STATE OF INDIANA
INDIANA UTILITY REGULATORY COMMISSION

PETITION OF THE CITY OF EVANSVILLE, INDIANA, FOR AUTHORITY TO ISSUE BONDS, NOTES, OR OTHER OBLIGATIONS, FOR AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR WATER SERVICE, AND FOR APPROVAL OF NEW SCHEDULES OF WATER RATES AND CHARGES.	)))))))))	**CAUSE NO. 45545**

PETITIONER'S SUBMISSION OF SUPPLEMENTAL WORKPAPER

Petitioner, the City of Evansville, Indiana ("Petitioner"), by counsel, hereby submits Supplemental Workpaper 1.

Respectfully submitted,

By: ______________________________

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing was served this 22nd day of June, 2021 by electronic mail to:

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DMS 20252068v1

PRELIMINARY ENGINEERING REPORT

WATER TREATMENT PLANT
Evansville, Indiana

JUNE 2021

PREPARED FOR:

Evansville
WATER AND SEWER UTILITY

AS PART OF:

refresh
EVANSVILLE

AECOM

VS ENGINEERING

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1.0 Introduction

This Water Treatment Plant Preliminary Engineering Report (PER) was organized by VS Engineering to follow the PER format required by SRF. AECOM submitted the April 2021 Evansville Water and Sewer Utility Water Treatment Plant Advanced Facility Plan Alternatives Report (AFP) to the Drinking Water State Revolving Fund on April 30, 2021 on behalf of the Evansville Water and Sewer Utility. The technical data and written information within this PER has been sourced from and references the AFP by AECOM.

1.1 Project Area

The City of Evansville is located in Vanderburgh County, Indiana (**Exhibit A-1**). The water treatment plant and water main distribution system for the City of Evansville is owned and operated by the Evansville Water and Sewer Utility (EWSU). This project, EWSU Water Treatment Plant, is located in Section 31, Township 6 South, and Range 10 West, in Pigeon Township, as shown in the 7.5 minute Evansville South Quadrangle USGS Topographic Map (**Exhibit A-2**). The area of focus is within the incorporated limits for the City of Evansville.

1.2 Population

The June 2016 Evansville-Vanderburgh County Comprehensive Plan (Plan) provides historical population trends and forecasts for growth through 2035 and is summarized in **Table 1**. **Table 1** shows the Vanderburgh County historical population data for each decade between 1960 and 2010, and the percent change between years.

Table 1 Vanderburgh County and Evansville Historical Population Data

Year	County Population	City Population	County % Change	City % Change
1960	165,794	141,543	-	-
1970	168,772	138,764	1.8%	-1.95%
1980	167,515	130,496	-0.7%	-5.96%
1990	165,058	126,272	-1.5%	-3.24%
2000	171,922	121,582	4.2%	-3.71%
2010	179,703	117,429	4.5%	-3.42%

Source: 2016 Evansville-Vanderburgh County Comprehensive Plan, Evansville-Vanderburgh County Area Plan Commission

Evansville's population decreased over the 50-year period between 1960 and 2010, while Vanderburgh County's population has generally increased. The population of Vanderburgh County and Evansville has a net loss of 10,000 over the 50-year period. Recently, there has been more growth within Vanderburgh County and an increase in Evansville's population since 2010. In July 2018, the US Census Bureau reported an estimated City population of 117,963, an approximate increase of 0.5% since 2010. A subsequent estimate in July 2019 indicated stability with an estimate of 117,979 people. The Comprehensive Plan included a section about future capacity needs of the water treatment plant and recommended an annual population growth rate of about 7% through 2035. However, this is a very aggressive growth model and can yield an unnecessarily large facility. Based on the historical data summarized above, it is recommended to utilize a lower and more representative rate of population growth to not drastically oversize the facility. The Water Treatment Plant Advanced Facility Plan by AECOM (AFP) considers an annual population growth rate of 1.5% for the future 30 year service area projection.

The proposed project will be constructed within property owned by the City of Evansville.

1.3 Service Area

The EWSU owns, operates, and maintains its water distribution and treatment systems. The service area includes the City of Evansville and the majority of Vanderburgh County. The existing and twenty-year service areas are depicted in **Exhibit A-3**.

2.0 Current Needs

The Evansville Water and Sewer Utility (EWSU) operates an aging conventional surface water treatment plant (WTP) which experiences typical demands of 20 to 25 million gallons per day (MGD). Various expansions and capital improvements have occurred at the WTP throughout the last 100+ years, resulting in a sprawling facility with varying levels of condition. Collectively, the WTP is in poor condition and failures of major equipment have occurred in recent years with imminent failure of additional infrastructure expected in the near-term. Treatment capabilities are also somewhat limited and the City experiences water quality issues such as taste and odor complaints.

EWSU provides drinking water services to area residences, businesses, and industries. EWSU has been providing drinking water to its residents and industries since the late 1800's. Water is currently delivered to over 62,000 customer accounts and serves a population of approximately 120,000 people. A detailed population projection can be found in the **AFP Section 3.1**.

2.1 Existing Service

The existing service area comprises of residential, wholesale, commercial, public authority and industrial drinking water customers. The wholesale drinking water customers include Gibson Water, German Township, and the Town of Elberfeld. **Table 2** shows the water usage by customer category taken from the **AFP Section 3.2**.

Table 2 Water Usage (Billion Gallons Annually) by Customer Category

Customer Types	2014	2015	2016	2017	Average	% of Total
Residential	2.68	2.61	2.54	2.50	2.58	39%
Wholesale	0.77	0.77	0.80	0.75	0.77	12%
Commercial	1.85	1.94	1.83	1.82	1.86	28%
Public Authority	0.37	0.36	0.31	0.33	0.34	5%
Industrial	0.96	1.07	1.03	1.00	1.01	15%
Total	6.62	6.74	6.50	6.41	6.57	-

Source: Evansville Water and Sewer Utility

2.2 Existing Land Use

The proposed service area of the water treatment plant will lie entirely within the existing service area. The water treatment plant serves agricultural, commercial, forest, government and institutional, industrial, infrastructure and utilities, parks and open spaces, residential, undeveloped, and other areas of land use according to the Evansville-Vanderburgh County Comprehensive Plan, Evansville-Vanderburgh County Area Plan Commission. The largest land use category within the City of Evansville is residential, and agricultural land use is the largest land use category in Vanderburgh County. Detailed information on existing land use is shown in the **AFP Section 3.2**.

2.3 Existing Water Treatment Plant

The Evansville Water and Sewer Utility (EWSU), shown in **Exhibit A-4**, operates an aging conventional surface water treatment plant (WTP) which experiences typical demands of 20 to 25 million gallons per day (MGD). Various expansions and capital improvements have occurred at the WTP throughout the last 100+ years, resulting in a sprawling facility with varying levels of condition. The EWSU WTP currently has a rated (approved) capacity of 60 MGD, although there are hydraulic restrictions which limit the maximum finished water production rate to approximately 45 to 50 MGD according to EWSU. Average daily flows typically do not exceed 30 MGD.

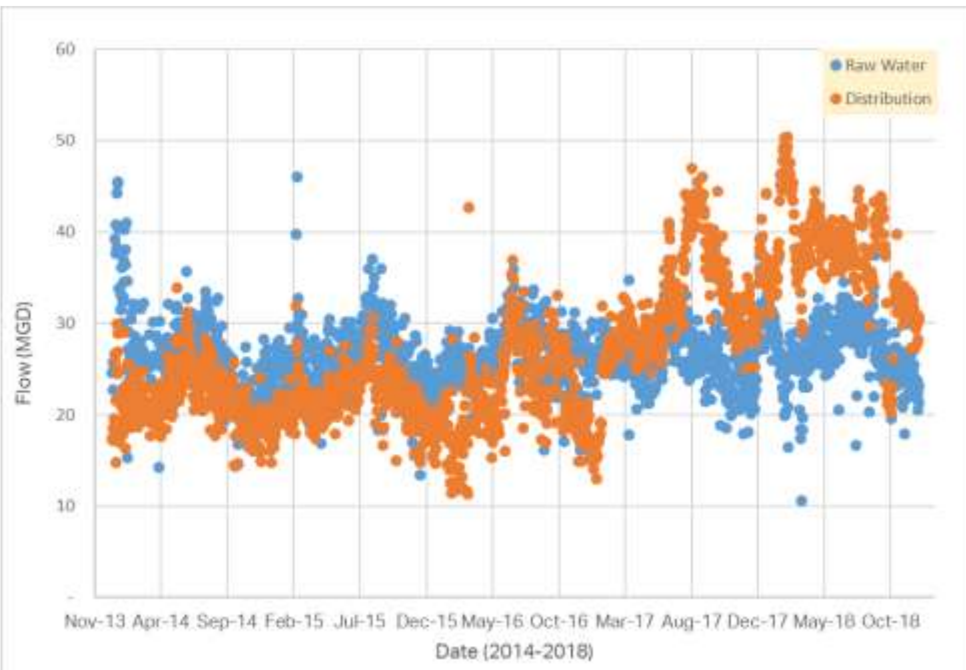

Figure 1 Pumped Water Flow

WTP pumped raw water flow and finished flow data can be found in **AFP Section 3.2**. The raw water supplied to the plant has not increased from early 2017 but data collected indicates that the finished water flow experienced a sustained increase from early 2017. The data collected from the WTP is considered invalid. EWSU uses insertion and transit-time ultrasonic type meters on its finished water systems, which can quickly lose accuracy and should be replaced with more reliable equipment. This discrepancy in distributed flow compared to raw water flow is shown in **Figure 1** Pumped Water Flow.

Table 3 2017 Individual Category Daily Water Use

Category	# of accounts or units	Annual Use (Billion Gal)	Average Use (gal/day/unit)
Residential	59,465	2.50	115
Person (estimated)	117,500	2.50	58
Commercial	3,570	1.82	1,397
Industrial	128	1.00	21,404
Public Authority	236	0.33	3,831
Wholesale	4	1.05	719,178
Total Demand	-	6.70	18,356,000

The average finished water flow value of 22 MGD is greater than 18.4 MGD sold to customers noted in the **Table 3** (difference of 3.6 MGD). This is assumed to be water lost through leaks, breaks and other undocumented water usages such as hydrants and storage tank overflows. This difference translates to a 16% loss of finished water, which is a high rate. EWSU is currently undertaking substantial waterline improvement and replacement projects and this loss is expected to decline.

Collectively, the WTP is in poor condition and failures of major equipment have occurred in recent years with imminent failure of additional infrastructure expected in the near-term. Treatment capabilities are also somewhat limited and the City experiences water quality issues such as taste and odor complaints.

2.4 Critical Treatment Equipment Infrastructure

Critical infrastructure was evaluated to identify areas of improvement critical to operation. A summary of recommended critical improvements for continued operation are shown in the **AFP Section 5.1**.

2.5 Building Systems Condition

The existing conditions of the boilers and HVAC systems, building architectural and structural, and electrical system are identified to be in poor condition throughout the WTP and reaching the end of useful life. Boilers and HVAC systems throughout the WTP have deteriorated due to age and a lack of dehumidification in the plant. The building architectural and structural components reaching the end of useful life pose a considerable safety risk. Electrical systems including the main plant switchgear and other electrical components pose a risk of power failure as well as safety risks to the plant. The WTP will require an electrical overhaul and the facility will need to be brought up to current code to ensure safe and reliable operations. The detailed information on building system conditions is located in the **AFP Section 5.2**.

2.6 Plant Performance

Performance of the river intake, pretreatment system, and filter system is observed and reported in the AFP Section 5.3. The river intake was constructed in 1980 and replaced the original wet well and pump station. The structure is in operational condition but much of the equipment, including the three travelling screens and six vertical turbine pumps are aging and require frequent rebuilds. The electrical equipment in the river intake system is nearing the point of failure. The system is able to convey raw water to the pretreatment systems. Further information regarding the river intake is located in the **AFP Section 5.3.1**.

2.7 Pretreatment Performance

Pretreatment performance was analyzed in the AFP. The north plant and south plant contain different pretreatment systems. The north plant utilizes coagulant mixed via a single mechanical rapid mixer while the south plant utilizes a static mixer. The north plant utilizes three-stage flocculation in square basins followed by primary and secondary sedimentation in square basins; where the south plant contains a single stage flocculation in a circular tank followed by primary and secondary sedimentation in circular basins. Average settled water turbidity in the primary basins during 2018 was 1.46 NTU and 1.97 for the north and south plants, respectively. Secondary basin effluent averaged 1.39 NTU and 1.66 NTU for the north and south plants, respectively. Although both are performing similarly, the north plant achieves slightly better results, likely due to mechanical mixing and multi-stage flocculation. The north WTP and south WTP sedimentation basin performance from January through December 2018 is displayed in the **AFP Section 5.3.2**.

2.8 Filter Performance

Filter performance of the WTP was analyzed in the AFP. The WTP has a total of 36 gravity filter beds. The original 12 filters have been abandoned. With 24 active filters, the plant yields three filter backwashes per day or approximately 7 to 8 days between a given filter backwash. With a total filter surface area of about 21,152 ft^2 and an average raw water flow of 26 MGD, the average effective filter loading rate is calculated as 0.85 gpm/ft^2. Filters are typically designed to operate at 2 to 4 gpm/ft^2 and this low loading lends an explanation to the extended run times. Detailed information on filter performance is reported in the **AFP Section 5.3.3.**

2.9 Chemical Facility and Usage

Chemical facility information and usage from 2016 through 2018 plant data was obtained and summarized by AECOM in the AFP. Chemicals used during this time frame include potassium permanganate, powder activated carbon, chlorine gas and chloramines, coagulant, ammonia, sodium hydroxide, fluoride, and sulfur dioxide. Average dosage is based on the recorded raw water flow rates and the amount of chemical use recorded for the year of 2018.

EWSU does not have a consistent usage of powder activated carbon. In 2016 and 2018 EWSU did not feed powder activated carbon, but in 2017, 40,000 pounds of powder activated carbon was delivered to EWSU. For the AFP, AECOM assumes that EWSU will feed an average of 15,000 pounds per year of powder activated carbon.

Sulfur dioxide does not have an average dosage established as total residuals discharge is not reliably tracked. **Table 4** shows the chemical use in 2018 and average dose based on raw water flow and finished water flow.

Table 4 Chemical Use and Average Dosage

Chemical	Usage in 2018	Dosage	Dosage Base	Total Cost
Potassium Permanganate	17,800 LBS	0.22 mg/L	Raw Water	$47,937
Powder Activated Carbon	-	8 mg/L for one week a year at a plant flow of 30 MGD	Finished Water	-
Chlorine Gas and Chloramines	410,000 LBS	5 mg/L	Raw Water	$88,770
Coagulant Hyper^{+}Ion® 4064 Aluminum based Chemical	5.8 Million LBS	28 mg/L	Raw Water	$616,639
Ammonia	225,000 LBS	1 mg/L	Raw Water	$32,945
Sodium Hydroxide	2.29 Million LBS	8 mg/L	Raw Water	$237,881
Fluoride	196,000 LBS	0.64 mg/L	Finished Water	$36,218
Sulfur Dioxide	15,500 LBS	-	-	$4,970

Detailed information on the chemical facilities and usage is shown in the **AFP Section 5.4**.

2.10 Clearwells and High Service Pumps

The plant features three (3) clearwells with volumes of 0.5 MG, 1.5 MG, and 6.5 MG. All three tanks are in poor condition and are generally not able to be taken out of service without drastically interrupting operations. Further information on clearwells is summarized in the **AFP Section 5.5**.

The plant has two high service pump stations; namely high service station #2 and #3 (#1 has been abandoned). Although clearwells are hydraulically connected, station #2 effectively pulls water from the 0.5 and 1.5 MG clearwells whereas station #3 effectively pulls from the 6.5 MG clearwell. Station #2 utilizes horizontal split case pumps and station #3 features vertical turbine pumps. The condition of each pump is variable, as rebuilds or replacements have been performed in the last 20 to 30 years. Overall, it would be extremely beneficial if EWSU had better control over diversion of flows between clearwells and pump stations; and the ability to take clearwells out of service for inspection and repair.

2.11 Residuals Management

EWSU does not currently implement any advanced residuals management at the WTP facility such as thickening or dewatering. All treatment residuals, including sludge blow-down from sedimentation basins, filter backwash, and process tank drains are sent directly to the Ohio River via four (4) permitted outfalls. These are identified as Outfalls 002, 003, 004, and 005 and the residuals stream(s) corresponding to each outfall is noted below:

- Outfall 002: Sludge from the south plant primary and secondary settling basins.
- Outfall 003: Basin drain outlet which is rarely used.
- Outfall 004: Filter backwash and stormwater collected onsite.
- Outfall 005: Sludge from the north plant primary and secondary settling basins.

There is also technically an outfall at raw water intake structure, as water used to backwash screens discharges into the river. Residuals management information is reported in the **AFP Section 5.6**.

3.0 Future Needs

3.1 Current and Future Population

In June 2019, the US Census Bureau reported a population for the City of Evansville to be approximately 117,979 people. The AFP considers an annual population growth rate of 1.5% through 2050 according to the **AFP Section 3.1**.

