

BASIS OF DESIGN REPORT
RUTLEDGE CREEK
WASTEWATER TREATMENT PLANT
TOWN OF AMHERST, VIRGINIA



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| | <u>Page</u> |
|---|-------------|
| Executive Summary | E-1 |
| Section 1 – Introduction | |
| 1.1 Background | 1-1 |
| 1.2 Purpose..... | 1-2 |
| Section 2 – Facility Description | |
| 2.1 General WWTP Description..... | 2-1 |
| 2.2 Preliminary Treatment..... | 2-2 |
| 2.3 Secondary Treatment | 2-5 |
| 2.4 Tertiary Filtration..... | 2-12 |
| 2.5 Disinfection & Post Aeration | 2-13 |
| 2.6 WWTP Support Systems..... | 2-13 |
| 2.7 Sludge Treatment and Disposal Facilities..... | 2-14 |
| Section 3 – Waste Characterization | |
| 3.1 Wastewater Generation & Influent Characteristics..... | 3-1 |
| 3.2 Effluent Monitoring..... | 3-3 |
| 3.3 Additional Testing Protocol | 3-5 |
| Section 4 – Basis of Design | |
| 4.1 Enhanced Nutrient Removal Alternatives..... | 4-1 |
| 4.2 Tier 1 & 2 TN Reduction – STAC System..... | 4-2 |
| 4.3 Tier 3 & 4 TN Reduction – BioDenipho System w/ Secondary Anoxic | 4-3 |
| 4.4 Tier 1 TP Reduction..... | 4-6 |
| 4.5 Tier 2 TP Reduction – Chemical Feed Facilities..... | 4-7 |
| 4.6 Tiers 3 & 4 TP Reduction – Anaerobic Selector | 4-8 |
| 4.7 Improvements for WLA Compliance..... | 4-9 |
| 4.8 Other Enhanced Nutrient Removal Alternatives..... | 4-10 |
| 4.9 Alternative Cost Summary..... | 4-11 |
| 4.10 WLA Implementation & Conclusions..... | 4-12 |
| Appendices | |
| Virginia Water Quality Improvements Fund Guidelines | A |
| WQIF Technical Assistance Grant Agreement..... | B |
| Rutledge Creek WWTP VPDES Permit..... | C |
| DEQ Basis of Design Guidance Memo..... | D |

EXECUTIVE SUMMARY



The Virginia State Water Control Board's approval of new Water Quality Standards for the Chesapeake Bay and passage of legislation establishing the Chesapeake Bay Watershed Nutrient Credit Exchange Program has created new requirements for significant dischargers in the Chesapeake Bay's watershed.

The Town of Amherst owns and operates the Rutledge Creek Wastewater Treatment Plant (VPDES No. VA0031321). The facility is identified as a significant discharger to the James River Basin. According to the approved Water Quality Management Program Regulations, the Rutledge Creek WWTP has an allocated total nitrogen concentration of 6 mg/L and a total phosphorus allocation of 0.5 mg/L at its current design capacity of 0.6 MGD. At full capacity this equates to a Waste Load Allocation (WLA) of 10,964 lbs/yr of total nitrogen, and 913 lbs/yr of total phosphorus.

These limits have not been incorporated into individual Virginia Pollutant Discharge Elimination System (VPDES) permits, but it is anticipated they will be in place by 2006 through general permit. According to its existing VPDES permit, the Rutledge Creek WWTP is required to monitor nutrients and submit a Basis of Design (BoD) Report to DEQ by January 10, 2006.

The BoD report is to address the construction and operation of a range of nutrient removal technologies up to and including the limits of technology. The range of nutrient removal technologies is separated into four levels, or tiers. The BoD report will enable the Town of Amherst to make informed decisions on the approach to complying with the nutrient loads allocated to the Rutledge Creek WWTP. The BoD report is also designed to assist in decisions on upgrade schedules and nutrient trading issues that may arise under the watershed group permit.

EXECUTIVE SUMMARY



Rutledge Creek WWTP currently receives an average daily flow of approximately 0.35 MGD. The Rutledge Creek WWTP was designed to treat an average daily flow of 0.6 MGD.

Effluent monitoring results from January to August 2005 were obtained and analyzed as part of the BoD report. Also, a testing protocol was developed and executed in October and November 2005 to further understand the waste load entering and leaving the facility. The sampling protocol called for consecutive days of testing in October and November on the influent, effluent, and waste streams of the treatment plant.

Process control testing was performed as part of the sampling protocol to gauge performance of the D-ditch system. These tests were completed to help identify any limiting factors, insufficiencies, and to aide in identifying process adjustments to maximize treatment efficiency.

Analysis of the monitoring results and testing protocol shows that the facility, on average, has produced a low nutrient effluent, with a TP of less than 1.0 mg/L and a TN of approximately 4.0 mg/L.

The Town of Amherst completed a facility upgrade in 2005 increasing the plant capacity from 0.4 MGD to 0.6 MGD. The upgrade consisted of installing a Kruger Double Ditch system. The existing D-Ditch system is a non-conventional oxidation ditch type of reactor, similar to a sequencing batch reactor in the fact that it is a self-contained process that operates in phases without the use of clarifiers. Given the uniqueness of the D-Ditch, the most feasible alternatives for upgrading the process will incorporate the existing treatment technology. The D-Ditch manufacturer (Kruger) assisted in the development of the alternatives for enhanced nutrient removal discussed in this section.

EXECUTIVE SUMMARY



The identified alternatives are presented below in Table E-1. The alternatives were identified to achieve the four treatment tiers defined by the Chesapeake Bay Program. A fifth alternative was developed to meet the approved waste load allocation for the Rutledge Creek WWTP. Capital costs and operations and maintenance (O&M) cost increases were generated and are also presented.

Table E-1: Alternative Cost Summary

| Alternative | WWTP Improvements | | | | | Effluent Limits (TN/TP) | Estimated Capital Cost | Estimated O&M Cost Increase (\$/year) |
|-------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------|------------------------|---------------------------------------|
| | STAC | Alum | Clarifiers | Anaerobic Selector | Secondary Anoxic | | | |
| Tier 1 | <input checked="" type="checkbox"/> | | | | | 8/- | \$250,000 | \$18,000 |
| Tier 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | | 8/1 | \$500,000 | \$80,000 |
| WLA | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | 6/0.5 | \$2,500,000 | \$96,000 |
| Tier 3 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 4/0.3 | \$3,500,000 | \$126,000 |
| Tier 4 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 3/0.1 | \$3,500,000 | \$126,000 |

At a minimum, the Town of Amherst will be required to design and construct the WLA Alternative identified above to comply with the effluent nutrient requirements recently adopted.

At the current flow rates, and given the effluent monitoring results reported, it is apparent that the Rutledge Creek WWTP is presently meeting average effluent TN concentration below 6 mg/L. As the influent wastewater flow rates increase, the plant will not be able to achieve compliance for TN. Also, since the existing effluent TP concentrations are

EXECUTIVE SUMMARY



approximately 1.0 mg/L, the facility will need the upgrade as soon as the 0.5 mg/L limit for TP is put into place.

Consideration should be given to the design and construction of the Tier 3 Improvements. The same treatment processes have been identified to meet Tier 3 and Tier 4 nutrient limits. From a permit perspective we believe the identified improvements will consistently meet the Tier 3 limits. Tier 4 limits, specifically TP (0.1 mg/L), will be more difficult to meet on a consistent basis since they are considered the limits of technology.

The construction of Tier 3 improvements may provide opportunities in the form of nutrient exchange with other facilities located in the Upper James River Basin (based on current developing rules), or could provide higher levels of treatment necessary to the Town of Amherst in the future.

Recent developments by the Department of Environmental Quality indicate that the new limits will be placed into existing permits through the Watershed General Permit. This will likely be enacted in 2006, and will supercede any existing schedules or requirements. Final schedules have not been released to date, however preliminary discussions indicate that the Rutledge Creek WWTP will be required to meet the WLAs by December 2010.

The Water Quality Improvement Fund (WQIF) was established as a result of action taken by the Virginia General Assembly in 1997. The fund was established in response to the need to finance nutrient reduction projects in the Chesapeake Bay Watershed. It is recommended that the Town of Amherst pursue financial assistance through the WQIF for the Tier 3 improvements identified in this report.

Based on discussions with DEQ, it is apparent that if grant money is approved and used for Tier 3 improvements, then the Rutledge Creek WWTP will be required through a

EXECUTIVE SUMMARY



technical performance standpoint to comply with Tier 3 effluent nutrient requirements (TN = 4mg/L, TP = 0.3 mg/L). These effluent nutrient requirements would then be incorporated into the VPDES permit during the next renewal cycle.

SECTION 1 – INTRODUCTION



1.1 Background

A large portion of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list. These waters are cited for not meeting the aquatic life use support goal. One of the main reasons for this is the number of nutrient (nitrogen and phosphorus) rich tributaries flowing into the Bay.

The Virginia State Water Control Board's approval of new Water Quality Standards for the Chesapeake Bay and passage of legislation establishing the Chesapeake Bay Watershed Nutrient Credit Exchange Program has created new requirements for significant dischargers in the Chesapeake Bay's watershed. Final limits for the Upper James River Basin are established as 6 mg/L for total nitrogen (TN) and 0.5 mg/L of total phosphorus (TP) for most dischargers on the significant discharger list. These limits have not been incorporated into individual Virginia Pollutant Discharge Elimination System (VPDES) permits, but it is anticipated they will be in place by 2006 through general permit. Even though not all requirements of the new legislation have been established, significant dischargers in the watershed are required to monitor nutrients, and are required to submit a Basis of Design (BoD) Report and an Interim Optimization Plan (IOP).

The Town of Amherst owns and operates the Rutledge Creek Wastewater Treatment Plant (VPDES No. VA0031321). The facility completed an upgrade from 0.4 MGD to 0.6 MGD in 2005. The treatment facility is equipped with the following unit processes:

- Screening & Grit Removal
- Influent Pump Station
- Phased Isolation Oxidation Ditch Secondary Treatment
- Disc Filter Tertiary Treatment
- UV Disinfection
- Post Aeration
- Aerobic Digestion & Sludge Drying Bed
- Septage Receiving Facilities

SECTION 1 – INTRODUCTION



Rutledge Creek is a tributary of the James River, and the treatment plant is listed on the significant discharger list. According to the approved Water Quality Management Program Regulations, the Rutledge Creek WWTP has an allocated total nitrogen concentration of 6 mg/L and a total phosphorus allocation of 0.5 mg/L at its current design capacity of 0.6 MGD. At full capacity, this equates to Waste Load Allocation (WLA) of 10,964 lbs/yr of total nitrogen, and 913 lbs/yr of total phosphorus.

1.2 Purpose

The BoD report is required by the Rutledge Creek VPDES permit (No. VA0031321) and is to be submitted to the Department of Environmental Quality (DEQ) no later than January 10, 2006. The permit requires that the BoD report address the construction and operation of a range of nutrient removal technologies up to and including the limit of technology. The range of nutrient removal technologies is separated into four levels, or tiers. The four tiers of treatment defined by DEQ for development of the BoD report are presented below in Table 1-1. In addition to the four tiers, the actual WLA is also included in the analysis of this report.

**Table 1-1:
Treatment Levels for Point Source Significant Municipal Dischargers**

| Level | Total Nitrogen (mg/L) | Total Phosphorus (mg/L) |
|---------|-----------------------|-------------------------|
| Tier 1* | 8.0 | --- |
| Tier 2 | 8.0 | 1.0 |
| Tier 3 | 4.0 | 0.3 |
| Tier 4 | 3.0 | 0.1 |
| WLA** | 6.0 | 0.5 |

* TN = 8.0 mg/L for those with BNR operating or planned; TN and TP for rest of facilities = 2000 conc.

** WLA = Waste Load Allocation for the Rutledge Creek WWTP.

SECTION 1 – INTRODUCTION



The Basis of Design Report is to evaluate various nutrient removal technologies to enable the Town of Amherst to make informed decisions on the approach to complying with the nutrient loads allocated to the Rutledge Creek WWTP. The BoD report is also designed to assist in decisions on upgrade schedules and nutrient trading issues that may arise under the watershed group permit.

SECTION 2 – FACILITY DESCRIPTION



2.1 General WWTP Description

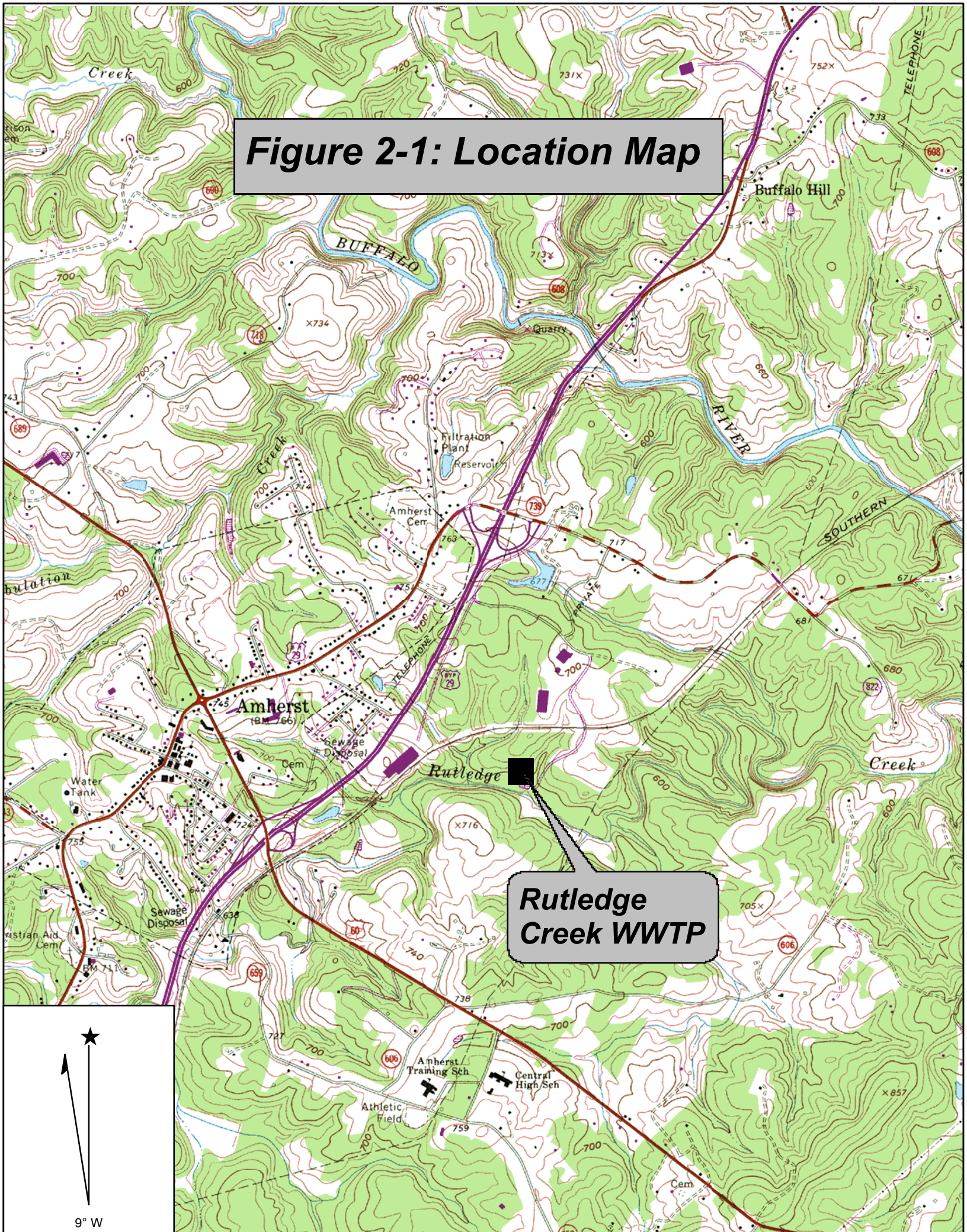
The Rutledge Creek WWTP (VPDES No. VA0031321) is located at the end of Industrial Drive in the Town of Amherst. See Figure 2-1 for a location map. The treatment plant is owned and operated by the Town of Amherst, and receives wastewater from the Town, nearby industrial parks, and Sweet Briar College. The VPDES permit has an effective date of December 28, 2004, and expires December 27, 2009. Current VPDES permit limits are summarized below in Table 2-1.

Table 2-1: Rutledge Creek WWTP Current VPDES Effluent Limits

| Parameter | Q < 0.38 MGD | | Q > 0.38 MGD | |
|------------------------|-----------------------|-----------|-----------------------|-------------|
| | Monthly Avg. | Avg. | Monthly Avg. | Weekly Avg. |
| BOD ₅ | 11.1 mg/L | 16.7 mg/L | 7.4 mg/L | 11.1 mg/L |
| TSS | 30 mg/L | 45 mg/L | 30 mg/L | 45 mg/L |
| Ammonia-N (Jun-Nov) | 14.7 mg/L | 14.7 mg/L | 12.1 mg/L | 12.1 mg/L |
| Fecal Coliform | 200 N/Cml | --- | 200 N/Cml | --- |
| Total Hardness | 120 mg/L (minimum) | --- | 120 mg/L (minimum) | --- |

The Town of Amherst completed a facility upgrade in 2005 increasing the plant capacity from 0.4 MGD to 0.6 MGD. The upgrade consisted of installing a Kruger Double Ditch system. In addition to the Kruger D-Ditch, the upgrade included the following new facilities: Lab/Control Building, Headworks and Influent Pump Station, Lime Feed Building, Disc Filter, UV disinfection, Post Aeration, Non-Potable Water System, and

Figure 2-1: Location Map



**Rutledge
Creek WWTP**

SECTION 2 – FACILITY DESCRIPTION



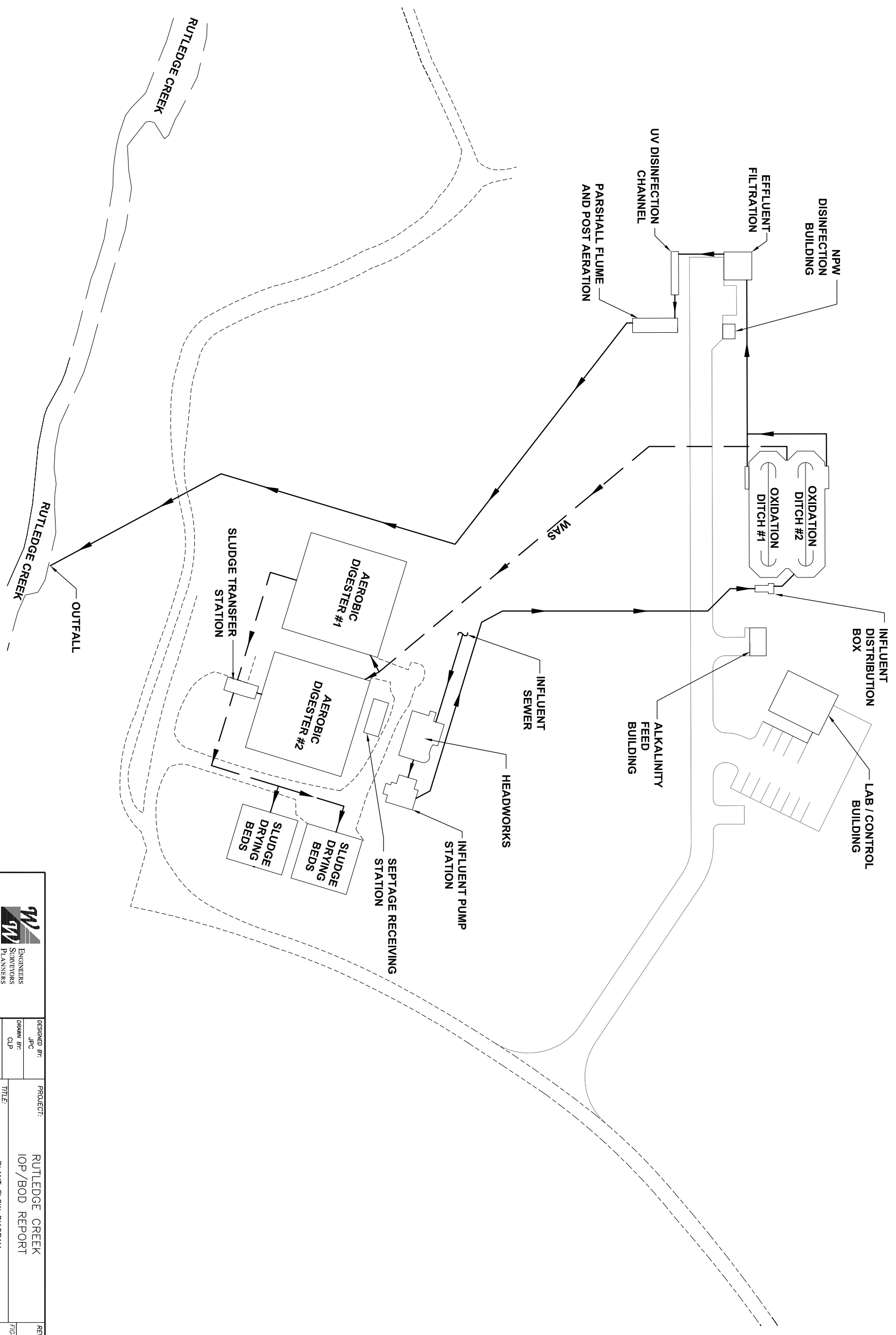
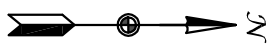
Septage Receiving Station. Elements of the original WWTP were converted for use as aerobic sludge digesters. Sludge drying beds are used to dewater sludge, which is disposed of in the local landfill. Effluent is discharged to Rutledge Creek, a tributary of the James River and part of the Chesapeake Bay Watershed.

2.2 Preliminary Treatment

Influent wastewater flows into the WWTP through a 24-inch sewer that enters the headworks operation in the southern area of the facility. Refer to Figure 2-2 for a plant flow diagram. The influent sewer discharges to a 4-ft. deep dual concrete channel. The primary channel consists of a mechanical step screen with ¼-inch openings. The secondary channel is provided with a manual bar screen with 1 ½-inch bar spacing. Screenings are washed and compacted, then discharged and stored in a nearby dumpster for offsite disposal at the landfill.



After screening, wastewater flows into a 7-ft. diameter vortex grit unit. De-gritted raw sewage then flows through a 24-inch sewer to the Influent Pump Station Wet Well. Grit is pumped from the bottom of the vortex unit to a classifier, and then discharges to a dumpster for offsite disposal. The headworks channel is provided with a 12-inch overflow pipe that transfers influent wastewater to the aerobic digesters if necessary. This operation is used to control infiltration and inflow (I&I) by sending excessive influent flow to the aerobic digesters during wet weather flows. The held volume can later be decanted from the digester to the headworks.



| | | | | |
|--|------------------------------|------------------------|--|-----------------------|
| <p>WMA ASSOCIATES ENGINEERS SUPERVISORS PLANNERS</p> <p>471 HILL ROBERT ROAD LYNCHBURG, VIRGINIA 24502 757-533-8225</p> | | DESIGNED BY: JPC | PROJECT: RUTLEDGE CREEK IOP/BOD REPORT | REVISION NUMBER: |
| DRAWN BY: CLP | TITLE: PLANT FLOW DIAGRAM | REVIEWED BY: JPC/HW | DISCIPLINE: | FIGURE NUMBER: 2-2 |
| WMA NUMBER: 240232.07 | FILE NAME: | SCALE: H: V: | DATE: | SHEET NUMBER: |

SECTION 2 – FACILITY DESCRIPTION



The 10 ft. x 12 ft x 15 ft deep wet well of the Influent Pump Station collects wastewater following preliminary treatment. The pump station consists of three Gorman-Rupp TG A-B suction lift pumps. The pumps are equipped with variable speed drives and 40 HP motors. Each pump is rated for 860 gpm at 88 ft TDH. A 10-inch force main was built from the pump station to the influent distribution box of the D-Ditch. The discharge header located in the pump station building is also provided with an emergency pump connection.



2.3 Secondary Treatment

The secondary treatment process consists of the Kruger D-Ditch. This process is similar to conventional oxidation ditches, excepted for its use of phased isolation ditch (PID) technology. The process is a closed loop reactor where aeration of the mixed liquor takes place. The system is similar to a sequencing batch reactor due to the fact that it does not require secondary clarifiers for settling the mixed liquor or a return activated sludge system. The ditches operate in a series of flow patterns that alternate process conditions within the ditch to perform specific treatment objectives. Although treatment and

clarification is carried out in a batch-type operation, influent flow to the ditches and effluent discharge is continuous.



The Rutledge Creek WWTP is provided with a number of components to provide aeration, mixing, and flow control to and from the unit. A partial list of major equipment is provided as follows:

SECTION 2 – FACILITY DESCRIPTION



- Influent Distributor
- Four 3.0-meter Horizontal Brush Aerators with 15 HP Motors
- Two 6.0 HP Submersible Mixers
- Two 5.0-meter Motor Actuated Effluent Weirs
- Two Manual Operated Rotating Scum Pipes
- Two Dissolved Oxygen Probes
- Two Ultrasonic Level Transmitters
- Programmable Logic Control (PLC) based Control Panel

The distributor directs wastewater from the Influent Pump Station into the respective ditch, depending on which phase the system is operating. The ambient ditch conditions are alternated between oxic, anoxic, and quiescent to accomplish nitrification, denitrification and clarification. The D-Ditch was not designed to fully denitrify at 0.6 MGD, and is currently operating with additional anoxic stages because it has not reached the design loading. The ability to perform anoxic treatment is due to additional equipment provided beyond what was needed to meet the effluent limits that were in place at the time of construction. As the hydraulic loading of the treatment plant increases, the treatment phases will be adjusted, decreasing the amount of time available for anoxic phases.



