HAWKINS WEIR
ENGINEERS, INC.
Engineering Client Success

August 21, 2019 EMAIL

Ms. Bailey Taylor, Enforcement Analyst
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

Re: NPDES Permit Number: AR0036692, AFIN-57-00423
Modified Corrective Action Plan Milestone: Wastewater Treatment Plant Master Plan
HWEI Project No. 2018149

Dear Ms. Taylor:

In accordance with the milestone schedule included in the City of Mena's Modified Corrective Action Plan (CAO LIS 18-046), we are submitting a copy of the Wastewater Treatment Master Plan. This Master Plan includes Hawkins-Weir Engineers' recommendations for the City of Mena to achieve consistent compliance with their permit limits and to address the City's long-term wastewater treatment needs. This document has been reviewed and approved by the City of Mena and they have authorized Hawkins-Weir Engineers to take the necessary steps to further evaluate funding options for the recommended alternative.

Hawkins-Weir Engineers is also currently assisting the City of Mena in performing a Lagoon Levee Analysis. The results and recommendations of this analysis will be included under a subsequent submittal to ADEQ, as outlined in the Modified Corrective Action Plan. The recommendations included in the Master Plan will be revisited and confirmed following completion of the Lagoon Levee Analysis.

Respectfully Submitted,

HAWKINS-WEIR ENGINEERS, INC.

Adrian J. Kaufman, P.E.

AJK/kad
Enclosure: One (1) Copy Wastewater Treatment Plant Master Plan

cc: Honorable Seth Smith, City of Mena, AR Mayor
Mr. Charles Pitman, Mena Water Utilities General Manager

MENA WATER UTILITIES

WASTEWATER TREATMENT PLANT
MASTER PLAN

AUGUST 2019

CERTIFICATE OF AUTHORIZATION
HAWKINS-WEIR ENGINEERS, INC.
No. 101
ARKANSAS-ENGINEER

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 15655
ADRIAN J. KAUFMAN
8/21/19

HW PROJECT NO. 2018149

PREPARED BY:

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Acronyms

ADEQ	Arkansas Department of Environmental Quality
ADH	Arkansas Department of Health
AEDC	Arkansas Economic Development Commission
ANRC	Arkansas Natural Resources Commission
AWWAC	Arkansas Water/Wastewater Advisory Committee
^oC	Degrees Celsius
CAO	Consent Administrative Order
CAP	Corrective Active Plan
CBOD or BOD_5	Biochemical Oxygen Demand
CDBG	Community Development Block Grant
cfs	Cubic Feet per Second
COD	Chemical Oxygen Demand
EPA	Environmental Protection Agency
^oF	Degrees Fahrenheit
ft	Feet
gpcd	Gallons per Capita per Day
GPD or gpd	Gallons per Day
GPH or gph	Gallons per Hour
HW or Engineer	Hawkins-Weir Engineers, Inc.
I&I	Infiltration and Inflow
MG	Million Gallons
MGD or mgd	Million Gallons per Day
mg/L	Milligrams per Liter
NH_3-N	Ammonia Nitrogen
NPDES	National Pollution Discharge Elimination System
O&M	Operation and Maintenance
RAS	Return Activated Sludge
RD	Rural Development
sq ft or sf or ft^2	Square Feet
SWD	Side Water Depth
TBD	To Be Determined
TDH	Total Dynamic Head
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UNO	Unless Noted Otherwise
USDA	United States Department of Agriculture
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant
TMDL	Total Maximum Daily Load

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1.0 Introduction

1.1 Authorization

The City of Mena authorized the preparation of this Wastewater Treatment Plant Master Plan by Hawkins-Weir Engineers, Inc. (HW) in accordance with an Agreement for Professional Services approved on January 9, 2019.

1.2 Purpose

The purpose of this Wastewater Treatment Plant (WWTP) Master Plan is to evaluate the City of Mena's existing WWTP as required by the Corrective Action Plan (CAP) approved by the Arkansas Department of Environmental Quality (ADEQ). The CAP was submitted to ADEQ in accordance with the executed Consent Administrative Order (CAO) LIS 18-046 entered into on June 10, 2018. The CAO was issued to address sanitary sewer overflows (SSOs), repeated discharges from an unpermitted outfall, and exceedances of permitted values for Total Suspended Solids (TSS) and Ammonia Nitrogen. This WWTP Master Plan is prepared based on the requirements for addressing permit violations outlined in the executed CAO.

In addition to addressing the CAO requirements, this report provides a long-range master plan for the City of Mena's wastewater treatment needs. When comparing project alternatives, the following design goals were considered:

- Provide consistent compliance with NPDES permit requirements
- Reduce surcharge of the collection system during wet weather
- Reduce operation and maintenance issues associated with the Utility's WWTP

2.0 Existing Wastewater Treatment Plant

2.1 Location

The City of Mena is located in Polk County, Arkansas along U.S. Highway 71 on the outskirts of the Ouachita National Forest. The existing WWTP is located approximately 3.5 miles southeast of the City Center, along Arkansas Highway 8.

2.2 Historical Data

2.2.1 Effluent

Based on effluent data from the previous three (3) years, the existing Mena WWTP has historically performed well over the course of its operational life. Figure 2-1 presents Ammonia Nitrogen and TSS concentrations along with average and peak daily flows from November 2015 through November 2018. The data shown indicates seven (7) exceedances over the past three (3) years: three (3) for Ammonia Nitrogen and four (4) for TSS. TSS permit exceedances for lagoon systems are not uncommon due to algae growth and peak flows that can flush suspended solids from the lagoons. The WWTP has historically complied with seasonal ammonia nitrogen limits, only experiencing permit exceedances within the past year.

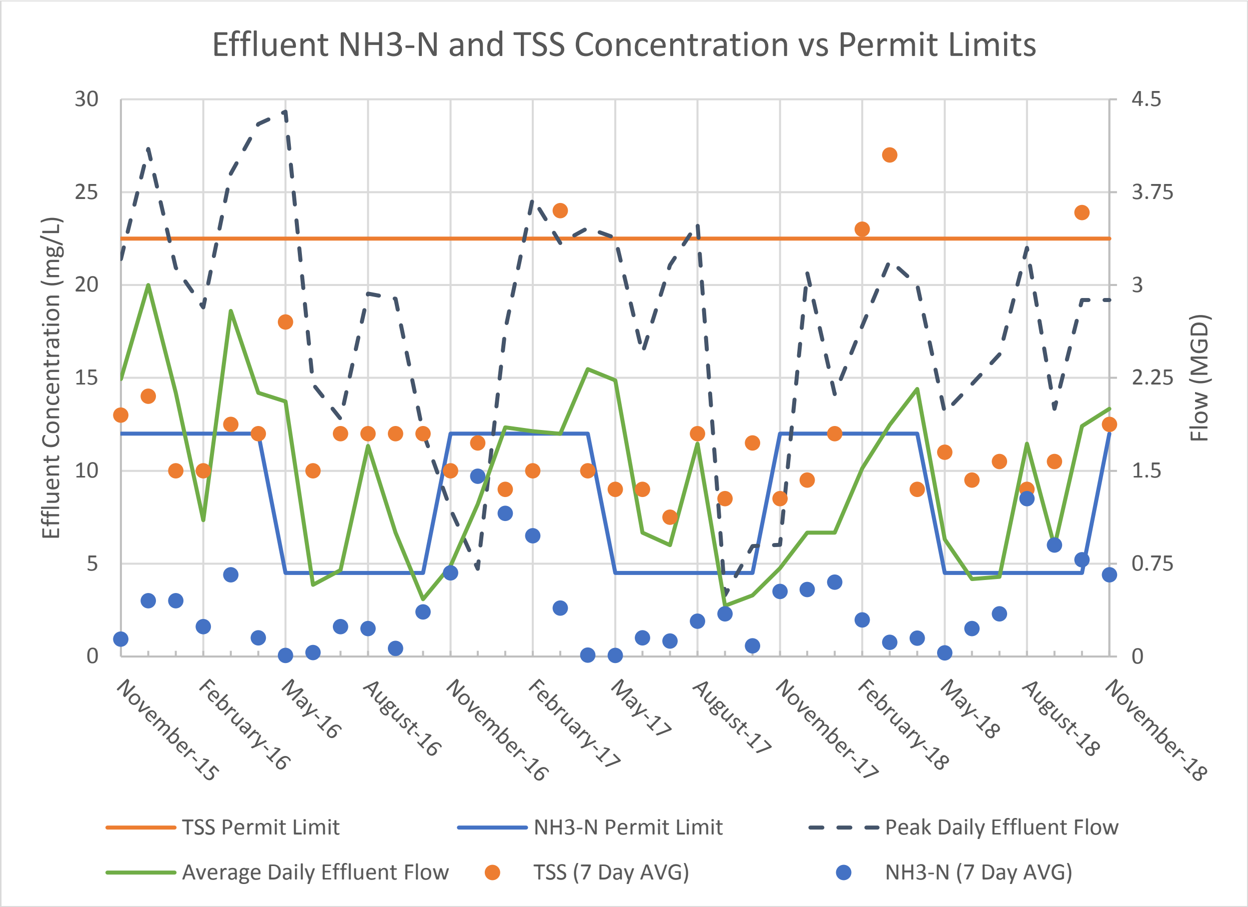


Figure 2-1: Historical Ammonia Nitrogen and TSS Effluent Concentrations

Per the Mena WWTP's NPDES permit, the rated capacity of the plant is 3.1 MGD. As shown in the effluent flow data previously charted in Figure 2-1, peak daily flows regularly exceed this design capacity. Additionally, the average peak day flow over the 36-month evaluation period is 2.6 MGD or approximately 84% of the existing treatment plant's design capacity. It is considered good practice to begin planning for treatment facility upgrades when the peak daily flow reaches 80% of the facility's rated capacity.

Outside of the permit excursions described previously, the existing WWTP has successfully complied with permit requirements for copper, BOD_5, dissolved oxygen, and pH throughout the previous three (3) years. Table 2-1 summarizes the compliance history for the Mena WWTP for a variety of other constituents.

