UNC
ENVIRONMENT, HEALTH & SAFETY

The University of North Carolina at Chapel Hill
Department of Environment, Health & Safety
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November 30, 2010

S. Jay Zimmerman
RRO Aquifer Protection Supervisor
DENR Division of Water Quality
1628 Mail Service Center
Raleigh NC 27699-1628

Subject: The University of North Carolina at Chapel Hill (UNC-Chapel Hill) Bingham Facility Pump and Haul Permit No. WQ0034607

Dear Mr. Zimmerman:

In accordance with the subject permit, I am writing to provide the project determination on the future wastewater activities as required by Condition I.1. The University is proposing to build an advanced secondary wastewater treatment facility having a capacity of 7500 gpd to support the existing buildings. No building expansion is planned. The wastewater system is anticipated to serve a facility that supports the University's biomedical research by housing colonies of dogs and related support activities, and because of its off campus location, the facility is also used for the temporary preventative quarantine of new small animals such as mice, birds and some primates, before they are transported to main campus. Attached is a description of the proposed wastewater system improvements.

Please contact me at 919-843-5913 if you have any questions or comments.

Sincerely,

Mary Beth Koza

Mary Beth Koza
Director, Environment, Health and Safety

cc: Larry Daw
Tom Konsler, Orange County NC Environmental Health Division

Proposed Wastewater System Improvements
UNC-Bingham Facility
November 30, 2010

1. Site-wide Gravity Sewer Collection System

   UNC proposes to construct improvements to the site-wide wastewater collection system that relies entirely on gravity flow to convey wastewater from each of the on-site buildings (Bingham #1, #2, #3 and the new central chilled water system building) to the new centralized wastewater treatment facility.

2. Biological and Physical/Chemical Wastewater Treatment System

   UNC proposes to construct a new 7,500 gpd capacity advanced secondary wastewater treatment facility with spray irrigation of the treated effluent wastewater. Initial site analyses confirmed that the available spray area at the site has adequate capacity to accommodate the spray irrigation of secondary effluent at a rate of at least 7,500 gpd. The final site spray capacity is currently being confirmed and may be somewhat higher than 7,500 gpd.

   The proposed new treatment facility will consist of all of the following unit treatment processes:

   a. Raw Sewage Influent Lift Station. This new lift station will receive raw wastewater from the gravity sewage collection system and will convey the flow to the new screen system and new influent equalization basin. The lift station will consist of duplex, submersible solids handling pumps mounted on slide rails. The pumps will be controlled based on liquid level in the 8′ inside diameter (ID) precast concrete wetwell via a new submersible pressure transducer. The pumping operation, liquid level and associated technical information will be continuously monitored via the new distributed control and SCADA system. The lift station will also include a 5′ ID precast concrete valve vault which will house the two new check valves, two new isolation gate valves and an emergency pump connection.
   b. Influent Mechanical Fine Screen. This automatically-cleaned , 1 mm-perforated plate screen is designed to removed both traditional screenings and animal hair. The screen will include a screenings wash system, dewatering auger/compactor, and bagging system.
   c. Influent Flow Equalization Basin. This 10,000 gallon, covered concrete basin will include a diffused, coarse-bubble aeration system, duplex submersible solids

handling transfer pumps on slide rails (for conveying the equalized flow to the downstream biological reactor), and a submersible transducer for continuously recording liquid level via the SCADA system. The purpose of the equalization basin is to dampen system hydraulic peaks, minimize biological shock loads and will help neutralize variable pH swings.

d. Activated Sludge Biological Reactor. UNC will utilize sequential batch reactor (SBR) technology for accomplishing biological treatment of the high strength wastewater generated at the Bingham Facility. The single SBR basin will work in concert with the influent equalization basin. The fill and draw reactor will include anoxic-aerobic-anoxic cycles to accomplish both biological oxidation (for removal of biological oxygen demand (BOD)) and biological nutrient reduction (both nitrogen and phosphorus). At the end of the batch treatment cycle, the SBR will function as a clarifier to provide solids/liquids separation via quiescent settling. After the solids have settled to the bottom of the reactor, the floating decanter will be activated to allow clear liquid to be withdrawn from 18" below the water surface. After the decant cycle, the waste activated sludge (WAS) pumps will be activated to waste biological solids from the reactor prior to refilling the SBR with wastewater and starting the new treatment cycle. The SBR includes an independent fine-bubble diffused aeration system, a floating direct drive mixer, an automatic floating decanter, duplex submersible waste activated sludge pumps, and a submersible pressure transducer (for continuously recording liquid level via the SCADA system). The SBR cycles will be split between fill and draw and will include mix-only (no aeration), mix and aerate, quiescent settling (for solid/liquid separation) and waste sludge pumping. The entire process will be controlled by the distributed controls system and monitored by the SCADA system.

