, there are liquid and solid transfer pump stations to send the liquid effluent and primary solids to the North Gulfport for further treatment. As a result of the initial primary treatment at the South Gulfport WWTF, the North Gulfport WWTF will have two new primary clarifiers instead of four as described in Alternative 1. Aside from the reduction in primary clarification in Alternative 2, all the other North Gulfport WWTF process units required and described in Alternative 1 remain the same for Alternative 2. HCUA did not want to pursue Alternative 2 during a review meeting because it did not provide any additional benefit compared to the other alternatives evaluated, and added the complexity of pumping solids under the bay. The proposed layout for North and South Gulfport WWTFs in Alternative 2 is shown on Figures 2-3, 2-4, and 25, respectively.

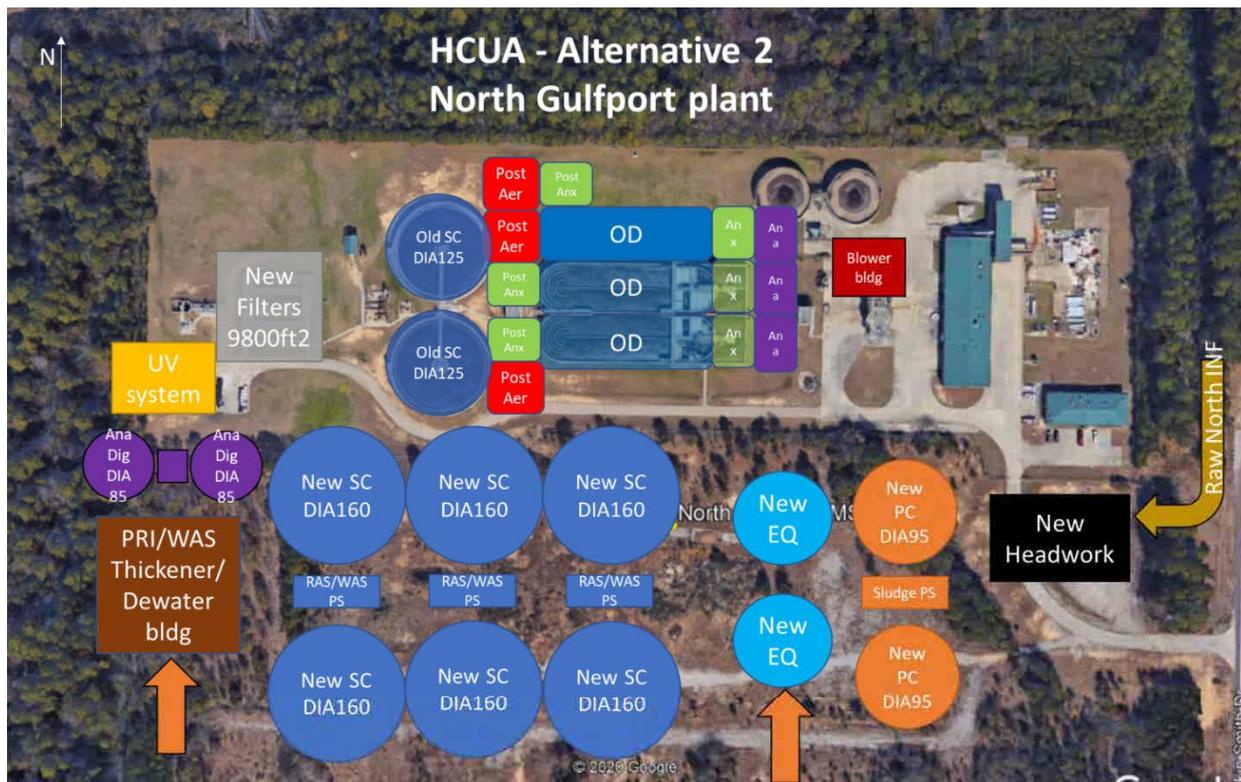


Figure 2-3. Proposed Layout for North Gulfport WWTF in Alternative 2



Figure 2-4. Proposed Layout for South Gulfport WWTf in Alternative 2A

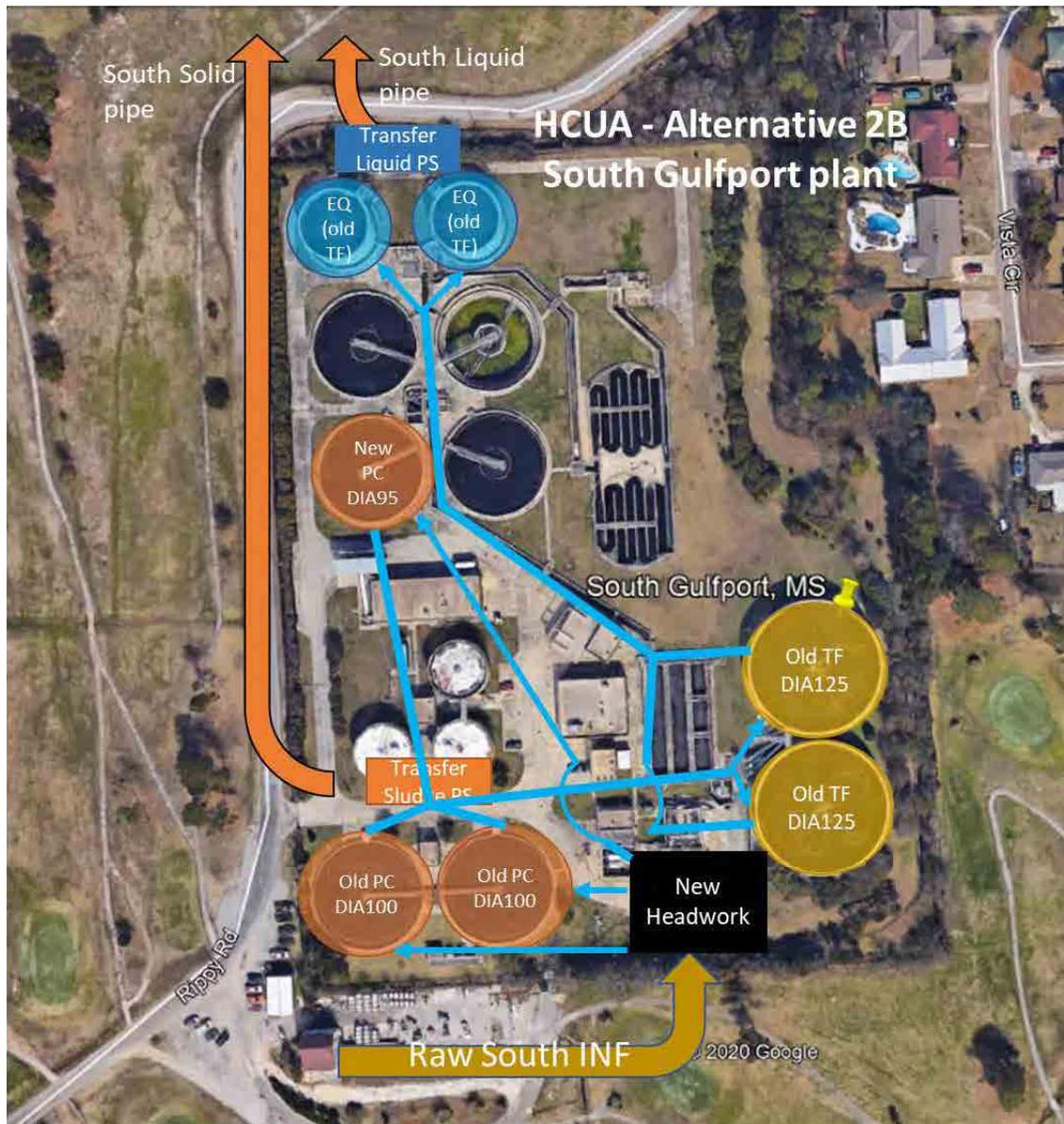


Figure 2-5. Proposed Layout for South Gulfport WWTF in Alternative 2B

### 2.3 Expansion and Modification of North and South Gulfport WWTFs as Separate Facilities (Alternative 3)

The third conceptual alternative (Alternative 3) involves maintaining the independent Gulfport WWTFs, while expanding and modifying the treatment process at each plant. Alternative 3 eliminates the need to send flow or sludge across Bayou Bernard and appears to be the most cost-effective compared to Alternative 1. As a result, Alternative 3 is recommended to address projected future flows and max month loads at the Gulfport WWTFs. Alternative 3 includes the following expansion and process modifications at the North Gulfport WWTF:

- New headworks consisting of three mechanical screens and two vortex grit systems
- Two new equalization basins of 3 million gallons of volume each, immediately downstream of headworks to control instantaneous peak flows
- Expansion and modification of the existing two trains of 2-stage (anoxic-aerobic) oxidation ditches at the North Gulfport WWTF into three trains of 5-stage (anaerobic-anoxic-aerobic-post anoxic-post aerobic) Bardenpho biological nutrient removal process
- A new blower building
- Expansion of the secondary clarification process to include two new 125-foot-diameter secondary clarifiers in addition to the existing two 125-foot-diameter secondary clarifiers