Table 2-1: Historical Effluent Concentrations for Other NPDES Constituents

Constituent	Unit	Mena WWTP Effluent Average	Mena WWTP Effluent Range	Permitted Effluent Concentration
BOD_5	mg/L	4	2 – 14	15
Dissolved Oxygen	mg/L	8.5	7.1 – 10.6	7.1
pH Maximum	S.U.	7.5	6.7 – 8.8	9
pH Minimum	S.U.	6.8	6.2 – 7.6	6
Copper	µg/L	2.0	0.009 – 3.8	21

2.2.2 Receiving Stream

The existing WWTP discharges into an unnamed tributary of Prairie Creek. Prairie Creek is listed on the 2016 303(d) list of impaired water bodies in the State of Arkansas for Dissolved Oxygen. Additionally, a Total Maximum Daily Load (TMDL) is in place for dissolved solids due to excessive turbidity within the stream.

2.2.3 Influent

To establish average dry weather flow rates and future plant capacity needs, influent flow rates were analyzed over a three (3) year period. During that period, the average dry weather flow rate was approximately 0.8 MGD. This was calculated as the average influent flow rate over several months where little or no rainfall was recorded at the WWTP. Assuming a current service population of 5,750, the discharge rate per person is calculated to be 140 gpcd. The peak daily flow rate over the evaluation period was approximately 4.4 MGD, or 800 gpcd. This represents a peaking factor of approximately six (6) for the City of Mena. Plant staff have indicated that the WWTP's influent pump station will operate at maximum capacity for several days after large storm events. Therefore, it is believed that the peak influent flow rate for the Mena WWTP is considerably higher than 4.4 MGD.

In early 2019, a sampling campaign was conducted to characterize the influent constituent loadings for the City of Mena's WWTP. These values are summarized in Table 2-2.

Table 2-2: Influent Sample Data for Mena WWTP

Constituent	Range (mg/L)	Average (mg/L)
TSS	22 - 54	35.7
BOD	18 - 33	25.2
Ammonia	1.09 - 11.8	5.5
pH	7.1 - 9	8.1
Alkalinity	12 - 36	26.0
Copper	0.64 - 0.83	0.7

It is apparent in the presented data that I&I is diluting the concentration of constituents in the wastewater as the values recorded are well below what is expected for domestic wastewater. Therefore, more sampling will be required to more accurately assess organic and inorganic loading in the wastewater.

2.2.4 NPDES Permit Requirements

The City of Mena's existing WWTP is authorized to discharge treated municipal wastewater to an unnamed tributary of Prairie Creek which flows into the Ouachita River under NPDES Permit Number AR0036692. This permit became effective on September 1, 2017 and will expire on August 31, 2022. A summary of the permit requirements is presented in Table 2-3.

Table 2-3: Current NPDES Permit Limits

Constituent	Monthly Average (mg/L, UNO)	7-Day Average (mg/L, UNO)
Biological Oxygen Demand ($CBOD_5$)	10	15
Total Suspended Solids (TSS)	15	22.5
Ammonia Nitrogen		
(April)	4.9	12
(May)	3	4.5
(June - October)	2.1	4.5
(November - March)	5.9	12
Dissolved Oxygen (DO)	7.1 (inst. Min.)	
Fecal Coliform	1000 colonies/100 mL	2000 colonies/100 mL
Total Residual Chlorine	0.011	
Total Recoverable Copper	10.5 µg/L	21 µg/L
Chronic WET Limits	Lethality Not < 100% Sub-lethality Not < 80%	

2.3 Existing Treatment Facilities

The City of Mena's existing WWTP was constructed in 1970 and originally included a 25-acre lagoon, a 30-acre lagoon, an influent pump station, and chlorine disinfection. Continuous backwash sand filtration, a chlorine contact basin, and post aeration were added in 1986. In 1996, fine bubble diffused aeration was added to both lagoons. In 2004, a coagulation basin was installed pre-filtration. The most recent update included the addition of a mechanically-raked bar screen which was installed in 2009.

2.3.1 Headworks

The existing headworks consists of a single mechanically raked bar screen manufactured by Duperon with a rated operating capacity of 3.1 MGD. The bar screen is housed in a concrete channel with a slide gate located at each end for isolation. The bar screen channel contains no automatic bypass for high flow rates. Therefore, the operator must manually divert flows around the bar screen to prevent overflows. Additionally, during maintenance periods, the lack of redundancy results in unscreened wastewater flowing directly into the influent pump station. Sending unscreened wastewater into the influent pump station increases the chances for pump maintenance issues such as pump clogging and impeller wear. Plant staff currently indicate no ongoing maintenance or operational concerns with this unit.

2.3.2 Pump Facilities

The influent pump station was constructed with the original WWTP in 1970. The pump station contains three (3) dry-pit submersible pumps each with a rated capacity of 1,260 gpm at 46-feet of TDH. The pumps have a 6-inch discharge and are manufactured by Yeoman-Chicago. The pump station has a maximum capacity of 4.4 MGD or 3,050 gpm and a firm capacity of 3.2 MGD or 2,200 gpm. The discharge pipe of the pump station includes a 12-inch electromagnetic flow meter and transmitter manufactured by Badger Meters.

The WWTP staff have indicated that after periods of heavy rainfall, the influent pump station will operate at its maximum capacity for several days before returning to typical dry weather flow rates. This is indicative of severe I&I into the sanitary sewer system. It also indicates that the wet weather peak flow rate is higher than the existing capacity of the influent pump station, with the remainder of the wastewater backing up within the collection system. In addition to the severe I&I, WWTP staff indicated that the pump station has flooded in recent years during heavy rainfall events.

2.3.3 Lagoons

Lagoon No. 1 is a 25-acre partially mixed lagoon with an approximate depth of 6-feet. The lagoon is a continuous flow through system with a designed detention time of approximately 16 days at the WWTP's maximum design capacity of 3.1 MGD. A baffle curtain is located within the eastern third of the lagoon to reduce short-circuiting. During a sludge removal effort in 2015, it was noted that several tears were present within the curtain. Sludge measurements were taken in 2015 and indicated an excessive buildup of sludge within the eastern portion of the lagoon. Sludge depths of up to 5.5-feet were measured near the Lagoon No. 1 influent pipe. Based on these measurements, it is estimated that approximately 30 MG of the 51 MG lagoon is occupied by sludge, thereby decreasing the detention time to 6.8 days at the design capacity. In 2015, an estimated 8% of the total sludge volume was removed from Lagoon No. 1.

Lagoon No. 2 is a 30-acre partially mixed lagoon with an approximate depth of 6-feet. The lagoon receives flow from Lagoon No. 1 and has a designed detention time of approximately 19 days at the treatment plant's maximum design capacity. Sludge measurements taken in 2015 indicated sludge depths between 1 to 2-feet throughout the lagoon. Based on these measurements, it is estimated that approximately 15 MG of the 68 MG lagoon is occupied by sludge, thereby decreasing the detention time to approximately 15.5 days at the design capacity.

The Utility has noted what is believed to be areas of abnormally high moisture along the back slope of the Lagoon No. 2 levee in approximately six (6) locations and along the back slope of the Lagoon No. 1 levee in an additional location. They have expressed concern that the moisture could be a result of seepage through the levee. Preliminary results from recent subsurface investigations performed at these locations indicate that the levees were not constructed utilizing impervious soils or other means to effectively prevent the migration of water through the levee. Additionally, these preliminary results indicate relatively high ground water levels at several locations around the lagoon levees. This potential issue is currently under further investigation and the final results of this evaluation will be of significant consequence to the viability of the improvement alternatives discussed within this report.

Both Lagoons contain manually operated bypass valves. The Lagoon No. 1 bypass valve allows raw wastewater to flow directly into Lagoon No. 2, facilitating maintenance on Lagoon No. 1 as required. Lagoon No. 2 contains an emergency bypass that discharges partially treated wastewater directly to the WWTP's outfall. The emergency bypass contains a Parshall flume for flow measurements during bypass events. Lagoon No. 2 was also constructed with an effluent valve, which would allow the lagoon to be isolated for maintenance. WWTP staff indicate that the valve is not operational, therefore Lagoon No. 2 cannot currently be removed from service.

2.3.4 Aeration System

Installed in 1996, the aeration system consists of two (2) 100-horsepower multistage centrifugal blowers controlled by variable frequency drives (VFDs). The blowers discharge into a common 12-inch ductile iron air header that feeds into each lagoon. Air laterals consist of 6-inch and 4-inch high density polyethylene (HDPE) pipes that float in each lagoon. Lagoon No. 1 contains ninety-one (91) 7-foot long fine bubble air diffuser units and Lagoon No. 2 contains thirty-three (33) 4-foot long fine bubble diffuser units. Preliminary calculations indicate that the aeration system is adequately sized to provide sufficient dissolved oxygen for BOD removal.

2.3.5 Coagulation Basin

Discharge from Lagoon No. 2 enters a concrete coagulation basin before filtration. Potassium Aluminum Sulfate, commonly known as alum, is fed into the coagulation basin to support the formation of floc prior to filtration. Plant staff have indicated that the basin hydraulically limits the capacity of the plant to 2.9 MGD. This has not been verified by HW.

2.3.6 Filtration

The Mena WWTP has four (4) continuous backwash, up-flow sand filters manufactured by Parkson Corporation. These filters remove solids and additional BOD as a final treatment step before chlorination. The sand filters are four (4) years past their expected design life of 30 years. Although they have been in continuous operation for 34 years, no operational issues are known at this time. However, due to their continuous service, corrosion is suspected to be present on the interior surfaces of the filters. The existing sand filters are no longer supported by the original manufacturer; therefore, no replacement parts or technical support are available for these units.

As part of normal operation, each filter sends approximately 150,000 gpd of backwash water into the headworks which is subsequently routed back into Lagoon No. 1, for a total of 600,000 gallons of backwash water per day. This is believed to be a substantial contributor to the excessive sludge buildup in Lagoon No. 1. Additionally, the pH of the alum laden sludge could be inhibiting the ammonia-nitrogen removal capacity of the treatment lagoons.

