WATER SYSTEM TECHNICAL AUDIT

FOR

CITY OF PARIS
BOURBON COUNTY, KENTUCKY

November 2020

Prepared by:

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Introduction

HMB Professional Engineers, Inc. was hired by the City of Paris to provide an Audit for their water distribution and treatment system. The purpose of the Audit is to document the evaluation of the existing water system and to recommend a plan to meet potential water distribution and treatment needs from 2021 through 2041. Information presented herein and the analysis performed to develop conclusions and recommendations is based upon interviews with the City of Paris staff, facility site visits, and documentation supplied by the City of Paris.

Description of Service Area

The City of Paris is located in Central Bourbon County situated along the Stoner Fork of the Licking River. Paris is the county seat of Bourbon County and is located approximately 18 miles north east of Lexington and 17 miles east of Georgetown. Bourbon County encompasses an area of 292 square miles. The economy is based on agricultural and manufacturing. The people derive their income from farming, commercial and/or factory work in Paris, Georgetown, or Lexington. Due to the increase in population density and the number of residents employed within Lexington/Fayette County, in 1980 Paris, along with Bourbon County, was added to the Lexington-Fayette metropolitan area. This area currently consisting of six counties in and around Lexington, is the 106th largest metropolitan area in the United States.

Paris has potential for future industrial, commercial and residential growth due to the availability of suitable land, reasonable transportation infrastructure in place or under design, and close proximity to employment opportunities an amenities. US 68 (Lexington Road) has the capacity to accommodate more traffic than currently uses the corridor. US 460 (Georgetown Road) is currently in the design phase of a road widening/straightening project that will accommodate increased traffic.

SECTION 2

Existing Water System

Existing Water System

The City of Paris existing water system is comprised of a water treatment plant, three tanks, six pumps, and approximately 125 miles of cast iron (CI), ductile iron (DI), copper, galvanized, steel, plastic, and PVC water lines. The system is centered on the dense downtown area. This downtown area is approximately 5 square miles and the water system in this area is comprised of mainly cast iron and ductile iron mains installed in the early to mid-20th century. Under the US 68 Bypass, a ductile iron main ranging in size from 8- to 16-inch was installed in 1980. Outside of the bypass, there are five C-900 PVC transmission mains running under major arterial roads, in addition to numerous smaller lines under collector streets.

Pipes:

The five C-900 PVC mains are under Winchester Road, Spears Mill Road, Middletown Road, Millersburg Road, and Georgetown Road. Leading away from Paris under Winchester Road is a 4-mile, 8-inch C-900 PVC main installed in 2005. This line connects at the 11th Street Tank and travels in the roadway right-of-way to Spears Mill Road. Following Spears Mill Road between Winchester Road and Middletown Road is a 3.5-mile, 6-inch C-900 PVC main installed in 2005. Beginning at the railroad bridge next to Hinkle Construction Services on the Northeast side of Paris and leading past Spears Mill Road to the Scott Creek bridge, a 7.5-mile, 8-inch C-900 PVC main installed in 2005 runs under Middletown Road. On the north side of Paris, a 6-mile, 8- to 6-inch C-900 PVC main installed in 2012 runs out Millersburg Road from where it intersects the US 68 bypass. This line was connected to the Kentucky American Water system in 2014 at the intersection of US 68 and Millersburg Road on the south side of Millersburg. Under Georgetown Road out from the US 68 bypass to Centerville is a 5-mile, 8-inch C-900 PVC main installed in 2005.

This is graphically shown in Figure 2.1 *(below)*: System Map attached here for reference:

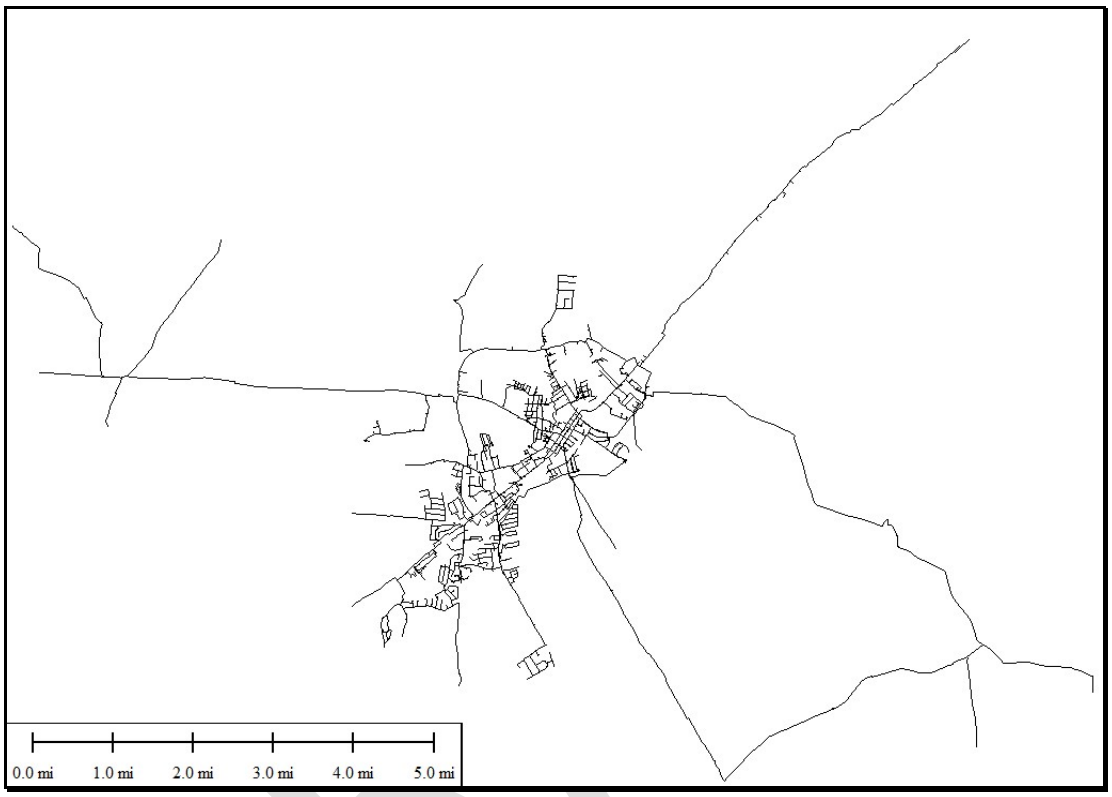

Figure 2.1: System Map

The system map shows the densely packed cast iron and ductile iron lines in downtown Paris and the PVC transmission lines under arterial roads leading away from Paris. Also useful in understanding the composition of Paris' water system is the following table (Table 2.1) detailing the materials of water lines in the system sorted by date of pipe installation. This table shows the percentage of line length by material for each date range:

Date Installed	CI/DI	PVC	Galv/Cop	Plas
pre-1950	88%	0%	12%	0%
1950-1975	71%	24%	5%	0%
1975-2000	84%	11%	1%	0%
2000-2019	8%	72%	1%	1%

Table 2.1: Material of pipe installed by date range

The age and material of water lines is most crucial for determining a system's condition. Although approximately 30% of the system's age is unknown or not recorded on the GIS system map, the percentage of the system with recorded ages is as follows:

5.6% over 70 years old (installed pre-1950)
18.0% between 45 and 70 years old (installed 1950-1975)
28.6% between 20 and 45 years old (installed 1975-2000)
47.7% less than 20 years old (installed since 2000)

Nearly half of the system has been installed in the past 20 years. Furthermore, only a quarter of the system is over 45 years old. However, the portion of the system that is over 45 years old and particularly over 70 years old warrant a closer look. Cast iron and ductile iron pipe can be optimistically expected to have a service life between 70 and 100 years (according to the Ductile Iron Pipe Research Association). Therefore, all CI and DI pipes installed prior to 1950 can be reasonably assumed to need investigation into rehabilitation or replacement. Considering the 30% of pipe length not tagged with an installation year, a reasonable total estimate of pipe needing investigation into rehabilitation or replacement is 10-15% of the system, approximately 65,000-100,000 LF of water line. As previously stated, nearly all this pipe is in the downtown core. A

Pumps:

The City of Paris water system has six operational pumps. These are the Backwash Pump (BWP), High Service Pump #1 (HSP #1), High Service Pump #2 (HSP #2), Raw Water Pump #1 (RWP #1), Raw Water Pump #2 (RWP #2), and 19th Street Booster. All pumps were subject to a vibration analysis by the Layne Company in October of 2020. At that time, several pumps are recommended for servicing. A map showing the locations of the pumps is shown here in Exhibit 2.3:

The Backwash Pump is a 1 stage, 60 HP Fairbanks Morse 24MC designed for 5000 GPM at 37' total dynamic head. Its vibration analysis is attached in Appendix A. The Layne Company recommends this pump for servicing.