Currently, the water treatment plant has a rated capacity of 60 MGD and customer water demand in the service area averages approximately 22 MGD. The location of the existing WTP is shown in **Exhibit A-4**. This section looks at factors affecting current and future demand including population growth and land use to identify a plant capacity for all treatment alternatives. The Water Treatment Plant Advanced Facility Plan by AECOM (AFP) considers an annual population growth rate of 1.5% for the future 30 year service area projection. The detailed population projection can be found in the **AFP Section 3.1**.

3.2 Future Water Treatment Plant Needs

The overall performance of the existing WTP is determined to be inadequate due to an aging system which is prone to failures, and continued dependence on this system is not a viable solution. It is important that the EWSU upgrade or replace the WTP as critical infrastructure is nearing the point of failure. A new WTP is absolutely vital to ensuring safe, high quality drinking water to the communities being served by the EWSU.

The wholesale accounts have experienced an increase in water usage since 2018 and metering data from October 2019 through September 2020 reports a total supplied volume of 0.828 billion gallons, which is an increase from the average water usage of 0.77 billion gallons for wholesale customers from 2014 through 2017. Furthermore, a recent wholesale account agreement allows for an increased supply of water and is estimated to result in an additional average demand of 600,000 gallons per day (0.219 billion gallons per year). As such, for the basis of the demand estimates, an initial annual wholesale demand of 1.05 billion gallons is considered.

3.3 Proposed Plant Capacity

The WTP proposed capacity was reviewed by AECOM in the **AFP Section 3.3**. The following information is taken from the AFP by AECOM. The WTP currently has a rated capacity of 60 MGD; although this flow cannot reliably be sustained due to hydraulic limitations in the aging plant. Demand projections are extrapolated through the year 2050 for this analysis, and a summary of the assumptions are as follows:

- Initial City population of 118,000 people and a per capita a demand of 70 gal/day/person, or 8.26 MGD (higher than the per capita estimate of 58 gal/day/person).

- City population growth rate of 1.5% per year, maintaining the same per capita demand through 2050.
- Initial wholesale demand of 2.88 MGD with a flow increase of 0.75% per year.
- Initial industrial demand of 3.0 MGD with a flow increase of 2.5% per year.
- Initial commercial demand of 5.0 MGD and a growth rate of 2.0% per year.
- Initial public authority demand of 1 MGD and a growth rate of 0.25% per year.
- Initial leaks and losses volume of 3.50 MGD remaining the same through 2050.
- Peak day demand factor of 1.4 times the average demand.

Using the factors and assumptions listed above, the average and peak water demand through the year 2050 is presented in Table 5.

Table 5 Projected Average and Peak Water Demand through 2050

Demand Source	2020 Demand (MGD)	2050 Demand (MGD)
Average Residential	8.26	12.91
Average Commercial	5.00	9.05
Average Industrial	3.00	6.29
Average Wholesale	2.88	3.60
Average Public Authority	1.00	1.08
Average Leaks and Losses	3.50	3.25
Average Day Demand	**23.6**	**36.4**
Peak Day Demand	**31.7**	**49.4**

As indicated in **Table 5**, the projected average day demand by 2050 is 36.2 MGD with a peak day demand of 49.4 MGD. Based on this projection, it is proposed to consider a firm capacity of 50 MGD for the new or upgraded WTP. Although this capacity is right at the peak demand, the City currently has approximately 37 million gallons in storage throughout the distribution system and plant clearwells, which will balance the available plant capacity during extremely high peak days or peak hour flows in excess of 50 MGD. Additionally, the alternatives evaluated in this report consider expansion capabilities should flows increase considerably before the end of the life cycle.

3.4 Groundwater Supply

Hydrogeological studies have been conducted for EWSU to investigate an alternative or supplemental source for raw water. It is determined in the **AFP Section 6.2** that the groundwater required to achieve a WTP capacity of 50 MGD is 60 MGD to account for losses through the softening and metals removal processes needed for groundwater treatment. AECOM evaluates the viability of groundwater to replace the WTP, groundwater treatment requirements, and the benefits of groundwater use in the **AFP Section 6.3**. The following is a summary of the description in the AFP.

Groundwater quality data is shown in the **AFP Section 6.3**. Groundwater quality data detected that both iron and manganese were above the secondary drinking water maximum concentration limit (MCL) values. Treatment strategies for these metals include oxidation of metals, chemical precipitation of the metals, and removal of the metals in their anoxic state. Detailed information regarding iron and manganese removal is located in the **AFP Section 6.3.1**.

The groundwater quality data shows that the groundwater hardness is considerably higher than levels found in the Ohio River. In the **AFP Section 6.3.2**, three methods for groundwater softening are described. These methods are lime and/or soda ash softening, RO or NF membrane softening, and ion exchange and softening. Of the three methods, ion exchange softening is not recommended due to the resultant salt usage and residuals generated at EWSU leading to increased issues.

Arsenic levels in the groundwater quality data were detected to be above the drinking water MCL values in two of the wells tested. Arsenic will need to be removed or diluted if groundwater feeding the plant exceeded the MCL. Arsenic removal methods are listed in the **AFP Section 6.3.3** however, given that the groundwater will be blended with surface water, it is anticipated that the final level of arsenic will be lower than the MCL and not require a treatment or removal process.

Groundwater use benefits include reduced TOC, reduction in taste and odor issues due to a lower presence of organic matter, lower chlorine demand, more stable temperatures, and mitigating short-term river contamination. Groundwater use benefits are described in the **AFP Section 6.4**.

4.0 Evaluation of Alternatives

This report provides a rigorous evaluation of treatment alternatives to either completely replace the WTP or perform major improvements to ultimately provide EWSU with an upgraded facility yielding long-term reliability and improved water quality. A 'do nothing' alternative is not considered viable given the condition of the plant and risks associated with equipment failures, health and safety hazards, and insufficient levels of treatment.

4.1 Surface Water Treatment

Surface water treatment infrastructure is evaluated in the AFP and options for improvement are identified and scored based on performance criteria in the **AFP Section 7.0**. The individual components considered for surface water treatment include river intake, pretreatment, filtration, and chlorine delivery method. The baseline plant flows and recovery, and baseline unit operational costs are listed in the **AFP Section 7.1**. Design considerations require approval through IDEM to establish surface water treatment design criteria and performance. Design considerations are described in the **AFP Section 7.2**.

Scoring criteria for surface water treatment alternatives is shown in the **AFP Section 7.3**. The scoring criteria categories include process robustness, operational conditions, residuals and environmental, social impacts, health and safety and construction sequencing. These criteria are further broken down to provide a detailed analysis of the two (2) alternatives for surface water treatment. The following is a summary of the river intake alternative descriptions in the AFP.

4.1.1 River Intake Alternative 1: Rehabilitation

Rehabilitation of river intake is presented in the **AFP Section 7.4.1**. The rehabilitation alternative considers a major overhaul of the process equipment, electrical systems, HVAC, and ancillary building systems as they are not in good condition. Rehabilitation received a non-monetary score of 7.687 out of 10. A total construction cost of $6,752,000 is estimated for River Intake Alternative 1.

4.1.2 River Intake Alternative 2: New Construction

New construction of River Intake is presented in the **AFP Section 7.4.2**. This alternative considers abandoning or demolishing the existing river intake facility and the construction of a new river intake facility. The new facility will consist of a new intake channel, screens, potassium permanganate feed system, and pump facility. This alternative for river intake will require permitting and coordination with the US Army Corps of Engineers or other regulatory authorities associated with construction within the Ohio River. New Construction of the River Intake received a non-monetary score of 8.595 out of 10. A total construction cost of $12,978,000 is estimated for River Intake Alternative 2.

4.2 Pretreatment

Pretreatment infrastructure and evaluated alternatives are presented in the **AFP Section 7.5**. Pretreatment consists of a combination of the following treatments: pre-oxidation, powder activated carbon addition, coagulation, flocculation, and sedimentation. The following is a summary of the description in the AFP.

4.2.1 Pretreatment 1: Conventional with Rehabilitation

Conventional pretreatment with rehabilitation is presented in **AFP Section 7.5.1**. This alternative considers retrofitting the north plant pretreatment infrastructure and repurposing or demolishing the south plant. A summary of reasons to repurpose or demolish the south plant is documented in the **AFP Section 7.5.1**. This alternative will rely on the south plant to be operational during the retrofitting of the north plant or the temporary installation of pumping and piping at ground level to bypass the raw water channel during influent modifications. A total construction cost of $13,610,000 is estimated for Pretreatment Alternative 1.

4.2.2 Pretreatment Alternative 2: Conventional with New Construction

Conventional pretreatment with new construction is presented in the **AFP Section 7.5.2**. This alternative considers new construction of pretreatment infrastructure. The new construction will provide the opportunity for a different layout and instead of the existing 6 parallel trains each with a peak hydraulic capacity of 10 MGD, the new construction can consider four parallel trains with a peak hydraulic capacity of 15 MGD each to achieve the total design hydraulic capacity of 60 MGD. Construction sequencing considers minimal downtime associated with tying the influent and effluent connections. Additional costs for coordination and shutdowns of the existing facility are included in the plant-wide alternatives. A total construction cost of $17,377,000 is estimated for Pretreatment Alternative 2.

4.2.3 Pretreatment Alternative 3: Ballasted Flocculation with Rehabilitation

Ballasted flocculation with rehabilitation is presented in the **AFP Section 7.5.3**. This alternative considers use of a ballasted flocculation system inside one of the existing north primary sedimentation basins. Ballasted flocculation rehabilitation will consider four parallel trains with a peak hydraulic capacity of 15 MGD each to achieve the total design hydraulic capacity of 60 MGD. This alternative may pose operational challenges as the entire north plant may be out of service for a period of several weeks during the retrofit. A total construction cost of $19,189,000 is estimated for Pretreatment Alternative 3.

4.2.4 Pretreatment Alternative 4: Ballasted Flocculation with New Construction

Ballasted flocculation with new construction is presented in the **AFP Section 7.5.4**. This alternative considers the new construction of a ballasted flocculation system. Coordination may be required if the basins are constructed in the location of the existing north or south plant pretreatment systems. Down-time of existing operations may be minimal as this alternative proposes new construction. A total construction cost of $24,044,000 is estimated for Pretreatment Alternative 4.

4.3 Filtration

Filtration methods considered for the proposed WTP include rehabilitation and new construction of conventional filtration, biologically active filtration (BAF) with ozone, and membrane gravity filtration (MGF). Filtration alternatives are reviewed in the **AFP Section 7.6**. Six filtration alternatives are identified in the AFP and analyzed as follows. The following is a summary of the description in the AFP.

4.3.1 Filtration Alternative 1: Conventional with Rehabilitation

Conventional filtration with rehabilitation consists of filter beds and ancillary system rehabilitation. This alternative provides a method for rehabilitation of the existing filtration system without changing much of the existing method. Detailed analysis of this alternative is provided in the **AFP Section 7.6.1.** A total construction cost of $17,125,000 is estimated for Filtration Alternative 1.

4.3.2 Filtration Alternative 2: Conventional with New Construction

Conventional filtration with new construction consists of constructing one centralized filter building. This alternative provides operational improvements as the filters are centralized and will minimize chemical feed injections, control panels, and other instrumentation. Filtration Alternative 2 will consist of 12 new filter beds arranged in four parallel bays of three filters per bay. Detailed analysis of this alternative is provided in the **AFP Section 7.6.2.** A total construction cost of $31,569,000 is estimated for Filtration Alternative 2.

4.3.3 Filtration Alternative 3: Ozone and Filtration with Rehabilitation

Ozone and Filtration with Rehabilitation consists of an ozone system addition. This alternative provides a method for rehabilitation of the existing filtration system without changing much of the existing method. Detailed analysis of this alternative is provided in the **AFP Section 7.6.3.** A total construction cost of $34,060,000 is estimated for Filtration Alternative 3.

4.3.4 Filtration Alternative 4: Ozone and BAF with New Construction

Ozone and BAF with new construction consists of deeper bed media profile. Filter feature media retaining underdrains, 6 inches of sand, and 36 inches of granular activated carbon. Detailed analysis of this alternative is provided in the **AFP Section 7.6.4**. A total construction cost of $53,626,000 is estimated for Filtration Alternative 4.

4.3.5 Filtration Alternative 5: MFG with Rehabilitation

MFG with Rehabilitation consists of retrofitting a portion of the existing filter beds with MFG. Existing filters 13-20 will be discontinued under this alternative as MFG offers a reduction in footprint compared to conventional filtration. Filters 29-32 are not required for MFG and it is proposed to discontinue the use of these filters as they are in the worst condition. This alternative provides a method for rehabilitation of the existing filtration system without changing much of the existing method. Detailed analysis of this alternative is provided in the **AFP Section 7.6.5.** A total construction cost of $48,025,000 is estimated for Filtration Alternative 5.

4.3.6 Filtration Alternative 6: MFG with New Construction

Ozone and BAF with new construction consists of the construction of a single building to house all membranes, blowers, and ancillary MFG equipment. This alternative provides an advantage of a reduced footprint and mitigates costs and operational issues. Detailed analysis of this alternative is provided in the **AFP Section 7.6.6.** A total construction cost of $50,823,000 is estimated for Filtration Alternative 6.

4.4 Disinfection

Disinfection alternatives are analyzed in the **AFP Section 7.7**. All disinfection alternatives require the use of chlorine in the disinfection process; however, the amount of chlorine required varies depending on the treatment process. Chlorine gas, bulk delivery of liquid sodium hypochlorite, and onsite generation of low-strength liquid sodium hypochlorite alternatives are considered in the AFP. The following is a summary of the description in the AFP.

4.4.1 Disinfection Alternative 1: Chlorine Gas

Chlorine gas use for disinfection is described in **AFP Section 7.7.1**. This alternative presents a similar system to EWSU's current disinfection system. Currently the EWSU uses 1-ton gas cylinders and chlorinators. The health and safety risks of chlorine gas have resulted in many large water and wastewater treatment utilities throughout the United States replacing this disinfection method to a safer system despite offering a low cost method for disinfection.

A total construction cost of $1,616,000 is estimated for Disinfection Alternative 1. This alternative was scored under the categories of process robustness, operational conditions, residuals and environmental, health and safety, and construction & sequencing. This alternative received a score of 4.755 out of 10.

4.4.2 Disinfection Alternative 2: Bulk Delivery of Sodium Hypochlorite

Disinfection Alternative 2: Bulk Delivery of Sodium Hypochlorite is described in **AFP Section 7.7.2**. Liquid sodium hypochlorite is commonly used at treatment facilities. Chemical degradation and off-gassing can be addressed with various strategies including adequate ventilation and receiving smaller deliveries in warmer months. Other methods to address these issues are provided in the AFP.

A total construction cost of $2,092,000 is estimated for Disinfection Alternative 2. This alternative was scored under the categories of process robustness, operational conditions, residuals and environmental, health and safety, and construction & sequencing. This alternative received a score of 8.340 out of 10.

4.4.3 Disinfection Alternative 3: Onsite Generation of Sodium Hypochlorite

Disinfection Alternative 3: Onsite Generation of Sodium Hypochlorite in **AFP Section 7.7.3**. This alternative requires salt input, electricity, and softened water. Onsite generation of sodium hypochlorite eliminates issues with corrosion of materials as the chemical will not experience excessive off-gassing. This solution will not crystallize in piping and carrier water and vented valves or pumps are not needed. In addition to the previously stated benefits, the amount of delivery truck traffic is typically less as deliveries consist of longer lasting salt instead of liquid hypochlorite. This alternative does have a higher capital cost for installation, additional equipment, and maintenance requirements.

A total construction cost of $5,602,000 is estimated for Disinfection Alternative 3. This alternative was scored under the categories of process robustness, operational conditions, residuals and environmental, health and safety, and construction & sequencing. This alternative received a score of 8.223 out of 10.

4.4.4 Clearwell(s) and UV Disinfection, High Service Pumps, and Other Improvements

Clearwells and UV disinfection are analyzed in the AFP and determined to not be warranted at the current time. Information regarding clearwells and UV disinfection, high service pumps, and other improvements is provided in the **AFP Section 7.8**.

4.4.5 Surface Water Summary and Recommendation

The AFP recommends the rehabilitation of the river intake for any plant-wide alternative due to the higher cost of new construction and with the existing structure in good condition and in a convenient location to a WTP that will remain at or near the existing site. In terms of chlorination, liquid sodium hypochlorite is recommended for all plant-wide alternatives due to reduced risks associated with chlorine gas and the relatively low cost of hypochlorite available to Evansville. These recommendations along with a summary of surface water treatment recommendations are provided in the **AFP Section 7.12**.

4.5 Groundwater Treatment

Two groundwater treatment alternatives for a 25 MGD capacity groundwater softening plant are presented in the **AFP Section 8.0**. These options are lime softening and membrane softening. Blending with a 25-MGD capacity surface water plant will be discussed in the evaluation of plant-wide alternatives. The following is a summary of the description in the AFP.

To meet a treated groundwater capacity of 25 MGD, 5 new collector wells are proposed in the **AFP Section 8.1**. The five collector wells have a rated firm capacity with the largest well out of service to be 31.2 MGD. The total cost for 5 new collector wells is $40,073,000.