2.3.7 Effluent Disinfection

The existing effluent disinfection system consists of a one-ton chlorine gas cylinder, a gaseous chlorinator, and a concrete contact basin. Chlorine is injected pre-filtration to provide a chlorine contact time of approximately 24 minutes at 3.1 MGD. The concrete contact basin contains baffled walls to create a serpentine flow through the entire structure to prevent short circuiting and ensure adequate chlorine contact time. Basin depth is maintained by a 90-degree V-notch weir. This weir provides instantaneous effluent flow measurement via a staff gauge located upstream of the weir which is utilized for discharge flow reporting.

The most recent NPDES permit for the Mena WWTP contained a total residual chlorine (TRC) limit of 0.011 mg/L with a compliance period of three (3) years. At present, the plant does not have a dechlorination system to meet this limit.

2.3.8 Post Treatment Aeration

Following disinfection, the wastewater flows into two (2) static cascade aerators manufactured by Parkson Corporation to provide additional dissolved oxygen to meet permit limits. Plant staff indicate no existing process or structural concerns with this system. During a site visit, foam was present within the post-aeration structure. Foam can be a concern at activated sludge treatment plants, however the foam within the post-aeration basin was white in color. This indicates the chlorine within the wastewater was potentially reacting with surfactants and not indicative of excessive filamentous organisms.

2.3.9 Electrical and SCADA

The wastewater treatment plant contains a 100-kW backup generator that provides emergency power for the influent pump station, bar screen, and chemical feed system. The aeration system contains no standby power.

The existing facility contains no electronic SCADA system. The influent pump station contains a flow meter with a local readout that totalizes the influent flow rate to the WWTP. The pump station also contains an auto dialer that alerts plant staff during power loss.

2.3.10 Process Layout

Exhibit A, located on the next page, presents a process flow diagram for the existing Mena WWTP.

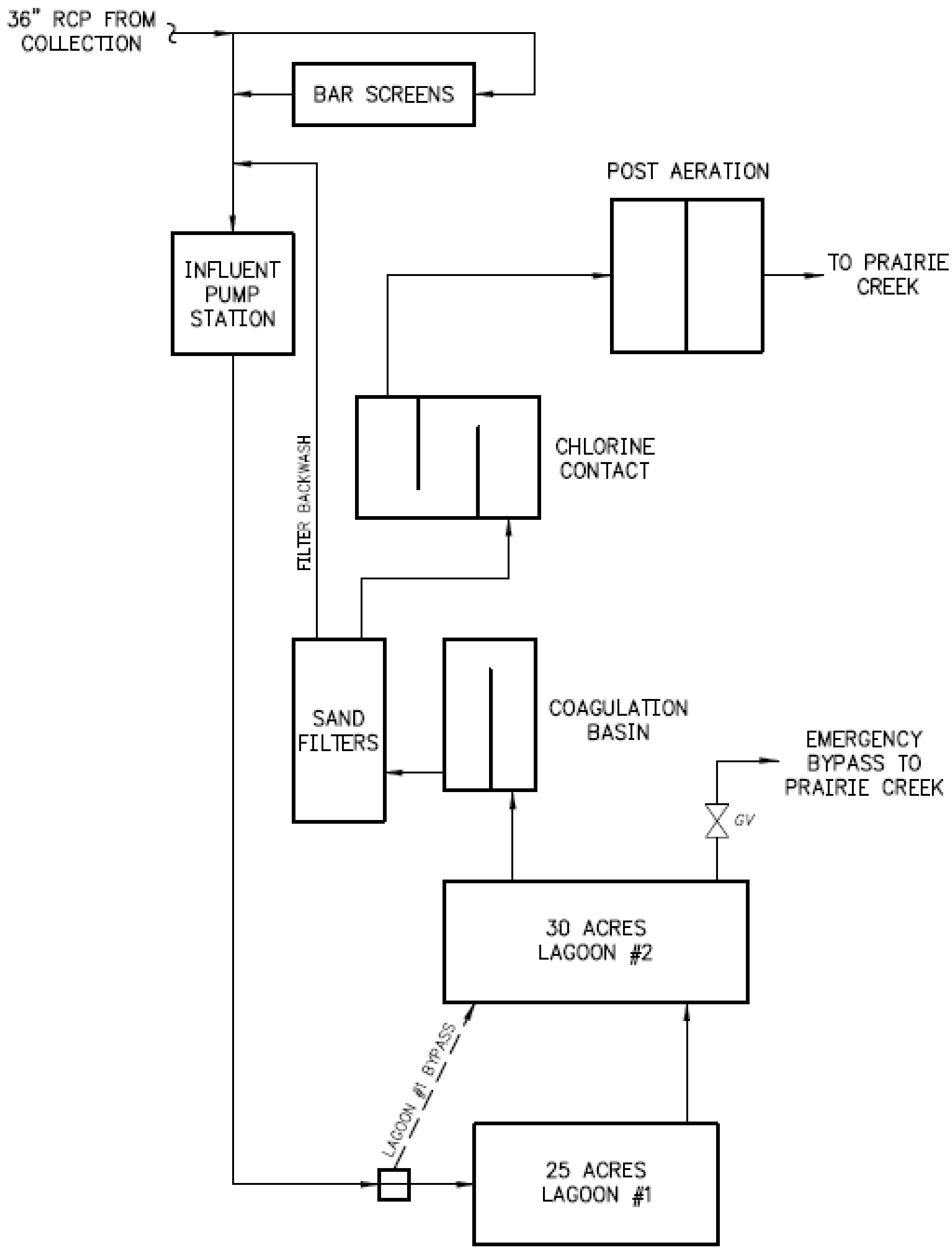


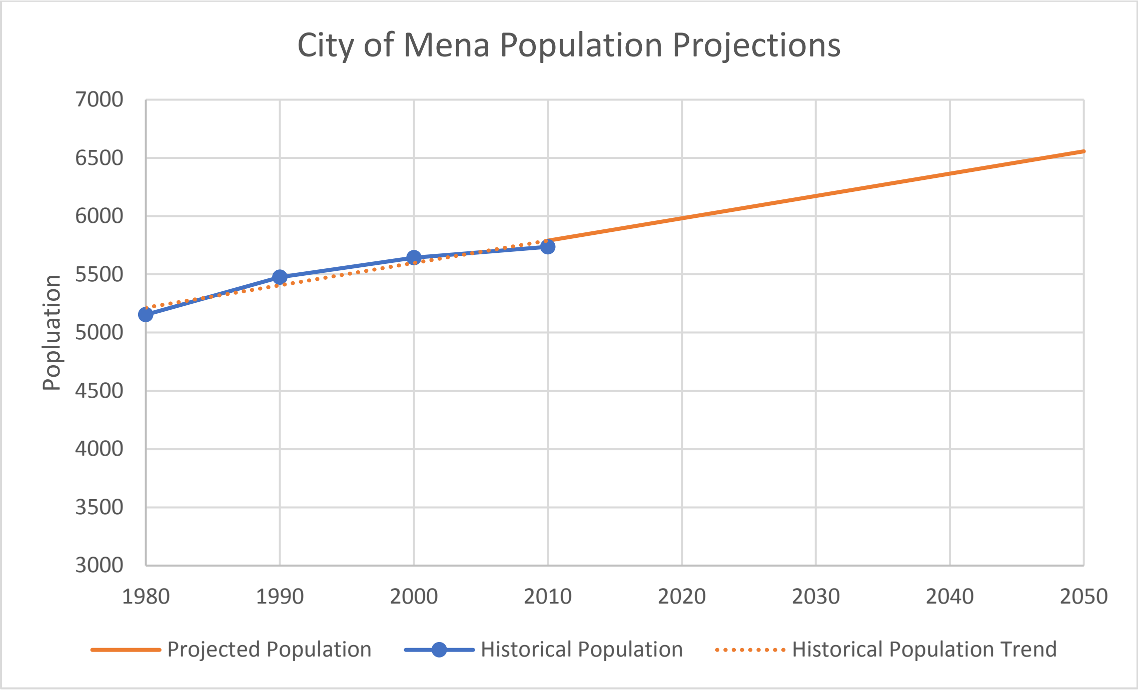
Exhibit A: Existing WWTP Process Flow Diagram

3.0 Long Range Wastewater Treatment Needs

3.1 Flow Projections

Based on demographic data obtained from the U.S. Census Bureau, the population of Mena has steadily increased since the 1980s[1]. For the purposes of this report, the population of Mena is estimated to grow linearly at a rate similar to population changes over the previous 50 years. This data is visualized in Figure 3-1. Using this data, the population in 2050 is estimated to be approximately 6,500 persons.

Figure 3-1: Population Projections for the City of Mena



This report evaluates the City's wastewater needs over the next 30 years and assumes that the current per capita per day flow rate and peaking factor will remain constant over the planning period. Therefore, the projected average dry weather flow rate is estimated to be 0.91 MGD with a minimum peak flow rate of 5.2 MGD.

3.2 Peak Flow Considerations

As discussed previously, the existing WWTP is limited by the capacity of the influent pump station, with excess flow backing up into the collection system for up to 10 days. For this reason, a peak flow rate of 9 MGD (peaking factor of approximately 10) was selected as the preliminary design basis to reduce the storage time within the collection system by 50%. These values were used as the design basis for all WWTP Improvement Alternatives discussed in Section 4. Prior to final design, flow rates should be measured within the collection system to establish a more accurate

[1] U.S. Census Bureau. (2019). Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkmk

measure of peak flow rates. These measurements will prevent oversize of the system and could potentially minimize the required capital investment.

3.3 Treatment Deficiencies

3.3.1 Peak Flow

As discussed within this report, the effluent flow rate of the WWTP is limited to 2.9 MGD while the influent flow rate can be up to 4.5 MGD with all pumps in operation. This leaves a large balance of flow to be stored within the existing lagoons prior to discharge. During periods of prolonged wet weather, the equalization storage volume within the lagoon system can become exhausted. Without active intervention the lagoons would overflow their levees, resulting in severe property damage and possibly a total loss of the Utility's wastewater treatment ability. Currently, the levees are protected utilizing the emergency bypass valve described previously. Plant staff operate the valve as necessary and record the total volume of water discharged and collect samples for submission to ADEQ.

