

PLAN TO EVALUATE AND OPTIMIZE OPERATION OF
CORNERSVILLE WASTEWATER TREATMENT PLANT
FOR
CITY OF LEWISBURG WATER & WASTEWATER DEPARTMENT
JRWCO 1960

A. Purpose

The City of Lewisburg operates the Town of Cornersville Wastewater Treatment Plant. The influent wastewater at the Cornersville Wastewater Treatment Plant is almost entirely generated by a residential septic tank effluent pump (STEP) wastewater collection system. The anaerobic environment along with the discharge of solids from septic tanks that are poorly maintained in this STEP collection system can cause the influent wastewater at the Cornersville Wastewater Treatment Plant to have an atypically high ammonia as nitrogen ($\text{NH}_3\text{-N}$) concentration. The Cornersville Wastewater Treatment Plant utilizes cyclical activated sludge technology to provide biological treatment. The control of the $\text{NH}_3\text{-N}$ concentration in the effluent from the Cornersville Wastewater Treatment Plant has been inconsistent and has resulted in violations of the NPDES effluent limitations for $\text{NH}_3\text{-N}$.

The purpose of this plan is to implement a rigorous data collection protocol that will allow the evaluation of the capability of the existing Cornersville Wastewater Treatment Plant to produce an effluent that can consistently meet NPDES permit effluent limitations for $\text{NH}_3\text{-N}$ while simultaneously producing a sludge with acceptable settling characteristics. If the outcome of this evaluation is that the existing Cornersville Wastewater Treatment Plant does not have adequate capacity to consistently meet NPDES permit effluent limitations for $\text{NH}_3\text{-N}$ while simultaneously producing a sludge with acceptable settling characteristics, the data collected should be adequate to allow the preliminary design of facilities improvements necessary to provide compliance with NPDES permit limitations.

B. Scope

The data collection protocol should include the following:

- 1) Collect the samples necessary to comply with NPDES permit influent monitoring requirements for carbonaceous biochemical oxygen demand (CBOD_5) from a location downstream from the flow equalization basin before influent flow is mixed with any other flow stream and before the influent enters the cyclical activated sludge reactors. These samples should be analyzed for CBOD_5 and $\text{NH}_3\text{-N}$. One of these influent samples collected each week should also be analyzed for total Kjeldahl nitrogen (TKN).

- 2) Collect samples from each of the two cyclical activated sludge reactors approximately 30 minutes after the aeration cycle begins on the same days that influent CBOD₅ samples are collected and analyze these samples for mixed liquor suspended solids (MLSS) and mixed liquor volatile suspended solids (MLVSS).
- 3) Measure dissolved oxygen concentration in each of the two cyclical activated sludge reactors approximately 30 minutes after the aeration cycle begins on the same days that influent CBOD₅ samples are collected.
- 4) Collect effluent samples on the same days that influent CBOD₅ samples are collected and analyze them for NH₃-N, CBOD₅ and alkalinity.

This data collection protocol should be followed for 90 days. After the first 30 days, the data collected will be used to determine if the aeration system in the cyclical activated sludge reactors is capable of maintaining dissolved oxygen concentrations necessary for nitrification to occur at its maximum rate and to determine if alkalinity is adequate to allow nitrification to occur at its maximum rate. Nitrification is the biochemical conversion of NH₃-N to nitrate as nitrogen (NO₃-N). If the aeration system and/or the alkalinity concentration is not adequate to allow nitrification to occur at its maximum rate and analysis of the data collected during the first 30 days indicate that the facilities are otherwise adequate to produce an effluent with characteristics in compliance with NPDES permit limitations, recommendations will be made to the City of Lewisburg that will provide for adequate aeration and alkalinity concentration. If facility improvements are necessary to provide adequate aeration and/or alkalinity concentration, the data collection protocol should be suspended until the facility improvements are completed.

After adequate aeration and alkalinity concentration are confirmed, the data collected will allow for the calculation of the MLVSS inventory necessary in the cyclical activated sludge reactors for nitrification to occur at the rate necessary to achieve compliance with NPDES permit effluent limitations for NH₃-N. This MLVSS inventory will be compared to the MLSS inventory necessary for satisfactory settling to occur. A sludge wasting protocol including the wasting of sludge during an aeration cycle will be proposed to allow more precise control of the sludge wasting process and sludge wasting volumes necessary to maintain an appropriate MLVSS inventory will be calculated utilizing the data collected. Data collection and operation under the proposed sludge wasting protocol should continue for the remaining 60 days of the previously described 90 day data collection protocol.

C. Anticipated Outcome

At the conclusion of the 90 day data collection protocol, one of more of the following outcomes is expected.

1. The cyclical activated sludge reactor aeration system is determined to be inadequate to allow the Cornersville Wastewater Treatment Plant to provide nitrification at the rate necessary to consistently meet NPDES permit limits.
2. The cyclical activated sludge reactor aeration system is determined to be adequate to allow the Cornersville Wastewater Treatment Plant to provide nitrification at the rate necessary to consistently meet NPDES permit limits.
3. The alkalinity concentration in the wastewater is determined to be inadequate to allow the Cornersville Wastewater Treatment Plant to provide nitrification at the rate necessary to consistently meet NPDES permit limits.
4. The alkalinity concentration in the wastewater is determined to be adequate to allow the Cornersville Wastewater Treatment Plant to provide nitrification at the rate necessary to consistently meet NPDES permit limits.
5. The rigorous data collection and modified sludge wasting protocol will allow the Cornersville Wastewater Treatment Plant to be operated in a manner that provides effluent quality that consistently meets NPDES permit limitations.
6. The rigorous data collection and modified sludge wasting protocol will demonstrate that the Cornersville Wastewater Treatment Plant facilities are inadequate to generate an effluent that consistently meets NPDES permit limitations.

If Anticipated Outcome Nos. 1, 3 and/or 6 are demonstrated, a plan to improve the Cornersville Wastewater Treatment Plant facilities to allow consistent compliance with NPDES permit limits should be developed.