4.5.1 Groundwater Alternative 1: Lime Softening

Lime Softening is analyzed in the **AFP Section 8.2**. This alternative proposes chemical precipitation consisting of lime or calcium hydroxide and soda ash and proposes a groundwater plant to be blended with treated surface water in a 50/50 blend. Lime softening requires pre-aeration, lime and soda ash feed, softening clarifiers, recarbonation, gravity filtration, and residuals handling. The total cost for the lime softening system is $38,484,000. The total annual operating cost of lime softening is $5,581,000.

4.5.2 Groundwater Alternative 2: Membrane Softening

Groundwater Alternative 2: Membrane Softening is analyzed in the **AFP Section 8.3**. This alternative also proposes a groundwater plant with a rated capacity of 25 MGD to be blended with 25 MGD of treated surface water. The target finished water hardness of the groundwater plant is 130 mg/L $CaCO_3$. Membrane softening requires pre-oxidation followed by detention and filtration, detention, granular media gravity filtration, membrane softening, post membrane treatment, and residuals handling. The total cost for the membrane system building is $32,120,000. The total cost for Membrane Softening Alternative 1 which consists of a brand new membrane softening facility is $91,481,500. The total cost for membrane softening Alternative 2, which consists of a rehabilitated facility, is $82,198,500. The total annual operating cost of membrane softening is $1,739,000.

4.5.3 Groundwater Summary and Recommendations

A summary and recommendation for groundwater treatment is provided in the **AFP Section 8.4**. The operational cost of lime softening is higher due to residuals disposal. In addition to a less extensive residuals management requirement, membrane concentrate potentially dilutes surface water residuals including mercury which may provide a net benefit. The membrane softening alternative is recommended in the AFP if groundwater is to be considered.

4.6 Evaluation of Plant Wide Alternatives

The primary objective for the project is to provide safe and reliable drinking water to the customers in the EWSU WTP service area. Of several alternatives considered, rehabilitation of the existing water treatment plant was screened out since the system has approached its service life and is not a viable option. Four alternatives, including a “No Action” alternative, have been developed and evaluated below. The previously discussed surface water treatment and groundwater treatment alternatives have been individually analyzed and developed into the following four (4) plant-wide alternatives. All four (4) plant-wide alternatives consider a finished water capacity of 50 MGD as stated in the **AFP Section 9.0**.

Projections in this report are based on a 30 year service area as the present worth life cycle analysis is based on the 30-year life cycle analysis in lieu of a 20-year life cycle analysis. The

30-year life cycle analysis is common to all alternatives and projections in the **AFP**. The 30-year project provides a common base to compare all alternative life cycle costs.

Following an initial evaluation of numerous treatment options, three primary WTP alternatives were identified for final project selection and are discussed below.

4.6.1 Alternative 1 – Rehabilitate Existing Plant

The Plant Wide Alternative 1 is described in the **AFP Section 9.1**. Under this alternative, the project includes the rehabilitation of the existing water treatment plant along with a smaller portion of new construction.

This alternative includes the rehabilitation of river intake, pretreatment improvements, ozone addition, rehabilitation and decommissioning of filters, chlorine disinfection improvements, one new clearwell and additional clearwell improvements, rehabilitation of high service pump stations #2 and #3, extending outfalls further into the Ohio River, the elimination of Outfall 002 once the south plant pretreatment system is decommissioned, and additional features. These improvements and further descriptions are provided in the **AFP Section 9.1** for Plant Wide Alternative 1.

The estimated construction costs associated with the work described in this section and is estimated at $121.8 million, and a summary is provided in **Table 6**. The 30-year life cycle costs are estimated to be $253.3 million and a summary is provided in **Table 7**.

Table 6 Plant Alternative 1 Total Estimated Construction Cost

Component Description	Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$3,500,000
Rehabilitate River Intake	$6,752,000
North Plant Pretreatment Improvements	$13,610,000
North Plant Ozone System Retrofit	$16,935,000
Rehabilitate Gravity Filters	$17,125,000
New Sodium Hypochlorite System	$2,092,000
PAC Feed Improvements	$1,000,000
Other Chemical Improvements (4 at $300k ea.)	$1,200,000
Demolish South Plant	$1,066,000

Component Description	Cost
Construct New 6 MG Clearwell	$10,960,000
Rehabilitate Existing 6.5 MG Clearwell	$734,000
Rehabilitate High Service Pump Stations #2, #3	$8,733,000
Extend 3 Plant Outfalls ($750k ea.)	$2,250,000
Building Renovations	$4,000,000
Interconnecting Site Utility / Electrical Work	$3,500,000
Other Demolition Work Throughout Plant	$2,000,000
Subtotal	**$95,457,000**
Additional Construction Contingencies (15%)	$14,319,000
Other Misc. Plant-Wide Improvements (5%)	$4,773,000
Phasing & Sequencing Plant Outages (5%)	$4,773,000
Remediation & Hazardous Martials	$1,000,000
Allowances	$500,000
Startup and Commissioning	$1,000,000
Total Estimated Construction Cost	**$121,822,000**

Table 7 Plant Alternative 1 30-Year Life Cycle Cost

Component Description	Cost
Initial Construction Cost	$121,822,000
River Intake 30-Year O&M Cost	$12,657,000
Pretreatment, PAC, & Coagulant 30-Year O&M Cost	$26,893,000
Ozone & Filtration 30-Year O&M Cost	$17,246,000
High Service Pumping 30-Year O&M Cost	$17,973,000

Sodium Hypochlorite 30-Year O&M Cost	$11,851,000
Sodium Hydroxide & Fluoride 30-Year O&M Cost	$6,450,000
Ammonia 30-Year O&M Cost	$1,200,000
Misc. Maintenance of New Infrastructure 30-Year Cost	$240,000
Misc. Maintenance of Existing Infrastructure 30-Year Cost	$37,000,000
Total 30-Year Life Cycle Cost	**$253,332,000**

4.6.2 Alternative 2A – New Surface Water Treatment Facility on Current Plant Property

This alternative considers primarily new construction of a surface water ozone and BAF facility at the existing site, although some portions of the existing plant are proposed for re-use as noted herein. Plant Alternative 2A – New Surface Water Treatment Facility on Current Plant Property is described in the **AFP Section 9.2**. The following information was taken from the AFP.

This alternative includes the rehabilitation of the river intake and improvements, pretreatment improvements, a new ozone feed system, new filtration building featuring 12 filters, bulk liquid sodium hypochlorite feed to replace chlorine gas cylinders, one new clearwell and the rehabilitation of the existing 6.5 MG clearwell including the construction of a new center divider wall to convert the basin into two parallel 3.25 MG clearwells, a new high service pump station, a full replacement of pumps and accessories in existing pump station #3, elimination of three existing outfalls and extension of one discharge to the river, and additional features. These improvements and additional information is provided in the **AFP Section 9.2**.

The estimated construction costs associated with the work described in this section is $141.6 million and a summary is provided in **Table 8**. The 30-year life cycle costs are estimated to be $237.6 million and are provided in **Table 9**.

Table 8 Plant Alternative 2A Total Estimated Construction Cost

Component Description	Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$3,500,000
Rehabilitate River Intake	$6,752,000
Raw Water Piping, Metering Vault	$900,000
New Conventional Pretreatment System	$17,377,000

Component Description	Cost
New Ozone Facility (Generation, Basin, LOX)	$19,630,000
New Biologically Active Filters & Building	$33,912,000
New Sodium Hypochlorite System	$2,092,000
PAC Feed Improvements	$1,000,000
Other Chemical Improvements (4 at $300k ea.)	$1,200,000
Demolish South Plant	$1,066,000
New 6 MG Clearwell	$10,960,000
New High Service Pump Station	$7,870,000
Rehabilitate Existing 6.5 MG Clearwell	$734,000
Rehabilitate High Service Pump Station #3	$5,718,000
Extend 1 Plant Outfall	$750,000
Building Renovations	$2,000,000
Interconnecting Site Utility / Electrical Work	$3,500,000
Other Demolition Work Throughout Plant	$2,000,000
Subtotal	**$120,961,000**
Additional Construction Contingencies (10%)	$12,096,000
Other Misc. Plant-Wide Improvements (2%)	$2,419,000
Phasing & Sequencing Plant Outages (3%)	$3,629,000
Remediation & Hazardous Materials	$1,000,000
Allowances	$500,000
Startup and Commissioning	$1,000,000
Total Estimated Construction Cost	**$141,605,000**

Table 9 Plant Alternative 2A 30-Year Life Cycle Cost

Component Description	Cost
Initial Construction Cost	$141,605,000
River Intake 30-Year O&M Cost	$12,657,000
Pretreatment, PAC, & Coagulant 30-Year O&M Cost	$27,095,000
Ozone & BAF System 30-Year O&M Cost	$13,798,000
High Service Pumping 30-Year O&M Cost	$17,973,000
Sodium Hypochlorite 30-Year O&M Cost	$11,851,000
Sodium Hydroxide & Fluoride 30-Year O&M Cost	$6,450,000
Ammonia 30-Year O&M Cost	$600,000
Misc. Maintenance of New Infrastructure 30-Year Cost	$300,000
Misc. Maintenance of Existing Infrastructure 30-Year Cost	$5,240,000
Total 30-Year Life Cycle Cost	**$237,569,000**

4.6.3 Alternative 2B – New Surface Water Treatment Facility on New Plant Property

Under this alternative, the project includes the same fundamental treatment process as Alternative 2A but with the plant being in a different location. The following information was taken from the **AFP Section 9.3**. A new site will be developed and re-use of any existing plant infrastructure will be limited. The new surface water treatment facility on new property provides the benefit of not requiring phasing for construction other than several short-duration tie-ins to raw water, finished water, and other temporary utilities. This provides the opportunity for the existing plant to remain operational while the new WTP is built. This may accelerate the construction schedule, eliminate risks associated with plant outages, and potentially save cost depending on the required level of rehabilitation of an existing facility. Three potential sites were evaluated for the new WTP location. The evaluation of these three sites is shown in the **AFP Section 9.3**. **Table 10** below, shows the cost estimate for the selected proposed WTP location, Site Option 1.

Table 10 Plant Alternative 2B Selected Site

Cost Description	Unit	Quantity	Unit Cost	Total Cost
Ex. Maintenance Building Demolition	SF	62,400	$10	$624,000
New Building - Office Area	SF	15,000	$144	$2,160,000
New Building - Warehouse Area	SF	70,000	$92	$6,440,000
Earthwork and Site Paving	LS	1	$710,000	$710,000
Site Stormwater Pond	CF	10,000	$19	$190,000
New Maintenance Building Fencing	LF	2,010	$90	$180,900
Miscellaneous Sitework	LS	1	$75,000	$75,000
Subtotal				**$10,379,900**
Land Acquisition	LS	1	$167,000	$167,000
Surveying, Legal Fees	LS	1	$30,000	$30,000
Architectural / Engineering Design	5%	of subtotal		$519,000
Estimating Contingency	25%	of subtotal		$2,595,000
Total Estimated Cost				**$13,690,900**

The recommended site proposed for Plant Alternative 2B is presently occupied by the Evansville Levee Authority and the City of Evansville street maintenance facility. Relocating the Levee Authority was investigated by EWSU but was determined to not be practical. However, the footprint of the maintenance facility alone is large enough for the new plant and EWSU can relocate this facility. The primary advantage of this site is the proximity to the existing river intake, Ohio River, and to the existing high service distribution waterlines. The disadvantage of this option is the schedule delay associated with relocation of the maintenance facility.

The river intake will be rehabilitated including replacement of pumps and screens along with building renovation and a new onshore potassium permanganate feed system. Pretreatment will include the construction of four new parallel trains of PAC contact, rapid mixing, three-stage flocculation, and sedimentation with inclined plate settlers. A new ozone feed system and contact basin are proposed for this alternative. The river intake, pretreatment, and ozone feed system are

Biologically Active Filtration: Biologically active filtration is like conventional filtration with the key differences of water being unchlorinated and different media profile. The profile features a small layer of sand and capped with a deep layer of granular activated carbon of three feet or more. Filters are like those noted in Alternative 2A, with the key differences being location and having provisions for clearwells beneath the beds to help reduce overall plant footprint on the new site. Otherwise, the functionality and general configuration of the filters are the same. Biologically active filtration information in this alternative is taken from the description in the **AFP Section 9.3**.

Chlorine Disinfection: Bulk liquid sodium hypochlorite will replace chlorine gas. A wing of new chemical feed facilities would be constructed adjacent to the new filters in this alternative.

Chlorine disinfection information in this alternative is taken from and further discussed in the **AFP Section 9.3**.

Clearwells: The existing 6.5 MG clearwell cannot be reused effectively due to hydraulics, as the elevation of the new site is over 10 feet lower than the existing site. This alternative will therefore include construction of a new clearwell with an effective volume of 5 MG (two parallel 2.5 MG clearwells). In this case, the clearwells would be located beneath the new filters rather than a stand-alone structure. Although a separate structure is more convenient, this is the only viable way to proceed on this site given the area restraints. Clearwell information in this alternative is taken from and further discussed in the **AFP Section 9.3**.

High Service Pumps: This alternative includes construction of a new high service pump station in the location shown on the conceptual site plan. The pump station would feature vertical turbine pumps to minimize the footprint and will pull water directly from the new clearwells. Existing pump stations #2 and #3 would not be re-used in this alternative. High service pump information in this alternative is taken from and further discussed in the **AFP Section 9.3**.

Residuals: No new residuals are created with these improvements and disposal of all waste streams are proposed to remain as a discharge to the Ohio River. However, given the lower elevation of the new site, it is unlikely that the residuals will have the ability to drain by gravity to the river, especially in high river conditions. Therefore, a residuals pump station with forcemain discharge to the river is included with this alternative. The existing outfalls can be abandoned and/or removed, and this new outfall will extend further into the Ohio River to conceal the visible discharge plume as required by IDEM. Residuals information in this alternative is taken from and further discussed in the **AFP Section 9.3**.

Other Features: This alternative includes new construction of many components which were otherwise reused in the previous alternative. One of the more substantial features is a new administration and maintenance building on the site. Other improvements include all new chemical feed facilities, residuals pump station, backwash supply holding tank, and other new infrastructure to develop the new site. This information is taken from and further discussed in the **AFP Section 9.3**.

Costs: Although this option features more new construction compared to the last, there are some cost saving opportunities. For instance, the project implementation and sequencing efforts are far less with the new site, avoiding temporary systems and plant downtimes which ultimately add cost. There are also less unknowns with new construction. Lastly, some of the new construction is estimated to be lower cost than rehabilitation. For example, a new administration and maintenance building is estimated to be lower cost than renovation of the existing buildings given the smaller square footage, limited remediation costs, and not having to gut interiors and replace major equipment such as boilers. The total estimated construction cost for this alternative is $140.0 million and is summarized in **Table 11**. The 30-year life cycle costs are estimated to be $230.9 million and a summary is provided in **Table 12**. This information is taken from the **AFP Section 9.3**.

Table 11 Plant Alternative 2B Total Estimated Construction Cost

Component Description	Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$2,853,000
Rehabilitate River Intake	$6,752,000
Raw Water Piping, Metering Vault	$1,610,000
New Conventional Pretreatment System	$17,377,000
New Ozone Facility (Generation, Basin, LOX)	$19,630,000
New Biologically Active Filters & Building	$33,912,000
New Chemical Facilities (all)	$6,612,000
New 5 MG Clearwell	$8,804,000
New High Service Pump Station	$11,130,000
Residual Pump Station Forcemain	$1,575,000
Filter Wash water Tank	$950,000
New Administration Building	$1,810,000
New Maintenance Building	$1,040,000
Interconnecting Site Utility / Electrical Work	$3,500,000
New Electric service entrance	$1,000,000
New Generator (2,000 KW)	$1,500,000
Subtotal	**$120,055,000**
Additional Construction Contingencies (3%)	$3,602,000
Other Misc. Plant-Wide Improvements (1%)	$1,201,000
Allowances	$500,000
Maintenance Building Relocation	$13,691,000
Startup and Commissioning	$1,000,000

Component Description	Cost
Total Estimated Construction Cost	**$140,049,000**

Table 12 Plant Alternative 2B 30-Year Life Cycle Cost

Component Description	Cost
Initial Construction Cost	$140,049,000
River Intake 30-Year O&M Cost	$12,657,000
Pretreatment, PAC, & Coagulant 30-Year O&M Cost	$27,095,000
Ozone & BAF System 30-Year O&M Cost	$13,798,000
High Service Pumping 30-Year O&M Cost	$17,973,000
Sodium Hypochlorite 30-Year O&M Cost	$11,851,000
Sodium Hydroxide & Fluoride 30-Year O&M Cost	$6,450,000
Ammonia 30-Year O&M Cost	$600,000
Misc. Maintenance of New Infrastructure 30-Year Cost	$450,000
Total 30-Year Life Cycle Cost	**$230,923,000**

It should be noted that limited information on subsurface conditions beneath the maintenance building is available, and there could be some risk of soil contamination due to the nature of this facility. Additional costs have not been included for removal and or remediation of soils, which can be highly variable depending on conditions. However, over 80,000 cubic yards of soil is anticipated to be disturbed in this alternative. For example, at a cost of $30 per cubic yard, the total additional cost would be $2.4 million.