3.3.2 TSS and Ammonia Removal

The existing Mena WWTP currently struggles to maintain compliance with Ammonia and TSS permit limits during peak flow events caused by excessive I&I. Peak flow rates can overload the existing sand filters and allow solids to be discharged with the effluent. Additionally, the lagoon system struggles to remove ammonia during colder months, as low temperatures interfere with the metabolism of nitrifying bacteria. Permit exceedances for ammonia are potentially exacerbated by the excessive volume of sludge within Lagoon No. 1. Volatilization of sludge can lead to the production of excess ammonia.

3.3.3 Copper

The Utility's WWTP NPDES Permit includes a limit for Total Recoverable Copper (Cu) of 10.5 ppb monthly average and 21 ppb 7-day average. Mena's WWTP was not designed to remove heavy metals such as copper. Any reduction achieved is likely due to algae uptake. Since alum, a necessary coagulant to aid filtration, is present in the filter backwash stream flowing to Lagoon No. 1, the pH in the lagoons is suppressed below the level where any significant precipitation of copper should be expected. The presence of ammonia in the lagoons would also inhibit copper precipitation. The Utility has recently observed increasing copper concentrations in the WWTP influent.

Copper removal within a wastewater treatment facility that primarily treats domestic wastewater is a very expensive process, both in terms of capital expenses and O&M costs. A more cost-effective solution to reduction of copper levels within the effluent is to identify the source of copper within the effluent stream and eliminate and/or restrict the discharge of soluble copper into the wastewater treatment plant. An alternative solution would be an evaluation of the effluent receiving stream to reevaluate the impact of copper and determine an updated discharge limit. For these reasons, none of the proceeding WWTP improvement alternatives consider copper removal within the preliminary design.

3.3.4 Disinfection

Chlorine disinfection is used to achieve compliance with the WWTP's fecal coliform permit limit. The WWTP is under an interim Total Residual Chlorine (TRC) limit of 0.1 mg/l until September 1, 2020. After that date, the TRC limit will be lowered to 0.011 mg/l. The existing Mena WWTP does not have a dechlorination system and will therefore not be able to meet the more stringent NPDES permit limit. Interim measures will be required to address the chlorine residual limit prior to construction of any potential plant improvements. The Utility is actively evaluating measures to achieve compliance with the pending TRC limit.

3.3.5 Lagoons

As discussed within Section 2.0, the current condition of the lagoon levees is largely unknown and is the subject of further evaluation. However, preliminary results from recent subsurface evaluations create cause for concern regarding the ability of the lagoon system to safely remain in service. Combined with the non-operational effluent valve and the accumulation of sludge in both lagoons, the remaining useful life of the lagoon system is in question.

3.4 Remaining Useful Life

Based on the information presented in the report, without significant repairs and/or modifications, the existing Mena WWTP has reached the end of its useful life. As the City's population continues to grow, the problem will only become amplified, leading to more frequent NPDES permit violations. It is recommended that the City begin evaluating options for addressing the repairs and/or modifications required to achieve consistent compliance and accommodate its future wastewater treatment needs. Section 4 presents three (3) alternatives that address the deficiencies identified within this report and by the CAO, with the exception of Copper removal.

4.0 WWTP Improvement Alternatives

4.1 Alternate Discharge Location

As a part of the evaluation of WWTP improvements, outfall locations on Prairie Creek and the Ouachita River were evaluated to potentially alleviate the Mena WWTP from its current NPDES copper discharge limits and provide more lenient limits for other constituents. Preliminary NPDES permit limits were provided by ADEQ for the purposes of this report and are presented in Table 4-1 and Table 4-2.

Table 4-1: Preliminary NPDES Permit Limits for Prairie Creek

Constituent	Monthly Average (mg/L, UNO)	7-Day Average (mg/L, UNO)
Biological Oxygen Demand ($CBOD_5$)		
(May – October)	10	15
(November – April)	15	22.5
Total Suspended Solids (TSS)		
(May – October)	15	22.5
(November – April)	20	30
Ammonia Nitrogen		
(April)	5	12.4
(May - October)	2.1	3.2
(November - March)	6	13.5
Dissolved Oxygen (DO)		
(May – October)	6.0 (inst. Min.)	
(November – April)	7.0 (inst. Min.)	
Fecal Coliform		
(May – October)	200 colonies/100 mL	400 colonies/100 mL
(November – April)	1000 colonies/100 mL	2000 colonies/100 mL
Total Phosphorus	Report	Report
Nitrate + Nitrite Nitrogen	Report	Report
Total Residual Chlorine	0.011 (inst. Max.)	
Total Recoverable Copper	10.6 µg/L	21.3 µg/L
Chronic WET Limits	Lethality Not < 99% Sub-lethality Not < 80%	

Table 4-2: Preliminary NPDES Permit Limits for the Ouachita River

Constituent	Monthly Average (mg/L, UNO)	7-Day Average (mg/L, UNO)
Biological Oxygen Demand ($CBOD_5$)		
(May – October)	10	15
(November – April)	20	30
Total Suspended Solids (TSS)		
(May – October)	15	22.5
(November – April)	20	30
Ammonia Nitrogen		
(April)	2.9	7
(May - October)	2.3	3.5
(November - March)	6.5	15
Dissolved Oxygen (DO)		
(May – October)	7.0 (inst. Min.)	
(November – April)	6.0 (inst. Min.)	
Fecal Coliform		
(May – October)	200 colonies/100 mL	400 colonies/100 mL
(November – April)	1000 colonies/100 mL	2000 colonies/100 mL
Total Phosphorus	Report	Report
Nitrate + Nitrite Nitrogen	Report	Report
Total Residual Chlorine	0.012 (inst. Max.)	
Total Recoverable Copper	11.5 µg/L	23.1 µg/L
Chronic WET Limits	Lethality Not < 91% Sub-lethality Not < 80%	

An analysis of the preliminary permit limits for alternate discharge locations quickly leads to the conclusion that little to no relief from the current NPDES permit limits is available. Although the preliminary limits included a caveat statement that it was uncertain if a Total Recoverable Copper Limit would be required, at this point it appears that little to no benefits would be gained from an investment in a new effluent pump station and force main. Therefore, an alternate discharge location is not recommended for any of the project alternatives at this time.

4.2 Alternative 1 - Modify Existing Wastewater Treatment Plant

Project Alternative No. 1 includes the repair and modification of the existing WWTP. This alternative proposes to remove sludge from Lagoon No. 1 and No. 2, increase the screening capacity of the headworks, construct a new tertiary filter system, and construct an alternate disinfection unit. The preliminary design for the treatment units will assume an average dry weather flow of 0.8 MGD and a peak wet weather flow rate of 9 MGD. The effluent capacity of the plant will remain 3.1 MGD to minimize capital costs, with the balance of flow stored within the treatment lagoons.

4.2.1 Description and Preliminary Design

4.2.1.1 Headworks

Alternative 1 includes installation of two (2) additional 3 MGD mechanically raked bar screens to increase the screening capacity to 9 MGD. A bypass channel will be installed adjacent to the screen structure with a manually raked coarse screen. The bypass channel will eliminate the need for the WWTP staff to manually bypass the bar screen during wet weather events in which one or more screens are out of service for maintenance or become blinded. The manually raked screen within the bypass channel will remove solids from 100% of the influent flow.

4.2.1.2 Influent Pump Station

This project alternative includes construction of a secondary wet weather pump station with a capacity of 4.5 MGD to increase the total pumping capacity of the WWTP to 9 MGD. During normal dry weather flow rates, screened wastewater will enter the existing influent pump station and be transferred into Lagoon No. 1. During periods of peak flow, a portion of the incoming flow would be diverted into the wet weather pump station and transferred into Lagoon No. 1.

4.2.1.3 Aerated Lagoons

As discussed in Section 2.3.3, excessive sludge is present in both Lagoon No. 1 and No. 2. This alternative proposes to remove approximately 225,000 cubic yards of sludge from the lagoons. This sludge would be pumped out of the lagoons, screened for solids, and dried onsite prior to land application. Sludge removal would regain approximately 30 MG of volume in Lagoon No. 1 and 15 MG within Lagoon No. 2. In addition to the sludge removal, additional site piping and valves would be installed to allow both Lagoon No. 1 and No. 2 to be removed from service for maintenance and cleaning as required. Preliminary calculations indicate that the existing aeration system is expected to be adequate to provide the necessary dissolved oxygen to remove BOD to within permit limits.

This alternative proposes to utilize the additional lagoon volume acquired via sludge removal as in-line equalization storage to limit the capacity requirements of the new tertiary filter system. A new outlet structure would be installed within Lagoon No. 2 to allow plant staff to more accurately control the water level. As a result of the continuously changing water elevation, the inside banks of Lagoon No. 2 would be lined with geotextile fabric and rip rap to eliminate ongoing lagoon side slope maintenance.

The results of the levee analysis, discussed within Section 2.0, will be of important consequence to this project alternative. Depending on the level of remediation required, levee repairs can be expensive and not cost effective. It is vital that the current condition of the existing WWTP lagoons be understood prior to selecting a project alternative. A preliminary cost estimate for assumed remediation of Lagoon No. 1 and No. 2's levees is included within the cost estimate presented in Section 4.2.3. However, it is important to note that this cost assumes the levees can be cost effectively repaired at the specific locations were excess moisture was noted. Costs for the complete rehabilitation of the levees are not included with this cost estimate as the extent of rehabilitation required is unknown at this time.

4.2.1.4 Tertiary Filtration

Alternative 1 proposes to install a new attached growth polishing filter following Lagoon No. 2. The new filter would benefit the Mena WWTP in several ways. First, the filter would allow for nitrification of the lagoon wastewater throughout the year, eliminating the issues with ammonia removal during cold weather. The new filter system would also remove additional BOD and TSS to create a high-quality effluent. In addition to the increased effluent quality, the continuous stream of alum-laden sludge would be eliminated prolonging the life of the lagoon system.

4.2.1.5 Disinfection

The existing WWTP utilizes gaseous chlorine stored in a one-ton cylinder for effluent disinfection. As discussed within this report previously, the most recent NPDES permit for the City of Mena included a TRC effluent limit of 0.011 mg/L which will require a form of dechlorination to achieve. Although this can be accomplished using addition of sodium thiosulphate or sulfur dioxide, these systems require additional chemical storage, injection, and containment equipment.