The High Service Pump #1 is a 3 stage, 300 HP Fairbanks Morse 17M7000W designed for 3150 GPM at 274' total dynamic head. Its vibration analysis is attached in Appendix A.

The High Service Pump #2 is a 3 stage, 200 HP Fairbanks Morse 15H7000 designed for 2400 GPM at 262' total dynamic head. Its vibration analysis is attached in Appendix A. This high service pump should be brought up to 300 HP by replacing motor.

The Raw Water Pump #1 is a 1 stage, 30 HP Fairbanks Morse 18H7100 designed for 2800 GPM at 34' total dynamic head. Its vibration analysis is attached in Appendix A. The Layne Company recommends this pump for servicing. In addition, the check valve in the pit needs to be replaced and piping modified to accommodate new valve.

The Raw Water Pump #2 is a 1 stage, 30 HP Fairbanks Morse 18MC designed for 2500 GPM at 34' total dynamic head. Its vibration analysis is attached in Appendix A. The Layne Company recommends this pump for servicing. In addition, the check valve in the pit needs to be replaced and piping modified to accommodate new valve.

The 19th Street Booster is a 1 stage, 20 HP Fairbanks Morse Horizontal Pump. Its vibration analysis is attached in Appendix A. The check valve needs to be replaced as soon as possible to avoid pump damage.

As previously stated, all pumps are in working order and not in immediate need of rehabilitation or replacement. However, High Service Pump #2 should be brought up to 300 HP to match HSP

#1. Should the City of Paris choose to expand the existing water treatment plant or implement a new raw water source, there would be obvious need for additional pumps to increase capacity.

Tanks:

The City of Paris operates three tanks as a part of the water system. The 10th Street Tank, Bypass Tank, and 19th Street Tank were all inspected in July of 2019 by Suez. The Bypass Tank is located on the northwest side of Paris, the 19th Street Tank is on the southwest side of the city, and the 10th Street Tank is on the south side of the city.

The 10th Street Tank is a 1 million-gallon tank built in 1959 located at 400 Winchester Road. The tank is serviced by a 4000 LF 16" cast iron line from the water treatment plant installed in 1959. This line follows a fence on Claiborne Farm. The tank has an 8' diameter riser and an overflow elevation of 1031.5'. The base elevation is approximately 884'-885'. This provides 147'-0" base to overflow. The overflow weir box was designed to receive 2100 GPM. According to the July 2019 inspection report, the tank is in good condition with only minor coating chipping, wall staining, and corrosion on ladder rungs, seams, and roof. The main recommendation of the report was to "install an active mixing system to preserve interior coating." Given the crucial nature of the line between the water treatment plant and the 10th Street Tank, the 16" cast iron pipe should be inspected as it is over 60 years old.

The 19th Street Tank is a 500 thousand-gallon tank built in 1950 and located at Main Street and 19th Street. The tank is serviced by a 5200 LF 12" cast iron line from the 10th Street Tank installed in 1959. This line follows a fence on Claiborne Farm before angling under the CSX-owned railroad tracks and over to the corner of Main and 19th. The tank is a steel standpipe and has a 30'-0" inner diameter and 3' thick walls. The base elevation is shown on the plans to be approximately 202' and the overflow elevation is 285'. However, it is our opinion that these numbers were based on a previous survey datum and are more than likely 902' and 985' per current USGS maps. According to the July 2019 inspection report, the tank is in fair condition,

with evidence of some corrosion on the exterior and interior of the tank. The vent is called for replacement in the report. The roof of the tank is reported to show "signs of prevalent corrosion" warranting rehabilitation. The main recommendations of the report were to renovate the interior and exterior walls and seams, provide adequate site drainage, and "install an active mixing system to preserve interior coating." The 12" cast iron water line from the 10th Street Tank to the 19th Street Tank should also be inspected since it is now over 60 years old and is a crucial piece of water infrastructure for the City of Paris.

The Bypass Tank is a 1 million-gallon tank built in 1985 and located at 4928 Martin Luther King Jr. Blvd. The tank is serviced by a series of water lines from the 10th Street Tank. The direct line between the two, starting at the 10th Street Tank is: 400 LF of 18" cast iron line installed in 1959, 2000 LF of 12" cast iron line installed in 1959, 1500 LF of 12" ductile iron line installed in 1981, and 6500 LF of 16" ductile iron line installed in 1981. The tank has a 96" riser. Its base elevation is 889.92' and overflow elevation is 1039.50'. According to the July 2019 inspection report, the tank is in great condition However, the roof of the tank is reported to show "signs of prevalent corrosion" warranting rehabilitation. The main recommendation of the report was to "install an active mixing system to preserve interior coating." In addition, the portions of the line from the 10th Street Tank to the Bypass Tank that lead through downtown Paris should be investigated as they are over 60 years old and cast iron.