Another variable cost component is work associated with the existing WTP which is no longer needed following completion of the new plant (other than the river intake). In the previous alternative, costs for demolition and other rehabilitation work was included since such work needed to occur for the improvements. In this case, the fate of the existing WTP is unknown. Three potential scenarios of the future of the existing WTP are listed in the **AFP Section 9.3** and include demolition for redevelopment with park or recreational space which has a total estimated demolition cost of approximately $1.8 million. The second potential scenario is the demolition of the existing WTP for site residential or commercial redevelopment which has a proposed estimated total demolition cost between $4 and $6 million. This second scenario is higher due to consideration of a full demolition required for residential and commercial development. The third potential scenario is renovation for commercial development. This third scenario is unpredictable without first identifying a potential developer and ultimate costs or revenue for this option would be variable.

The unknown risk of site contamination and fate of the existing WTP could impact costs, requiring an additional $2 to $8 million onto the base project cost. The existing WTP will stay operational during the construction of the new facility and may be 4 to 5 years away from the start of new plant construction. The fate of the existing WTP should be determined and subsequently financed through a separate project following new plant construction.

4.6.4 Alternative 3 – New Ground Water Blended Treatment Facility

This alternative consists of a 50/50 blend of ground and surface waters. The groundwater train will feature south plant rehabilitation and construction of a new membrane softening facility with the north plant undergoing improvements surface water treatment. The following information was taken from the **AFP Section 9.4**.

This alternative includes the rehabilitation of the river intake and improvements, surface water pretreatment improvements, surface water filtration, five new groundwater collector wells, groundwater pretreatment, groundwater filtration, groundwater membrane softening, chlorine disinfection, new construction of a 6 MG clearwell consisting of two parallel 3 MG tanks, high service pump improvements including rehabilitating high service pump stations #2 and #3 for water supply to the distribution system, surface water and groundwater residuals improvements. These improvements and additional information is provided in the **AFP Section 9.4**.

The estimated construction costs associated with work described in this section and is estimated at $175.6 million, and a summary is provided in **Table 13**. The 30-year life cycle costs are estimated to be $297.6 million and a summary is provided in **Table 14**. Estimated construction costs for this alternative are taken from and further described in the **AFP Section 9.4**.

Table 13 Plant Alternative 3 Total Estimated Construction Cost

Component Description	Estimated Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$3,500,000
Rehabilitate River Intake	$4,823,000
North Plant Pretreatment Improvements	$7,163,000
Rehabilitate Gravity Filters	$9,013,000

Component Description	Estimated Cost
Groundwater Wells and Conveyance	$40,073,000
GW Pretreatment (oxidation, detention)	$1,422,000
GW Pretreatment (filtration)	$9,013,000
GW Membrane Softening Facility	$35,979,000
New Sodium Hypochlorite System	$2,092,000
PAC Feed Improvements	$800,000
Other Chemical Improvements (4 at $300k ea.)	$1,200,000
Demolish South Plant Primaries	$693,000
Construct New 6 MG Clearwell	$10,960,000
Rehabilitate Existing 6.5 MG Clearwell	$734,000
Rehabilitate High Service Pump Stations #2, #3	$8,733,000
Extend 3 Plant Outfalls ($750k ea.)	$2,250,000
Building Renovations	$4,000,000
Interconnecting Site Utility / Electrical Work	$3,500,000
Other Demolition Work Throughout Plant	$2,000,000
Construction Subtotal	**$147,948,000**
Additional Construction Contingencies (10%)	$14,795,000
Other Misc. Plant-Wide Improvements (2%)	$2,959,000
Phasing & Sequencing Plant Outages (5%)	$7,397,000
Remediation & Hazardous Martials	$1,000,000
Allowances	$500,000
Startup and Commissioning	$1,000,000
Total Estimated Construction Cost	**$175,599,000**

Table 14 Plant Alternative 3 30-Year Life Cycle Cost

Component Description	Cost
Initial Construction Cost	$175,599,000
GW & Membrane System 30-Year O&M Cost	$52,170,000
River Intake 30-Year O&M Cost	$6,328,500
SW Pretreatment 30-Year O&M Cost	$13,446,500
Conventional Filtration 30-Year O&M Cost	$11,913,000
High Service Pumping 30-Year O&M Cost	$17,973,000
Sodium Hypochlorite 30-Year O&M Cost	$11,851,000
Fluoride & Corrosion Inhibitor 30-Year O&M Cost	$3,450,000
Ammonia 30-Year O&M Cost	$600,000
Misc. Maintenance of New Infrastructure 30-Year Cost	$300,000
Misc. Maintenance of Existing Infrastructure 30-Year Cost	$3,930,000
Total 30-Year Life Cycle Cost	**$297,561,000**

4.6.5 Alternative 4 – Do Nothing

If no action is taken, the existing water treatment plant will continue to fail as the existing infrastructure and equipment are nearing the end of their useful life. Potential risks and consequences associated with a 'do nothing' approach are outlined in detail in the **AFP Section 9.5.** A 'do nothing' approach is not considered a viable alternative as this will result in significant capital dollars spent to keep up the WTP on an annual basis and may result in the inability to provide drinking water to residents for an extended period.

4.7 Residuals Management

Mercury is present in the Ohio River at varying concentrations. The **AFP Section 10.0** shows the existing TSS and Mercury sampling results. Residuals management alternatives analyzed by AECOM in the AFP are as follows:

1. Do nothing" option and renew or re-apply for current variance.

2. Use groundwater as the water source.
3. Rehabilitate the existing south plant for residuals dewatering and disposal.
4. Replace the river intake with riverbank filtration (RBF) collector wells.
5. Send residuals to the wastewater treatment plant for treatment and disposal.
6. Utilize dewatering bags for solids removal and disposal

4.7.1 Do Nothing

The Do Nothing alternative for residuals management is discussed in detail in the **AFP Section 10.1**. Doing nothing for residuals from the new WTP will require a new variance application which brings a risk in a variance not being granted, or elevated mercury levels above the allotted concentration allowed under the variance. If a new variance is not granted, or elevated levels of mercury return, costs to implement an emergency type of project will include the following:

- Construction Cost: $140,049,000
- Total Project Cost: $150,902,000
- 30-Year Life Cycle Cost: $230,923,000

These costs and further information on a do nothing alternative for residuals is discussed in detail in the **AFP Section 10.1**

4.7.2 Groundwater Source

The Groundwater Source alternative is discussed in detail in the **AFP Section 10.2**. Using groundwater could potentially replace or supplement the surface water source and dilute or eliminate mercury returning to the river. Using a 100% groundwater source is not recommended due to limited aquifer transmissivity and subsequent hydraulic capacity of collector wells in the vicinity of the WTP. Therefore a high level cost estimate for ten collector wells and 50% groundwater WTP is presented in **Table 15** and taken from the **AFP Section 10.2**. The 30-year life cycle cost is presented in **Table 16**.

Table 15 High-Level Project Cost Estimate of 100% Groundwater WTP

Cost Component	Unit	Quantity	Unit Cost	Project Cost
Collector Wells, Conveyance, Power	EA	10	$5,200,000	$52,000,000
Metals Oxidation Systems	LS	1	$2,300,000	$2,300,000
Gravity Filtration Systems	LS	1	$22,000,000	$22,000,000
Membrane Softening Facility	LS	1	$38,500,000	$38,500,000
Clearwells & High Service Pumping	LS	1	$14,000,000	$14,000,000
Chemical Feed Facilities	LS	1	$7,000,000	$7,000,000
Residuals - Red Water Filtration System	LS	1	$3,600,000	$3,600,000
Plant Facilities - Admin, Maintenance, Etc.	LS	1	$4,000,000	$4,000,000
Construction Subtotal				**$143,400,000**
Land Acquisition / Utilities Allowance	LS			$5,000,000
Estimating Contingency	10%	Construction Subtotal		$14,340,000

Contractor General Conditions	10%	Construction Subtotal	$14,340,000
Contractor Overhead and Profit	12%	Construction Subtotal	$17,208,000
Escalation to Midpoint	3%	Construction Subtotal	$4,302,000
Engineering and Permitting	3.5%	Construction Subtotal	$5,019,000
Bidding, Construction Admin. & Inspection	4%	Construction Subtotal	$5,736,000
Testing and Commissioning	0.5%	Construction Subtotal	$717,000
Total Project Cost			**$210,062,000**

Table 16 Groundwater Source 30-Year Life Cycle Cost

Cost Component	Unit	Quantity	Cost	Annual Cost
Electricity - Well Pumps	kWh	8,114,453	$0.10	$811,445
Electricity - Membrane Feed Pumps	kWh	10,093,922	$0.10	$1,009,392
Electricity - Aerators	kWh	653,496	$0.10	$65,350
Electricity - High Service Pumps	kWh	8,000,165	$0.10	$800,016
Electricity - Misc. Process	kWh	980,244	$0.10	$98,024
Electricity - Building Systems	kWh	490,122	$0.10	$49,012
Membrane Replacement Annual Fund	LS	1	$577,500	$577,500
Chemical - Membrane Cleaning	LS	1	$50,000	$50,000
Chemical - Sodium Hypochlorite	lb	164,381	$0.81	$133,149
Chemical - Sodium Hydroxide	lb	1,826,460	$0.36	$657,526
Chemical - Fluoride	lb	82,191	$0.78	$64,109
Chemical - Corrosion Inhibitor	lb	273,969	$1.20	$328,763
Chemical - Antiscalant	lb	168,034	$2.15	$361,274
Residuals Disposal - Red Water Sludge	Ton	1,621	$150	$243,147
Collector Well Maintenance	LS	1	$30,000	$30,000
Aerator / Detention Tank Maintenance	LS	1	$10,000	$10,000
Membrane System Maintenance	LS	1	$50,000	$50,000
High Service Pump Maintenance	LS	1	$15,000	$15,000
Chemical Feed Maintenance	EA	5	$5,000	$25,000
Misc. Maintenance	LS	1	$15,000	$15,000
Annual O&M Cost				**$5,393,707**
Replacement Component	**Life (yrs)**	**$/Replace**	**# Replaced**	**30-Year Cost**
Well Pumps	20	$13,000,000	1	$13,000,000
Membrane Feed Pumps	15	$3,000,000	2	$6,000,000
Electrical Systems	20	$9,000,000	1	$9,000,000
Instrumentation / SCADA	20	$4,000,000	1	$4,000,000
Chemical Equipment	10	$3,500,000	2	$7,000,000
High Service Pumps	15	$4,800,000	2	$9,600,000
Misc. Equipment	10	$1,000,000	3	$3,000,000

Cost Component	Unit	Quantity	Cost	Annual Cost
Salvage Component (Remaining Life)	Life (yrs)	Remain Life	Full Value	30-Year Salvage
Well Pumps	20	10	$13,000,000	($4,333,000)
Membrane Feed Pumps	15	15	$3,000,000	($3,000,000)
Electrical Systems	20	10	$9,000,000	($3,000,000)
Instrumentation / SCADA	20	10	$4,000,000	($1,333,000)
Chemical Equipment	10	10	$3,500,000	($3,500,000)
High Service Pumps	15	15	$4,800,000	($4,800,000)
Misc. Equipment	10	10	$1,000,000	($1,000,000)
Alternative Cost Summary				**Cost Value**
Groundwater WTP Project Cost				$210,062,000
Alternative Cost Summary				**Cost Value**
Annual O&M Cost				$5,393,707
30-Year O&M Cost				$161,811,000
30-Year Replacement Costs				$51,600,000
30-Year Salvage Value				($20,966,000)
Total 30-Year Life Cycle Cost				**$402,507,000**

4.7.3 Residuals Management at the South Plant

Residuals management at the South Plant is discussed in the **AFP Section 10.3**. This alternative for residuals management consists of retrofitting a portion of the existing south plant as a new dewatering facility.

This alternative will recycle all filter backwash waste to the head of the WTP and direct all TSS to the pretreatment sludge waste stream. Pretreatment sludge from the new WTP will be pumped to the existing south secondary clarifiers via a new residuals pump station on the WTP site. The existing sludge pump station at the south plant will be rehabilitated to pump thickened sludge from the clarifiers to a new 300,000 gallon above ground, bolted steel, glass-lined sludge storage tank with mechanical mixing. A new dewatering building will be constructed to contain three thickened sludge transfer pumps, a polymer activation and feed system, two dewatering centrifuges, thickened solids screw conveyors discharging to a cake storage area, an electrical room, restroom, office, and other miscellaneous building features. Dewatered solids from the conveyor system will be stored adjacent to the dewatering building and feature a concrete pad covered by a pavilion structure, and then the dewatered solids will be hauled to a landfill for disposal. Thickener effluent and centrifuge centrate, or supernatant will be combined and sent to Outfall 005, which will be exteneded further into the river to conceal the plume. It is assumed that EWSU will need to hire five (5) additional full-time personnel to operate the facility at an average of 8 hours per day, 365 days per year. Three personnel will perform primary operations and two personnel will operate solids loading activities. Detailed components and activities associated with retrofitting the South Plant for residuals management is detailed in the **AFP**

Section 10.3. Table 17 below shows the total project cost and **Table 18** shows the 30-year life cycle cost.

Table 17 Residuals Management Facility Project Costs

Dewatering Cost Component	Unit	Quantity	Unit Cost	Project Cost
Backwash Recycle - Pump Station Modifications	LS	1	$880,000	$880,000
Backwash Recycle - Influent Modifications	LS	1	$366,000	$366,000
Additional Forcemain Length	LF	140	$350	$49,000
Demolition (Clarifiers, Mechanisms)	LS	1	$800,000	$800,000
Sitework, Piping and Roadway Improvements	LS	1	$900,000	$900,000
New Thickening Clarifier Mechanism	EA	2	$928,000	$1,856,000
New Sludge Pumps	EA	2	$30,000	$60,000
Ex. Pump Station Miscellaneous Rehab	LS	1	$100,000	$100,000
300,000 Gallon Bolted Steel Tank	GAL	300,000	$1.75	$525,000
Thickened Sludge Mixers	LS	1	$150,000	$150,000
Thickened Sludge Transfer Pumps	EA	3	$30,000	$90,000
Dewatering Building	SF	3,600	$180	$648,000
Dewatering Centrifuge	EA	2	$1,700,000	$3,400,000
Polymer Activation and Storage System	LS	1	$100,000	$100,000
Screw Conveyor System	LS	1	$900,000	$900,000
Cake Storage - Concrete	CY	590	$750	$443,000
Cake Storage - Pavilion	SF	8,800	$80	$704,000
Front End Loader	EA	2	$90,000	$180,000
Drain Pump Station / Sanitary	LS	1	$250,000	$250,000
Non-potable Water System	LS	1	$200,000	$200,000
Process Valves, Piping, and Supports	LS	1	$600,000	$600,000
Extension of Outfall 005	LS	1	$750,000	$750,000
Site Fencing	LF	1,200	$65	$78,000
Site Security	LS	1	$50,000	$50,000
HVAC and Plumbing	LS	1	$500,000	$500,000
Electrical and Control Systems	LS	1	$2,400,000	$2,400,000
Standby Generator	LS	1	$500,000	$500,000
Construction Subtotal				**$17,479,000**
Estimating Contingency	25%	Construction Subtotal		$4,370,000
Contractor General Conditions	10%	Construction Subtotal		$1,748,000
Contractor Overhead and Profit	12%	Construction Subtotal		$2,097,000
Escalation to Midpoint	3%	Construction Subtotal		$524,000
Engineering and Permitting	8%	Construction Subtotal		$1,398,000
Bidding, Construction Admin. & Inspection	10%	Construction Subtotal		$1,748,000
Testing and Commissioning	2%	Construction Subtotal		$350,000
Total Project Cost - Dewatering Addition Only				**$29,714,000**

Dewatering Cost Component	Unit	Quantity	Unit Cost	Project Cost
Total Project Cost - New Plant (Alternative 2b)				$150,902,000
Total Project Cost - New Plant with Dewatering				**$180,616,000**

Table 18 Residuals Management Facility 30-Year Life Cycle Cost

Cost Component	Unit	Quantity	Cost	Annual Cost
Thickening Elec. (Drives, Mixers, Pumps)	kWh	524,257	$0.10	$52,400
Dewatering Elec. (Centrifuge, Conveyor)	kWh	1,494,690	$0.10	$149,500
Misc. Building Systems Elec.	kWh	200,779	$0.10	$20,100
Polymer Chemical	Pounds	120,620	$2.90	$349,800
Dewatered Solids Storage / Loading - Fuel	Gal	10,950	$4.00	$43,800
Landfill Tipping Fee	Dry Ton	8,041	$16.50	$132,700
Truck Hauling Fee (14 CY truck - 1/day)	Hauls	365	$100	$36,500
Additional Personnel (w/ Benefits)	FTE	5	$75,000	$375,000
Dewatering Equipment Maintenance	LS	1	$50,000	$50,000
Replacement Component	**Life (yrs)**	**$/Replace**	**# Life Cycles**	**30-Year Cost**
Residuals Pumps	15	$180,000	2	$360,000
Thickened Sludge Pumps	10	$60,000	3	$180,000
Thickened Sludge Transfer Pumps	7	$90,000	4	$360,000
Replacement Component	**Life (yrs)**	**$/Replace**	**# Life Cycles**	**30-Year Cost**
Thickener Drives/Mechanisms	20	$1,856,000	1	$1,856,000
Mixers	20	$150,000	1	$150,000
Dewatering Centrifuges	15	$3,400,000	2	$6,800,000
Screw Conveyors	20	$900,000	1	$900,000
Electrical Systems	20	$1,800,000	1	$1,800,000
Front End Loader	20	$180,000	1	$180,000
Salvage Component (Remaining Life)	**Life (yrs)**	**Remain Life**	**Full Value**	**30-Year Salvage**
Residuals Pumps	15	15	$180,000	($180,000)
Thickened Sludge Pumps	10	10	$60,000	($60,000)
Thickened Sludge Transfer Pumps	7	5	$90,000	($64,000)
Thickener Drives/Mechanisms	20	10	$1,856,000	($619,000)
Mixers	20	10	$150,000	($50,000)
Dewatering Centrifuges	15	15	$3,400,000	($3,400,000)
Screw Conveyors	20	10	$900,000	($300,000)
Electrical Systems	20	10	$1,800,000	($600,000)
Front End Loader	20	10	$180,000	($60,000)
Alternative Costs Summary				**Cost Value**
Dewatering System Project Cost				$29,714,000
Annual Dewatering O&M Cost				$1,209,800

Dewatering: 30-Year O&M Costs	$36,294,000
Dewatering: 30-Year Replacement Cost	$12,586,000
Dewatering: 30-Year Salvage Cost	($5,333,000)
Dewatering: Total 30-Year Life Cycle Cost	**$73,261,000**
WTP (Alternative 1): 30-Year Life Cycle Cost without Dewatering	$241,776,000
WTP (Alternative 1): 30-Year Life Cycle Cost with Dewatering	**$315,037,000**

4.7.4 Riverbank Filtration

Riverbank filtration is discussed in the **AFP Section 10.4**. This alternative considers replacing the surface water intake structure with water drawn from riverbank filtration collector wells.

