From:	Marshall Fall
To:	Trotta, Jacqueline
Cc:	Jerry Caldwell; Richard Chappell
Subject:	Corrective Action Plan for the City of Blytheville
Date:	Monday, November 17, 2014 3:38:05 PM
Attachments:	Corrective Action Plan.pdf

Jacqueline,

As you requested, please find attached the detailed Corrective Action Plan for the City of Blytheville's wastewater treatment facilities.

If you have any questions or concerns, please free to contact me or Jerry.

Marshall Fall, E.I.
Civil Engineer Intern • Smith Seckman Reid, Inc.
2995 Sidco Drive • Nashville, TN 37204
D: 615.514.6166 • C: 615.428.0923 • E: mfall@ssr-inc.com
www.SSR-Inc.com

CITY OF BLYTHEVILLE

BLYTHEVILLE, ARKANSAS

CORRECTIVE ACTION PLAN

WASTEWATER TREATMENT FACILITIES ASSESSMENT AND
RECOMMENDED PLAN FOR CORRECTIVE MEASURES

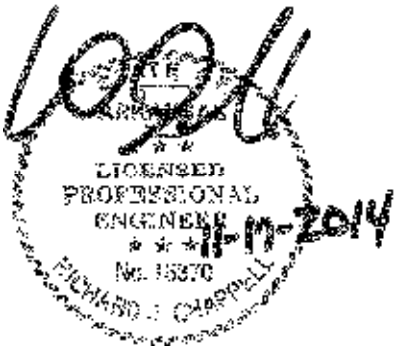
Smith
Seckman
Reid, Inc.

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

SSR Project No.:
14-41-027.0

Date:
November 17, 2014

Table of Contents

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 WWWTF 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 WWWTF 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 WWWTF 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.

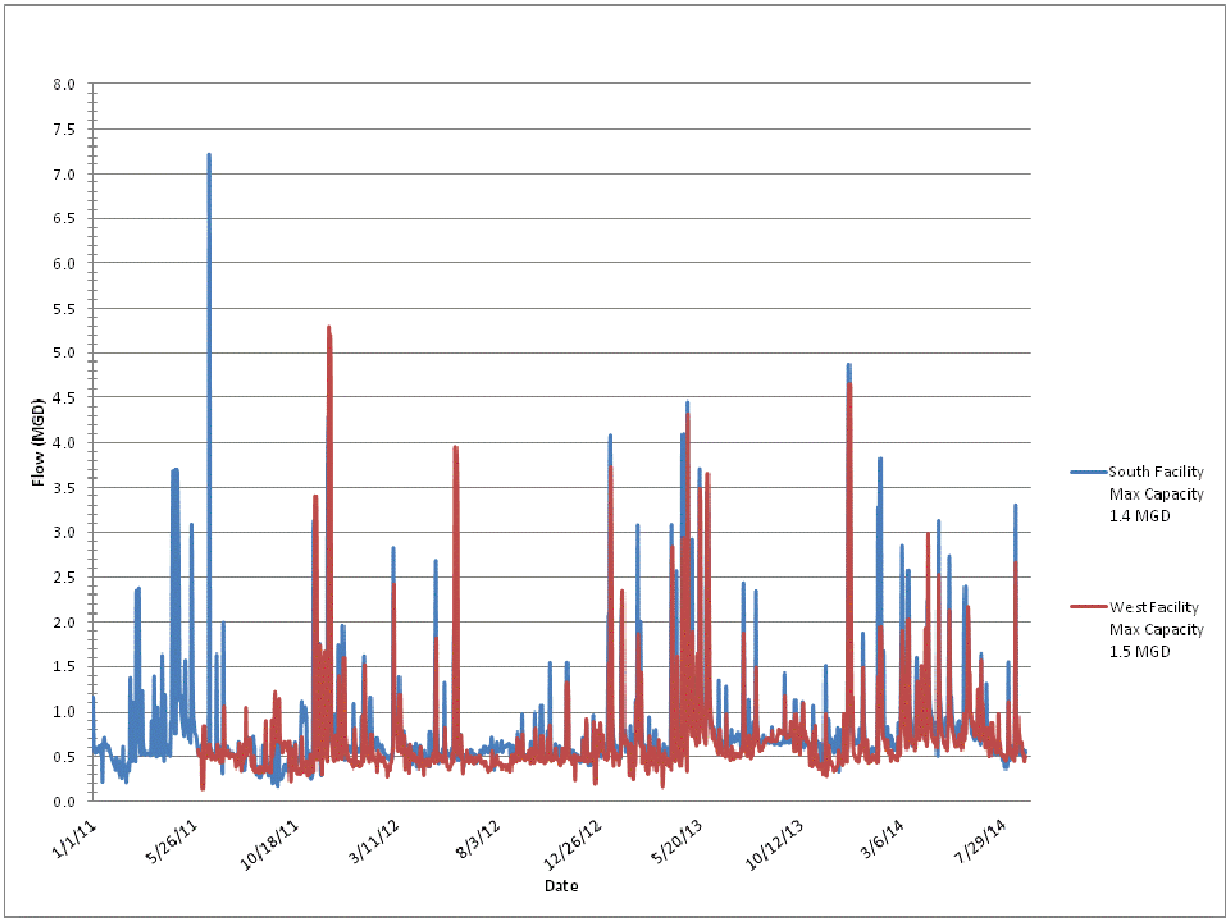
2.3 Influent and Effluent Flows

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). Because the nitrification process is temperature dependant, the permit limits differ for the colder winter months (October to March) and warmer summer months (April to September). These limits have