Water Treatment Plant:

The City of Paris has one water treatment plant located at 700 Scott Avenue on the east side of the city. The treatment plant is located directly adjacent to the power house. The treatment plant draws water from Stoner Creek with two raw water intake pumps. The original water treatment plant was built in 19— and consisted of a filter building and settling basins with a 4 HR @ 1050 GPM design. This was significantly expanded in 1960 with the design and construction of clear wells, filters, flocculation basins, and settling basin. The 1960 plans are included in Appendix 2 of this report for reference. The treatment plant currently uses chlorine gas to disinfect the water

and treats approximately 3 million gallons per day. The portion of the plant constructed in 1960 is in fair condition, but the original settling basins are in immediate need of rehabilitation or replacement as spalling of concrete has exposed steel reinforcement causing significant structural concern.

In addition to the structural issues of the original water treatment plant, there are capacity concerns for the expanded plant. The operators of the water treatment plant struggle to achieve chlorine contact time for disinfection processes and are therefore forced to reduce the output of the plant to maintain minimum EPA regulations. This is a serious concern and one that warrants expanding the plant's capacity. Furthermore, the City of Paris has expressed interest in using sodium hypochlorite as opposed to chlorine gas for disinfection. This would eliminate the handling, storing, and usage risks involved with chlorine gas, but also require training, potentially higher cost, and new handling risks.

It is recommended for the City of Paris to consider undergoing an upgrade of the water treatment plant to include rehabilitation, replacement, retrofitting, and expansion.

System Deficiencies:

The known system deficiencies are listed here as well as explained in further detail in Section 6, under "Red Flag Projects."

1. Raw Water pumps and clearwell vent are below 100-year floodplain elevation.
2. Malfunctioning check valves at raw water pumps and 19th street booster.
3. Broken actuated plug valves on existing treatment facility.
4. Outdated manual data entry for water treatment data.
5. Chlorine Gas used for disinfection.
6. Aging Cast Iron distribution pipes in downtown area.
7. Creek Crossings at Main Street and 2nd Street are not operating.

8. 19th Street to Cypress 6" water line through cemetery needs replacement/reroute.
9. Clintonville Road (Idlewind Area) has non-functional hydrants that need to be tied to existing 8" line.
10. 16" Ductile Iron Transmission Main from water treatment plant to 10th Street Tank runs under diesel tanks.
11. Existing 1960 clarifying basin has structural defects.
12. Future capacity issues with current size of water treatment plant – insufficient infrastructure for required contact time.

SECTION 3

Forecast of Flows

Forecast of Flows

Population Trends

Population data for Paris and the surrounding area of Bourbon County have indicated stagnant growth over the past decade. Census data conducted in 2010 lists the population of Paris as 9,810. While the current population of Paris is estimated to be 9,846, which equates to a 0.37% growth over the decade or a 0.037% increase per year. Table 3.1 (below) shows the population estimates for each of the past 10 years.

Table 3.1 - Historical Population Values

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
City of Paris	9,810	9,840	9,850	9,810	9,840	9,880	9,870	9,850	9870	9,860	9,846
% Change	-	0.31	0.10	-0.41	0.31	0.41	-0.10	-0.20	0.20	-0.10	-0.14
Bourbon Co.	19,967	20,055	20,061	20,038	20,074	20,182	20,147	20,132	20,184	20,236	20,288
% Change	-	0.44	0.03	-.011	0.18	0.54	-0.17	-0.07	0.26	0.26	0.26

Utilizing the information above the population can projected using the following formulas:

Equation 3.1: $P\,(1 + 0.037\%)^{N} = Q$ *City*

Equation 3.2: $P\,(1 + 1.608\%)^{N} = Q$ *County*

Where: P = current population

N = the number of years projected

Q = Projected population

Using this method, the City of Paris' population can be estimated to be 9,919, a 0.74% increase over 20 years. Bourbon County's population can be estimated to be 27,912, 1.38% increase over 20 years.