4.7.5 Wastewater Plant Diversion

Wastewater plant diversion is evaluated in the **AFP Section 10.5.** This alternative evaluates the TWTP operational and biosolids characteristics. This option is higher in cost than Alternative 3 and therefore is not recommended.

4.7.6 Dewatering Bags

Dewatering bags are evaluated in the **AFP Section 10.6**. This alternative for residuals management is determined to be a poor fit for the EWSU WTP as dewatering bags are typically used for temporary use or for smaller capacity water treatment facilities.

4.8 Proposed Alternative Scoring Considerations

The scoring criteria for the Proposed Alternative are discussed in the **AFP Section 11.2**. The scoring criteria included technical, social, environmental, and monetary factors. Technical factors reviewed include process robustness including turbidity spikes in the river, river spills/contaminants, taste and odor control, organics and disinfection byproducts. Additional technical factors reviewed include distribution water quality impacts, ease of operation, impacts to operations during construction, length of construction period, and reliability and redundancy.

Social factors reviewed include susceptibility to malevolent threats, visibility from Veterans Memorial Parkway, beneficial land re-use, and flexibility for future expansion. Environmental factors reviewed include susceptibility to earthquake, susceptibility to tornado, susceptibility to flooding, and potential soil contamination.

Plant-Wide Alternative 1 received an overall score of 1200, Plant-Wide Alternative 2A received an overall score of 1340, Plant-Wide Alternative 2B received a score of 1400, and Plant-Wide Alternative 3 received an overall score of 1260.

The benefit to cost ratios for each alternative is shown in **Table 19**.

Table 19 Final Alternatives Benefit-to-Cost Ratios and Rank

Alt.	Non-Monetary Benefits Score	Construction Cost	30-Year Life Cycle (Billions)	Benefit-to-Cost Ratio	Rank
1	67.1	$121,822,000	$0.253	265	3
2A	76.9	$141,605,000	$0.238	324	2
2B	**84.6**	**$140,049,000**	**$0.231**	**366**	**1**
3	68.2	$175,599,000	$0.298	229	4

5.0 Evaluation of Environmental Impacts

Environmental impacts include those direct impacts caused by construction, operation, and maintenance of the project, and indirect impacts caused by changing the surrounding environment.

5.1 Disturbed and Undisturbed Land

The majority of the construction will occur within the City of Evansville property and on previously disturbed land. As a result, construction on undisturbed areas and tree removal will be will not occur, or be kept at a minimum. Specific environmental issues that could potentially be encountered are addressed in the following sections.

5.2 Historic, Architectural, & Archaeological Sites (SHAARD)

According to the Indiana State Historic Architectural and Archaeological Research Database (SHAARD) and the National Register of Historic places, there are no historic, architectural, or archaeological sites which will be impacted by the project. A historic site map is included in **Exhibit A-5**.

5.3 Wetlands

Wetlands will not be impacted by the construction or operation of the project. There are no known wetlands within the Project Area. A National Wetland Inventory map is included in **Exhibit A-6**.

5.4 100-Year Floodplains and Floodways

The floodplain map for the project area is provided in **Exhibit A-7**. The project area is located within an area protected by a levee system previously accredited by FEMA. All improvements will be limited to the WTP and project area, and thus will have no impact on the levee system.

5.5 Surface Water

No negative impacts are expected from project construction. Design and construction work along the Ohio River will be extensively coordinated with the US Army Corps of Engineers, and Ohio River regulatory authorities.

5.6 Groundwater

Groundwater control measures will be in accordance with geotechnical recommendations based on the final design of the WTP. No negative impacts are anticipated for the construction of the WTP facility.

5.7 Induced/Secondary Impacts

The EWSU, through the authority of its council, planning commission, or other means, will ensure that future development, as well as future water supply, treatment, storage, or distribution system projects connecting to SRF-funded facilities will not adversely affect wetlands, wooded areas, steep slopes, archaeological/historical /structural resources or other sensitive environmental resources. The EWSU will require new development and treatment works projects to be constructed within the guidelines of the IDEM, IDNR, U.S. Fish and Wildlife Service, and other environmental review authorities.

5.8 Plants & Animals

There are no stream crossings. Measures will be taken to ensure no streams, wetlands, or wooded areas will be affected during the construction of the project. Tree removal is not anticipated for this project as the project is located on previously developed land.

5.9 Farmland

There are no farmlands within the Project Area that will be affected by construction activities. A soils map is shown in **Exhibit A-8**.

5.10 Noise & Air Quality

Construction activities may generate noise and dust particles, but some level of disruption is expected. Excess dust will be prevented from becoming airborne by occasionally wetting exposed soils. Dust is only a short-term concern. Construction should not impact ozone, produce airborne pollutants, or impact other current or future air quality concerns.

5.11 Open Space & Recreational Opportunities

There are no open spaces, recreational facilities, or trails within the Project Area that will be affected by construction activities.

5.12 National Landmarks

According to the National Park Service's Online List of National Parks and Natural Landmarks, there are no national landmarks impacted by the project.

5.13 Mitigation Measures

Adequate erosion control measures will be practiced on site during all construction activities. Additionally, contractors will be required to restore disturbed land to its pre-construction conditions or better. Construction activities may generate some noise, fumes, and dust normally resulting from such activity. The adverse impacts caused by dust may be alleviated by periodic wettings of exposed soil to reduce the suspension of particles. Work activities can be limited to normal daytime hours to reduce noise impacts.

6.0 Proposed Project

The recommended plant wide alternative is Alternative 2B. This project involves construction of a new surface water treatment plant utilizing conventional pretreatment, ozone, and biologically active filtration treatment processes. The location of the new WTP is proposed to be east of Waterworks Road and very little of the existing WTP will be reused except for the river intake and low service pump station. Note that if a dewatering facility is required, the additional project cost is anticipated to be approximately $30 million and the annual O&M cost increases by about $1.2 million.

In coordination with EWSU and project stakeholders, it was determined that Alternative 2B – New Surface Water Treatment Facility on New Property is the most cost-effective solution to provide the long-term water quality to the customers. Alternative 2B is the selected plan which would provide the required level of service, result in the minimum total cost over the planning period, and meet Federal, State, and local agency requirements.

The Preliminary Engineering Report (PER) requests funds for the construction of a drinking water treatment plant and the necessary appurtenances within the Project Area. The location and of the proposed drinking water treatment plant is shown on **Exhibit A-9**. A description of the recommended project is described in the **AFP Section 9.3**. The figure for the proposed project process flow diagram is located in the **AFP Figure A6-7**. The figure for the proposed project site plan is located in the **AFP Figure A6-8**.

6.1 Raw Water Analysis

A water quality analysis of the Ohio River was prepared using data from the City of Evansville's SCADA server spanning 2014 through 2018. **Table 20** below was prepared by AECOM to provide the raw surface water quality data and presented in the **AFP Section 4.1**. Detailed data and information on each component for the surface water is shown in the **AFP Section 4.0**. A supplemental raw water analysis is also provided in **Attachment E**.

Table 20 Raw Surface Water Quality Data

Parameter	Units	Average	10th Percentile	90th Percentile
Turbidity	NTU	54	14	110
Suspended Solids	mg/L	72	15	158
Total Organic Carbon	mg/L	3.8	2.8	4.7
Iron	mg/L	0.29	0.09	0.55
Manganese	mg/L	0.19	0.07	0.34
Calcium	mg/L	37	31	44
Magnesium	mg/L	10	7	13
Total Hardness	mg/L $CaCO_3$	130	107	154
Alkalinity	mg/L $CaCO_3$	88	74	104

Parameter	Units	Average	10th Percentile	90th Percentile
pH	S.U.	7.78	7.63	7.93
Atrazine	ug/L	0.33	BDL	0.90
Chloride	mg/L	16	10	22
Sulfate	mg/L	38	27	52
Phosphorus	mg/L	0.18	0.09	0.27
Silica	mg/L	3.9	1.5	6.2
Total Dissolved Solids	mg/L	242	184	308
Total Coliforms	CFU/100 mL	6,125	687	15,531
e. coli	CFU/100 mL	176	5	403
CSMR	None	0.43	0.26	0.63
LSI	None	-0.35	-0.64	-0.02

6.2 Hydraulic Model

Hydraulic modeling of the WTP and distribution system infrastructure was completed by HNTB. The September 2016, Water Master Plan by HNTB provided a comprehensive overview of the WTP and distribution system infrastructure.

6.3 Preliminary Design Summary

The design for the project is based upon existing and proposed main capacities, applicable Drinking Water Standards, Ten State Standards, and IDEM policies. A planning level design summary for the project is included in **Attachment F** of this report.

6.4 Project Cost

The cost to implement the Selected Plan, including dewatering, totals $ 166,925,000. Details of the individual cost for the project are provided in **Section 4.6.3** of this report. This project cost includes cost necessary to implement the WTP, dewatering facility, construction administration and bidding, inspection and materials testing, interest, permitting fees and legal expenses as shown in **Table 21**.

Table 21 Proposed Project Cost

Component Description	Cost
Civil Site Work (Roads, Drainage, Fencing etc.)	$2,853,000
Rehabilitate River Intake	$6,752,000
Raw Water Piping, Metering Vault	$1,610,000
New Conventional Pretreatment System	$17,377,000
New Ozone Facility (Generation, Basin, LOX)	$19,630,000
New Biologically Active Filters & Building	$33,912,000
New Chemical Facilities (all)	$6,612,000
New 4 MG Clearwell	$8,804,000
New High Service Pump Station	$11,130,000
Residual Pump Station Forcemain	$1,575,000
Filter Washwater Tank	$950,000
New Administration Building	$1,810,000
New Maintenance Building	$1,040,000
Interconnecting Site Utility / Electrical Work	$3,500,000
New Electric service entrance	$1,000,000
New Generator (2,000 KW)	$1,500,000
Dewatering	$27,650,000
Other Misc. Plant-Wide Improvements (1%)	$1,201,000
Allowances	$500,000
Startup and Commissioning	$1,000,000
General Construction Costs	**$150,406,000**
Additional Construction Contingencies (3%)	$4,512,180
Total Construction Costs	**$154,919,000**
Construction Adminstration and Bidding (2.5%)	$3,872,975
Inspection and Materials Testing (2%)	$3,098,380
Interest Incurred through Financing (2.25%)	$3,485,678
Permitting Fees and Legal Expenses (1%)	$1,549,190
Total Non-Construction Costs	**$12,006,000**
Total Project Cost	**$166,925,000**

6.5 Project Schedule & Phasing

A project schedule has been developed for the project based on need, benefit and cost and is shown in the **AFP Figure 11-1**. The potential schedule is based on the **AFP** and as follows:

- SRF Loan Closing Anticipated : July 2022
- Construction Projected to Begin: 2022
- Substantial Completion Anticipated : 2025
- WTP Commissioning Anticipated : 2025

6.6 Green Project Reserve

Evansville Water and Sewer Utility (EWSU) is planning to construct a new 50 MGD water treatment plant (WTP) to replace its aging facility. The project consists of rehabilitation of the existing river intake pump station and construction of a completely new treatment process using conventional pretreatment, ozonation, biologically active filtration, disinfection, pumping to distribution, residuals handling and chemical feed facilities, an administration and maintenance building, and related site and utility improvements. The project will include several Green Project Reserve Sustainability Incentives which are described herein. **Attachment F** provides the Green Project Reserve Form.

Water Efficiency: The new facility design includes water efficiency savings as follows:

1. **Internal water reuse**: The treatment process will include internal water reuse to minimize the raw and partially treated water requirements. These include the following:
    a. **Ozone Motive and Cooling Water**: Water used for the ozone motive and open-loop cooling water streams will be pulled from the treatment plant's settled water basin rather than the finished water source (estimated at 540 gpm while operating). Doing so will eliminate the need to send this water through the filtration and disinfection processes, saving energy due to use of lower-head pumps and chemicals. The secondary pumping systems have an estimated construction cost of $250,000 and are estimated to save approximately $21,000 per year in electricity and $3,500 per year in sodium hypochlorite chemical.

    b. **Backwash Recycle**: If the full residuals system is ultimately required by IDEM, the plant will incorporate filter backwash recycle rather than directing all backwash waste to the river (up to 10% of the plant flow). Backwash recycle improvements are included with the residuals treatment cost and has an estimated construction value of $2.1 million.

Energy Savings: The new facility design includes energy savings as follows:

1. **Variable Frequency Drives (VFDs):** The project features six (6) 150 HP low service pumps and six (6) 400 HP high service pumps, all of which will include VFDs. The estimated cost for a 150 and 400 HP VFD are $24,000 and $58,000, respectively. Since pump selection is based upon the head required at maximum flow conditions, operating at an average flow of 25 MGD results in estimated energy savings as follows:
    a. Low Service example: Operating at an average of 6' of head below the pump design point results in 34 kW of lower operational power, or a savings of $30,000 per year.
    b. High Service example: Operating at an average of 20' of head below the pump design point results in 114 kW of lower operational power, or a savings of $100,000 per year.

2. **Premium efficiency motors**: The new project features pumping and mixing equipment with a total rated motor horsepower of nearly 3,600 HP, with average day conditions drawing approximately half of that load. Using premium efficiency motors will result in considerable cost savings. For example, increasing motor efficiency by 3% for a connected load of 1,800 HP results in a savings of 40 kW, or over $35,000 in average annual savings.

7.0 Legal, Financial, & Managerial Capabilities

7.1 Management Resolution

Resolutions from the Evansville Water and Sewer Utility Board, including an Authorization Resolution, and PER Acceptance Resolution can be found in **Attachments A and B**.

7.2 SRF Project Financing Information

The SRF Project Financing Information can be found below in **Attachment C**.

7.3 Land Acquisition Schedules

Land acquisition of the City of Evansville Street Maintenance Facility, under the Evansville Public Works Department, will occur in the third quarter of 2021. The proposed construction schedule can be found in the **AFP Figure 11-1**.

7.4 Inter-Local Governmental Agreement

The Evansville Public Works Street Maintenance Department will be relocated in order for the WTP to be constructed within the existing Public Works Department Street Maintenance building. An inter-local government agreement is currently being prepared.

8.0 Public Participation

8.1 Time & Place of Public Hearing

The public hearing will be held after initial submittal and review by SRF.

8.2 Public Hearing Transcript & Sign-up Sheet

The public hearing notice, sign-up sheet, and meeting minutes will be included upon completion of the public hearing.

8.3 Public Hearing Comments

Public hearing comments and responses to those comments will be included upon completion of the comment period after the public hearing.

9.0 References

AECOM. (2021). *Evansville Water and Sewer Utility Water Treatment Plant Advanced Facility Plan*.

Evansville-Vanderburgh County Area Plan Commission. (2016). *Evansville-Vanderburgh County Comprehensive Plan 2015-2035.*

Great Lakes Upper Mississippi River Board. (2012). *Recommended Standards for Water Works.* Health Research Inc.

HNTB. (2008). *Evansville, Indiana Residuals Handling and Dechloramination.*

HNTB. (2016). *EWSU Water Master Plan.* Evansville Water and Sewer Utility.

Ramboll. (2016). *Application fo a Variance from Indiana Water Quality Standars - Mercury*.

