CH2MHILL

CH2M HILL
10123 Alliance Road
Suite 300
Cincinnati, Ohio 45242
Tel 513.530.5520

August 7, 2013

Mr. Michael Busse
Village Administrator
Village of Covington
1 South High Street
Covington, Ohio 45318

SUBJECT: Wastewater Treatment Facility Study
Final Report

Dear Mr. Busse:

Please find enclosed (6) copies of the subject final report for your use. We look forward to meeting again with you to present the outcome of the study to Village Council on Tuesday, September 3, 2013. In the interim, if you have any questions on the final report, please contact me.

We appreciate and thank you for the assistance you have given to us to complete this study. It has been a pleasure to serve your needs and those of the Village and we look forward to continued involvement in the future.

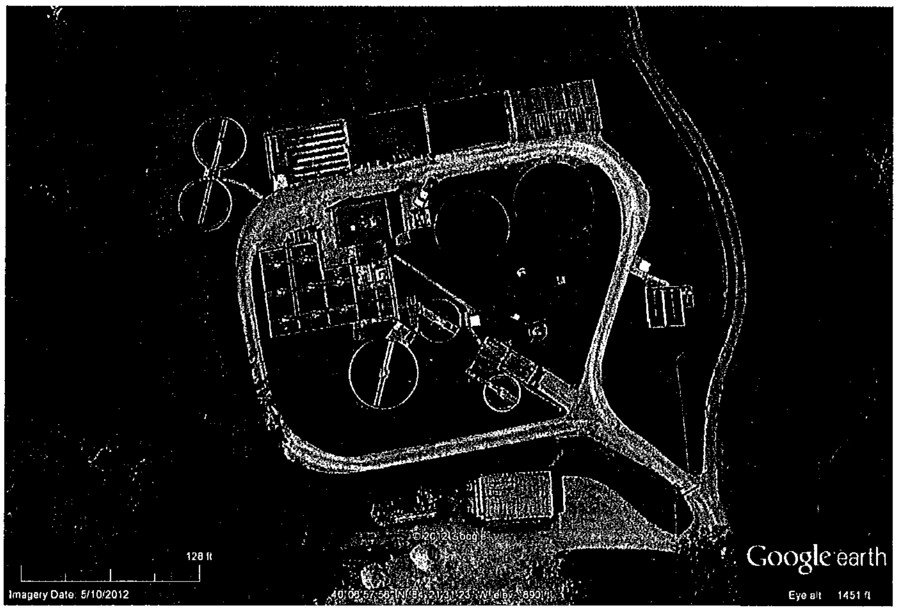
Sincerely,

CH2M HILL, Inc.

Alan H. Smith, P.E.
Principal Project Manager

Technical Report

Wastewater Treatment Facility Study



Prepared for

Village of Covington, Ohio

Final Report - August 2013

TABLE OF CONTENTS

Section No. **Page No.**

TABLE OF CONTENTS (Continued)

Appendices

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Wastewater treatment facilities in the Village of Covington were originally constructed adjacent to the Stillwater River in 1941 at the site of the existing plant. Since that time, various improvements to the plant have been undertaken. These consisted of a plant expansion in 1956 and installation of plant effluent disinfection facilities in 1968. The plant was last expanded in 1980 to treat an average daily flow of 750,000 gallons per day.

Over the years, the Village has recognized and made substantial investment in its infrastructure to provide for the needs of its citizens. Wastewater collection and treatment facilities, being a part of this infrastructure, are keys to community health, area development and local water quality. In an effort to protect its investment and to identify specific areas of needed improvement, a study of the existing wastewater treatment facility has been completed, the results of which are presented herein.

In addition to this primary objective, the report also serves as a guide for future efforts to: 1) upgrade and replace existing facilities which have reached the end of their useful life, 2) accommodate current and future wastewater flows and 3)comply with impending regulatory initiatives such as phosphorus control. Prudent wastewater planning and cost-effective design solutions will address the challenges presently experienced at the treatment facility and protect the assets that the Village has invested in over the years.

The wastewater treatment facility is presently faced with the following challenges that impact the reliability of treatment systems and their performance:

- The age of existing plant structures, some over 70 years old, are in need of repair to ensure that they are safe and will provide reliable service for the foreseeable future.
- Existing plant equipment is reaching or has reached the end of its useful life and is in need of replacement with reliable, more efficient newer technology that costs less to operate.
- Plastics and rag accumulation reduces treatment efficiency, plugs piping, adds trash to the plant sludge and contributes to excessive and costly plant maintenance.
- The plant is not presently capable of meeting impending nutrient removal requirements, specifically phosphorus, which will likely be imposed in the near future by the state regulatory authority.
- The hydraulic grade line of the plant and the outfall to the Stillwater River enables river water to back into and flood plant structures, thus limiting treatment capacity.
- Although adequate on-site sludge storage capability exists at the plant, cost saving options for sludge handling and disposal are limited.

Alternatives ranging from: 1) decommissioning the existing plant and pumping the Covington wastewater to a nearby utility and 2) construction of a new treatment facility to replace the existing facility and 3) upgrading the existing treatment facility were evaluated as part of this study. In addition, the impact of the potential inclusion of West Covington on the existing treatment facility was considered in the study.

The alternative of decommissioning the Village's wastewater treatment facility and pumping the wastewater to a nearby utility, such as Piqua, would contribute to the consolidation and regionalization of wastewater treatment in the area. This approach would require a service agreement endorsed by each utility and an amendment to the Covington Facility Planning Area (FPA) granted by the Miami Valley Regional Planning Commission and approved by Ohio EPA to reflect the conveyance of wastewater from the Covington FPA to the Piqua FPA for treatment as proposed.

Implementation of this alternative would avoid the costs associated with: 1) meeting increasingly stringent NPDES permit discharge requirements to the Stillwater River, 2) operation and maintenance of older treatment facilities, 3) chemical consumption used in the treatment of wastewater and 4) sludge handling and disposal.

A dual force main system that would extend approximately five miles east along Brown Road from the Covington WWTP to a connection point with the City of Piqua sewer system was evaluated. Parallel force mains would enable repairs to be made while keeping the pumping stations in operation. This approach would improve safety, reliability and continued service.

To convey the wastewater over this distance, two booster pump stations would be required along the route of the force mains in addition to a main pump station located at the existing treatment plant where the four raw sewage siphons terminate. The preliminary cost estimate for this alternative is $16.8M.

The alternative of constructing a new treatment facility near the site of the existing three acre treatment facility is driven by the condition of the plant and the age of its equipment and its structures. A new facility equipped with current technology would operate more efficiently and be designed for the demands of meeting increasingly stringent regulatory requirements.

From a regulatory perspective, a new wastewater treatment facility would be considered a "new source" and, as such, would be required to meet limits much more stringent than the current limits contained in the Village's NPDES permit.

As part of this alternative, a new submersible pump station would be constructed on the existing plant site near the existing pretreatment structure. This pump station would convey all wastewater flow to the new treatment plant site (unspecified location). The remainder of the treatment facility would be demolished followed by site restoration. Implementation of this alternative would ensure that the Village's wastewater planning needs are addressed for the next 20 years. The preliminary cost estimate for this alternative is $13.4M.

Based on the outcome of the study, it is recommended that the Village continue its investment, as it has in the past, in its existing treatment facilities. With the current economic climate characterized by financial restraint, increasingly stringent regulatory requirements and the recurring need for resources to replace and maintain existing wastewater infrastructure assets, the Village must focus on capital improvements that contribute the most value to its rate payers. The proposed plan of prioritized improvements, as presented herein, seeks to achieve that goal, reflecting the concerns of its rate payers while addressing identified wastewater management challenges.

Recommended plant improvements have been placed in three categories based on urgency of need with Priority 1 representing the most urgent need, followed by categories 2 and 3. The preliminary opinion of probable construction costs for the Priority 1 near-term improvements are estimated to cost $565,000 (2013) and include the installation of fine screening equipment, an effluent pump station and improvements to solids handling and management.

Intermediate need Priority 2 improvements consist of broad-based improvements to upgrade and restore the physical condition of existing facilities and, in some cases, convert existing facilities to a more productive function. The preliminary opinion of probable construction costs for the Priority 2 improvements is estimated to be $960,000 (2013).

The longer range Priority 3 improvements consist of needed but least urgent needs and include grit capture improvements, chemical feed system for phosphorus control and cleanout and demolition of anaerobic digester equipment. The preliminary opinion of probable construction costs for the Priority 3 improvements is estimated to be $175,000 (2013).

It is recommended that the Village proceed with the detailed design of the Priority 1 improvements as described herein and begin planning for future capital investment to meet intermediate and longer range needs.

1.0 INTRODUCTION

The Village of Covington owns and operates a wastewater treatment facility located at 200 Bridge Street, on the western edge of the corporation boundary. The plant serves a population of approximately 2,600 people along with several industries. The plant was originally constructed beginning in the 1940s and has been expanded and upgraded as recently as 1982. The plant has a permitted flow of 750,000 gallons per day (gpd) discharged to the Stillwater River and is governed by Ohio EPA Permit No. 1PB00013*HD which is set to expire on June 30, 2016.

The plant is comprised of a raw sewage comminution, grit capture and removal facilities, pre-aeration and primary treatment, trickling filters, intermediate clarifiers, activated sludge aeration basins capable removing carbonaceous and nitrogenous materials, final clarifiers, a return sludge pumping station and gaseous chlorine disinfection facilities and post-aeration. Sludge produced by the plant is pumped to a previously constructed anaerobic digester where it is stored and hauled off-site as a liquid.

The plant is currently faced with the following challenges as outlined below:

1) The age of existing plant equipment is reaching or has reached the end of its useful life and is in need of replacement with reliable, more efficient newer technology that costs less to operate;

2) The plant grinds and releases incoming raw sewage in lieu of fine screening the wastewater to remove rags, plastics and other trash. This situation contributes to accumulation of debris in distribution piping, pump impellers and treatment structures, adds trash to the plant sludge stream and increases plant equipment maintenance;

3) The existing grit capture and removal system is ineffective in protecting downstream unit processes from grit and debris accumulation, thus reducing treatment efficiency and contributing to excessive plant maintenance;

4) The plant is not presently capable of meeting impending nutrient removal requirements, specifically phosphorus, which may be imposed in the near future;

5) The hydraulic grade line of the plant and the existing outfall to the Stillwater River enables river water to back into and flood plant structures, notably the chlorine contact tank, during seasonally high river stage, thus limiting treatment capacity;

6) Sludge stabilization facilities are presently not provided and the current means of handling and disposing of liquid sludge is costly to the Village.

7) Some existing plant equipment and treatment units are not functional and are not being used for their intended purpose; this includes the sludge gravity thickener and anaerobic digester.

1.1 Objectives of Study

This report summarizes the work undertaken in the study to assist the Village with wastewater treatment challenges described previously and develop a program to address areas of need. The objectives of the study are as follows:

- Assess the condition and capacity of Covington's existing wastewater treatment facilities.
- Identify, through hydraulic and process evaluations, capacity-limiting unit processes and any performance issues that may exist.
- Develop and analyze alternatives to the present method of treating wastewater and sludge generated, including: 1) modifying and upgrading existing facilities, 2) decommissioning all or a portion of the existing treatment facilities and conveying wastewater to a nearby utility; and 3) construction of a new wastewater treatment plant nearby.
- Prepare preliminary planning level cost estimates of proposed alternatives.
- Recommend and prioritize treatment process improvements to the Village.
- Draft a report which summarizes the outcome of the study.

2.0 EXISTING CONDITIONS

2.1 Facility Planning and Service Areas

The Miami Valley Regional Planning Commission (MVRPC) is the designated water quality planning agency for Miami County. MVRPC has developed eleven facility planning areas (FPAs) located within Miami County, including the Covington FPA. A facility planning area is a discrete geographical study area developed for determining the needs and cost effective methods of providing sewer service.

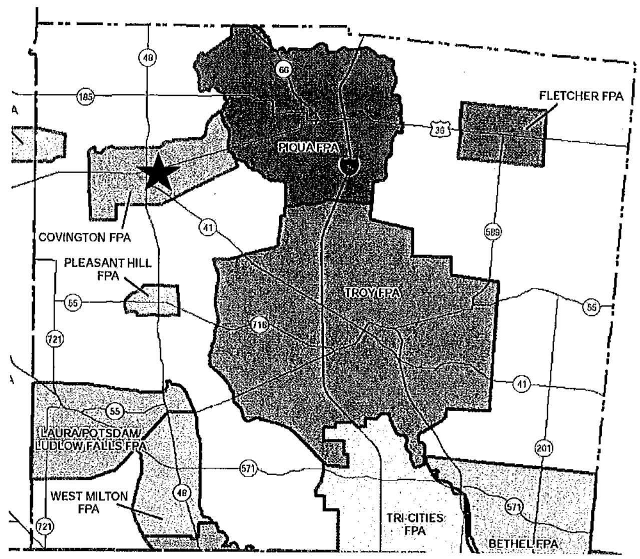


Figure 2.1
Location of Covington Facility Planning Area in Miami County

The Village of Covington is the designated management agency that is responsible for identifying and developing wastewater management options within its own facility planning area (Figure 2.1). These management options are intended to represent the current and best understanding concerning where sewers will be extended and where areas will remain un-sewered over a given planning horizon.

The Village of Covington is served by a centralized wastewater collection system that conveys sanitary wastewater to the Village's publicly-owned treatment facility located on the west bank of the Stillwater River. The current service area within the Village boundary includes approximately 864 acres, or 1.35 square miles. Un-sewered areas in close proximity to the Village include West Covington.

2.2 Wastewater Treatment

The Village of Covington WWTP was originally constructed in the 1941. At that time, treatment consisted of a grease tank, primary settling tank, trickling filter, intermediate settling tank, aeration tank and a secondary settling tank. Solids were anaerobically digested and dewatered on sludge drying beds.

The plant was expanded in 1956. Raw sewage comminution was added along with a second trickling filter, a second aeration tank and a new secondary settling tank. The existing secondary settling tank was converted to a primary settling tank.

Effluent disinfection using chlorination was added in 1968. Planning for the present-day treatment facilities was begun in 1972, the same year that Congress enacted the Clean Water Act and created the Environmental Protection Agency. Construction began on the plant in 1980 under Contract 79-3 and was completed in 1982.

The 1982 expansion and upgrade included construction and installation of: a new pretreatment structure and associated facilities, a new pump station and wet well, two new intermediate clarifiers, an aeration tank flow splitter, one additional aeration tank, a final clarifier flow splitter, one additional final clarifier, a new chlorine contact tank, new post-aeration facilities, a sludge thickener, an expansion to the sludge drying beds, a new laboratory building, a new control building and miscellaneous site improvements, including a plant perimeter access road.

Currently, the plant operates as a two-stage biological treatment system, with the initial stage consisting of rock media trickling filters followed by intermediate clarifiers and the second stage consisting of conventional activated sludge.

Plant sludge is hauled as a liquid from the plant on a weekly basis. The Village maintains a contract with a local sludge hauler who regularly removes liquid sludge from the plant. The following provides an overview and discussion of the major unit processes at Covington's existing WWTP.

2.3 Wastewater Flows and Loadings

Plant monthly operating data during the 2012 period were reviewed and analyzed with the following flows and loadings summarized:

- Minimum day, average day, peak 30-day moving average (30 DMA), peak 7-day moving average (7 DMA), peak day and an estimate of peak hourly flow;
- Minimum day, average day, peak 30-day and peak day mass loadings for total suspended solids (TSS), carbonaceous biochemical oxygen demand (cBOD5) and ammonia nitrogen (NH4-N).

Table 2-1 summarizes the data for calendar year 2012. The plant operates well below its design average flow of 750,000 as contained in NPDES Permit No. 1PB00013*HD.

Table 2-1
Village of Covington WWTP
Contract 79-3 Design Flows and Loading Rates

	Flow (gpd)	TSS		BOD_5		NH_4-N	
		(lb/day)	(mg/L)	(lb/day)	(mg/L)	(lb/day)	(mg/L)
Design Average	750,000	1,940	311	3,630	581	100	16
Peak Hourly	1,560,000	3,070	236	5,890	453	143	11
Notes: Peak hourly flow from Contract 79-3.							

Table 2-2 Village of Covington WWTP Existing Flow and Loading Rates (2012)							
	Flow	TSS		$cBOD_5$		NH_4-N	
	(gpd)	(lb/day)	(mg/L)	(lb/day)	(mg/L)	(lb/day)	(mg/L)
Minimum Day	63,000	89		128			
Average Day	230,000	459	239	618	322		
Peak 30-Day Average	321,000	975		1,055			
Peak 7-Day Average	571,000	---		---			
Peak Day	1,128,000	2,512		2,532			
Peak Hour (est.)	1,560,000	---		---			
Peak 30-Day/Avg Day Ratio	---	2.12		1.71			
Peak Day/Avg Day Ratio	---	5.47		4.09			

Notes: 1. Concentration determined by dividing load in lb/day by flow rate.

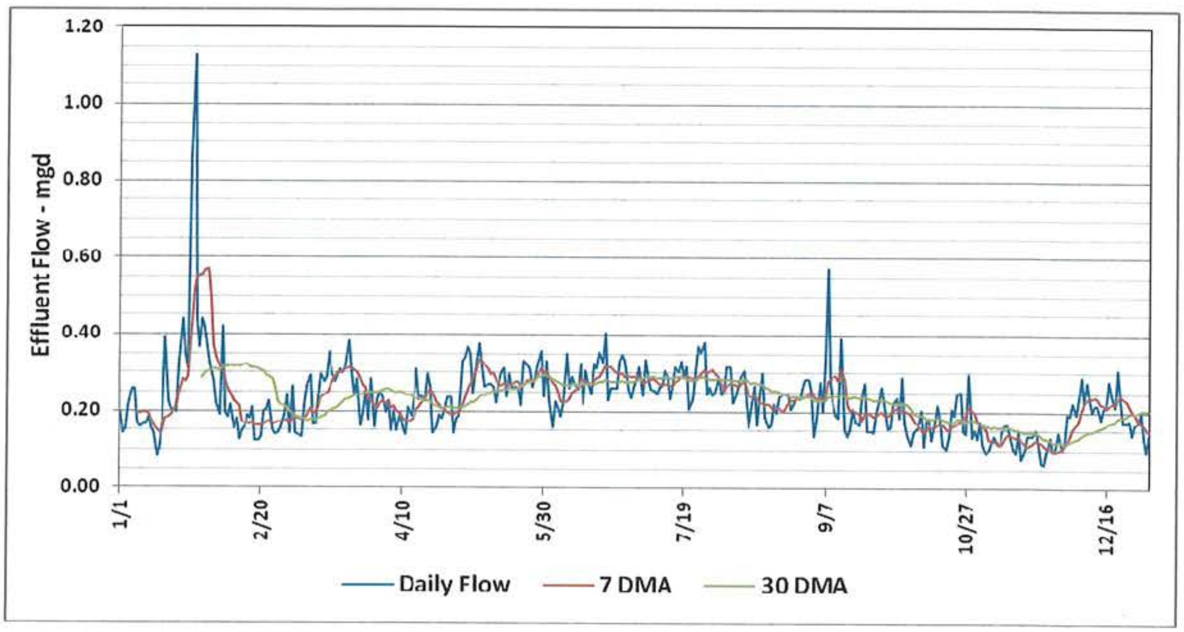


Figure 2.2
Compilation of Plant Effluent Flows -2012

2.3.1 Pretreatment Facilities

There are four cast iron pipe siphon lines that deliver wastewater across the Stillwater River to the wastewater treatment plant. The 12-inch and the 8-inch pipes discharge to the pretreatment structure. The 4-inch and 8-inch siphons that serve the Bridge Street trunk sewer discharge to the south and east side of the pretreatment structure, respectively. Each pipe line has been installed with a gate valve that enables maintenance to be performed on the upstream siphon.

The pretreatment structure has been designed with a raw sewage comminutor (i.e. grinder) installed in a channel which grinds and releases debris such as rags, wood and plastics present in the raw wastewater.

Incoming flows that exceed the hydraulic capacity of the comminutor discharge over a small weir and are bypassed around the comminutor channel to the grit chamber. This bypass flow is screened through a coarse bar rack having 2-inch clear openings.

Figure 2.3
Pretreatment Structure with Raw Sewage Comminutor

After raw sewage comminution, the wastewater enters the grit chamber. The grit chamber consists of a 7 foot diameter steel-lined upper chamber and a 3 foot diameter lower chamber.

Wastewater flow is designed to feed tangentially into the upper chamber. A small, motor-driven grit agitator is mounted on top of the chamber to induce vortex action intended to separate the heavier grit and maintain suspension of the organic material in the wastewater. The vortex is intended to direct the heavier grit inward where it falls and collects in the lower chamber. Captured grit is removed from the lower chamber using a 2-inch air line which lifts and pumps the grit slurry to an inclined screen where it is dewatered prior to hauling to a landfill.

Figure 2.4
Grit Slurry Air Lift and Grit Dewatering Screen Enclosure

A 4-inch drain is installed on the grit dewatering screen enclosure to return the excess water back to the raw sewage flow stream. Grooves cast into the concrete structure and stop plates have been provided to isolate flow from the raw sewage comminutor and grit chamber.

<u>Field Notes and Observations:</u>

- The raw sewage grinder operates well; however, the shredded rags and other material tends to re-weave downstream, causing plugging in the trickling filter distribution arms and rock media as well as the final clarifier suction header.

- The grit agitator drive unit was rebuilt several years ago, and the bearings in the agitator have been replaced twice. The drive and its base plate have been re-coated but require further surface preparation and re-coating work.
- Grit slurry tends to cascade down the static screen and carry excess water. A sludge drying bed is used to further dewater the captured grit so it is capable of being land-filled.
- The grit dewatering screen lacks the typical curvature and wire construction that current static screens feature, which enhance dewatering of the material.
- Grit has been observed to accumulate in significant amounts in other areas of the plant such as the pre-aeration and primary clarifiers. This suggests that the existing grit system is marginally effective in capturing the applied grit load. Grit loads are greatest during wet weather flow events, especially after prolonged dry periods when the grit tends to collect in the sewers and is flushed out. The high velocities associated with peak flow events tend to sweep the grit through the grit chamber without capture under these conditions.

2.3.2 Pre-Aeration Tanks

Flow leaves the pre-treatment facilities through a 14-inch pipe by gravity. Valves installed on the 14-inch piping enable the wastewater to be: 1) conveyed directly to pre-aeration, or 2) diverted into the transfer wet well, thus bypassing the pre-aeration tanks, primary tanks and the trickling filters, or 3) diverted to primary treatment, thus bypassing the pre-aeration tanks. Normal operation is to direct flow to the pre-aeration tanks.

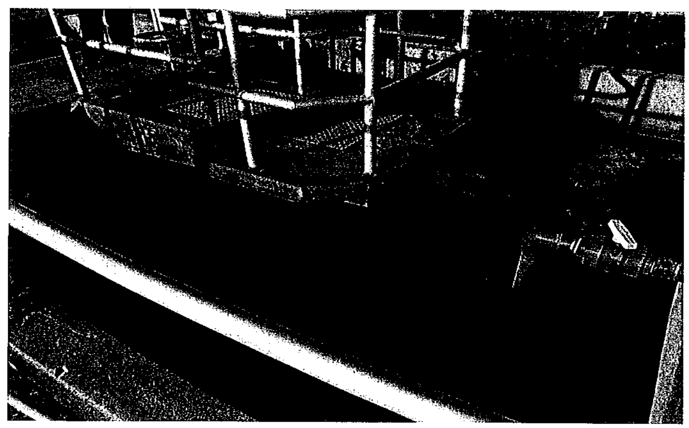


Figure 2.5
(East) Pre-Aeration Tank with 12-inch Overflow/Bypass to Wet Well

Table 2-3 Pre-aeration - Design Parameters	
Tanks	2
Dimensions	1 @ 10 ft x 10 ft 1 @ 10 ft x 14 ft
Side Water Depth	10 ft
Volume, Total (est.)	18,860 gal
Detention Time Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 36 min 17 min
Air Requirement	100 cfm

There are two pre-aeration tanks that operate in series. The first of which is approximately 10 feet square by 10 feet deep. The second tank is 15 feet square by 10 feet deep with sloping sides. This was formerly used as a small settling tank that was re-purposed under Contract 79-3. A telescopic sludge valve exists that can remove sludge and grit from this sloped tank.

Flow passes from the east tank to the west tank through three 15-inch square wall openings below the water surface and passes to the primary tanks influent channel through a 12-inch cast iron pipe. A 12-inch overflow pipe has been installed in the east pre-aeration tank to direct excess flows to the transfer wet well, thus bypassing primary treatment and the trickling filters. The bypass flow is then pumped to the intermediate clarifiers.

The badly corroded original air piping installed in the pre-aeration tanks was recently replaced with PVC piping and valves. New coarse bubble air diffusers (four diffusers per tank) were also installed to improve air distribution.

The original grease skimmers installed in each pre-aeration tank have been removed.

Field Notes and Observations:

- When the coarse bubble diffusers and the piping were replaced, the tanks were dewatered for the first time since Contract 79-3. The first tank was found to be full of grit and debris to approximately 3 feet below the water surface according to plant staff. This accumulation severely impacted the distribution of air to the tanks and confirms the ineffectiveness of the grit capture equipment.
- The railing around the tanks does not meet OSHA safety requirements for minimum railing height (42 inches) and is severely corroded and in need of replacement.
- Pumping sludge to the sludge storage tank (former anaerobic digester) has been observed to cause the displacement of an equal volume of sludge from the storage tank which flows into the east pre-aeration tank, thus contributing additional odors and recycle solids to process.
- Pre-aeration of raw sewage expels corrosive hydrogen sulfide vapor and odors into the air; the concrete tanks are in poor condition with large cracks evident in the walls.