This alternative proposes to install an alternate disinfectant such as a Peracetic Acid chemical feed system or ultraviolet light system to replace the existing chlorine feed. Peracetic Acid is an emerging disinfectant that is used in lieu of traditional chlorine gas or sodium hypochlorite systems. The chemical produces no known harmful byproducts and does not currently require quenching prior to discharge into bodies of water. Similarly, ultraviolet light systems do not require quenching and have the added benefit of providing disinfection with very little contact time.

4.2.2 Process Layout

Exhibit B presents a preliminary process flow diagram for Project Alternative No. 1.

4.2.3 Preliminary Cost Estimate

Table 4-3 shows a summary of the estimated total project costs associated with Project Alternative No. 1. This estimate was prepared utilizing a 20% contingency and cost provisions for Contractor's overhead and profit, engineering services, administrative and legal expenses, and construction administration and inspection.

Table 4-3: Project Alternative No. 1 Preliminary Cost Estimate

Project Alternative No. 1	
Sludge Removal & Disposal	$6,750,000.00
Treatment Plant Improvements	$7,100,000.00
Total Estimated Project Cost	$13,850,000.00

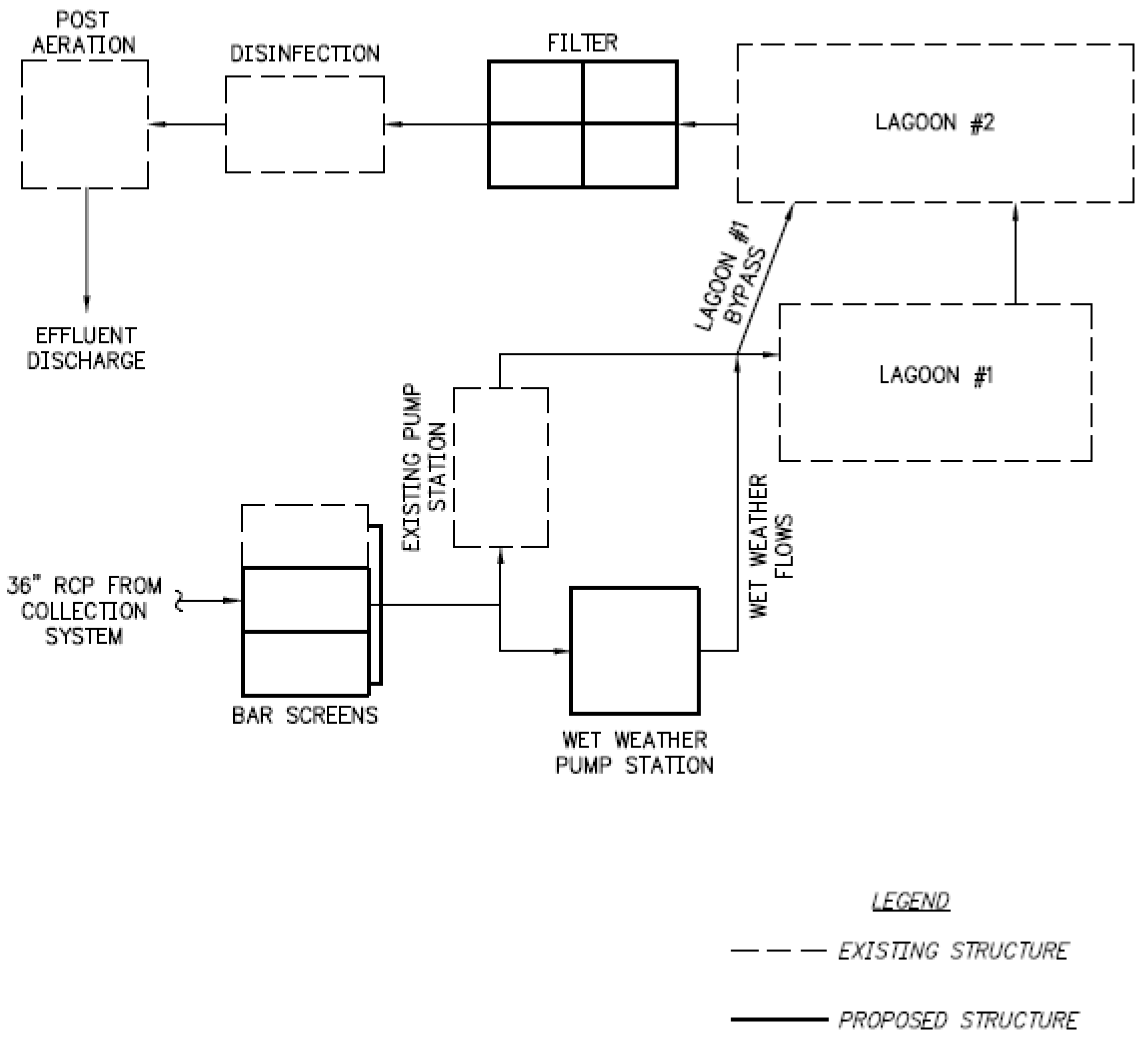


Exhibit B: Alternative No. 1 Process Flow Diagram

4.3 Alternative 2 - Construct New Wastewater Treatment Plant at Existing Site

Project Alternative No. 2 includes the construction of a new activated sludge treatment plant at the site of the existing WWTP. This alternative proposes to construct a sludge treatment cell within Lagoon No. 1, construct equalization (EQ) storage within Lagoon No. 2, increase the screening capacity of the headworks, and construct an alternate disinfection unit. Additionally, the existing gravity sand filters, coagulation basin, and chlorine disinfection equipment would be demolished as a part of this project alternative.

The preliminary design for the treatment units will assume an average dry weather flow of 0.8 MGD and a peak wet weather flow rate of 9 MGD. The effluent capacity of the plant will range between 2.6 – 5.2 MGD to minimize capital costs, with the balance of flow stored within the EQ lagoon.

4.3.1 Description and Preliminary Design

4.3.1.1 Headworks

Similar to Alternative No. 1, Alternative No. 2 includes installation of two (2) additional bar screens as well as a bypass channel.

4.3.1.2 Influent Pump Station

This project alternative includes construction of a new influent pump station with a capacity of 4.5 MGD to increase the total pumping capacity of the WWTP to 9 MGD. During normal dry weather flow rates, screened wastewater would flow to the new influent pump station and be transferred into an activated sludge treatment unit. The existing influent pump station would remain and serve as a wet weather pump station. During periods of peak flow, a portion of the incoming flow would be diverted into the wet weather pump station and transferred into Lagoon No. 2 for temporary storage until it can be treated by the activated sludge treatment unit.

4.3.1.3 Activated Sludge Wastewater Treatment Plant

Alternative No. 2 proposes to construct a new activated sludge treatment plant at the existing WWTP site. The treatment unit would be constructed on adjacent property acquired by the City of Mena. The activated sludge treatment process is designed for BOD, TSS, and ammonia removal within the Utility's current NPDES permit limits at both average dry weather and peak flow rates. The preliminary design is sized for an average dry weather flow of 0.8 MGD and a peak flow of 2.56 MGD (peaking factor of 3.2). The excess flow would be diverted into the new equalization storage basin and pretreated. As peak flows subside the wastewater would return to the activated sludge treatment train. Sludge produced from the activated sludge system would be pumped into the new sludge treatment unit. Sludge would be removed from the treatment unit, dewatered, tested, and disposed of on a periodic basis.

To prepare the City of Mena for expected population growth, two larger variations of the activated sludge WWTP were analyzed, a base flow of 1.25 and 1.5 MGD. The costs for these larger treatment units are presented along with the base alternative in Section 4.3.3.

4.3.1.4 Equalization Storage

This alternative includes conversion of the existing Lagoon No. 2 into an equalization storage basin. As discussed previously, the existing Lagoon has a current usable volume of approximately 50 MG. With a peak influent capacity of 9 MGD and peak effluent capacity of 2.56 MGD, the new equalization storage would provide approximately 8 days of storage during peak flow events. Wastewater diverted to the equalization storage basin would be pretreated via the existing aeration system to prevent the wastewater from turning anaerobic and interfering with the activated sludge treatment process. A new staged outlet structure would be constructed within Lagoon No. 2 to facilitate the transition into an equalization basin.

As discussed within Project Alternative No. 1, the condition of the existing lagoon levees is vital to the cost effectiveness of this alternative. Remediation measures could add considerable expense to the WWTP improvements. A preliminary cost estimate for potential remediation measures is included within Section 4.3.2, however this estimate is preliminary and will be updated after the levee analysis is completed. It is not recommended that the City of Mena proceed with any project alternatives until the levee analysis is completed.

4.3.1.5 Tertiary Filtration and Parallel Treatment

In lieu of the previously discussed equalization storage, a polishing filter could be installed after the activated sludge treatment unit to be used for effluent polishing and wet weather flow treatment. This potential aspect of Project Alternative No. 2 is discussed in more detail in Section 4.4.1.5.

4.3.1.6 Solids Handling

This alternative proposes to convert the existing Lagoon No. 1 into an aerobic sludge digester. WAS from the primary treatment unit would be pumped into the sludge digester where the water content would be decreased. The existing aeration system would be utilized to aerobically digest the sludge to increase the sludge quality for future land application or disposal at a landfill.

4.3.1.7 Disinfection

Similar to Alternative No. 1, this project alternative proposes to replace gaseous chlorine with an alternate disinfection system.

4.3.2 Process Layout

Exhibit C presents a preliminary process flow diagram for Project Alternative No. 2.

4.3.3 Preliminary Cost Estimate

Table 4-4 shows a summary of the estimated total project costs associated with Project Alternative No. 2. This estimate was prepared utilizing a 20% contingency and cost provisions for Contractor's overhead and profit, engineering services, administrative and legal expenses, and construction administration and inspection.

