

CITY OF BLYTHEVILLE

BLYTHEVILLE, ARKANSAS

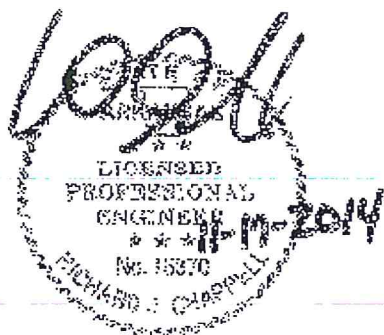
CORRECTIVE ACTION PLAN

WASTEWATER TREATMENT FACILITIES ASSESSMENT AND
RECOMMENDED PLAN FOR CORRECTIVE MEASURES



CORRECTIVE ACTION PLAN

Wastewater Treatment Facility
Assessment and Recommended
Plan for Corrective Measures



Richard Chappell, P.E. BCEE
Project Engineer



Marshall Fall, E.I
Project Manager

Prepared for:
City of Blytheville

Prepared by:
Smith Seckman Reid, Inc.
2650 Thousand Oaks Blvd.
Suite 3200
Memphis, TN 38118
Tel 901.683.3900
Fax 901.683.3990

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1 Executive Summary

In April 2014, the City of Blytheville (City) received a Notice of Violation (NOV) from the Arkansas Department of Environment Quality (ADEQ). The NOV was in response to a review of monthly operating reports (MORs) from the City's South Wastewater Treatment Facility (SWWTF), which showed violations of the plant's National Pollutant Discharge Elimination System (NPDES) permit (No. AR0022578). This NOV described two violations concerning nitrogen-ammonia concentrations in the SWWTF effluent. Also in April 2014, the City received a second NOV for discharge violations at the City's West Wastewater Treatment Facility (WWWTF). This facility had 13 violations of NPDES Permit No. AR0022560. The violations included excessive fecal coliform (colonies), ammonia concentrations, and total suspended solids (TSS) concentrations in the plant effluent.

In an e-mail correspondence dated Tuesday, August 19, 2014, ADEQ requested that the City issue a detailed Corrective Action Plan (CAP) to address the violations at the two treatment plants. ADEQ also requested that the CAP address measures by the City to begin treating for mercury removal.

After reviewing plant data and the existing operations at each plant, the following corrective actions were developed. Once implemented by the City, these corrective actions should allow each treatment plant to return to compliance with their respective NPDES permit.

1. Consult with existing aeration and mixing equipment manufacturer to initiate field investigations aimed at confirming all aeration and mixing equipment is operating as designed. Implement equipment repair and/or replacement recommendations suggested by manufacturer.
2. Aggressively locate areas of inflow and infiltration that could be affecting the establishment of a healthy nitrifying biomass within the process basins, focusing on areas of the collection system feeding the South and West WWTF pumping stations.
3. Increase the rate of sludge recycling to maintain a mixed liquor concentration between 1,500 and 5,000 mg/L. Repair and/or replace equipment to ensure sufficient recycling is occurring.
4. Implement a detailed engineering study to identify the source(s) of mercury in the influent waste stream. This study will establish the forms that the mercury occurs (e.g., metallic, ionic, organic).
5. Conduct rate study and review capital expenditure plans to ensure adequate revenue stream to allow for effective operation, maintenance, repair, and replacement of WWTF equipment.
6. Install synthetic media in the primary basins of each plant to encourage the growth of nitrifying bacteria and prevent bacteria from washing out of the facilities during heavy flow events.
7. Incorporate automatic control measures at all pumping facilities and/or construct influent equalization basins to prevent surging of the treatment basins.
8. Based on the mercury speciation study, construct appropriate treatment technologies necessary to remove mercury from the plant effluent.

2 General Information

2.1 Description of Wastewater Treatment Facilities

The City treats wastewater at three treatment facilities. This CAP will address issues with two of the facilities, the WWTF and the SWWTF. These two facilities are modified lagoons that use the BIOLAC® technology. The facilities consist of traveling screens, a primary aeration and mixing basin, integral clarifiers to facilitate settling, a basin that incorporates both aerated and non-aerated polishing, and ultra-violet disinfection. The capacity of the WWTF is 1.5 million gallons per day (MGD) and the capacity of the SWWTF is 1.4 MGD. These facilities were built adjacent to retired non-aerated lagoons that were repurposed as sludge disposal basins for each facility. Both facilities were constructed and commissioned in 1989.