Water Treatment Plant Production

The Paris Water Treatment Plant is currently sized to treat 3.0 million gallons per day (MGD) but is limited by its water withdraw permit which limits the amount of water that can be taken from Stoner Creek to 2.6 MGD. Average daily flows:

2018 - 2.15 MGD
2019 – 2.30 MGD
2020 – 1.76 MGD

SECTION 4

Raw Water Supply & Interconnections

Raw Water Supply & Interconnection

Raw Water Supply

The City of Paris withdraws water from Stoner Creek under permit number _____ *(see Appendix D)*. Under this permit the City is authorized to withdraw up to 2.6 million gallons per day (MGD). This permit was renewed in the Spring of 2019. Currently the Water Treatment Plant is capable of treating 3.0 MGD. In anticipation of increased demand, the City desires to increase their withdraw from Stoner Creek. Average daily withdraws and their relation to the withdraw and treatment capacity are shown below in Table 4.1.

Table 4.1: Withdrawal Comparison

Year	Average Daily withdrawal (MGD)	Daily Withdrawal in comparison to Permit (%)	Daily withdrawal in comparison to WTP Capacity (%)
2018	2.15	83.0	72.0
2019	2.30	88.5	77.0
2020*	1.76	68.0	59.0

* *2020 data is through July 31*

Data for 2020 shows that the average daily withdrawal is considerably less than the previous two years. Consideration must be given to the fact that during most of the year represented by this data, there was a global pandemic resulting from COVID-19 which made several changes to residential, commercial, and industrial demand. During this time large portions of the population were ordered to stay within the confines or their residence. Additionally, several commercial and industrial entities were ordered to have either partial or full shutdowns to slow the spread of the disease. The impact experienced from a water production perspective is that commercial and industrial users did not have their normal demand due to a decrease in personnel onsite and a reduction to processes that require water usage. Taking the

impact of the Pandemic into consideration it was determined to not include the data for 2020 when analyzing the daily withdrawal.

Excluding 2020 from the data set, years 2018 and 2019 show the daily withdrawal exceeding 83% of the current permit limit. Additionally, 2019 shows the average daily withdrawal only 100,000 gallons per day short of

By analyzing water sales data from 2018 and 2019 it can be determined that water demand can be broken up into residential customers accounting for approximately 50%, industrial/commercial users approximately 38%, and bulk customers using 12% of the daily water sold.

Capital Improvements Plan

The City of Paris existing water system has several key deficiencies requiring capital improvement. These problems include aging lines, outdated treatment level recording methods, chlorine gas storage, an aging water treatment plant, and raw water intake pumps located below the 100-year flood elevation. In response, the following "Red Flag Projects" are suggested, in order of priority and ease of implementation:

Red Flag Projects

1. Raise raw water intake pumps 5 feet, to an elevation above 100-year floodplain.
2. Replace check valves in raw water pump pit and 19th street booster.
3. Replace plug valves at existing water treatment facility.
4. Upgrade SCADA system for existing treatment facility and tanks.
5. Switch chemical treatment from chlorine gas to sodium hypochlorite.
6. Rehabilitate or replace aging cast iron transmission and distribution pipes.
7. Reinstate creek crossings at Main Street and 2nd Street under Stoner and Houston Creeks.
8. Connect Clintonville Road hydrants to 8" main.
9. Repair structural deficiencies at existing treatment facility.
10. Expand existing water treatment facility through construction.

Raise Raw Water Pumps:

This "red flag project" would help with ease of operation in times of flooding. Currently the two raw water intake pumps sit at an elevation approximately 5 feet lower than the 100-year flood level. According to FEMA map 21017C0153C, effective 1/6/2011, the cross section with 1% annual chance water surface elevation 800.3 for Stoner Creek is located just upstream of the raw water intake pumps. This indicates that the pumps will need to be elevated above 800.3. The work associated with this adjustment would be a shaft extension for both pumps, steel frame and mounting hardware for both pumps, and clearwell extension equal to the pump shaft extension above the 100-year flood level.

Estimated Cost: TBD

Including

Pump Shaft Extensions

Clearwell Extension

Installation

Replace Check Valves:

The check valve for the raw water pumps is leaking. This valve should be replaced and requires minor pipe modifications to accommodate a new check valve. Similarly, the check valve at the 19th street booster pump is also broken and requires replacement. Currently, the check valve is not holding. The pump could be damaged if no action is taken. The check valve should be replaced as soon as possible.