The brush aerators (rotors) are operated and controlled by the PLC, and operate during oxic stages. In addition to phased control, the rotors are controlled by dissolved oxygen (DO) levels in the respective ditches. The DO probes monitor oxygen levels during the specific phases and transmit a signal to the PLC that turns the rotors on or off to increase or reduce the DO level in the ditch.

The effluent weirs control the liquid level in the ditches and the flow of effluent from the ditches. The PLC adjusts the weir based on level indicators in the ditches to provide

SECTION 2 – FACILITY DESCRIPTION



optimal submergence of the rotors. This maximizes oxygen transfer and reduces power consumption.

The theory of operation for the D-Ditch is as follows:

Phased Isolation Ditch Technology in the D-Ditch mode of operation can be best understood by following the process through one complete 8-hour cycle of operation. One complete cycle set forth in this example consists of eight phases. The phases are labeled B, D, E, F, H, J, K, and L. Please note that Phases H, J, K, and L are simply “mirror images” of Phases B, D, E, and F.

The cycle begins with Phase B followed by Phase D. Note that these phases are exactly the same and in this example the total duration of both phases is 3 hours (1.5 hrs each). If denitrification is desired additional anoxic phases will be incorporated into the system (refer to Table 2.2, phases A-D). In Phases B and D, the influent wastewater is directed to Ditch 1 (See Figure 2.3). Ditch 1 is in the aeration mode of operation. The rotors in Ditch 1 aerate the mixed liquor, resulting in the degradation of the influent BOD and nitrification of ammonia-nitrogen.

In Phases B and D, the influent enters Ditch 1, where the effluent weirs are raised producing a hydraulic gradient that forces the mixed liquor to Ditch 2, where the biosolids settle. The motorized effluent weirs are lowered in Ditch 2 to allow the treated and clarified effluent to continue on to further treatment, such as filtration and disinfection. The process will continue to operate in the mode for 3 hours, before advancing to Phases E and F.

Table 2.2: D-Ditch Operational Phases

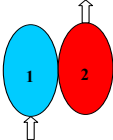
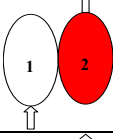
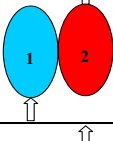
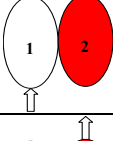
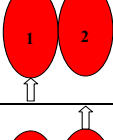
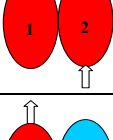
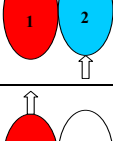
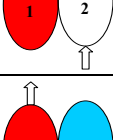
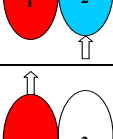
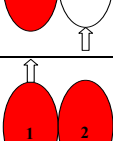
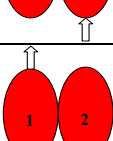
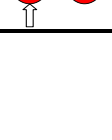
| Phase | Flow Pattern/ Process Conditions | Operator Input. Time (min) | Ditch 1 | Ditch 2 |
|-------|---|-------------------------------|---|---|
| A |  | Default: 0 Range: 0-60 | <ul style="list-style-type: none"> • Denitrification • Rotors off • Mixers on • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| B |  | Default: 90 Range: 0-180 | <ul style="list-style-type: none"> • Nitrification • Rotors on • Mixers on • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| C |  | Default: 0 Range: 0-60 | <ul style="list-style-type: none"> • Denitrification • Rotors off • Mixers on • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| D |  | Default: 90 Range: 0-180 | <ul style="list-style-type: none"> • Nitrification • Rotors on • Mixers on • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| E |  | Default: 30 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| F |  | Default: 30 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir up | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down |
| G |  | Default: 0 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Denitrification • Rotors off • Mixers on • Weir up |
| H |  | Default: 90 Range: 0-180 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Nitrification • Rotors on • Mixers on • Weir up |
| I |  | Default: 0 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Denitrification • Rotors off • Mixers on • Weir up |
| J |  | Default: 90 Range: 0-180 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Nitrification • Rotors on • Mixers on • Weir up |
| K |  | Default: 30 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir up |
| L |  | Default: 30 Range: 0-60 | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir down | <ul style="list-style-type: none"> • Settling • Rotors off • Mixers off • Weir up |



Figure 2.3: D-Ditch Process Phases B & D.

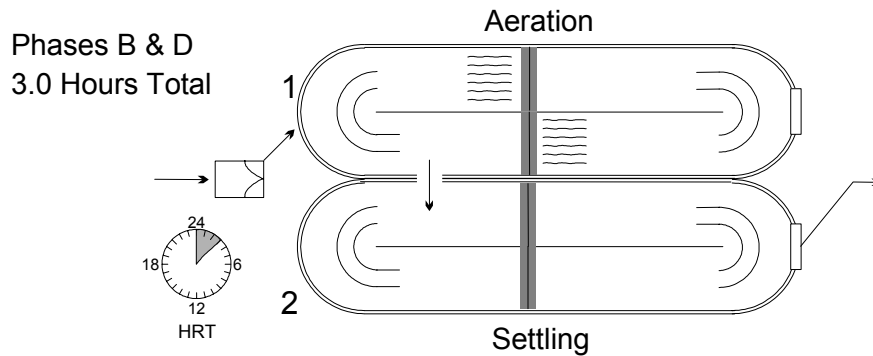
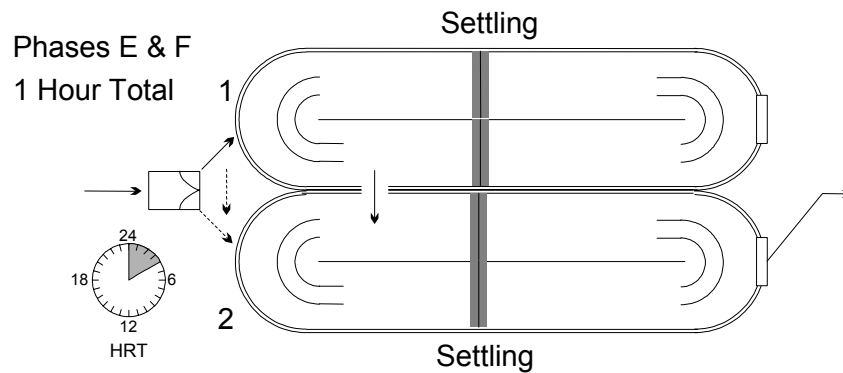


Figure 2.4: D-Ditch Process Phases E & F.



Phases E and F are intermediate phases with a total duration of 1.0 hour (0.5 hrs each), during which quiescent conditions are maintained in both ditches (See Figure 2.4). During these phases, Ditch 2 is still settling from the previous phase, and will continue settling throughout the duration of these phases. In addition, the effluent will continue to be discharged from Ditch 2 through both phases. After thirty minutes the system moves from Phase E to Phase F. The automated flap gate-type flow distributor in the distribution chamber, which was directing the influent to Ditch 1, switches position from the left to the right. This directs the influent to the inlet pipe discharging to Ditch 2, instead of Ditch 1. The purpose of Phase F

SECTION 2 – FACILITY DESCRIPTION



is to completely isolate Ditch 1 from flow patterns to promote quiescent conditions. The distributor is operated automatically via PLC, however, the unit can also be operated manually in the event of an emergency

In Phases H and J, the effluent weirs in Ditch 2 are raised and the effluent weirs in Ditch 1 are lowered. The hydraulic gradient is now shifted so that the flow direction is from Ditch 2 to Ditch 1, with Ditch 1 discharging effluent (See Figure 2.5). It must be noted that Phases H and J are exactly the same and that anoxic sub-cycles can be included into the phasing by turning all of the rotors off and turning the mixer on. (refer to Table 2.2, phases G-J).

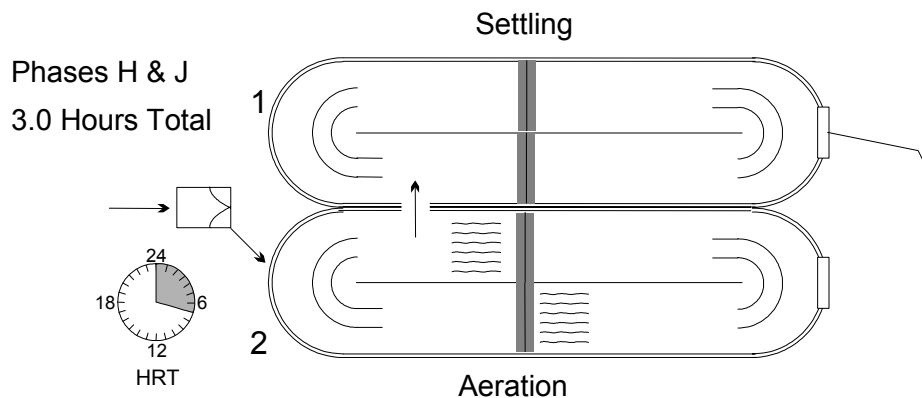


Figure 2.5: D-Ditch Process Phases H & J.

Ditch 1, which was quiescent in Phases E and F, will continue settling during Phases H and J. The rotors in Ditch 2 are turned on, and will maintain oxic conditions in Ditch 2 throughout Phases H & J (3.0 hours).

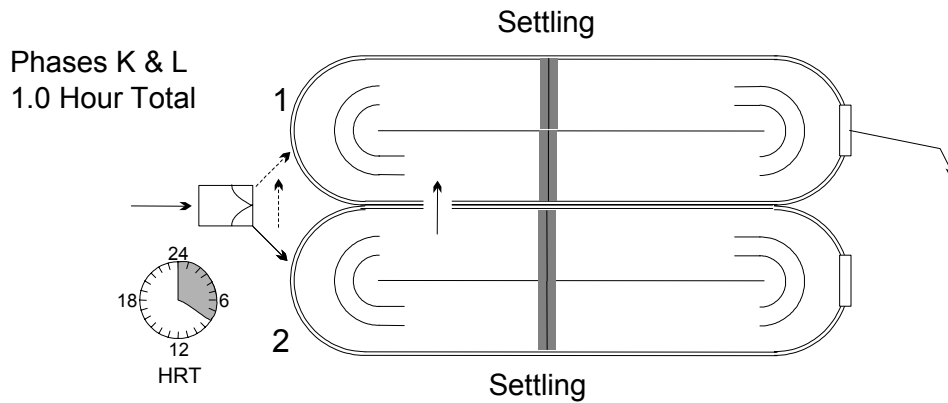


Figure 2.6: D-Ditch Process Phases K & L.

Phases K and L are other intermediate phases with a total duration of 1.0 hour (0.5 hrs each). Phase K is initiated by discontinuing aeration in Ditch 2. Ditch 1 continues to discharge effluent (See Figure 2.6). At the end of Phase K, the influent flow distributor changes position to direct flow back into Ditch 1 signaling the start of Phase L. The purpose of Phase L is to completely isolate Ditch 2 from flow patterns to promote quiescent conditions. At the end of phase L, the entire cycle will have been completed. The weirs in Ditch 1 will be raised, while the weirs in Ditch 2 are lowered and another 8 hour cycle of operation will begin.

One should note that based on a Hydraulic Retention Time (HRT) of 24 hours, one complete 8 hour cycle accounts for 33% of the HRT. In addition, sludge can be wasted from the ditch under oxic conditions as mixed liquor or during settling phases as settled sludge.

A total of twelve (12) phases are programmed into the system. All twelve phases are illustrated in Table 2.2 above. Please note that if the time duration of a phase

SECTION 2 – FACILITY DESCRIPTION



is set to zero, the system will skip the phase in sequence and move into the following phase. The example provided above illustrates how the system will run based on the default settings.

2.4 Tertiary Filtration

Effluent from the D-Ditch flows by gravity to a Kruger Hydrotech Disc Filter. The Disc Filter is used as a polishing process to enhance TSS and BOD removal. The unit is mounted in a 22-ft. 8-in. square concrete structure with room for a future unit if needed. The structure is completed with an inlet channel, filtered water channel, and emergency bypass channel.



Water flows into the center of the drum of the unit and fills the filter segments. The filter segments are partially submerged. The head of the D-Ditch effluent pushes the water through the filter material, and solids are trapped on the inside of the unit. Filtered water passes through disc to the outside of the filter element. The filter elements are static until a maximum pre-determined head level is reached. When the head increases to approximately 12-inches, the unit initiates a backwash cycle. The filter elements are spun while simultaneously receiving countercurrent backwash from high-pressure spray nozzles. The backwash flow enters the waste channel and is sent to the Influent Pump Station. The filter disc unit is susceptible to iron fouling, and has experienced significant operational problems as a result.

SECTION 2 – FACILITY DESCRIPTION



2.5 Disinfection & Post Aeration

Disc Filter effluent flows by gravity to the ultraviolet (UV) disinfection channels. Two 2-ft. channels are provided for UV disinfection. Currently, one channel is used and the second is for future use. The primary UV channel is equipped with two banks of UV lamps. A weir is used to maintain a proper channel depth.



From the UV channel, wastewater flows to the Parshall Flume and Step Aerator. An ultrasonic meter is mounted in the flume to monitor effluent flow rates. The step aerator consists of 12 – 9-inch steps that increase dissolved oxygen levels prior to discharge.

2.6 WWTP Support Systems

The Rutledge Creek Lab/Control Building houses the laboratory, motor control center, the programmable logic controller and operator interface. From this location, the operators can monitor and operate various WWTP functions.

The non-potable water (NPW) system aids in a number of functions around the facility. Primary uses for NPW are for mix water at the Lime Feed



SECTION 2 – FACILITY DESCRIPTION



Building, backwash for the disc filter, spray wash for the step screen unit, and slurry wash at the vortex degriiter. Yard hydrants around the facility are also provided for wash down purposes. The NPW system derives water from the end of the UV Disinfection Channel. A submersible pump supplies water to the NPW Building. The building is provided with a 116-gallon diaphragm tank and a hypochlorite feed system for disinfection.

2.7 Sludge Treatment and Disposal Facilities

Waste activated sludge from the D-Ditch is sent to the Aerobic Digesters. The digesters are converted aeration basins from the original WWTP. The concrete digesters are capable of holding and treating 219,000 gallons of waste sludge each. The digesters are provided with diffused aeration and mixing equipment. The digesters are also equipped with a septage receiving facility. Following treatment, inert sludge is transferred to the sludge drying beds. A polymer is mixed with the sludge during application to the beds to facilitate dewatering.



Rutledge Creek WWTP is equipped with 8 square sludge drying beds. The beds measure approximately 22-ft x 22-ft. The drying beds are also provided with roof covers to maintain a dry environment. Dried sludge is removed and hauled to a local landfill for final disposal.

SECTION 3 – WASTE CHARACTERIZATION



3.1 Wastewater Generation and Influent Characteristics

Rutledge Creek WWTP currently receives an average daily flow of approximately 0.35 MGD. This flow is generated by domestic, commercial, and industrial sources located throughout and surrounding the Town of Amherst.

Wastewater treatment plant flow data was collected and analyzed from January – August 2005, and are summarized in Table 3-1. The effluent flows were provided by a flow element at the Parshall flume. Flow rates are transmitted to the Control Building and recorded by the WWTP operational system.

**Table 3-1: Rutledge Creek WWTP Flow Rates
(1/05 – 8/05)**

| Month | Monthly Average Effluent Flow (MGD) | Peak Day Effluent Flow (MGD) |
|---------------------------|--|-------------------------------------|
| January | 0.3320 | 0.7213 |
| February | 0.3483 | 0.4090 |
| March | 0.3865 | 0.7142 |
| April | 0.4379 | 0.5571 |
| May | 0.3369 | 0.4126 |
| June | 0.3291 | 0.4113 |
| July | 0.3420 | 0.4993 |
| August | 0.3292 | 0.4406 |
| Average | 0.3552 | 0.5207 |
| Peak:Average Ratio | | 1.5 |

* Flows as reported on DMRs.

Daily influent flow rates varied between 0.3291 MGD to 0.4379 MGD. Peak flows represented in Table 3-1 were peak day flow rates as recorded on the Monthly Data Review Sheets.

SECTION 3 – WASTE CHARACTERIZATION



The Rutledge Creek WWTP was designed to treat an average daily flow of 0.6 MGD, and a peak design capacity of 1.2 MGD. The hydraulic design capacity of the treatment plant is 1.8 MGD. The peak:average ratio is 1.5 during this analysis. This is within the design ratio of 2.0 and the hydraulic design ratio of 3.0.

The Rutledge Creek operators collect and test influent wastewater samples on a regular basis, usually two times per week. The collected data from January – August 2005 was analyzed and is presented below in Table 3-2.

**Table 3-2: Rutledge Creek WWTP Influent Monitoring Results
(1/05 – 8/05)**

| Month | Average BOD ₅ Loading | | Average TSS Loading | |
|----------------------|----------------------------------|------------|---------------------|------------|
| | mg/L | Kg/D | mg/L | Kg/D |
| January | 155 | 340 | 175 | 357 |
| February | 144 | 234 | 144 | 233 |
| March | 206 | 351 | 635 | 1115 |
| April | 114 | 193 | 142 | 239 |
| May | 154 | 273 | 179 | 314 |
| June | 144 | 218 | 143 | 217 |
| July | 92 | 128 | 109 | 153 |
| August | 100 | 134 | 132 | 177 |
| Averages | 142 | 240 | 223 | 378 |
| Design Values | 140 | -- | 170 | -- |

The actual loading presented in Table 3-2 is close to the design criteria presented by the D-Ditch manufacturer's literature. Design information is presented below.

SECTION 3 – WASTE CHARACTERIZATION



- BOD₅ = 140 mg/L
- TSS = 170 mg/L
- TKN = 40 mg/L

The actual influent TSS loading is slightly higher than target values. This is due to an unusually high loading that occurred in March 2005. Neglecting March, the actual TSS loads were equivalent to the design figures. Design temperatures range from 10-25°C. Actual temperatures ranged from 10-12°C in cold weather months, to 22-24°C in warm weather months. Influent pH typically ranged from 6.9-7.6.

3.2 Effluent Monitoring

Effluent monitoring results from January to August 2005 were obtained and analyzed. Monitoring was completed in accordance with the VPDES permit requirements to ensure compliance with effluent limitations, presented in Table 2-1. In addition to the effluent monitoring required to meet existing permit limits, the facility is required to monitor various nutrients discharged to Rutledge Creek. Complete monitoring requirements are outlined in the VPDES permit. A summary of monitoring results is presented in Table 3-3.

Included in the monthly Discharge Monitoring Report (DMR) are effluent levels of total phosphorus (TP), orthophosphate, total nitrogen (TN), total kjeldahl nitrogen, and nitrite + nitrate. The Rutledge Creek WWTP operators are required to report these constituents twice per month. Analysis of the monitoring shows that the facility, on average, has produced a low nutrient effluent, with a TP of less than 1.0 mg/L and a TN of approximately 5.0 mg/L. The highest effluent TN recordings occurred in January and February at 11.4 mg/L and 8.7 mg/L, respectively. According to plant personnel, the elevated effluent nitrogen levels occurred due to the inability to waste sludge during construction.

SECTION 3 – WASTE CHARACTERIZATION



**Table 3-3: Rutledge Creek WWTP Effluent Monitoring Results
(1/05 – 8/05)**

| Month | BOD5 | | TSS | | Total Phos. | | Ortho Phos. | | TKN | | NO2+NO3 | | Total N | | Ammonia |
|------------------|------------|------------|------------|------------|-------------|------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | mg/L | Kg/D | mg/L | Kg/D | mg/L | Kg/D | mg/L | Kg/D | mg/L | Kg/D | mg/L | Kg/D | mg/L | Kg/D | mg/L |
| Jan* | 4.3 | 5.7 | 4.4 | 5.8 | 1.2 | 1.4 | 0.0 | 0.0 | 11.1 | 12.2 | 0.3 | 0.3 | 11.4 | 12.5 | --- |
| Feb* | 3.2 | 4.3 | 4.1 | 5.4 | 0.4 | 0.5 | 0.1 | 0.1 | 8.1 | 10.8 | 0.6 | 0.8 | 8.7 | 11.6 | --- |
| Mar | 6.5 | 9.5 | 5.8 | 8.8 | 0.5 | 0.7 | 0.0 | 0.0 | 2.0 | 2.9 | 0.9 | 1.3 | 2.9 | 4.2 | --- |
| Apr | 5.7 | 9.1 | 9.9 | 15.1 | 0.4 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.8 | 1.0 | 1.8 | --- |
| May | 3.4 | 4.6 | 4.9 | 6.7 | 0.7 | 1.1 | 0.3 | 0.4 | 3.4 | 1.3 | 3.9 | 5.6 | 4.9 | 6.9 | --- |
| Jun | 3.1 | 3.9 | 4.3 | 5.5 | 1.3 | 1.7 | 0.5 | 0.7 | 1.1 | 1.7 | 4.4 | 6.0 | 5.5 | 7.7 | 1 |
| Jul | 3.1 | 4.2 | 6.6 | 9.2 | 0.9 | 1.3 | 0.4 | 0.4 | 1.2 | 1.7 | 2.7 | 4.8 | 3.8 | 6.5 | 0.8 |
| Aug | 1.1 | 1.4 | 2.6 | 3.4 | 1.3 | 1.7 | 1.0 | 1.2 | 0.3 | 0.4 | 1.6 | 2.0 | 1.9 | 2.3 | 0.2 |
| Averages* | 3.8 | 5.5 | 5.6 | 8.0 | 0.8 | 1.1 | 0.4 | 0.5 | 1.3 | 1.3 | 2.4 | 3.6 | 3.3 | 4.9 | 0.7 |

*January/February data not factored into averages due to digester construction activities.



3.3 Additional Testing Protocol

To further understand the waste load entering and leaving the facility a testing protocol was developed and executed in October and November 2005. The sampling protocol called for three consecutive days of testing in October on the influent, effluent, and waste streams of the treatment plant. The following parameters were include in the protocol:

- COD (soluble)
- BOD₅
- CBOD₅
- TSS
- Ammonia
- TKN
- Nitrite + Nitrate
- Total Nitrogen
- Orthophosphate
- TP (soluble & particulate)
- Alkalinity
- pH
- DO
- Temperature

The samples were collected as 24-hour composites, with the exception of pH, DO, and temperature, which were grab samples. All waste sludge sampling was obtained as grab samples. The first round of sampling took place October 18-20. A second data set was developed in November. The November testing analyzed the influent conditions only. Results of the October and November testing are presented in Tables 3-4 and 3-5.

Process control testing was performed as part of the sampling protocol to gauge performance of the D-ditch system. These tests were completed to help identify any limiting factors, insufficiencies, and to aide in identifying process adjustments to maximize treatment efficiency. Testing was performed for the parameters listed below; results are presented in Table 3-6.

- Alkalinity
- pH
- DO
- Temperature
- SRT
- MLSS
- MLVSS
- Waste Rates
- SVI
- Lime Addition

SECTION 3 – WASTE CHARACTERIZATION



Table 3-4: Influent and Effluent Testing Protocol Results

| Parameter (mg/L unless otherwise noted) | Influent Testing Results | | | | | | Effluent Testing Results | | | |
|--|--------------------------|--------|--------|----------|--------|------------------|--------------------------|--------|--------|------------------|
| | October | | | November | | Influent Avg. | October | | | Effluent Avg. |
| | Day 1 | Day 2 | Day 3 | Day 1 | Day 2 | | Day 1 | Day 2 | Day 3 | |
| COD | 92 | 91 | 100 | 470 | 2080* | 188.3 | 11 | 84 | 46 | 47.00 |
| BOD5 | 153 | 119 | 182 | 194 | 56* | 162.0 | 1.2 | 1.9 | 2.7 | 1.93 |
| CBOD5 | 125 | 218 | 155 | 153 | 190 | 168.2 | nd | 2 | 4 | 3.00 |
| TSS | 117 | 127 | 178 | 207 | 47 | 135.2 | 0.9 | 2.4 | 4 | 2.43 |
| Ammonia | 20.4 | 20 | 9 | 20.6 | 19.4 | 17.9 | 0.278 | 0.317 | 0.302 | 0.30 |
| TKN | 27.9 | 23.2 | 10.9 | 24.2 | 22.3 | 21.7 | nd | nd | nd | nd |
| Nitrite+Nitrate | nd | 0.49 | 0.11 | nd | 0.36 | 0.32 | 3.35 | 3.84 | 3.76 | 3.65 |
| Total Nitrogen | 27.9 | 23.69 | 11.01 | 24.2 | 22.66 | 21.9 | 3.35 | 3.84 | 3.76 | 3.65 |
| Orthophosphate | 2.14 | 5.85 | 3.1 | 2.84 | 1.48 | 3.1 | 0.31 | 0.38 | 0.41 | 0.37 |
| Total Phosphorus | 4.25 | 6.5 | 3.6 | 4 | 6.35 | 4.9 | 0.35 | 1.3 | 1.2 | 0.95 |
| Soluble Phosphorus | 1.2 | 3.1 | 2.9 | 1 | 3.9 | 2.42 | 0.19 | 0.55 | 0.14 | 0.29 |
| Particulate Phosphorus | 3.05 | 3.4 | 0.7 | 3 | 2.45 | 2.52 | 0.16 | 0.75 | 1.06 | 0.66 |
| Alkalinity | 195 | 204 | 194 | 181 | 166 | 188 | 150 | 158 | 160 | 156 |
| pH, (s.u.) | 7.3 | 7.2 | 7.2 | 7.2 | 7.4 | 7.26 | 7.8 | 7.8 | 7.7 | 7.8 |
| D.O. | 1 | 1.8 | 1.8 | 1.6 | 1.9 | 1.62 | 8.7 | 8.7 | 8.6 | 8.7 |
| Temperature (°C) | 20.8 | 20.6 | 20.8 | 18.8 | 16.9 | 19.6 | 20.7 | 20.9 | 21.4 | 21.0 |
| Flow (MGD) | 0.3361 | 0.3155 | 0.3285 | 0.3361 | 0.3103 | 0.33 | 0.3361 | 0.3155 | 0.3285 | 0.33 |

*Values were disregarded due to inconsistency.