The source of wastewater for the SWWTF is four pumping stations with a combined total capacity of 8,060 gallons per minute (GPM). The source of wastewater flow for the WWTF is three pumping stations with a combined total capacity of 6,325 GPM. The pump stations and their respective pumping capacities are summarized in Table 2.1.

Table 2.1- Flow Source (PS Capacities)

South Plant	County Road	1,400 GPM x 2 pumps
	Byrum Road	1,400 GPM x 2 pumps 700 GPM x 1 pump
	College	180 GPM x 2 pumps
	Barker	700 GPM x 2 pumps
West Plant	Shop Lift	1,700 GPM x 2 pumps 7,00 GPM x 1 pump
	820	650 GPM x 2 pumps 700 GPM x 1 pump
	Alert Pad	225 GPM x 1 pump

2.2 Description of Need

In the last eighteen months, the West and South WWTFs have experienced ongoing effluent violations of their respective NPDES permits. Violations have included ammonia (both concentrations and loads), fecal coliform colonies, and TSS concentrations.

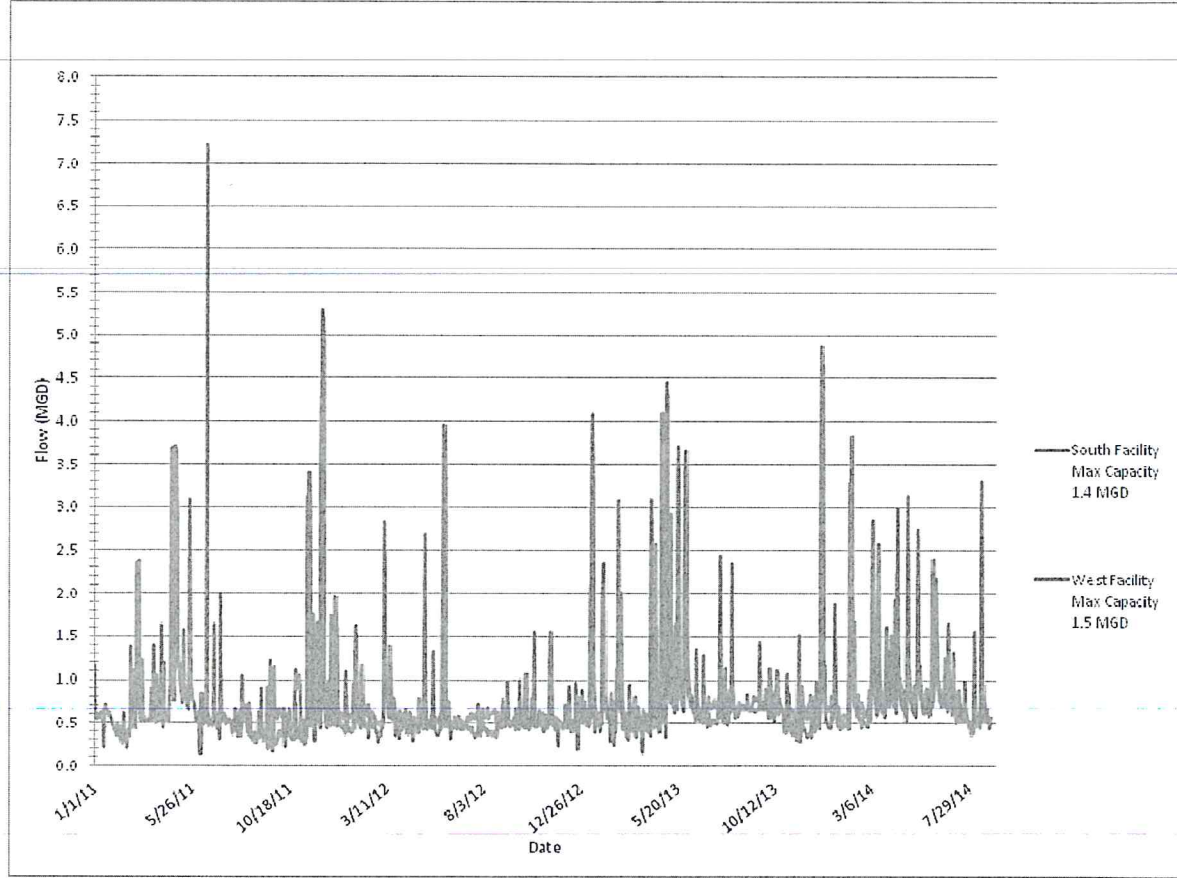
2.3 Influent and Effluent Flows

The daily effluent flows for each treatment facility are summarized in Table 2.2 and Figure 2.1. The Figure also illustrates how frequently the influent flows exceed the design flow of each facility. As evidenced by the Figure below, both facilities have multiple days where influent flows exceed the plant's design capacity. Over the last two years, influent flows have exceeded the design flow by as much as 200 percent.

Table 2.2 – Daily Effluent Flows

Flow Condition	South Plant (million gallons)	West Plant (million gallons)
Minimum Day	0.343	0.148
Average Day	0.854	0.687
Maximum Day	4.851	5.274

Figure 2.1 – Daily Effluent Flows



These flow excursions are directly related to rainfall events as identified in the Daily Operation Report Calculations (DOR's) provided by the City. During these spikes, the plant loses a majority of its microbial treatment ability due to the washout of the nitrifying organisms from the treatment basins. This is confirmed by the Daily Monitoring Reports (DMRs) that show lower-than-normal mixed liquor suspended solids (MLSS) concentrations in the primary mixing basin (as compared to pre-rainfall concentrations) and high total suspended solids (TSS) concentrations in the effluent after every rain event that increased plant flow. The carbonaceous biochemical oxygen demand (CBOD) loading in the influent flow also drops significantly during and immediately after every rainfall event that affects flow due to dilution by inflow and infiltration. This diluted CBOD loading further promotes degradation of the biomass used to treat the wastewater.