Table 4-4: Project Alternative No. 2 Preliminary Cost Estimate

Project Alternative No. 2	
Total Estimated Project Cost	$8,500,000.00
Additional Items (Cost Increase)	
WWTP (1.25 MGD)	$1,300,000.00
WWTP (1.5 MGD)	$2,200,000.00
Tertiary Filter System	$1,200,000.00

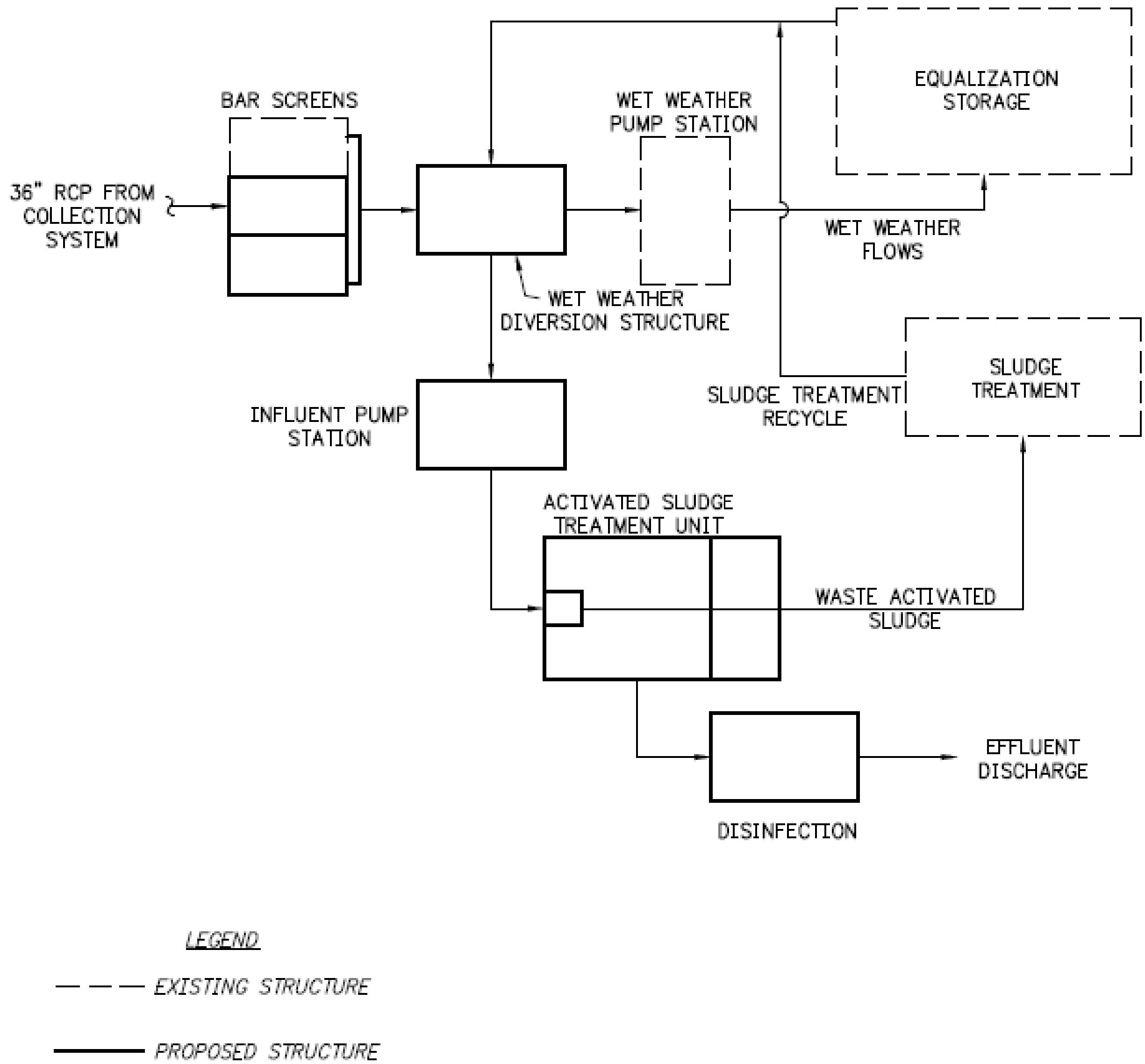


Exhibit C: Alternative No. 2 Process Flow Diagram

4.4 Alternative 3 - Construct New Wastewater Treatment Plant at Alternate Site

4.4.1 Description and Preliminary Design

Project Alternative No. 3 includes the construction of a new activated sludge treatment plant at an alternate site. Additionally, this alternative proposes to abandon Lagoon No. 1 and No. 2, increase the screening capacity of the headworks, construct a solids handling facility, construct a tertiary filtration system that would be utilized for effluent polishing and wet weather treatment, and construct a new alternate disinfection unit. In addition to the abandonment of Lagoon No. 1 and 2, the existing WWTP building, gravity sand filters, coagulation basin, chlorine contact chamber, and post-aeration basin will be abandoned as a part of this project alternative.

The preliminary design for the treatment units assumes an average dry weather flow of 0.8 MGD and a peak wet weather flow rate of 9 MGD. The effluent capacity of the plant would range between 2.6 – 5.2 MGD to minimize capital costs, with the balance of flow treated by the parallel treatment unit.

4.4.1.1 Location

This Alternative proposes to construct a new WWTP at a new site inside the Mena City Limits. For the purposes of this report, a 20-acre property owned by the City of Mena was assumed to be the location of the new WWTP. However, it is recommended that a site selection study be performed prior to design if this alternative is selected.

4.4.1.2 Influent Pump Station

In general, the City of Mena's sanitary sewer collection system flows by gravity to the existing WWTP site via two main interceptor lines that feed into a combined interceptor on the east side of town. This project alternative proposes to reroute a portion of the existing gravity collection system to the new WWTP site. The remainder of the flow is proposed to be routed to a new pump station at the existing WWTP site.

A preliminary analysis of the collection system indicates that approximately one (1) mile of 18-inch interceptor could be eliminated from the collection system with this project alternative. Based on a conservative estimate of I&I within the City's collection system, this section could eliminate up to 105,000 gpd of excess flow during wet weather events. In all likelihood, additional I&I could be eliminated via this project alternative, however a more detailed study would be required.

4.4.1.3 Lagoon No. 1 and No. 2 Abandonment

Lagoon No. 1 and No. 2 would be abandoned as a part of this alternative. The existing inlet pipes and outlet structures would be plugged. The existing aeration system would be utilized to aerobically digest the existing sludge. After digestion, both lagoons would transition into a large sludge drying beds. As the sludge reaches an appropriate solids concentration the sludge can be windrowed for further thickening then land applied or transported to a landfill. This process could occur in situ and would not require large land areas to dewater the sludge.

An alternative to the abandonment of Lagoon No. 2 could be to utilize the lagoon as a side stream EQ storage basin. This option would utilize the storage volume within the lagoon to store excess wastewater during peak wet weather events. EQ storage could be utilized to reduce the amount of parallel flow blending and pumping capacity required for wet weather events.

4.4.1.4 Wastewater Treatment Plant

Alternative No. 3 proposes to construct a new activated sludge treatment plant at an alternate site. The treatment unit would be constructed on property either acquired by the City of Mena or property that is already owned by the City. The activated sludge treatment process would be designed for BOD, TSS, and ammonia removal within the Utility's current NPDES permit limits at both average dry weather and peak flow rates. The preliminary design is sized for an average dry weather flow of 0.8 MGD and a peak flow of 2.56 MGD (peaking factor of 3.2). The excess flow would be diverted around the secondary treatment and into the new polishing filter. As peak flows subside the wastewater would return to the activated sludge treatment train. Sludge produced from the activated sludge system would be pumped into the new solids handling facility. Similar to Project Alternative No. 2, this alternative included analysis of two larger variations of the activated sludge WWTP.

4.4.1.5 Tertiary Filtration and Parallel Treatment

In lieu of EQ storage as provided in Project Alternative No. 2, Project Alternative No. 3 proposes to the install a polishing filter after the activated sludge treatment unit. The polishing filter would remove additional TSS and BOD prior to disinfection and discharge. During wet weather flows an alternate treatment path would be utilized to maintain compliance with NPDES permit limits. A portion of the wet weather influent would be diverted around the activated sludge treatment unit and into the tertiary filtration system directly. The balance of the wet weather influent would flow through the activated sludge treatment unit and blend with effluent from the tertiary filter prior to disinfection. This unit eliminates the need for large volumes of equalization storage and provides a higher quality effluent.

4.4.1.6 Solids Handling

Project Alternative No. 3 proposes to construct and install a dedicated solids handling system at the new WWTP site. The solids handling system would receive WAS from the main treatment unit and dewater the sludge until a desirable solids concentration is achieved. From this point, the solids can either be land applied or transported to a landfill for disposal. To limit the presence of objectionable odors, the solids-handling system would be installed indoors.

4.4.1.7 Disinfection

This project alternative proposes to construct a new disinfection system at the new WWTP site. It is recommended that both Peracetic Acid and UV disinfection be considered during the detailed design phase of this alternative.

4.4.1.8 Treatment Building

This alternative proposes to construct a new treatment building at the new WWTP site. This building would house the lab facilities, disinfection feed system, and the solids-handling system. In addition to a new treatment building, an asphalt driveway, concrete sidewalks, and a concrete parking lot would be constructed for the treatment building and surrounding process units.

4.4.1.9 Discharge Location

Alternative No. 3 proposes to discharge treated and disinfected effluent into nearby Ward Creek, which flows eastward into Prairie Creek and thence into the Ouachita River. The preliminary design assumes that the WWTP effluent would be able to drain by gravity, eliminating the need for an effluent pump station. Preliminary NPDES permit limits were provided by ADEQ for the purposes of this report and are presented in Table 4-5.