Estimated Cost: TBD

Including

Raw Water Pumps Check Valve

19th Street Booster Check Valve

Replace Plug Valves:

The existing actuated plug valves at the water treatment plant are not operable. These valves should be replaced with manual flanged gate valves. This replacement should be completed as soon as possible to increase the productivity of the existing treatment plant.

Estimated Cost:	$4,959.44
Including	
2 x 8" manual gate valve	$2,283.30
4 x 8"x1/8" Ring Set	$141.14
1 x Removal of existing plug valves	$2,400.00
60 miles travel	$135.00

Upgrade Existing SCADA:

The SCADA system at the tanks is due for an upgrade to the "guardian" service. Currently, SCADA monitors approximately a third of all daily recorded data. However, this data is then transcribed and merged with manually recorded levels, entered with pencil on paper. The daily log sheet is transferred to a daily summary sheet which is, in turn, recorded as a line on a monthly operating report. The transcription process (several times over) is prone to human error and should be replaced with SCADA software which can store data, show reports, and analyze trends over time.

To fully upgrade, load cells and flow meters will be necessary to monitor chemical feed rates for: delpac 2000, permanganate, carbon, caustic, chlorine gas (to be switched to sodium hypochlorite), fluoride, and ammonia.

In addition, the plant computer system will need to be upgraded to Windows 10 and Wonderware software installed. TeamViewer of VPN service will need to be employed for remote access. Ideally, the operators will have tablets for any manual data entry required.

Estimated Cost:	$52,450
Including	
SCADA Radio Upgrade	$8,700
Data Logging	$16,000
Delpac 2020	$9,100
Sodium Permanganate	$4,550
Carbon Slurry	$4,550
Caustic Solution	$4,550
Ammonia	$5,000

Switch to Sodium Hypochlorite:

Currently, the Paris water treatment facility uses chlorine gas to treat the raw water from Stoner Creek. There are many health risks associated with handling chlorine gas. For this reason, it is recommended that the treatment process utilize sodium hypochlorite in the future.

Estimated Cost:	$13,385.00 +
Including	
Sodium Hypo Feed and Monitoring Equipment	$13,385.00
Operator Training	TBD
Miscellaneous Installation	TBD

Rehabilitate or Replace Existing Pipes:

As discussed in section 2 of this report, there are aging cast iron water pipes in need of rehabilitation or repair to limit water loss. An estimated 10-15% of the Paris water pipes were installed over 70 years ago. CCTV of these pipes would better reveal the condition and necessity of a targeted rehabilitation project. In our estimation, at least 15,000 LF of water line could need rehabilitation through lining methods. An additional 5,000 LF of water line could need replacement. As previously noted, nearly all these lines are located inside of the bypass in the downtown area of Paris. An example of a cast iron line needing replacement is the 1,800 LF line from 19th Street to Cypress Road. This is a 6-inch cast iron line installed in 1939. An example of a cast iron line likely needing rehabilitation is the 4,600 LF line from the water treatment plant along Scott Ave. This is a 10-inch cast iron main installed in 1939. Also located inside the bypass are 132 of 159 reported hydrant leaks (83%) and 291 of 344 reported water leaks (85%).

Estimated Cost:	$675,000
Including	
Replace Approximately 5,000 LF of 6-10" Water Lines	$300,000
Rehab Approximately 15,000 LF of 6-16" Water Lines	$375,000

Reinstate Creek Crossings:

Critical creek crossings at Main Street and 2nd Street are currently valved off and need rehabilitation to be reinstated. At Main Street, the crossing is a 20-foot deep 6" ductile iron main. The 2nd Street crossing is a 6" cast iron main. Reinstating these creek crossings would greatly increase efficiency and redundancy of the system, allowing the city more flexibility to make repairs in emergency situations.

Estimated Cost:	$294,000.00
Including	
Administration	$7,500.00
Land, Appraisals, Easements	$15,000.00
Engineering	$40,000.00
Construction	$205,000.00

Connect Clintonville Hydrants:

There are at least 5 non-performing hydrants connected to a 4" AC line off Clintonville Road in the Idlewind Area. These hydrants need to be connected to the 8" main on Clintonville Road. Known issues include hydrants at 435 Clintonville Road and four hydrants in Yorkshire Estates.

Estimated Cost: TBD

Including

Install approx. X LF of 4" water line

8" tapping sleeve and valve

Repair Structural Deficiencies at Existing Treatment Facility:

The existing Paris water treatment facility has significant structural defects on the old settling basin in need of repair. There are missing members, spalling concrete, and cracking. Corrosion of reinforcement and corresponding loss of strength is evident. In addition, the electric actuated plug valves are no longer operational and need to be replaced with manual gate valves for reliable operation. At a minimum, the valves should be replaced. Further repair should be scheduled for the structural issues regarding the clarifier. Cosmetic concrete cracks should be monitored to ensure they do not progress and become structural problems.