Both facilities were originally designed to have a hydraulic residence time of between 24 and 48 hours to allow for adequate treatment. When the plant receives flows in excess of the design flow, three conditions occur that affect the treatment capabilities of the plants: (1) the hydraulic residence time is reduced such that there is not adequate time for treatment to occur; (2) the additional flow has a very low concentration of CBOD, sharply decreasing the strength of the waste stream, and depriving the biomass of needed nutrients for growth and treatment abilities; and (3) the MLSS concentration in the treatment basin is significantly reduced due to washout of the biomass from the basins, thereby preventing adequate treatment of subsequent incoming flows. As a result of these conditions, each facility could possibly be out of compliance for multiple permit limits for several days while the biomass attempts to reestablish itself.

2.4 Influent and Effluent Quality

Plant MORs were analyzed for the South and the West WWTFs to diagnose the violations reported by ADEQ. The information submitted covered nearly four years of operating data from 2011 to 2014 for the two plants. The data included influent and effluent properties that are monitored on a regular basis to verify the plant's compliance with the NPDES permits and ability to treat the waste stream.

2.4.1 pH

The pH level in the wastewater will significantly impact the rate of microbial growth. Most microorganisms thrive in wastewater with pH levels in the 6.5 to 8.5 range. If the pH levels are below 6.5, the stream is considered acidic. Above a pH of 8.5, the stream is considered basic. The NPDES permits for the South and West WWTFs have a minimum and 7-day average maximum effluent limits. The effluent data from both the West and the South WWTFs suggest that neither plant is having an issue with the pH levels in their effluent stream. A summary of effluent pH data for both plants is provided in Table 2.3.