Table 4-5: Preliminary NPDES Permit Limits for Ward Creek

Constituent	Monthly Average (mg/L, UNO)	7-Day Average (mg/L, UNO)
Biological Oxygen Demand ($CBOD_5$)		
(May – October)	10	15
(November – April)	15	22.5
Total Suspended Solids (TSS)		
(May – October)	15	22.5
(November – April)	20	30
Ammonia Nitrogen		
(April)	4.9	12
(May)	3	4.5
(June - October)	2.1	4.5
(November - March)	5.9	12
Dissolved Oxygen (DO)		
(May – October)	6.0 (inst. Min.)	
(November – April)	7.0 (inst. Min.)	
Fecal Coliform	1000 colonies/100 mL	2000 colonies/100 mL
Total Phosphorus	Report	Report
Nitrate + Nitrite Nitrogen	Report	Report
Total Residual Chlorine	0.011 (inst. Max.)	
Total Recoverable Copper	10.5 μg/L	21 μg/L
Chronic WET Limits	Lethality Not < 100% Sub-lethality Not < 80%	

The preliminary NPDES permit limits for Ward Creek are very similar to the Mena WWTP's current permit limits for a tributary of Prairie Creek. The information provided by ADEQ included caveat statements that the Total Recoverable Copper and Chronic WET Limits were estimates and could not be considered final without a detailed study. Additionally, the preliminary limits included report requirements for Total Phosphorus and Nitrate + Nitrite Nitrogen. Report requirements are typically issued prior to NPDES permit limits. Therefore, the design of new wastewater treatment plant should include provisions for future nitrogen and phosphorus removal.

4.4.2 Process Layout

Exhibit D presents a preliminary process flow diagram for Project Alternative No. 3.

4.4.3 Preliminary Cost Estimate

Table 4-6 presents a summary of the estimated project costs associated with Project Alternative No. 3. This estimate was prepared utilizing a 20% contingency and cost provisions for Contractor's overhead and profit, engineering services, administrative and legal expenses, and construction administration and inspection.

Table 4-6: Project Alternative No. 3 Preliminary Cost Estimate

Project Alternative No. 3	
Total Estimated Project Cost	$10,750,000.00
Additional Items	
WWTP (1.25 MGD)	$1,600,000.00
WWTP (1.5 MGD)	$2,500,000.00

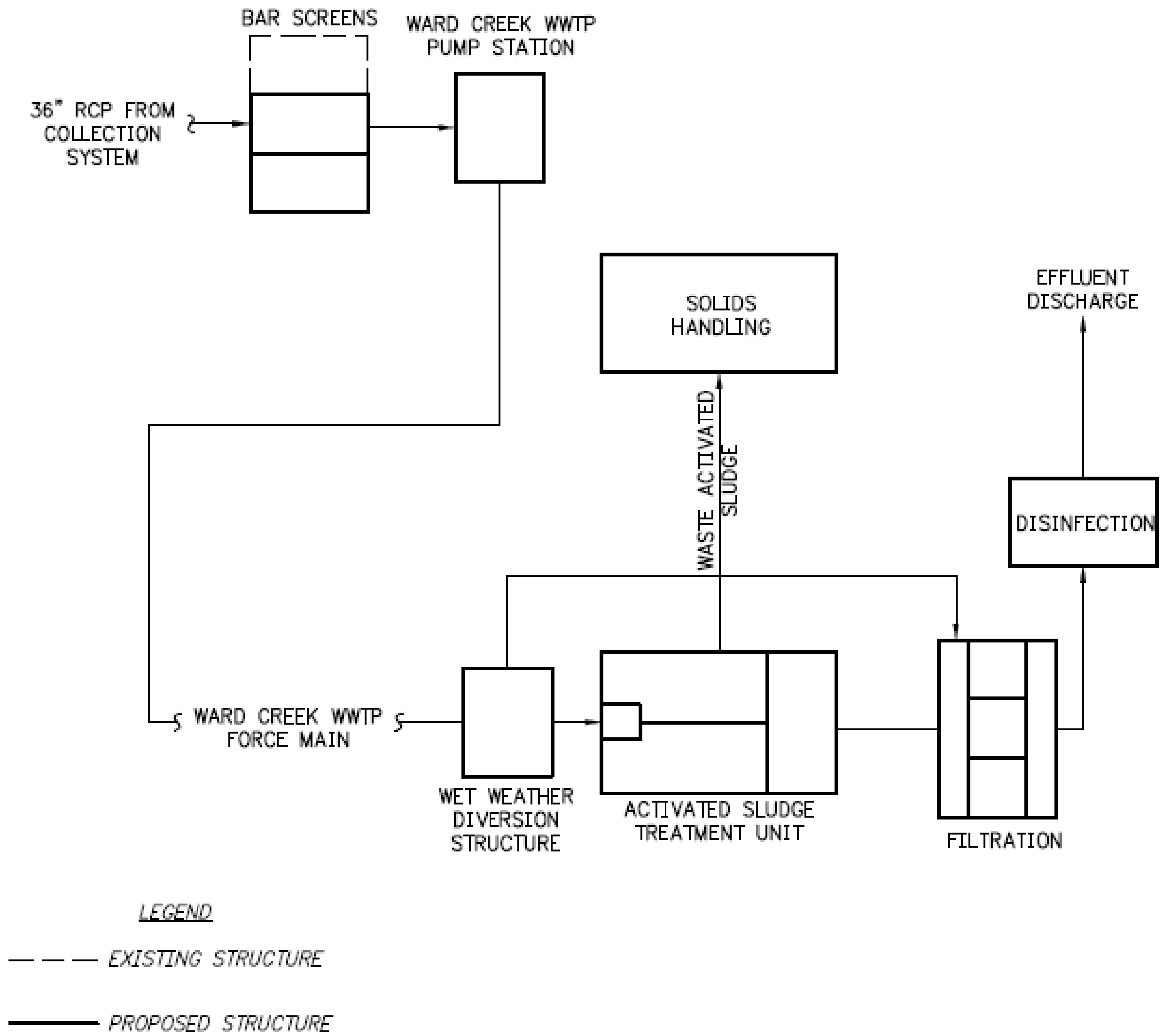


Exhibit D: Alternative No. 3 Process Flow Diagram

4.5 Present Worth Analysis

A present worth analysis was performed on Project Alternatives No. 2 and No. 3 to compare present and future O&M costs. As the most expensive and least effective option, Project Alternative No. 1 was excluded from this analysis. For the purposes of this evaluation, the analysis included a select group of costs and is therefore not exhaustive. Electricity costs for equipment present within both systems were excluded as the difference is expected to be negligible. The present worth analysis serves to accurately express O&M expenses within the total project cost in an effort to improve this report's role as a decision tool for the City of Mena.

The present worth analysis is based on a 30-year planning period and utilizes the Discount Rates as reported in the Office of Management and Budget's (OMB) Circular A-94 Appendix C, Revised February 2018. This document reports a real discount rate of 0.6% which represents the discount rate which the OMB has adjusted to eliminate the effect of expected inflation. An electricity cost of $ 0.12 per kilowatt-hr (kWh) was utilized. Additionally, the expected O&M cost was assumed to be approximately 1% of the total construction cost. This was based on two (2) activated sludge treatment plants within western Arkansas that indicated their annual O&M expenses were approximately 0.7% to 1.5% of the total construction cost. The present worth analysis is presented in Table 4-7.

Table 4-7: Present Worth Analysis

Item	Alternative No. 2	Alternative No. 3
Electricity Costs	$ 21,000	$ 42,000
Operation and Maintenance	$ 85,000	$ 107,000
Total Yearly Expenses	$ 106,000	$ 149,000
30 Year Present Value	$ 2,900,000	$ 4,080,000
Total Project Cost	$ 11,400,000	$ 14,830,000

4.6 Recommendation

Without significant modifications to the existing WWTP infrastructure, NPDES permit violations for ammonia and other constituents will continue. Additionally, the existing lagoon system with or without process modifications will not be able to cost effectively achieve permit limits for total nitrogen or total phosphorus. Preliminary results from recent subsurface investigations of the existing levees create cause for concern regarding the long-term viability of the lagoons. Therefore, HW recommends that the City of Mena proceed with the replacement of the existing WWTP with a modern activated sludge treatment system at an alternate site as described in Project Alternative No. 3. The improvements implemented within this project alternative are summarized in Table 4-8.

Table 4-8: Project Alternative No. 2 Design Summary

Treatment Unit	Project Alternative No. 2 Design	Design Treatment/Storage Capacity
Headworks	Expand screening capacity	9 MGD
Influent Pump Station	Construct new influent pump station to transfer flow from the gravity collection system to the new WWTP	9 MGD
Lagoon No. 1	Abandon	NA
Lagoon No. 2	Abandon	NA
Sand Filters	Abandon and Demolish	NA
Coagulation Basin	Abandon and Demolish	NA
Activated Sludge Treatment Unit	New Construction	2.6 – 5.2 MGD
Tertiary Filtration Unit	New Construction	6.5 MGD
Disinfection	New alternate disinfection system	9 MGD

Project Alternative No. 2 addresses all of the compliance issues noted as deficient in the CAO as well as the treatment deficiencies discussed within this report while requiring a capital expense of approximately $2 million less than Project Alternative No. 3. However, preliminary results from the recent levee analysis lead HW to believe that the lagoons could no longer be viable for the treatment of wastewater. Although the lagoon levee analysis has not been completed, for budgetary purposes it is recommended that the City of Mena plan for the construction of a new WWTP at a new site as described above.

Project Alternative No. 3 provides additional benefits beyond those of Alternative No. 2 that are not captured within the cost analysis included within this report. The diversion of a portion of the influent wastewater from the main gravity interceptors could immediately reduce I&I into the collection system, thereby reducing the total volume of water to be treated and potentially reducing the size and total cost of the equipment to be included in Project Alternative No. 3. The tertiary filtration unit included with Project Alternative No. 3 will also produce a higher quality effluent, allowing the City of Mena to meet stricter NPDES permit limits. Additionally, with the parallel treatment and effluent blending included as part of Alternative No. 3, the WWTP will have the ability to treat an increased wastewater flow rate and eliminate the need to rely on storage within the collection system.

5.0 Wastewater Rates

5.1 Current Wastewater Rates

Table 5-1 shows the City of Mena's current sewer rate structure effective as of 2019. Mena averages approximately 2,700 sewer customers: 2,645 within the city limits, 55 outside the city limits, and 1 large industrial user.