2.3.3 Primary Treatment

Flow enters the two primary tanks through a common influent trough, which has been installed near the middle of the tanks. A single row of effluent weir launders are

Figure 2.6
Primary Tank Influent Channel

located on each side of the influent trough. Both tanks are 24 feet long and 9.5 feet deep. The east tank is 10 feet wide and the west tank is 15 feet wide. Each tank is equipped with plastic chain and flight collectors which were installed approximately 10 years ago.

Waste activated sludge is pumped to the primary tank influent trough and is co-settled along with the raw sludge solids. The chain and flight collectors move the sludge to a hopper where manually-operated telescopic valves (2 per tank, 4 total) transfer the settled sludge to the waste sludge well. Two sludge pumps are provided to transfer the sludge to the holding tank (described later).

Primary effluent from each tank flows via an 8-inch pipe by gravity to the trickling filter splitter box for subsequent treatment.

Table 2-4
Primary Treatment -Design Parameters

Tanks	2
Geometry	Rectangular
Sludge Removal Mechanism	Chain and Flight Collectors
Side Water Depth	9.5 ft
Surface Area, Total	600 ft^2
Surface Loading	
Design average flow (0.75 mgd)	1,250 gpd/ft^2
Peak flow (1.56 mgd)	2,600 gpd/ft^2
Weir Length, Total	100 ft
Weir Loading	
Design average flow (0.75 mgd)	7,500 gpd/lf
Peak flow (1.56 mgd)	15,600 gpd/lf

<u>Field Notes and Observations:</u>

- Significant cracking and spalling (indicated by repairs) of the primary tank concrete walls is evident. The adjacent aeration tanks operate at a higher hydraulic grade line, and leakage through the concrete wall from the aeration tanks into the west primary tank was observed.
- The west effluent launders are fiberglass; however, the east effluent launders are the original concrete with significantly corroded steel weir plates.
- The telescopic sludge valve floor stands are badly corroded but operable.
- The shafts for the submerged drain valves are severely corroded beneath the walkway deck.
- The waste activated sludge (WAS) discharge line is operated by a manual valve into the influent trough. Although the WAS flow is metered, wasting excess sludge to primary treatment can exceed the solids loading capacity of the tanks and lead to washout of sludge solids and plugging the trickling filter media.

- *Ten States Standards* recommends a maximum surface loading rate for primary settling tanks that receive waste activated sludge of 1,200 gpd/ft^2 at the peak hourly flow; however, he surface loading at design average flow conditions exceeds this maximum rate.
- The railing along the influent trough does not meet the code-required minimum height of 42 inches and is severely corroded. All of the railing is top mounted, with concrete spalling observed, some of which has been patched.

2.3.4 Secondary Treatment

The Covington WWTP has a two-stage biological treatment system. The first stage consists of an attached growth system consisting of two rock media trickling filters. The trickling filters have been designed as "high rate" filters based on the applied loadings and recirculation of filter effluent. Successful operation of the filters depends on fine screening and primary treatment to minimize clogging of the distribution arms and the rock media.

The second biological treatment stage consists of an activated sludge system which maintains a suspended culture of microorganisms in each of three aeration tanks. Like the trickling filters, the growth of biomass is proportional to the applied organic loading. To control the biomass and maintain the health of the biological culture, excess (i.e. waste activated) sludge is removed from the activated sludge system at regular intervals.

2.3.4.1 Trickling Filters

Primary effluent enters the trickling filter splitter box through two 8-inch pipes. Flow splitting is accomplished using two 12-inch mud valves. A 12-inch pipe feeds each filter from the splitter box. The west trickling filter is 54-foot diameter, and the east trickling filter is 58-foot diameter. Six feet of rock media is installed in each filter.

Figure 2.7
Rock Media Trickling Filters

Each filter has a total of four 6-inch distributor arms that are hydraulically driven by the applied flow; flows less than the design average flow typically require the operation of a recirculation pump to drive the distributor arms and keep the media wetted. The distribution mechanisms in both trickling filters were repaired last year. Some concrete repair has been performed on each filter.

The trickling filter effluent from the east filter flows by gravity through a 12-inch pipe and combines with the effluent from the west filter en route to the recirculation wet well via a common 16-inch pipe. Filter effluent flow can also be diverted into the transfer station wet well where flow is pumped and metered to the intermediate clarifiers. Metering is also provided on the trickling filter recirculation flow.

Table 2-5 Trickling Filter - Design Parameters	
Tanks	2
Size	1 @ 54 ft diameter x 7.9 ft deep 1 @ 58 ft diameter x 6.75 ft deep
Volume, total	35,930 ft^3
Area, total	4,930 ft^2
Hydraulic Loading Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 152 gpd/ft^2 316 gpd/ft^2
Organic Loading (BOD_5) Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 70 lb/day/1,000 ft^3 138 lb/day/1,000 ft^3
Recirculation Pumps	2 @ 260-520 gpm Variable speed, 7.5 HP motors

Field Notes and Observations:

- The trickling filter flow distribution arms are severely corroded and at the end of their useful life. Both center hubs are corroded and exhibit significant leakage. The distribution arms are corroded and leaking and also are frequently plugged with stringy material that has passed through the channel grinder in the pretreatment facility. This condition leads to poor flow distribution and sub-standard filter performance.
- The splitter box does not provide a reliable and positive means for distributing flow to each trickling filter resulting in poor flow distribution and also tends to entrap and accumulate floating debris.
- The concrete walls are badly spalled and in need of repair or replacement.

2.3.4.2 Trickling Filter Effluent Transfer Pumps

The transfer pump station, located underneath the maintenance shop contains three sets of pumps: the trickling filter effluent transfer pumps, the sludge transfer pumps, and the trickling filter recirculation pumps.

The trickling filter effluent transfer pumps direct the effluent from the trickling filters to the intermediate clarifiers to settle out any biomass sloughed off from the filters as well as any solids that escape primary treatment. The two Gorman-Rupp pumps are direct-drive, constant speed type and controlled by floats installed in the wet well located immediately east of the pump room. The newer, larger capacity pump has a 15 HP motor, while the motor on the older pump is rated 10 HP. Some valves were replaced when the newer pump was installed approximately two years ago.

Fields Notes and Observations:

- Some of the existing valves were reported to be non-operational when the newer pump was installed; the operation of the remaining existing valves is also suspect.
- The pumps are constant speed, and when the larger pump starts, the wet well can be drained rapidly. This can lead to excessive cycling of the pumps, and also result in flow surging at the intermediate clarifiers.

2.3.4.3 Trickling Filter Recirculation Pumps

Maintaining a consistent hydraulic loading to the trickling filters is a key operational requirement for successful performance of the filters. The trickling filter recirculation pumps are used to re-circulate trickling filter effluent back to trickling filter splitter box in order to maintain the performance of the filters especially during low-flow periods.

The two Gorman-Rupp pumps are constant-speed, belt-driven and controlled by floats in the recirculation wet well. The motor horsepower of the newer pump could not be determined; the older pump is 7.5 HP. As with the effluent transfer pumps, some valves were replaced when the newer pump was installed approximately two years ago.

Field Notes and Observations:

- Some of the existing valves are suspected of not being operational.
- These constant speed pumps have replaced the original pumps which were variable-speed type. This type of pump can lead to excessive cycling of the pumps and uneven flows delivered to the trickling filters.

2.3.4.4 Intermediate Clarifiers

There are two intermediate clarifiers installed between the trickling filters and the aeration tanks. Each tank is 35-foot diameter, with a segmented rake sludge collector and a center sludge draw-off hopper. Trickling filter effluent is pumped to the intermediate settling tank splitter box via an 8-inch pipe and distributed to the center well of each tank.

Figure 2.8
Intermediate Clarifier Drive Platform

Sludge is scraped toward the center of each tank and removed through a 6-inch pipe that terminates in the sludge well located between the clarifiers. Manual operation of each telescopic valve transfers sludge to the well from each clarifier. The collector drive motors are rated at 0.75 HP. Settled effluent is collected in an outboard weir launder and conveyed to a common junction box. Return activated sludge is pumped to the same junction box via a 6-inch force main. The resulting mixed liquor is conveyed to the aeration tank flow splitter through a 16-inch ductile iron pipe.

Table 2-6 Intermediate Clarifiers - Design Parameters	
Tanks	2
Geometry	Circular
Sludge Removal Mechanism	Mechanical Scraper
Overall Diameter	35 ft
Side Water Depth	9.25 ft
Surface Area, Total	1,924 ft^2
Surface Loading Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 390 gpd/ft^2 810 gpd/ft^2
Weir Length, Total	220 ft
Weir Loading Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 3,410 gpd/lf 7,090 gpd/lf

Field Notes and Observations:

- The drives are operating satisfactorily, and the seals in the south collector drive have been replaced once. However, the structural drive platform and bridge on each tank is severely corroded. Conduit for the drives mounted on the underside of the support structure is corroded and broken in some locations.
- No surface skimming removal has been provided and the tanks do not have any weir cleaning mechanism. The existing steel weirs are corroded.
- The railing installed around the tank perimeter is top mounted and has resulted in concrete spalling at some locations.

2.3.4.5 Aeration Tanks

Mixed liquor is conveyed to the aeration tank splitter box, which contains three weir gates to distribute flow to the three tanks. Aeration Tank 1 was constructed as part of Contract 79-3, while aeration tanks 2 and 3 were constructed prior to 1979. All three tanks are 20 feet wide and have a water depth of 11.5 feet and are operated in parallel.

Figure 2.9
Aeration Tank with Surface Aerator

Aeration Tank 3 is 40 feet long and has two surface aerators. Aeration Tanks 1 and 2 are both 61 feet long with three surface aerators installed in each. The surface aerators are manufactured by Philadelphia Mixers and are equipped with 2-speed motors. The aeration tank effluent is collected in a trough and discharges through an 8-inch pipe to a common 16-inch header that conveys flow to the final clarifier flow splitter.

Table 2-7 Aeration Tank - Design Parameters	
Tanks	3
Geometry	Single Pass-Rectangular
Dimensions	1 @ 20 ft x 40 ft 2 @ 20 ft x 61 ft
Side Water Depth	11.5 ft
Volume, total	278,700 gal
Detention Time Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 8.8 hr 4.3 hr
Aerators (8 total)	2-speed surface type 7.5/10 HP motors

Field Notes and Observations:

- Surface aeration is less effective compared to energy efficient fine pore diffused aeration systems.
- Color of the aeration tank contents is dark black, possibly dues to heavy recycle or excessively long sludge age.
- Typically only one surface aerator per tank is operated. Even at low speed, this operation results in excess dissolved oxygen according to plant staff.
- The drives appear to be operating satisfactorily.
- Railings do not meet code requirements.

2.3.4.6 Final Clarifiers

Mixed liquor from the aeration tanks is conveyed to the final clarifier flow splitter. The installed weir gates provide a positive flow split to the two final clarifiers. The older, smaller final clarifier is 30-foot diameter, equipped with a perimeter feed trough, a square center effluent trough and a plow-type sludge scraper. A surface skimmer is provided to remove floatable material to the return sludge well.

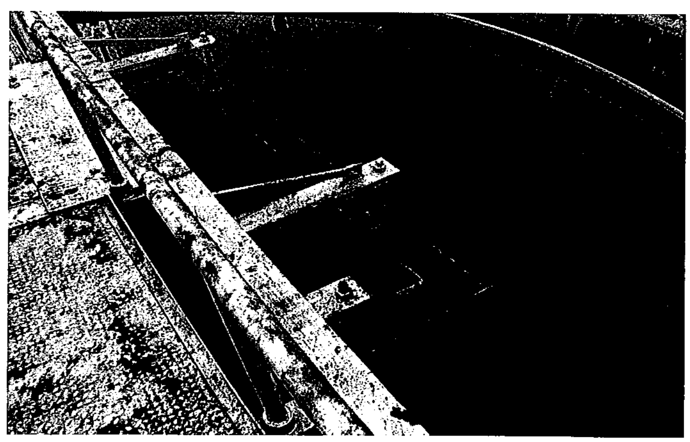


Figure 2.10
Older Final Clarifier with
Center Square Effluent Weir Launder

Settled sludge is conveyed to the return activated sludge pump station wet well. Clarified effluent is conveyed by gravity via a 10-inch pipe to Manhole 3.

The newer final clarifier was constructed as part of Contract 79-3. It is 45-ft diameter and has a 9 foot side water depth, a 12-inch influent center-feed pipe, and an outboard weir launder. A single suction header for the removal of sludge is provided. The suction header is connected to a sludge manifold. A telescopic valve is installed on the sludge manifold which controls the sludge removal rate.

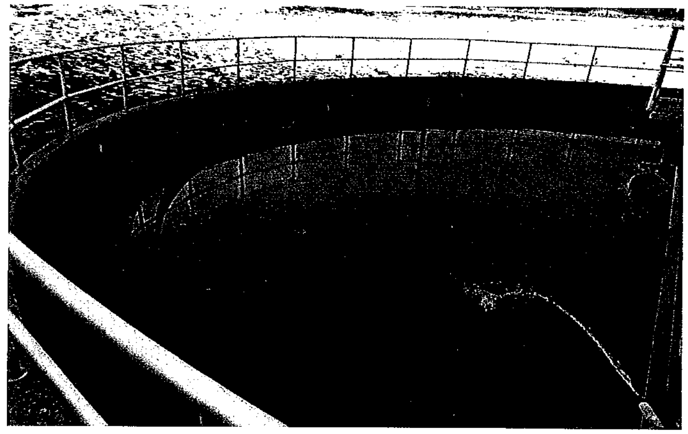


Figure 2.11
Newer Final Clarifier (45 ft diameter)

The collector mechanism has a 0.75 HP electric motor. A surface skimmer arm pushes scum to a peripheral scum box that drains back to the return activated sludge wet well. Clarified effluent is conveyed via a 12-inch pipe to Manhole 3.

Table 2-8
Final Clarification - Design Parameters

Tanks	2
Geometry	Circular
Feed Mechanism	1 – center feed 1 – peripheral feed
Dimensions	1 @ 45 ft diameter 1 @ 30 ft diameter
Side Water Depth	9 ft
Surface Area, Total	2,300 ft^2
Surface Loading Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 320 gpd/ ft^2 6,80 gpd/ ft^2
Return Sludge Pumps	3 @ 700 gpm Constant speed, 15 HP motors

<u>Field Notes and Observations</u>

- The older final clarifier has not been dewatered recently, so the condition of the collector arms is not known with certainty.
- The clarifier appears to perform satisfactorily.
- Scum build-up in the influent trough of the older clarifier is significant, but does not extend the full perimeter of the tank to the scum dip tube.

- The older final clarifier has a perimeter chain link fence instead of railing which does not meet code requirements.
- The collector drive platform and railings on each final clarifier are severely corroded.
- The suction-type collector arms of the newer final clarifier often become plugged due to stringy material that passes through the channel grinder in the pretreatment facility. Plant personnel are required to lower the return sludge telescopic valve to increase flow and use a pick to manually remove rags and stringy material that block the slip tube.
- Scum and skimmings are conveyed to the return activated sludge wet well and are pumped back to the intermediate settling tanks.
- There is no positive means of removing scum and skimmings and it tends to accumulate within the plant.
- Algae tends to grow and accumulate on the weir and weir launder surfaces; mechanized cleaning of these surfaces would be beneficial.

2.3.4.7 Return Activated Sludge Pumping

Return activated sludge (RAS) is manually removed from each final clarifier using telescopic valves that are installed in a common wet well located adjacent to the newer clarifier. RAS is pumped and metered through a 6-inch pipe to the intermediate clarifier effluent junction box to form mixed liquor just upstream of the aeration tanks.

The three return activated sludge pumps are end-suction type centrifugal pumps, and are less than 10 years old and in good condition. Buried yard valves have been provided to divert pumped RAS to the primary tanks through a 6-inch pipe.

Field Notes and Observations:

- The RAS pumps are constant speed pumps controlled by floats in the wet well, and they cycle frequently, sending slugs of return sludge to the intermediate settling tanks effluent junction box. Variable speed drive motors would benefit the pump operation and process.

2.3.5 Effluent Disinfection

Plant effluent flow from final clarification is conveyed by gravity through a 12-inch pipe that terminates at the older (west) chlorine contact tank. An additional chlorine contact basin was added as part of Contract 79-3, and the basins are arranged so that either basin can be bypassed.

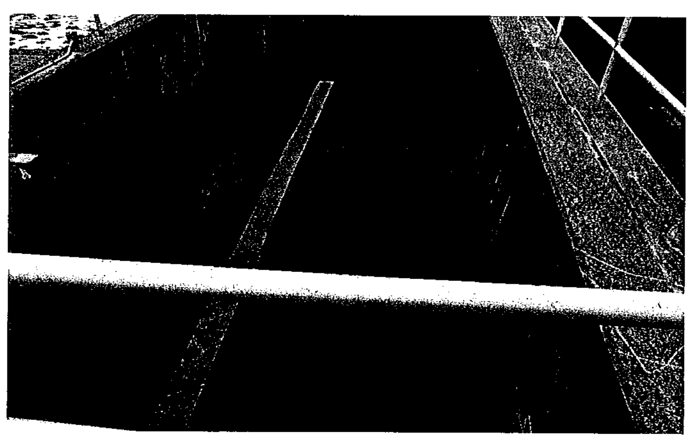


Figure 2.12
Chlorine Contact Basins

The chlorine building contains 150 pound chlorine cylinders and two chlorinators (one duty/one standby). The wall-mounted chlorinators feed chlorine solution to the plant effluent at Manhole 3 en route to the contact basins. Chlorine dosage is manually set to feed approximately 3 pounds of chlorine per day.

Each contact basin is divided by a baffle which creates a 2-pass system to limit short-circuiting and provide sufficient time for the chlorine solution to react and disinfect the effluent flow.

Table 2-9 Chlorine Contact Tank - Design Parameters	
Tanks	2
Geometry	2-Pass Rectangular
Dimensions	1 @ 10 ft x 25 ft 1 @ 11 ft x 25 ft
Side Water Depth	4.25 ft
Volume, Total	16,690 gal
Detention Time	
Design average flow (0.75 mgd)	32 min
Peak flow (1.56 mgd)	15 min

Liquid sodium thiosulfate is used to de-chlorinate the plant effluent after disinfection to comply with seasonal NPDES conditions. A solution of sodium thiosulfate is drip-fed at the head end of the post-aeration basin.

Effluent flow is monitored at the downstream end of the newer (east) chlorine contact basin. Flow metering consists of a v-notch weir with an ultrasonic level transmitter.

Field Observations:

- The effluent flow meter is impacted by the Stillwater River when the river stage rises to a critical level. The 25-year flood elevation (885.40) submerges the v-notch weir and renders the meter ineffective at this river stage.
- The top of concrete at the structure (883.38) is below the 100-year flood elevation (887.5), which will cause the entire structure to be submerged and rendered ineffective at this river stage.

Figure 2.13
Plant Outfall

2.3.6 Post Aeration

Following effluent disinfection, the plant effluent is aerated in a dedicated basin to ensure that sufficient oxygen (minimum of 6.0 mg/L) is present prior to release at the plant outfall. The post-aeration basin is a 2-pass system, designed to limit flow short circuiting.

Compressed air is fed through a 3-inch line from the blowers located adjacent to the digester control building.

Table 2-10 Post Aeration - Design Parameters	
Tanks	1
Geometry	2-Pass Rectangular
Dimensions	7 ft x 12 ft
Side Water Depth	9 ft
Volume, Total	5,600 gal
Detention Time Design average flow (0.75 mgd) Peak flow (1.56 mgd)	 11 min 5 min
Air Requirement	75 cfm

2.4 Solids Handling

Plant sludge is produced from three unit processes: raw sludge from primary treatment, sloughed-off trickling filter biomass captured within the intermediate clarifiers and excess or waste activated sludge from the activated sludge system.

The waste activated sludge is co-settled with the raw sludge in the primary tanks and is removed manually via telescopic valves to the no.1 and no.2 waste sludge wells. Intermediate sludge is similarly withdrawn to the no.1 waste sludge well.

Two waste sludge pumps located in the existing pump station pump the sludge produced each day to the former anaerobic digester for storage and eventual removal from the plant by a contract hauler. The plant sludge is not stabilized prior to hauling.

An option exists to pump the sludge to the gravity thickener; however, operational difficulties with the gravity thickener (e.g. poor settling and solids stratification) led to the decision to bypass the gravity thickener and use the digester as a holding tank.

2.4.1 Sludge Gravity Thickening

The sludge gravity thickener was designed to work in combination with the anaerobic digester to thicken the sludge prior to anaerobic digestion. This strategy conserves digester volume and reduces the water

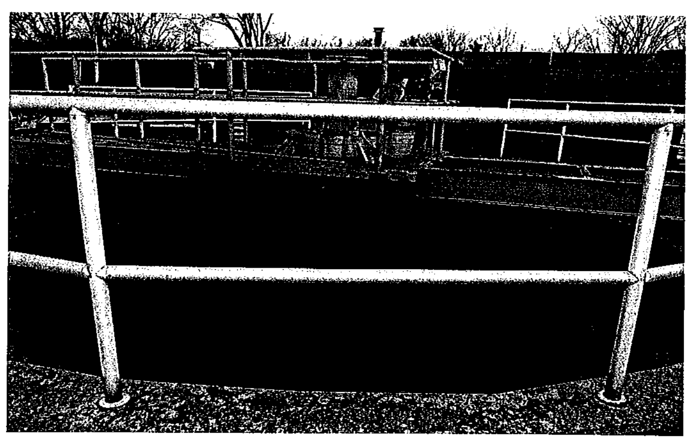


Figure 2.14
Sludge Gravity Thickener – Out of Service

content of the sludge which can limit gas production.

Plant staff indicates that operation of the gravity thickener was unsuccessful. Significant operational difficulties were experienced, including poor settling and solids stratification which led to the decision to bypass the gravity thickener and use the anaerobic digester for sludge storage.

The gravity thickener is 25-ft diameter, 10-ft side water depth tank constructed as part of Contract 79-3. The collector mechanism has a 1.5 HP drive motor. Two sludge transfer and recirculation pumps are installed in the Control House located between the sludge gravity thickener and anaerobic digester. These pumps have the capability to: 1) transfer gravity thickened sludge to the digester, 2) re-circulate the contents of the digester through the existing boiler's heat-exchanger, 3) transfer digested sludge to the sludge drying beds and 4) transfer sludge to the truck hauling station. These pumps are presently used for the sole purpose of pumping to the truck hauling station.

Gravity thickener overflow is piped back via a 6-inch line to the transfer wet well upstream of pre-aeration.

Field Notes and Observations:

- The gravity thickener is currently offline and has been that way for a number of years. The collector drive structure and the weir plates are heavily corroded.

2.4.2 Sludge Stabilization - Anaerobic Digestion

The anaerobic digester is a buried concrete tank having a 40 foot diameter and a 13 foot side water depth. The tank is currently used only for the storage of sludge.

The digester gas compressor is located in the basement of the digester control building. It is currently seized and inoperable.

The process boiler is located on the top floor of the digester control building. Since the tank is no longer being operated as a digester, the boiler is not needed or utilized. The boiler requires significant rehabilitation before being placed back into service and reused.

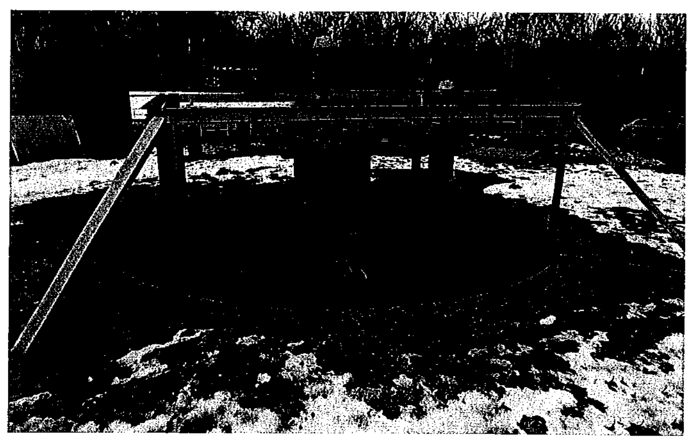


Figure 2.15
Anaerobic Digester with Floating Cover

The digester has a floating gas cover that was installed to control gas production. The digester has a volume of 21,800 cubic feet.

Digester supernatant is piped back to the pre-aeration tanks.

Field Notes and Observations:

- The floating gas cover experiences leaks of stored sludge and septic gas release.

- The existing pressure/vacuum relief valve and flame trap and its steel cover plate adjacent to the gas holder are severely corroded and likely unsafe.
- A significant quantity of grit has likely accumulated in the digester and reduces its capacity to store sludge.
- When sludge is pumped to the digester for storage, an equal volume of dark black supernatant is displaced which is recycled back through the treatment plant; this unnecessarily increases the cost of treatment and impacts the performance of primary settling.

2.4.3 Sludge Dewatering

The plant has a total of six sludge drying beds. Three (61 feet x 31 feet) beds were built originally in the 1940s and three smaller (34 feet x 20 feet) covered beds were added under Contract 79-3. These facilities are no longer in use but are available if needed. The total area of the drying beds is 7,710 square feet which can hold approximately 58,000 gallons. Filtrate from the drying beds is recycled through the plant via the transfer wet well located upstream of pre-aeration.

2.4.4 Sludge Hauling

Sludge is pumped from the anaerobic digester to the truck hauling station and hauled from the plant as a liquid. Approximately 4,500 gallons of liquid sludge is removed each week on average and hauled off site by a contract hauler. The volume of sludge pumped to the digester each week typically exceeds the volume hauled because the pumped sludge total solids content is low.