Table 2.3 –Effluent pH Readings

	Permit Limit (High/Low)	South Plant	West Plant
7-Day Average (SU)	6.0/9.0	7.5	7.3
Monthly Average (SU)	6.0/9.0	7.5	7.3

2.4.2 Ammonia

The ammonia level in the effluent flow is a direct reflection of the amount of nitrification provided by biological processes within each lagoon treatment facility. Ammonia is removed from the waste stream by conversion into nitrites and nitrates by nitrifying bacteria. Several of the waste stream properties that have a major effect on the nitrification process were closely analyzed for this CAP in order to assess operating conditions both WWTFs. The NPDES permits have three effluent discharge limitations that must be met to avoid violations (i.e., monthly average concentration, 7-day average concentration, and monthly mass loadings). The permit limits differ for the colder winter months (October to March) and warmer summer

months (April to September) for the WWTF only. These limits have been violated multiple times at the WWTF. A summary of South and West WWTFs effluent ammonia data is provided in Table 2.4.

Table 2.4 – Effluent Ammonia Readings

Effluent Reading	South Plant/Permit Limit	West Plant/Permit Limit	
		Winter Months (Oct - Mar)	Summer Months (Apr-Sept)
7-day avg. (mg/L)/Permit Limit	5.0/3.0	2.1/5.0	2.8/5.0
Monthly Avg. (mg/L)/ Permit Limit	3.0/2.0	2.1/3.0	1.8/2.8
Mass (lb/Day)/ Permit Limit	38/23	12.5/38	14.0/35.0

2.4.3 Carbonaceous Biochemical Oxygen Demand (CBOD)

CBOD is a measure of organic oxygen demand of the waste stream. This measurement is typically used to determine the “strength” of the waste stream. Wastewater with primarily domestic waste typically has a CBOD concentration between 160 and 180 mg/L. Based on the data provided by the City, the South and West WWTFs see widely varying concentrations of CBOD in the influent. Both the South and West facility’s data suggest that neither plant has an issue with CBOD concentrations in the effluent. A summary of effluent CBOD data is provided in Table 2.5.

Table 2.5 – Effluent CBOD Readings

Effluent Reading	South Plant/Permit Limit		West Plant/Permit Limit
	Winter Months (Oct - May)	Summer Months (June-Sept)	
7-Day Average (mg/L)	3.1/37.5	2.5/45	3.9/37.5
Monthly Average (mg/L)	3.1/255	2.6/30	3.9/25
Monthly Average (lbs/day)	23.5/292	15.0/350	23.3/313

2.4.4 Total Suspended Solids (TSS)

TSS is a measurement of solids of a particular size in the waste stream. This measurement is typically reported in units of mg/L (concentration) or lbs/day (mass). Excessive levels of TSS in a plant effluent can have several adverse effects on the receiving waters. High levels of TSS can cause scum to collect at or near discharge sites which can harbor harmful pathogens. TSS can also block out sunlight that native organisms in the receiving water body depend on for survival. One of the most important effects of high TSS levels is the effect it has on disinfection. High TSS levels will inhibit the effectiveness of the UV disinfection process by limiting the transitivity of the ultraviolet rays. In short, the suspended solids block the ultraviolet rays from reaching the target organisms. A high level of TSS in an effluent stream can also indicate that the hydraulic residence time for treatment is insufficient.

Based on the data provided by the City, as influent flows increase beyond the design capacities of each plant, the TSS concentrations in the effluent also increases due to solids being washed out of the plants. A summary of effluent TSS data is provided in Table 2.6.

Table 2.6 – TSS Readings

Effluent Reading	Permit Limit (South/West)	South Plant	West Plant
7-day Average (mg/L)	45	9.7	12.9
Monthly Average (mg/L)	30	9.9	13.1
Monthly Average (lb/day)	350/375	69.3	102.3

2.4.5 Fecal Coliform

Fecal coliform is a bacterium found in the intestines of warm blooded animals. It is an indicator organism that can suggest the presence of more harmful pathogenic organisms. High levels of fecal coliform can indicate poor treatment process performance of the WWTFs. The City's WWTF has violated the NPDES discharge permit twice by exceeding the allowable concentration of fecal coliform in the plant effluent. An analysis of the plant data indicates that the dates of the violations correlate to the dates the plant received an excessive volume of flow causing solids to be washed out of the plant. A high concentration of solids in the effluent stream can reduce the effectiveness of the UV disinfection system causing pathogens to survive through the process. A summary of the average effluent fecal coliform readings for the 2011-2014 data is provided in Table 2.7.