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AECOM

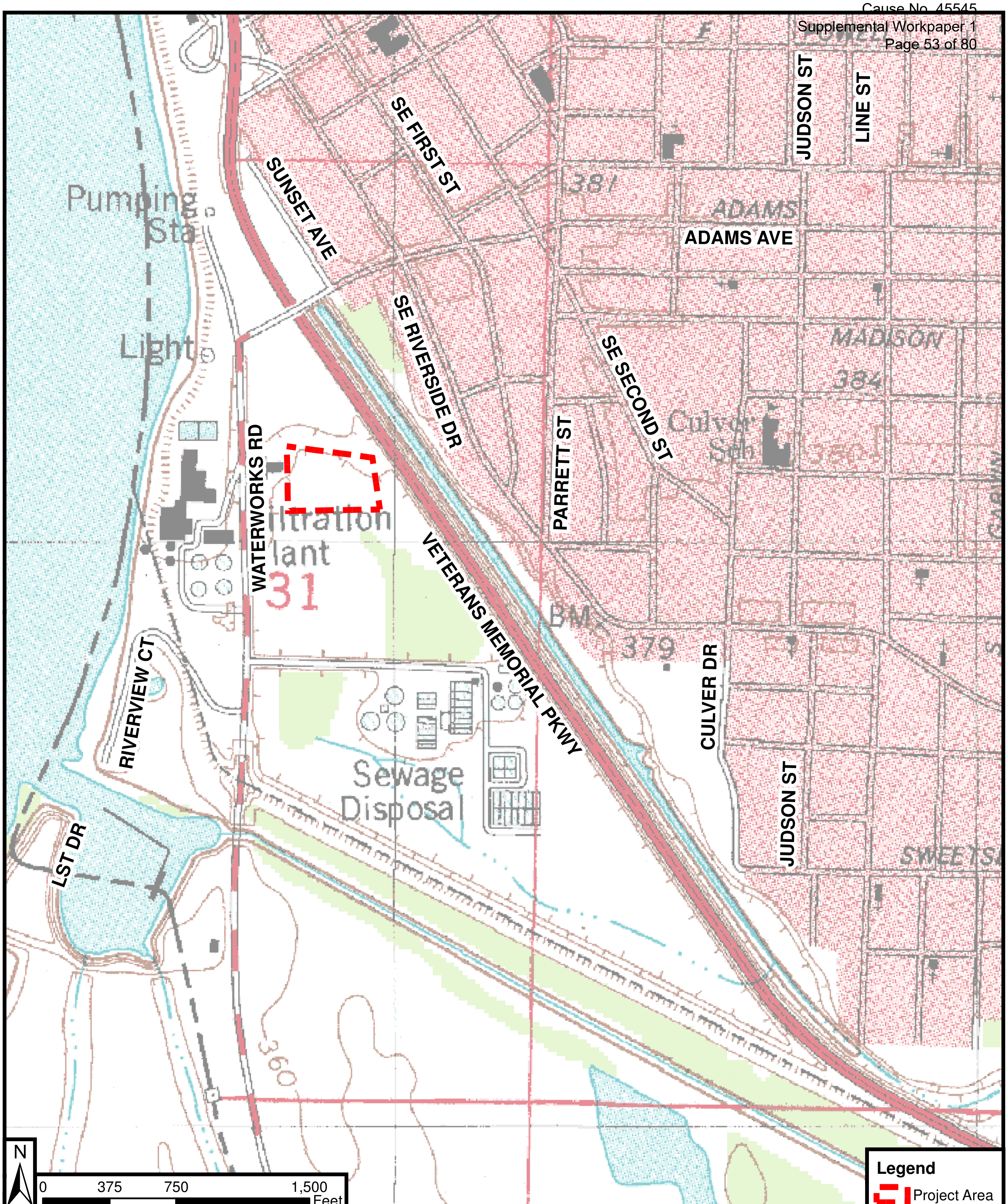
Evansville Water and Sewer Utility

Exhibit A-1
State Location Map

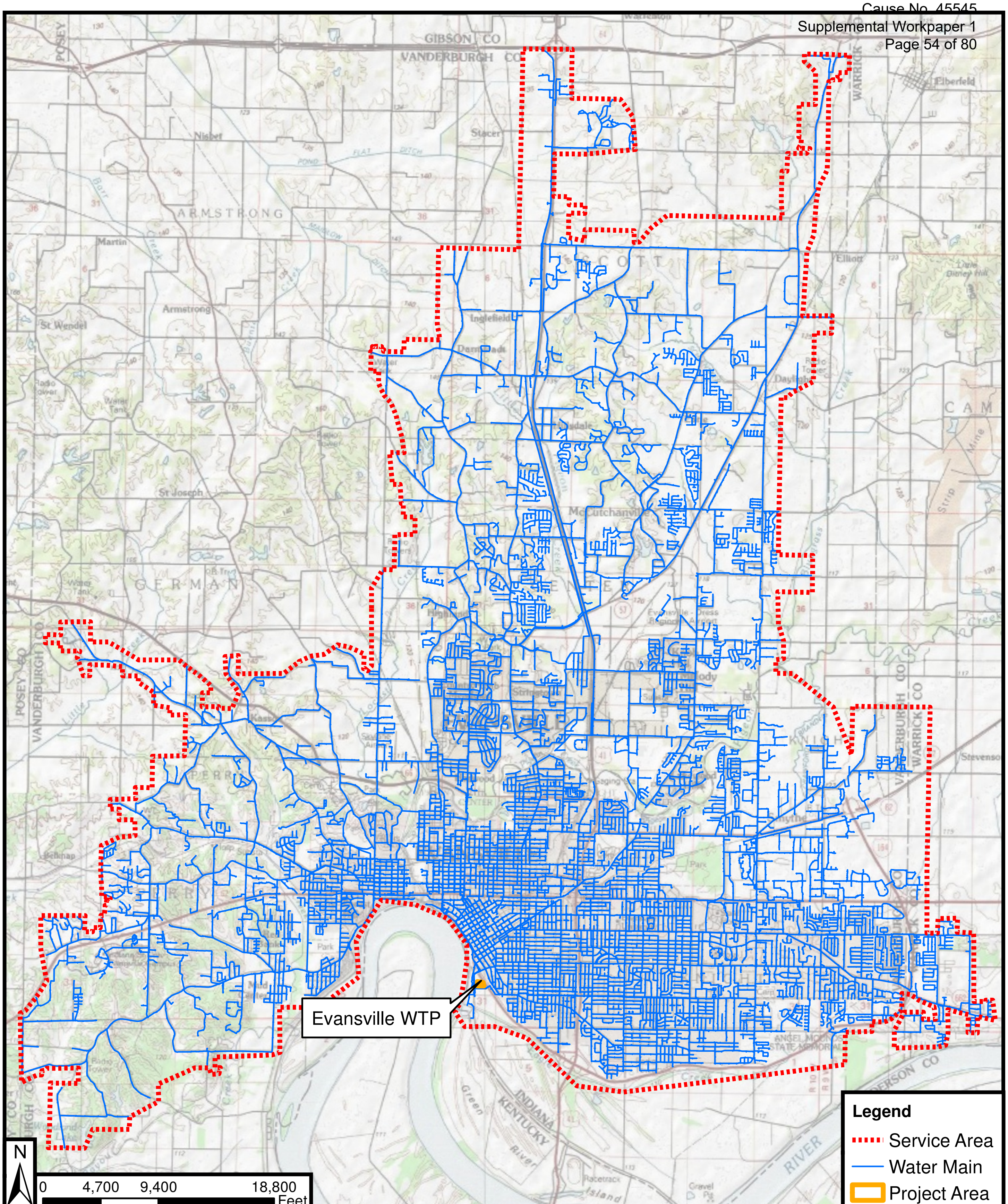
VS ENGINEERING

refresh EVANSVILLE

EWSU WTP AFP PER
June 2021



AECOM	Evansville Water and Sewer Utility	**Exhibit A-2** **Project Location Map**
VS ENGINEERING	refresh EVANSVILLE	EWSU WTP AFP PER June 2021



AECOM	Evansville Water and Sewer Utility	**Exhibit A-3 Service Area Map**
VS ENGINEERING	refresh EVANSVILLE	**EWSU WTP AFP PER June 2021**

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Evansville Water and Sewer Utility

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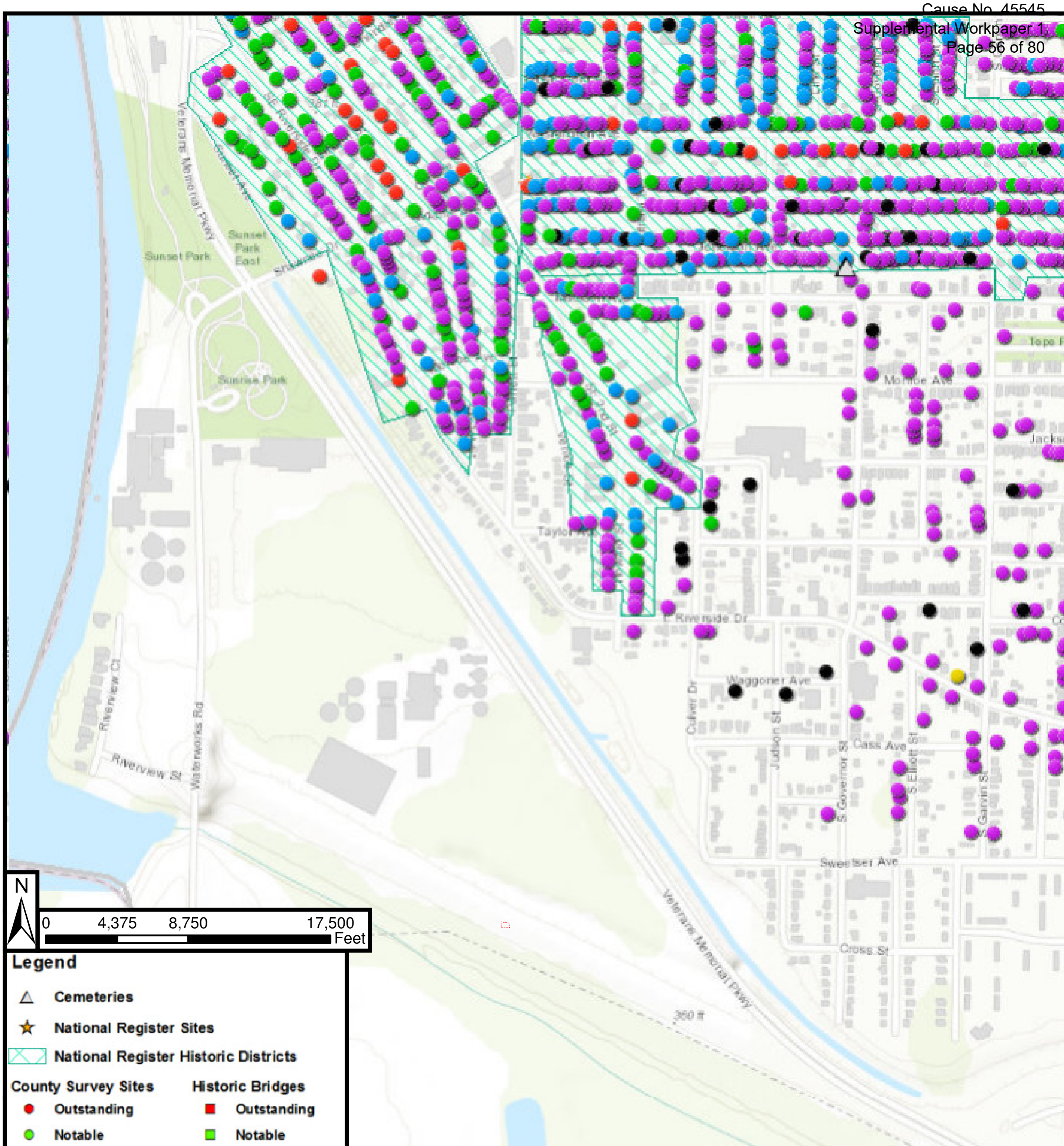
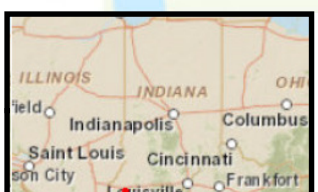
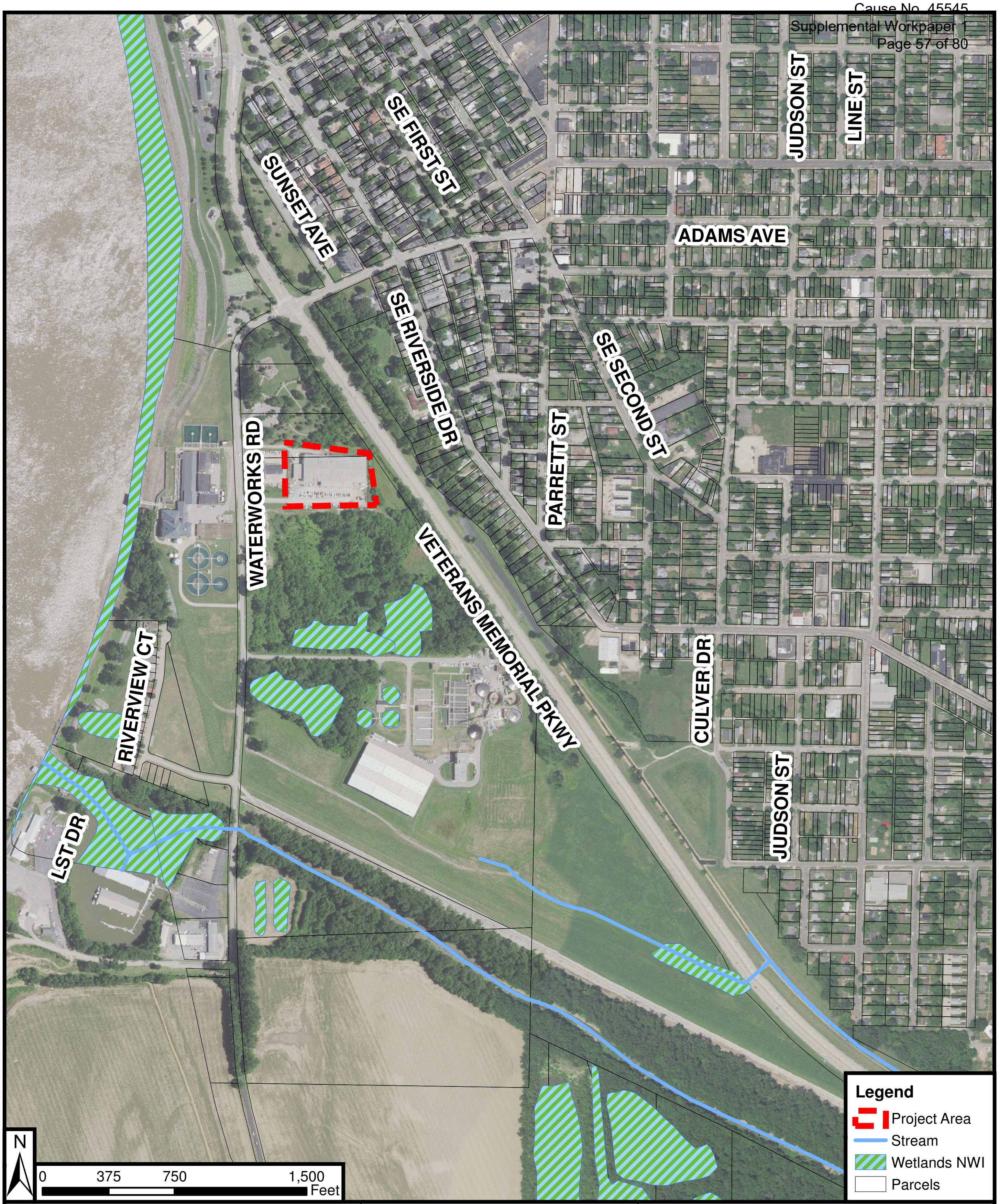
Exhibit A-4 Existing Site Map