Estimated Cost:	$275,813.00
Including	
Valve Replacement and Installation	$4,959.44
Add Structural Items	
Blast Cleaning	$1,350.00
Concrete Patching	$10,000.00
Partial Depth Patching	$10,000.00
Remove and Reinstall Railing	$3,750.00
New Sluice Gates	$10,000.00
Remove Concrete Masonry	$48,000.00
Masonry Coating	$13,200.00
Concrete (3500 psi)	$94,900.00
Epoxy Steel Reinforcement	$26,800.00
Power Wash Inside Tank Walls	$2,650.00
Contingency	$55,163.00

Expand Water Treatment Facility:

In order to prepare for future water demand and achieve necessary contact times, the existing water treatment facility should be expanded through new construction.

Estimated Cost: TBD

Including

Clarifier

Piping

SECTION 5

Water Treatment Plant

SECTION 6

Capital Improvements Plan

Capital Improvements Plan

The City of Paris existing water system has several key deficiencies requiring capital improvement. These problems include aging lines, outdated treatment level recording methods, chlorine gas storage, an aging water treatment plant, and raw water intake pumps located below the 100-year flood elevation. In response, the following "Red Flag Projects" are suggested, in order of priority and ease of implementation:

Red Flag Projects

1. Raise raw water intake pumps 5 feet, to an elevation above 100-year floodplain.
2. Replace check valves in raw water pump pit and 19th street booster.
3. Replace plug valves at existing water treatment facility.
4. Upgrade SCADA system for existing treatment facility and tanks.
5. Switch chemical treatment from chlorine gas to sodium hypochlorite.
6. Rehabilitate or replace aging cast iron transmission and distribution pipes.
7. Reinstate creek crossings at Main Street and 2nd Street under Stoner and Houston Creeks.
8. Connect Clintonville Road hydrants to 8" main.
9. Repair structural deficiencies at existing treatment facility.
10. Expand existing water treatment facility through construction.

Raise Raw Water Pumps:

This "red flag project" would help with ease of operation in times of flooding. Currently the two raw water intake pumps sit at an elevation approximately 5 feet lower than the 100-year flood level. According to FEMA map 21017C0153C, effective 1/6/2011, the cross section with 1% annual chance water surface elevation 800.3 for Stoner Creek is located just upstream of the raw water intake pumps. This indicates that the pumps will need to be elevated above 800.3. The work associated with this adjustment would be a shaft extension for both pumps, steel frame and mounting hardware for both pumps, and clearwell extension equal to the pump shaft extension above the 100-year flood level.

Estimated Cost: TBD

Including

Pump Shaft Extensions

Clearwell Extension

Installation

Replace Check Valves:

The check valve for the raw water pumps is leaking. This valve should be replaced and requires minor pipe modifications to accommodate a new check valve. Similarly, the check valve at the 19th street booster pump is also broken and requires replacement. Currently, the check valve is not holding. The pump could be damaged if no action is taken. The check valve should be replaced as soon as possible.

Estimated Cost: TBD

Including

Raw Water Pumps Check Valve

19th Street Booster Check Valve

Replace Plug Valves:

The existing actuated plug valves at the water treatment plant are not operable. These valves should be replaced with manual flanged gate valves. This replacement should be completed as soon as possible to increase the productivity of the existing treatment plant.

Estimated Cost:	$4,959.44
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2 x 8" manual gate valve	$2,283.30
4 x 8"x1/8" Ring Set	$141.14
1 x Removal of existing plug valves	$2,400.00
60 miles travel	$135.00

Upgrade Existing SCADA:

The SCADA system at the tanks is due for an upgrade to the "guardian" service. Currently, SCADA monitors approximately a third of all daily recorded data. However, this data is then transcribed and merged with manually recorded levels, entered with pencil on paper. The daily log sheet is transferred to a daily summary sheet which is, in turn, recorded as a line on a monthly operating report. The transcription process (several times over) is prone to human error and should be replaced with SCADA software which can store data, show reports, and analyze trends over time.

To fully upgrade, load cells and flow meters will be necessary to monitor chemical feed rates for: delpac 2000, permanganate, carbon, caustic, chlorine gas (to be switched to sodium hypochlorite), fluoride, and ammonia.