Table 2-11 summarizes the hauled from the plant during calendar year 2012.

Table 2-11 Hauled Sludge (2012 Basis)	
Average Day Mass Volume	 257 lb/day[1] 4,500 gal/week
Total Solids Content (Estimated)	4.8 %
Hauling Cost	$47,000/year
On Site Sludge Storage	254 days [2] 344 days [3]
Notes: [1] Based on 2012 data reported to OEPA. [2] Based on digester volume and average day hauling rate. [3] Based on digester and sludge drying bed volume..	

Field Notes and Observations:

- Adequate sludge storage capacity exists at plant site.

2.5 Supplemental Plant Systems

2.5.1 Process Air Blowers

Two rotary lobe blowers provide process air to the unit processes throughout the plant, including pre-aeration, post-aeration and air lift pumping of grit slurry. Each blower has a 15 HP motor and is belt-driven. The blowers have been installed outdoors next to the digester control building.

Field Notes and Observations:

- One of the blowers was recently rebuilt and the other unit is also in need of a re-build.
- The blowers are located outside of the digester control building and are exposed to the weather and can be exposed to corrosive gases emitted from the sludge storage tank.
- The silencers have experienced severe corrosion and have been patched to extend their useful life.

Figure 2.16
Process Air Blowers

- The exposed epoxy coating on the equipment and piping has chalked because of UV exposure and is failing. Much of the piping and equipment shows severe corrosion.

2.5.2 Potable Water

Potable water is provided to the plant via a 4-inch line that is reduced to 2-inch before entering the plant. Potable water is distributed to the digester control building, chlorine building, laboratory, return sludge pump structure and to various yard hydrants throughout the plant. A backflow prevention device is provided to protect the potable water distribution system from contamination.

2.5.3 Natural Gas

Natural gas is supplied to the plant from Dayton Power and Light (DP&L). Gas is supplied to the heat exchanger located in the digester control building and unit heaters in the pump station located below the laboratory.

2.5.4 Electrical System

400 amp, 480 volt, 3-phase electrical power is furnished to the WWTP from overhead lines to a DP&L meter pole located north of the laboratory building. An automatic transfer switch is located in the laboratory building which distributes power to motor control center (MCC-A). MCC-A provides power to the following equipment:

- Raw sewage comminutor
- Grit agitator
- Primary sludge collector drives
- Intermediate clarifier collectors
- Trickling filter recirculation pumps

- Secondary transfer pumps
- Mechanical aerators
- Final clarifier collector drives
- Waste sludge pumps

A separate breaker with step-down transformer serves lighting panels A, C and D.

A 125 amp service breaker feeds power from MCC-A to MCC-B located in the digester control building. MCC-B provides power to the following equipment:

- Gravity thickener drive
- Sludge transfer pump
- Sludge recirculation pump (digester)
- Heat exchanger draft fan (digester)
- Hot water circulation pump (digester)
- Gas mixing pump (digester)
- Process air blowers

A separate breaker with step-down transformer serves lighting panel B at this location.

Motor Control Centers: The motor control centers in the laboratory building and digester control building are Square D, Model 4 units. These units are just over 30 years old and in very good condition.

Disconnect Switches: The disconnect switch enclosures for the outdoor equipment are stainless steel and are in good condition; however, the majority of support materials are not corrosion resistant and have rusted away leaving the enclosures supported by conduits. The disconnect switches in the laboratory building and digester control building are either stainless or painted steel and are in good condition.

Outdoor Lighting: Plant outdoor lighting is a mixture of wall fixtures, small flood lights and pole fixtures. Except for a couple of fixtures (wall pack on Aeration Tank side of laboratory building and the yard light) most do not work. The pole light is seven feet above grade and doesn't provide light at the draw off well where it is needed. New and additional light fixtures are needed to provide for a safe working environment.

Standby Generator: A diesel engine driven emergency generator (Marathon Electric) rated at 200 KW/250 KVA, 480V and equipped with a 1,000 gallon fuel tank is located in a dedicated space within the laboratory building. The transfer switch is manufactured by ASCO. When a utility power outage occurs, the emergency generator will start and the automatic transfer switch will close and transfer power to the generator supply lines. A separate manual transfer switch is provided to connect the well field pumps to the generator. Further investigation is necessary to confirm if the existing generator is large enough for future loading conditions.

<u>Field Notes and Observations:</u>

- Conduits in the area of the intermediate settling tanks are extremely rusty and one of the conduits is cracked.
- The receptacle at the intermediate settling tanks doesn't work.

- Installation of electric operators and a PLC could be used to simplify and automate the sludge draw-off operation.
- The lighting panelboards in the laboratory building and the digester control building contained very few if any spares. A new panelboard should be provided.
- The existing starters for the return sludge pumps located at the pump vault are beginning to rust. Replacement of the controls with VFDs would provide a more constant flow rate and perhaps require a lower horsepower pump. The VFDs would need to be installed indoors in the laboratory building.
- The digester control building has gas piping, a gas compressor and sludge pumps in the lower level of the building. The controls and disconnects in the area of the gas compressor are explosion-proof while the other half of the building with the sludge pumps has only non-hazardous location equipment. The lower level also opens into the upper level where the MCC and the sludge heat exchanger are located. According to the National Fire Protection Association (NFPA) Section 820, this space should be classified as a Class 1, Division 2 area requiring 12 air changes per hour. All equipment in the classified area has to be rated for the classified area and the area must be separated from the upper level.
- The controls for the blowers at the digester control building have been provided with selector switches to allow the operator to choose which of the blowers is to operate during a power failure. The controls for the aeration drives should be modified to operate in the same manner, i.e. the personnel selects which of the drives would operate during a power failure.

2.6 Hydraulic Profile

Table 2-12 summarizes the hydraulic profile for two flow rates which include the design average flow rate of 0.75 MGD, and peak hour flow rate of 1.56 MGD. Recycle flows of up to 100% of design average flow for the trickling filter recirculation and for return activated sludge were assumed.

Ten States Standards requires treatment facilities to remain fully operational and accessible during the 25-year flood. The 25-year flood level for the Stillwater River at the plant outfall is approximately 885.40. Table 2-12 summarizes the hydraulic profile through the plant during the 25-year flood for design average and peak hour flow rates. Even under the typical flow conditions (not shown), the plant effluent weir, which is used for measuring total plant flow, and the weirs immediately upstream and downstream of the final clarifiers are impacted by the 25-year flood elevation.

Ten States Standards also requires treatment facilities to be protected from physical damage by the 100-year flood. The 100-year flood level for the Stillwater River at the plant outfall is approximately 887.50. As can be noted in Table 2-12, the aeration tank splitter box weirs and structures downstream are impacted by the 100-year flood elevation.

Table 2-12
Village of Covington WWTP
Hydraulic Grade Line (feet) [1, 2]

Location	Top of Concrete Elevation (feet)	Design Average Flow 25-Yr Flood	Peak Hourly Flow 25-Yr Flood	Design Average Flow 100-Yr Flood	Peak Hourly Flow 100-Yr Flood
Stillwater River	N/A	885.40	885.40	887.50	887.50
12" Outfall Pipe	883.38	885.67	886.58	887.77	888.68
Effluent V-Notch Weir (EL 876.78)	883.38	885.67	886.58	887.77	888.68
Post Aeration Basin	883.38	885.67	886.58	887.77	888.68
Newer Chlorine Contact Basin	883.38	885.68	886.59	887.78	888.69
Older Chlorine Contact Basin	883.38	885.69	886.60	887.78	888.70
12" Settled Effluent Pipe	886.28	885.94	887.69	888.04	889.78
Newer Final Clarifier (Weir @ EL 883.70)	886.28	885.94	887.69	888.04	889.78
12" Mixed Liquor Pipe	887.00	886.01	887.85	888.11	889.94
Final Clarifier Splitter Box (Weir @ EL 884.50)	887.00	886.02	887.85	888.11	889.94
Aeration Tank 3 Effluent Pipe	889.00	886.17	888.32	888.31	890.42
Aeration Tank 3 (Weir @ 885.89)	889.00	886.18	888.32	888.31	890.42
Aeration Tank 3 Influent Pipe	890.50	886.30	888.76	888.49	890.85
Aeration Tank 1 Effluent Pipe	889.00	886.30	888.41	888.35	890.50
Aeration Tank 1 (Weir @ 885.89)	889.00	886.30	888.41	888.35	890.50
Aeration Tank 1 Influent Pipe	890.50	886.48	888.75	888.50	890.85
Aeration Tank Splitter Box (Weirs @ 887.00)	890.50	887.26	888.77	888.51	890.85
16" Int. Settling Tank Effluent Pipe	891.75	887.38	889.04	888.62	891.12
Int. Settling Tanks (Weirs @ 889.89)	891.75	889.94	889.96	889.94	891.12
12" Int. Settling Tank Influent Pipe	891.75	889.96	890.02	889.96	891.17
Int. Settling Tank Splitter Box (Weirs @ 890.50)	891.75	890.70	890.82	890.70	891.21
Transfer Pump Wet Well [3]	885.00	873.00	873.00	873.00	873.00
54' Trickling Filter Effluent Box	882.03	873.09	873.22	873.09	873.22
58' Trickling Filter Effluent Box	882.03	873.32	873.77	873.32	873.77
Trickling Filter Splitter Box	885.28	882.69	883.03	882.69	883.03
North Primary Settling Tank Effluent Pipe	886.03	882.79	883.31	882.79	883.31
North Primary Settling Tank (Weir @ EL 884.03)	886.03	884.06	884.07	884.06	884.07
Primary Settling Tank Influent Channel	886.03	884.06	884.08	884.06	884.08
Second Pre-Aeration Tank	886.03	884.11	884.32	884.11	884.32
First Pre-Aeration Tank	886.03	884.15	884.47	884.15	884.47
14" Grit Effluent Pipe	887.25	884.19	884.64	884.19	884.64
Grit Tank (Weir @ EL 884.75)	887.25	885.02	885.20	885.02	885.20
Grit Tank Influent Channel	887.25	885.31	885.66	885.31	885.66

Notes:
1. HGL elevations in **red** exceed the top of concrete elevation for the associated structure.
2. HGL elevations in **blue** exceed the upstream weir elevation.
3. Assumed water elevation in Transfer Pump Wet Well to allow model to converge.

3.0 REGULATORY ISSUES

3.1 Introduction

The management of wastewater within any given area requires consideration of various regulatory and environmental matters. Protection and improvement of the existing surface water quality is a major goal and will likely result in strict discharge limits for new sources of treated wastewater discharge. As well, flood protection must be considered in plans to develop new wastewater conveyance and treatment facilities. The following section discusses various regulatory matters that factor into this study, each of which is individually discussed below.

3.2 Current Water Quality

The Stillwater River from its headwaters to Biesner Road (River Mile 57.0) is designated as Warmwater Habitat (WWH) and Exceptional Warmwater Habitat (EWH) from Biesner Road to its confluence with the Great Miami River. The Village of Covington discharges treated wastewater to the EWH of the Stillwater River at RM 32.2. Based on the results of the most recent water quality and biological survey of the Stillwater River, 55 miles are in full attainment, 8.2 miles are in partial attainment and 3.3 miles are in non-attainment with aquatic life uses. The river quality below the Covington WRF discharge is in full attainment.

3.3 Total Maximum Daily Loading

The Total Maximum Daily Load (TMDL) program, established under Section 303(d) of the Clean Water focuses on identifying and restoring polluted rivers, streams, lakes and other surface waterbodies.

A TMDL is a written, quantitative assessment of water quality problems in a waterbody and contributing sources of pollution. It specifies the amount a pollutant needs to be reduced to meet water quality standards (WQS), allocates pollutant load reductions, and provides the basis for taking actions needed to restore a waterbody.

Ohio's TMDL process consists of a 5-year cycle to assess waterbody health (biological, chemical and physical habitat), develop a stream restoration target, implement a solution, validate the results and monitor progress.

The initial TMDL report for the Stillwater River Watershed was written and approved by USEPA in June 2004. This report addressed nutrient impacts, including total phosphorus, as well as stream habitat impacts throughout the basin. Based on available data and modeling outcome, it was determined that the Covington WWTP would be required to limit the discharge of total phosphorus to 0.79 mg/L to meet an Stillwater River in-stream total phosphorus target of 0.17 mg/L.

Later, Ohio EPA decided to recompile the 2004 Stillwater River TMDL watershed model to address concerns expressed by NPDES permit holders in the watershed. In the new analysis that was released in the 2009 TMDL Report for the Stillwater River, permit limits for total phosphorus were no longer required for five communities, which included the Village of Covington. Thus, the initial recommendation to limit the discharge of total phosphorus to 0.79 mg/L was removed because the Stillwater River downstream of the Covington WWTP outfall was not impaired.

Ohio EPA has indicated recently that the Stillwater River will be re-assessed again this year with field work slated to begin the summer of 2013. If a TMDL is required, it will likely be completed sometime in 2016. Efforts to control the discharge of total phosphorus and total nitrogen should not be initiated until the re-assessment of the Stillwater River is completed, the impacts are known and the consequences of the impacts are revealed to the permit holders within the basin.

Planning for wastewater improvements should incorporate sufficient flexibility to adapt to future nutrient control initiatives, should they eventually be imposed on the Village of Covington. The WWTP currently discharges an average total phosphorus concentration of 2.38 mg/l and an average total oxidized nitrogen concentration, including nitrate and nitrite, of 12.47 mg/L (2012).

3.4 NPDES Permit

The Village of Covington NPDES Permit that became effective July 1, 2011 and is set to expire June 30, 2016 was based on the outcome of the 2009 TMDL Report of the Stillwater River. Table 3-1 summarizes the numerical limits contained in the current permit.

Table 3-1
Village of Covington
NPDES Permit (1PB00013*HD) Limits

Parameter	30-Day Average	7-Day Average
$cBOD_5$, mg/l	25	40
Total Suspended Solids, mg/l	30	45
$NH_4 - N$, mg/l	5	10
Dissolved Oxygen, mg/l	6.0 mg/l (minimum)	
Total Residual Chlorine, mg/L	0.019	
E. Coli, #/100 mL	126	284
pH	6.5 – 9.0	
** Effluent loadings (not shown) are based on a design flow of 0.75 mgd.		

The current wasteload allocation for the Covington WWTP is based upon a design average (permitted) flow of 0.75 mgd. A review and analysis of flows over the past several years has revealed that the annual average flow is no greater than 50% of the design average flow. Future facilities planning, as will be discussed later in this report, will be based on the current design average flow of 0.75 mgd.

3.4.1 Water Quality Criteria for Bacteria

Ohio EPA adopted new rules in December 2009 which included new water quality criteria for bacteria. Criteria for the bacteria *E. coli* have replaced standards for *F. coli* (fecal coliform), as *E. coli* has been shown to be a better predictor of the potential for impacts to human health from exposure to wastewater effluent and surface waters which contain wastewater effluent. The standard recreation season when monitoring for bacteria is required has been changed to May 1st through October 31st. The new rules also grant authority to the Director of Ohio EPA to extend effluent disinfection requirements beyond the May 1st through October 31st recreation season if necessary. These new rules became effective on March 15, 2010.

The numerical limits for *E.coli* that are included in Covington's NPDES permit are:

- 126 colony counts per 100 milliliters (30-day average)
- 284 colony counts per 100 milliliters (7-day average).

The Covington WWTF has had some difficulty meeting these limits on a consistent basis using chlorine-based disinfection.

3.5 Flood Plain Considerations

The base flood (100-year flood) is the flood that has a 1 percent chance of being equaled or exceeded in any given year. The base flood elevation (BFE) is the water surface elevation of the 1 percent annual chance flood. For the study area located along the Stillwater River at Covington, the BFE and floodway areas has been determined. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the base flood can be carried without increase in flood height.

Any new construction in the floodplain will require planning to ensure that flood levels are not affected. Wastewater treatment and pumping stations (i.e. structures, electrical and mechanical equipment) will require physical damage protection from the BFE. Treatment plants and pumping stations should remain fully operational and accessible during the 25-year flood.

4.0 PROJECTED WASTEWATER FLOWS AND LOADS

4.1 Introduction

An overview of the steps that have been taken as part of this study to develop future flows and loadings for the Village of Covington is presented in this section. This task has been undertaken with the presumption that future conditions cannot be predicted with absolute certainty; however, it was completed with a level of confidence based on input from published resources.

4.2 Population

The 2010 U.S. Census reported that the Village of Covington had a total population of 2,584, very close to the population of 2,559 reported by the U.S. Census in 2000. This population difference represents a 1.0% increase (average annual increase of 0.1%) for this decade of record. A review of past census figures over the preceding 50 years (1960-2010) suggests this average annual increase is consistent. Accordingly, if this annual rate of growth continues over the next 20 years (2033), the population of Village of Covington can expect to be in the range of 2,630.

Table 4-1
Village of Covington
Population Change (1960-2010)

Census Year	Covington Population	Pop. Change
1960	2,473	-----
1970	2,575	4.12%
1980	2,610	1.36%
1990	2,603	(0.27%)
2000	2,559	(1.69)
2010	2,584	0.98%
2020 (proj)	2,607	
2030 (proj)	2,630	
Average (10 year) change		**0.90%**

4.3 Projected Wastewater Flows and Loadings

Based on the previous population projection, wastewater production within the Village of Covington would not be expected to change significantly, unless new industrial users or sewer extensions to contiguous unsewered areas, such as West Covington, are considered for inclusion.

Such action to provide service to a contiguous, unsewered area would likely require amendments to the Village's sewer use ordinance. Changes to the facility planning area boundary would not be necessary since West Covington is currently located within the Covington FPA.

4.3.1 West Covington Incremental Flows and Loadings

The small community of West Covington is located due west of Covington on the and in close proximity to Covington's wastewater treatment facility. Records obtained from the Miami County Public Health Department (Table 4-2) indicate that there are a total of 55 dwellings that have home sewage treatment systems (HSTSs) in West Covington.

Table 4-2 West Covington Summary of Home Sewage Treatment Systems		
Location	**Total HSTS**	**Average Permit Age**
Covington-Gettysburg Road	22	1978
Elm Street	5	1974
Fletcher Road	5	1986
Front Street	10	1980
Main Street	4	1972
Walnut Street	9	1975
Total	55	
Data from the Miami County Public Health Department, 2013		

The population of West Covington, based on an average household size (3 people per household) is estimated to be 165. A sewer extension to this community, if considered, would have a minor (approximately 6.5%) hydraulic impact on Covington's existing wastewater treatment facility.

Table 4-3 Village of Covington WWTP Wastewater Flow Projections		
Flow Parameter, gpd	**2012 (Baseline)**	**Estimated Incremental Flow from West Covington**
Average Dry Weather Flow	176,000	11,500
Average Daily Flow	230,000	15,000
Peak 30-Day Flow	321,000	21,000
Peak Day Flow	1,128,000	26,000
Peak Hourly Flow (est.)	1,560,000	63,000

Similarly, the loading impact of this small community on Covington's existing wastewater treatment facility would be very low and would not likely require any facilities expansion. Refer to Table 4-4.

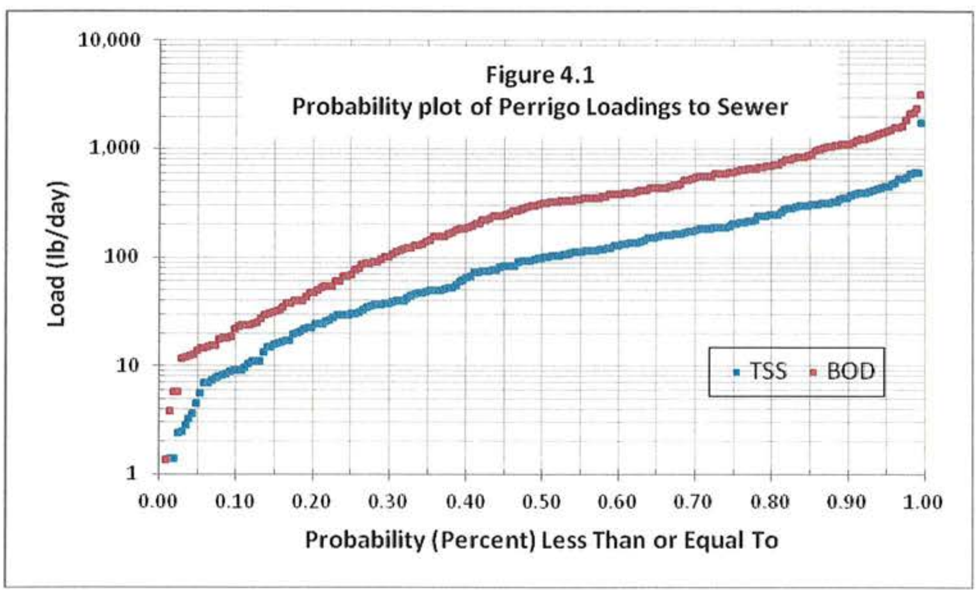
Table 4-4 Village of Covington WWTP Load Projections					
	Average Flow (mgd)	TSS (lb/day)	$cBOD_5$ (lb/day)	(est.) NH_4-N (lb/day)	(est.) TP (lb/day)
2012 Baseline	0.230	459	618	31	15
Incremental Load	0.0123	24	33	1.6	0.8
Total Load - Average Day Basis	-----	483	651	33	16
Note: Incremental load based on inclusion of West Covington to Covington's sewer system.					

4.3.2 Significant Industrial Flows and Loadings

Perrigo Nutritionals located in Covington, Ohio, manufactures millions of pounds of powdered infant formula each year and is the largest industrial contributor, both in terms of flow and loadings, to the wastewater treatment facility. The average TSS load discharged from Perrigo is 143 pounds per day, while the average BOD load discharged this facility is 421 pounds per day.

The average daily TSS and BOD loading from Perrigo represents 31 percent and 68 percent respectively, of the raw sewage loading to the Covington WWTF. The 54,000 gallon per day average flow from Perrigo accounts for 23 percent of the average flow at the Covington WWTF. For purposes of this study, the loading magnitude for TSS and BOD and flows from Perrigo are assumed to be constant for the foreseeable future.

Figure 4.1 is a graph of the probability of total suspended solids (TSS) and 5-day biochemical oxygen demand discharge to the sewer from this source. This graph shows the variability of the loading which can range from less than 10 pounds per day to in excess of 3,000 pounds per day for BOD.



5.0 ALTERNATIVES DEVELOPMENT AND ANALYSIS

Several wastewater management alternatives have been developed in conjunction with input from the Village of Covington. These alternatives include the following:

- Alternative 1 - Decommission the Village's existing wastewater treatment facility and convey wastewater to a nearby utility for treatment and disposal;
- Alternative 2 - Construct a new wastewater treatment facility to replace the Village's existing wastewater treatment facility;
- Alternative 3 - Modify and upgrade the existing wastewater treatment facility based on a prioritized needs assessment;

It is assumed that the "No Action Alternative" in which the existing treatment facilities would continue to be operated and maintained without modification is not a viable alternative for the Village.

5.1 Decommission the Village's Existing Wastewater Treatment Facility

5.1.1 Purpose and Need

The purpose of this alternative is to decommission the existing wastewater treatment facility located at 200 Bridge Street and which discharges treated wastewater from the Village of Covington to the Stillwater River. As part of this alternative, wastewater produced within Covington's 864 acre service area would be conveyed to and treated at the City of Piqua wastewater treatment facility. This alternative would contribute to the consolidation and regionalization of wastewater treatment in the area and would require a service agreement endorsed by both parties and an amendment to the Covington Facility Planning Area (FPA) to reflect the conveyance of wastewater from the Covington FPA to the Piqua FPA for treatment as proposed.

Implementation of this alternative would enable the Village to reduce the risk of environmental impact on the Stillwater River from the existing treatment facilities, many of which have reached the end of their useful life and most of which are inefficient and outdated.

Decommissioning the WWTP and routing the wastewater to the City of Piqua would avoid the costs associated with: 1) meeting increasingly stringent NPDES permit discharge requirements, 2) operating and maintaining older treatment facilities, 3) chemical consumption and 4) sludge handling and disposal.

5.1.2 Description of Work

This alternative would consist of the following work:

- Mechanical, electrical and concrete demolition and associated earthwork as necessary to decommission the existing wastewater treatment structures and equipment;

- Construction of a pump station at the site of the present Covington wastewater treatment facility and construction of two booster pumping stations along the route of conveyance;
- Installation of a force main aligned eastward along Brown Road a distance of approximately five miles to convey Village of Covington wastewater to the City of Piqua wastewater collection system;
- Site modifications as necessary to accommodate the wastewater pump station facilities, including use and modification of the existing emergency generator to serve the pump station and conversion of the existing trickling filters to equalization basins.

5.1.2.1 Pump Station

The existing plant site occupies approximately three acres. The new pump station is proposed to be a submersible type pump station constructed on the existing plant site near the existing pretreatment structure where all four raw sewage siphons terminate. This type of pump station is presently used at the existing plant and requires no above ground construction except for a concrete slab, pump retrieval equipment and pump control equipment.

The pump station would be designed for a design average flow of 750,000 gallons per day and a peak hourly flow of 1.56 million gallons per day, consistent with the Contract 79-3 design flow basis. The proposed pumping station would consist of four pumps having a firm capacity (largest pump out of service) equal to the peak hourly flow rate. Each pump would have an estimated capacity of 370 gallons per minute and be equipped with a variable frequency drive to control the rate and cost of pumping.

The design capacity of the wet well would be sufficient to prevent excessive pump cycling. The wet well would have an emergency overflow to dedicated equalization storage facilities for sustained flow excursions beyond the peak hourly flow.

Power to the pump station would be furnished from the existing motor control center. The existing Laboratory Building would be retained where the electrical switch gear is located. Emergency power would be provided to the pump station from a new standby generator; the existing generator would be evaluated for re-use.