SECTION 3 – WASTE CHARACTERIZATION



Table 3.5 – Waste Testing Protocol Results

| Parameter (mg/L unless otherwise noted) | October | | | Avg. |
|--|---------|-------|-------|--------------|
| | Day 1 | Day 2 | Day 3 | |
| COD | 2950 | 1650 | 540 | 1713 |
| BOD5 | 809 | 771 | 780 | 786 |
| CBOD5 | 1260 | 1380 | 1740 | 1460 |
| TSS | 13705 | 11825 | 10510 | 12013 |
| Ammonia | 4.22 | 0.153 | 2.26 | 2.2 |
| TKN | 6 | nd | 3.9 | 5.0 |
| Nitrite+Nitrate | nd | 0.36 | 0.59 | 0.5 |
| Total Nitrogen | 6 | 0.36 | 4.49 | 3.6 |
| Orthophosphate | 12.6 | 27.6 | 18 | 19.4 |
| Total Phosphorus | 14.5 | 34 | 20.5 | 23.0 |
| Soluble Phosphorus | 2.3 | 1.9 | 1.1 | 1.8 |
| Particulate Phosphorus | 12.2 | 32.1 | 19.4 | 21.2 |
| Alkalinity | 566 | 548 | 500 | 538 |
| pH, (s.u.) | 7.1 | 7.2 | 7.2 | 7.2 |
| D.O. | 0.4 | 1.2 | 0.2 | 0.6 |
| Temperature (°C) | 20.8 | 21.2 | 20.8 | 20.9 |

Table 3.6 – Process Control Testing Results

| Parameter | Ditch 1 | | | Ditch 2 | | | Avg. |
|---|---------|-------|-------|---------|-------|-------|-------------|
| | Day 1 | Day 2 | Day 3 | Day 1 | Day 2 | Day 3 | |
| Alkalinity, (mg/L as CaCO ₃) | --- | 236 | 207 | 227 | --- | --- | 223 |
| pH, (s.u.) | 7.3 | 7.2 | 7.2 | 7.2 | 7.2 | 7.1 | 7.2 |
| D.O., (mg/L) | 1 | 1.4 | 1.5 | 1.2 | 1.2 | 0.5 | 1.1 |
| Temperature, (°C) | 20.5 | 20.4 | 20.9 | 26.6 | 20.6 | 21.2 | 21.7 |
| SRT, (d) | 11 | 11 | 16 | 11 | 11 | 16 | 12.7 |
| MLSS, (mg/L) | 3155 | 3380 | 3090 | 3115 | 3150 | 3115 | 3167 |
| MLVSS, (mg/L) | 2110 | 2215 | 2095 | 2050 | 2115 | 2160 | 2124 |
| SVI | 65 | 59 | 65 | 74 | 67 | 67 | 66 |
| Lime Addition, (lbs/d) | 145 | 145 | 145 | --- | --- | --- | 145 |

SECTION 4 – BASIS OF DESIGN



4.1 Enhanced Nutrient Removal Alternatives

The existing D-Ditch system is a non-conventional oxidation ditch type of reactor, similar to a sequencing batch reactor in the fact that it is a self-contained process that operates in phases without the use of clarifiers. Given the uniqueness of the D-Ditch, the most feasible alternatives for upgrading the process will incorporate the existing treatment technology. The D-Ditch manufacturer (Kruger) assisted in the development of the alternatives for enhanced nutrient removal discussed in this section. Other possible alternatives are discussed at the end of the section.

The identified alternatives are presented below in Table 4-1. The alternatives were identified to achieve the four treatment tiers defined by the Chesapeake Bay Program. A fifth alternative was developed to meet the approved waste load allocation (WLA) of TN = 6 mg/L, TP 0.5 mg/L, for the Rutledge Creek WWTP.

Table 4-1: Alternative Summary

| Alternative | Effluent Limits (TN/TP) | Process Improvements/ Additions | | | | |
|-------------|-------------------------|---------------------------------------|---|-------------------------------------|---|-------------------------------------|
| | | Online Nitrogen Control System (STAC) | Alum Feed Facilities (Phosphorus Precipitation) | Secondary Clarifiers w/RAS | Upfront Anaerobic Selector Tanks (BioDenipho) | Secondary Anoxic Tanks |
| Tier 1 | 8/- | <input checked="" type="checkbox"/> | | | | |
| Tier 2 | 8/1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | |
| WLA | 6/0.5 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | |
| Tier 3 | 4/0.3 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Tier 4 | 3/0.1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |



4.2 Tier 1 & 2 TN Reduction – STAC System

To provide Tier 1 and Tier 2 (TN = 8.0 mg/L) levels of treatment at the Rutledge Creek WWTP, an online nitrogen control system is proposed to work in conjunction with the existing D-Ditch system. The D-Ditch manufacturer, Kruger, refers to this as the STAC System.

The STAC system allows automatic adjustment of phase length in response to effluent nitrogen concentration and can improve overall plant performance. The system is made up of an on-line analyzer that monitors real time concentrations of ammonia and nitrates in turn sending signals to the PLC to control the D-Ditch phases. During the oxic phases, influent ammonia is oxidized to nitrate (nitrification). The analyzer monitors the ammonia level until it is reduced, at which point the D-Ditch switches to an anoxic phase where nitrate is converted to nitrogen gas (denitrification). The submersible mixers keep the biosolids in suspension during this process and the influent BOD serves as the carbon source. The analyzer then proceeds to monitor the nitrate concentration present in the Ditch until it is also reduced, resulting in a phase change to the next oxic treatment cycle.

The implementation of this system does not require the construction of any new processes. Adding the STAC system consists of adding the analyzer, along with the sampling lines, and other required appurtenances, and adjusting the PLC programming to operate with the new equipment.

It should be noted that at current waste loading, the plant is achieving TN reduction well within 8 mg/L. This is due to plant optimization, which consists of additional anoxic treatment phases programmed into the D-Ditch control system. However, as the flows reach design levels, the facility will not be able to operate the additional phases, and will reduce the amount of time available for anoxic treatment.



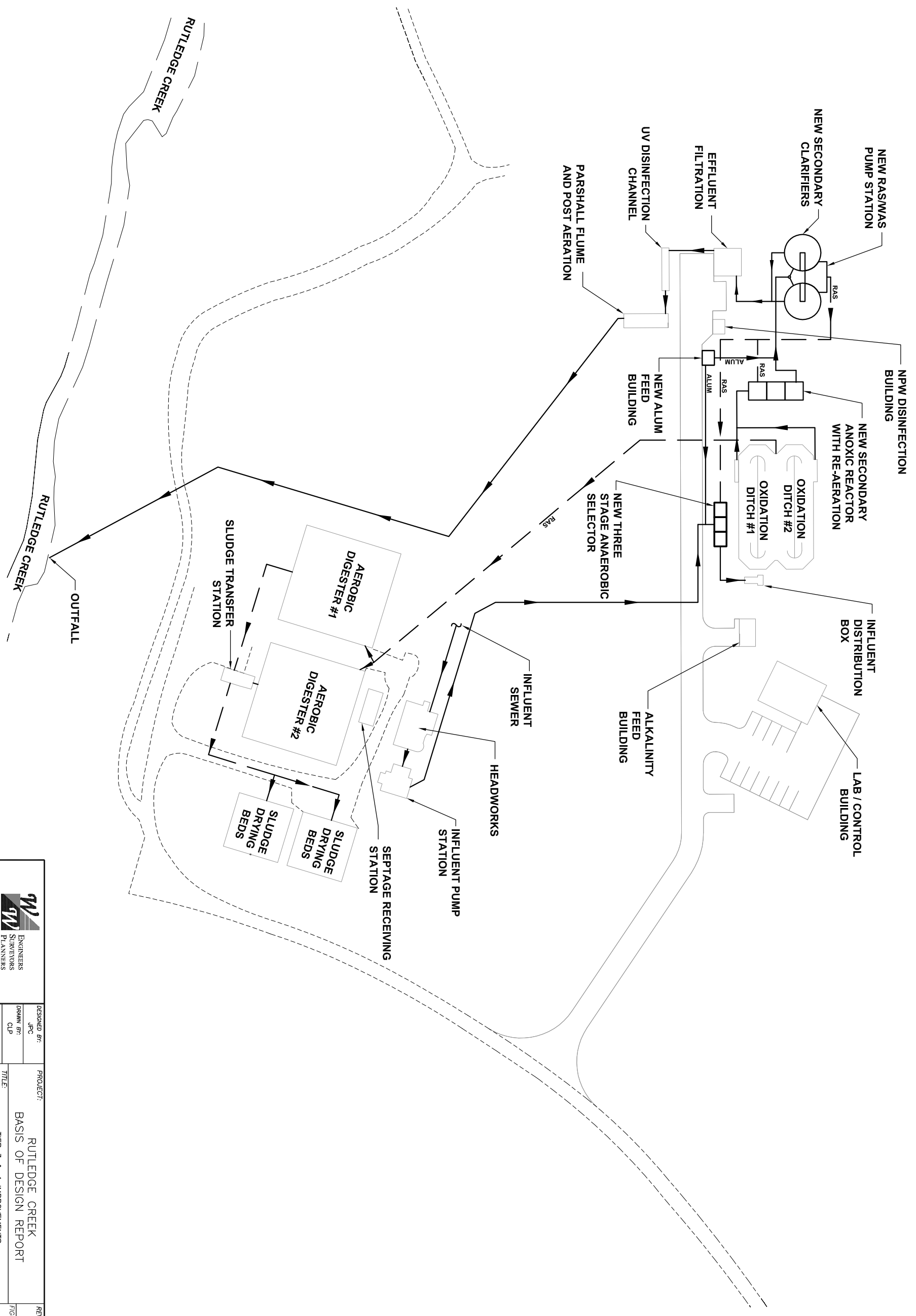
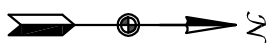
4.3 Tiers 3 & 4 TN Reduction – BioDenipho System w/ Secondary Anoxic Tank

The upgrade to Tier 3 (TN = 4.0 mg/L) and Tier 4 (TN = 3.0 mg/L) for enhanced nutrient removal requires considerable construction improvements at the Rutledge Creek facility. These improvements consist of adding a three-stage anaerobic selector, secondary anoxic tanks with re-aeration, and secondary clarifiers with a return activated sludge (RAS) pump station. The anaerobic selector will be added for biological phosphorus removal discussed later in this section. The other improvements will serve to enhance nitrification and denitrification operations. Refer to Figure 4-1 for a preliminary schematic of the improvements.

The BioDenipho system will act in conjunction with the STAC system discussed above, and the phased isolation ditch technology previously discussed. The process control programming will be modified to remove the current settling phases of the D-Ditch, dedicating the entire treatment cycle to oxic and anoxic phases controlled by a combination of dissolved oxygen input from the existing DO probes, and also relying on the online nitrogen analyzer to properly maintain the balance between nitrification and denitrification. The phases will be reduced to four main operating phases as illustrated in Figure 4-2. Phases are also capable of alternating strictly based on time limits.

A secondary anoxic treatment tank with re-aeration will be constructed between the D-Ditch and the secondary clarifiers as shown in Figure 4-1. The secondary process will consist of three stages with the first two anoxic, followed by a re-aeration stage. This process will require the addition of a carbon source to fuel the denitrification reaction. To accommodate the carbon need, return activated sludge will be blended into the anoxic zone. This process is referred to as RAS bleed.

The total design hydraulic residence time for the secondary process is approximately two hours. Each anoxic tank will be equipped with a submersible mixer. The re-aeration




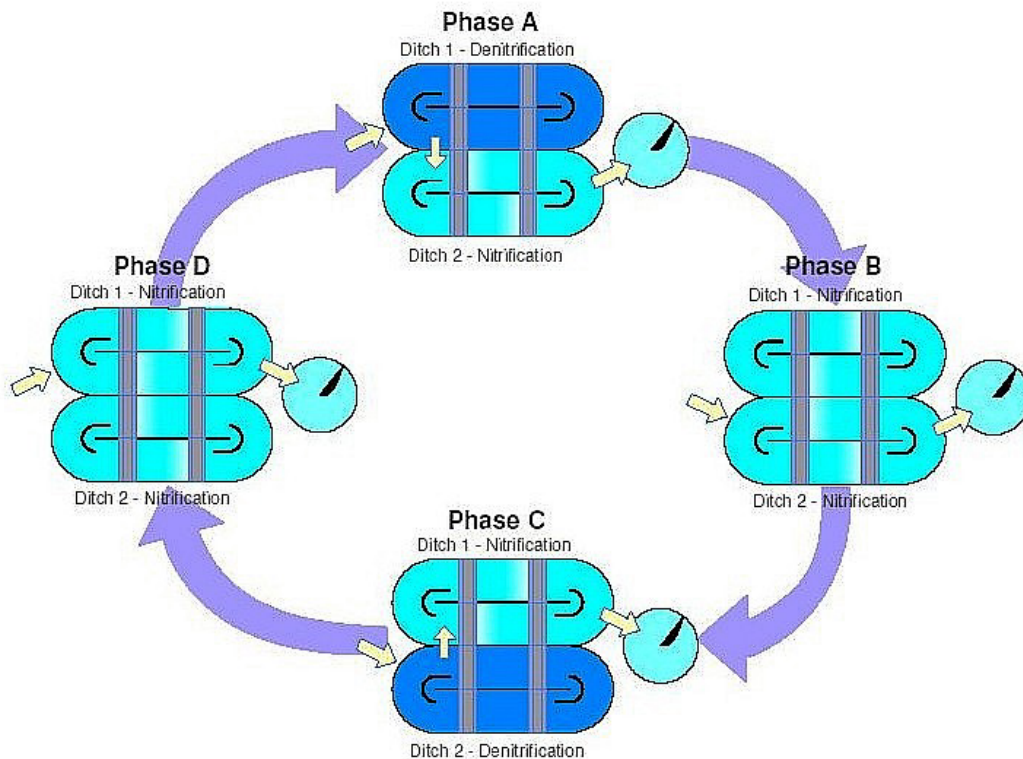
| | | | | | | | |
|---|--|-----------------------------------|--|--|--|---|--|
|  WMA ASSOCIATES ENGINEERS SUPERVISORS PLANNERS | | DESIGNED BY: JPC | | PROJECT: RUTLEDGE CREEK BASIS OF DESIGN REPORT | | REVISION NUMBER: FIGURE NUMBER: 4-1 | |
| REVIEWED BY: JPC/HW | | TITLE: TIER 3 & 4 IMPROVEMENTS | | DISCIPLINE: H/V | | DATE: | |
| WMA NUMBER: 240292.07 | | FILE NAME: | | SCALE: | | SHEET NUMBER: | |

Figure 4-2: BioDenitro/BioDenipho Main Operating Phases



process will consist of mixing and aeration to provide oxic conditions in order to reduce any remaining oxygen demand. Consideration will also be given to provide a supplemental carbon feed system consisting of methanol or acetic acid. This process addition will provide Tier 3 and 4 treatment, effectively equal to the current limits of technology for nitrogen reduction.

Settling will take place in the new clarifiers as shown in Figure 4-1. A splitter box with adjustable weir gates will be provided to evenly distribute wastewater from the oxidation ditch to two circular secondary clarifiers. Each secondary clarifier will be approximately 40 feet in diameter, with a side water depth of about 14 feet. Based on the 0.6 MGD design flow and a mixed liquor suspended solids concentration (MLSS) of 3,500 mg/L,

SECTION 4 – BASIS OF DESIGN



each clarifier will have a solids loading rate of approximately $0.3 \text{ lb/ft}^2\text{-hr}$ and an overflow rate of about 240 GPD/ft^2 .

Influent wastewater will discharge to each clarifier through a center column. Clarified effluent will flow over a continuous v-notch weir located around the circumference of each clarifier. A suction manifold will be installed on the bottom of each clarifier to remove settled sludge; the manifold will be piped to a return activated sludge/waste activated sludge (RAS/WAS) pump station located between the clarifiers.

Each clarifier will be equipped with a surface scum removal system, consisting of a revolving scum trough, rotating scum collection ring, stationary skimmer blades, and scum pump. Scum will be pumped to the aerobic digesters for disposal. Provisions for foam control will be made for each clarifier as well.

The RAS/WAS Pump Station will share a common reinforced concrete walls with the clarifiers as shown in Figure 4-1. A total of three recessed impeller type pumps will be provided for sludge transfer. Two pumps will be used to return activated sludge to the Anaerobic Selector or to waste sludge to the aerobic digesters for stabilization. The discharge header will be valved to allow these two pumps to discharge to either location. The third pump will be dedicated to waste sludge service. The discharge piping for each pump will be equipped with a magnetic flow meter/motorized pinch valve arrangement to control the return and waste sludge flow rates.

4.4 Tier 1 TP Reduction

The Rutledge Creek WWTP will not require any process modifications to achieve Tier 1 phosphorus reduction requirements, since there is no current phosphorus limit in place for the facility. The facility currently achieves low effluent total phosphorus concentrations,

SECTION 4 – BASIS OF DESIGN



typically around 1.0 mg/L. These concentrations can be attributed to lime addition, and the fact that the facility is not at full hydraulic capacity.

4.5 Tier 2 TP Reduction – Chemical Feed Facilities

To ensure the Tier 2 limit of 1.0 mg/L TP at design flows, additional chemical feed facilities will be required. The addition of lime to the D-Ditch does assist in current phosphorus removal, but is not specifically designed to do so at this facility. More common multivalent metal ions used in phosphorus precipitation are aluminum (Al^{+3}), and iron (Fe^{+3}). For this study, alum (aluminum sulfate) will be the precipitant of choice. Alum is preferred over lime because it produces less sludge and is easier to operate and maintain. Lime is also limited by the degree of phosphorus removal required and the alkalinity of the wastewater. Lime addition will continue to be used for alkalinity control and to optimize pH for precipitation.

Typically, organic phosphorus compounds usually settle out during the sedimentation process, or are transferred to orthophosphates during biological treatment. Likewise, polyphosphate compounds are converted to orthophosphate forms due to biological enzymatic activity during secondary treatment. Since polyphosphate compounds are not converted to orthophosphates until biological treatment, it is more efficient to add metallic salt cations after secondary treatment.

Alum will be added to the D-Ditch during the final treatment phases of the process, to ensure proper blending of the alum and wastewater. The flocculation that happens with alum addition is the formation of aluminum phosphate particles that attach themselves to one another and become heavy and settle to the bottom of the D-Ditch during the settling phase. The aluminum sulfate and phosphorus mixture can then be withdrawn with the waste sludge to the aerobic digester.



For aluminum, the molar ratio required to precipitate phosphorus is approximately 1:1. A typical range can actually be as high as 3 metal ions to 1 phosphorus ion due to competing reactions, and the effects of alkalinity, pH, and ligands found in the wastewater. The alum will be stored in a bulk storage tank located in a new Alum Feed Building. The new fiberglass reinforced plastic tank will be approximately 6,000 gallons to accommodate a 30-day supply plus additional storage for usage. The alum will be fed through metering pumps to the D-Ditch.

4.6 Tiers 3 & 4 TP Reduction – Anaerobic Selector

To reach Tier 3 (TP = 0.3 mg/L) and Tier 4 (TP = 0.1 mg/L) phosphorus limits, biological phosphorus removal will be required. The addition of a three stage upfront anaerobic selector will reduce TP levels prior to alum precipitation, resulting in less chemical usage and the associated costs.

The anaerobic selector will be constructed adjacent to the D-Ditch as shown in Figure 4-1. Refer to Table 4-2 for a summary of the process design. Other Tier 3 & 4 improvements include the construction of secondary clarifiers and a RAS pump station, as previously discussed. The RAS will be pumped into the first cell of the selector. Wastewater from the Influent Pump Station will be re-routed from the D-Ditch distribution box to the second cell of the Anaerobic Selector. The effluent from the third cell will flow by gravity to the existing D-Ditch distribution box. Each cell will be provided with a 3 horsepower submersible mixer.

Biological phosphorus removal is achieved by creating an anaerobic zone upstream of an aerobic treatment process. Various microorganisms present in wastewater utilize phosphorus for cell maintenance, synthesis, energy transport, and is stored for subsequent use. The primary organisms responsible are *Acinetobacter*. During anaerobic conditions, the microorganisms release stored phosphorus in the presence of volatile fatty acids.



Table 4-2: Anaerobic Selector Process Summary

| Process Description | Values |
|-----------------------------------|---------------|
| Number of Trains | 1 |
| Number of Stages per Train | 3 |
| HRT, hours | 2 |
| Volume per Stage, ft ³ | 2,200 |
| Length/Stage, ft | 10 |
| Width /Stage, ft | 14 |
| Side Water Depth, ft | 15.5 |
| Number of Mixers per Stage | 1 |
| Mixer Power, HP | 2.7 |

Following the anaerobic process, the waste stream is subjected to an aerobic phase (oxic) where the microorganisms then uptake phosphorus above normal levels. When settling occurs, the sludge containing the excess phosphorus is wasted, resulting in biological phosphorus removal.

Since Tier 3 and Tier 4 improvements include secondary clarifier improvements, additional alum feed points will be provided upstream of the clarifiers. Multiple alum addition points will provide flexibility in managing when and where the chemical is added. It should also be noted that while the above discussed improvements apply to Tier 3 and Tier 4, the Tier 4 level of phosphorus reduction of 0.1 mg/L on a consistent basis may be difficult due to technology considerations.

4.7 Improvements for WLA Compliance

The final waste load allocations (WLA) were adopted by the State Water Control Board during the generation of this report. The final nutrient limits for the Rutledge Creek

SECTION 4 – BASIS OF DESIGN



WWTP are TN = 6 mg/L and TP = 0.5 mg/L. This WLA is consistent with most dischargers to the Upper James, above the fall line. This limit falls between Tiers 2 and 3 identified above. Because of this, a fifth alternative was identified to meet WLA compliance.

The WLA compliance alternative will be similar to the Tier 3 improvements, without the upfront anaerobic selector. The addition of Alum feed facilities, and secondary clarifier improvements will provide the WWTP with the means to remove TP to 0.5 mg/L. Secondary clarifiers and the RAS/WAS pump station will be identical to those discussed above for Tiers 2 and 3. The return activated sludge will be sent directly to the D-Ditch, instead of passing through an anaerobic selector.

4.8 Other Enhanced Nutrient Removal Alternatives

As mentioned previously, the most feasible alternatives for enhanced nutrient removal at the Rutledge Creek WWTP revolve around using the existing D-Ditch. Other alternatives considered in the preparation of this report include the denitrification filters and membrane bioreactor (MBR) technology.

Denitrification filters are capable of producing Tier 4 levels of nitrogen reduction through fixed film biological denitrification. These filters typically have a deeper bed than conventional filters, made up of various types of media supported by a gravel under drain. Media depths are usually 5 ft or more. The filters are usually equipped with an air scour system and backwash equipment. An upflow version of the denitrification filter is also available. These systems do require a supplemental carbon feed source to facilitate the denitrification reaction. Methanol feed systems are more common for larger facilities. In smaller wastewater plants, acetic acid feed systems can be considered. Methanol is preferred on a cost basis, but is more hazardous to handle, store, and



maintain. Careful control over the supplemental carbon feed systems is required to ensure proper treatment.

In addition to the cost associated with denitrification filters and carbon feed systems, other factors such as the operation and control required and occupational safety challenges associated with this alternative were considered to eliminate this treatment technology.

Membrane bioreactors (MBR) are a developing treatment technology. Various forms of membranes treatment options are available. The most common are hollow fiber, or flat plate membranes. Typically the membranes are submerged in reactors with high (>10,000 mg/L) mixed liquor concentrations. The filtered product, or permeate, either flows by gravity from the membranes, or is pumped. This technology is capable of providing Tier 3 to Tier 4 nutrient reduction. Possible drawbacks, or unproven points, associated with MBRs include, maintenance concerns, membrane life expectancy, membrane replacement costs, and need for fine screening upstream of the process. Although some installations have been constructed recently, none are currently operational in the Commonwealth of Virginia. Given the developing nature of the technology, the associated costs, and previously mentioned concerns, MBRs were not considered a viable option for the Rutledge Creek WWTP at this time.

4.9 Alternative Cost Summary

Capital costs for the various improvements discussed were generated and are summarized below in Table 4-3. The reported costs represent the price to reach the respective tier, or level, at the 0.6 MGD design flow for the treatment plant. In addition to the capital expenditures, the operations and maintenance (O&M) costs will increase when improvements are implemented. The estimated increase in O&M costs are also presented below in Table 4-3 and are based on the WWTP operating at full design capacity.



Table 4-3: Alternative Cost Summary

| Alternative | WWTP Improvements | | | | | Effluent Limits (TN/TP) | Estimated Capital Cost | Estimated O&M Cost Increase (\$/year) |
|-------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------|------------------------|---------------------------------------|
| | STAC | Alum | Clarifiers | Anaerobic Selector | Secondary Anoxic | | | |
| Tier 1 | <input checked="" type="checkbox"/> | | | | | 8/- | \$250,000 | \$18,000 |
| Tier 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | | 8/1 | \$500,000 | \$80,000 |
| WLA | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | 6/0.5 | \$2,500,000 | \$96,000 |
| Tier 3 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 4/0.3 | \$3,500,000 | \$126,000 |
| Tier 4 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 3/0.1 | \$3,500,000 | \$126,000 |

4.10 WLA Implementation & Conclusions

At a minimum, the Town of Amherst will be required to design and construct the WLA Alternative identified above to comply with the effluent nutrient requirements recently adopted. This alternative consists of the following improvements:

- Online Nitrogen Control System (STAC)
- Secondary Clarifiers w/ RAS Pump Station
- Alum Feed Facilities

The total estimated cost of complying with the WLA is presented as \$2,500,000. This total cost represents the implementation of all the improvements at the design flow rate of 0.6 MGD. The current flow rate was stated in Section 3 as approximately 0.35 MGD. At the current flow rates, and given the effluent monitoring results reported to this date, it is likely that the Rutledge Creek WWTP will continue to produce average effluent TN concentration below 6 mg/L. However, since the existing effluent TP concentrations are

SECTION 4 – BASIS OF DESIGN



approximately 1.0 mg/L, the facility will need the upgrade as soon as the 0.5 mg/L limit for TP is put into place.