Table 2.7 – Fecal Coliform Readings

Effluent Reading	South Plant/Permit Limit	West Plant/Permit Limit	
		Winter Months (Oct - Mar)	Summer Months (Apr-Sept)
7-day avg. (colonies/100 ml)	234/2000	361/2000	172/400
Monthly Avg. (colonies/100 ml)	293/1000	400/1000	238/200

3 Proposed Treatment Plant Corrections

The proposed treatment facility corrective actions described below intend to mitigate violations of each plant's NPDES permit by attempting to utilize existing facilities and personnel to the greatest extent practical. Recommendations are made on the basis of short, medium, and long term time frames. Short-term actions should be completed within three months, medium-term actions within one year, and long term actions may take several years.

3.1 Short Term Actions

1. Upon visual inspection of the existing facilities, the WWTF treatment process appears to be hindered by a lack of mixing within the primary and polishing basins (the SWWTF does not appear to have this issue). To correct this issue, the City will contact the original equipment manufacturer and request a site visit from a trained technician capable of evaluating the aeration and mixing process within the primary and polishing basins and confirming the design conditions are being met by the installed equipment. Manufacturer should evaluate the operation of the traveling aerators and the operating condition of the diffusers to ensure adequate aeration and mixing is taking place within the basins. The manufacturer will offer options and suggestions to upgrade, repair and/or replace existing equipment that will be implemented by the City to improve these processes. The anticipated date for completion of this action is March 2015.
2. Increase efforts to identify inflow and infiltration locations and make repairs focusing on the systems that feed to the South and West WWTF pumping stations. This action shall be an immediate and continuous effort.
3. For the WWTF, increase the rate of sludge recycling from the clarifiers to the front-end of the plant to maintain a MLSS concentration in the treatment basins of between 1,500 and 5,000 mg/L. This action shall be a continuous effort.
4. Review budget and capital plans and rates for adequate revenue stream. The anticipated date for completion of an initial evaluation is February 2015. More in-depth evaluations and modifications will need to occur and further actions taken by June 2015.
5. Re-confirm previous sources of mercury discharge by areas of the collection system for the presence of mercury. Identify point sources for mercury. The anticipated date for completion of this action is March 2015.
6. Repair and or replace any equipment that may not be performing as designed or is not operable. The anticipated date for completion of this action is July 2015.

3.2 Medium Term Actions

1. Appropriate pre-treatment equipment to remove mercury from identified point sources, such as amalgam separators, shall be installed at required locations. Necessary City ordinances, as required, will need to be passed. The anticipated date for completion of this action is September 2015.
2. Continue inflow and infiltration investigations and repairs throughout the collection system. Inflow and infiltration should show signs of reduction by January 2016.
3. Continue source determination testing for mercury. In the event the concentration cannot be reduced to a sufficient level by pre-treatment methods at the identified sources, the City shall begin development of means to fund the design of necessary treatment technologies. The anticipated date for completion of this action is January 2016.

4. Install a system of synthetic media in the primary basins of each plant to provide the nitrifying bacteria a surface area for attached growth. This improvement will mitigate washout of ammonia removing bacteria during high flow events. The anticipated date for completion of this action is January 2016.

3.3 Long Term Actions

1. Design and implement control logic to prevent the pump stations from conveying flows that exceed each plant's capacity thus preventing the flooding the treatment processes and washout of biomass used to treat the wastewater. At any given time, there is a possibility that the pump stations for each plant could run at full capacity. If this scenario occurs, the plant will receive a surge of flow exceeding the capacity of the plant, possibly causing flooding of the headworks building and eventually washing out the treatment basin biomass. The City will compare costs associated with these control improvements to the cost of constructing flow equalization basins to find the most cost-effective solution. The anticipated date for completion of this action is January 2018.
5. Continue collection system rehabilitation projects focusing on the most serious areas to further mitigate the impacts of infiltration and inflow. This action shall be a continuous effort.
6. If it is found to be necessary, design and construct necessary treatment technologies to remove mercury from the plant effluent. Four types of treatment shall be considered; precipitation, carbon adsorption, ion exchange, and biological treatment. Each technology shall be evaluated based on effectiveness to remove type of mercury present at the facilities, capital cost, and operation and maintenance costs. The anticipated date for completion of this action is January 2020.