5.1.2.2 Wastewater Conveyance

As part of this alternative, a dual force main system is proposed that would extend approximately five miles east along Brown Road from the Covington WWTP to a connection point with the City of Piqua collection system. By providing parallel force mains, required velocities can be maintained while minimizing pumping head to save energy. Additionally, parallel force mains would enable repairs to be made while keeping the pumping station in operation. This approach would ensure safety, reliability and continued service during pump station maintenance.

The route of the proposed force mains is illustrated in Figure 5.1. The proposed force mains would be routed from the existing wastewater treatment plant site east along East Bridge Street. At the Stillwater River, the force mains would be installed underneath the stream using auger bore (trenchless) methods. The length of the auger bore would be approximately 250 linear feet and require one launch shaft and one receiving shaft on either side of the stream. Except for the stream crossing, the force main installation would be open cut.

From the stream crossing, the force mains would continue east along East Bridge Street, turn north onto South Pearl Street, then east onto East Walnut Street, which turns into Brown Road outside the Village boundary. The force mains would terminate at a manhole at the west end of a 12- or 15-inch sanitary sewer on Brown Road located on the west side of Piqua.

The proposed routing of the force main is approximately 26,000 linear feet. Based on the peak hourly flow, the total discharge head is approximately 550 feet. This discharge head is too high for a single submersible pump station of the proposed flow capacity.

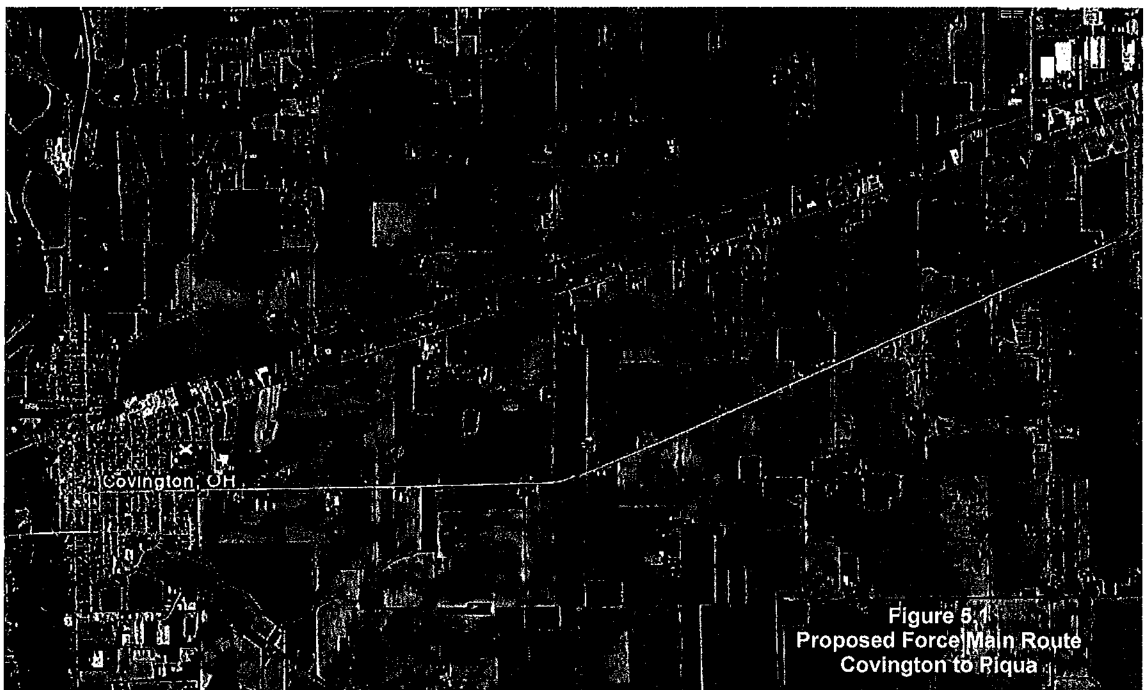


Figure 5.1
Proposed Force Main Route
Covington to Piqua

y

the proposed flow over this distance, two booster pump stations are proposed to be installed along the route of the force mains. A total of three pump stations in series would reduce the required total discharge head by one-third to 183 feet which is attainable by a submersible pump station.

The proposed booster pump stations would be wet well/dry pit pump type stations. The booster pump stations would be located at equal distances along the force mains to ensure the discharge head of each pump station is approximately the same. Odor and corrosion control facilities, presumably chemical dosing, would be required at the pump stations to mitigate odor and hydrogen sulfide-induced corrosion along the long force main route.

The pipeline alignment would follow existing utility easements where they exist. Construction along Brown Road is presumed to occur entirely within the County rights-of-way. A maintenance easement of approximately 15 feet would be required along the entire length of the route. Temporary construction easements would likely be required at, as yet, unknown locations along the pipe route.

5.1.2.3 Decommission Existing Facilities

As part of the alternative, the existing Covington WWTP would be decommissioned once the pump station and force mains become operational. Decommissioning the facilities would involve converting the existing trickling filters to wet weather equalization and storage basins. The filter basins have a combined volume of approximately 260,000 gallons.

The existing Laboratory Building would be retained for use following modification.

Preliminary Cost Estimate

The following key assumptions were made in the development of the preliminary cost estimate:

- The force main would consist of parallel 6-inch plastic pipes, approximately 26,000 linear feet each.
- The force mains would be routed in the existing rights-of-way and would terminate at a manhole on the west side of Piqua's collection system on Brown Road.
- The average force main depth would be 6 feet.
- The force mains would have 25 utility crossings, 25 shared manholes, and 5 air release valves on each force main.
- The force mains would cross under the Stillwater River and would be installed via auger bore. Each force main would have a separate auger bore, using common launching and receiving pits. The pit depths would be approximately 25 feet.
- The pump station at the existing wastewater treatment facility would be a submersible pump station, with an estimated depth of 30 feet and two grit pits located upstream of the wet well.
- The booster pump stations would be wet well/dry pit booster pump stations, with an estimated depth of 10 feet.
- Odor and corrosion control facilities would be provided at each pump station.

Assumptions pertaining to mechanical, electrical and structural demolition and earthwork needed to decommission the wastewater treatment facility:

- All demolition waste materials are considered to be non-hazardous.
- Existing plant site would require normal grading and seeding.

- Existing access roadway to remain.
- Regulatory approval for plant decommissioning can be obtained.
- Outfall to Stillwater River would remain for emergency overflow of planned pump station equalization facilities.
- Covered sludge drying beds would remain; all other drying beds would be removed.
- Laboratory Building would remain.

Based on the above assumptions, Table 5-1 summarizes the preliminary cost estimate for the alternative to decommission the existing wastewater treatment facility and pump flow to the City of Piqua's collection system.

Table 5-1
Decommission Existing Wastewater Treatment Facility and Pump to a Nearby Utility
Preliminary Construction Cost Estimate

Item/Description	Cost
Demolition of Existing Wastewater Treatment Facility	$250,000
Earthwork	$50,000
Pump Stations and Force Mains	
River Crossings	$1,452,000
Pump Stations	$4,498,000
Force Mains	$10,600,000
Pump Stations and Force Mains Subtotal	$16,550,000
Total Estimated Construction Cost	**$16,850,000**

5.2 Construct a New Wastewater Treatment Facility

5.2.1 Purpose and Need

The purpose of this alternative is to construct a new treatment facility near the site of the existing treatment facility. The existing plant is situated on an approximate three acre parcel on the west bank of the Stillwater River. Much of the equipment comprising the plant is in excess of 30 years old and has reached the end of its useful life. A new facility equipped with current technology would operate more efficiently and be designed to adapt to the demands of meeting increasingly stringent regulatory requirements.

From a regulatory perspective, a new wastewater treatment facility sized to accommodate the design flows would be considered a "new source" and, as such, would be required to meet best available demonstrated control technology (BADCT) criteria. The new discharge limits that would be imposed are considerably more stringent than the limits contained in the Village's existing NPDES permit.

Table 5-2 summarizes the existing and new source BADCT limits per Ohio Administrative Code, Chapter 3745-1-05. As part of this alternative, a new submersible pump station would be constructed on the existing plant site near the existing pretreatment structure where all four raw sewage siphons terminate. This pump station would convey all wastewater flows to the new treatment plant site. The remainder of the treatment facility would be demolished followed by site restoration. Implementation of this alternative would ensure that the Village's wastewater planning needs are addressed for the next 20 years.

Table 5-2
Best Available Demonstrated Control Technology (BADCT) Criteria
Source: Ohio Administrative Code Chapter 3745-1-05

Parameter	30-Day Average		7-Day Average	
	Existing Permit	New Source Permit	Existing Permit	New Source Permit
cBOD5 , mg/L	25	10	40	15
TSS, mg/L	30	12	45	18
NH4-N (Summer), mg/L	5	1.0	10	1.5
NH4-N (Winter), mg/L	5	3.0	10	4.5
Total Phosphorus	---	1.0	---	1.5
E. Coli, #/100 mL	126	126	284	235
Dissolved Oxygen, mg/L	6.0		6.0	

Note: New limits for total phosphorus are determined on a case-by-case basis based on the results of TMDL analysis and permit limits could be lower than noted.

5.2.2 Description of Work

The new treatment facility alternative would consist of the following work:

- Demolition of the existing wastewater treatment structures and equipment;
- Construction of a pump station at the site of the existing pretreatment structure and installation of a force main to the proposed site of the new treatment facility;
- Inclusion and treatment of flows from West Covington;
- Site modifications as necessary to accommodate the wastewater pump station facilities, including use and modification of the existing emergency generator to serve the pump station and conversion of the existing trickling filters to equalization basins that would have an emergency overflow to the Stillwater River;
- Construction of new facilities at an as yet undetermined location near existing treatment facility and having a parcel size no less than three acres.

5.2.3 Preliminary Cost Estimate

Table 5-3 Construct New Wastewater Treatment Facility Preliminary Construction Cost Estimate	
Item/Description	**Cost**
Div. 1 - General Requirements	$425,000
Div. 2 - Site Work	$1,175,000
Div. 3 - Concrete	$2,560,000
Div. 4 – Masonry & Superstructures	$280,000
Div. 5 - Metals	$390,000
Div. 6 - Wood & Plastics	$10,000
Div. 7 - Thermal & Moisture Protection	$35,000
Div. 8 - Doors & Windows	$55,000
Div. 9 - Finishes	$40,000
Div. 10 - Specialties	$0
Div. 11 - Equipment	$2,275,000
Div. 12 - Furnishings	$60,000
Div. 13 - Special Construction	$0
Div. 14 - Hoisting Equipment	$25,000
Div. 15 - Mechanical	$1,470,000
Div. 16 – Electrical & Instrumentation	$1,900,000
Subtotal	$10,700,000
Contingency @ 25%	$2,675,000
Total Estimated Construction Cost	**$13,375,000**
Note: Estimated construction cost excludes land acquisition cost.	

5.3 Modify and Upgrade the Existing Wastewater Treatment Facility

5.3.1 Purpose and Need

The purpose of this alternative is to protect the investment the Village has made in the existing facilities. This is accomplished by maintaining wastewater treatment operations at the existing wastewater treatment facility located at 200 Bridge Street but implement plant modifications and process upgrades where feasible and where necessary to improve:

- ***Safety*** – Where improvements are proposed, comply with building code requirements to ensure the safety of plant staff

- ***Reliability*** – seeks to reduce and streamline treatment processes and retire equipment that the current treatment system requires. Less equipment means fewer potential fail points, thus improved mechanical reliability;
- ***Simplicity*** – a streamlined treatment process improves plant hydraulics and results in a simpler process to operate which places less fewer demands on plant staff. Control issues between the various unit processes are reduced, thus lowering maintenance costs;
- ***Flexibility*** – plant modifications and upgrades will be flexible and adaptable to enable the plant to comply with future regulatory initiatives such as phosphorus and nitrogen removal;
- ***Energy Efficiency*** – opportunities exist to reduce the consumption of energy through simplifying treatment operations and upgrading or replacing equipment; increased energy efficiency translates to lower operating costs;
- ***Cost Effectiveness*** – implementing plant improvements that make sense from an economic perspective and meet current needs to sustain treatment operations;
- ***Reuse of Existing Facilities*** – where feasible, this approach saves time and capital expenditures in bringing new facilities into operation sooner and protects the Village's investment in existing facilities;
- ***Site Use Efficiency*** - the proposed site layout is optimized to flow easily with the existing process layout, preserves flexibility and is arranged to maximize the land available for future use through compact design and arrangement of facilities, while also maintaining adequate access.

5.3.2 Description of Work

The ensuing discussion on upgrading and modifying the existing wastewater treatment facility is based on the design criteria summarized in Table 3-1.

Certain facilities are needed to resolve or improve an immediate treatment need, to reduce the cost of treatment or to replace a critical asset that has reached the end of its useful life. Other facilities that will be discussed may be deferred and phased-in at a later date to facilitate project financing. Each individual process is discussed in the order of treatment beginning with raw sewage screening.

5.3.2.1 Raw Sewage Screening

Existing Situation: The treatment facility does not currently have a screening system that physically removes incoming wastewater debris. Instead, incoming wastewater passes through a grinder (also referred to as a comminutor) that shreds and releases material such as plastics, paper and rags back into the flow stream. This shredded material tends to re-weave downstream and cause plugging of pipes, gates, valves and other means of hydraulic conveyance, resulting in equipment downtime and avoidable maintenance.

Analysis & Alternatives: There are a large number of raw sewage screen manufacturers in the marketplace. Selection of a specific type of screen is a design-related matter and beyond the scope of this study; however, the semi-cylindrical spiral screen is one type of screen that would be suitable for installation at the Covington WWTF.

The semi-cylindrical spiral screen is a versatile and inexpensive solution for processing flows up to 8 mgd. The screen is composed of a perforated or wedge-wire basket connected to the end of a conveying tube. The basket rests on the floor of the channel and captures material in the raw sewage as flow passes through the basket. A shaftless spiral screw extends throughout the length of the unit and is used to transport the screened material from the basket, out of the channel to the discharge point of the unit.

The screen is typically installed at 35° or 45° inclination from horizontal. Most units are provided with a compaction/dewatering zone and the screens typically produce a discharge that is 20-25% dry solids and can go directly to the landfill.

The screen is supplied with a support stand that allows the unit to be pivoted out of the channel for maintenance purposes. The screen is generally operated by an upstream liquid level sensor. The level activation point is typically set to the basket height or just below it.

Refer to Appendix B for catalog cutsheets of this type of screen.

Recommendation: It is recommended that the existing raw sewage grinder be removed from service and be replaced by a new mechanized fine screen having a screen field with 3 millimeter clear opening. The screen should be equipped with a screenings compaction and discharge conveyor capable of producing dry screenings that can be directly land-filled without further handling. The new fine screen would be installed in the existing 20-inch wide comminution channel. A concrete masonry unit (CMU) structure is recommended to enclose and protect the screening system from freezing conditions. The proposed structure would be equipped with ventilation equipment sized for the space and building classification.

This is a high priority plant modification that would improve downstream treatment and substantially reduce maintenance activities associated with accumulation of debris and plugging of hydraulic conveyance elements.

5.3.2.2 Grit Capture and Pre-Aeration

Existing Situation: The existing grit system consists of a small vortex-type grit chamber equipped with a motor-driven paddle. The paddle mechanism is intended to maintain suspension of organic material and allow grit and stones to settle to the bottom of the chamber where grit is removed using an air-lift pump. The resultant grit slurry is discharged to an inclined wedge-wire screen which is intended to dewater the grit and fall into a container for subsequent removal and land-filling.

Grit capture efficiency is low and this process accomplishes very little in protecting downstream treatment processes. Plant staff confirms that substantial accumulation of grit has been observed in the primary and pre-aeration tanks. Wet grit that is captured is collected and spread out on the sand drying beds for dewatering to enable this material to be land-filled.

Analysis & Alternatives: Effective grit capture and removal will not only reduce the accumulation of gritty material within the plant but will also reduce the rate of wear of rotating mechanical surfaces, such as pump shafts and bearings. Alternatives considered include: 1) eliminate plant grit removal, 2) upgrade the existing grit system, 3) retrofit new grit facilities in existing structures and 4) construct new grit capture facilities.

Grit is present in wastewater conveyed by either separate sanitary or combined sewer systems, with far greater quantities in combined systems. Without grit removal, grit would continue to collect in downstream structures. Provision for grit removal is common practice for plants with mechanical equipment and sludge handling processes that grit can and often does impair. For these reasons, elimination of grit removal from plant processes will not be considered further.

Upgrading the existing system would consist of replacing the gear motor, paddle drive tube, paddles, air scour piping, baffles and grit dewatering screen. The condition of the steel grit tank is not known and likely needs to be replaced along with the other equipment. Reconditioning this asset as stated would extend the life of the process, but the grit capture efficiency may not significantly improve because the process relies on "providing sufficient retention time at slow flow for the grit to settle to the bottom" as stated in the plant O&M Manual

Peak grit loading to the WWTF occurs during peak plant flows following rainfall, especially after a prolonged period of dry weather when gritty materials tend to accumulate in the sewers and are flushed out during rain events. It does not appear that the existing grit removal system has been designed for high flows; consequently, grit is swept through the grit chamber under these conditions. Therefore, upgrading the existing grit system is not recommended.

The existing pre-aeration tanks are an ideal location for the installation of new higher efficiency grit capture equipment due to: 1) their location in the flow path, 2) available tank space for retrofitting equipment and 3) access to space for grit slurry pumping and dewatering.

Pre-aeration is common in plants that serve outlying areas that have unusually long sewer runs. They are designed to "freshen" the sewage by introducing air to oxygenate the flow; however, this process is more effective in purging dissolved gases such as hydrogen sulfide from the sewage into the air. This tends to create odors and promotes corrosion of exposed steel surfaces and damage to concrete surfaces which is clearly evident in and around the pre-aeration tanks. For these reasons, the pre-aeration tanks were considered as a possible candidate location for new grit facilities.

One type of high efficiency grit capture system that would be suitable for retrofitting into the west pre-aeration tank consists of submerged, stacked, hydraulically independent polyethylene trays. The stacked tray design occupies a small footprint which would reduce concrete costs for retrofitting this system into the existing west pre-aeration tank. This type of grit removal system is capable of 95 percent removal of all grit greater than or equal to 150 microns at peak flow. Refer to Appendix C for catalog cutsheets of this type of high efficiency grit removal system.

The tangential feed arrangement establishes a vortex flow pattern causing solids to settle on each tray. Flow spirals between the stacked trays and grit settles out by gravity along the sloped surface of each tray and into the center opening, eventually falling to a cone-shaped grit sump. De-gritted effluent flows out of the trays, over a weir and into an effluent trough. The grit slurry is pumped to a dewatering unit which produces a material that can be land-filled without further handing.

Retrofitting new grit facilities into the west pre-aeration tank would, however, cause flooding at the primary tanks and would increase the water surface in the existing pretreatment structure. Accordingly, this alternative would require that: 1) the primary tanks be removed from service and 2) redesign of the upstream pretreatment structure to accommodate a new higher hydraulic grade line.

Removal of the primary treatment process would have a negative impact on the trickling filters since the solids and organic loading on the trickling filters would increase. In fact, standard engineering practice is to install primary treatment upstream of trickling filters unless high efficiency fine screens are provided. Therefore, retrofitting new grit removal facilities into the pre-aeration location is not desirable.

Construction of a new concrete structure to contain more efficient grit capture equipment would be more costly than a retrofit application and properly locating these facilities downstream of screening would be a challenge, given the existing plant layout.

As a low cost alternative to high efficiency grit removal system described previously, the east and west pre-aeration tanks could be isolated and bypassed with all incoming flow directed to the primary tanks. The primary tanks would then serve as a grit collector. This option is currently available with the existing pipe and valve arrangement and would eliminate the discharge of corrosive foul air associated with pre-aeration. The extent of work required to enable these tanks to function as grit collectors, including the relocation of the digester supernatant discharge, would require further investigation during a future design phase.

Recommendation:

In the near-term, it is recommended that raw sewage flow bypass pre-aeration and be conveyed directly to the primary treatment tanks which will require modification to serve as grit collectors. This would reduce plant odors and corrosive gas emissions associated with blowing air into raw sewage. Captured grit would be removed with the raw sludge at a frequency determined by the rate of sludge accumulation. Grit loading is highest during wet weather events, so the removal frequency may need to be adjusted during these periods.

The plant would benefit from new dedicated, high efficiency grit capture equipment, although the increased complexity and cost associated with these new facilities does not warrant their construction in the near term. Should new, improved grit capture facilities be planned in the future, they should be coordinated with plans for the complete re-design of the plant headworks.

5.3.2.3 Primary Treatment

Existing Situation: Primary treatment consists of two rectangular settling tanks and associated raw sludge collection by mechanical chain and flight collectors and pumping equipment. The primary settling tanks receive and co-settle waste activated sludge that is pumped from the final clarifiers along with the raw sewage solids. Overflow from the sludge holding tank (former anaerobic digester) that is heavily laden with septic solids has been observed to recycle back into the primary tanks when sludge is pumped to the holding tank. The estimated removal of TSS and BOD_5 through the primary tanks is 60 percent and 30 percent, respectively.

The addition of waste activated sludge solids and solids from the sludge holding tank overflow hinders the ability of these tanks to perform as originally designed. *Ten States Standards* limits primary settling tanks that process waste activated sludge to 1,200 gallons per square foot per day at the peak hourly flow rate. Therefore, the rated capacity of the primary settling tanks is 720,000 gallons per day based on the current practice of sludge co-settling compared to the original design capacity based on the Contract 79-3 plant improvements of 1.56 million gallons per day (MGD).

Primary settling is typically provided ahead of trickling filters that have rock media. This serves to minimize problems with media clogging due to excessive solids loading. Properly sized fine screens can eliminate solids-related media clogging concerns if the screen field is capable of removing suspended solids material greater than or equal to 3 millimeters.

Analysis & Alternatives: Alternatives for primary treatment include: 1) maintaining and upgrading the existing primary treatment process, 2) construct additional primary settling capacity to comply with *Ten States Standards* criteria for sludge co-settling and 3) removing the primary treatment process, inclusive of primary settling tanks and associated sludge handling equipment.

Based on initial field observation and subject to further field inspection, upgrading the existing primary treatment process would consist of the following as a minimum:

- Concrete removal and replacement (notably at tank walls)
- Caulking of concrete joints
- Handrailing replacement to meet code requirements;
- Replacement of weirs on primary effluent launders;
- Replacement of telescopic sludge valves and valve stands;
- Replacement of tank drain valves and shafts

Construction of additional primary settling capacity is necessary to comply with *Ten States Standards* if co-settling with waste activated sludge is continued. The performance of primary treatment would improve, however, if co-settling with waste activated sludge is discontinued. This action would also restore the capacity of the primary settling tanks to 1.56 MGD.

Primary treatment serves to reduce the solids loading and BOD loading that is associated with settleable solids on downstream unit processes. Therefore, removal of the primary treatment process would impact downstream unit processes such as the trickling filters and the activated sludge system. The magnitude of the impact would require process modeling and analysis of the results to provide assurance that proper plant performance is maintained. Process modeling is beyond the scope of this study but should be undertaken as a future phase of work to confirm performance.

Recommendation: It is recommended that the primary treatment system be upgraded and improved as described previously. Capital investment in primary treatment provides one of the highest returns on capital investment compared to other wastewater treatment unit processes in terms of cost per pollutant removed. As well, loading reductions in primary treatment minimize operational problems in downstream biological treatment processes, lowers oxygen demand and decreases energy consumption. An additional benefit of primary treatment is that of equalizing variations in raw sewage quality, especially in cases where local industrial waste discharge is variable in strength and in volume.

Discontinuance of co-settling waste activated sludge with raw sludge will improve the performance of primary treatment and restore the rated capacity of this unit process from 720,000 GPD to 1.56 MGD; otherwise, if co-settling is continued, an expansion of primary treatment would be needed to comply with *Ten States Standards*. Handling of waste activated sludge is discussed further in Section 5.3.2.7 and Section 5.3.2.10.

5.3.2.4 Trickling Filters

Existing Situation: The two trickling filters were originally designed as "high rate" filters, based on the magnitude of their hydraulic and organic loading rates. Referring to Table 5-5, these filters are significantly under-loaded at present. This is because the current average daily plant flow (2012) is 30 percent of the design average value; and secondly, the organic strength of the wastewater is 55 percent of the design value. Although under-loaded, these filters remove up to 75 percent of the applied BOD load from primary treatment.

The trickling filters show evidence of media clogging which results in localized areas of ponding on the media surface. This situation can result from the absence of raw sewage screening.

The physical condition of the rotary distributor (center column) and rotary distributor arms is poor as evidenced by severe corrosion and leakage at each location. The distributor rams are prone to plugging, a condition that can be eliminated with a properly sized raw sewage screen. The concrete walls that contain the filter media are in excess of 40 years old and are badly spalled and in need of repair.

Table 5-4
Trickling Filters
Comparison of Design vs Actual Loading

Parameter	Design	Current (2012)	Typical Range
Hydraulic Loading			
@ Average Day	152 gpd/ft^2	47 gpd/ft^2	
@ Peak	316 gpd/ft^2	228 gpd/ft^2	230-900 gpd/ft^2
Organic Loading			
BOD	581 mg/L	322 mg/L	
@ Average Day	71 lb/day/1000 ft^3	12 lb/day/1000 ft^3	
@ Peak	138 lb/day/1000 ft^3	70 lb/day/1000 ft^3	30-150 lb/day/1000 ft^3

** Loadings based on both filters in use and does not include recycle
Average daily plant flow in 2012 was 230,000 gallons
The peak condition for current (2012)is based on the peak day flow

The two recirculation pump and two (filter effluent) transfer pump motors were originally equipped with variable frequency drive units. Each set of pumps has been replaced with constant speed motors whose start/stop operation can contribute to inconsistent flows being delivered to the filters (recirculation pumps) as well as the intermediate clarifiers (transfer pumps).