Consideration should be given to the design and construction of the Tier 3 Improvements. The same treatment processes have been identified to meet Tier 3 and Tier 4 nutrient limits. From a permit perspective we believe the identified improvements will consistently meet the Tier 3 limits. Tier 4 limits, specifically TP (0.1 mg/L), will be more difficult to meet on a consistent basis since they are considered the limits of technology. The construction of Tier 3 improvements may provide opportunities in the form of nutrient exchange with other facilities located in the Upper James River Basin (based on current developing rules), or could provide higher levels of treatment necessary to the Town of Amherst in the future.

Recent developments by the Department of Environmental Quality indicate that the new limits will be placed into existing permits through the Watershed General Permit. This will likely be enacted in 2006, and will supercede any existing schedules or requirements. Final schedules have not been released to date, however preliminary discussions indicate that the Rutledge Creek WWTP will be required to meet the WLAs by December 2010.

The Water Quality Improvement Fund (WQIF) was established as a result of action taken by the Virginia General Assembly in 1997. The fund was established in response to the need to finance nutrient reduction projects in the Chesapeake Bay Watershed. In July 2005, the fund received \$65.7 million in appropriations for point source nutrient reduction implementation. The 2006 allocation is estimated to be \$54.4 million. It is recommended that the Town of Amherst pursue financial assistance through the WQIF for the Tier 3 improvements identified above. Grant applications for WQIF are due by January 27, 2006 for facilities located in the James River Basin. Guidelines for the WQIF are attached in Appendix A of this report.

SECTION 4 – BASIS OF DESIGN



Based on discussions with DEQ, it is apparent that if grant money is approved and used for Tier 3 improvements, then the Rutledge Creek WWTP will be required through a technical performance standpoint to comply with Tier 3 effluent nutrient requirements (TN = 4mg/L, TP = 0.3 mg/L). These effluent nutrient requirements would then be incorporated into the VPDES permit during the next renewal cycle.

VIRGINIA WATER QUALITY IMPROVEMENT FUND

GUIDELINES

**Issued by:
W. Tayloe Murphy, Jr.
Secretary of Natural Resources
Office of the Governor
Richmond, Virginia
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www.naturalresources.virginia.gov

| | |
|--|----------------|
| INTRODUCTION..... | Page 2 |
| SECTION A: NONPOINT SOURCE PROJECTS | Page 6 |
| SECTION B: POINT SOURCE PROJECTS | Page 11 |
| PROJECT CONTACT INFORMATION | Page 20 |

VIRGINIA WATER QUALITY IMPROVEMENT FUND

GUIDELINES

INTRODUCTION

The purpose of the Virginia Water Quality Improvement Act of 1997 (Act) is “to restore and improve the quality of state waters and to protect them from impairment and destruction for the benefit of current and future citizens of the Commonwealth” (Section 10.1-2118 of the *Code of Virginia*). The Act was amended in 2005 to better reflect current water quality needs and priorities in Virginia particularly the implementation of Chesapeake Bay “Tributary Strategy Plans” and the removal of Virginia waters on the Clean Water Act list of impaired waters. Because this is a shared responsibility between state and local governments and individuals, the Act also creates The Water Quality Improvement Fund (Fund). The Code establishes the purpose of the Fund “to provide Water Quality Improvement Grants to local governments, soil and water conservation districts, institutions of higher education and individuals for point and nonpoint source pollution prevention, reduction and control programs” (Section 10.1-2128.B. of the *Code of Virginia*).

The Department of Environmental Quality has the responsibility to provide technical and financial assistance to local governments, institutions of higher education and individuals for the control of point source pollution. The Department of Conservation and Recreation has the responsibility to provide technical and financial assistance to local governments, soil and water conservation districts, institutions of higher education and individuals for nonpoint source pollution prevention, reduction and control programs. Because of the nature of nonpoint source pollution controls, the Department of Conservation and Recreation will seek the assistance and support of other state agencies to provide the necessary expertise and resources to properly implement the nonpoint source elements of the Act.

Payments into the Water Quality Improvement Fund in accordance with the Chesapeake Bay Watershed Nutrient Exchange Program created under 62.1-44.19:12 shall be utilized in a manner to achieve point or nonpoint source reductions in accordance with the requirements established in the nutrient exchange program in addition to the requirements presented in these guidelines. Since the fund is nonreverting, any money not spent in the fiscal year appropriated will remain in the Fund for use in subsequent years. Note that grants from the Fund will be provided as matching funds to the recipient.

DEFINITIONS

The following definitions apply to these guidelines:

“Agricultural Best Management Practice” as used within these guidelines shall mean those practices outlined within the Virginia Agricultural BMP Manual published by the Department of Conservation and Recreation.

“Chesapeake Bay Agreement” means the Chesapeake Bay Agreement of 2000 and any amendments thereto.

“Fund” means the Virginia Water Quality Improvement Fund established by the Virginia Water Quality Improvement Act, Section 10.1-2128 of the *Code of Virginia*.

“Impaired water” means water that is not meeting one or more state water quality standards, as required by the Clean Water Act; water with fish or shellfish harvesting prohibition by the Virginia Department of Health; and/or water where biological monitoring indicates moderate to severe impairment and is listed by stream segment on Virginia’s 303(d) Total Maximum Daily Load Priority List.

“Individual” means any corporation, foundation, association or partnership, or one or more natural persons.

“Institutions of higher education” means any educational institution meeting the requirement of Section 60.2-220 of the *Code of Virginia*.

“Local government” means any county, city, town, municipal corporation, authority, district (including soil and water conservation districts), commission or political subdivision of the Commonwealth.

“Nonpoint source pollution” means pollution of state waters washed from the land surface in a diffuse manner and not resulting from a discernible, defined or discrete conveyance.

“Nutrients” means nitrogen and phosphorus.

“Point source pollution” means pollution of state waters resulting from any discernible, defined or discrete conveyance.

“Publicly-owned treatment works” means a publicly-owned sewage collection system consisting of pipelines or conduits, pumping stations and force mains, and all other construction, devices, and appliances appurtenant thereto, or any equipment, plant, treatment works, structure, machinery, apparatus, interest in land, or any combination of these, not including an onsite sewage disposal system, that is used, operated, acquired, or constructed for the storage, collection, treatment, neutralization, stabilization, reduction, recycling, reclamation, separation, or disposal of wastewater, or for the final disposal of residues resulting from the treatment of sewage, including but not limited to: treatment or disposal plants; outfall sewers, interceptor

sewers, and collector sewers; pumping and ventilating stations, facilities, and works; and other real or personal property and appurtenances incident to their development, use, or operation.

"Reasonable sewer costs" means the amount expended per household for sewer service in relation to the median household income of the service area as determined by guidelines developed and approved by the State Water Control Board for use with the Virginia Water Facilities Revolving Loan Fund established pursuant to Chapter 22 (§ 62.1-224 et seq.) of Title 62.1.

"Sediment" means 1) soil particles which become dislodged and mobilized by water in the form of rain once the absorption capacity of the soil is exceeded, resulting in erosion of the land, and transport of soil to a receiving waterbody, and 2) soil particles that are dislodged from streambanks and shorelines by agents such as fast-moving water or wind, or animals, or soil particles transported by wind from distant sources and directly deposited in a waterbody.

"Significant discharger" means (i) a publicly-owned treatment works discharging to the Chesapeake Bay watershed with a design capacity of 0.5 million gallons per day or greater, (ii) a publicly-owned treatment works discharging to the Chesapeake Bay watershed east of the fall line with a design capacity of 0.1 million gallons per day or greater, (iii) a planned or newly expanding publicly-owned treatment works discharging to the Chesapeake Bay watershed, which is expected to be in operation by 2010 with a permitted design of 0.5 million gallons per day or greater, or (iv) a planned or newly expanding publicly-owned treatment works discharging to the Chesapeake Bay watershed east of the fall line with a design capacity of 0.1 million gallons per day or greater, which is expected to be in operation by 2010.

"Southern Rivers Watersheds" means those watersheds located in Virginia that drain to water bodies other than the Chesapeake Bay including waters draining directly to the Atlantic Ocean.

"State-of-the-art nutrient removal technology" means technology that will achieve at least a 3 mg/L total nitrogen concentration or at least a 0.3 mg/L total phosphorus concentration in effluent discharges.

"State waters" means all waters on the surface or under the ground, wholly or partially within or bordering the Commonwealth or within its jurisdictions.

"Suspended solids" means the portion of total solids in water that is retained by a glass fiber-filter. Suspended solids analyses are important in the control of biological and physical wastewater treatment processes and for assessing compliance with regulatory wastewater effluent limits. The measurement of suspended solids is commonly used as a water quality parameter to assess the amount of sediment entering a waterbody.

"Total Maximum Daily Load" (TMDL) means the maximum amount of a pollutant that a waterbody can receive without violating water quality standards. A TMDL includes best estimates of pollution from nonpoint sources, natural background sources, pollution from point sources, a margin of safety, and takes into account seasonal variations.

“Tributary Strategy Plans” means plans that are developed by the Secretary of Natural Resources pursuant to the provisions of the Chesapeake Bay Agreement for the tidal tributaries of the Chesapeake Bay and the tidal creeks and embayments of the western side of the Eastern Shore of Virginia. This term shall include any amendments to the tributary strategy plans initially developed by the Secretary of Natural Resources pursuant to the Chesapeake Bay Agreement.

“Water Quality Improvement Grants” means grants available from the Fund to local governments, institutions of higher education, and individuals for projects designed (i) to achieve nutrient reduction goals in tributary strategy or (ii) to achieve other water quality restoration, protection or enhancement benefits.

DEVELOPMENT OF THESE GUIDELINES

Section 10.1-2129.B. of the *Code of Virginia* specifies that “the Secretary of Natural Resources, in consultation with the Secretary of Agriculture and Forestry, the State Forester, the Commissioner of Agriculture and Consumer Services, and Directors of the Departments of Environmental Quality and Conservation and Recreation and with the advice and guidance of the Board of Conservation and Recreation, the Virginia Soil and Water Conservation Board, the State Water Control Board, and the Chesapeake Bay Local Assistance Board, shall develop written guidelines that (i) specify eligibility requirements; (ii) govern the application for and distribution and conditions of Water Quality Improvement Grants; and (iii) list criteria for prioritizing funding requests.”

The Code also specifies that “in developing the guidelines the Secretary shall evaluate and consider, in addition to such other factors as may be appropriate to most effectively restore, protect and improve the quality of state waters: (i) specific practices and programs proposed in any tributary strategy plan and the associated effectiveness and cost per pound of nutrients removed; (ii) water quality impairment or degradation caused by different types of nutrients released in different locations from different sources; and (iii) environmental benchmarks and indicators for achieving improved water quality. The process for development of guidelines pursuant to this subsection shall at a minimum, include (a) use of an advisory committee composed of interested parties; (b) a sixty-day public comment period on draft guidelines; (c) written responses to all comments received; and (d) notice of the availability of draft guidelines and final guidelines to all who request such notice.”

For information regarding these guidelines, contact the Office of the Secretary of Natural Resources at 804-786-0044 or visit www.naturalresources.virginia.gov. Information is also available from the Department of Environmental Quality (www.deq.virginia.gov) and the Department of Conservation and Recreation (www.dcr.virginia.gov). Specific contact information is on page 20 of this document.

SECTION A

NONPOINT SOURCE PROJECTS

CHAPTER 1: GOALS AND OBJECTIVES

The goal of the nonpoint source grant component of the Virginia Water Quality Improvement Fund (WQIF) is to improve water quality throughout the Commonwealth of Virginia and in the Chesapeake Bay by reducing nonpoint source pollution. Nonpoint source pollution is a significant cause of degradation of state waters throughout the Commonwealth. Within the Chesapeake Bay watershed the immediate priority is to implement the Tributary Strategies, which focus on reducing nutrients, sediment and suspended solids entering the Chesapeake Bay and its tributary rivers. In the Southern Rivers watersheds (Virginia waters not draining to the Chesapeake Bay), the goal is to achieve measurable improvements in water quality, which can include nutrient and sediment reductions as well as reduction of other pollutants. Particular attention will be paid to reducing the causes of impairment for stream segments on the 303(d) TMDL list of impaired waters prepared by the Virginia Department of Environmental Quality. Other uses of grant funds may include providing protection or restoration of other priority waters such as those containing critical habitat or that serve as water supplies.

CHAPTER II: ELIGIBLE ACTIVITIES

Eligible categories of activities for funding support are the Agricultural Best Management Practices Cost-Share Program, Conservation Reserve Enhancement Program, Water Quality Initiative Projects and Cooperative Nonpoint Source Pollution Programs with Local Governments.

Agricultural Best Management Practices Cost-Share Program – Agricultural conservation practices that are most effective in reducing excess nutrients and sediment from agricultural lands will be implemented through the Virginia Agricultural Best Management Practices (BMP) Cost-Share Program. The Program is administered by the Department of Conservation and Recreation with reliance on local implementation by the state's Soil and Water Conservation Districts (SWCDs or districts). Specified amounts of WQIF funds are made available to districts to enable implementation of cost-effective, priority BMPs that farmers will implement with financial incentives to offset their costs. BMPs supported through state financial incentives must be implemented in accordance with the *Virginia Agricultural BMP Manual*. Cost share expenditures are guided by agreements signed by DCR and the 47 districts.

Conservation Reserve Enhancement Program – WQIF funds will be utilized to support Virginia's commitment for participation in the USDA Conservation Reserve Enhancement Program (CREP). More than 75% of the total CREP program funding is provided by federal dollars and the state share will be provided with WQIF funds. Under the USDA-administered CREP program, which is implemented through the SWCDs, eligible landowners may receive

cost-share financial incentives for eligible program BMPs for establishment of riparian buffer and wetlands restoration and for rental payments for up to 15 years. DCR also provides additional financial incentives to landowners to enter into permanent easements on the riparian lands. WQIF funding provides Virginia's share of the landowner BMP payments and supports the acquisition of permanent easements. The present CREP acreage goals for which Virginia has contractual obligations with USDA are 25,000 acres for the Virginia Chesapeake Bay Watershed and 15,000 acres in the Southern Rivers area.

Water Quality Initiatives – Funding for water quality initiatives will be considered by the Department of Conservation and Recreation to address other nonpoint source pollution priority needs and particularly cost effective, innovative and new initiatives which further advance Virginia's nonpoint source programs and provide for measurable water quality improvements. These may include initiatives with other state agencies, soil and water conservation districts, planning district commissions, local governments, educational institutions and individuals on nonpoint source pollution reduction, education, research and implementation projects. Examples may include but are not limited to initiatives to provide further incentives for agricultural and urban nutrient management activities, alternative waste management and reuse alternatives for animal waste products, diet and feed management projects to reduce nutrient content and more efficiently manage animal wastes, water quality impairments from mining operations, animal waste transport projects, riparian buffer initiatives and other effective forest management programs, conservation easement programs, innovative urban stormwater and effective urban BMP practices and restoration projects which provide for measurable water quality improvements.

Cooperative Nonpoint Source Pollution Program Projects with Local Governments – In accordance with § 10.1-2127.B. and C. of the *Code of Virginia*, DCR will work cooperatively with local governments to provide matching funds for nonpoint source projects which address locally identified solutions for nonpoint source problems that cause local water quality problems and/or contribute to the impairment of other state waters outside the jurisdiction. These projects, which shall be evaluated on a competitive basis, should clearly delineate state and local government responsibilities for the water quality initiatives to be supported by WQIF funding. Projects that implement one or more components of a tributary strategy to address nutrient and sediment reductions will receive the highest priority in the Chesapeake Bay drainage area. Other state priorities include projects that address reducing a pollutant/source which is the cause of impairment for one or more stream segments on the 303(d) TMDL list of impaired waters prepared by the Virginia Department of Environmental Quality or which provide protection or restoration of other priority waters such as those containing critical habitat or water supply waters or which further the implementation of the Chesapeake Bay Preservation Act in Tidewater Virginia. Example projects may include but are not limited to urban and suburban nonpoint source initiatives to include stormwater management, septic system rehabilitation, effective urban BMP initiatives, reimbursements for local tax credits that produce water quality improvements and acquisition of conservation easements related to the protection of water quality and stream buffers.

CHAPTER III: MATCHING FUNDS

Requirements for matching funds for WQIF funds shall be as outlined below:

Agricultural Best Management Practices Cost-Share Program – WQIF funds that are allocated to the Agricultural BMP Cost Share Program will be spent in accordance with the cost-share guidelines and matching funds requirements outlined in the Virginia Agricultural BMP Manual.

Conservation Reserve Enhancement Program – WQIF funds allocated to the Conservation Reserve Enhancement Program will be spent in accordance with the USDA CREP program requirements and matched as required by this program.

Water Quality Initiatives – WQIF funds allocated for water quality initiatives will be made from the Fund for 50% of the cost of a project, with the remaining 50% supplied from other federal, state, local or private sources. Projects demonstrating high cost-effectiveness for nutrient or sediment reduction and where the fiscal constraints of the applicant are demonstrably severe, a grant beyond the stated percentages may be awarded. The Director of the Department of Conservation and Recreation shall consult with the Secretary of Natural Resources before approving grants above a 50% level.

Cooperative Nonpoint Source Pollution Program Projects with Local Governments – WQIF funds provided to local governments shall be matched with 50% of the cost of the project being supplied from sources provided or secured by localities. However, some local governments who are able to demonstrate fiscal stress may be eligible to receive a greater percentage of funding for approved projects. All requests for greater than 50% funding will be evaluated by considering the applicant's comparative revenue capacity, revenue efforts and fiscal stress rating, as reported by the Virginia Commission on Local Government. The Director of the Department of Conservation and Recreation shall consult with the Secretary of Natural Resources before approving grants greater than a 50% level.

CHAPTER IV: DISTRIBUTION AND APPLICATION FOR FUNDS

The Department of Conservation and Recreation is responsible for managing the distribution of the nonpoint WQIF grants. This includes managing the allocation of funding to the Agricultural Cost Share Program and Conservation Reserve Enhancement Program and soliciting applications for Water Quality Initiative grants and Cooperative Nonpoint Source Pollution Program Projects with Local Governments. In distributing the nonpoint source grants, a priority will be given to implementation of agricultural best management practices. The Department is responsible for establishing a competitive application process for Water Quality Initiative grants and Cooperative Nonpoint Source Pollution Program Projects with Local Governments.

CHAPTER V: CRITERIA FOR PRIORITIZING FUNDING REQUESTS

The following criteria will be utilized in prioritizing the distribution of funds for Water Quality Initiative grants and Cooperative Nonpoint Source Pollution Program Projects with Local Governments:

- pounds of total nitrogen and the pounds of total phosphorus reduced by the project;
- whether the location of the water quality restoration, protection or improvement project or program is within a watershed or subwatershed with documented water nutrient loading problems or adopted nutrient reduction goals;
- documented water quality impairments to be addressed;
- availability of other funding mechanisms for the project;
- implementation of cooperative programs developed pursuant to subsection B of § 10.1-2127;
- project cost-effectiveness in achieving measurable reductions of nonpoint source pollutants including nutrients and sediments; and
- whether the project addresses a priority water quality initiative identified by the Governor, the General Assembly, the Secretary of Natural Resources, or DCR.

The Department of Conservation and Recreation staff will review all applications for consideration for funding and may form a grant review committee, comprised of other state agencies and interested parties, as appropriate, to provide necessary technical expertise and guidance in prioritizing the funding requests.

The Director of the Department of Conservation and Recreation shall make final funding determinations in accordance with Section 10.1-2132.B. of the WQIA.

Allocations of funding to the Agricultural Cost Share Program and the Conservation Reserve Enhancement Program will be made separately in accordance with the requirements established for these programs and by the consideration of the criteria established above, as specified in the *Code of Virginia*.

CHAPTER VI: GRANT AGREEMENTS

All Water Quality Improvement Grants are governed by a legally binding and enforceable grant agreement between the recipient and DCR as outlined in Section 10.1-2130 of the *Code of Virginia*. Such agreements require reporting by the grant recipient of the estimated pollutant reductions to be achieved by the project and requirements for ongoing operation and maintenance. The Department may utilize multi-year agreements to administratively manage these funds as determined appropriate by the Department and grant recipient.

Agreements between DCR and local SWCDs for the distribution of state funds for the Agricultural Best Management Practices Cost-Share Program and the Conservation Reserve Enhancement Program shall be administered in accordance with separate requirements developed for these programs and shall be presented to the Virginia Soil and Water Conservation Board prior to becoming effective. These programs quantify and track estimated pollutant reductions from each conservation practice installed and require that installed conservation practices be maintained by the landowner for the anticipated practice lifespan with follow-up inspections by DCR or the SWCDs to ensure compliance.

Prior to executing the grant agreements for Water Quality Initiative projects or Cooperative Nonpoint Source Pollution Program Projects, the Department of Conservation and Recreation will prepare and make available a list of the proposed grant agreements for public review and comment for a period of at least 30 days but no more than 60 days.

SECTION B

POINT SOURCE PROJECTS

CHAPTER I: PROGRAM COMPONENTS

I. Goals and Objectives

The main objectives of the Water Quality Improvement Fund (WQIF) point source program are as follows:

1. Concentrate efforts on implementing point source nutrient control actions proposed in the tributary strategy plans, as defined by Section 10.1-2117 of the *Code of Virginia*.
2. Make the WQIF compatible and consistent with existing funding programs administered by the Department of Environmental Quality (DEQ) Construction Assistance Program (CAP).
3. Enhance customer service and convenience by integrating the WQIF procedures, to the maximum extent possible, with those in use by the CAP. This may include:
 - schedules for application, review, and award;
 - general notifications, solicitation letters, and public participation methods;
 - application information and documentation for reimbursement requests;
 - criteria for prioritizing projects;
 - definitions for eligible components of the scope of work;
 - assessment of “reasonable sewer costs” as defined by Section 10.1-2177; and
 - construction evaluations on active projects.
4. Subsequent to implementation of the tributary strategy plans and as available funding allows, support other projects related to point source pollution controls that are clearly demonstrated as likely to achieve measurable and specific water quality improvements.
5. Assist with identifying other potential funding sources for the local share of projects.
6. Support and enhance the point source pollution program through separate technical assistance funding made available to local governments and individuals.

II. Project Prioritization - Funding Distribution

The Virginia Water Quality Improvement Act (the “Act”) directs the Secretary of Natural Resources to develop:

- written guidelines for distribution and conditions of WQIF awards; and
- criteria for prioritizing funding requests outside the Bay watershed.

For projects located in the Chesapeake Bay watershed, the Act requires that the Director of the Department of Environmental Quality enter into grant agreements with all facilities designated as significant dischargers that apply for grants.

For projects located outside the Chesapeake Bay watershed, the criteria for prioritizing funding requests includes:

- the pounds of nutrient reduction for each project;
- whether the location of the project is within a watershed or subwatershed with documented nutrient loading problems or adopted nutrient reduction goals;
- whether the location of the project is within a watershed with a documented water quality impairment; and
- availability of other funding mechanisms.

III. Project Eligibility

The WQIF is currently a special-purpose grant program, and the type and location of a point source project eligible for funding is specified under Section 10.1-2131 of the Act. Until all tributary strategy plans are developed and implemented, grants shall only be made for the purpose of financing the cost of design and installation of biological nutrient removal facilities or other nutrient removal technology at publicly-owned treatment works designated by DEQ as a significant discharger. “For purposes of these guidelines, publicly-owned treatment works that use the Public-Private Education Facilities and Infrastructure Act (the “Act”; Section 56-757.1, et seq.) to facilitate design and installation of nutrient removal technology shall be eligible for WQIF grant funds available pursuant to §10.1-2129.A.2 of the Water Quality Improvement Act.” A tributary strategy plan is considered “implemented” regarding point source actions when the plan’s recommended point source nutrient controls have been installed.

Funding for projects other than nutrient removal within the Chesapeake Bay Watershed is permitted if the Director of the DEQ determines that there is sufficient funding available for substantial and continuing progress in implementing the tributary strategies (Section 10.1-2131.C. of the Act). Such eligible projects must clearly demonstrate the likelihood of achieving measurable and specific water quality improvements.

The General Assembly may designate through the Appropriations Act the allocation of funds deposited into the Fund. These designations may detail circumstances under which a grantee is eligible for funding, who otherwise would not be eligible according to these guidelines.

Information on any such special appropriations and eligibility criteria contained in a future Appropriations Act will be included in the Request for Proposals soliciting WQIF Point Source Grant Applications.

IV. Allowable Costs

Under the Water Quality Improvement Act, WQIF point source grants shall be used solely to finance the costs of design and installation of biological nutrient removal facilities or other nutrient removal technology at publicly-owned treatment works for compliance with the effluent limitations for total nitrogen and total phosphorus as required by the tributary strategy plans or applicable regulatory requirements. Subsequent to the implementation of the tributary strategy plans, or if the Director makes the finding provided for in Section 10.1-2131.C of the Act, the DEQ Director may authorize WQIF grants for projects that are clearly demonstrated to achieve measurable and specific water quality improvements. The program will allow that nutrient control systems be sized to treat the flow in any reasonable and necessary expansion of the wastewater facility, which is generally limited to a 20-year design life. In general, associated pre-design and final design costs will be eligible for cost share. Joint or regional projects that involve more than one publicly-owned facility are eligible and encouraged where cooperative arrangements exist and economies of scale may be realized.

As provided in Section 10.1-2131.C. of the Act, the cost for design and installation of biological nutrient removal, state-of-the-art nutrient removal technology, or other nutrient control technology (including recycle/reuse) at publicly-owned treatment works meeting the nutrient reduction goal in an approved tributary strategy plan and incurred prior to execution of a grant agreement is eligible for reimbursement from the WQIF. Such expenses must be necessary and attributable to the project and the debt must be incurred or construction begun after June 2000 (when the Chesapeake 2000 Agreement established the revised nutrient reduction goals aimed at removing the Bay and its tidal tributaries from the “Impaired Waters List” by 2010). Reimbursement shall be made pursuant to an executed agreement consistent with the Act. If the original source of funding for the nutrient reduction facilities was the State Revolving Loan Fund (RLF), the WQIF grant shall be applied to the principal of any outstanding balance of the loan.