EWSU WTP AFP PER
June 2021





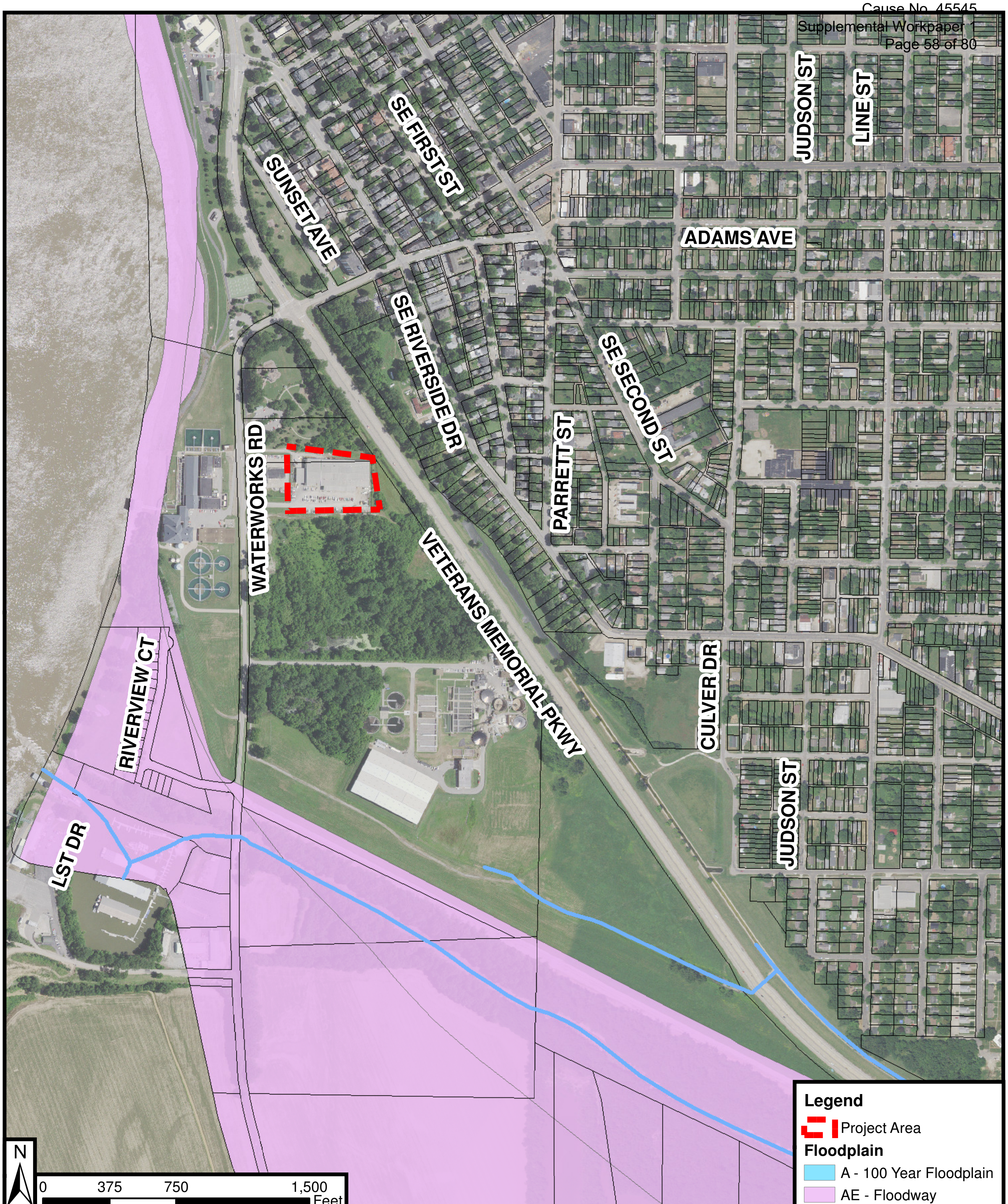
AECOM	Evansville Water and Sewer Utility	**Exhibit A-5** **Historic Properties (SHAARD)**
VS ENGINEERING	refresh EVANSVILLE	**EWSU WTP AFP PER** **June 2021**



Evansville Water and Sewer Utility

Exhibit A-6 Wetlands Map

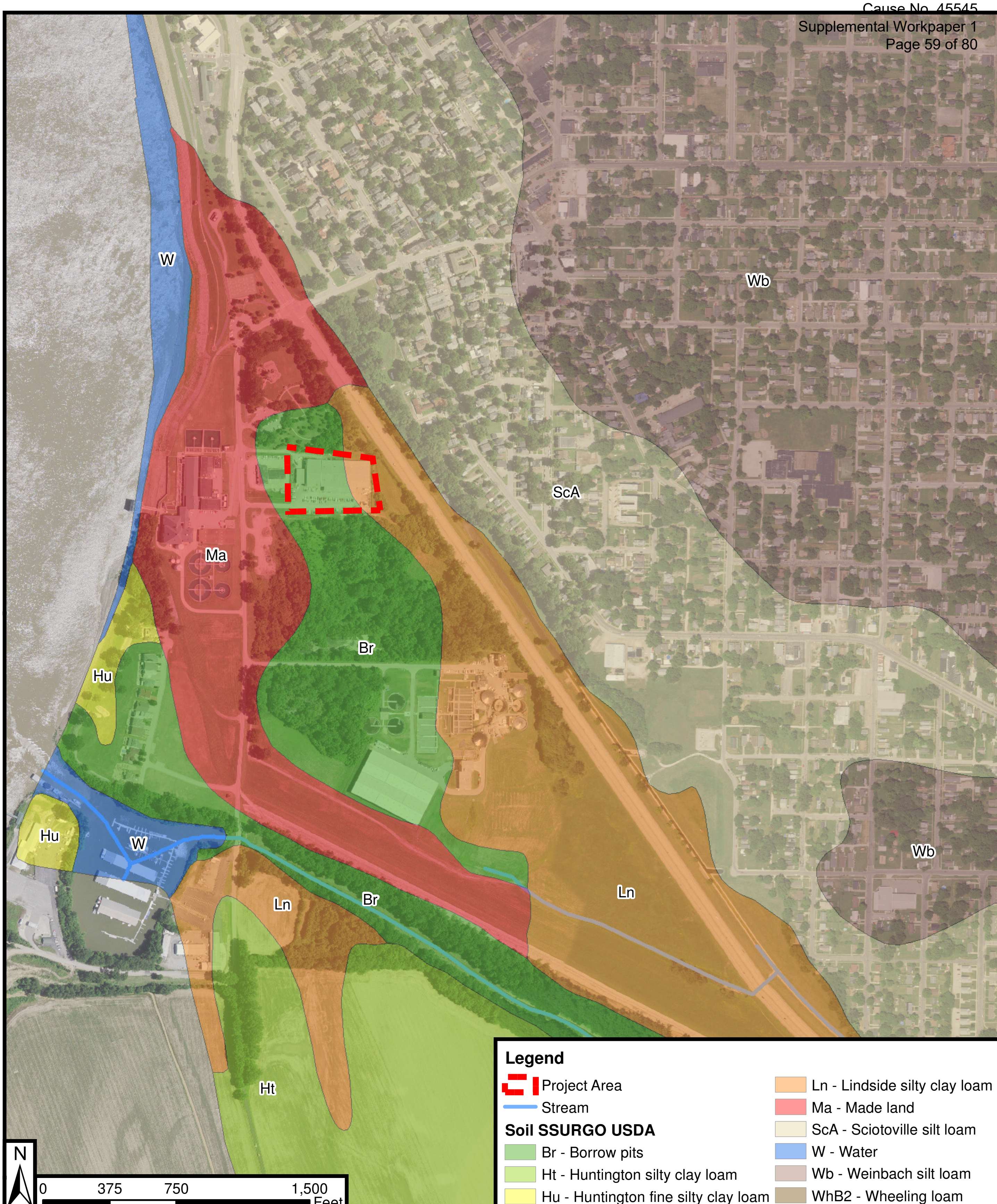
EWSU WTP AFP PER
June 2021



Evansville Water and Sewer Utility

Exhibit A-7
100-yr Floodplain Map

EWSU WTP AFP PER
June 2021



Evansville Water and Sewer Utility

Exhibit A-8
Soil Map

EWSU WTP AFP PER
June 2021

AECOM	Evansville Water and Sewer Utility	**Exhibit A-9 Proposed Site Map**
VS ENGINEERING	refresh EVANSVILLE	EWSU WTP AFP PER June 2021

ATTACHMENT A

SIGNATORY AUTHORIZATION RESOLUTION

DOCUMENTS TO BE PROVIDED TO SRF UPON RESOLUTION

Attachment A: DWSRF Loan Program
Signatory Authorization Resolution

Whereas, the _________ [insert name of Utility / Political Subdivision] of _________ [insert location], Indiana, (the "Participant") has plans for a drinking water infrastructure improvement project to meet State and Federal regulations, such as the Safe Drinking Water Act, and the Participant intends to proceed with the construction of such project:

Now, therefore, be it resolved by the Council / Board of Trustees, the governing body of the Participant, that:

1. _________ [insert name] be authorized to make application for a State Revolving Fund Loan ("SRF Loan") and provide the SRF Loan Program such information, data and documents pertaining to the loan process as may be required, and otherwise act as the authorized representative of the Participant; and

2. The Participant agrees to comply with State and Federal requirements as they pertain to the SRF Loan Program; and

3. Two certified copies of this Resolution be prepared and submitted as part of the Participant's Preliminary Engineering Report.

Adopted and Passed by the Council / Board of Trustees of the Utility / Political Subdivision of _________ [insert location], Indiana, this _________ [insert day] day of _________ [insert month], of 20____ [insert year].

Council / Board of Trustees

____
[insert name], President

Attest: ______________________________
[insert name], Secretary / Clerk Treasurer

Approved and signed by the Mayor of _________ [insert location], Indiana this _________ [insert day] day of _________ [insert month], of 20____ [insert year].

____
[insert name], Mayor

Attest: ______________________________
[insert name], Secretary / Clerk Treasurer

ATTACHMENT B

PER ACCEPTANCE FORM

DOCUMENTS TO BE PROVIDED TO SRF UPON ACCEPTANCE

Attachment B: DWSRF Loan Program
PER Acceptance Resolution

Whereas, the _________ [insert Utility / Political Subdivision] of _________ [insert location], Indiana, has caused a Preliminary Engineering Report ("PER"), dated _________, to be prepared by the consulting firm of_________; and

Whereas, said PER has been presented to the public at a public hearing held on _________ [insert date], at _________ [insert location], for public comment; and

Whereas, the _________ [insert Utility / Political Subdivision] Council / Board of Trustees finds that there was not sufficient evidence presented in objection to the recommended project in the PER.

Now, therefore be it resolved that:

1. The PER dated _________ [insert date] _________be approved and adopted by the _________ [insert Utility / Political Subdivision] Council / Board of Trustees; and

2. Said PER be submitted to the State Revolving Fund Loan Program for review and approval.

Adopted and Passed by the Council / Board of Trustees of the Utility / Political Subdivision of _________ [insert location], Indiana, this _________ [insert day] day of _________ [insert month], of 20____ [insert year].

Council / Board of Trustees

____
[insert name], President

Attest: _____________________________
[insert name], Secretary / Clerk Treasurer

Approved and signed by the Mayor of _________ [insert location], Indiana this _________ [insert day] day of _________ [insert month], of 20____ [insert year].

____
[insert name], Mayor

Attest: _____________________________
[insert name], Secretary / Clerk Treasurer

ATTACHMENT C

FINANCIAL INFORMATION FORM

Attachment C: DWSRF Loan Program
Financial Information Form

Proposed Project Costs:

Supply / wells cost	$ 6,752,000
Transmission / distribution System cost	$ 1,610,000
Treatment cost	$ 133,240,000
Storage cost	$ 8,804,000
Subtotal construction cost	$ 150,406,000
Contingencies (should not exceed 10% of construction cost)	$ 4,513,000
Non-construction costs	$ 12,006,000

e.g., engineering, legal and financial services related to the project, land costs, start-up costs, and construction inspection

Total Proposed Project Cost	$ 166,925,000

The following are not SRF Loan Program eligible:

Previously funded SRF components that have not met useful life	$ 0
Materials and work done on private property	$ 0
Grant applications and income surveys done for other agencies	$ 0
Expenses incurred as a part of forming a utility, Regional Sewer / Water District, or Conservancy District	$ 0
Total Ineligible Costs	$ 0

List other grant / loan funding sources and amounts

Other grants	$ 0
Other loans	$ 0
Hook-on fees	$ 0
Cash on hand	$ 0
Total Other Funding Sources	$ 0
Requested SRF Loan	$ 166,925,000
Estimated post-project user rate for 4,000 gallons	$ 45.86
Anticipated SRF interest rate	2.85%

Financial Advisor:

Firm Contact Baker Tilly Municipal Advisors, LLC

Name Doug Baldessari, CPA

Bond Counsel:

Firm Contact Barnes & Thornburg LLP

Name Thomas A. Pitman

ATTACHMENT D

PUBLIC NOTICE, COMMENTS, & TRANSCRIPT OF PUBLIC HEARING

DOCUMENTS TO BE PROVIDED UPON PUBLIC HEARING COMPLETION

Attachment D: DWSRF Loan Program
Public Notice

Notice of Public Hearing
[Name of water system/community]
Preliminary Engineering Report (PER) to obtain assistance from the Drinking Water State Revolving Fund (DWSRF) Loan Program

The [name of water system/community] will hold a public hearing at [time] on [date] at [place], [address]. The [name of water system/community]'s engineering consultant will present the recommended upgrades to [name of water system/community]'s drinking water infrastructure, which will include [general description], as described in the PER. The project will be funded through a DWSRF loan.

At this hearing, there will be the opportunity for questions and comments from the public. Participation is welcomed and encouraged. If special assistance is required at the meeting, please contact [phone#, name]. Copies of the PER are available for public viewing starting [date of notice] through [date 5 days following hearing] at [location]. Written comments regarding this project should be sent to [contact name, mailing address] prior to [date, 5 days following hearing].

ATTACHMENT E

PRELIMINARY DESIGN SUMMARY

Attachment E: DWSRF Loan Program
Preliminary Design Summary

INSTRUCTIONS: List existing and proposed design information.

1. General information
   1.1. Project name: Evansville Water and Sewer Utility (EWSU) new water treatment plant
2. Design information
   2.1. Current population: City: 118,000 - Served Population 173,000 (per IDEM)
   2.2. Design year and population: 2050 Design Year. Estimated City pop. of 184,400 and total served pop. of 253,300
   2.3. Average Design Flow: Current 23.6 MGD, 2050 = 36.4 MGD
      2.3.1. Domestic: Current = 13.3 MGD, 2050 = 18.7 MGD
      2.3.2. Commercial: Current = 6.1 MGD, 2050 = 10.2 MGD
      2.3.3. Industrial: Current = 4.2 MGD, 2050 = 7.5 MGD
   2.4. Peak design flow: 50 MGD
3. Water supply
   3.1. Surface water
      3.1.1. Location: Ohio River, intake location: 37° 57' 27.43" N - 87° 34' 27.34" W
      3.1.2. Type: River
      3.1.3. Volume: Median flow of > 23,000 cubic feet per second (14,800 MGD) near Evansville
   3.2. Ground water: NA
      3.2.1. Number of wells:
      3.2.2. Location:
      3.2.3. Type and diameter
      3.2.4. Capacity:
      3.2.5. Well house:
      3.2.6. Aquifer type:
   3.3. Emergency power: Yes, diesel generators. Secondary power is available if needed but currently not used at WTP
4. Flow meters
   4.1. Type: Magnetic (M) differential pressure (DP), and thermal mass (TM)
   4.2. Location: 2x raw water (DP), x12 filter effluent (DP), x2 finished water (M), various process areas: ozone (TM), filter air scour (TM)
5. Treatment
   5.1. Provide raw water analysis Attached at end of this form
   5.2. Pumps Yes - Vertical turbine with VFD
      5.2.1. Number: Six
      5.2.2. Capacity: 12 MGD Each, or 60 MGD firm capacity with one out of service
   5.3. Clarification 4 trains of conventional clarification w/ plate settlers
      5.3.1. Rapid mixing

5.3.1.1. Number: 4 parallel trains, each sized for 15 MGD

5.3.1.2. Size: 10 HP mixer. Each chamber is 6.5' x 6.5' x 6' SWD.

5.3.1.3. Detention time: 13 seconds at 15 MGD

5.3.2. Flocculation

5.3.2.1. Number: 4 parallel trains of 3-stage flocculation, each sized for 15 MGD

5.3.2.2. Size: 2 flocculatros per stage, each 2 HP. Each stage in 44' wide x 18' long x 17' SWD

5.3.2.3. Detention time: 35 minutes at 15 MGD

5.3.2.4. Flocculation speed: VFD motors. Initial set-point of Stage 1: 57 s^{-1}, Stage 2: 46 s^{-1}, Stage 3: 34 s^{-1}

5.3.2.5. Velocity: 1.5 feet per minute at 15 MGD

5.3.3. Sedimentation

5.3.3.1. Number: 4 parallel trains with plate settlers, each rated for 15 MGD

5.3.3.2. Size: 44' wide x 65' long x 17' SWD

5.3.3.3. Detention: NA w/ plate settlers, approximately 35 minutes

5.3.3.4. Baffle location: NA w/ plate settlers

5.3.3.5. Overflow rate: NA w/ plate settlers: Loading of <0.5 gpm/ft^2 considering 80% efficiency

5.3.3.6. Velocity: NA w/ plate settlers

5.3.3.7. Sludge removal: Hoseless traveling sludge collector w/ control valve - diverted to residuals pump station

5.4. Filtration

5.4.1. Type: Gravity, biologically active with sand and GAC

5.4.2. Number and size of units: 12 units, each 22' x 44' (968 ft^2 each)

5.4.3. Peak flow rate: 4 gpm/ft^2 loading rate, or 5.58 MGD per filter

5.4.4. Average flow rate: Approximately 2.1 MGD per filter, or loading rate of 1.5 gpm/ft^2

5.4.5. Backwash rate: Maximum of 15 gpm/ft^2 without using air scour (14,520 gpm)

5.4.6. Backwash pumps (number and capacity): NA - Backwash tank filled from high service (50 MGD capacity)

5.4.7. Backwash tank capacity: 300,000 gallons

5.4.8. Wastewater tank capacity: 185,000 gallons

5.4.9. Method of cleaning: Filters are backwash with air scour, automatic control. Tanks cleaned manually

5.4.10. Disposal of backwash solids: Pending IDEM Requirements: Disposal to Ohio River or Dewatering/Landfill

5.5. Aeration NA

5.5.1. Type:

5.5.2. Loading rate:

5.6. Iron and Manganese Control

5.6.1. Type: Any iron and manganese present in river is oxidized and removed with the pretreatment & filtration processes