Analysis & Alternatives: Alternatives evaluated for the trickling filters include: 1) removing the trickling filters, 2) upgrading the existing filters and 3) converting the filters to another process function.

In spite of their age and present condition, the trickling filters deliver very good pollutant removal performance. Without this unit process, the activated sludge system would require expansion to accommodate the increased loading that the trickling filters currently remove. Accordingly, the option of removing the filters from the flow path is not considered a cost effective pursuit and will not be considered further.

Based on field observation and subject to further field inspection, upgrading the existing trickling filters would consist of the following as a minimum at each:

- Concrete removal and replacement (at tank walls);
- Replacement of rotary distributor arms;
- Replacement of rotary distributor (center column);
- Installation of variable frequency drives on recirculation pump motors to provide improved control of recirculation rate;
- Redesign of the trickling filter splitter box to improve flow distribution and eliminate entrapment of scum and other floating debris;
- Replacement of rock media with plastic media

Replacement of the rock media with plastic media would reduce clogging and improve performance. Another benefit associated with use of plastic media is that primary treatment could be eliminated if raw sewage fine screening down to 3 millimeters is provided. The magnitude of this impact would require process modeling and analysis to confirm proper performance is maintained without primary treatment. Process modeling is beyond the scope of this study but should be undertaken as a future phase of work to confirm performance of the trickling filters without primary treatment.

Conversion of the existing trickling filters to another process function would require an expansion of the activated sludge system to accommodate the incremental load. This is not considered a cost effective option and will not be considered further.

Recommendation: The trickling filter/activated sludge process functions is an integrated system with the design of the activated sludge process dependent upon the performance of the filters. As such, the trickling filters should be retained and upgraded as described previously to maintain the integrity and reliability of the system. Otherwise, costly improvements to the activated sludge system, including additional aeration tank capacity and final clarifiers, would be needed if the filters were eliminated from service or re-purposed. Therefore, it is recommended that the trickling filters be retained for use and upgraded as described previously.

5.3.2.5 Intermediate Clarifiers

Existing Situation: The two intermediate clarifiers remove the solids produced in the trickling filters before the partially treated flow enters the activated sludge system. These tanks have been very conservatively designed with an 810 gpd/ft^2 overflow rate at the peak design flow and are currently under-loaded at current flows.

Flow is pumped to the intermediate clarifiers from the transfer pump wet well via an 8-inch pipe. Flow is distributed to each clarifier and the accumulated sludge is removed manually via telescopic valves and flows by gravity via a 10-inch pipe to the waste sludge well located on the west side of the pump station. From this location, the sludge is combined with co-settled waste activated and primary sludge and pumped to the sludge storage tank.

The condition of the clarifiers is fair with a substantial amount of corrosion on the steel weirs and drive platform and concrete spalling was noted on the exposed walls of each clarifier. The electrical conduit serving the sludge collector drives, mounted under the drive platform, is heavily corroded and broken in some locations.

Analysis & Alternatives: Alternatives evaluated for the intermediate clarifiers include: 1) removing the intermediate clarifiers, 2) maintaining and upgrading the existing filters and 3) converting the intermediate clarifiers to another process function.

It has been reported that the reduced oxygen demand afforded by intermediate clarification is typically considered less significant than the savings in capital and operating costs gained by eliminating intermediate clarification. Although this makes a case for the removal of the intermediate clarifiers, it is more desirable to provide a means to bypass the intermediate clarifiers, rather than removing them.

The option to pump directly to the aeration tank flow splitter from the transfer well could be undertaken at relatively low cost and provide additional operational flexibility in managing plant flows. Redirecting the return sludge flow to the aeration tank flow splitter could also be accomplished cost-effectively.

Secondly, maintaining and upgrading the intermediate clarifiers would consist of the following:

- Concrete removal and replacement (at tank walls);
- Replacement of the steel weirs with fiberglass reinforced plastic weirs
- Abrasive blasting and coatings application on collector drive platforms and walkways
- Installation of variable frequency drives on the transfer pump motors to provide more cost effect pumping of flows to subsequent treatment.

Conversion of the intermediate clarifiers to another process function is possible if a means is provided to bypass the intermediate clarifiers and direct the return sludge flow and pumped flow from the transfer wet well directly to the aeration tank flow splitter. The intermediate clarifiers have a combined capacity of 133,000 gallons. These tanks could be converted to aerobic digesters to stabilize and reduce the mass of sludge solids and provide an additional option to the Village for sludge disposal and re-use.

Recommendation: It is recommended that a means be provided to direct flow from the transfer pumps to the aeration tank flow splitter to provide the plant operators with the option to bypass the intermediate clarifiers and convert the clarifiers to aerobic digesters in the future. A field trial of bypassing the intermediate clarifiers and directing trickling filter effluent to the aeration basins should be undertaken and evaluated prior to the conversion of the intermediate clarifiers to aerobic digesters.

The digesters should be equipped with the capability to be decanted with the supernatant returned to the primary settling tanks. In addition, due to their present physical condition, the intermediate clarifiers should be upgraded as described above, pending further investigation.

5.3.2.6 Aeration Basins

Existing Situation: The mixed liquor that is formed at the intermediate clarifiers flows by gravity through a 16-inch pipe to the aeration tank flow splitter where flow is distributed to each of three aeration basins via an 8-inch pipe. Flow then proceeds in through the three tanks in parallel. The hydraulic detention time at the design for of 0.75 MGD is 8.8 hours. At the current average daily flow of 0.23 MGD, the detention time is approximately 29 hours.

A total of eight, two-speed surface aerators have been installed to oxygenate the mixed liquor. Surface aerators are less efficient than the energy efficient fine pore diffused aeration systems; however, due to the fact that the plant is under-loaded, only one surface aerator is typically operated at low speed in each tank.

Mixed liquor from each tank discharges over a weir and exists from each tank through an 8-inch pipe. Each 8-inch pipe joins a common 16-inch header pipe which directs flow to the final

Recommendations: The activated sludge system which includes the aeration tanks, final clarifiers and return sludge pumping system is essential to producing a nitrified effluent meeting the conditions of the NPDES discharge permit. Therefore, alternatives were not explored for this unit process but suggested ways to improve, even enhance the operation of the activated sludge system are proposed. These are discussed below.

- The wood baffle installed upstream of the tank outlet weir traps scum and floatables and should be removed;
- Piping should be provided to enable the aeration tanks to be operated as three tanks in series; this will eliminate flow imbalances associated with parallel tank operation and provide additional operational flexibility;
- Replacement of surface aerators with fine pore diffused aeration should be considered to reduce energy costs, reduce maintenance and improve sludge settleability; this would include electrical demolition and mechanical removal of the surface aerators, draft tubes and removal of the concrete walkways that support the aerator equipment;
- Replacement of handrailing to meet code requirements.

In addition to the above proposed improvements, consideration should be given to removing one of the aeration tanks from service, given the current under-loaded condition of the plant and the excessive hydraulic detention time under aeration.

Secondly, the existing dual biological systems consisting of attached growth trickling filters and suspended growth activated sludge limits the ability of the aeration tanks to accomplish biological phosphorus removal. Biological phosphorus (bio-P) removal depends upon an adequate supply of soluble carbon (soluble BOD) in the form of volatile fatty acids to enable bio-P to occur under alternating anaerobic/aerobic conditions.

The performance of the trickling filters upstream of the aeration basins effectively reduces the soluble BOD such that bio-P would not be expected to occur. For this reason, future NPDES requirements to remove phosphorus from the plant effluent should consider chemical addition. This is discussed in Section 6.

5.3.2.7 Final Clarifiers/Return Sludge Pumping

Existing Situation: The two final clarifiers are shallow at 9 feet side water depth, but have a conservative surface loading rate of 662 gpd/ft^2 at the peak flow. The clarifiers have unequal tank diameters and each tank has a unique means of distributing influent flow and removing settled sludge. Aeration tank effluent enters a splitter box which divides the flow using slide gates. A 12-inch gate directs flow to the small clarifier, while a 24-inch gate directs flow to the larger tank.

The larger (45 foot diameter) clarifier has a center feed column which distributes flow outward in a radial fashion. The center column also supports the tank walkway and drive platform. A single rotating arm equipped with suction orifices is used to remove settled sludge. Settled sludge flows through the orifices into a header that is connected to a suction manifold. A telescopic valve installed on the manifold is used for sludge flow control. Plugging of the telescopic valve and orifices on the suction header is a significant problem that routinely occurs and which would be eliminated with the installation of a raw sewage fine screen. A surface skimmer has been provided which removes floatable materials from the tank surface and conveys these materials to the return sludge well.

The older and smaller (30 foot diameter) clarifier has a peripheral influent feed arrangement whereby flow is directed inward. Settled sludge is scraped to the center of the tank using a rotating sludge collector mechanism fitted with plows. Settled sludge is removed through a telescopic sludge valve which also routinely plugs with rags and debris. This tank also has a peripheral skimmer that removes floatables between the tank wall and scum baffle to the return sludge well.

The return sludge well located next to the large final clarifier is aerated to prevent septic conditions from developing and to limit settling. The three original return sludge pump motors were equipped with variable frequency drive motors. These pumps have since been replaced with comparably sized constant speed motor driven non-clog centrifugal pumps. Return sludge is metered through a 4-inch magnetic flow meter and is pumped to and combines with effluent from the intermediate clarifiers. Wasting activated sludge to the primary settling tanks is a manual operation which occurs on a daily basis or at an as-needed frequency.

The physical condition of the final clarifiers is fair to good. The exposed steel surfaces on each tank are heavily corroded and in need of replacement or re-coating. The chain link fencing installed around the perimeter of the small tank does not meet code requirements. Aside from recurrent valve and orifice plugging due to the lack of raw sewage screening, the mechanical condition of the equipment is in good shape.

A skimmings handling system has not been provided for floatables that are skimmed from tank surfaces; consequently, these materials are recycled through the plant and tend to buildup in the aeration tanks, return sludge well, clarifier inlets and flow splitting structures.

Recommendations: As with the aeration tanks, alternatives were not explored for the final clarifiers because the final clarifiers are considered an integral plant unit process. Suggested ways to improve the reliability and improve the operation of these clarifiers are proposed. These are discussed below.

- Installation of variable frequency drives on the return sludge pump motors to provide improved and more cost effective control of return sludge flow;

- Elimination of co-settling waste activated sludge with raw sludge solids which reduces primary treatment capacity (Refer to Section 5.3.2.10 for proposed plan);
- Replacement of chain link fencing around small tank perimeter with code-compliant aluminum railing;
- Abrasive blasting and re-coating of exposed steel surfaces, inclusive of steel platforms and walkways;
- Installation of automated "algae sweep" brush cleaning equipment for weir and weir launder surfaces;
- Construction of a skimmings well and pump station that is designed to eliminate the recycling of tank skimmings which tend to accumulate within the plant.

Figure 5.2
"Algae Sweep" Cleaning Equipment for Exposed Clarifier Surfaces

5.3.2.8 Effluent Disinfection

Existing Situation: The plant effluent is disinfected prior to Stillwater River discharge using a chlorine solution system. Components of this system include: 150-pound chlorine gas cylinders, two manually adjustable chlorinators, a chlorine diffuser and a contact tank that has been correctly sized to provide 15 minutes of detention time at the peak hourly flow.

Flow from each final clarifier is routed to Manhole 3 and chlorine solution is delivered through a diffuser into the combined effluent at this location. The 12-inch plant effluent pipe conveys flow to the 2-pass west contact tank after which time it continues through a second 2-pass tank that was added under contract 79-3.

Liquid sodium thiosulfate is drip-fed at the post aeration tank inlet to de-chlorinate the plant effluent to comply with NPDES permit conditions.

Plant effluent flow is measured at the v-notch weir overflow of the chlorine contact tank with an ultrasonic level sensor. During periods of high river stage, river water backs into the chlorine contact tank through the plant outfall pipe and submerges the v-notch weir, thus rendering the flow meter ineffective and limiting the plant's ability to manage and treat wet weather induced high flows. This occurs at the 25-year flood (El. 885.40).

In addition, the top of concrete at the chlorine contact tank and post aeration basin is located at El. 883.38 which is below the base (100 year) flood elevation of 887.50. During base flood occurrence, these structures would be fully submerged and useless.

Analysis & Alternatives: The existing chlorine-based effluent disinfection system costs an estimated $2,400 per year to operate (Note: the chlorine usage rate has increased recently from 3 pounds per day to, at times, 4-5 pounds per day for unknown reasons). The majority of this cost is associated with the purchase of chlorine gas cylinders ($2,070/year) and the balance for the cost of dechlorination using sodium thiosulfate liquid. The combined cost does not include any maintenance associated with parts replacement or other maintenance. Replacement of the chlorine-based disinfection facilities with an ultraviolet light disinfection system is analyzed below.

Ultraviolet (UV) light disinfection is a physical process in which ultraviolet energy is absorbed into bacterial cells and preventing their reproduction. Low-pressure mercury arc-lamps are the most efficient and effective source of UV radiation for disinfection systems. One of the principal advantages of UV light disinfection is that it leaves no residual by-product in the plant effluent that could affect aquatic life in the receiving stream. Contact times are typically short, on the order of 60 seconds or less. For this reason, UV light systems do not take up much space and long, narrow, shallow channels are typical.

UV light disinfection systems are designed as modules with each module capable of being isolated from the others for maintenance. These systems require periodic cleaning to remove biological growth and scale associated with water hardness.

The proposed location for installing the UV light disinfection system is in the chlorine contact tank, immediately adjacent to the post aeration tank. The overall length of the UV channel inclusive of space for control weir would measure an estimated 20 feet long x 18 inches wide x 20 inches deep. Refer to Appendix D for catalog cutsheets of a low pressure UV light disinfection system consisting of two banks in series with each bank having 6 modules and each module furnished with 4 lamps for a total of 48 lamps. The total estimated cost to operate the UV disinfection system is presented in Table 5-6.

Table 5-5 UV Disinfection System Estimated Annual Costs	
Current Average Flow, gpd	230,000
Design Average Flow, gpd	750,000
Peak Hourly Flow, gpd	1,560,000
Parameter	**Estimate**
UV Banks in Operation	One
Yearly Usage	4,380 hours (6 months)
Lamps in Use	24
Energy Use	2.1 KW
Energy Unit Cost	$0.06/KW-hr
Estimated Yearly Energy Cost	**$552/year**
Average Lamp Replacement	8 lamps/year
Lamp Replacement Cost	**$480/year**
Total Estimated Operating Cost	**$1,032/year**

Based on the above analysis, an estimated $1,038 per year in operation and maintenance savings can be realized with the UV disinfection system.

Recommendations: Ultraviolet (UV) technology provides a proven, accepted and environmentally friendly method of disinfecting wastewater. In contrast to chemical disinfection, UV produces no by-products. It also eliminates the risk to plants operators associated with handling dangerous chemicals. Two major advantages of UV disinfection versus chemical methods are increased disinfection effectiveness (especially against viruses) as well as space-savings due to shorter reaction times. Since no chemicals are introduced to the water, no post-treatment (i.e. dechlorination) is required to remove chemical by-products before discharge to the environment.

In the construction of new wastewater treatment plants, UV light disinfection is most often selected for disinfection because of the cost savings in both initial construction and long term operation. UV is the only cost-effective disinfection alternative that does not have the potential to create or release carcinogenic by-products into the environment. In addition, UV is an effective disinfectant for chlorine-resistant protozoa like *Cryptosporidium* and *Giardia*. While unregulated in wastewater, these harmful protozoa, if left untreated, can find their way into drinking water intakes located downstream of the wastewater treatment plant.

In retrofitting to existing plants, the operation and maintenance cost savings associated with UV disinfection does not often provide a reasonable return on the capital investment to purchase UV equipment and modify existing structures or build new structures to accept the equipment. For this reason, although annual cost savings can be realized, the return on investment associated with the retrofit of UV disinfection equipment into the plant would not be realized within the anticipated 20-year life span of the equipment.

For this reason, it is recommended that the Village continue with chlorine-based disinfection unless other factors such as operator health and safety or new regulatory drivers bring about a clear need to convert to UV light disinfection.

5.3.2.9 Post Aeration/Effluent Pumping

Existing Situation: Aeration of the plant effluent, referred to as post-aeration, is often necessary to ensure that NPDES permit requirements are met. The WWTF is required to produce an effluent having a dissolved oxygen concentration no less than 6.0 mg/L at the discharge outfall. This is being met consistently by the facilities provided which consist of a post aeration basin which measures 12 feet by 7 feet , two small centrifugal blowers and a diffused air system installed in the post aeration tank.

Recommendations: There is a critical need to provide an effluent pumping station to ensure plant safety, to protect the plant from flooding and to enable the measurement of effluent flow rate during high river stage. The preferred location of the pump station is between the post aeration basin and the plant outfall.

The pump station is proposed as a submersible station having three pumps capable of delivering the peak hourly flow of 1.56 MGD with one pump out of service. The pumps would normally be off-line with plant effluent conveyed by gravity to the plant outfall via existing Manhole 7. A level sensing system would be installed in Manhole 7 to monitor river stage.

Two motorized gates would be installed in the post aeration basin. The outlet gate to the Manhole 7 would be in the "normally open" position and the gate to the effluent pumping station would be in the "normally closed" position. When the water level in the Manhole 7 reaches a pre-determined maximum, the gate to the effluent pump station would be called to open and the "normally open" gate to the Manhole 7 would be called to close. At this stage, the flow would be directed into the submersible effluent pump station and be pumped via force main to Manhole 7. As part of this work, Manhole 7 will need to be raised about 5.5 feet so that it extends two feet above the 100-year base flood elevation of 887.50. The top of casting at Manhole 7 is presently at El. 884.00.

After the level in the manhole recedes, the motorized gates would be called to resume their "normal" positions.

As part of the plant effluent pump station, a drain line from each chlorine contact tank to the pump station wet well is recommended to facilitate the bi-annual draining and cleaning of these tanks. The pump discharge is recommended to be configured to enable the chlorine contact tank drainage to be pumped to the sludge drying beds via a hose connection or buried piping.

5.3.2.10 Solids Handling, Storage and Disposal

Existing Situation: Plant sludge is comprised of raw sludge from primary settling, trickling filter humus from the intermediate clarifiers and waste activated sludge from the final clarifiers. Waste activated sludge is pumped to and co-settled with raw sludge in the primary settling tanks and sludge from the intermediate clarifiers is combined with the co-settled sludge in the sludge wells. The combined sludge is pumped to the former anaerobic digester for storage and eventual removed from the plant on a weekly basis by a contract hauler. Records obtained from the Village indicate that the cost to haul sludge from the plant is $47,000 per year.

The 25 foot diameter sludge gravity thickener was originally designed to thicken sludge prior to anaerobic digestion. Lime addition facilities have been provided to provide alkaline stabilization of the sludge if the anaerobic digester is out of service. Problems with the operation of the gravity thickener years ago resulted in the decision to decommission and not utilize this tank to thicken sludge. Its present physical condition is fair. The sludge collector drive platform and steel weir plates are heavily corroded.

The existing 40 foot diameter digester tank is no longer used to anaerobically stabilize the sludge solids, but is used to store sludge generated by the plant. It is suspected that the tank is full of grit, grease and other unwanted debris such as rags and plastics that have accumulated over the years and consume needed storage volume. This condition often contributes to the displacement of septic sludge through the 6-inch digester supernatant pipe when sludge is pumped to the tank for storage. The supernatant pipe currently discharges to the east pre-aeration tank.

Within the digester control building, the existing gas compressor, boiler and heat exchanger are very old and have not been used in years. Accordingly, this equipment is in poor to fair condition and would require significant expense to recondition. The space inside the building should be classified as a Class 1, Division 2 area which requires additional ventilation to meet NFPA 820 requirements. At present, the building is under-ventilated.

Outside the building, the exposed floating gas cover, pressure/vacuum relief valve and flame arrestor and waste gas burner are corroded and in poor condition and are likely unsafe.

A total of six sludge drying beds have been installed on the north end of the plant. The process of sludge drying is not being utilized currently since liquid sludge is hauled from the plant on a weekly basis. The drying beds are in good condition, although the condition of the 8-inch drain lines leading from the drying beds to the transfer wet well could not be verified. The combination of the digester storage tank and sludge drying bed volume provides an estimated 344 days of on-site sludge storage volume.

Analysis & Alternatives: Standards for the use or disposal of sewage sludge are contained in 40 CFR Part 503. Part 503 establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in Part 503 are pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site.

The plant would benefit from an improved solids management strategy that would reduce the present cost of liquid sludge disposal yet produce a reusable sludge product that could be land-applied or land-filled. At the present time, the sludge being generated is not being stabilized through aerobic, anaerobic or alkaline sludge treatment techniques to remove pathogenic bacteria. Each of these techniques is classified as a process to significantly remove pathogens (PSRP) as listed in 40 CFR Part 503.

Sludge handling alternatives considered include: 1) maintain current practice of handling and removing liquid sludge from plant via contract hauler, 2) anaerobic sludge stabilization and dewatering, 3) aerobic sludge stabilization and dewatering, 4) no sludge stabilization followed by dewatering and land-filling and 5) no stabilization followed by land application.

Maintain the Current Practice of Hauling Liquid Sludge costs the Village $47,000 per year (based on 2012 records). Approximately 96% of this cost is for hauling water. The equivalent cost to haul sludge on a dry solids basis is $0.60 per pound of dry solids, based on 4% total solids content of the hauled sludge. Since most of the sludge volume being hauled is in the form of water, the current practice of hauling liquid sludge is not a cost effective means of solids disposal.

Anaerobic Sludge Digestion has been used for plants with flows less than 1 MGD; however, comparative analysis typically shows that this process becomes more cost effective for plants with average wastewater flows greater than 2 MGD. Use of anaerobic sludge digestion at the Covington WWTF would require that the existing equipment within the digester control building be re-conditioned or completely replaced at a significant cost. The condition of the piping and equipment inside the digester is not known but it is suspected that the digester would have to be completely cleaned of the debris that has accumulated in the tank. Additionally, a new mixing system would be required to ensure that the digester is properly mixed and functions as intended. The benefits associated with an investment of this magnitude would not justify the cost. For this reason, anaerobic sludge digestion is not considered further.

Aerobic Sludge Digestion functions similar to the activated sludge system. The objective is to produce a stable sludge product by oxidizing sludge organisms and other biodegradable organic and nitrogenous materials and reduce the sludge mass and volume. This could be accomplished by converting the two intermediate clarifiers, having a total volume of 133,000 gallons, into aerobic digesters. The main disadvantage is the relatively high energy cost associated with aeration, nutrient recyle impacts and reduced efficiency in cold weather.

No Sludge Stabilization Followed by Sludge Dewatering/Land-filling would consist of pumping all plant sludge to the existing gravity thickener where the combined sludge would be mechanically or aerobically mixed. Modifications to the gravity thickener would be necessary to convert this tank to a holding tank. Sludge would then be pumped from the thickening tank via existing 6-inch sludge bed influent piping to a fabric (polypropylene) sludge dewatering bag system installed in two 20 cubic yard steel roll-off containers placed on the existing sludge drying beds. A polymer feed system would be necessary to flocculate the sludge solids before entering the sludge dewatering bags.

The dewatering bags would retain the sludge solids and release free water which would escape the roll-off container, percolate through the sand beds, collect in the 6-inch sludge bed drains and be conveyed to the transfer wet well. A preliminary economic analysis of this alternative (Refer to Appendix E) has indicated that dewatering the sludge in this manner and disposing at a local land-fill would result in a sludge disposal cost of $0.16 per pound of dry solids. Disposal of the dewatered sludge solids at a local land-fill transfer station would result in an estimated cost of $0.22 per pound of dry solids. In either case, the capital investment is low and the savings are worthy of a full-scale pilot investigation to confirm the economics of this option.

No Sludge Stabilization Followed by Sludge Dewatering/Land-application is similar to the above option with the exception of applying the dewatered sludge on local agricultural fields rather than land-filling. This option would require the additional capital expense of purchasing necessary field equipment suited for land-application of dewatered sludge solids or this service could be contracted to a local hauler. If self-performed, the Village must identify and secure local fields, obtain regulatory approval to inject or incorporate the sludge below the soil surface within specified time periods, maintain careful accounting of the sludge application rates and comply with 40 CFR 503 requirements.

Recommendations: In the near term, it is recommended that the Village conduct a full-scale pilot evaluation of using sludge dewatering bags to confirm the economics of this sludge management option. In the longer term, subject to the outcome of the pilot investigation, proceed with necessary modifications to the existing gravity thickener and install permanent polymer feed system to facilitate the sludge dewatering process.

Land application of liquid sludge by the Village would require that the sludge be injected below the soil surface using tractor drawn tank wagons with injection shanks and tank trucks fitted with flotation tires. This equipment minimizes odor problems and reduces ammonia volatilization by immediate mixing of soil and sludge.

Injection can be used either before planting or after harvesting crops, but it is likely to be unacceptable for forages and sod production. Some injection shanks can damage the sod or forage stand and leave deep injection furrows in the field. Subsurface injection will minimize runoff from all soils and can be used on slopes up to 15%. Injection should be made perpendicular to slopes to avoid having liquid biosolids run downhill along injection slits.

Dewatered sludge can be applied to cropland by equipment similar to that used for applying animal manure. Typically, dewatered biosolids will be surface-applied and incorporated by plowing or another form of tillage. Biosolids application methods such as incorporation and injection can be used to meet 40 CFR 503 vector attraction reduction requirements.