The purchase of land, easements, and/or rights-of-way are not allowable costs, nor are any legal, administrative, and engineering expenses related to these purchases, unless the land is an integral part of the treatment process. Other stipulations on allowability of cost may also apply, and all costs are reviewed and considered on a case-by-case basis.

V. Reimbursement

Disbursement of grant funds is made on a periodic reimbursement basis not more frequently than once per month. Invoices must substantiate all requests for disbursement of grant funds. All payment requests must be reviewed and approved by DEQ staff prior to actual disbursement of funds. Reimbursement requests must be submitted in duplicate, one copy to the appropriate DEQ Regional Office and one copy to DEQ’s Chesapeake Bay Program.

The availability of grant funds in the WQIF for point source pollution control projects is subject to appropriation by the General Assembly and allocations made by the Secretary of Natural Resources. In the event of a shortfall, the Commonwealth is strongly committed to managing the WQIF to ensure full funding of all executed agreements and to following an equitable process for distribution of available funds among all grantees. This distribution process (such as Pro Rata of estimated construction expenses) will be addressed in more detail in the agreement signed with each grant recipient.

VI. State Cost Share Percentage

As provided in Section 10.1-2131.E of the Act, grants shall be awarded in the following manner:

1. In communities for which the ratio of annual sewer charges to reasonable sewer cost is less than 0.30, the Director of the Department of Environmental Quality shall authorize grants in the amount of 35 percent of the costs of the design and installation of biological nutrient removal facilities or other nutrient removal technology;
2. In communities for which the ratio of annual sewer charges to reasonable sewer cost is equal to or greater than 0.30 and less than 0.50, the Director shall authorize grants in the amount of 45 percent of the costs of the design and installation of biological nutrient removal facilities or other nutrient removal technology;
3. In communities for which the ratio of annual sewer charges to reasonable sewer cost is equal to or greater than 0.50 and less than 0.80, the Director shall authorize grants in the amount of 60 percent of the costs of design and installation of biological nutrient removal facilities or other nutrient removal technology; and
4. In communities for which the ratio of annual sewer charges to reasonable sewer cost is equal to or greater than 0.80, the Director shall authorize grants in the amount of 75 percent of the costs of the design and installation of biological nutrient removal facilities or other nutrient removal technology.

The "reasonable sewer cost" for each WQIF grantee will be determined using guidelines developed and approved by the State Water Control Board for use with the Virginia Water Facilities Revolving Fund. The grantee's annual sewer charge shall be defined as the average yearly expense for residential sewer service per connection that is currently being charged at the time application is made for WQIF cost-share. The above ratios will be calculated by dividing the current annual sewer charge by the reasonable sewer cost. Where multiple jurisdictions are provided sewer service through a District/Authority or an inter-municipal sewer agreement, a weighted average of the median household income and a weighted average sewer charge will be calculated for comparison to the "reasonable sewer costs." Annual sewer charges will be requested as part of each application.

As authorized by § 62.1-44.19:15, WQIF may receive payments as a result of the acquisition of nutrient allocations. Such payments shall be promptly applied to achieve equivalent point or

nonpoint source reductions in the same tributary beyond those reductions already deemed necessary by state or federal law or as established in the relevant tributary strategy.

If appropriations are made to the WQIF from surplus funds remaining after any fiscal year, grants awarded using those funds shall be for the sole purpose of designing and installing state-of-the-art nutrient removal technologies at publicly-owned treatment works designated as significant dischargers. These funds shall also be available for grants to eligible applicants when the design and installation of state-of-the-art nutrient removal technology utilizes the Public-Private Education Facilities and Infrastructure Act (Section 56-575.1 et seq.). The grant amount to be awarded shall use the above ratios to determine the cost-share percentage.

The Director may approve a point source grant application request that exceeds the authorized grant amount outlined in Section 10.1-2131.E. of the Act and described above in Section F.1-4. Whenever a grant application exceeds the authorized grant amount outlined above, or when there is no stated limitation on the amount of the grant, the Director shall consider the comparative revenue capacity, revenue efforts and fiscal stress as reported by the Commission on Local Government.

VII. Grant Agreement

A legally binding and enforceable agreement between the recipient and the Department of Environmental Quality shall govern all WQIF point source grants. In accordance with Section 10.1-2131 of the Act, the agreement shall include the following:

1. Numerical effluent concentration limits on nutrient discharges to state waters designed to achieve the nutrient reduction goals of the applicable tributary strategy plan. Consistent with Section 62.1-44.19:12 et seq. of the *Code of Virginia*, such concentration limits shall be based upon the technology installed by the facility and shall be expressed as annual average values.
2. Enforceable provisions related to the maintenance of the numerical concentration limits that will allow for exceedences of no more than ten (10) percent and for exceedences caused by extraordinary conditions. The enforceable provisions will also include contractual or stipulated penalties in an amount sufficient to ensure compliance with the agreement, which may include repayment with interest for any non-performance or breach.
3. Recognition of the authority of the Commonwealth to make the Virginia Water Facilities Revolving Fund (Section 62.1-224 et seq. of the *Code of Virginia*) available to local governments for their local share of the cost of designing and installing biological nutrient removal facilities or other nutrient removal technology, based on financial need and subject to availability of revolving loan funds, priority ranking, and revolving loan distribution criteria.

Grant agreements shall be made available for public review and comment for a period of no less than 30 days but no more than 60 days prior to execution. In addition to the standard terms and

conditions of a state contract for financial assistance (including, but not limited to, project scope, schedules, budget and compensation provisions), the agreement shall:

1. provide for payment of the total amount of the grant, subject to the availability of funds;
2. govern design and installation;
3. require the grantee to complete installation of the nutrient removal facilities and place them into service regardless of the amount of grant funds received; and
4. require proper long-term operation, monitoring and maintenance of funded projects, including design and performance criteria.

VIII. Technical Assistance Grants

Under Section 10.1-2131 of the Act, the DEQ Director may, at any time, authorize grants, including grants to institutions of higher education, for Technical Assistance (TA) related to nutrient reduction. The criteria used in making determinations for award of TA grants are:

- If the proposals are for work such as pilot demonstration projects and engineering studies for nutrient reduction (e.g., Basis of Design Reports).
- If the proposals will advance the understanding about, and the capabilities of, nutrient-reduction systems.
- If the results of the proposal lead to more cost-effective implementation actions for point sources.
- If the proposal for planning and/or design work is associated with a retrofit project and the applicant is not eligible to receive a construction grant, the TA grant will be limited to a cost-share of no more than 10% of the total construction cost (or cost for design, whichever is less) and must lead to approved plans and specifications.
- If the proposal is associated with evaluating and implementing measures to optimize or enhance existing operations (e.g., interim optimization plans). Projects of this type will generally involve only treatment process or system revisions, rather than changes at the facility that involve construction.

CHAPTER II: SUMMARY OF PROGRAM REQUIREMENTS

I. Introduction

This section provides a brief synopsis of the program requirements as they relate to other statutory or regulatory requirements included by reference, such as procurement law, and plans and specifications approval, so that grantees are fully aware of them and can act accordingly.

II. Procurement

All procurement made during the course of planning, design, and construction of the grant project must be purchased, acquired, or contracted for in accordance with Chapter 7

(Section 11-35 et seq.) of Title 11 of the *Code of Virginia*, also known as the Virginia Public Procurement Act. The WQIF point source program requires all participants to follow the provisions of the Procurement Act regardless of locality size.

III. Local Share

Prior to grant award, sufficient documentation must be provided by the applicant to demonstrate that the local share of the project is, or will be, available to fulfill the grantee's obligations under the agreement. Examples of acceptable forms of local share include, but are not limited to, general obligation revenue bonds, other state or federal grant funds or loans, and municipal budget items and revenue streams.

IV. Pre-Design Studies/Pilot Testing

Eligible pre-design tasks include any essential studies prior to final design, such as bench or pilot scale testing of conventional or innovative technologies, and cost-effectiveness analysis.

The grantee or its consultant will develop a Preliminary Engineering Proposal (PEP) or planning document, which assesses the current situation, projects future needs, develops alternatives, estimates the monetary costs, and presents a selected plan.

V. Design/Construction

The design and drafting of plans and specifications must conform to the Virginia Sewage Collection and Treatment (SCAT) Regulations [9 VAC 25-790 et. seq.] Close contact with the applicable Regional Offices of the DEQ is helpful in reducing delays at this stage. Since it is likely that installation of the nutrient reduction system is part of a larger scale or more complex plant upgrade or expansion project, a Preliminary Engineering Conference with the Department of Environmental Quality is strongly recommended prior to full-scale design. Final plans and specifications must be submitted for review, comment, and approval to the Department of Environmental Quality. Processing of the plans and specifications will proceed as outlined in the SCAT Regulations, ultimately leading to the issuance of a Certificate to Construct.

The grantee may then proceed to advertise for construction bids, and is encouraged to hold a pre-bid conference so that the project can be presented to bidders and any questions they may have can be resolved. The bidding document must be structured to the extent practicable such that the cost for eligible project components can be readily determined. The grantee is responsible for, and must retain records that document, the use of proper bidding and bid selection when securing construction services. During construction the grantee must provide project inspection, documented with reports, to track construction progress, quality, and conformance with plans and specifications.

DEQ will conduct periodic (usually monthly) Interim Project Evaluations (IPE) to provide routine monitoring of WQIF construction projects. The IPE will assess compliance with program requirements by verifying that: the project is being managed properly, construction is

generally in accordance with the approved plans and specifications, and disbursement requests coincide with actual work in place.

VI. Post-Construction/Operation and Maintenance

In addition to awarding the grant, the agreement signed by the grantee and DEQ shall govern the long-term operation and maintenance of the facilities installed with grant funds. Section 10.1-2131.C. of the Act specifies that grant agreements related to nutrient control shall include: (i) numerical concentrations on nutrient discharges designed to achieve the nutrient reduction goals of the applicable tributary strategy plan; and (ii) enforceable provisions related to the maintenance of the numerical concentrations that will allow for exceedences of no more than 10%, and (iii) for exceedences caused by extraordinary conditions (defined in the agreement).

All grant agreements will contain a provision that requires the owner to monitor their discharge and report the total nitrogen and (if applicable) total phosphorus concentrations so that performance can be tracked. If nutrient monitoring requirements are not already contained in the plant's discharge permit, the agreement will specify the same sampling frequencies and analytical methods used in the VPDES permit program.

Agreements may also contain incentives designed to encourage the Grantee to operate the project to achieve pollution reductions greater than specified in the Agreement.

CHAPTER III: GRANTEE SELECTION

I. Application Solicitation

The annual point source grant cycle begins with the distribution of this guidance document and a solicitation for applications. The deadline for submission of applications is provided in the application form and will allow at least 45 days for proposal development. Applications must be sent to:

Virginia Department of Environmental Quality
P.O. Box 10009
Richmond, VA 23240
ATTN: WQIF Program Manager

II. Grant Priority Funding List Requirements

Funds can only be used to finance the cost to design and install biological nutrient removal, state-of-the-art nutrient removal technology, or other nutrient control technology at publicly-owned treatment works designated as a significant discharger and meeting the nutrient reduction goal in an approved tributary strategy plan. DEQ staff will prioritize the eligible applications using the criteria in Chapter I paragraph (II) of Section B of this section, assess the cost-effectiveness of proposed actions, and review the proposals to ensure consistency with tributary strategy goals. Such prioritization will recognize the requirement under Section 10.1-2131.B. of the Act that the Director shall enter into grant agreements with all facilities designated as significant dischargers that apply for grants. DEQ staff will present the prioritized list of qualified proposals to the State Water Control Board for their information and comment, along with recommendations for funding. Final approval and funding decisions will be made by the DEQ Director who has the responsibility and authority to award grants under this program in accordance with Section 10.1-2122 of the Act.

The state is strongly committed to manage the award and allocation of grants to ensure full funding of all executed agreements, as well as to follow an equitable process for distribution of available funds among all grantees in the event of a shortfall. The distribution process will be addressed in the agreement signed with each grant recipient.

In subsequent years, new projects will be added to the priority list. Once the cost share needs to implement all the Chesapeake Bay Tributary Strategy Plans are satisfied, or it is determined by the DEQ Director that there is sufficient funding above that required for substantial and continuing progress in implementation of the Tributary Strategy Plans, grant applications will be considered for any point source project that is clearly demonstrated as likely to achieve measurable and specific water quality improvements. At that stage, the Act requires that potential grant projects be prioritized, in accordance with specified criteria in Section 10.1-2129, and other factors the Secretary of Natural Resources deems appropriate. No project can receive financial assistance under the WQIF unless it is on the priority-funding list. However, it is not a requirement that projects receive cost share assistance in priority order.

Contact Information:

Nonpoint Source Projects:

J. Richard Hill, Jr.

Nonpoint Source Planning and Grants Program Manager

Department of Conservation and Recreation

203 Governor Street, Suite 206

Richmond, Virginia 23219

804-786-7119, FAX 804-7861798, rick.hill@dcr.virginia.gov

Point Source Projects:

Robert W. Ehrhart

Department of Environmental Quality -WQIF Program Manager

P.O. Box 10009

Richmond, VA 23240-0009

804-698-4466, FAX 804-698-4116, rwehrhart@deq.virginia.gov

VIRGINIA WATER QUALITY IMPROVEMENT FUND

TECHNICAL ASSISTANCE GRANT AGREEMENT

Contract #440-S-05-019

THIS AGREEMENT is made as of this 27th day of July 2005 by and between the Department of Environmental Quality, an agency of the Commonwealth of Virginia (the "DEQ") and Town of Amherst (the "Grantee"). The Grantee has contracted with a "Project Engineer" to complete an approvable Basis of Design (BoD) and Interim Optimization Plan (IOP).

Pursuant to the Virginia Water Quality Act of 1997, Chapter 21.1, Title 10.1 of the Code of Virginia (1950), as amended (the "Act"), the General Assembly created the "Virginia Water Quality Improvement Fund" (the "Fund"). The Director of the DEQ (the "Director") is authorized by the Act to make Water Quality Improvement grants for technical assistance related to nutrient reduction, pursuant to Section 10.1-2131 of the Code.

The Grantee has been approved by the Director to receive grant monies (the "Grant") from the Fund subject to the terms and conditions described herein for the purpose of providing technical assistance in the development of a BoD report and IOP. For the purposes of this Agreement, "technical assistance" means cost share, not to exceed the amount specified in Article IV, Section 4.0, for the expense of developing the aforementioned reports.

Among the terms and conditions contained in this Agreement that govern disbursement of the grant are the outstanding submittals related to an acceptable BoD report and IOP and as governed by Exhibit C.

As required by the Act, this Agreement provides for payment of the grant, as a technical assistance grant and based on the Grantee's obligation to provide an acceptable PEP and IOP. This Agreement is supplemental to the State Water Control Law, Chapter 3.1, Title 62.1 of the Code of Virginia (1950), as amended, and it does not limit in any way the DEQ's other water quality restoration, protection and enhancement, or enforcement authority.

ARTICLE I DEFINITIONS

1.0 The capitalized terms contained in this Agreement shall have the meanings set forth below unless the context requires otherwise and any capitalized terms not otherwise defined herein shall have the meaning assigned to such terms in the Act:

- (a) "Act" means the Virginia Water Quality Improvement Act of 1997, Chapter 21.1, Title 10.1 of the Code of Virginia (1950), as amended.
- (b) "Agreement" means this Technical Assistance Grant Agreement between the DEQ and the Grantee, together with any amendments or supplements hereto.
- (c) "Authorized Representative" means any member, official or employee of the Grantee authorized by resolution, ordinance or other official act of the governing body of the Grantee to perform the act or sign the document in question.

- (d) "Basis of Design Report" shall be the generic document referred to in the VPDES permit and further defined and detailed in DEQ Permit Guidance (GM05-2009).
- (d) "Director" means the Director of the DEQ.
- (e) "Facility" means all plants, systems, unit processes, equipment or property related to the Project, and owned, operated, or maintained by the Grantee and used in connection with the treatment of wastewater.
- (f) "Fund" means the Virginia Water Quality Improvement Fund.
- (g) "Grant" means the particular grant described in Section 4.0 of this Agreement, with such changes thereto as may be approved in writing by the DEQ and the Grantee.
- (i) "Preliminary Engineering Proposal" means an engineering report and preliminary plans as described in 9 VAC 25-790-110. Submittal of the PEP shall constitute an acceptable substitute for the BoD requirement, provided it meets the criteria contained in the DEQ's GM05-2009 (or subsequent guidance).
- (j) "Project" means the evaluation of specific nutrient reduction technologies available to achieve varying nutrient levels at the facility, as required by the VPDES permit and/or Tributary Strategy Plan.
- (k) "Project Budget" means the budget for the Project as set forth in Exhibit B to this Agreement, with such changes therein as may be approved in writing by the DEQ and the Grantee.
- (l) "Project Costs" means the costs associated with the formal evaluation of processes designed to reduce nutrients at varying concentrations in the discharge and as described in the Project Budget.
- (m) "Project Engineer" means the Grantee's engineer who must be a licensed professional engineer registered to do business in Virginia and designated by the Grantee as the Grantee's engineer for the Project in a written notice to the DEQ.
- (n) "State of the art nutrient removal technology" means technology that will achieve at least a 3 mg/l total nitrogen concentration and at least a 0.3 mg/L total phosphorus concentration in effluent discharges.
- (n) "Technical assistance" means cost share, not to exceed the amount specified in Article IV, Section 4.0, for the formal evaluation of nutrient reduction alternatives and development of the document(s) identified in Exhibit B for the Project.

ARTICLE II
SCOPE OF PROJECT

2.0 The Grantee will see that the Project properly evaluates alternatives available to control nutrients at varying concentrations in the discharge, as described in Exhibit A to this Agreement to meet the requirements set forth in the Virginia Sewage Collection and Treatment Regulations (9 VAC 25-790), as evidenced by the acceptance of the BoD Report [or PER] by DEQ.

ARTICLE III SCHEDULE

3.0 The Grantee will see that the Project includes acceptable documents and the IO Plan is properly implemented in accordance with the schedule in Exhibit C to this Agreement.

ARTICLE IV COMPENSATION

4.0 Grant Amount. The total grant award from the Fund under this Agreement shall not exceed \$26,950.00 and represents the Commonwealth's seventy percent share of the eligible Project Costs.

4.1 Payment of Grant. Subject to the availability of monies in the Fund allocated to point source pollution control and Section 4.3 herein, the DEQ will pay the Grantee for eligible Project costs incurred by the Grantee in an amount not to exceed \$26,950. Disbursement of the Grant will be in accordance with the payment provisions set forth in Section 4.2 herein and the Project Budget (exhibit B).

4.2 Application of Grant Funds. The Grantee agrees to apply the Grant solely and exclusively to the payment or the reimbursement of the Grantee for the payment of eligible Project costs for planning/design. Grant eligible reimbursement shall not exceed 95% of the approved cost share for either document, until the BoD and/or IOP has received final acceptance by DEQ.

Upon receipt a requisition and accompanying invoice, signed by the Authorized Representative containing an invoice as evidence of the actual payment of eligible Project costs and all other information called for by, and otherwise being in the form of, Exhibit D to this Agreement, the Director shall request the Comptroller to issue a general warrant directing the State Treasurer to disburse the Grant to the Grantee in accordance with such requisition to the extent approved by the DEQ.

4.3 Availability of Funds. The DEQ and Grantee recognize that the availability of monies in the Fund allocated to point source pollution control is subject to appropriation by the General Assembly and allocations made by the Secretary of Natural Resources, and that at times there may not be sufficient monies in the Fund to permit prompt disbursement of grant funds due and owing the Grantee pursuant to this Agreement. To minimize the potential for such disruption in disbursements of grant funds and in satisfaction of its obligations under the Act, the DEQ covenants and agrees to (1) manage the allocation of grants from the Fund to ensure full funding of executed grant agreements, (2) forecast the estimated disbursements from the Fund in satisfaction of approved grants and make this forecast publicly available each year for use in the State's budgetary process, and (3) promptly disburse to the Grantee any grant funds due and owing the Grantee pursuant to this Agreement when sufficient monies are available in the Fund to make such disbursements. The DEQ may determine that monies are not sufficient to promptly disburse grant funds when there are competing grant requests.

4.4 Agreement to Complete Project. The Grantee agrees to assure the Project shall be properly designed and submitted for approval as described in Exhibit A to this Agreement, and in accordance with the schedule in Exhibit C to this Agreement.

ARTICLE V
MONITORING AND REPORTING

5.0 Monitoring. The Grantee will monitor numerical discharge concentrations for total nitrogen and total phosphorus. The location, type, and frequency of the monitoring will be conducted, at a minimum, in accordance with the requirements contained in VPDES Permit No. VA0031321. Each sample will be analyzed using EPA-approved test methods and reported to the Department with the Grantee's monthly Discharge Monitoring Report.

ARTICLE VI
GENERAL PROVISIONS

6.0 Disclaimer. Nothing in this Agreement shall be construed as authority for either party to make commitments which will bind the other party beyond the covenants contained herein.

6.1 Force Majeure. If at any time the Grantee determines that it is unable to comply with the schedule in Exhibit C to this Agreement, the Grantee will promptly provide written notification to the DEQ. This notification will include a statement of the reasons for failure to maintain the schedule, any actions to be taken to minimize delay(s), and an estimate of any time necessary to extend the contract period. Given this notification, if acceptable to the DEQ, then Exhibit C will be modified to provide a no-cost time extension for the Project. In providing any such notification, the Grantee shall have the burden of proving that the alleged failure to maintain the Project schedule was due to causes beyond the control of the Grantee.

In the alternative, failure by the Grantee to maintain the schedule or complete the Project by the termination date of this Agreement may, at the discretion of the DEQ, constitute a breach which is subject to the provisions of Article VI, Section 6.12 (Termination), of this Agreement.

6.2 Integration and Modification. This Agreement constitutes the entire Agreement between the Grantee and the DEQ. No alteration, amendment or modification of the provisions of this Agreement shall be effective unless reduced to writing, signed by both the parties and attached hereto. This Agreement may be modified by agreement of the parties for any purpose, provided that any significant modification to this Agreement must be preceded by public notice of such modification.

6.3 Collateral Agreements. Where there exists any inconsistency between this Agreement and other provisions of collateral contractual agreements which are made a part of this Agreement by reference, the provisions of this Agreement shall control.

6.4 Non-Discrimination. In the performance of this Agreement, the Grantee warrants that it will not discriminate against any employee, or other person, on account of race, color, sex, religious creed, ancestry, age, national origin or other non-job related factors. The Grantee agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination clause.

6.5 Conflict of Interest. The Grantee warrants that it has fully complied with the Virginia Conflict of Interest Act as it may apply to this Agreement.

6.6 Applicable Laws. This Agreement shall be governed in all respects whether as to validity, construction, capacity, performance or otherwise, by the laws of the Commonwealth of Virginia. The Grantee further agrees to comply with all laws and regulations applicable to the Grantee's performance of its obligations pursuant to this Agreement.

6.7 Records Availability. The Grantee agrees to maintain complete and accurate books and records of the Project Costs, and further, to retain all books, records, and other documents relative to this Agreement for five (5) years after final payment. The DEQ, its authorized agents, and/or State auditors will have full access to and the right to examine any of said materials during said period. Additionally, the DEQ and/or its representatives, will have the right to access work sites during normal business hours, after reasonable notice to the Grantee, for the purpose of ensuring that the provisions of this Agreement are properly carried out.

6.8 Liability Insurance. The Grantee shall take out and maintain during the life of this Agreement such bodily injury and property damage liability insurance, or self-insurance as shall protect it, to such an extent as is usual and customary for the Grantee, from claims for damages for personal injury, including death, as well as from claims for property damage, which may arise from its activities under this Agreement.

6.9 Severability. Each paragraph and provision of this Agreement is severable from the entire Agreement; and if any provision is declared invalid, the remaining provisions shall nevertheless remain in effect.

6.10 Notices. All notices given hereunder shall be in writing and shall be sent by United States certified mail, return receipt requested, postage prepaid, and shall be deemed to have been received at the earliest of: (a) the date of actual receipt of such notice by the addressee, (b) the date of the actual delivery of the notice to the address of the addressee set forth below, or (c) five (5) days after the sender deposits it in the mail properly addressed. All notices required or permitted to be served upon either party hereunder shall be directed to:

DEQ: Virginia Department of Environmental Quality
Chesapeake Bay Program
P.O. Box 10009
Richmond, VA 23240
Attn.: Program Manager

Grantee: Town of Amherst
P.O. Box 280
Amherst, VA 24521
Attn: Town Manager

6.11 Exhibits. All exhibits to this Agreement are incorporated herein by reference.

6.12 Termination. This Agreement may be terminated under either of the following circumstances:

(a) by mutual agreement of the DEQ and the Grantee.

(b) in the event of breach by the Grantee of this Agreement, the DEQ shall have the right to immediately rescind, revoke, or terminate the Agreement. In the alternative the DEQ may give written notice to the Grantee specifying the manner in which the Agreement has been breached. If a notice of breach is given and the Grantee has not substantially corrected the breach within thirty (30) days of receipt of the written notice, the DEQ shall have the right to terminate this Agreement

ARTICLE VII
COUNTERPARTS

7.0 This Agreement may be executed in any number of Counterparts, each of which shall be an original and all of which together shall constitute but one and the same instrument.

WITNESS the following signatures, all duly authorized.

