HAWKINS WEIR ENGINEERS, INC.

Engineering Client Success

January 28, 2019

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

Re: NPDES Permit Number: AR0036692, AFIN-57-00423
Corrective Action Plan Milestone: Algae Bloom Mitigation Analysis
HWEI Project No. 2018149

Dear Ms. Taylor:

Hawkins-Weir Engineers, Inc. has been retained by the Mena Water Utilities to address the majority of the requirements of their Corrective Action Plan (CAP), dated November 17, 2018, and prepare a Long-Range Wastewater Treatment Masterplan. The CAP required that an Algae Bloom Mitigation Analysis be submitted by January 31, 2019. Please find that analysis enclosed.

Respectfully Submitted,

HAWKINS-WEIR ENGINEERS, INC.

Aaron M. Benzing, P.E.

AMB/hcd
Enclosure: One (1) Copy Algae Bloom Mitigation Analysis

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

110 So. 7th Street • P.O. Box 648 • Van Buren, AR 72957 • Ph: (479) 474-1227 • Fax: (479) 474-8531
211 Natural Resources Drive • Little Rock, AR 72205 • Ph: (501) 374-4846
438 East Millsap Road • Suite 107 • Fayetteville, AR 72703 • Ph: (479) 455-2206
403 Garrison Avenue • Suite 101 • Fort Smith, AR 72901 • (479) 242-4685
www. hawkins-weir.com

ALGAE BLOOM MITIGATION ANALYSIS

MENA WASTEWATER TREATMENT PLANT

FOR

CITY OF MENA
MENA, ARKANSAS

HWEI PROJECT NO. 2018149

JANUARY 2019

PREPARED BY:

HAWKINS WEIR ENGINEERS, INC.

Engineering Client Success

110 So. 7th Street • P.O. Box 648 • Van Buren, AR 72957 • Ph: (479) 474-1227 • Fax: (479) 474-8531
211 Natural Resources Drive • Little Rock, AR 72205 • Ph: (501) 374-4846
438 East Millsap Road • Suite 107 • Fayetteville, AR 72703 • Ph: (479) 455-2206
403 Garrison Avenue • Suite 101 • Fort Smith, AR 72901 • (479) 242-4685
www. hawkins-weir.com

Algae Bloom Mitigation Analysis

Background

This analysis has been prepared on behalf of the City of Mena by Hawkins-Weir Engineers, Inc. as a requirement of the Corrective Action Plan (CAP) submitted to the Arkansas Department of Environmental Quality (ADEQ) in fulfillment of the Consent Administrative Order (CAO) LIS 18-046. This aspect of the CAP is intended to analyze and address the effect of algae blooms Lagoon #2 on the effluent of the wastewater treatment plant.

Introduction

Algae is commonly seen as a nuisance throughout the water cycle. Excessive growth of algae is a common sign of eutrophication, enrichment of an environment with inorganic substances such as nitrogen and phosphorus. These algae can hinder aquatic life, cause objectional odors, and reduce the quality of surface waters in general. However, from a wastewater treatment perspective, algae are essential for the proper function of a treatment pond. Algae are autotrophic organisms that uptake inorganic nutrients (such as nitrogen and phosphorus) and fix carbon dioxide to grow in the presence of sunlight. A major byproduct of this metabolic process is the production of oxygen. These nutrients are produced by bacteria during the breakdown of complex organic and inorganic substances. In turn, the oxygen produced supports the continued growth of lagoon bacteria. This symbiotic relationship is vital to the effective operation of a wastewater treatment lagoon.

Left uncontrolled, algae can also have a negative impact on National Pollution Discharge Elimination System (NPDES) permit holders' ability to treat wastewater within the permit limits. The formation of algal biomass can lead to an increase in the total suspended solids (TSS) concentration of the treatment lagoons effluent. Although different from the TSS present in the influent, the turbidity is still a monitored effluent characteristic that must be controlled. Another indirect compliance issue caused by algae is biochemical oxygen demand (BOD). Without the presence of sunlight, algae will begin to consume oxygen to continue its metabolic processes. During this "dark-phase" the consumed oxygen will be reflected as an increase in a 5-day BOD concentration.

Mena Wastewater Treatment Plant Effluent Quality

To determine the potential effect of algae blooms on effluent quality at the Mena Wastewater Treatment Plant, TSS and BOD_5 concentrations for the past three years were analyzed. The results of this analysis are presented in Figure 1.