6.0 PROPOSED PLAN AND PRIORITIZATION OF IMPROVEMENTS

A summary of the proposed improvements at the Covington WWTF is provided in Table 6-1 based on the analysis presented in Section 5.0 Each improvement is numbered by the order in which it was developed. Order of magnitude cost estimates for the priority 1 improvements follow in Table 6-2. Individual descriptions for each proposed improvement, including prioritization, benefits and implementation are provided in a tabular format following Table 6-2.

Table 6-1
Village of Covington Wastewater Treatment Facility
Proposed Improvements

No.	Improvement Description	Priority
I-1	Replace Raw Sewage Grinder with Fine Screen	1
I-2	Bypass/Decommission Pre-Aeration Tanks	2
I-3	Upgrade Existing Primary Treatment Facilities	2
I-4	Upgrade Existing Trickling Filters	2
I-5	Convert Intermediate Clarifiers to Aerobic Digesters	2
I-6	Upgrade Existing Aeration Tanks	2
I-7	Upgrade Existing Final Clarifiers and Sludge Pumping	2
I-8	New Effluent Pump Station	1
I-9	Convert Existing Gravity Thickener to Mixed Sludge Holding Tank	1
I-10	New Sludge Dewatering Facilities – Pilot Investigation	1
I-11	New Chemical Feed System for Phosphorus Control	3
I-12	New Scum Handling Facilities	2
I-13	Sludge Digester Cleanout/Demolition of Anaerobic Digester Equipment	3

Table 6-2a
Preliminary Opinion of Construction Costs
Priority 1 Proposed Improvements

No.	Improvement Description	Cost
I-1	Replace Raw Sewage Grinder with Fine Screen	$190,000
I-8	New Effluent Pump Station	$280,000
I-9	Convert Existing Gravity Thickener to Mixed Sludge Holding Tank	$ 75,000
I-10	New Sludge Dewatering Facilities – Pilot Investigation	$ 20,000
	Total Estimated Cost	$565,000

Table 6-2b Preliminary Opinion of Construction Costs Priority 2 Proposed Improvements		
No.	**Improvement Description**	**Cost**
I-2	Bypass/Decommission Pre-Aeration Tanks	$15,000
I-3	Upgrade Existing Primary Treatment Facilities	$110,000
I-4	Upgrade Existing Trickling Filters	$350,000
I-5	Convert Intermediate Clarifiers to Aerobic Digesters	$150,000
I-6	Upgrade Existing Aeration Tanks	$115,000
I-7	Upgrade Existing Final Clarifiers and Return Sludge Pumping	$150,000
I-12	New Scum Handling Facilities	$70,000
	Total Estimated Cost	$960,000

Table 6-2c Preliminary Opinion of Construction Costs Priority 3 Proposed Improvements		
No.	**Improvement Description**	**Cost**
I-11	New Chemical Feed System for Phosphorus Control	$35,000
I-13	Sludge Digester Cleanout & Demolition of Anaerobic Digester Equipment	$140,000
	Total Estimated Cost	$175,000

I-1 Replace Raw Sewage Grinder with Fine Screen — Priority 1

Description of improvement:

- This improvement would replace the existing raw sewage grinder located in the pretreatment structure with a new fine screen and screenings dewatering and bagging unit.

Benefits:

- Replaces the "shred-and-release" method of grinding with a "screen-and-remove" approach for the management of incoming raw sewage debris..
- General improvement to all downstream unit processes.
- Prevent damage to equipment and instrumentation.
- Reduce maintenance associated with clogging.

Implementation:

- Modification of the existing pretreatment structure is necessary to accommodate new screen.
- New screen would benefit from a masonry block structure to protect equipment from freezing weather and enable maintenance to be performed in inclement weather conditions.
- Fine screen will require higher headloss which will increase water level in channel.

I-2	Bypass/Decommission Pre-Aeration Tanks	Priority 2

Description of improvement:

- This improvement would remove the (2) existing pre-aeration tanks from service and bypass incoming raw sewage directly to primary treatment.

Benefits:

- Eliminates the odors and corrosive gas that is expelled when aerating raw sewage.
- Eliminates the cost associated with aerating raw sewage.
- Transfers grit load that escapes upstream grit capture to primary tanks.

Implementation:

- Requires the relocation of the 6-inch digester supernatant discharge pipe from the east pre-aeration tank to the primary influent channel.
- Requires some modification of primary tanks such as influent flow baffle installation to improve grit capture.
- A new higher efficiency grit capture system of the type described in this report should be planned for the future.

I-3	Upgrade Existing Primary Treatment Facilities	Priority 2

Description of improvement:

- Upgrade the existing (2) primary treatment tanks as described in Section 5.3.2.3 due to deteriorating physical condition (also refer to the improvements described in I-2-Bypass/Decommission Pre-Aeration Tanks).

Benefits:

- Prolong and protect asset life.
- Restore peak treatment capacity if sludge co-settling is discontinued.
- Improve grit capture.
- Improve process performance.

Implementation:

- Primary treatment upgrade is necessary only if the trickling filters are utilized. Replacement of trickling filter rock media with plastic media could eliminate the need for primary treatment if fine screening is provided.

I-4	Upgrade Existing Trickling Filters	Priority 2

Description of improvement:

- Upgrade the (2) existing trickling filters as described in Section 5.3.2.4, including replacement of center column rotary distributors, distribution arms, installation of VFDs on recirculation pumps, re-design of influent splitter box, concrete repair in each tank and optional replacement of existing rock media with plastic media.

Benefits:

- Prolong and protect asset life.
- Improve process efficiency (plastic media would provide increased surface area, improved airflow and hydraulic capacity).
- Eliminate ponding of media.

Implementation:

- The trickling filter/activated sludge process functions as an integrated system with the design of each system dependent upon the other.
- Energy requirements are low compared to aeration tank surface aerators.
- One tank would be removed from service at a time with work performed and completed before work on the other filter begins.

I-5	Convert Intermediate Clarifiers to Aerobic Digesters	Priority 2

Description of improvement:

- A process option to bypass the existing intermediate clarifiers would be provided; trickling filter effluent and return sludge flow would be pumped directly to the aeration tanks which would enable the intermediate clarifiers to be utilized as aerobic sludge digesters (Refer to Section 5.3.2.10).

Benefits:

- Better use of existing tanks.
- Reduction in sludge volume.
- Sludge stabilization via aerobic digestion would provide sludge disposal options to Village.

Implementation:

- Conversion work would include plugging existing 16-inch clarifier effluent piping, re-routing the flow from the transfer well and return sludge pumps to the aeration tank flow splitter, modification to the existing aeration tank flow splitter, concrete repairs in each intermediate clarifier, re-coating existing steel surfaces, removal of sludge scrapers and telescopic sludge valves and installation of blowers and diffused aeration and a decanting system to remove and recycle digester supernatant.
- Conversion work should be undertaken only after a field trial of bypassing the intermediate clarifiers and directing trickling filter effluent to the aeration basins is performed and evaluated.

I-6	Upgrade Existing Aeration Tanks	Priority 1

Description of improvement:

- This improvement consists of replacing the (8) existing surface aerators with a more efficient diffused aeration system and piping modifications to enable the (3) aeration tanks to operate in series.

Benefits:

- Reduced energy costs.
- Improved operational flexibility.
- Removal of floatables entrapment

Implementation:

- Aeration tanks would undergo modification one tank at a time and be completed before work on the other tanks is initiated.
- Consideration should be given to remove one aeration tank from service due to low-loaded conditions.

I-7	Upgrade Existing Final Clarifiers & Sludge Pumping	Priority 2

Description of improvement:

- This improvement consists of improving the physical condition of the (2) final clarifiers and installing VFDs on the return sludge pumps.

Benefits:

- Prolong and protect asset life.
- Improved operational control of return sludge pumping.

Implementation:

- The final clarifiers would undergo modification one tank at a time and be completed before work on the other tank is initiated.
- New brush cleaning equipment for weirs and weir launder surfaces, aluminum handrailing and recoating of existing steel surfaces are included with this improvement.

I-8	New Effluent Pump Station	Priority 1

Description of improvement:

- At high Stillwater River stage, water backs into the WWTP which floods existing structures, reduces treatment capacity and renders effluent flow monitoring ineffective. This improvement consists of constructing a submersible pump station located between the post aeration tanks and plant outfall.

Benefits:

- No flooding of structures.
- Improved treatment capacity at high river stages.
- Improved effluent flow monitoring.

Implementation:

- Effluent pumping is a critical plant need. The proposed work is described in Section 5.3.2.9.

I-9	Convert Gravity Thickener to Sludge Holding Tank	Priority 1

Description of improvement:

- The existing gravity thickener is not currently in use. This improvement consists of making modifications necessary to convert this tank to a mixed sludge holding tank. All plant sludge will be pumped to this tank where it will be mixed and thickened, then pumped from this tank to sludge dewatering facilities.

Benefits:

- Existing tankage restored to functional usage.
- More cost effective sludge handling strategy compared to current sludge management.

Implementation:

- This work will be coordinated with full-scale pilot demonstration of sludge dewatering activities using fabric bags placed in roll-off containers (Refer to Improvement I-10)

I-10	Full Scale Pilot Demonstration Sludge Dewatering Facilities	Priority 1

Description of improvement:

- Sludge is presently stored in the former anaerobic digester and is hauled by an outside contractor as a liquid from the plant on a weekly basis. The cost to haul the liquid sludge is approximately $0.60 per pound of dry solids. The cost to haul dewatered solids is estimated to be $0.22 per pound of dry solids. This improvement will consist of a full-scale pilot demonstration of sludge dewatering at the plant site using fabric bags placed in roll-off containers. The roll-off containers will be placed in designated sludge drying beds.

Benefits:

- Savings in sludge handling costs.
- Existing drying beds restored to functional use.

Implementation:

- Implementation would consist of contracting with a supplier of sludge dewatering bags (U.S. Fabric) and arranging for roll-off container leasing through Rumpke. A polymer feed system will be required to feed a cationic polymer into the sludge stream to flocculate the sludge solids and release water.

I-11	Chemical Feed System for Phosphorus Control	Priority 3

Description of improvement:

- The existing trickling filter/activated sludge biological treatment system does not allow for effective biological phosphorus removal due to the low BOD levels in the aeration tank influent. Accordingly, if future regulatory policy requires phosphorus removal by dischargers on the Stillwater River, then a chemical feed system will be necessary to control effluent phosphorus concentrations down to 1.0 mg/L. Effluent phosphorus concentrations required below a level of 1.0 mg/L will require supplemental treatment such as tertiary filtration to reliably comply with lower phosphorus concentrations.
- Chemical feed system would be designed for liquid alum, ferric chloride or some other cost effective chemical that would be fed to the mixed liquor flow splitter box, upstream of the final clarifiers.

Benefits:

- Low cost control of effluent phosphorus.

Implementation:

- This work should not be implemented until such time that total phosphorus limits are imposed.

I-12	New Scum Handling Facilities	Priority 2

Description of improvement:

- The plant lacks a means to remove scum, skimmings and other floatables from tank surfaces. These materials are recyled back through the plant and tend to accumulate in aeration tanks, flow splitters, sludge storage and other quiescent areas.
- This improvement consists of installing a submersible scum handling pump station that would accept skimmings removed from the final clarifier skimmers and instead of being conveyed to the return sludge well. Skimmings would be pumped to the aerobic digesters for further treatment.

Benefits:

- Eliminate the entrapment of floatable materials within plant.

Implementation:

- This work should be undertaken in conjunction with upgrading of the final clarifiers (Refer to Improvement I-7)

I-13	Sludge Digester Cleanout & Demolition of Anaerobic Digester Equipment	Priority 3

Description of improvement:

- The existing below grade sludge storage tank (former anaerobic digester) is full of grit, scum and grease which consume storage volume and contributes to the displacement and recycle of septic sludge back through the plant when sludge is pumped to the storage tank.
- This improvement consists of hiring a contractor to perform digester cleanout activities and hauling of all resultant debris from the plant to a landfill for disposal.
- Removal and salvaging of the anaerobic digester equipment within the digester control building is included in this improvement since anaerobic digestion is not used and the equipment is outdated and has not been used in years and would not be cost-effective to re-condition and re-use. This would include removal of the boiler and heat exchanger, natural and digester gas piping and mixing system, digester gas compressor, waste gas burner and flame trap and associated electrical and controls demolition.

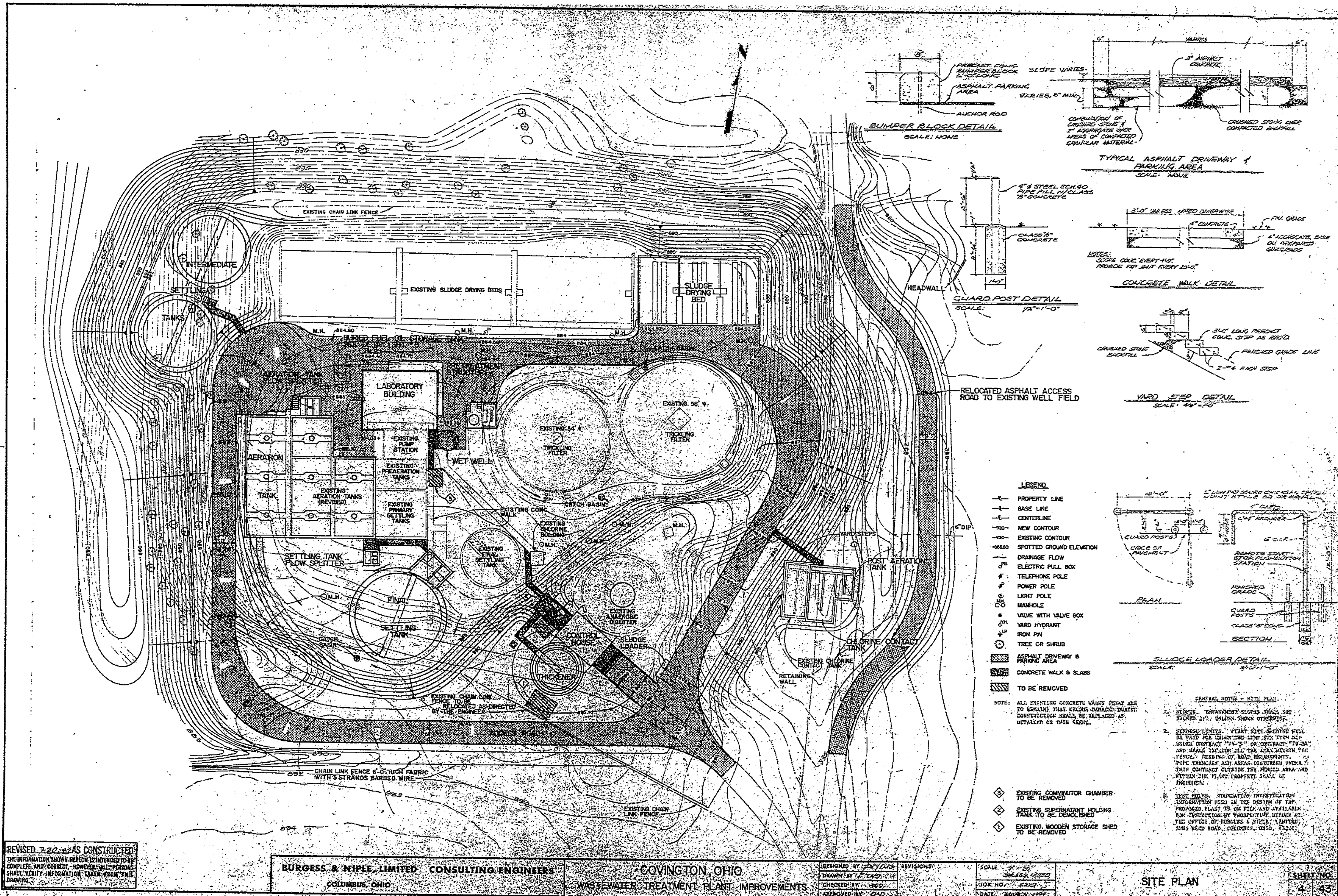
Benefits:

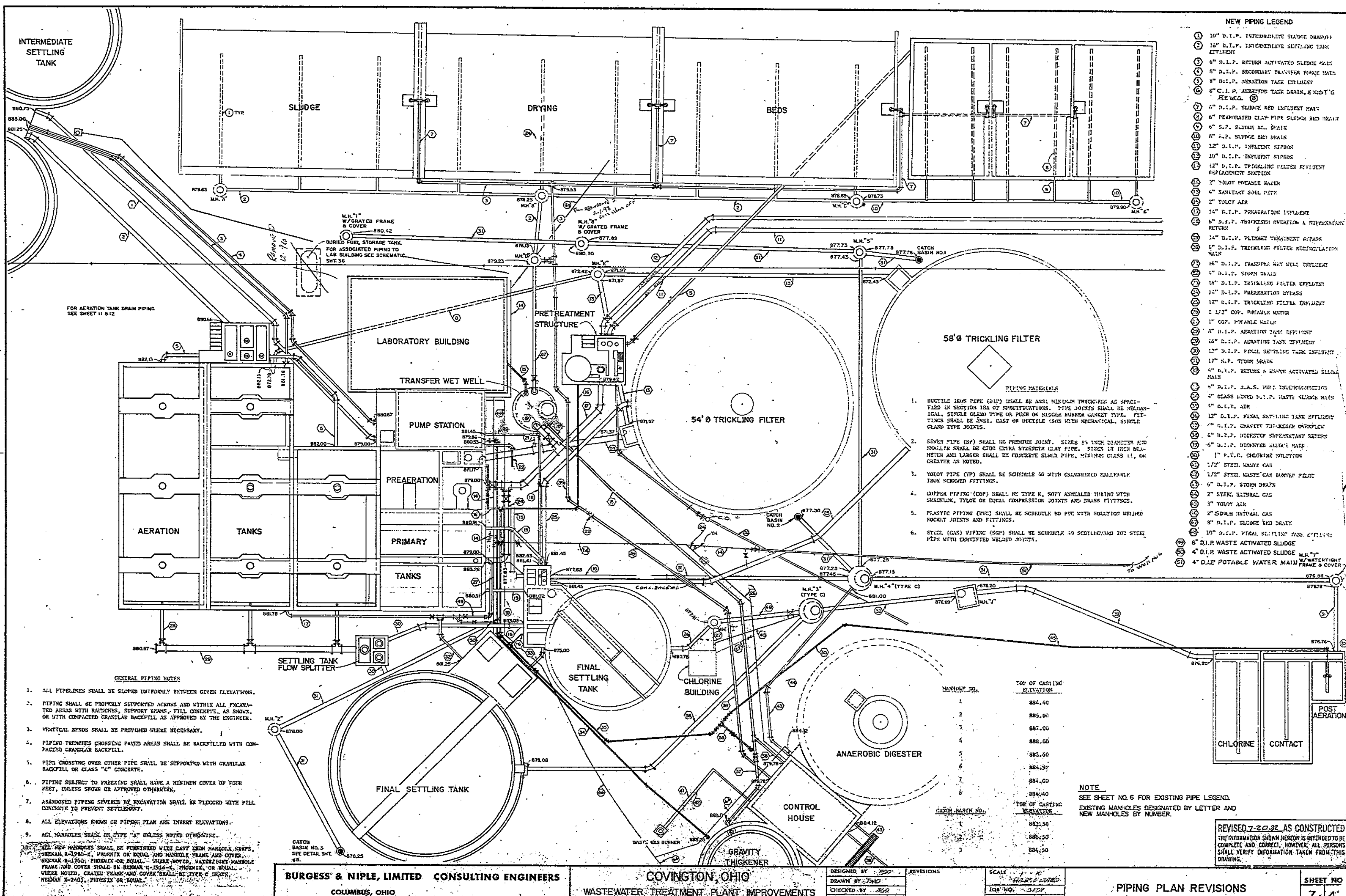
- Cleanout of digester will restore and increase usable tank volume.
- Control building space could be used for some other process function or storage.
- Building code compliance.

Implementation:

- Digester cleanout should precede the demolition work and be undertaken when availability and resources permit its removal from service.

Appendix A
Covington Wastewater Treatment Facility
Existing Site Plan/Flow Diagram/Piping Plan


BUMPER BLOCK DETAIL
SCALE: NONE
PRECAST CONC. BUMPER BLOCK
ASPHALT PARKING AREA
ANCHOR ROD
TYPICAL ASPHALT DRIVEWAY & PARKING AREA
SLOPE VARIES
3" ASPHALT CONCRETE
CRUSHED STONE OVER COMPACTED BACKFILL
GUARD POST DETAIL
CLASS "C" CONCRETE
CONCRETE WALK DETAIL
4" CONCRETE
FIN. GRADE
YARD STEP DETAIL
CRUSHED STONE BACKFILL
FINISHED GRADE LINE
2-7" EACH STEP
SLUDGE LOADER DETAIL
PLAN
SECTION
GUARD POSTS
EDGE OF PAVEMENT
REMOTE START-STOP PUSHBUTTON STATION
FINISHED GRADE
RELOCATED ASPHALT ACCESS ROAD TO EXISTING WELL FIELD
HEADWALL
EXISTING CHAIN LINK FENCE
EXISTING SLUDGE DRYING BEDS
SLUDGE DRYING BED
INTERMEDIATE
SETTLING
TANKS
BURIED FUEL OIL STORAGE TANK
AERATION TANK FLOW SPLITTER
LABORATORY BUILDING
AERATION
TANK
EXISTING AERATION TANKS (REVISED)
EXISTING PUMP STATION
EXISTING PREAERATION TANKS
EXISTING PRIMARY SETTLING TANKS
WET WELL
EXISTING 54' ⌀ TRICKLING FILTER
EXISTING 58' ⌀ TRICKLING FILTER
CATCH BASIN
EXISTING CONC. WALK
EXISTING FINAL SETTLING TANK
EXISTING CHLORINE BUILDING
SETTLING TANK FLOW SPLITTER
FINAL SETTLING TANK
CONTROL HOUSE
SLUDGE LOADER
EXISTING ANAEROBIC DIGESTER
THICKENER
YARD STEPS
POST AERATION TANK
CHLORINE CONTACT TANK
EXISTING CHLORINE CONTACT TANK
RETAINING WALL
EXISTING CHAIN LINK FENCE TO BE RELOCATED AS DIRECTED BY THE ENGINEER
CHAIN LINK FENCE 6'-0" HIGH FABRIC WITH 3 STRANDS BARBED WIRE
EXISTING CHAIN LINK FENCE
M.H.
LEGEND
PROPERTY LINE
BASE LINE
CENTERLINE
NEW CONTOUR
EXISTING CONTOUR
SPOTTED GROUND ELEVATION
DRAINAGE FLOW
ELECTRIC PULL BOX
TELEPHONE POLE
POWER POLE
LIGHT POLE
MANHOLE
VALVE WITH VALVE BOX
YARD HYDRANT
IRON PIN
TREE OR SHRUB
ASPHALT DRIVEWAY & PARKING AREA
CONCRETE WALK & SLABS
TO BE REMOVED
NOTE: ALL EXISTING CONCRETE WALKS (THAT ARE TO REMAIN) THAT BECOME DAMAGED DURING CONSTRUCTION SHALL BE REPLACED AS DETAILED ON THIS SHEET.
GENERAL NOTES - SITE PLAN
EXISTING COMMINUTOR CHAMBER TO BE REMOVED
EXISTING SUPERNATANT HOLDING TANK TO BE DEMOLISHED
EXISTING WOODEN STORAGE SHED TO BE REMOVED
REVISED AS CONSTRUCTED
BURGESS & NIPLE, LIMITED CONSULTING ENGINEERS
COLUMBUS, OHIO
COVINGTON, OHIO
WASTEWATER TREATMENT PLANT IMPROVEMENTS
DESIGNED BY
DRAWN BY
CHECKED BY
APPROVED BY
REVISIONS
SCALE
JOB NO.
DATE
SITE PLAN
SHEET NO.
4
43