DEPARTMENT OF ENVIRONMENTAL QUALITY

By: [Signature]
Deputy Director

Date: 7.27.05

Town of Amherst

By: [Signature]

Authorized Representative

Date: 7/19/05

EXHIBIT A
PROJECT DESCRIPTION

Grantee: Town of Amherst
Grant #: 440-S-05-19

Basis of Design (BoD) Report for Nutrient Removal Alternatives

Project engineer will prepare the BoD Report for an upgrade to the Town of Amherst's Wastewater Treatment Plant. The purpose of the report is to evaluate alternatives available to achieve nutrient removal levels associated with the VPDES permit and/or Tributary Strategy Plan. At a minimum, the evaluation shall include process configurations for the existing WWTP designed to achieve conventional Enhanced Nutrient Removal (annual averages of 5.0 mg/l for TN and 0.5 mg/l for TP) and State of the Art Nutrient Removal Technology.

For each screened alternative, an impact on the sludge production (increase/decrease) and sludge quality associated with the process should also be evaluated.

For the screened/recommended alternative that is retained for further evaluation, the engineer will: a) prepare site layouts and process schematics for relevant portions of the plant, b) identify process control needs, and c) establish the advantages and disadvantages of each alternative with respect to performance, operability, maintainability, reliability and cost.

Interim Optimization Plan

An Interim Optimization Plan report to address opportunities for optimizing nutrient removal at the 0.6 MGD facility will be provided. The following general steps are anticipated by the project engineer.

- a. Analyze process control, hydraulic, and chemical requirements for short term nutrient removal improvements.
 - b. Prepare an itemized list of potential short term improvements including: operational changes (such as, but not limited to, cyclic aeration or creating anoxic conditions) and temporary process alterations (such as recycle piping/pumping) to the treatment plant.
 - c. Prepare a cost estimate for the short term nutrient removal alternatives identified.
 - d. Summarize the findings (items b. and c.) into a draft IOP report and meet with OWNER to review report.
 - e. Incorporate OWNER comments into IOP, prior to submitting report to DEQ.
 - f. Respond to DEQ comments on Interim Optimization Plan.
-

**EXHIBIT B
PROJECT BUDGET**

| PROJECT COMPONENTS | TOTAL COST | ELIGIBLE COST |
|----------------------------------|-----------------|-----------------|
| 1. Prepare and submit BoD Report | \$25,000 | \$25,000 |
| 2. Laboratory Analysis Testing | \$3,500 | \$3,500 |
| 3. Prepare and submit IOP | \$10,000 | \$10,000 |
| TOTAL PROJECT COST | \$38,500 | \$38,500 |
| Grant Percentage | | x 70% |
| Grant Amount = | | \$26,950 |

**EXHIBIT C
PROJECT SCHEDULE**

| | | |
|----|---|-------------------------------------|
| 1. | Submit BoD Report to DEQ for Acceptance | By December 27, 2005 |
| 2. | Submit IOP to DEQ for Acceptance | By December 27, 2005 |
| 3. | Implement IOP | Within 60 days of Acceptance by DEQ |

EXHIBIT D

REQUISITION FOR REIMBURSEMENT

(To be on Grantee's Letterhead)

Department of Environmental Quality
Chesapeake Bay Program
P.O. Box 10009
Richmond, VA 23240
Attn: Program Manager

RE: **Virginia Water Quality Improvement Fund**
Grantee: Town of Amherst
Grant #: 440-S-05-19

Dear Program Manager:

This requisition, Number _____, is submitted in connection with the referenced Grant Agreement, dated as of *[insert date of grant agreement]* between the Department of Environmental Quality and *[insert Grantee]*. Unless otherwise defined in this requisition, all capitalized terms used herein shall have the meaning set forth in Article I of the Grant Agreement. The undersigned Authorized Representative of the Grantee hereby requests disbursement of grant proceeds under the Grant Agreement in the amount of \$_____, for the purposes of payment of the Project Costs as set forth on Schedule I attached hereto.

Copies of invoices relating to the items for which payment is requested are attached.

The undersigned certifies that the amounts requested by this requisition will be applied solely and exclusively to the reimbursement of the Grantee for the payment of Project Costs.

Sincerely,

(Authorized Representative of the Grantee)

Attachments

SCHEDULE 1
 VIRGINIA WATER QUALITY IMPROVEMENT FUND
 FORM TO ACCOMPANY REQUEST FOR REIMBURSEMENT

REQUISITION # _____
 GRANTEE: _____
 GRANT #: 440-S-05-19

CERTIFYING SIGNATURE: _____
 TITLE: _____

| Cost Category | Grant Eligible Cost (@ 70%) | Previous Disbursements | Expenditures This Period | Total Expenditures To Date | Estimated Balance Remaining |
|-------------------------|-----------------------------|------------------------|--------------------------|----------------------------|-----------------------------|
| BoD Report | \$17,500 | | | | |
| Laboratory Analysis | \$2,450 | | | | |
| IOP | \$7,000 | | | | |
| | Noneligible Costs | | | | |
| Town's Share BoD Report | \$7,500 | | | | |
| Town's Share Laboratory | \$1,050 | | | | |
| Town's Share IOP | \$3,000 | | | | |
| TOTALS: | \$38,500 | | | | |

Total Grant Amount \$ _____
 Previous Disbursements \$ _____
 This Request \$ _____
 Grant Proceeds Remaining \$ _____



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

SOUTH CENTRAL REGIONAL OFFICE
7705 Timberlake Road, Lynchburg, Virginia 24502
(434) 582-5120 Fax (434) 582-5125
www.deq.virginia.gov

Robert G. Burnley
Director

Thomas L. Henderson
Regional Director

December 28, 2004

Mr. Jack Hobbs, Town Manager
Town of Amherst
P.O. Box 280
Amherst, Virginia 24521

**CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

RE: VPDES Permit No. **VA0031321; Reissuance**
Rutledge Creek Wastewater Treatment Plant

Dear Mr. Hobbs:

Your VPDES permit is enclosed along with the final public participation item (No. 29) of the fact sheet. A Discharge Monitoring Report (DMR) form for 001 is included with the permit. Please make additional copies of the DMR for future use. The first DMR for the month of **January** is due by **February 10, 2005**. Please send the DMR to:

Department of Environmental Quality
South Central Regional Office
7705 Timberlake Road
Lynchburg, VA 24502

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Department of Environmental Quality. In the event that this decision is served on you by mail, three days are added to the period.

Alternatively, any owner under §§62.1-44.16, 62.1-44.17, and 62.1-44.19 of the State Water Control Law aggrieved by any action of the state water Control Board taken without formal hearing, or by inaction of the Board, may demand in writing a formal hearing of such owner's grievance, provided a petition requesting such hearing is filed with the Board. Said petition must meet the requirements set forth in §1.23(b) of the Board's Procedural Rule No. 1. In cases involving actions of the Board, such petition must be filed within thirty days after notice of such action is mailed to such owner by certified mail.



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit No.: VA0031321
Effective Date: December 28, 2004
Expiration Date: December 27, 2009

AUTHORIZATION TO DISCHARGE UNDER THE
VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM

AND

THE VIRGINIA STATE WATER CONTROL LAW

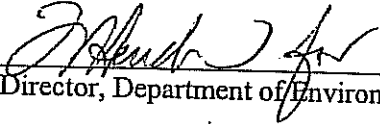
In compliance with the provisions of the Clean Water Act as amended and pursuant to the State Water Control Law and regulations adopted pursuant thereto, the following owner is authorized to discharge in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in this permit.

Owner: **Town of Amherst**
Facility Name: **Rutledge Creek Wastewater Treatment Plant**
City: **Amherst, Virginia**
County: **Amherst**
Facility Location: **731 Industrial Drive**

The owner is authorized to discharge to the following receiving stream:

Stream: **Rutledge Creek**
River Basin: **James River**
River Subbasin: **James River (Upper)**
Section: **11**
Class: **III**
Special Standards: **None**

The authorized discharge shall be in accordance with this cover page, Part I - Effluent Limitations and Monitoring Requirements and Part II - Conditions Applicable To All VPDES Permits, as set forth herein.



Director, Department of Environmental Quality

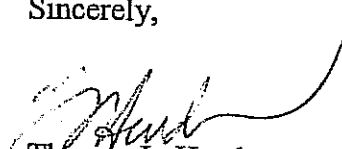
12/28/04

Date

Town of Amherst – Rutledge Creek Wastewater Treatment Plant
VPDES Permit Final Package – VA0031321
December 28, 2004
Page 2 of 2

If you have any questions about the permit, please call Kevin Crider at (434) 582-5120, ext. 6012 or by e-mail kacrider@deq.virginia.gov.

Sincerely,



Thomas L. Henderson
Regional Director

Enclosure: Fact Sheet Public Participation Item (No.29), DMR and VPDES Permit

cc: OWPP
EPA, Region III-3WP12
SCRO Compliance (Permit Part I, Attachment A, Transmittal Letter and DMR Only)
Permit File – VA0031321

ADJACENT STATE COMMENTS RECEIVED ON DRAFT PERMIT: Document any comments received from an adjacent state and noted how resolved.

Not Applicable.

OTHER AGENCY COMMENTS RECEIVED ON DRAFT PERMIT: Document any comments received from any other agencies (e.g., VIMS, VMRC, DGIF, etc.) and noted how resolved.

Not Applicable.

OTHER COMMENTS RECEIVED FROM RIPARIAN OWNERS/CITIZENS ON DRAFT PERMIT: Document any comments received from other sources and note how resolved.

PUBLIC NOTICE INFORMATION: 1st Comment Period: **Start Date:** September 16, 2004
End Date: October 18, 2004

The application and draft permit received public notice in accordance with the VPDES Permit Regulation. During the initial public notice period, a request for hearing dated 10/8/04 were received from the owner (Town of Amherst) on 10/15/04. The basis for the hearing request was the Copper and Nickel limits remaining in the reissued permit. A copy of the comment letter is attached.

In the previous cycle the effluent hardness was estimated (50mg/l) and a nickel limit was placed into the permit for the lower tier. In this permit cycle, an actual hardness datum of 94 mg/l was submitted and thus showed no need for the nickel limit at the lower flow tier. Applying a minimum hardness of 120 mg/l on the new WWTP indicates no need for a limit, therefore in lieu of copper and nickel limits for the higher flow tier, a minimum hardness limit was proposed to Town of Amherst in an email dated 11/10/04. By email dated 11/10/04 from Town Manager Jack Hobbs, Amherst withdrew their request for hearing and agreed to the proposed minimum hardness limit.

On September 30, 2004, Copies of the draft permit and fact sheet requested by Carolyn Pravlik (Washington D.C.). Draft permit transmitted on October 1, 2004 and FS transmitted on October 4, 2004 to Email Address: cpravlik@verizon.net After the copies were transmitted, no further information was requested.

On October 5, 2004, Copies of the draft permit and fact sheet requested by Tom Bledsoe (Chesapeake Bay Foundation). Draft permit and FS transmitted on October 7, 2004 to Email Address: VA_Intern1@savethebay.cbf.org After the copies were transmitted, no further information was requested.

PUBLIC NOTICE INFORMATION: 2nd Comment Period: **Start Date:** November 25, 2004
End Date: December 27, 2004

Persons may comment in writing or by e-mail to the DEQ on the proposed reissuance of the permit within 30 days from the date of the first notice. Address all comments to the contact person listed below. Written or e-mail comments shall include the name, address, and telephone number of the writer, and shall contain a complete, concise statement of the factual basis for comments. Only those comments received within this period will be considered. The Director of the DEQ may decide to hold a public hearing if public response is significant. Requests for public hearings shall state the reason why a hearing is requested, the nature of the issues proposed to be raised in the public hearing and a brief explanation of how the requestor's interests would be directly and adversely affected by the proposed permit action.

All pertinent information is on file and may be inspected, and arrangements made for copying by contacting Kevin A. Crider at: Department of Environmental Quality (DEQ), South Central Regional Office, 7705 Timberlake Road, Lynchburg, Virginia 24502. Telephone: (434) 582-5120 x6012. Facsimile: (434) 582-5125. E-mail: kacrider@deq.virginia.gov.

applied. Attach any memoranda or other information which helped to develop permit conditions (i.e. flow determination memo, tier determinations, PReP complaints, special water quality studies, STORET data and other biological and/or chemical data, etc.

SEE ATTACHMENT 9

24. **303(d) LISTED SEGMENTS:** Indicate if the facility discharges directly to a segment that is listed on the current 303(d) list, if the allocations are specified by an approved TMDL and, if so, provide all appropriate information/calculations. If the facility discharges directly to a stream segment that is on the current 303(d) list, the fact sheet must include a description of how the TMDL requirements are being met.

This facility discharges directly to *Rutledge Creek*. This stream segment receiving the effluent is listed on Part 1A of the approved 2002 303(d) list for non-attainment of Fecal Coliform. A TMDL has not been prepared or approved for this stream segment. The permit contains a TMDL reopener clause which will allow it to be modified, in compliance with section 303(d)(4) of the Act once a TMDL is approved.

SEE ATTACHMENT 10

25. **CHANGES TO PERMIT:** Use TABLE A to record any changes from the previous permit and the rationale for those changes. Use TABLE B to record any changes made to the permit during the permit processing period and the rationale for those changes [i.e., use for comments from the applicant, VDH, EPA, other agencies and/or the public where comments resulted in changes to the permit limitations or any other changes associated with the special conditions or reporting requirements].

SEE ATTACHMENT 11

26. **NPDES INDUSTRIAL PERMIT RATING WORKSHEET:**

N/A - This is a municipal facility.

27. **EPA/VIRGINIA DRAFT PERMIT SUBMISSION CHECKLIST:**

SEE ATTACHMENT 12

28. **DEQ PLANNING COMMENTS RECEIVED ON DRAFT PERMIT:** Document any comments received from DEQ planning.

The discharge is in conformance with the existing planning documents for the area.

29. **PUBLIC PARTICIPATION:** Document comments/responses received during the public participation process. If comments/responses provided, especially if they result in changes to the permit, place in the attachment.

VDH COMMENTS RECEIVED ON DRAFT PERMIT: Document any comments received from the Virginia Dept. of Health and noted how resolved.

By memorandum dated April 6, 2004, the VDH provided the following comments on the application:
"There are no public water supply raw water intakes located within 15 miles downstream of the discharge. We do not object to the discharge."

New Agency guidance does not require the VDH to review draft permits prior to issuance, therefore there were no comments received.

EPA COMMENTS RECEIVED ON DRAFT PERMIT: Document any comments received from the U.S. Environmental Protection Agency and noted how resolved.

The draft permit was transmitted to EPA on July 12, 2004 because the facility discharges to a stream segment listed on Part 1A of 303(d) list for Fecal Coliform. By letter dated August 13, 2004, EPA has no objections to the adequacy of the draft permit.

Following the comment period, the Board will make a determination regarding the proposed reissuance. This determination will become effective, unless the Director grants a public hearing. Due notice of any public hearing will be given.

30. **ADDITIONAL FACT SHEET COMMENTS/PERTINENT INFORMATION:**

The Town of Amherst completed the study of Bacteria Standards for E. Coli and submitted the results to DEQ SCRO on November 7, 2004. However, this study was completed while the plant used chlorination as a disinfectant, thus the permittee is required to complete another study based on the Ultraviolet disinfection system being in place.

This facility is being expanded from 0.4 MGD to 0.6 MGD with a projected completion date around late September 2004; however, the flows will not immediately increase. Even with the design flow going to 0.6 MGD, the permit will allow for limitations for the 0.4 MGD facility to continue until such time as there have been three (3) consecutive months which equal or exceed 95% of the monthly average flow (0.38 MGD). The limitations for the 0.4 MGD facility have been shown to be protective of water quality. Once there have been three consecutive months which equal or exceed a monthly average flow of 0.38 MGD (regardless of reason), the limitations will revert to the tighter requirements for the 0.6 MGD facility.

The permit expired on August 4, 2004 due to the finalization of the DEQ Nutrient Guidance Document 04-2017, which was received by the regional office on July 19, 2004 and the receipt of the last set of Form 2A data received on July 22, 2004. The nutrient monitoring and special conditions were included in the permit and the draft was submitted on July 30, 2004 for owner concurrence. Comments were received from the owner on August 27, 2004 (dated August 19, 2004) and a revised draft permit and public notice was submitted to the owner on September 8, 2004.

31. **SUMMARY OF SPECIFIC ATTACHMENTS LABELED AS:**

- Attachment 1 Site Inspection Report/Memorandum
- Attachment 2 Discharge Location/Topographic Map
- Attachment 3 Schematic/Plans & Specs/Site Map/Water Balance
- Attachment 4 Discharge/Outfall Description
- Attachment 5 Limitations/Monitoring
- Attachment 6 Special Conditions
- Attachment 7 Effluent/Sludge/Ground Water Limitations/Monitoring Rationale/Suitable Data/
Stream Modeling/Antidegradation/Antibacksliding
- Attachment 8 Special Conditions Rationale
- Attachment Material Stored
- Attachment 9 Receiving Waters Info./Tier Determination/STORET Data
- Attachment 10 303(d) Listed Segments
- Attachment 11 TABLE A and TABLE B - Change Sheets
- Attachment NPDES Industrial Permit Rating Worksheet
- Attachment 12 EPA/Virginia Draft Permit Submission Checklist
- Attachment 13 Chronology Sheet
- Attachment

PERMITTEE NAME, ADDRESS (INCLUDE FACILITY NAME/LOCATION IF DIFFERENT)

DEPARTMENT OF ENVIRONMENTAL QUALITY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
DISCHARGE MONITORING REPORT (DMR)

Municipal Minor 12/07/21
DEPT. OF ENVIRONMENTAL QUALITY
(REGIONAL OFFICE)

NAME Rutledge Creek WWTP
ADDRESS PO Box 280
Amherst VA 24521
FACILITY 731 Industrial Dr
LOCATION

VA0031321 PERMIT NUMBER 001 DISCHARGE NUMBER
MONITORING PERIOD
YEAR MO DAY TO YEAR MO DAY

Lynchburg VA 24502
NOTE: READ PERMIT AND GENERAL INSTRUCTIONS BEFORE COMPLETING THIS FORM.

| PARAMETER | QUANTITY OR LOADING | | QUALITY OR CONCENTRATION | | | NO. EX. | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|------------------------------|---------------------|---------|--------------------------|---------|---------|---------|-----------------------|-------------|
| | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | | | |
| 001 FLOW | REPORTD | | | ***** | ***** | | | |
| | REQRMNT | 0.6 | NL | ***** | ***** | MGD | | REC |
| 002 PH | REPORTD | ***** | ***** | ***** | ***** | | | |
| | REQRMNT | ***** | ***** | ***** | ***** | | | |
| 003 BOD5 | REPORTD | | | 6.0 | ***** | SU | 1/DAY | GRAB |
| | REQRMNT | 16.8 | 25.2 | ***** | ***** | KG/D | | |
| 004 TSS | REPORTD | | | ***** | ***** | 1.1.1 | MG/L | 8HC |
| | REQRMNT | 45.4 | 68.1 | ***** | 45 | ***** | MG/L | 8HC |
| 006 COLIFORM, FECAL | REPORTD | ***** | ***** | ***** | ***** | | | |
| | REQRMNT | ***** | ***** | ***** | ***** | | | |
| 012 PHOSPHORUS, TOTAL (AS P) | REPORTD | | | ***** | ***** | 200 | N/CML | GRAB |
| | REQRMNT | NL | ***** | ***** | ***** | | | |
| 013 NITROGEN, TOTAL AS N | REPORTD | | | ***** | ***** | NL | MG/L | 8HC |
| | REQRMNT | NL | ***** | ***** | ***** | | | |
| 068 TKN (N-KJEL) | REPORTD | | | ***** | ***** | NL | MG/L | CALC |
| | REQRMNT | NL | ***** | ***** | ***** | | | |

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

| BYPASSES AND OVERFLOWS | TOTAL OCCURRENCES | TOTAL FLOW(M.G.) | TOTAL BOD5(K.G.) | OPERATOR IN RESPONSIBLE CHARGE | | DATE | | |
|---|-------------------|------------------|------------------|--|-----------|------------------|-----|-----|
| | | | | TYPED OR PRINTED NAME | SIGNATURE | YEAR | MO. | DAY |
| <p>I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHER AND EVALUATE THE INFORMATION SUBMITTED. BASED ON MY KNOWLEDGE OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR OBTAINING THE INFORMATION, THE INFORMATION SUBMITTED IS TO THE BEST OF MY KNOWLEDGE AND BELIEF TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS. SEE 18 U.S.C. § 1001 AND 33 U.S.C. § 1319. (Penalties under these statutes may include fines up to \$10,000 and/or maximum imprisonment of between 6 months and 5 years.)</p> | | | | <p>PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT</p> | | <p>TELEPHONE</p> | | |
| | | | | TYPED OR PRINTED NAME | SIGNATURE | YEAR | MO. | DAY |
| | | | | TYPED OR PRINTED NAME | SIGNATURE | YEAR | MO. | DAY |

BY LAW (33 U.S.C. § 1318 40 CFR 122.6 FAILURE TO REPORT OR FAILURE TO REPORT TRUTHFULLY
CAN RESULT IN CIVIL PENALTIES NOT TO EXCEED \$10,000 PER DAY OF VIOLATION: OR IN CRIMINAL PENALTIES NOT TO EXCEED
\$25,000 PER DAY OF VIOLATION OR BY IMPRISONMENT FOR NOT MORE THAN FIVE YEARS, OR BOTH.

GENERAL INSTRUCTIONS

1. Complete this form in permanent ink or indelible pencil.
2. Be sure to enter the dates for the first and last day of the period covered by the report on the form in the space marked "Monitoring Period".
3. For those parameters where the "permit requirement" spaces are blank or a limitation appears, provide data in the "reported" spaces in accordance with your permit.
4. Enter the average and, if appropriate, maximum quantities and units in the "reported" spaces in the columns marked "Quantity or Loading".
 $KG/DAY = \text{Concentration}(mg/l) \times \text{Flow}(MGD) \times 3.785$.
5. Enter maximum, minimum, and/or average concentrations and units in the "reported" spaces in the columns marked "Quality or Concentration".
6. Enter the number of samples which do not comply with the maximum and /or minimum permit requirements in the "reported" space in the column marked "No. Ex.".
7. Enter the actual frequency of analysis for each parameter (number of times per day, week, month) in the "reported" space in the column marked "Frequency of Analysis".
8. Enter the actual type of sample collected for each parameter in the "reported" space in the column marked "Sample Type".
9. Enter additional required data or comments in the space marked "additional permit requirements or comments".
10. Record the number of bypasses during the month, the total flow in million gallons and BOD5 in kilograms in the proper columns in the section marked "Bypasses and Overflows".
11. The operator in responsible charge of the facility should review the form and sign in the space provided. If the plant is required to have a licensed operator, the operator's certificate number should be reported in the space provided.
12. The principal executive officer should then review the form and sign in the space provided and provide a telephone number where he/she can be reached.
13. You are required to sample at the frequency and type indicated in your permit.
14. Send the completed form to your Dept. of Environmental Quality Regional Office by the 10th of each month.
15. You are required to retain a copy of the report for your records.
16. Where violations of permit requirements are reported, attach a brief explanation in accordance with the permit requirements describing causes and corrective actions taken. Reference each violation by date.
17. If you have any questions, contact the Dept. of Environmental Quality Regional Office.

A. INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning with the permit's effective date and lasting until the permit's expiration date **OR** upon three (3) consecutive months with the monthly average effluent flow equal to or greater than 0.38 MGD, if earlier, the permittee is authorized to discharge from outfall serial number 001, after Parshall Flume.

Such discharges shall be limited and monitored by the permittee as specified below:

| EFFLUENT CHARACTERISTICS | DISCHARGE LIMITATIONS | | | | | | MONITORING REQUIREMENTS | | |
|---|-----------------------|---------|----------------|-------|---------|---------|-------------------------|-------------|------------|
| | MONTHLY AVERAGE | | WEEKLY AVERAGE | | MINIMUM | MAXIMUM | FREQUENCY | SAMPLE TYPE | |
| | mg/l* | kg/day* | mg/l* | kg/d* | mg/l* | mg/l* | | | |
| Flow (MGD) [a] | NL | | NA | | NA | NL | | Continuous | TIRE |
| BOD ₅ [d] | 11.1 | 16.8 | 16.7 | 25.2 | NA | NA | | 2 Days/Week | 8-HC |
| Total Suspended Solids [d] | 30 | 45.4 | 45 | 68.1 | NA | NA | | 1/Week | 8-HC |
| Ammonia (June - Nov) [c] | 14.7 | NA | 14.7 | NA | NA | NA | | 1/Month | 8-HC |
| pH (standard units) | NA | | NA | | 6.0 | 9.0 | | 1/Day | Grab |
| Hardness | NA | | NA | | 120 | NA | | 1/Week | 8-HC |
| Fecal Coliform (N/CML - geometric mean) [b] | 200 | | NA | | NA | NA | | 3 Days/Week | Grab |
| Total Phosphorus [c] | NL | NL | NA | NA | NA | NA | | 2/Month [f] | 8 HC |
| Total Phosphorus (kg/month) [g] | NA | NA | NA | NA | NA | NL | | 1/Month | Calculated |
| Total Phosphorus (kg/calendar year) [g] | NA | NA | NA | NA | NA | NL | | 1/Month | Calculated |
| Orthophosphate [c] | NL | NL | NA | NA | NA | NA | | 2/Month [f] | 8 HC |
| Total Kjeldahl Nitrogen (as N) [c] [e] | NL | NL | NA | NA | NA | NA | | 2/Month [f] | 8 HC |
| Nitrate plus Nitrite (as N) [c] [e] | NL | NL | NA | NA | NA | NA | | 2/Month [f] | 8 HC |
| Total Nitrogen [e] | NL | NL | NA | NA | NA | NA | | 2/Month [f] | 8 HC |
| Total Nitrogen (kg/month) [g] | NA | NA | NA | NA | NA | NA | | 2/Month [f] | Calculated |
| Total Nitrogen (kg/calendar year) [g] | NA | NA | NA | NA | NA | NL | | 1/Month | Calculated |
| | NA | NA | NA | NA | NA | NL | | 1/Month | Calculated |

* = UNLESS OTHERWISE NOTED NA = NOT APPLICABLE NL = NO LIMIT, MONITORING REQUIREMENT ONLY

TIRE = TOTALIZING, INDICATING AND RECORDING EQUIPMENT

- [a] See Part I.D.6.a. and b. for additional flow requirements.
- [b] See Part I.B. and C. for additional bacterial and chlorine limitations and monitoring requirements, respectively.
- [c] See Parts I.D.7.a. and I.D.7.b. for quantification levels and reporting requirements, respectively.
- [d] See Part I.D.9. for additional instructions regarding effluent monitoring frequencies.
- [e] Total Nitrogen, which is the sum of Total Kjeldahl Nitrogen and Nitrates plus Nitrites, shall be derived from the results of those tests.
- [f] 2/Month = two samples taken during the calendar month, no less than two weeks apart.
- [g] See Part I.D.12. for calculation procedures.
 - a. The design flow of this treatment facility is 0.6 MGD.
 - b. There shall be no discharge of floating solids or visible foam in other than trace amounts.
 - c. At least 85% removal for BOD5 and TSS must be attained for this effluent.

A. FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. Upon three (3) consecutive months with the monthly average effluent flow equal to or greater than 0.38 MGD and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 001, after Parshall Flume.

Such discharges shall be limited and monitored by the permittee as specified below:

| EFFLUENT CHARACTERISTICS | DISCHARGE LIMITATIONS | | | | | | MONITORING REQUIREMENTS | |
|---|-----------------------|---------|----------------|-------|---------|---------|-------------------------|-------------|
| | MONTHLY AVERAGE | | WEEKLY AVERAGE | | MINIMUM | MAXIMUM | FREQUENCY | SAMPLE TYPE |
| | mg/l* | kg/day* | mg/l* | kg/d* | mg/l* | mg/l* | | |
| Flow (MGD) [a] | NL | | NA | | NA | NL | | |
| BOD ₅ [d] | 7.4 | 16.8 | 11.1 | 25.2 | NA | NA | Continuous | TIRE |
| Total Suspended Solids [d] | 30 | 68.1 | 45 | 102.1 | NA | NA | 2 Days/Week | 8-HC |
| Ammonia (June - Nov) [c] [d] | 12.1 | NA | 12.1 | NA | NA | NA | 1/Week | 8-HC |
| pH (standard units) | NA | | NA | | NA | NA | 1/Month | 8-HC |
| Hardness | NA | | NA | | 6.0 | 9.0 | 1/Day | Grab |
| Fecal Coliform (N/CML - geometric mean) | NA | | NA | | 120 | NA | 1/Week | 8-HC |
| | 200 | | NA | | NA | NA | 3 Days/Week | Grab |
| Total Phosphorus [c] | NL | NL | NA | NA | NA | NA | 2/Month [f] | 8 HC |
| Total Phosphorus (kg/month) [g] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Total Phosphorus (kg/calendar year) [g] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Orthophosphate [c] | NL | NL | NA | NA | NA | NA | 2/Month [f] | 8 HC |
| Total Kjeldahl Nitrogen (as N) [c] [e] | NL | NL | NA | NA | NA | NA | 2/Month [f] | 8 HC |
| Nitrate plus Nitrite (as N) [c] [e] | NL | NL | NA | NA | NA | NA | 2/Month [f] | 8 HC |
| Total Nitrogen [e] | NL | NL | NA | NA | NA | NA | 2/Month [f] | 8 HC |
| Total Nitrogen (kg/month) [g] | NA | NA | NA | NA | NA | NA | 1/Month | Calculated |
| Total Nitrogen (kg/calendar year) [g] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |

* = UNLESS OTHERWISE NOTED NA = NOT APPLICABLE NL = NO LIMIT, MONITORING REQUIREMENT ONLY
TIRE = TOTALIZING, INDICATING AND RECORDING EQUIPMENT

- [a] See Part I.D.6.b. for additional flow requirements.
- [b] See Part I.B. and C. for additional bacterial and chlorine limitations and monitoring requirements, respectively.
- [c] See Parts I.D.7.a. and I.D.7.b. for quantification levels and reporting requirements, respectively.
- [d] See Part I.D.9. for additional instructions regarding effluent monitoring frequencies.
- [e] Total Nitrogen, which is the sum of Total Kjeldahl Nitrogen and Nitrates plus Nitrites, shall be derived from the results of those tests.
- [f] 2/Month = two samples taken during the calendar month, no less than two weeks apart.
- [g] See Part I.D.12. for calculation procedures.
 - a. The design flow of this treatment facility is **0.6 MGD**.
 - b. There shall be no discharge of floating solids or visible foam in other than trace amounts.
 - c. At least 85% removal for BOD5 and TSS must be attained for this effluent.

B. BACTERIAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS – ADDITIONAL INSTRUCTIONS

1. Beginning no later than July 1, 2005, the permittee shall initiate a demonstration study as described below.
 - a. *E. coli* monitoring shall be performed at the minimum prescribed below:

Once per week by grab sample taken between 10 a.m. and 4 p.m. until a minimum of 12 data points are collected.
 - b. Effluent flow shall be measured within 15 minutes of the time each *E. coli* sample is taken. The date and time the samples were collected shall also be recorded.
 - c. If only one datum is collected in any given calendar month, it shall be compared to the single sample maximum of 235 colonies/100 ml for compliance with the applicable water quality criterion. If more than one datum are collected in any given calendar month, the geometric mean for that month shall be compared to the 126 colonies/100 ml for compliance with the applicable water quality criterion.

Upon initiation of the study, reports of progress shall be submitted with the monthly discharge monitoring reports. The reports are to include the data collected during the previous month.

2. a. No later than January 10, 2006, the permittee shall either:
 - (1) Complete the demonstration study and submit the results to the DEQ regional office; or,
 - (2) Advise the DEQ regional office, in writing, that the demonstration study is still ongoing. The latest status of the study is to be provided.
 - b. The submitted results of the demonstration study, as described in I.B.1. above, shall include the following:
 - (1) The original data set, including the following information/data for each sample:
 - (a) Date and time sample collected
 - (b) *E. coli* result (N/100 ml)
 - (c) Fecal coliform (N/100 ml)
 - (d) Flow (mgd)
 - (2) The geometric mean calculations and results; and
 - (3) A summary of results in tabular format and a statement of successful or unsuccessful demonstration of the requirements of Part I.B.3.
3. During the demonstration period, the permittee is to provide a data set which demonstrates adequate disinfection showing no exceedences of the applicable *E. coli* criterion in a minimum of 12 consecutive samples collected as under Part I.B.1. In addition, there must be full compliance with the permitted fecal coliform limitations during the demonstration period. Once the above is completed and submitted, then upon written notification from DEQ, beginning with the month following receipt of the

written notice and continuing until the permit expiration date:

- a. The fecal coliform limitations and monitoring required by Part I.A. shall no longer be required; and,
- b. The following limitations and monitoring requirements shall become effective:

| | <u>Discharge Limitations</u> | <u>Monitoring Requirements</u> | |
|------------------------------|------------------------------|--------------------------------|-----------------------------------|
| | <u>Monthly Average</u> | <u>Frequency</u> | <u>Sample Type</u> |
| <i>E. coli</i> (n/100 ml) | 126* | 3/Week | Grab (Between 10 AM & 4 PM) |

* Geometric Mean

- 4. If the results of the study demonstrate that there are any exceedences of the applicable *E. coli* criterion in the data set collected under Part I.B.1. while the fecal coliform limitations are being complied with, then the permittee shall achieve compliance with the final limits for *E. coli* specified in Part I.B.3.b. above in accordance with the following schedule:

- a. Submit Progress Report **By January 10, 2007, and annually thereafter**
- b. Achieve compliance with final limits **By January 1, 2009**

Annually = Between January 1 and December 31, due January 10 of following year.

Upon achievement of the final limits for *E. coli*, the fecal coliform limitations and monitoring required in Part I.A. shall no longer be required.

- 5. *E. coli* sampling and analysis shall be performed in accordance with 40 CFR 141.21, except that maximum holding times shall be limited in accordance with 40 CFR 136 to six hours.

C. TOTAL RESIDUAL CHLORINE (TRC) LIMITATIONS AND MONITORING REQUIREMENTS

- 1. If, based on the results of the demonstration study in I.B. above, the permittee elects to convert to chlorination as the disinfection method, compliance with the final TRC limitations and monitoring requirements specified in Part 2.C. below shall be achieved in accordance with the following schedule:

- a. **Submit Proposed Plan for Achievement of Compliance or Select Engineering Firm for Design of Facilities** **No later than March 10, 2005.**
- b. **Submit Progress Reports to the DEQ Regional Office** **Quarterly after #1, with the first report due July 10, 2005.**
- c. **Achieve Compliance with Part I.A. Limitations** **No later than July 1, 2007.**

Quarterly = In accordance with the following schedule: 1st quarter (January 1 – March 31, due April 10); 2nd quarter (April 1 – June 30, due July 10); 3rd quarter (July 1 – September 30, due October 10); 4th quarter (October 1 – December 31, due January 10).

No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit to the DEQ Regional Office, either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

2. The TRC shall be limited and monitored as follows:

a. Effluent TRC shall be monitored, following dechlorination, 1/day by grab sample and limited as specified below:

| TRC ($\mu\text{g/l}$) | <u>Monthly Average</u> | <u>Weekly Average</u> | <u>Quantification Level</u> |
|-------------------------|------------------------|-----------------------|-----------------------------|
| | 17 | 21 | 100 |

b. TRC shall also be monitored at the outlet of the chlorine contact tank, prior to dechlorination, 3 per day @ 4-hour intervals by grab sample.

c. No more than 9 of all samples taken after the chlorine contact tank, prior to dechlorination, shall be less than 1.0 mg/l for any one calendar month.

d. No TRC sample collected after the chlorine contact tank, prior to dechlorination, shall be less than 0.6 mg/l.

D. OTHER REQUIREMENTS OR SPECIAL CONDITIONS

1. Permit Reopeners

a. Sludge Reopener

This permit may be modified or, alternatively, revoked and reissued if any applicable standard for sewage sludge use or disposal promulgated under Section 405(d) of the Clean Water Act is more stringent than any requirements for sludge use or disposal in this permit, or controls a pollutant or practice not limited in this permit.

b. Nutrient Enriched Waters Reopener

This permit may be modified or, alternatively, revoked and reissued to incorporate new or alternative nutrient limitations and/or monitoring requirements should the State Water Control Board adopt nutrient standards for the waterbody receiving the discharge, including the Chesapeake Bay or its tributaries, or if a future water quality regulation or statute requires new or alternative nutrient control.

This permit may be modified or, alternatively, revoked and reissued to incorporate annual maximum total nitrogen and total phosphorus effluent limitations based on three years of monitoring data collected as required by this permit.

c. Total Maximum Daily Load (TMDL) Reopener

This permit shall be modified or, alternatively, revoked and reissued if any approved waste load allocation procedure, pursuant to section 303(d) of the Clean Water Act, imposes waste load allocations, limits or conditions on the facility that are not consistent with the requirements of this permit.

2. Licensed Wastewater Operator Requirement

The permittee shall employ or contract at least one Class II licensed wastewater works operator for the facility. The license shall be issued in accordance with Title 54.1 of the Code of Virginia and the regulations of the Board for Waterworks and Wastewater Works Operators. The permittee shall notify the DEQ Regional Office, in writing, whenever he is not complying, or has grounds for anticipating he will not comply with this requirement. The notification shall include a statement of reasons and a prompt schedule for achieving compliance.

3. Reliability Class Requirement

The permitted treatment works shall meet Reliability Class II.

4. Certificate to Construct (CTC) and Certificate to Operate (CTO) Requirements

The permittee shall, in accordance with the Sewage Collection and Treatment Regulations, obtain a CTC and a CTO from the DEQ prior to constructing wastewater treatment facilities and operating the facilities, respectively.

5. Operations and Maintenance (O & M) Manual

The permittee shall review the existing O & M Manual and notify the DEQ Regional Office, in writing, that it is still accurate and complete. If the O & M Manual is no longer accurate and complete, a revised O & M Manual shall be submitted for approval to the DEQ Regional Office. The permittee will maintain an accurate, approved O & M Manual for the treatment works. This manual shall include, but not necessarily be limited to, the following items, as appropriate:

- a. Treatment works design, operation, routine preventative maintenance of units within the treatment system, critical spare parts inventory and record keeping;
- b. Techniques to be employed in the collection, preservation and analysis of effluent samples;
- c. Procedures for handling, storing, and disposing of all wastes, fluids, and pollutants characterized in Part I.D.8 (Materials Handling and Storage) that will prevent these materials from reaching state waters.

Any changes in the practices and procedures followed by the permittee shall be documented and submitted for approval, as noted above, within 90 days of the effective date of the changes. Upon approval of the submitted manual changes, the revised manual becomes an enforceable part of this permit. Noncompliance with the O & M Manual shall be deemed a violation of the permit.

Letter/Revised Manual Due: No later than January 10, 2006

6. Flow Requirements

a. 95% Effluent Flow Limitation

Upon three consecutive months with the monthly average effluent flow equal to or greater than 0.38 MGD, the monitoring and reporting requirements of Part I.A.2. of this permit shall become effective on the first of the following month. The permittee shall initiate those monitoring and reporting requirements at that time and notify the DEQ Regional Office with the DMR representing the third consecutive month.

b. 95% Design Capacity Notification

A written notice and a **plan of action** for ensuring continued compliance with the terms of this permit shall be submitted to the DEQ Regional Office when the monthly average flow influent to the sewage treatment plant reaches 95 percent of the design capacity authorized in this permit for each month of any three consecutive month period. The written notice shall be submitted within 30 days and the plan of action shall be received at the DEQ Regional Office **no later than 90 days from the third consecutive month for which the flow reached 95 percent of the design capacity.** The plan shall include the necessary steps and a prompt schedule of implementation for controlling any current or reasonably anticipated problem resulting from high influent flows. Failure to submit an adequate plan in a timely manner shall be deemed a violation of this permit.

7. Compliance Reporting Under Part I.A. and I.B.

a. Quantification Levels

(1) The quantification levels (QL) shall be as follows:

| <u>Effluent Characteristic</u> | <u>Quantification Level</u> |
|--------------------------------|-----------------------------|
| Ammonia as N | 0.2 mg/l |
| Total Phosphorus | 0.1 mg/l |
| Orthophosphate | 0.1 mg/l |
| Total Kjeldahl Nitrogen | 0.5 mg/l |
| Nitrate-Nitrite | 0.5 mg/l |

(2) The permittee may use any approved method which has a QL equal to or lower than the QL listed in a.(1) above. The QL is defined as the lowest concentration used to calibrate a measurement system in accordance with the procedures published for the method.

(3) It is the responsibility of the permittee to ensure that proper QA/QC protocols are followed during the sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used and the required QLs have been attained.

b. Reporting

(1) **Monthly Average** -- Compliance with the monthly average limitations and/or reporting requirements for the parameters listed in a.(1) above shall be determined as

follows: All concentration data below the specified QL listed in a.(1) above shall be treated as zeros. All concentration data equal to or above the QL shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, for the month. This arithmetic average shall be reported on the DMR as calculated. If all data are below the QL, then the average shall be reported as "<QL". If reporting for quantity is required on the DMR and the calculated concentration is <QL, then report "<QL" for the quantity; otherwise, use the calculated concentration to calculate the quantity.

- (2) **Maximum Weekly Average** – Compliance with the weekly average limitations and/or reporting requirements for the parameters listed in a.(1) above shall be determined as follows: All concentration data below the specified QL listed in a.(1) above shall be treated as zeros. All concentration data equal to or above the QL shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each complete calendar week entirely contained within the reporting month. The maximum value of the weekly averages thus determined shall be reported on the DMR. If all data for each weekly average are below the QL, then the average shall be reported as "<QL". If reporting for quantity is required on the DMR and the calculated concentration for each weekly average is <QL, then report "<QL" for the quantity; otherwise, use the calculated maximum value of the weekly averages to calculate the quantity.
- (3) Any single datum required shall be reported as "<QL" if it is less than the QL listed in a.(1) above. Otherwise, the numerical value shall be reported.

8. **Materials Handling and Storage**

Any and all product, materials, industrial wastes, and/or other wastes resulting from the purchase, sale, mining, extraction, transport, preparation and/or storage of raw or intermediate materials, final product, by-product or wastes, shall be handled, disposed of and/or stored in such a manner so as not to permit a discharge of such product, materials, industrial wastes and/or other wastes to State waters, except as expressly authorized.

9. **Effluent Monitoring Frequencies**

If the facility permitted herein is issued a Notice of Violation for any of the parameters listed below, then the following effluent monitoring frequencies shall become effective upon written notice from DEQ and remain in effect until permit expiration.

| <u>Effluent Parameter</u> | <u>Frequency</u> |
|---------------------------|------------------|
| BOD ₅ | 3/Week |
| TSS | 3/Week |

No other effluent limitations or monitoring requirements are affected by this special condition.

10. **Indirect Dischargers**

The permittee shall provide adequate notice to the DEQ Regional Office of the following:

- a. Any new introduction of pollutants into the treatment works from an indirect discharger which

would be subject to Section 301 or 306 of Clean Water Act and the State Water Control Law if it were directly discharging those pollutants; and

- b. Any substantial change in the volume or character of pollutants being introduced into the treatment works by a source introducing pollutants into the treatment works at the time of issuance of this permit.

Adequate notice shall include information on (i) the quality and quantity of effluent introduced into the treatment works, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the treatment works.

11. Sludge Use and Disposal

The permittee shall conduct all sewage sludge use or disposal activities in accordance with the Sludge Management Plan (SMP) approved with the issuance of this permit. Any **proposed changes** in the sewage sludge use or disposal practices or procedures followed by the permittee shall be documented and **submitted for Department of Environmental Quality and Department of Health approval 90 days prior to the effective date of the changes**. Upon approval, the revised SMP becomes an enforceable part of the permit. The permit may be modified or, alternatively, revoked and reissued to incorporate limitations or conditions necessitated by substantive changes in sewage sludge use or disposal practices.

12. Nutrient Reporting Calculations

For each calendar month, the DMR shall show the total monthly load (kg) and the cumulative load for the calendar year, to date (kg) calculated in accordance with the following formulae.

$$ML = ML_{avg} * d$$

where: ML = total monthly load in kg
ML_{avg} = monthly average load as reported on DMR (kg/d)
d = number of discharge days in the calendar month

$$AL-YTD = \sum_{(Jan-current\ month)} ML$$

where: AL-YTD = calendar year-to-date annual load in kg

The total nitrogen load and total phosphorus load for each calendar year (AL) shall be shown on the December DMR due January 10th of the following year.

13. Nutrient Reports

- a. Basis of Design Report for Nutrient Removal

A Basis of Design Report addressing the construction and operation of a range of nutrient removal technologies up to and including the limit of technology, shall be submitted to the Department of Environmental Quality. Additional information on the scope and contents of a Basis of Design Report is available from DEQ staff.

Basis of Design Report Due: No later than January 10, 2006

- b. Interim Optimization Plan for Nutrient Removal

A report addressing alternatives and interim measures that may be taken to optimize nutrient

removal with the existing facilities shall be submitted to the Department of Environmental Quality. The report shall describe alternatives considered and a plan to implement the selected interim measures.

Interim Optimization Plan Due: No later than January 10, 2006

E. PRETREATMENT

1. The permittee's pretreatment program has been approved. The program is an enforceable part of this permit. The permittee shall:
 - a. Implement a pretreatment program that complies with the Clean Water Act, Water Control Law, State regulations and the approved program.
 - b. Submit to the DEQ Regional Office an annual report that describes the permittee's program activities over the previous year. The annual report shall be submitted no later than January 31 of each year and shall include:
 - (1) An updated list of the Significant Industrial Users* showing the categorical standards and local limits applicable to each.
 - (2) A summary of the compliance status of each Significant Industrial User with pretreatment standards and permit requirements.
 - (3) A summary of the number and types of Significant Industrial User sampling and inspections performed by the POTW.
 - (4) All information concerning any interference, upset, VPDES permit or Water Quality Standards violations directly attributable to Significant Industrial Users and enforcement actions taken to alleviate said events.
 - (5) A description of all enforcement actions taken against Significant Industrial Users over the previous 12 months.
 - (6) A summary of any changes to the submitted pretreatment program that have not been previously reported to the DEQ Regional Office.
 - (7) A summary of the permits issued to Significant Industrial Users since the last annual report.
 - (8) POTW and self-monitoring results for Significant Industrial Users determined to be in significant non-compliance during the reporting period.
 - (9) Results of the POTW's influent/effluent/sludge sampling, not previously submitted to DEQ.
 - (10) Copies of newspaper publications of all Significant Industrial Users in significant non-compliance during the reporting period. This is due no later than March 31 of each year.

- (11) Signature of an authorized representative.
- c. Submit any changes to the approved pretreatment program to the DEQ Regional Office and obtain approval before implementation of the changes.
- d. Ensure all Significant Industrial Users' permits are issued and reissued in a timely manner and that the Significant Industrial User permits issued by the POTW are effective and enforceable.
- e. Inspect and sample all Significant Industrial Users at a minimum of once a year.
 - (1) Sampling shall include all regulated parameters, and shall be representative of the wastewater discharged.
 - (2) Inspection of the Significant Industrial Users shall cover all areas which could result in wastewater discharge to the treatment works including manufacturing, chemical storage, pretreatment facilities, spill prevention and control procedures, hazardous waste generation and Significant Industrial User's self-monitoring and records.
- f. Implement the reporting requirements of Part VII of the VPDES Permit Regulation.
- g. Review the Enforcement Response Plan (ERP) and ensure it meets state and federal regulatory requirements. The approved ERP is an enforceable part of this permit and shall be implemented.
- h. Develop local limits or reevaluate local limits using current influent, effluent and sludge monitoring data and submit the data and results of the evaluation to the DEQ Regional Office within one year of the effective or modification date. All Significant Industrial Users shall be sampled at the end of any categorical process and at the entrance to the treatment works.
- i. Ensure that adequate resources are available to implement the approved program.
- j. Meet all public participation requirements and annually public notice Significant Industrial Users in significant non-compliance with pretreatment standards and requirements for the previous 12 months.
- k. Submit to the DEQ Regional Office a survey of all Industrial Users discharging to the POTW. The information shall be submitted to the POTW on the DEQ's Discharger Survey Form or an equivalent form that includes the quantity and quality of the wastewater. Survey results shall include the identification of significant industrial users of the POTW.

Survey Due: No later than July 10, 2005.

In lieu of the survey, the permittee may elect to develop, submit for approval and implement the plan to continuously survey the industrial community in their jurisdiction.

2. The DEQ may require the POTW to institute changes to its pretreatment program:
 - a. If the approved program is not implemented in a way satisfying the requirements of the Clean Water Act, Water Control Law or State regulations;
 - b. If problems such as pass-through, interference, water quality standards violations or sludge

contamination develop or continue; and

- c. If federal, state or local requirements change.

* A significant industrial user is one that:

- Has a process wastewater (**) flow of 25,000 gallons or more per average workday;
- Contributes a process wastestream which makes up 5-percent or more of the average dry weather hydraulic or organic capacity of the POTW;
- Is subject to the categorical pretreatment standards; or
- Has significant impact, either singularly or in combination with other Significant Dischargers, on the treatment works or the quality of its effluent.

** Excludes sanitary, non-contact cooling water and boiler blowdown.

F. TOXICS MANAGEMENT PROGRAM

1. Biological Monitoring:

- a. In accordance with the schedule in 2. below, the permittee shall conduct quarterly acute and chronic toxicity tests for a period of five quarters using 24-hour flow-proportioned composite samples of final effluent from outfall 001.

The acute multi-dilution NOAEC tests to use are:

- 48 Hour Static Acute test using *Pimephales promelas*
- 48 Hour Static Acute test using *Ceriodaphnia dubia*

These acute tests are to be conducted using 5 geometric dilutions of effluent with a minimum of 4 replicates, with 5 organisms in each. The NOAEC (No Observed Adverse Effect Concentration), as determined by hypothesis testing, shall be reported converted to TU_a (100/NOAEC). The LC_{50} should also be determined and noted on the submitted report. Tests in which control survival is less than 90% are not acceptable.

The chronic tests to use are:

- Chronic 7-Day Static Renewal Survival and Growth Test using *Pimephales promelas*
- Chronic 3-Brood Static Renewal Survival and Reproduction Test using *Ceriodaphnia dubia*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. Results which cannot be determined (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. Express the test NOEC as TU_c (Chronic Toxic Units), by dividing 100/NOEC for DMR reporting. Report the LC_{50} at 48 hours and the IC_{25} with the NOEC's in the test report.

The permittee may provide additional acute and/or chronic tests to address data variability during the period of data generation. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the

WET testing methods cited in 40 CFR 136.3

- b. The test dilutions should be able to determine compliance with the following endpoints:
- (1) Acute NOAEC of 100% effluent equivalent to a TU_a of 1.0
 - (2) Chronic NOEC of 78% effluent equivalent to a TU_c of 1.28
- c. All toxicity test data will be evaluated by STATS.EXE for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should evaluation of the data indicate that a limit is needed, a WET limit and compliance schedule will be required and the toxicity tests of 1.a. may be discontinued.
- d. If after evaluating the data, it is determined that no limit is needed, the permittee shall continue acute and chronic toxicity testing (both species) of the outfall annually, as on the reporting schedule in 2.
- e. All applicable data will be reevaluated for reasonable potential at the end of the permit term.