5.7. Softening NA

5.7.1. Type:

5.7.2. Chemical feed location:

5.7.3. Sludge removal and disposal method:

5.7.4. Number and size of brine tank:

5.7.5. Brine waste disposal:

6. Disinfection

6.1. Type of disinfectant used: Sodium hypochlorite (free chlorine) - water is also ozonated but not requesting CT credit

6.2. Type of chemical feed system: Sodium hypochlorite (free chlorine)

6.3. Capacity: Two 2.5 MG clearwells. Two 10,300 gallon sodium hypochlorite storage tanks

6.4. Disinfectant dosage: Chlorine residual of 1.8 mg/L +/-

6.5. Contact time: 5 million gallon clearwell = 144 minutes at 50 MGD

6.6. Point of application: Primary - filtered water well ahead of clearwell. Normally not before filters due to biologically acitve

6.7. Automatic switchover: NA for liquid system - redundant metering pumps provided

6.8. Ventilation provided: Continuously exhausted

6.9. Safety equipment: Emergency eyewash in room, separated containment area, fire suppression, high storage tank level alarms

6.10. Testing equipment: Pump calibration column, residual chlorine analyzers, lab analyzer

6.11. Housing: Chemical feed area housed in new masonry building

7. Controls

7.1. Type: Fully automated with plant-wide SCADA system

8. Water storage

8.1. Type: Cast in place concrete clearwell structure located below filters. Numerous storage tanks in City

8.2. Number: Two clearwells. Eight storage tanks in Ciy

8.3. Capacity: Clearwells: 2.5 million gallons each. Others: 20 MG, 4 MG, 1.5 MG, 1 MG, and four (4) 0.5 MG tanks

8.4. High and low water level: Clearwell; High level of 350 feet. Low operating level of 346 feet (increase production)

8.5. Elevation at bottom of tank: Clearwell: 333 feet.

8.6. Available pressure: Vertical turbine pump submergence in clearwell results in 8 to 12 feet to center of pump bowls

8.7. Booster pump: Six vertical turbine high service pumps, each rated at 10 MGD

9. Distribution system

9.1. Type of pipe material: Varies. Approx 45% cast iron, 33% PVC, 15% ductile, 3% concrete, and 4% others

9.2. Diameter and lengths: Over 5.3 million linear feet of waterlines ranging in size from 1 inch to 60 inch.

9.3. Number of hydrants: Approximately 6,424

9.4. Number and size of valves: Approximately 26,900 ranging from 1 to 60 inch

9.5. Separation distance from sanitary sewers: 10' minimum horizontal and 18" minimum vertical separation

9.6. Separation distance from other water mains: Variable throughout City and numerous interconnections and looping exists

9.7. Fire protection: Coverage throughout city via hydrants and elevated storage

10. Miscellaneous

10.1. Laboratory equipment: Incubators, waterbath, autoclave, nanopure water, refrigerators, spectrophotometer, GCMS, turbidimeter, pH probe, conductivity meter, chlorine analyzer, fluoride analyzer, blue/green algae analyzer, TOC analyzer, atrazine spec., fume hood, hot plates, colorimeters, lab sinks, storage and glassware, computers

10.2. Safety equipment: Eyewash stations, handrails, fall protection, ladder safety cages, various alarms

10.3. Fence location and type: Full perimeter chain link fence and CCTV security cameras

10.4. Emergency power: Yes, diesel generators. Secondary power is available if needed but currently not used at WTP

10.5. Sampling facilities: Yes, diesel generators. Secondary power is available if needed but currently not used at WTP

10.6. Utility building: 3-bay garage

Parameter	Unit	Avearge	Median	Standard Deviation	5th Percentile	95th Percentile
Turbidity	NTU	54	42	44	11	140
Total Suspended Solids	mg/L	72	50	69	12	206
Total Dissolved Solids	mg/L	242	238	51	172	334
Total Organic Carbon	mg/L	3.75	3.70	0.77	2.60	5.10
Iron	mg/L	0.29	0.23	0.22	0.07	0.68
Manganese	mg/L	0.19	0.16	0.20	0.06	0.41
Calcium	mg/L CaCO3	93	94	12	74	112
Magnesium	mg/L CaCO3	39	38	10	26	56
Total Hardness	mg/L CaCO3	133	132	18	104	162
pH	SU	7.78	7.79	0.22	7.60	7.98
Total Alkalinity	mg/L CaCO3	88	88	12	70	108
Chloride	mg/L	15.7	15.0	5.1	9.0	24.3
Sulfate	mg/L	38	37	10	24	58
Silica	mg/L	3.9	3.9	1.9	0.7	6.7
Phosphorus	mg/L	0.18	0.17	0.08	0.08	0.31
Atrazine	ug/L	0.35	0.18	0.45	0.00	1.22
Total Coliforms	CFU/100 mL	6,098	3,255	8,931	435	19,863
Fecal Coliforms	CFU/100 mL	171	52	445	3	650
Tempearture	Degrees F	61	63	16	37	82

ATTACHMENT F

GREEN PROJECT RESERVE

Attachment F: DWSRF Loan Program

STATE REVOLVING FUND LOAN PROGRAM

GREEN PROJECT RESERVE SUSTAINABILITY INCENTIVE

DRINKING WATER CHECKLIST
REVISED OCTOBER 2015

SRF Loan Program Participant Information

Participant Name: Evansville Water and Sewer Utility

Project Name/Location: New Water Treatment Plant / Evansville, IN

Date: June 1, 2021 Revision No. 0

Instructions

This checklist shall be completed by the SRF Loan Program participant and be updated as the project changes from concept to design through construction completion. A checklist should be submitted with:

1. The SRF Loan Program Application,
2. The Preliminary Engineering Report, along with GPR project description and cost estimates,
3. The Post-Bid Documents, including GPR construction costs, and
4. Construction completion.

Please see the *U.S. EPA Green Project Reserve Guidance,* available at www.srf.in.gov, for a detailed review of eligibility; definition of the GPR categories; examples of ineligible projects; categorical projects and those that require business cases. **All GPR projects, components, and activities must be eligible for SRF funding.**

Check all that apply to the project:

I. GREEN INFRASTRUCTURE

1. Categorical Projects
   - ☐ The following types of projects, done at a utility-owned facility or as part of a water infrastructure project, can be counted toward the GPR if they are a part of an eligible DWSRF project:
     - ☐ Pervious or porous pavement,
     - ☐ Bioretention,
     - ☐ Green roofs,
     - ☐ Rainwater harvesting/cisterns,
     - ☐ Gray water use,
     - ☐ Xeriscape,
     - ☐ Landscape conversion programs, and
     - ☐ Moisture and rain sensing irrigation equipment.

2. Decision Criteria For Business Cases
   - ☐ Green infrastructure projects are designed to mimic the natural hydrologic conditions of the site or watershed.
   - ☐ Projects capture, treat, infiltrate, or evapotranspire stormwater on the parcels where it falls and does not include inter basin transfers of water.

- ☐ GPR project is in lieu of or to supplement municipal hard/gray infrastructure.
- ☐ Other - Please provide an attachment explaining the scope of the project and brief explanation of the approach for the business case.

II. WATER EFFICIENCY

1. Categorical Projects
   - ☐ Installing or retrofitting water efficient devices such as plumbing fixtures and appliances.
     - ☐ For example – showerheads, toilets, urinals, and other plumbing devices.
     - ☐ Water sense labeled products.
     - ☐ Implementation of incentive programs to conserve water such as rebates.
   - ☐ Installing any type of water meter in previously unmetered areas, if rate structures are based on metered use.
     - ☐ Can include backflow prevention devices if installed in conjunction with water meter.
   - ☐ Replacing existing broken/malfunctioning water meters with:
     - ☐ Automatic meter reading systems (AMR), for example:
       - ☐ Advanced metering infrastructure (AMI)
       - ☐ Smart meters
     - ☐ Meters with built in leak detection,
     - ☐ Can include backflow prevention devices if installed in conjunction with water meter replacement.
   - ☐ Retrofitting/adding AMR capabilities or leak equipment to existing meters (not replacing the meter itself).
   - ☐ Conducting water utility audits, leak detection studies, and water use efficiency baseline studies, which are reasonably expected to result in a capital project or in a reduction in demand to alleviate the need for additional capital investment.
   - ☐ Developing conservation plans/programs reasonably expected to result in a water-conserving capital project or in a reduction in demand to alleviate the need for additional capital investment.
   - ☐ Recycling and water reuse projects that replace potable sources with non-potable sources:
     - ☐ Gray water, condensate, and wastewater effluent reuse systems (where local codes allow the practice).
     - ☐ Extra treatment costs and distribution pipes associated with water reuse.
   - ☐ Retrofit or replacement of existing landscape irrigation systems to more efficient landscape irrigation systems, including moisture and rain sensing controllers.
   - ☐ Projects that result from a water efficiency related assessments (such as water audits, leak detection studies, conservation plans, etc) as long as the assessments adhered to the standard industry practices referenced above.
   - ☐ Distribution system leak detection equipment, portable or permanent.
   - ☐ Automatic flushing systems (portable or permanent).
   - ☐ Pressure reducing valves (PRVs).
   - ☒ Internal plant water reuse (such as backwash water recycling).

2. Decision Criteria for Business Cases
   - ☒ Water efficiency can be accomplished through water saving elements or reducing water consumption. This will reduce the amount of water taken out of rivers, lakes, streams, groundwater, or from other sources.
   - ☒ Water efficiency projects should deliver equal or better services with less net water use as compared to traditional or standard technologies and practices.
   - ☒ Efficient water use often has the added benefit of reducing the amount of energy required by a drinking water system, since less water would need to be treated and transported; therefore, there are also energy and financial savings.

- ☐ Proper water infrastructure management should address where water losses could be occurring in the system and fix or avert them. This could be achieved, for example, by making operational changes or replacing aging infrastructure.
- ☒ Other – Please provide an attachment explaining the scope of the project and brief explanation of the approach for the business case. See attached summary

3. Example Projects Requiring a Business Case
   - ☐ Water meter replacement with traditional water meters.
   - ☐ Distribution pipe replacement or rehabilitation to reduce water loss and prevent water main breaks.
   - ☐ Storage tank replacement/rehabilitation to reduce water loss.
   - ☐ New water efficient landscape irrigation system.

III. ENERGY EFFICIENCY

1. Categorical Projects
   - ☐ Renewable energy projects, which are part of a larger public health project, such as wind, solar, geothermal, and micro-hydroelectric that provide power to a utility. Micro-hydroelectric projects involve capturing the energy from pipe flow.
     - i. Utility-owned renewable energy projects can be located on-site or off-site
     - ii. Includes the portion of a publicly owned renewable energy project that serves the utility's energy needs
     - iii. Must feed into the grid that the utility draws from and/or there is a direct connection
   - ☐ Utility energy management planning, including energy assessments, energy audits, optimization studies, and sub-metering of individual processes to determine high energy use areas, which are reasonably expected to result in energy efficiency capital projects or in a reduction in demand to alleviate the need for additional capital investment.
   - ☒ National Electric Manufacturers Association (NEMA) Premium energy efficiency motors (http://www.nema.org/gov/energy/efficiency/premium/).

2. Decision Criteria For Business Cases
   - ☒ Projects should include products and practices which will decrease environmental impacts, such as reducing greenhouse gas emissions, and provide financial savings.
   - ☒ Projects should include approaches to integrate energy efficient practices into daily management and long-term planning.
   - ☒ Operator training in conjunction with any energy savings project is strongly encouraged in order to maximize the energy savings potential.
   - ☐ Using existing tools such as Energy Star's Portfolio Manager (http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager) or Check Up Program for Small Systems (CUPSS) (http://www.epa.gov/cupss/) to document current energy usage and track anticipated savings.
   - ☒ Other – Please provide an attachment explaining the scope of the project and brief explanation of the approach for the business case. See attached summary

3. Example Projects Requiring A Business Case
   - ☒ Energy efficient retrofits, upgrades, or new pumping systems and treatment processes (including variable frequency drives (VFDs)).
   - ☐ Pump refurbishment to optimize pump efficiency (such as replacing or trimming impellers if pumps have too much capacity, replacing damaged or worn wearing rings/seals/bearings, etc).
   - ☐ Projects that result from an energy efficiency related assessments (such as energy audits, energy assessment studies, etc), that are not otherwise designated as categorical.
   - ☐ Projects that cost effectively eliminate pumps or pumping stations.
   - ☐ Projects that achieve the remaining increments of energy efficiency in a system that is already very efficient.

- ☐ Upgrade of lighting to energy efficient sources (such as metal halide pulse start technologies, compact fluorescent, light emitting diode, etc).
- ☐ Automated and remote control systems (SCADA) that achieve substantial energy savings (see AWWA M2 Instrumentation and Control).

IV. ENVIRONMENTALLY INNOVATIVE

1. Categorical Projects
   - ☐ Total/integrated water resources management planning, or other planning framework where project life cycle costs (including infrastructure, energy consumption, and other operational costs) are minimized, which enables communities to adopt more efficient and cost-effective infrastructure solutions.
     - ☐ Plans to improve water quantity and quality associated with water system technical, financial, and managerial capacity.
     - ☐ Eligible source water protection planning:
       - ☐ Periodic, updated, or more detailed source water delineation or assessment as part of a more comprehensive source water protection program,
       - ☐ Source water monitoring (not compliance monitoring) and modeling as part of a more comprehensive source water protection program.
     - ☐ Planning activities by a utility to prepare for adaptation to the long-term effects of climate change and/or extreme weather.
   - ☐ Utility Sustainability Plan consistent with EPA's SRF sustainability policy.
   - ☐ Greenhouse gas (GHG) inventory or mitigation plan and submission of a GHG inventory to a registry (such as Climate Leaders or Climate Registry), as long as it is being done for a facility which is eligible for DWSRF assistance.
   - ☐ Source Water Protection Implementation Projects.
     - ☐ Voluntary, incentive based source water protection measures pursuant to Section 1452(k)(1)(A)(ii), where the state primacy agency has determined that the use of such measures will reduce or preclude the need for treatment.
   - ☐ Construction of US Building Council LEED certified buildings, or renovation of an existing building, owned by the utility, which is part of an eligible DWSRF project.
     - ☐ Any level of certification (Platinum, Gold, Silver, Certified).
     - ☐ All building costs are eligible, not just stormwater, water efficiency and energy efficiency related costs. Costs are not limited to the incremental additional costs associated with LEED certified buildings.

2. Decision Criteria For Business Cases
   - ☐ State programs are allowed flexibility in determining what projects qualify as innovative in their state based on unique geographical and climatological conditions.
     - ☐ Technology or approach whose performance is expected to address water quality but the actual performance has not been demonstrated in the state; or
     - ☐ Technology or approach that is not widely used in the state, but does perform as well or better than conventional technology/approaches at lower cost; or
     - ☐ Conventional technology or approaches that are used in a new application in the state.
   - ☐ Other – Please provide and attachment explaining the scope of the project and brief explanation of the approach for the business case.

3. Example Projects Requiring A Business Case
   - ☐ Projects or components of projects that result from total/integrated water resources management planning (including climate change) consistent with the Decision Criteria for environmentally innovative projects and that are DWSRF eligible,
   - ☐ Application of innovative treatment technologies or systems that improve environmental conditions and are consistent with the Decision Criteria for environmentally innovative projects, such as:
     - ☐ Projects that significantly reduce or eliminate the use of chemicals in water treatment,

- ☐ Treatment technologies or approaches that significantly reduce the volume of residuals, minimize the generation of residuals, or lower the amount of chemicals in the residuals,
- ☐ Trenchless or low impact construction technology,
- ☐ Using recycled materials or re-using materials on-site.

☐ Educational activities and demonstration projects for water or energy efficiency (such as rain gardens).

☐ Projects that achieve the goals/objectives of utility asset management plans.

V. CLIMATE AND EXTREME WEATHER RESILIENCY

1. Categorical Projects – none at this time.

2. Decision Criteria for Business Cases

- ☐ Utility functions and performance can be disrupted by climate change/extreme weather events.
  - ☐ Flooding
  - ☐ Drought
  - ☐ Tornado
  - ☐ Lightning
  - ☐ Earthquake
- ☐ Incorporate project elements that provide flexibility to adapt operations and functionality as external conditions change.
- ☐ Project components designed to perform beyond the minimum Building Code or Design Standards.
- ☐ Utilize climate resiliency and adaptation strategies when siting or routing key project structures or components.
- ☐ Ability to modify or expand proposed facilities based on future climate change issues.
- ☐ Other - Please provide an attachment explaining the scope of the project and brief explanation of any aspects in the planning, construction or operation phase that support the approach for the business case.

3. Examples of Projects Requiring a Business Case

- ☐ Utilizing natural, native and drought resistant planted elements that are economically replaced at project sites for storm water control or landscaping.
- ☐ Siting new structures away from flash flood areas or poor structural soils in former waterway areas.
- ☐ Consideration of finished floor elevation above the 100-year flood elevation or normal code requirements.
- ☐ Increasing structural, roof (snow) or wind loadings beyond code requirements for new structures.
- ☐ Incorporate passive cooling systems for instrumentation, control or power panel rooms subject to high heat conditions.