e. Post SBR Equalization Basin (EQ). Secondary effluent will be decanted from the SBR intermittently and flow via gravity to the adjacent Post SBR Equalization Basin. The Post SBR EQ basin will be equipped with a coarse bubble aeration system for mixing, duplex submersible transfer pumps and a submersible pressure transducer (for control of the transfer pumps and for continuously recording liquid level via the SCADA system). The purpose of the post SBR EQ basin is to equalize flow to the downstream sand filtration and disinfection processes to optimize treatment performance.

f. Tertiary Sand Filtration. The existing wastewater treatment system at the site will largely be demolished; however, the existing deep-bed sand filters will be relocated from the existing site to the new treatment system site and will be re-used as a tertiary filter for secondary effluent flow from the post SBR EQ basin

transfer pumps. Influent flow will enter the filters from the top and the effluent will pass downward through 30" of mixed sand media to remove residual suspended solids and reduce turbidity. The sand filters were originally designed as denitrifying filters, so it is proposed that a secondary source of carbon be feed with the filter influent to drive denitrification through the filter. Although not technically necessary, (since the SBR will be designed to accomplish complete nitrification and partial denitrification), the denitrification sand filters can serve as a backup to enhance denitrification and to add secondary protection against biological system upsets.

g. Chlorine Disinfection System. The existing raw wastewater generated by the research animals at the Bingham site is extremely dark in color. The dark color has prevented the existing low pressure UV system from operating properly and, as a result, disinfection of the effluent has proven to be unreliable. As such, a new chlorine disinfection process and contact tank is being proposed as part of the new treatment works. The system will include bulk sodium hypochlorite storage, duplex peristaltic metering pumps, a rapid mix zone with mechanical mixer, and a serpentine contact tank divided into two separate reactors with slide gates so that one side can be cleaned periodically.

h. Secondary Effluent Pumping Station and Forcemain. This new lift station will receive secondary effluent via gravity from the chlorine contact tank. The lift station will convey the effluent into the wet weather storage basin via a new effluent forcemain. The effluent pumping station will consist of duplex, submersible solids handling pumps mounted on slide rails. The pumps will be controlled based on liquid level in the 8' ID precast concrete wetwell via a new submersible pressure transducer. The pumping operation, liquid level and associated technical information will be continuously monitored via the new distributed control and SCADA system. The lift station will also include a 5' ID precast concrete valve vault which will house the two new check valves, two new isolation gate valves and an emergency pump connection.

i. Secondary Effluent Wet Weather Storage Basin. The existing synthetically-lined, earthen wet weather storage basin has been determined to be structurally unsound (by others). In addition, the synthetic liner has multiple perforations and does not have provision for gas ventilation from under the liner. As such, it is proposed that the contents of the basin be pumped out and disposed of via pump and haul to OWASA. The liner will then be removed and disposed of in a sanitary landfill. Then, the filled embankments will be removed and the soil fill will be stockpiled in a prepared, adjacent site. The bottom of the basin will then be properly prepared (removal of any residual rock fragments, graded smooth,

and installation of a 12"- thick sand cushion over the saprolitic rock). A new, screened intake structure will be installed in the bottom of the basin and tied back to the existing suction line from the lift station. Next, the side slopes will be graded 3:1 from the bottom upward until reaching existing grade. The fill soil will then be utilized to construct the above-grade embankments, compacting each layer in 12" lifts. The inner and outer slopes will be graded to maintain a consistent 3:1 slope . After final grading to the requisite elevations, bentonite clay will be transported from off-site to create a full 12"- thick impervious liner over the entire bottom and interior slopes of the basin. Lastly, a filter fabric will be placed over the clay and then stone rip rap will be placed over the fabric to create a stable, non-eroding surface.

j. Dedicated Secondary Effluent Irrigation Pumping Station. The existing precast concrete pump building will be re-used. The self priming centrifugal pumps will be replaced with larger pumps including new variable frequency drives. A new programmable logic controller (PLC) will be installed inside the irrigation pump station and will be interconnected with the site-wide distributed control system via telemetry. The PLC will control and monitor all functions of the irrigation system including monitoring wet weather basin level, irrigation pump status, irrigation flowrate and total flow, irrigation zone valve status, time and volume of effluent applied to each irrigation zone, and natural precipitation volume.

k. Dedicated Secondary Effluent Irrigation System. A completely new effluent irrigation system consisting of transmission mains, irrigation zone controls, laterals and conventional impact-style irrigation sprinklers will be constructed on an expanded spray site. The new spray sites fully comply with mandatory setback requirements as listed in 2T.0500 and will be designed for an annual average daily volume of 7,500 gpd.

3. Site-Wide Distributed Control, SCADA and Telemetry System

UNC proposes to construct a new site-wide distributed control, SCADA and telemetry system that will allow their operators to continuously monitor key water and wastewater processes throughout the site. This system will also be accessible from the main campus and alarms will automatically be reported over a broad network to ensure any alarm condition is evaluated and corrected quickly.