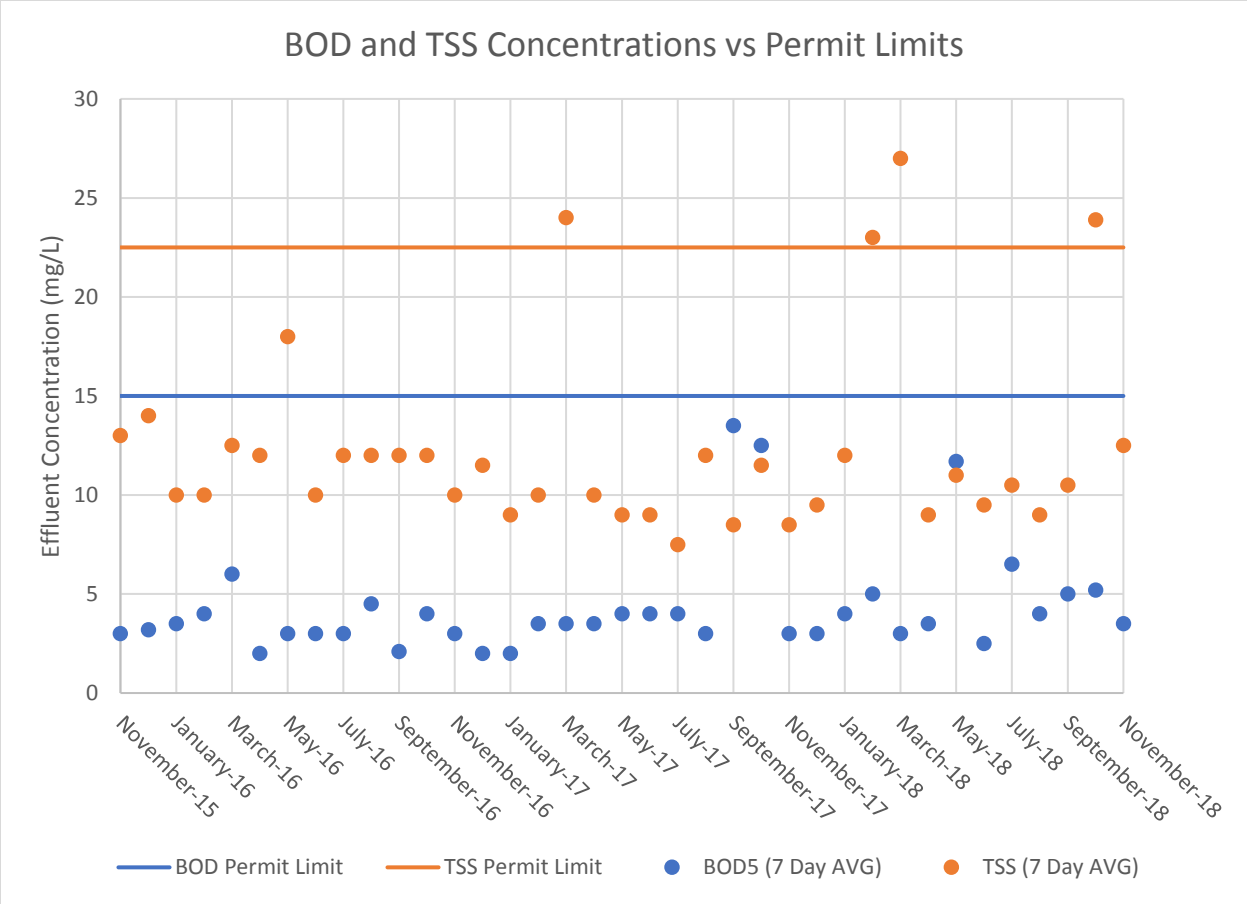

Figure 1: Effluent Characteristics for Mena WWTP

As shown in presented data, the Mena WWTP has had four (4) permit violations within the last three years, all of which were for total suspended solids. All of these violations occurred in cold weather months which is outside of the time period where algae blooms are typically the heaviest. Additionally, none of the TSS violations were accompanied by abnormally high BOD_5 concentrations. This indicates that the increased TSS concentrations were not caused by algae within Lagoon #2.

Algae Bloom Mitigation

The most commonly employed technique to prevent the growth of algae in wastewater treatment ponds is floating covers. These covers block sunlight, thereby inhibiting the growth of photosynthetic organisms such as algae. Typical costs for these systems range from $2 – $4 dollars per square foot. Therefore, the expected cost to cover the entire 33-acre Lagoon #2 would range in cost between $2.9 million and $5.9 million.

Alternatively, only a portion of the lagoon could be covered. Algae will die after 10 days without sunlight, representing approximately 15% of the 65-day detention time in lagoon 2. Therefore, the last 5.1 acres could be covered to effectively kill the algae. This alternative would cost between $450,000 and $900,000. This would effectively prevent increases in BOD but the biomass created could increase TSS concentrations or increase sludge accumulation in the lagoon depending on the settling time of the algal biomass.

Although effective in theory, it is important to understand the wastewater treatment process as a whole when evaluating a floating cover system. Lagoon #2 currently discharges into a series of sand filters, the primary function of which is to remove any remaining solids from the effluent. In this case, algae are the primary solids present within the effluent. Therefore, a floating cover system would be excessive and potentially redundant in this application.

Recommendation

In addition to this analysis, Hawkins-Weir Engineers is preparing a long-range plan for the City of Mena that will evaluate the following:

- Improvements to current WWTP to achieve consistent compliance
- Replacement of WWTP with new WWTP on the same site
- Replacement of WWTP with new WWTP on alternate site

This long-range plan will be completed by June of 2019 and will consider, if required, any additional improvements needed for the City of Mena to address algae blooms. Due to the large capital investment required, the location of the sand filters, and the lack of permit violations related to alae blooms, Hawkins-Weir Engineers recommends no algae mitigation improvements be made to the current WWTP until the long-range plan is complete.