Table 5-1: City of Mena Wastewater Rate Structure

Sewer (Inside City Limits)	
Minimum Bill (for first 1,000 gallons)	$ 8.97
Additional Sewage (at 100-gallon increments)	$ 3.77 per 1,000 gallons
Sewer (Outside City Limits)	
Minimum Bill (for first 1,000 gallons)	$ 12.22
Additional Sewage (at 100-gallon increments)	$ 4.22 per 1,000 gallons
Sewer (Large Industrial User)	
Minimum Bill (for first 1,000 gallons)	$ 8.97
Additional Sewage (at 100-gallon increments)	$ 3.77 per 1,000 gallons

Based upon an average usage of 4,000 gallons per month, the average sewer bill for customers within the city limits is $20.28 and $24.88 for customers outside the city limits. The lone industrial discharger, Nidec Motor Corporation, discharges approximately 14,000 gpd or 420,000 gallons per month into the sanitary sewer system. Based upon this average discharge, the average bill for industrial dischargers is $1,590.

5.2 Historical Wastewater Expenses

The City of Mena provided revenues and expenses of the wastewater system for the previous three (3) years. This information is presented in Table 5-2.

Table 5-2: Historical Wastewater Revenue and Expenses (2016-2018)

	2016	2017	2018
Average Customer Count	2,698	2,704	2,695
Expenses	$ 783,976	$ 857,842	$ 829,357
Revenue	$ 725,352	$ 727,480	$ 708,700
Net Wastewater Income	$ (58,624)	$ (130,362)	$ (120,657)

5.3 Wastewater Rate Analysis

The Arkansas Natural Resources Commission (ANRC) publishes a survey of Arkansas City Public Sewer System (CPSS) Retail Sewer Rates. The March 2019 survey includes 440 residential sewer rate structures across Arkansas and their relative rankings based on number of customers, wastewater treatment capacity, and other criteria. As noted previously, the design capacity of the Mena WWTP is 3.1 MGD which places the facility within the 91st percentile of treatment plants within Arkansas. Additionally, the service population of 2,700 customers places Mena within the 86th percentile of service populations within the state. However, the average sewer bill at 4,000 gallons per month is comparable to systems having approximately 300 customers and a plant capacity of 170,000 gpd (44th percentile). An average sewer bill for public utilities of similar size to Mena ranges from $35.31 – $38.52. Based on this data, Mena's wastewater service rates are significantly lower than the average rate for systems of comparable size.

6.0 Project Funding Options

6.1 Loan Funding

The Arkansas Water/Wastewater Advisory Committee (AWWAC) administers loans and grant funds from USDA Rural Development (RD), the Arkansas Natural Resources Commission (ANRC), and the Arkansas Economic Development Commission (AEDC). These loan funds can be used for treatment plants, distribution lines, collection lines, water and/or sewer service extensions, storage tanks, and water source development. The AWWAC reviews loan funding applications prior to submission to the selected commission or agency and makes a recommendation to the applicant on which funding sources to pursue. Submission to AWWAC requires a preliminary engineering report, funding pre-application, and an environmental impact assessment of the project in question.

6.1.1 USDA Rural Development

USDA Rural Development administers a Water & Waste Disposal Loan & Grant Program in Arkansas. Loan funds are available depending on income level, and all loans are payable over a 40-year period. Interest rates and eligibility are based on the applicant's median household (MHI) level compared to percentages of the State Non-Metropolitan Median Household Income (SNMHI)[2]. For Arkansas, the current SNMHI is $48,200. If the applicant is not eligible for either the intermediate or poverty rates, then the market interest rate applies. These three (3) MHI levels and associated loan interest rates and potential grant funding percentages are described in Table 6-1.

Table 6-1: USDA Rural Development Loan and Grant Eligibility Requirements

Classification	MHI Range	Grant	Loan Interest Rate
Market	MHI ≥ $48,200	0%	4.25%
Intermediate	$38,560 ≤ MHI < $48,200	Up to 45%	3.375%
Poverty	MHI < $38,599	Up to 75%	2.5%

MHI levels are based on the 2006-2010 American Community Survey (ACS) 5-Year Estimate as available through the U.S. Census Bureau. The City of Mena has an MHI of $27,837, minimally qualifying the city for the Poverty interest rate and up to 75% grant funding[3]. It is important to note that USDA RD requires initial loan payments be calculated assuming no grant funding. During the review process, USDA RD will determine the grant percentage for the applicant.

6.1.2 ANRC Loan Funding

ANRC currently administers three (3) Federal and three (3) State programs that provide financial assistance through loans and grants for water and wastewater projects. Loans are available over

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[2] *Statewide nonmetropolitan median household income* refers to the median household income of the State's nonmetropolitan counties and portions of metropolitan counties outside of cities, towns, or places of 50,000 or more population.

[3] U.S. Census Bureau. (2019). *Selected Economic Characteristics 2013-2017 American Community Survey 5-Year Estimates.* Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkmk

a variety of different repayment periods. A summary of the available interest rates and loan terms is presented in Table 6-2.

Table 6-2: ANRC Loan Interest Rates

Term	State Interest Rates	Federal Interest Rates
10 years	2.75%	1.50%
20 years	3.90%	2.50%
30 years	4.25%	3.0%

6.1.3 AEDC Community Development Block Grant

The AEDC administers a Community Development Block Grant (CDBG) Program through the United States Department of Housing and Urban Development (HUD) to provide funding for projects related to economic development including public infrastructure. These grant funds are available to projects demonstrating a benefit to low- and moderate-income (LMI) persons. HUD describes this as projects whose benefited communities contain a population of at least 51% LMI persons. As of 2014, the City of Mena has an LMI percentage of 52%, qualifying the city for the CDBG Program[4].

6.2 Municipal Bond Funding

An alternate source for project funding is Municipal Bonds. These are tax-exempt bonds issued at relatively low interest rates for public entities without reoccurring income, such as municipalities. Bonding agencies provide capital for projects for a lending fee, which includes service fees and interest. The current market rate for Municipal Bonds is approximately 3.0%. Bonds can be issued through many different agencies or banks and are the most time effective source of project funding discussed within this section.

6.3 Project Funding

This report assumes that project funding will be through USDA Rural Development's Water & Wastewater Disposal Loan & Grant Program as described previously. Table 6-3 presents a summary of the funding details for the Proposed Project.

Table 6-3: Proposed Project Funding Details

Proposed Project Funding Details	
Project Amount	$10,750,000.00
Annual Interest Rate (Poverty Assumed)	2.5%
Number of Payments	480
Monthly Payment	$35,450.00
Annual Payment	$425,400.00

[4] Arkansas Economic Development Commission. (2019). *Community Development Block Grant.* Retrieved from https://www.arkansasedc.com/community-resources/community-development-block-grant.

6.4 Wastewater Rate Adjustment

It is assumed that the City of Mena will increase sewer rates in order to fund the loan-portion of the selected wastewater improvements. The existing wastewater rate structure has historically been insufficient to cover the operating expenses of the wastewater treatment and collection system. A sample rate adjustment is presented in Table 6-4. The operating expenses for the sewer department were assumed to be $850,000 based on the historical expenses presented in Table 5-2.

Table 6-4: Sample Rate Increase

Sewer (Inside City Limits)	
Minimum Bill (for first 1,000 gallons)	$ 18.00
Additional Sewage (per 1,000 gallons)	$ 6.75
Average Monthly Bill	$ 38.25
Rate Increase	89%
Sewer (Outside City Limits)	
Minimum Bill (for first 1,000 gallons)	$ 21.00
Additional Sewage (per 1,000 gallons)	$ 8.00
Average Monthly Bill	$ 45.00
Rate Increase	81%

The rate adjustment proposed in Table 6-4 would create a yearly revenue of approximately $1,300,000 dollars which would be sufficient to cover the existing operating expenses as well as the required monthly loan payments. The proposed city limit rate of $38.25 for 4,000 gallons of sewer is within the range of expected sewer rates of utilities of a similar size to Mena. As discussed previously, USDA RD requires initial loan payments be calculated assuming that no grant funding is awarded. It is likely that the City of Mena will qualify for some grant funding, therefore a more detailed wastewater rate study is recommended prior to rate increases when the actual loan payment is calculated.

7.0 Conclusions and Recommendations

The City of Mena's existing WWTP requires repairs and process modifications to consistently comply with NPDES permit requirements and meet the City's future wastewater needs. Without capital improvements and process modifications, permit exceedances will continue indefinitely. Additionally, the City will be unable to comply with future permit limits for nutrient removal.

This report analyzed three (3) project alternatives to modify and/or replace the existing WWTP. Project Alternative No. 2, the construction of a new WWTP at the existing site, had the lowest total project cost based on the documented assumptions. However, the viability of Alternative No. 2 is highly dependent on the condition of the existing lagoon levees. Since preliminary results from the recent subsurface investigations bring into question the long-term viability of the existing levees, it is not recommended that the City of Mena budget for Alternative No. 2 at this time. To achieve consistent compliance with permit requirements and to ensure long-term reliable wastewater service is provided for the City of Mena, HW recommends that the City moves forward with the planning and implementation of Project Alternative No. 3. This recommendation will be reaffirmed following the final results and recommendations of the ongoing lagoon levee analysis.

7.1 Project Milestone Schedule

A.	WASTEWATER TREATMENT MASTER PLAN	SEPTEMBER 1, 2019
B.	LEVEE ANALYSIS	SEPTEMBER 1, 2019
C.	SUBMISSION TO AWWAC	NOVEMBER 1, 2019
D.	CONSTRUCTION PERMIT APPLICATION (INTERIM TRC)	DECEMBER 1, 2019
E.	PROGRESS REPORT #3	JANUARY 10, 2020
F.	MINOR MODIFICATION OF NPDES PERMIT APPLICATION	FEBRUARY 1, 2020
G.	PROGRESS REPORT #4	JULY 10, 2020
H.	CONSTRUCTION OF INTERIM TRC IMPROVEMENTS COMPLETE	AUGUST 1, 2020
I.	PROGRESS REPORT #5	JANUARY 10, 2021
J.	PROGRESS REPORT #6	JULY 10, 2021
K.	DESIGN OF SELECTED IMPROVEMENTS COMPLETE	NOVEMBER 1, 2021
L.	CONSTRUCTION PERMIT APPLICATION (WWTP IMPROVEMENTS)	DECEMBER 1, 2021
M.	MODIFICATION OF NPDES PERMIT APPLICATION	FEBRUARY 1, 2023
N.	CONSTRUCTION OF IMPROVEMENTS COMPLETE	NOVEMBER 1, 2023
O.	FINAL COMPLIANCE DATE	DECEMBER 1, 2023