INTERMEDIATE SETTLING TANK
SLUDGE
DRYING
BEDS
LABORATORY BUILDING
TRANSFER WET WELL
PUMP STATION
PRETREATMENT STRUCTURE
PREAERATION
PRIMARY
TANKS
AERATION
TANKS
58'Ø TRICKLING FILTER
54'Ø TRICKLING FILTER
CATCH BASIN NO.1
CATCH BASIN NO.2
CATCH BASIN NO.3 SEE DETAIL SHT. 48
FINAL SETTLING TANK
FINAL SETTLING TANK
SETTLING TANK FLOW SPLITTER
CHLORINE BUILDING
ANAEROBIC DIGESTER
CONTROL HOUSE
GRAVITY THICKENER
CHLORINE
CONTACT
POST AERATION
WASTE GAS BURNER
FOR AERATION TANK DRAIN PIPING SEE SHEET 11 & 12
M.H."1" W/GRATED FRAME & COVER
M.H."8" W/GRATED FRAME & COVER
M.H."7" W/WATERTIGHT FRAME & COVER
M.H."4" (TYPE C)
M.H."3" (TYPE C)
M.H."2"
BURIED FUEL STORAGE TANK. FOR ASSOCIATED PIPING TO LAB BUILDING SEE SCHEMATIC SHT. 36
NEW PIPING LEGEND
1 10" D.I.P. INTERMEDIATE SLUDGE DRAWOFF
2 16" D.I.P. INTERMEDIATE SETTLING TANK EFFLUENT
3 6" D.I.P. RETURN ACTIVATED SLUDGE MAIN
4 8" D.I.P. SECONDARY TRANSFER FORCE MAIN
5 8" D.I.P. AERATION TANK INFLUENT
6 8" C.I.P. AERATION TANK DRAIN, EXIST'G REMOV. 8
7 6" D.I.P. SLUDGE BED INFLUENT MAIN
8 6" PERFORATED CLAY PIPE SLUDGE BED DRAIN
9 6" S.P. SLUDGE BE. DRAIN
10 8" S.P. SLUDGE BED DRAIN
11 12" D.I.P. INFLUENT SIPHON
12 10" D.I.P. INFLUENT SIPHON
13 12" D.I.P. TRICKLING FILTER EFFLUENT REPLACEMENT SECTION
14 2" YOLOY POTABLE WATER
15 4" SANITARY SOIL PIPE
16 2" YOLOY AIR
17 14" D.I.P. PREAERATION INFLUENT
18 6" D.I.P. THICKENER OVERFLOW & SUPERNATANT RETURN
19 14" D.I.P. PRIMARY TREATMENT BYPASS
20 6" D.I.P. TRICKLING FILTER RECIRCULATION MAIN
21 16" D.I.P. TRANSFER WET WELL INFLUENT
22 4" D.I.P. STORM DRAIN
23 16" D.I.P. TRICKLING FILTER EFFLUENT
24 14" D.I.P. PREAERATION BYPASS
25 12" D.I.P. TRICKLING FILTER INFLUENT
26 1 1/2" COP. POTABLE WATER
27 1" COP. POTABLE WATER
28 8" D.I.P. AERATION TANK EFFLUENT
29 16" D.I.P. AERATION TANK EFFLUENT
30 12" D.I.P. FINAL SETTLING TANK INFLUENT
31 12" S.P. STORM DRAIN
32 6" D.I.P. RETURN & WASTE ACTIVATED SLUDGE MAIN
33 6" D.I.P. R.A.S. WELL INTERCONNECTION
34 4" GLASS LINED D.I.P. WASTE SLUDGE MAIN
35 4" D.I.P. AIR
36 12" D.I.P. FINAL SETTLING TANK EFFLUENT
37 6" D.I.P. GRAVITY THICKENER OVERFLOW
38 6" D.I.P. DIGESTER SUPERNATANT RETURN
39 6" D.I.P. DIGESTED SLUDGE MAIN
40 1" P.V.C. CHLORINE SOLUTION
41 1/2" STEEL WASTE GAS
42 1/2" STEEL WASTE GAS BURNER PILOT
43 6" D.I.P. STORM DRAIN
44 2" STEEL NATURAL GAS
45 3" YOLOY AIR
46 2" SDR.11 NATURAL GAS
47 8" D.I.P. SLUDGE BED DRAIN
48 10" D.I.P. FINAL SETTLING TANK EFFLUENT
49 6" D.I.P. WASTE ACTIVATED SLUDGE
50 4" D.I.P. WASTE ACTIVATED SLUDGE
51 4" D.I.P. POTABLE WATER MAIN
PIPING MATERIALS
1. DUCTILE IRON PIPE (DIP) SHALL BE ANSI MINIMUM THICKNESS AS SPECIFIED IN SECTION 18A OF SPECIFICATIONS. PIPE JOINTS SHALL BE MECHANICAL, SINGLE GLAND TYPE OR PUSH ON SINGLE RUBBER GASKET TYPE. FITTINGS SHALL BE ANSI, CAST OR DUCTILE IRON WITH MECHANICAL, SINGLE GLAND TYPE JOINTS.
2. SEWER PIPE (SP) SHALL BE PREMIUM JOINT. SIZES 15 INCH DIAMETER AND SMALLER SHALL BE C700 EXTRA STRENGTH CLAY PIPE. SIZES 18 INCH DIAMETER AND LARGER SHALL BE CONCRETE SEWER PIPE, MINIMUM CLASS III, OR GREATER AS NOTED.
3. YOLOY PIPE (YP) SHALL BE SCHEDULE 40 WITH GALVANIZED MALLEABLE IRON SCREWED FITTINGS.
4. COPPER PIPING (COP) SHALL BE TYPE K, SOFT ANNEALED TUBING WITH SWAGELOK, TYLOK OR EQUAL COMPRESSION JOINTS AND BRASS FITTINGS.
5. PLASTIC PIPING (PVC) SHALL BE SCHEDULE 80 PVC WITH SOLUTION WELDED SOCKET JOINTS AND FITTINGS.
6. STEEL (GAS) PIPING (SGP) SHALL BE SCHEDULE 40 SCOTCHGUARD 202 STEEL PIPE WITH CERTIFIED WELDED JOINTS.
GENERAL PIPING NOTES
1. ALL PIPELINES SHALL BE SLOPED UNIFORMLY BETWEEN GIVEN ELEVATIONS.
2. PIPING SHALL BE PROPERLY SUPPORTED ACROSS AND WITHIN ALL EXCAVATED AREAS WITH HAUNCHES, SUPPORT BEAMS, FILL CONCRETE, AS SHOWN, OR WITH COMPACTED GRANULAR BACKFILL AS APPROVED BY THE ENGINEER.
3. VERTICAL BENDS SHALL BE PROVIDED WHERE NECESSARY.
4. PIPING TRENCHES CROSSING PAVED AREAS SHALL BE BACKFILLED WITH COMPACTED GRANULAR BACKFILL.
5. PIPE CROSSING OVER OTHER PIPE SHALL BE SUPPORTED WITH GRANULAR BACKFILL OR CLASS "C" CONCRETE.
6. PIPING SUBJECT TO FREEZING SHALL HAVE A MINIMUM COVER OF FOUR FEET, UNLESS SHOWN OR APPROVED OTHERWISE.
7. ABANDONED PIPING SEVERED BY EXCAVATION SHALL BE PLUGGED WITH FILL CONCRETE TO PREVENT SETTLEMENT.
8. ALL ELEVATIONS SHOWN ON PIPING PLAN ARE INVERT ELEVATIONS.
9. ALL MANHOLES SHALL BE TYPE "A" UNLESS NOTED OTHERWISE.
10. ALL NEW MANHOLES SHALL BE FURNISHED WITH CAST IRON MANHOLE STEPS, NEENAH R-1980-E, PHOENIX OR EQUAL AND MANHOLE FRAME AND COVER, NEENAH R-1760, PHOENIX OR EQUAL. WHERE NOTED, WATERTIGHT MANHOLE FRAME AND COVER SHALL BE NEENAH R-1916-E, PHOENIX, OR EQUAL. WHERE NOTED, GRATED FRAME AND COVER SHALL BE TYPE C GRATE, NEENAH R-2405, PHOENIX OR EQUAL.
NOTE
SEE SHEET NO. 6 FOR EXISTING PIPE LEGEND.
EXISTING MANHOLES DESIGNATED BY LETTER AND NEW MANHOLES BY NUMBER.
REVISED 7-20-82 AS CONSTRUCTED
THE INFORMATION SHOWN HEREON IS INTENDED TO BE COMPLETE AND CORRECT, HOWEVER, ALL PERSONS SHALL VERIFY INFORMATION TAKEN FROM THIS DRAWING.
BURGESS & NIPLE, LIMITED CONSULTING ENGINEERS
COLUMBUS, OHIO
COVINGTON, OHIO
WASTEWATER TREATMENT PLANT IMPROVEMENTS
DESIGNED BY
DRAWN BY
CHECKED BY
APPROVED BY
REVISIONS
SCALE
JOB NO.
DATE
PIPING PLAN REVISIONS
SHEET NO 7-4

Appendix B
Raw Sewage Screen Equipment Catalog Cut Sheets

WESTECH
an employee-owned company

Proposal For:
Covington, Ohio WWTP

Equipment:
CleanFlo™ Spiral Screen

Engineer:
CH2M Hill

Represented By:
B.L. Anderson, Inc.
Pete Schneider
8887 Eagle Ridge Court
West Chester, Ohio 45069
P: 513-314-3148

Furnished By:
WesTech Engineering, Inc.
Salt Lake City, UT 84115
Contact: Stephen Rioux
Phone: (801) 265-1000
Fax: (801) 265-1080

WesTech Proposal: 1360335
Friday, May 10, 2013

ITEM: "A" - One (1) CleanFlo™ Spiral Screen Model FSI4

EACH UNIT FURNISHED COMPLETE BY WESTECH WITH THE FOLLOWING COMPONENTS:

BASIS OF DESIGN

Application:	Domestic Sewage Screening
Peak Design Flow:	1.6
Downstream Water Level:	9.1 inches @ peak flow
Clean Screen Headloss:	5.1 inches
Max Allowed Upstream Level:	17 inches
Channel Width:	20 inches
Channel Depth:	30 inches
Screen Opening:	1/4 inch
Opening Type:	Perforated
Angle of Inclination:	35 degrees from horizontal
Discharge Height:	59 inches from top of channel
Discharge Height w/ Bagger:	50 inches from top of channel

FINE SCREEN

- Semi-cylindrical screenings basket from type 304 stainless steel
- Conveyor tube with wear bars from type 304 stainless steel.
- Neoprene side seals fastened to basket to prevent bypass around the screen.
- Shaftless spiral screw from high strength alloy steel with protective primer coating and brushes attached in the basket area. Brushes are supplied in sections each covering 180° of the spiral and shall have nylon bristles molded into a plastic core and attached to the screw with stainless steel fasteners.
- Dual chambered dewatering and discharge zone from type 304 stainless steel with hinged access door.
- Dewatering zone drain flush spray system from type 304 stainless steel with manual ball valve.
- Plastic hose for drain connection to direct pressure back into the channel.
- Drive unit with 1 HP motor suitable for 460/3/60 electrical supply.
- Basket mounted spray bar from type 304 stainless steel.
- Centralized washing system with type 304 stainless steel piping, connecting all unit spray locations to single point for customer connection. Includes manual ball valves and solenoids.

FINE SCREEN SUPPORTS

- A stand from type 304 stainless steel is supplied to support the fine screen unit. Support shall allow unit to be rotated out of the channel.

HARDWARE

- Assembly fasteners from type 18-8 stainless steel.
- Anchor rods from type 18-8 stainless steel.

CONTROLS AND ELECTRICAL DEVICES

- One (1) NEMA 4X type 304 stainless steel main control panel suitable for 480/3/60 electrical supply. Control panel shall contain the following devices for operation of the screen unit:
    1. Step down control transformer and through door disconnect with handle.
    2. Branch circuit protection.
    3. Full voltage reversing motor starter.
    4. Emergency stop pushbutton.
    5. Screen HOA switch.
    6. Screen FOR switch, spring return Reverse to Off.
    7. Basket spray HOA switch.
    8. Compaction zone spray HOA switch.
    9. Load monitor for overload protection.
    10. Hour meter for each motor.
    11. Control power and run indicating lights.
    12. Alarm light indicating overcurrent and starter overload.
    13. Alarm reset pushbutton.
    14. Programmable control relay provides control logic functions.
    15. Run and alarm auxiliary contacts.

- One (1) NEMA 4X local Emergency Stop pushbutton for field mounting at the unit.
- One (1) NEMA 4X safety microswitch mounted to dewatering/discharge access door.
- Two (2) NEMA 4X 120V solenoid valve to control water spray functions.
- One (1) mercury-free type float switch with stainless steel mounting bracket.

SPARE PARTS

- One (1) set of spare brushes.

FIELD SERVICE

- One (1) trip and one (1) day for installation inspection, start up, and instruction of plant personnel.

CLARIFICATIONS/COMMENTS

- Unit anchorage designed around RedHead A7 adhesive system. Adhesive and applicator by others.
- Float switch installation requires a suitable length of 1" pipe by others for suspension in the channel.

OPTIONAL ITEMS

- Item A-1: Bagging System - Continuous bagger assembly to collect dewatered screenings at discharge with refillable bag cassette.
- Item A-2: Ultrasonic Level Sensor - One (1) Milltronics Pointek ULS200 ultrasonic sensor with stainless steel mounting bracket. (Replaces float switch).

- Item A-3: Weather protection system - Conveyor tube wrapped with self regulating heat trace cable supplied with insulation and protective type 304 stainless steel jacket. Electrical wiring routed to a factory mounted conduit box for field connection. Includes One (1) NEMA 4X ambient temperature thermostat to control heat tracing and GFCI circuit breaker mounted in the control panel.

NOTE: ANY ITEM NOT LISTED ABOVE TO BE FURNISHED BY OTHERS:

ITEMS NOT BY WESTECH: Electrical wiring, conduit or electrical equipment, piping, valves, or fittings, shimming material, lubricating oil or grease, shop or field painting, field welding, erection, detail shop fabrication drawings, performance testing, unloading, storage, concrete work, hoist or lifting apparatus, grating, platforms, stairs, handrailing, or field service (except as specifically noted).

This proposal section has been reviewed for accuracy and is approved for issue:
By: **Stephen Rioux** Date: May 10, 2013

BUDGET PRICING

ITEM	EQUIPMENT	PRICE (U.S.)
"A"	(1) CleanFlo™ Spiral Screen FSI4	$50,000
"A-1"	Continuous Bagger Assembly	$1,500
"A-2"	Ultrasonic Level Sensor	$1,600
"A-3"	Weather Protection System	$5,000

The above mentioned equipment was designed according to the information which we received. The dimensions may vary slightly depending on the plant's actual design parameters. Assumed values may have been used, therefore, all information shall be verified by the Engineer.

Unless otherwise indicated, prices listed are for equipment only. All optional items will be offered with the purchase of the scoped equipment only. No optional items will be sold separately.

Prices are for a period not to exceed 30 days from date of proposal.

Warranty: A written supplier's warranty will be provided for the equipment specified in this section. The warranty will be for a minimum period of (1) year from start-up or 18 months from time of equipment shipment, whichever comes first. Such warranty will cover all defects or failures of materials or workmanship which occurs as the result of normal operation and service except for normal wear parts (i.e. squeegees, skimmer wipers, etc.).

Terms: Terms are net **30 days** from shipment with no retentions allowed.

Sales Tax: No sales taxes, use taxes, or duties have been included in our pricing.

Freight: Prices quoted are **F.O.B. shipping point** with freight allowed to a readily accessible location nearest to jobsite. All claims for damage or loss in shipment shall be initiated by purchaser.

Submittals: Submittals will be made approximately **6 to 8 weeks** after purchase order is received in our office.

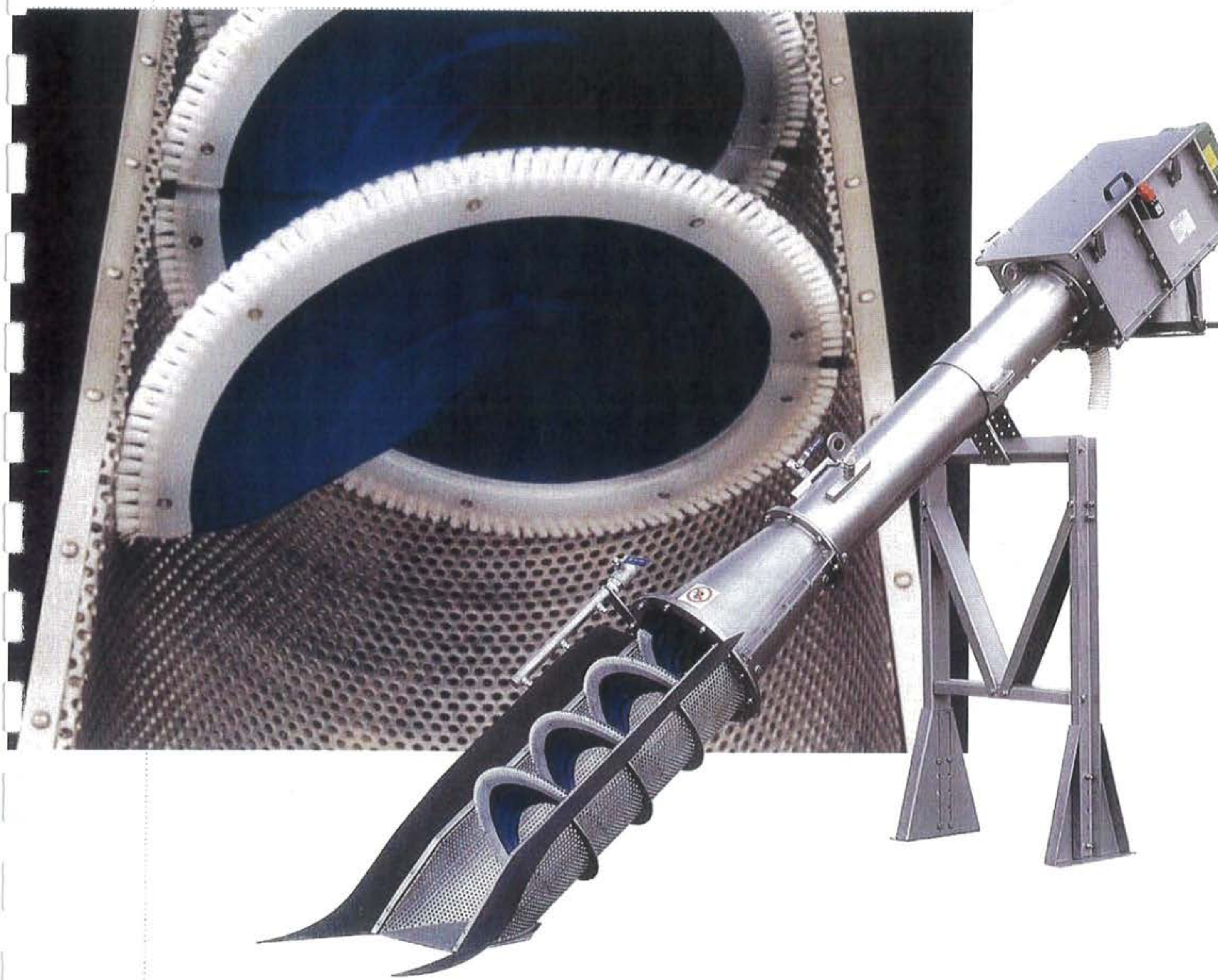
Shipment: Estimated shipment time is **18 to 20 weeks** after approved submittal drawings are received in our office.

Field Service: Prices do not include field service unless noted in equipment description. Additional field service is available at $960.00 per day plus expenses.

Paint: If your equipment has paint included in the price, please take note of the following. Primer paints are designed to provide only a minimal protection from the time of application (usually for a period not to exceed 30 days). Therefore, it is imperative that the finish coat be applied within 30 days of shipment on all shop primed surfaces. Without the protection of the final coatings, primer degradation may occur after this period, which in turn may require renewed surface preparation and coating. If it is impractical or impossible to coat primed surfaces within the suggested time frame, WesTech strongly recommends the supply of bare metal, with surface preparation and coating performed in the field. All field surface preparation, field paint, touch-up and repair to shop painted surfaces are not by WesTech.

WESTECH

The Innovative Shaftless Spiral Screen



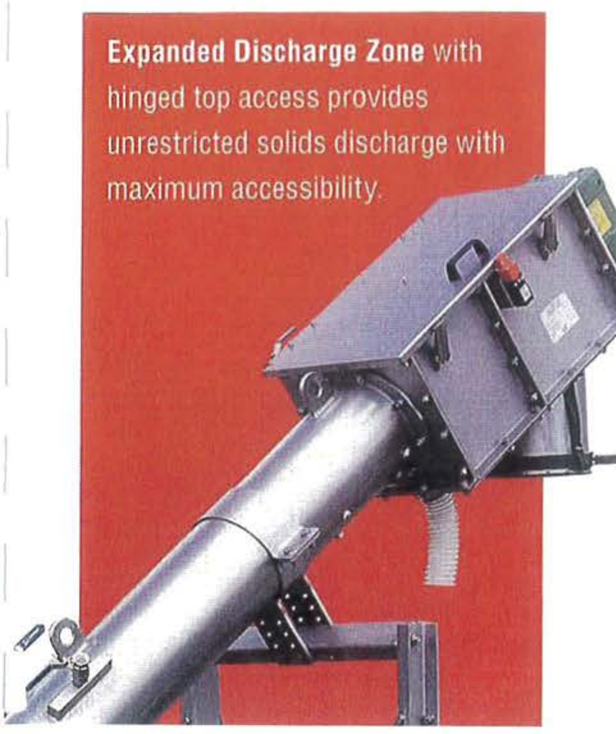
» CleanFlo™ SPIRAL

CleanFlo™ SPIRAL Screen

WesTech CleanFlo™ Spiral systems are designed to address the screening needs of industrial and municipal process treatment plants. Built to withstand tough duty in real-world applications, these quality units offer many design and operational benefits.

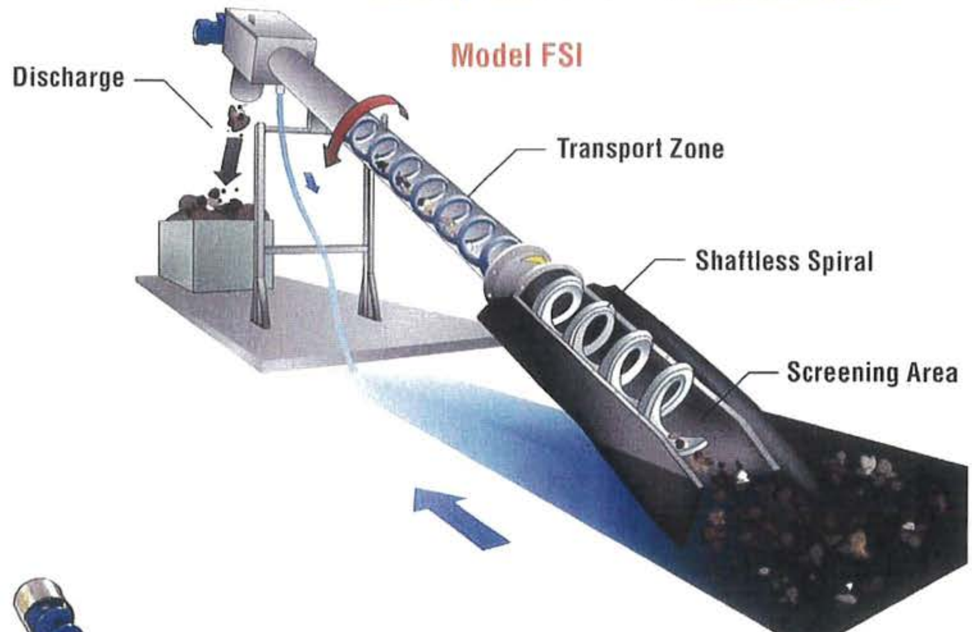
Shaftless Spiral technology enables efficient transport of stringy material or sludge. The shaftless, high-strength alloy steel spiral eliminates entanglement of solids around a shaft. No intermediate or end bearings are required, which reduces maintenance requirements.

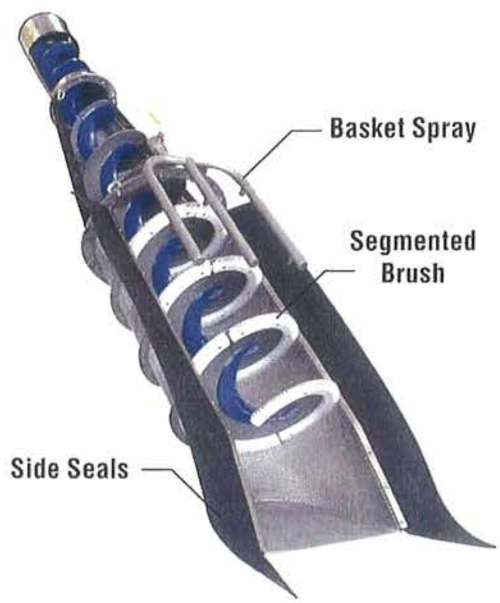
Screening Products - By combining a segmented brush with the spiral, the screen is cleaned as the spiral conveys collected material to the discharge. Side seals prevent bypass, yet are flexible enough to allow pivoting of the screen from the channel. The spiral is supported by easily replaceable wear bars in the transport zone.



Expanded Discharge Zone with hinged top access provides unrestricted solids discharge with maximum accessibility.

Easily Installed in Channels...





Screening, washing, and compaction all are integrated into a single unit driven by one motor located at the top of the mechanism.

Standards:

- Wedgewire and perforated plate available in a wide range of screen openings
- Throughputs up to 9 MGD
- Variable lengths up to 30 ft
- 35 or 45 degree screen inclination
- Pivoting mounting stand
- Screenings pass paint filter test

Optional Equipment:

- Bagging device to encapsulate screenings, contain odors, and improve overall hygiene.
- Heat trace for transport and washing systems.

...or Tank Units

Model FST

Package plants are available for municipal plant inlet screening, industrial wastewater pretreatment, or septage receiving stations. All the features of the in-channel units are provided in a self-contained stainless steel tank.

Options include:

- Automatic tank wash down
- Card readers and automated billing systems
- Flow recording, conductivity, and pH sensors
- Automatic flow control valves

Model TSF

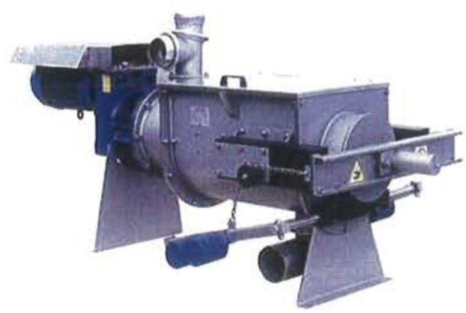
A complete inlet works combining fine screening, aerated grit removal, and optional grease removal all pre-engineered into a compact, stainless steel tank. TSF units are ideal for pumped flows or when space is limited. A minimum of civil work is required to complete the installation.