2. Reporting Schedule:


The permittee shall supply 1 copy of the toxicity test reports specified in this Toxics Management Program in accordance with the following schedule:

| <u>Period</u> | <u>Compliance Periods</u> | <u>DMR/Report Submission Dates</u> |
|-------------------------|--------------------------------|------------------------------------|
| 1 st quarter | January 1 – March 31, 2005 | April 10, 2005 |
| 2 nd quarter | April 1 - June 30, 2005 | July 10, 2005 |
| 3 rd quarter | July 1 - September 30, 2005 | October 10, 2005 |
| 4 th quarter | October 1 - December 31, 2005 | January 10, 2006 |
| 5 th quarter | January 1 – March 31, 2006 | April 10, 2006 |
| 1 st Annual | April 1 – December 31, 2006 | January 10, 2007 |
| 2 nd Annual | January 1 – December 31, 2007 | January 10, 2008 |
| 3 rd Annual | January 1 – December 31, 2008 | January 10, 2009 |
| 4 th Annual | January 1 – September 30, 2009 | October 10, 2009 |

COMMONWEALTH OF VIRGINIA
Department of Environmental Quality
Division of Water Quality Programs
Ellen Gilinsky, Director

Subject: Guidance Memo No. 05-2009
VPDES Nutrient Limitations for Significant Discharges to the Chesapeake Bay Watershed

To: Regional Directors

From: Ellen Gilinsky, Ph.D., Director 

Date: May 24, 2005

Copies: Rick Weeks, Regional Water Permit Managers, CBP staff, OWPP staff, OOT Staff, OWE Staff

Summary:

The purpose of this guidance is to provide DEQ's permitting strategy for establishing nutrient limits in VPDES permits for all significant discharges to the Chesapeake Bay. This guidance replaces GM 04-2017 "Nutrient Monitoring and Maximum Annual Loads for VPDES Permitted Facilities on the DEQ Chesapeake Bay Program's List of Significant Discharges" and reflects key changes made as a result of the State Water Control Board approval of new Water Quality Standards for the Chesapeake Bay and the passage of legislation establishing the Chesapeake Bay Watershed Nutrient Credit Exchange Program. Effective upon the issuance of this guidance, VPDES permits for dischargers in the Shenandoah/Potomac, Rappahannock and Eastern Shore Basins that are on the DEQ Chesapeake Bay Program's (CBP) Significant Discharger List (SDL) should include interim monitoring requirements, final Total Nitrogen and Total Phosphorus annual loading limitations, a schedule of compliance, requirements for submittal of a Basis of Design (BOD) Report and an Interim Optimization Plan (IOP), a nutrient reopener and watershed general permit special condition as specified in this guidance. VPDES Permits for York and James River Basins discharges on the SDL should include interim monitoring requirements, requirements for submittal of a BOD Report and an IOP, a nutrient reopener clause and watershed general permit special condition.

Electronic Copy:

An electronic copy of this guidance in PDF format is available for staff internally on DEQNET, and for the general public on DEQ's website at <http://www.deq.virginia.gov/waterguidance/permits.html>.

Contact Information:

Please contact Allan Brockenbrough, Office of Water Permit Programs, at (804) 698-4147 or abrockenbrough@deq.virginia.gov with any questions regarding the application of this guidance.

Disclaimer:

This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate any particular method nor does it prohibit any particular method for the analysis of data, establishment of a wasteload allocation, or establishment of a permit limit. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

VPDES Nutrient Limitations for Significant Dischargers to the Chesapeake Bay Watershed

Background and Purpose

Significant portions of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list of impaired waters for not meeting the aquatic life use support goal, and the 2004 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report indicates that 83% of the mainstem Bay does not fully support this use support goal under Virginia's water quality assessment guidelines. Nutrient enrichment is cited as one of the primary causes for impairment. Virginia is committed to protect and restore the Chesapeake Bay and its tributaries from the harmful effects of nutrient enrichment, and through participation in the Chesapeake Bay Program and implementation of special state initiatives, Virginia maintains a firm commitment to rehabilitate its estuarine resources.

In addition to the voluntary nutrient reduction efforts that have been ongoing for over 20 years, several regulatory initiatives are underway to achieve the river basin nutrient load allocations agreed to by the Chesapeake Bay Program partners in April of 2003. Virginia's current regulatory initiatives include (1) development of a regulation to govern the inclusion of technology-based, numerical nitrogen and phosphorus limits in VPDES permits, (2) a parallel effort to update and amend the Water Quality Management Planning regulation 9 VAC 25-720 to include yearly nitrogen and phosphorus waste load allocations consistent with the *Commonwealth of Virginia Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy (January 2005)*, and (3) the adoption of new Water Quality Standards for the Chesapeake Bay and its tidal tributaries. These new Standards were adopted by the State Water Control Board in March 2005. Additional criteria to address site-specific conditions in the York and James River Basins are scheduled to be presented to the Board in June 2005. Additionally, on March 24, 2005 Governor Mark Warner signed legislation authorizing a Chesapeake Bay Watershed Nutrient Credit Exchange Program and directing DEQ to issue a watershed general permit for point source discharges of nutrients to the Chesapeake Bay and its tributaries.

With the Board's adoption of new Water Quality Standards for the Chesapeake Bay and its tidal tributaries, VPDES permit must include effluent limitations necessary to meet the criteria. The limitations are established in wasteload allocations published in the *Commonwealth of Virginia Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy (January 2005)*. Until such time that the new Water Quality Standards are formally in effect, the final wasteload allocations included in the Tributary Strategy represent DEQ's best professional judgment as to the effluent limitations necessary to meet the Board's general criteria (9 VAC 25-260-20) which requires control of substances which nourish undesirable or nuisance aquatic plant life. Final wasteload allocations have not been developed for SDL permitted facilities in the York and James River Basins. Final Total Nitrogen and Total Phosphorus limitations in these two basins will be implemented upon adoption of final Tributary Strategy allocations.

The DEQ Chesapeake Bay Program (CBP) maintains a list of significant discharges of nutrients to the Chesapeake Bay and its tributaries. Nitrogen and phosphorus loads from these discharges are determined from discharge monitoring or are estimated using default values where no data exists. These data and estimates support computer modeling efforts used to evaluate current

impacts, to predict future nutrient impacts, and to assist in establishing nutrient reduction goals set forth in the Chesapeake Bay Tributary Strategies. Such data has traditionally been collected through requirements in VPDES permits, grant funding agreements, and voluntary monitoring. These efforts have resulted in the collection of a significant amount of data for many of the facilities on the CBP Significant Discharger List (SDL). However, for many others there are still data gaps that could be filled, and there exists a lack of consistency in the data and frequency with which it is collected.

To assist in establishing consistent data to support regulatory actions currently underway and to provide definitive load estimates for nutrients from affected VPDES permitted discharges, DEQ is committed to increasing the confidence level in the current nutrient loads attributed to CBP SDL discharges. To address these data issues, DEQ has made a decision to include minimum nutrient data collection and frequency requirements in all VPDES permits for facilities listed on the CBP SDL.

BOD Reports and an IOP will be required of most facilities on the SDL. The BOD report will evaluate the installation of a range of nutrient removal technologies and will enable the permittee to determine the most appropriate treatment technology for their facility and assist in decisions on upgrade schedules and nutrient trading issues that are expected to be required under the watershed group permit. The IOP will establish the nutrient treatment capabilities of the existing facility and aid in minimizing nutrient loads currently being discharged.

The following sections identify the affected discharges, establish nutrient monitoring requirements to be included in VPDES permits for these discharges, specify permit language, and provide the basis for Total N and Total P annual load limitations for each individual CBP SDL facility.

Affected Permitted Discharges

Affected permitted discharges are VPDES permitted discharges listed on the CBP SDL. The list is dynamic and changes over time. Updates to the list are maintained by CBP staff and communicated by the CBP unit manager to the Director, Office of Water Permit Programs and to the Regional Water Permit Managers. The most current list is available to the public at the following url:

<http://www.deq.virginia.gov/bay/VASignificantListbyVPDES.pdf>

Because the CBP SDL can change as new facilities come online, design flows increase or wastewater characteristics change, regional office staff should initiate contact with central office (CBP) staff for any discharge they suspect may be a significant source of nutrients. Additionally, because the facility list is closely tied to effluent concentration, regional office staff should refrain from waiving nutrient testing requirements contained in Form 2A and/or 2C.

This guidance should be applied to VPDES permit reissuances which have not yet gone to public notice. If a draft permit has received public notice with interim effluent limitations as outlined in GM 04-2017, then it may be reissued without the interim effluent limitations as long as the permit is re-noticed at the expense of the permittee. If such a permit is in the

Shenandoah/Potomac, Rappahannock or Eastern Shore Basins, it should include final limitations and a schedule of compliance.

Nutrient Monitoring Requirements and Effluent Limitations

Permits for facilities that are on the CBP SDL should, upon permit reissuance, contain a minimum level of nutrient monitoring as follows:

Parameters:

- Total Phosphorus
- Orthophosphate
- Total Nitrogen
 - Total Kjeldahl Nitrogen (as N)
 - Nitrate plus Nitrite (as N)
 - Total Nitrogen (to be derived as the sum of TKN and Nitrate plus Nitrite)

Sampling Type and Collection Frequency:

- Sample type should be consistent with the sampling requirement for BOD in the VPDES permit.
- Collection frequency should be a minimum of twice a month (2/M), no less than 7 days apart, for facilities with minor industrial or minor municipal permits, and weekly (1/W) for facilities with major industrial or major municipal permits.

Additionally, CBP SDL permits in the Shenandoah/Potomac, Rappahannock and Eastern Shore Basins should include final annual Total Nitrogen and Total Phosphorus load limitations consistent with the allocations listed in the *Commonwealth of Virginia Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy (January 2005)* and the proposed Water Quality Management Planning regulation 9 VAC 25-720. Annual load limitations should be converted from the allocations included in the Tributary Strategy and listed “to the kilogram”. Do not round the figure to two significant digits or convert the previously rounded values in the draft WQMP Regulation. A schedule of compliance will also be required in these permits. The Clean Water Act and Virginia’s VPDES Regulation require compliance “as soon as possible”. Because most facilities will require significant upgrades to meet the new limitations, a 4-year schedule of compliance is appropriate. The 4-year schedule may be shortened on a case-by-case basis if a facility already has the equipment necessary to meet the limitation at design flow or if only a minor upgrade is required. A sample Part I.A and an example schedule of compliance are included for use in VPDES permit development. Final Total Nitrogen and Total Phosphorus limitations in the York and James River Basins will be implemented upon adoption of final Tributary Strategy allocations for those basins.

Basis of Design Report and Interim Optimization Plan

VPDES permits for all facilities on the CBP SDL which have not initiated design of improvements to meet final effluent limitations should include a special condition requiring the submittal of a BOD Report within one year of the permit effective date. For facilities with a potential to discharge a nutrient load equivalent to a municipal POTW of less than 1 MGD, the report should include an analysis of a range of treatment alternatives up to the technology

necessary to meet the wasteload allocations included in the Water Quality Management Planning Regulation. Because small incremental improvements at the larger facilities can generate significant nutrient credits for trading, these facilities should be required to evaluate treatment alternatives up to and including the limit of technology as defined by Tier 4 in the following table taken from the Chesapeake Bay Program report *Nutrient Reduction Technology Cost Estimates for Point Sources in the Chesapeake Bay Watershed (November 2002)*. These concentrations **are annual averages**.

| Point Source Category | Tier 1 | Tier 2 | Tier 3 | Tier 4 |
|-------------------------|---|---|--|--|
| Significant Municipals | TN=8.0 mg/l for those with BNR operating or planned; TN and TP for rest of facilities = 2000 conc. | TN = 8.0 mg/l TP = 1.0 mg/l or permit limit if less | TN = 4.0 mg/l TP = 0.3 mg/l or permit limit if less | TN = 3.0 mg/l TP = 0.1 mg/l |
| Significant Industrials | TN and TP = 2000 conc. or permit limit if less | Generally a 50% reduction from Tier 1 (or 2000 conc. or permit limits if less | Generally an 80% reduction from Tier 1 (or 2000 conc.) or permit limit if less | TN = 3.0 mg/l TP = 0.1 mg/l or permit limit if less |

At a minimum, the BOD Report should include the following:

- a. wastewater characterization
- b. evaluation of the existing treatment facility
- c. description and process flow diagrams of each alternative
- d. basis of design for cost estimates
- e. estimates of project's cost (total)(dated, keyed to construction cost index, escalated, etc.)
- f. advantages and disadvantages of each alternative
- g. individual differences, requirements, limitations
- h. selection of preferred alternative for each treatment tier
- i. justify selection and present tabulated comparisons
- j. characteristics of treatment process performance
- k. operation and maintenance expenses
- l. annual expense requirements (tabulation of annual operation, maintenance, personnel, debt obligation)

Due to differences in various waste characteristics and/or other unique process constraints (e.g. high levels of refractory organic nitrogen in some industrial wastestreams), every permittee may not be able to obtain the effluent concentrations identified in the table above. In such cases, the BOD Report should identify the annual average effluent concentrations that could be obtained given the commensurate level of treatment. Although treatment tiers are defined above in terms of effluent concentrations, reductions in nutrient loads are the real goal for the CBP. Pollution prevention measures that provide an equivalent reduction in nutrient loads should be encouraged. Permittees may submit a more comprehensive Preliminary Design Report to fulfill this requirement as long as it includes the elements outlined above.

Additionally, within one year of the permit effective date all CBP SDL dischargers which are not currently meeting final wasteload allocations for Total N and Total P should be required to submit a separate plan to address operational strategies and/or process modifications that may be

utilized to optimize nutrient removal with the existing facility. DEQ is committed to providing assistance in the development of the IOP. The Water Quality Division's Office of Operator Training will assist permittees who have contacted that office in establishing and adhering to the required written plan to optimize nutrient removal with the existing facility. Additionally, grant funding to offset a portion of the costs to develop the BOD Report and the IOP may be provided at the discretion of the DEQ Director in accordance with the provisions of the Virginia Water Quality Improvement Act (WQIA) and its accompanying guidelines. Compliance with the requirement to submit a BOD Report and the IOP in accordance with the permit condition is not contingent upon receipt of a Technical Assistance grant under the WQIA. In addition, receipt of grant funding for this purpose does not obligate the Commonwealth to provide additional grant funding for design and construction of any nutrient removal facilities.

Permit Language

Reopener Clause - Upon reissuance, VPDES permits for all facilities in the Chesapeake Bay watershed should contain the following reopener clause:

Chesapeake Bay Nutrients Reopener

This permit may be modified or, alternatively, revoked and reissued to incorporate new or alternative nutrient limitations and/or monitoring requirements should the State Water Control Board adopt new nutrient standards for the waterbody receiving the discharge, including the Chesapeake Bay or its tributaries, or if a future water quality regulation or statute requires new or alternative nutrient control.

General Permit Clause - VPDES permits for all facilities on the SDL should include the following special condition.

General Permit Controls

*Upon the permittee obtaining coverage under a watershed general permit issued for the control of Total Nitrogen and Total Phosphorus loadings to the Chesapeake Bay or its tidal tributaries, the Total Nitrogen and Total Phosphorus annual load limitations and any associated monitoring requirements and schedule(s) of compliance contained herein shall be waived in lieu of those in the general permit. **(For discharges with Total P limitation based on a Nutrient Enriched Waters designation, the following sentence should be added as appropriate – see note below)** Upon the effective date of the permittee's watershed general permit Total Phosphorus limitation, the monthly average and weekly **(choose one average or maximum)** Total Phosphorus limitations contained herein are also waived.*

Note: The second sentence above is only applicable to limits based on a Nutrient Enriched Waters designation. It is not applicable to any limitations required under a Special Standards designation (9 VAC 25-260-310) (e.g. Policy for the Potomac Embayments, Occoquan Watershed Policy, Chickahominy watershed above Walker's Dam, etc.) or any other more stringent limitations necessary to maintain local water quality.

Nutrient Reporting Condition - All reissued permits on the CBP SDL should contain the following special condition. See attachment for example effluent limitations page.

Nutrient Reporting Calculations

For each calendar month, the DMR shall show the total monthly load (kg) and the cumulative load for the calendar year-to-date (kg), calculated in accordance with the following formulae.

$$ML = ML_{avg} * d$$

where:

ML = total monthly load in kg (Parameter Codes 791 and 793)

ML_{avg} = monthly average load as reported on DMR (kg/d)

d = number of discharge days in the calendar month

$$AL\text{-YTD} = \sum_{(Jan\text{-current month})} ML$$

where:

$AL\text{-YTD}$ = calendar year-to-date annual load in kg (Parameter Codes 805 and 806)

$$AL = \sum_{(Jan\text{-Dec})} ML$$

where:

AL = calendar year annual load in kg/yr (Parameter Codes 792 and 794)

Basis of Design Report and Interim Optimization Plan - VPDES permits for all SDL facilities which have not initiated design of improvements to meet the final wasteload allocations should contain the following special condition requiring submittal of a BOD Report.

Basis of Design Report for Nutrient Removal

Within one year of the effective date of this permit, a Basis of Design Report addressing the construction and operation of a range of nutrient removal technologies up to and including [choose one - the limit of technology (for potential loads equivalent to a municipal design capacity of 1 MGD or greater) or the treatment necessary to meet the wasteload allocations included in the Water Quality Management Planning Regulation (for loads equivalent to a municipal design capacity of less than 1 MGD)], shall be submitted to the Department of Environmental Quality. Additional information on the scope and contents of a Basis of Design Report is available from DEQ staff. A more comprehensive (choose one Preliminary Engineering Report or Conceptual Engineering Report) may be submitted to fulfill this requirement.

VPDES permits for all existing SDL facilities which are not currently meeting final wasteload allocations should contain the following special condition requiring submittal of an IOP.

Interim Optimization Plan for Nutrient Removal

Within one year of the effective date of this permit, a report addressing operating alternatives and interim measures that may be taken to optimize nutrient removal with the existing facilities shall be submitted to the Department of Environmental Quality. The report shall describe alternatives considered and a plan to implement the selected interim measures.

Schedule of Compliance – All permits containing final Total N and Total P annual load limits should include a 4-year schedule of compliance unless modified to address site specific conditions.

Schedule of Compliance

The permittee shall comply with the Total Phosphorus and Total Nitrogen limitations included in Part I. A. in accordance with the following schedule of compliance.

| | |
|---|--|
| <i>1. Select a design engineer</i> | <i>Within 18 months of the permit effective date</i> |
| <i>2. Submit final, approvable plans and specifications</i> | <i>Within 24 months of the permit effective date</i> |
| <i>3. Submit progress reports.</i> | <i>By January 10th of each year</i> |
| <i>4. Comply with effluent limitations</i> | <i>Within 48 months of the permit effective date</i> |

Within 14 days of the due date for items 1, 2, and 4 above, the permittee shall submit a report to the DEQ Regional Office indicating whether the requirement was met.

Fact Sheet Language

The following suggested Fact Sheet language is provided for use by permit writers to provide justification for the required nutrient monitoring, submittal of the BOD Report and Interim Optimization Plan, and for total nitrogen and total phosphorus limitations in VPDES permits for affected permitted discharges:

Nutrient Reporting, Basis of Design Report and Interim Optimization Plan

Rationale: Significant portions of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list of impaired waters for not meeting the aquatic life use support goal, and the 2004 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report indicates that 83% of the mainstem Bay does not fully support this use support goal under Virginia's water quality assessment guidelines. Nutrient enrichment is cited as one of the primary causes for impairment.

(For facilities with final annual load limits) - Guidance Memorandum 05-2009 implements DEQ's best professional judgment decision to limit nutrient loadings from facilities listed on the Chesapeake Bay Program Significant Discharger List. Guidance Memorandum 05-2009 provides the basis for this decision and specifies the procedure for determining annual effluent limitations for these parameters for each affected facility. The guidance memorandum also establishes that dischargers be required to: monitor and report effluent nutrient loads; submit a Basis of Design Report to construct and operate a range of nutrient removal technologies; and submit an Interim Optimization Plan for the removal of nutrients with the existing facility.

(For facilities without final annual load limits) - Guidance Memorandum 05-2009 implements DEQ's best professional judgment decision to limit nutrient loadings from facilities listed on the Chesapeake Bay Program Significant Discharger List once the applicable water quality standards have been adopted and final waste load allocations are established in the Commonwealth of Virginia, Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy. The guidance memorandum establishes that, until such time, dischargers be required to: monitor and report effluent nutrient loads; submit a Basis of Design Report to construct and operate a range of nutrient removal technologies; and submit an Interim Optimization Plan for the removal of nutrients with the existing facility. Guidance Memorandum 05-2009 provides the basis for this decision and specifies the monitoring and reporting requirements as well as special conditions to be included in each affected permit

Fact Sheet language for the reopener clause and schedule of compliance are included in the VPDES Permit Manual. Fact Sheet language for the General Permit Clause is as follows:

General Permit Clause

Rationale: The Virginia General Assembly, in their 2005 session, enacted a new Article 4.02 (Chesapeake Bay Watershed Nutrient Credit Exchange Program) to the Code of Virginia to address nutrient loads to the Bay. Section 62.1-44.19:14 of the law requires the development of a watershed general permit that authorizes point source discharges of total nitrogen and total phosphorus and provides for the control of those nutrients in lieu of the individual VPDES permits, unless the individual permits contain more restrictive limits that are necessary to protect local water quality. That section of the law also sets forth various items to be contained within the general permit. Section 62.1-44.19:15 sets forth the requirements for new and expanded dischargers which are captured by the requirements of the law.

Information Clearinghouse and Operator Assistance

It is the permittee's responsibility to track and report nutrient load status toward any annual load limit. As part of development of the plan to minimize the discharge of nutrients required by the special condition in the VPDES permit, it is recommended that the permittee contact the Water Quality Division's Office of Operator Training. As resources and time allow, the Office of Operator Training will assist permittees who have contacted that office in establishing and adhering to plan of action to minimize the further discharge of nutrients.

The Office of Operator Training is developing an information clearinghouse for the purpose of promoting and assisting permittees in maximizing the nutrient removal efficiency of their existing facilities through operational control and/or other means. The Office of Operator Training will lead the technical aspects of this initiative and the Chesapeake Bay Program will lead the procedural aspects. DEQ's water permitting program will encourage, through contact by regional office permit writers, permitted facilities in the Chesapeake Bay drainage area to participate in the effort and take advantage of the information available through the clearinghouse.

Communication

Regional office staff should inform affected permittees of their status as a significant discharger, the initiatives of this guidance and the implications thereof, and should encourage consideration by the permittees to adopt proactive measures to reduce the discharge of nutrients from the affected permitted discharge.

Compliance

Compliance will be evaluated at the end of each calendar year. Facilities that did not exceed the annual effluent limitation in their VPDES permit will be considered in compliance, whereas those that exceeded the annual effluent limitation will be deemed out of compliance.

Such discharges shall be limited and monitored by the permittee as specified below: LIMITS NOTED ARE EXAMPLES

| EFFLUENT CHARACTERISTICS | DISCHARGE LIMITATIONS | | | | | | MONITORING REQUIREMENTS | |
|--|-----------------------|---------|----------------|-------|---------|---------|-------------------------|-------------|
| | MONTHLY AVERAGE | | WEEKLY AVERAGE | | MINIMUM | MAXIMUM | FREQUENCY | SAMPLE TYPE |
| | mg/l* | kg/day* | mg/l* | kg/d* | mg/l* | mg/l* | | |
| Flow (MGD) [a] | NL | | NA | | NA | NL | Continuous | TIR |
| Flow (MGD) [a] | 20 | 38 | 30 | 57 | NA | NA | 3 Days/Week | 8-HC |
| Total Suspended Solids | 30 | 57 | 45 | 85 | NA | NA | 3 Days/Week | 8-HC |
| Ammonia | 1.4 | NA | 1.4 | NA | NA | NA | 3 Days/Week | 8-HC |
| Total Residual Chlorine (ug/l) [b] [c] | 88 | NA | 130 | NA | NA | NA | 1/Day | Grab |
| Dissolved Oxygen | NA | NA | NA | NA | 6.0 | NA | 1/Day | Grab |
| Effluent (standard units) | NA | NA | NA | NA | 6.0 | 9.0 | 1/Day | Grab |
| Total Phosphorus [e] | NL | NL | NA | NA | NA | NA | 2/Month | 8 HC |
| Total Phosphorus – Monthly (kg/mo) [f] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Total Phosphorus – Year to Date (kg/yr)[f] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Total Phosphorus – Calendar Year (kg/yr)[f][g] | NA | NA | NA | NA | NA | 7,513 | 1/Year | Calculated |
| Orthophosphate [e] | NL | NL | NA | NA | NA | NA | 2/Month | 8 HC |
| Total Kjeldahl Nitrogen (as N) [e] | NL | NL | NA | NA | NA | NA | 2/Month | 8 HC |
| Nitrate plus Nitrite (as N) [e] | NL | NL | NA | NA | NA | NA | 2/Month | 8 HC |
| Total Nitrogen [d, e] | NL | NL | NA | NA | NA | NA | 2/Month | Calculated |
| Total Nitrogen – Monthly(kg/mo) [f] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Total Nitrogen – Year to Date (kg/yr)[f] | NA | NA | NA | NA | NA | NL | 1/Month | Calculated |
| Total Nitrogen – Calendar Year (kg/yr)[f][g] | NA | NA | NA | NA | NA | 107,513 | 1/Year | Calculated |

Unless otherwise noted NL = No limitation, monitoring required. NA = Not applicable TIRE = Totalizing, indicating and recording equipment
 [a] Design flow of this treatment facility is MGD. See Part I. [a], for additional flow requirements. (REFERENCE THE 95% FLOW CONDITION)
 [b] See Part I.B for additional chlorine monitoring instructions.

[c] See Parts I. a. and I. b. for quantification levels and reporting requirements, respectively.

[d] Total Nitrogen, which is the sum of Total Kjeldahl Nitrogen and Nitrates plus Nitrites, shall be derived from the results of those tests.

[e] 2/Month = two samples taken during the calendar month, no less than 7 days apart.

[f] See Part I. for nutrient reporting requirements

[g] Effluent monitoring and reporting required upon effective date of permit. See Part I. for schedule of compliance for effluent limitations.

[h] There shall be no discharge of floating solids or visible foam in other than trace amounts.