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Wastewater Handling for Williams Corner

Background

Williams Corner will be located in northern Chatham County which does not have access to a city or county wastewater collection system. The site is comprised of approximately 100 acres at the corner of 15-501 and Old Lystra Road. This location is appropriate for dense commercial and residential development however limited by wastewater treatment availability.

Blake & Associates, Inc. is an environmental consulting firm in Chatham County and has over 30 years experience in design and construction of onsite wastewater systems in North Carolina and South Carolina and Virginia. M. Travis Blake is the Senior Design Consultant with Blake & Associates, Inc. with a number of very successful and innovative systems that combine high technological and natural systems. He is a recognized authority on artificial wetlands, artificial dunes and onsite wastewater treatment systems.

Proposal

Initial proposals were to analyze the soil characteristics for onsite absorption type systems. This approach was discarded since it would require enormous amounts of land. The cost of the land required that the property be efficiently developed in order to make it financially practical. Therefore the key to developing the property would be to devise a wastewater treatment system that could generate a high quality effluent so the effluent could be "reused or recycled" for multiple purposes.

The proposed plan takes into consideration the area's characteristics of relatively poor draining soils (low percolation properties), moderate rainfall levels, ambient evaporation capacity and evapotranspiration. In addition, recently refined membrane treatment technologies are able to produce an effluent with very high "reuse" capabilities. The treated water can be used for irrigation, evaporative cooling, landscape water features and offsite irrigation. Designing this type of treatment system and incorporating intense water use reduction technologies enables the project to be financially feasible and will have an extremely high degree of disposal options and redundancies.

Preliminary Design Components

The current influent design load is calculated at approximately 40,000 GPD. The plants from US Filter will be delivered to handle 100,000 GPD and the permit revised when additional capacity is needed above the permitted discharge capacity of 40,000 GPD. The basic plant schematic is attached and also a preliminary discharge component layout relative to each components elevation. The plant engineering and final specifications of the components will be provided by the project's wastewater engineer, Michael Wicker, P.E. of Withers and Ravenel. Information from Soil and Environmental Consultants, Eric Lappala (hydrologist) and the project's HVAC engineer will be used to size the discharge components.

Treatment Plant

The Reclaimed Water Treatment Plant will receive the raw domestic strength wastewater from the development. Initially this flow is estimated to be approximately 40,000 GPD based on the calculated needs of the project. Capacity for growth to 100,000 GPD is incorporated into the design.

The treatment system will consist of an influent pumping station, mechanical fine screening device to remove debris and trash, a 25,000 gallon equalization basin to dampen system peak flows, the packaged wastewater treatment plant with membrane filtration, ultra-violet disinfection and sludge digestion/holding tank. The units will be enclosed and odor control provided. An effluent pump station will be constructed to pump the reclaim water to the discharge components.

The main component of the treatment plant will be two 100,000 GPD MBR packaged systems provided by US Filter. This package plants provide biological treatment with aeration and micro-filtration with submerged membrane filters in each steel vessel. The aeration within the aerobic reactor provides the oxygen necessary for the biomass to breakdown the wastewater and the submerged membranes retain the biomass in the process while filtering the water to reclaim water quality. The continuous pumping of wastewater and air across the membranes scours the surface to prevent solids fouling of the membrane filters.

The MBR equipment offered will provide the following typical effluent quality that meets or exceeds the State of North Carolina reclaim water standards:

Typical Effluent Water Quality Parameters

Parameter	Units	Quality (95%ile)
Suspended Solids	mg/L	< 5
Turbidity	NTU	< 0.2
Total Nitrogen (TN)	mg/L	7
Total Phosphorous (TP)	mg/L	<1.0
BOD ₅	mg/L	< 5
COD	mg/L	<20

The ultra-violet disinfection system will then be used to disinfect the wastewater to the reclaim water standards to less than 14/100 ml of fecal coliform content. This is to insure the removal of pathogens, viruses and fecal matter to a level of safety for human contact. The membranes in the plant routinely remove any particle greater than 3 microns. Most pathogens are greater than 3 microns.

The waste residual biosolids from the Reclaimed Treatment Plant will be treated onsite in a 40 day detention basin, where the biosolids will be further digested with an aeration process. These digested biosolids will be stored in an aerated sludge basin and thickened to a smaller volume by a decanting/ fill method. The supernatant will be returned to the equalization basin and recycled through the MBR treatment process for further treatment. The thickened sludge will be removed periodically by a licensed residual biosolids contractor for disposal at a permitted facility for composting or land application of the biosolids. This permit will be held separately by the contractor; not Williams Corner.

Non-Discharge Components

The reclaimed water treatment plant is assumed to be installed at the lowest elevation in the system. The rest of the system will be sized by the engineer based on evaporative cooling demands, soil and hydrology. The basic outline is attached. The non-discharge components will be installed per the NCDWQ reclaim water requirements with separate water lines and components clearly marked as reclaim water components. The system installed will be a 100% reclaim water system with no discharge to surface waters of the State.

In order of importance for the reclaim water are as follows:

1. Land Application
 - a. Preliminary calculations will give a total loading volume exceeding 44,000 GPD. The design load is approximately 40,000 GPD at full build-out.
 - b. Total retention area will be for approximately 120 days. This will likely be only 30 days since the calculations do not include the evaporative cooling component or the 18 acres of the "borrow pit" as additional wetting area.
2. Evaporative cooling
 - a. Peak demand when all buildings are completed will range from 25,000 GPD to 50,000 GPD.
 - i. Cooling towers come online when the three 40,000 medical buildings begin construction. Even though the land wetting is adequate for the volume of reuse water produced. Evaporative cooling is the best use. Land applications will provide backup and flexibility for the unified system.
 - b. The entire system including the evaporative cooling system will be maintained by the WWTP operator. This is necessary for a proper unified monitoring and control system and is required by DWQ.

3. Waterscapes

- a. Constructed waterfalls, streams and fish ponds.
 - i. These will flow into the retention pond.
 - 1. The retention pond is conservatively calculated for 120 day storage to insure an adequate storage volume. The North Carolina Division of Water Quality requires a minimum of 30 day storage. A lesser period of 120 days will be possible since the evaporative cooling operates even during times there can not be any wetting of land areas and the preliminary calculation do not include the 18 acres of the “borrow pit” area which will be graded and landscaped.

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Williams Corner
Project Director***