- Expansion of the solids process to include two new 70-foot-diameter aerobic digesters in addition to the existing two 70-foot-diameter digesters
- Addition of gravity belt thickener in existing solids processing building and two new belt filter presses in a newly constructed dewatering building
- Replacement of the existing filters and ultraviolet system with new filters and ultraviolet systems

Alternative 3 includes the following process expansions and modifications at the South Gulfport WWTF:

- New headworks consisting of four mechanical screens and three vortex grit systems
- Retrofitting the existing first-stage trickling filters into equalization basins
- Retrofitting the existing primary clarification process into a Chemically Enhanced Primary Treatment
- Constructing a new biological nutrient removal system using integrated fixed-film activated sludge technology, which is configured with two trains with each train having three passes divided into eight zones in series
- Construction of a new blower building
- Construction of two new 70-foot-diameter anaerobic digesters
- Expansion of the solids process to include two new gravity belt thickeners and three new belt filter presses in a newly constructed dewatering building
- Expansion of chlorine contact basins

The proposed layout for the North and South Gulfport WWTF in Alternative 3 is shown on Figures 2-6 and 2-7.



Figure 2-6. Proposed Layout for North Gulfport WWTF in Alternative 3



Figure 2-7. Proposed Layout for South Gulfport WWTF in Alternative 3

### 3. Cost Estimates for the Proposed Alternatives

In the cost estimates analysis, the CH2M HILL Parametric Cost Estimating System (CPES), a proprietary cost estimating and design tool, was used to determine the capital cost estimates for the three alternatives. In the CPES model, the percentages used for the general project costs, contractor markups, and non-construction costs are shown in Table 3-1. Table 3-2 shows the cost comparison for the conceptual alternatives (excluding Alternative 2) for the North and South Gulfport WWTFs. As shown in Table 3-2, Alternative 3, which expands and modifies the Gulfport WWTFs as independent facilities, the most cost-effective option for HCUA appeared. Costs presented are rounded. For a breakdown of Alternative 3 costs reference the North Gulfport WWTF TM and the South Gulfport WWTF TM respectively (Jacobs 2020a, 2020b).