In addition, the plant computer system will need to be upgraded to Windows 10 and Wonderware software installed. TeamViewer of VPN service will need to be employed for remote access. Ideally, the operators will have tablets for any manual data entry required.

Estimated Cost:	$52,450
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Data Logging	$16,000
Delpac 2020	$9,100
Sodium Permanganate	$4,550
Carbon Slurry	$4,550
Caustic Solution	$4,550
Ammonia	$5,000

Switch to Sodium Hypochlorite:

Currently, the Paris water treatment facility uses chlorine gas to treat the raw water from Stoner Creek. There are many health risks associated with handling chlorine gas. For this reason, it is recommended that the treatment process utilize sodium hypochlorite in the future.

Estimated Cost:	$13,385.00 +
Including	
Sodium Hypo Feed and Monitoring Equipment	$13,385.00
Operator Training	TBD
Miscellaneous Installation	TBD

Rehabilitate or Replace Existing Pipes:

As discussed in section 2 of this report, there are aging cast iron water pipes in need of rehabilitation or repair to limit water loss. An estimated 10-15% of the Paris water pipes were installed over 70 years ago. CCTV of these pipes would better reveal the condition and necessity of a targeted rehabilitation project. In our estimation, at least 15,000 LF of water line could need rehabilitation through lining methods. An additional 5,000 LF of water line could need replacement. As previously noted, nearly all these lines are located inside of the bypass in the downtown area of Paris. An example of a cast iron line needing replacement is the 1,800 LF line from 19th Street to Cypress Road. This is a 6-inch cast iron line installed in 1939. An example of a cast iron line likely needing rehabilitation is the 4,600 LF line from the water treatment plant along Scott Ave. This is a 10-inch cast iron main installed in 1939. Also located inside the bypass are 132 of 159 reported hydrant leaks (83%) and 291 of 344 reported water leaks (85%).

Estimated Cost:	$675,000
Including	
Replace Approximately 5,000 LF of 6-10" Water Lines	$300,000
Rehab Approximately 15,000 LF of 6-16" Water Lines	$375,000

Reinstate Creek Crossings:

Critical creek crossings at Main Street and 2nd Street are currently valved off and need rehabilitation to be reinstated. At Main Street, the crossing is a 20-foot deep 6" ductile iron main. The 2nd Street crossing is a 6" cast iron main. Reinstating these creek crossings would greatly increase efficiency and redundancy of the system, allowing the city more flexibility to make repairs in emergency situations.

Estimated Cost:	$294,000.00
Including	
Administration	$7,500.00
Land, Appraisals, Easements	$15,000.00
Engineering	$40,000.00
Construction	$205,000.00

Connect Clintonville Hydrants:

There are at least 5 non-performing hydrants connected to a 4" AC line off Clintonville Road in the Idlewind Area. These hydrants need to be connected to the 8" main on Clintonville Road. Known issues include hydrants at 435 Clintonville Road and four hydrants in Yorkshire Estates.

Estimated Cost: TBD

Including

Install approx. X LF of 4" water line

8" tapping sleeve and valve

Repair Structural Deficiencies at Existing Treatment Facility:

The existing Paris water treatment facility has significant structural defects on the old settling basin in need of repair. There are missing members, spalling concrete, and cracking. Corrosion of reinforcement and corresponding loss of strength is evident. In addition, the electric actuated plug valves are no longer operational and need to be replaced with manual gate valves for reliable operation. At a minimum, the valves should be replaced. Further repair should be scheduled for the structural issues regarding the clarifier. Cosmetic concrete cracks should be monitored to ensure they do not progress and become structural problems.

Estimated Cost:	$275,813.00
Including	
Valve Replacement and Installation	$4,959.44
Add Structural Items	
Blast Cleaning	$1,350.00
Concrete Patching	$10,000.00
Partial Depth Patching	$10,000.00
Remove and Reinstall Railing	$3,750.00
New Sluice Gates	$10,000.00
Remove Concrete Masonry	$48,000.00
Masonry Coating	$13,200.00
Concrete (3500 psi)	$94,900.00
Epoxy Steel Reinforcement	$26,800.00
Power Wash Inside Tank Walls	$2,650.00
Contingency	$55,163.00

Expand Water Treatment Facility:

In order to prepare for future water demand and achieve necessary contact times, the existing water treatment facility should be expanded through new construction.

Estimated Cost: TBD

Including

Clarifier

Piping