been violated multiple times at the WWWTF. 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		West Plant	
	Winter Months (Oct - Mar)	Summer Months (Apr-Sept)	Winter Months (Oct - Mar)	Summer Months (Apr-Sept)
7-day avg. (mg/L)/Permit Limit	1.8/5.0	0.5/5.0	2.1/5.0	2.8/5.0
Monthly Avg. (mg/L)/ Permit Limit	2.1/3.0	0.5/2.8	2.1/3.0	1.8/2.8
Mass (lb//Day)/ Permit Limit	13.1/38	3.4/35	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	Permit Limit (South/West)	South Plant	West Plant
Monthly Average (mg/L)	25/25	3.0	3.9
7-Day Average (mg/L)	37.5/37.5	3.0	3.9
Monthly Average (lbs/day)	313/313	20.2	23.3

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 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)	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 WWWTF 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	Permit Limit	South Plant	West Plant
7-day avg. (colonies/100 ml)	100	234	256
Monthly Avg. (colonies/100 ml)	100	293	319

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 treatment process appears to be hindered by a lack of mixing within the primary basin at the WWWTF. 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 cells 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 primary basin. 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.

2. Increase efforts to locate inflow and infiltration locations and make repairs.

3. Repair and or replace any equipment that may not be performing as designed or is not operable.

4. For the WWWTF, 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.

5. Prepare for ADEQ to enforce compliance with the NPDES permit regarding mercury levels in the effluent stream. The DMRs suggest the effluent permit limits will not be met without the addition of new and/or modified treatment processes. In the short term, the City will embark on an engineering study aimed at determining the source or sources of the mercury in the plant influent, indentify the forms that the mercury occurs (i.e., metallic, ionic, organic), and identify methods to reduce the mercury concentration in the plant effluent.

6. Review budget and capital plans and rates for adequate revenue stream.

3.2 Medium Term Actions

1. Continue inflow and infiltration investigations and repairs throughout the collection system focusing on the systems that feed to the South and West WWTF pumping stations.

2. 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.

3. Continue source determination study for mercury. Begin development of means to fund the design of necessary treatment technologies to reduce mercury concentrations in the treated effluent.

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.

2. Design and construct necessary treatment technologies to remove mercury from the plant effluent.

3. Continue collection system rehabilitation projects focusing on the most serious areas to further mitigate the impacts of infiltration and inflow.

From: Marshall Fall
To: Trotta, Jacqueline
Cc: Jerry Caldwell; Richard Chappell; cityofblytheville@att.net
Subject: Re: Corrective Action Plan for the City of Blytheville
Date: Wednesday, November 19, 2014 5:49:30 AM

Jacqueline,

I will sit down with the sr. engineer as soon as we can to address the questions and revise the CAP. I'm sure we will be able to sit down and discuss it today and have you a timeframe for a revision today.

I will talk to you soon.

Marshall

Sent from my iPhone

On Nov 18, 2014, at 5:02 PM, "Trotta, Jacqueline" <Trotta@adeq.state.ar.us> wrote:

> Mr. Fall,
>
> I noticed that the Corrective Action Plan had some vague timelines of when each corrective action would be completed. Would it be possible for those timelines to be more specific? The Department typically prefers the CAP to have a milestone schedule with dates or at least anticipated dates of completion. Also, the could you be more specific on what studies will be done and what technologies will be used for the Mercury issue? Would it be possible for you to revise the CAP to include this? If so, give a date of when you can get it to me. Feel free to contact me if you have any questions.
>
> Thanks,
>
> Jacqueline Trotta
> Enforcement Analyst
> Water Division
> Arkansas Department of Environmental Quality
> 5301 Northshore Drive
> North Little Rock, AR 72118
> 501-682-0632
>
> ---
>
> **From:** Marshall Fall [mailto:mfall@ssr-inc.com]
> **Sent:** Monday, November 17, 2014 3:36 PM
> **To:** Trotta, Jacqueline
> **Cc:** Jerry Caldwell; Richard Chappell

Subject: Corrective Action Plan for the City of Blytheville

Jacqueline,

As you requested, please find attached the detailed Corrective Action Plan for the City of Blytheville's wastewater treatment facilities.

If you have any questions or concerns, please free to contact me or Jerry.

Marshall Fall, E.I.
Civil Engineer Intern • Smith Seckman Reid, Inc.
2995 Sidco Drive • Nashville, TN 37204
D: 615.514.6166 • C: 615.428.0923 • E: mfall@ssr-inc.com
www.SSR-Inc.com <image001.gif> <image002.gif>