- Compacted dry screenings
- Grit removal efficiencies from 75 to 95%
- Can be installed above or below grade
- Totally enclosed
- Stainless steel construction

Other Products

Shaftless Screw Compactor

- Absence of intermediate and end bearings
- Multiple inlet hoppers available
- Conveying lengths up to 100 ft and more
- No mechanical components in contact with the handled product
- Low speed



Screw Press/Separator

Separation of solids from effluent with compaction and dewatering of the extracted solids

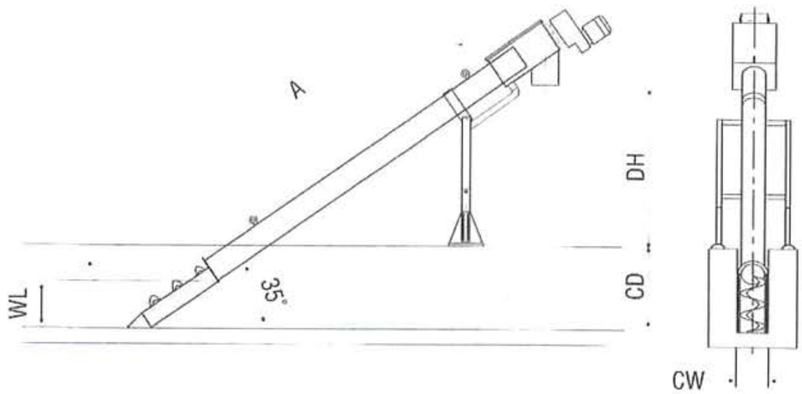
Applications Include:

- ANIMAL WASTE
- FOOD PROCESSING
- SLAUGHTERHOUSE
- TANNERIES
- CHEMICAL
- PAPER MILL

Model Selection

For optimal machine selection, the following criteria are relevant:

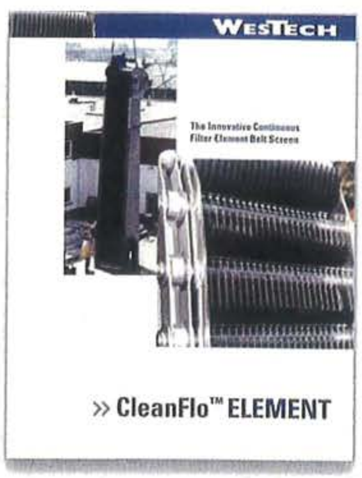
- Screening opening
- Maximum and minimum throughput capacity
- Downstream water level
- Upstream water level (if limited to a certain level)
- Minimum/maximum channel width
- Required discharge height (distance between channel bottom and solids discharge point)
- Discharge capacity (size and weight of solids)
- Characteristics of solids

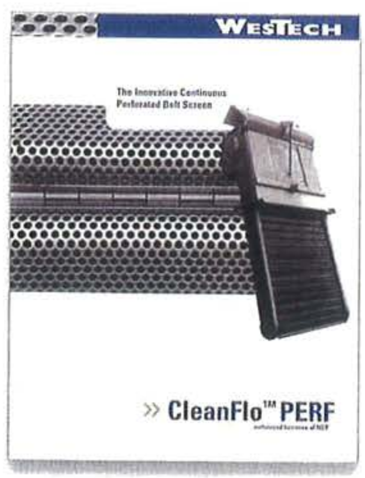


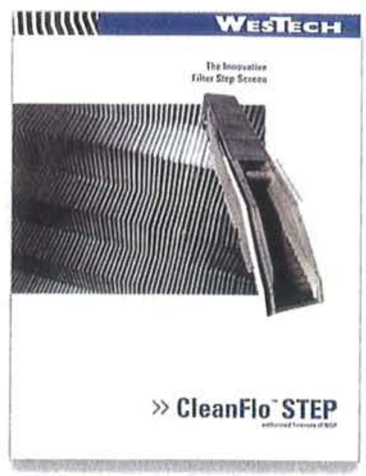
Standard Dimensions at 35° Inclination

	FSI2	FSI3	FSI4	FSI5	FSI6	FSI7
A	199"	199"	199"	199"	209"	222"
CD	31"	31"	31"	36"	39"	42"
CW	12"	14"	18"	22"	26"	33"
WL max	17"	17"	18"	23"	27"	31"
DH	59"	59"	59"	59"	59"	59"

Other WesTech Screening Products







WesTech
an employee owned company

PO Box 65068 • Salt Lake City, Utah 84165-0068
Phone: (801) 265-1000 • Fax (801) 265-1080
e-mail: info@westech-inc.com
www.westech-inc.com

ISO 9001 CERTIFIED WesTech QUALITY SYSTEM

Represented by:

CleanFlo Spiral (Channel Mitt™) In Channel Spiral Screen

The semi-cylindrical spiral screen is a versatile and inexpensive solution for small flows up to 7-8 MGD. The screen is composed of a perforated or wedgewire basket (depending on screening orifice size) connected to the end of a conveying tube. The basket rests on the floor of the channel and captures material in the wastestream as flow passes through the basket. A shaftless spiral screw extends throughout the length of the unit and is used to transport the screened material from the basket, out of the channel to the discharge point of the unit. The screen is installed at an angle with most standardized for 35° or 45° inclination from horizontal. Most units are provided with a compaction/dewatering zone and the screens typically produce a discharge that is 20-25% dry solids. If greater dryness or washing is required, the screen can be designed to feed a separate washer/compactor unit. The screen is supplied with a support stand that allows the unit to be pivoted out of the channel for maintenance purposes.

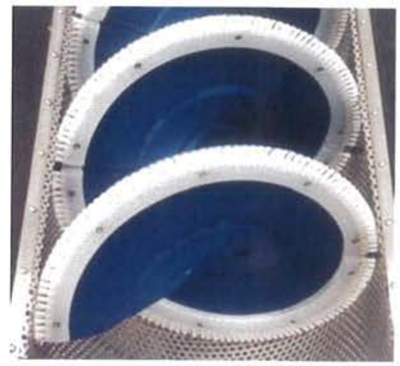
The screen is generally operated by an upstream liquid level sensor. As material collects in the basket reducing the open area, the level upstream of the screen will rise. The maximum allowable upstream level from the unit is determined by the model's basket height. A water level above the basket height will flow over the side seals of the basket and bypass the unit. The level activation point is typically set to the basket height or just below it. Utilizing the full basket height has several benefits. First, it maximizes the available open area and flow capacity of the unit. Secondly, at flows lower than the capacity, it will allow for the maximum collection of material on the basket prior to activation of the unit. Minimizing the run time of the screen in this way maximizes the life of the screen and replaceable components, and can also improve solids dryness as detention time in the conveying tube is increased. Finally, allowing the upstream level to reach the full basket height improves the conveyance of the material, as the differential head will hold the material to the basket face causing it to be more easily transported by the shaftless screw.

There are a variety of features that make the WesTech CleanFlo Spiral unique among spiral screens.

With spiral screens, brushes are attached to the ends of the spiral screw in the basket area to clean the basket during operation. The WesTech design utilizes sectioned brushes. The sectioned brushes each cover 180° of the spiral, and allow for individual pieces to be replaced due to localized wear. The individual

3625 S. West Temple, Salt Lake City, UT 84115 Tel: 801.265.1000 Fax: 801.265.1080 www.westech-inc.com

pieces also make replacement of the brush much easier since each section may be replaced from the face of the spiral. Brushes with bristles pinched into a channel section cover the entire basket length or multiple spiral pitches requiring them to be wrapped/unwrapped around the spiral during replacement. This typically requires removal of the screen basket or other disassembly that is not necessary with the WesTech sectioned pieces. The WesTech brush bolts straight to the spiral flight with stainless steel bolts and lock nuts, and does not require additional clips or fastening devices that may pull loose during operation, or become lost during replacement.



Spiral screens provide compaction by terminating the spiral flights in a perforated drum or tube section. This ensures that material is carried into the dewatering zone faster than it is removed to the discharge of the unit. The subsequent compression dewaters the screenings. On most units, the dewatered material is finally pushed out of the perforated section to a vertical discharge. The conveyor tube at the discharge is the same or only slightly large diameter than at the compression area. This means that the compressed material will remain confined around the shaft extending from the spiral screw to the gear reducer. Reversed pitch flights and stationary cutters are required in this case to physically cut the material away from the shaft. On the WesTech unit, the dewatered material is transitioned from the cylindrical compaction drum, to a much larger rectangular cross sectional chamber. This expansion prevents material from being pressed against the shaft, allowing it to discharge from the unit by gravity without requiring additional physical means of separation. The pictures included illustrate the compaction and discharge zones of the unit externally, and with the overhead access door opened.

The WesTech standard spiral is composed of continuously formed sections from low carbon steel that runs the length of the conveyor tube and basket. In the transition cone area and basket,

3625 South West Temple Salt Lake City, Utah 84115 Fax (801) 265-1080 Phone (801) 265-1000

additional type 304 stainless steel flighting is welded to the section increasing the OD of the spiral. This creates a spiral height larger than most other manufacturer's spirals fabricated with concentric sections that do not maintain a constant ID through the basket area. The larger flight height assists in the reduction of "roll back" of material in the basket area, especially at inclinations greater than 40°. The standard spiral is supplied with a protective epoxy primer coating.

3625 South West Temple Salt Lake City, Utah 84115 Fax (801) 265-1080 Phone (801) 265-1000

WesTech
Municipal and Industrial Process Equipment

CleanFlo™ Spiral Screen
Shaftless Spiral Technology

Understanding Screenings Transport

Semi-cylindrical Spiral screens are designed with a fixed screening basket located in a channel at an angle that can range from 35 to 50 degrees from vertical. Flow passes through the screen while solids are retained on the interior of the basket screen surface. WesTech's CleanFlo™ Spiral design utilizes a full diameter shaftless spiral screw with attached brushes to clean the screen when activated by high water level. The shaftless screw acts as a conveyor pushing material up the incline of the basket screen, out of the water, and transported to the discharge point where it is compacted and dewatered prior to discharge.

The transport of material is achieved as captured material rests principally against the basket and is pushed by the spiral flight in a conveying fashion.

As material is being conveyed a portion will be in contact with the pushing face of the screw. The amount (or height) of contact is proportional to the screen inclination. If the material rises to a point higher than the flight height then a "recycle" condition can occur wherein material climbs over the spiral flight, or "clings" to the flight during the spiral rotation. Either effect can allow a portion of material to fall back through the open center of the shaftless spiral.

Figure 1 – Solids being pushed up the screen panel.

A small amount of recycle can be beneficial as it creates a churning action that aids in breaking up of attached organics and providing a washing action as screenings are recycled in the basket zone.

Screen designs utilizing a central shaft experience similar "rollback" where the stringy material rolls back down the incline entangling around the shaft requiring manual cleaning and removal.

As the screen angle of inclination increases over 35°, the amount of material recycled due to rollback is increased. Too much recycled material will cause the screen to operate more frequently and for longer durations, decreasing the overall efficiency. The CleanFlo™ Spiral screen is designed with certain features to aid in minimizing and controlling the amount of rollback.

Not All Shaftless Spirals are Created Equal

Most shaftless spiral screen companies manufacturer their spiral screw by enlarging the ID of the spiral in the basket area to facilitate a concentric increase in the overall OD of the spiral. This creates a relatively small flight height in the basket, with a large

3625 S. West Temple, Salt Lake City, UT 84115 Tel: 801.265.1000 Fax: 801.265.1080 www.westech-inc.com

open center that material can "recycle" through.

The WesTech CleanFlo™ Spiral screen shaftless spiral is fabricated with a continuous

Figure 2 – Continuous ID spiral flight is painted blue. Added flight height in the cone and basket is highlighted in gray.

ID throughout the length of the unit (Figure 3). Additional flight height is welded to the OD in the transition cone and basket areas. This larger flight improves the conveyance of material out of the basket, limiting the rollback of material over the flight and through the ID of the spiral.

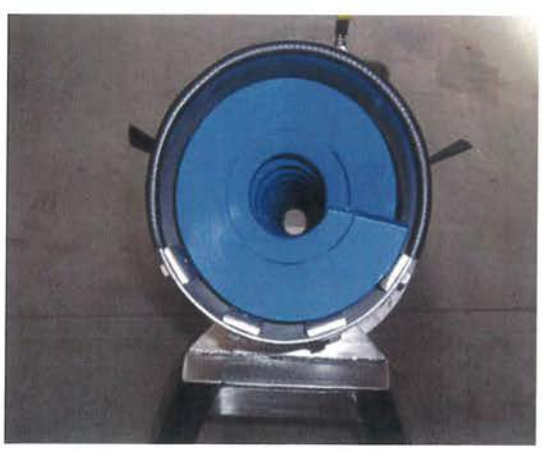


Figure 3 – End view of WesTech spiral from conveyor tube to basket illustrating continuous ID.

Recommended Operating Procedures

It is recommended that the water level setpoint for operation of the unit be set as close to the full basket height as possible. At a minimum we would like to see that level set to half the basket height. Utilizing the full basket allows more material to be captured closer to the top of the basket, minimizing transport and utilizes to a greater degree the natural differential water head to pin material against the basket of the unit allowing it to be more easily conveyed by the spiral flight.

Further Considerations

A basket mounted spray bar is recommended for use on installation angles greater than 35°. The spray bar is provided to aid in pushing material off the spiral flight and into the basket to improve the efficiency of the screen by further controlling the amount of recycle or rollback.

Figure 4 – Cutaway view of a WesTech unit and spiral.

Appendix C
Grit Capture and Removal Equipment Catalog Cut Sheets

Eutek HeadCell®

Advanced Stacked Tray Grit Separation

Water & Wastewater Solutions
Grit Removal at its Finest...™

Eutek HeadCell® - Stacked Tray Grit Separation

The Eutek HeadCell® is the ideal grit separator for both new and retrofit applications. The Eutek HeadCell® is a multiple tray separator that can be sized to remove fine grit over a wide range of flows with less than a foot of headloss. The Eutek HeadCell® provides high performance with a small footprint.

Applications

- New wastewater treatment plants
- Treatment plant retrofits
- Sediment removal pretreatment for potable water
- Grit removal for industrial effluent
- Pre-treatment for MBR and many other process upgrades

Advantages

- Large surface area in a small footprint
- No moving parts or external power source
- Less than a foot of headloss to operate
- Double treatment capacity in the same footprint as existing equipment
- Economical to own and operate
- Accommodates high turndown ratios

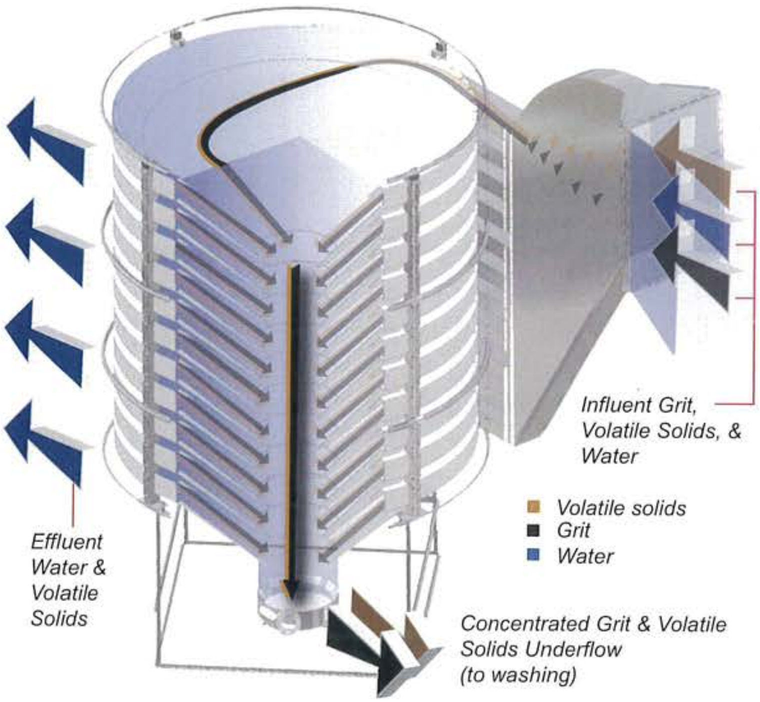
How it Works

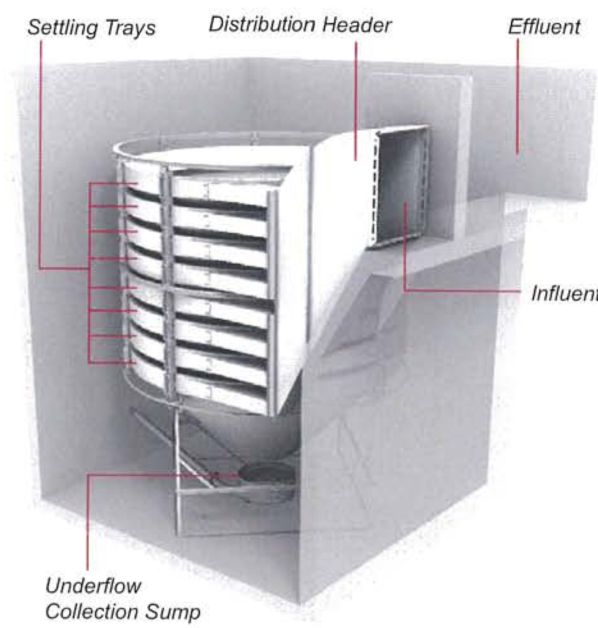
The stack of hydraulically independent polyethylene trays are submerged in a concrete chamber. Screened sewage enters the influent duct and passes into the grit chamber. The influent duct directs the flow into the high efficiency distribution header to evenly distribute the influent tangentially into the modular multiple-tray system.

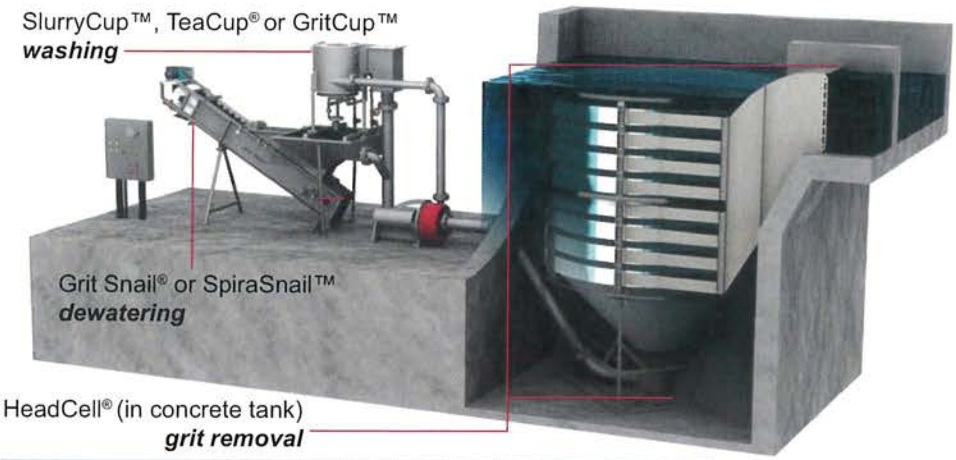
Tangential feed establishes a vortex flow pattern causing solids to fall into a boundary layer on each tray. Grit settles out by gravity along the sloped surface of each tray and then solids are swept to the center opening which allows them to fall to a common collection sump.

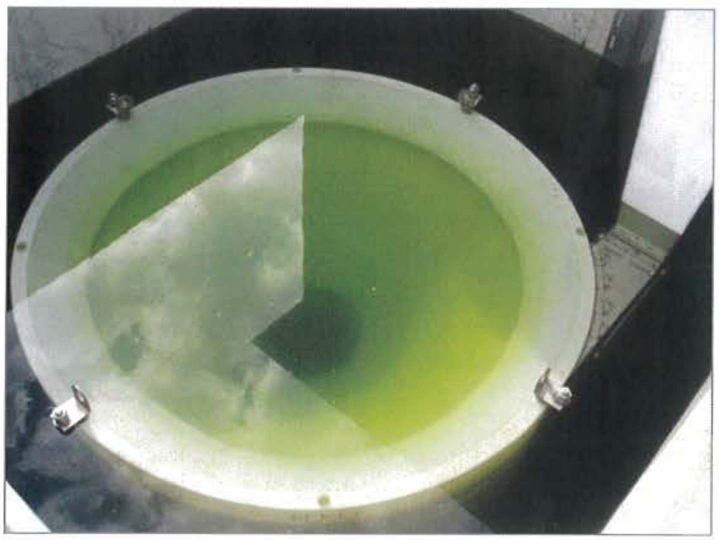
Degritted effluent flows out of the trays, over a weir and into an effluent trough. The HeadCell® typically requires less than 12 inches of headloss.

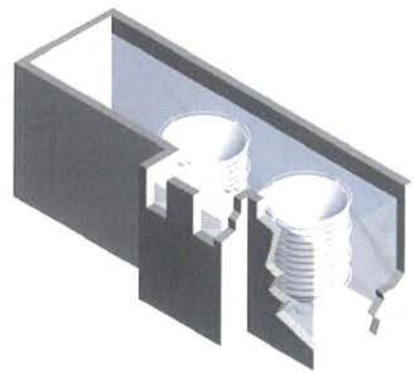
Often, the settled solids are continuously pumped from the grit sump to a Eutek SlurryCup™ or Eutek TeaCup® grit washing system and then dewatered by a Eutek Grit Snail® dewatering escalator, depending on grit load.











Two Eutek HeadCell® Units Retrofitted Into An Existing Grit Basin

Configurations

The Eutek HeadCell® fits into existing structures and uses existing channels, which significantly reduces concrete costs during installation. A retrofitted Eutek HeadCell® system can increase flow capacity and still capture finer grit in the same footprint. Inlet and outlet orientation and location can be configured to meet many design requirements.

Eutek HeadCell® Performance

- Removes 95% of particles equal to or greater than 75 microns at the design flow rate when used with Hydro washing and dewatering equipment
- Typically less than 12" inches headloss at peak flow
- Less than 15% volatile solids and greater than 60% total solids

Design Notes

- Short settling distances eliminate inefficiency and increase grit capture
- Large surface area effectively uses plant space
- Evenly split flows eliminate short circuiting
- Continuous boundary layer flows over hydrophobic surfaces, minimizes grease buildup and keeps trays clean
- All-hydraulic design with no moving parts ensures a long product life

Capacity

- Sized for peak flow at peak grit loads
- Virtually no turndown ratio limits
- Modular and expandable combinations to fit any size plant

What is HX?

HX is Hydro Experience, the essence of Hydro. It's interwoven into every strand of Hydro's story, from our products to our people, our engineering pedigree to our approach to business and problem-solving.

HX is a stamp of quality and a mark of our commitment to optimum process performance. A Hydro solution is tried, tested and proven.

There is no equivalent to Hydro HX.

Water & Wastewater Solutions

2925 NW Aloclek Drive Suite 140
Hillsboro, OR 97124

Tel: (503) 615 8130
Fax: (503) 615 2906

www.hydro-int.com

Grit Removal at its Finest... ™

Appendix D
Ultraviolet Disinfection Equipment
Catalog Cut Sheets

SCOPE OF SUPPLY FOR ULTRAVIOLET DISINFECTION EQUIPMENT
TROJANUV3000™PTP

Project Name:	Covington, OH WWTP
Attention:	Jim Gagnon
Engineer:	CH2M Hill
Quote No:	HPT_04.22.13
Date:	April 22, 2013
Model Number:	**D3600K**
Total Units Included:	2
Unit Configuration:	Single Unit [ ] In Series [x] In Parallel [ ]

Design Criteria: Current Peak Design Flow:	1,600,000 gpd
UV Transmission:	65% minimum
Total Suspended Solids:	30 mg/l, 30 day average
Max Mean Particle Size:	30 microns
Disinfection Limit:	126 E-coli per 100 ml, based on a 30 day geometric mean of consecutive daily grab samples

We are pleased to submit the following scope of equipment supply based on the above criteria. The equipment described herein is named as the basis for the design.

The purchaser is responsible for reading all information contained in this Supply Contract. Trojan / Representative will not be held accountable for the supply of equipment not specifically detailed in this document. Detailed installation instructions are provided with the shop drawings and are available upon request. Changes to the Scope of Supply that affect selling price will be handled through a change order.

Please refer all inquiries to Trojans' Manufacturer Representative:

Contact: Timothy B. Shaw, PE
Company: The Henry P. Thompson Co.
Phone: (513) 248-3231

ULTRAVIOLET MODULES – By Trojan

Each UV module will be supplied completely assembled containing lamps, quartz sleeves and electronic ballasts. Each module will be supplied with a 10 foot (3.0 m) weather-proof cable and standard 120 Volt plug for connection to a GFI receptacle.

Quantity:	12 UV modules will be supplied each containing 4 lamps
Material of Construction:	316 stainless steel frame
Approximate Weight:	38 lbs. / 17 kg per module
Enclosure Rating	Type 6P

MONITORING SYSTEM – By Trojan

Two (2) Type 4X fiberglass Monitoring Panel(s) will be supplied per Unit for monitoring system parameters, including lamp age and UV intensity. The monitoring system includes a submersible UV sensor, mounted on one module, to measure UV intensity in mW/cm^2. Approximate weight of the Monitoring Panel is 10 lbs / 4.5 kg.

Installation Contractor's Responsibility:

The Installation Contractor to be responsible for wall mounting the Monitoring Panel as shown on the layout drawings. The Installation Contractor to be responsible for the supply, installation and connection of the following at each Monitoring Panel:

One (1) 120 Volt (230 Volt), 1 phase, 2 wire (plus ground), 50 / 60 Hz, 5 Amps power supply
One (1) 4-20 mA for remote indication for UV intensity (required if UV intensity will be monitored remotely)
One (1) dry contact for low UV intensity alarm (required if remote low UV intensity alarm is required)

POWER DISTRIBUTION RECEPTACLES (PDRs) – By Trojan

Type 3R, impact resistant thermoplastic duplex GFI PDRs will be provided to power the UV Modules.

Quantity Supplied:	6 PDR(s) will be supplied (one PDR per 2 modules)
Total Current Draw:	38.04 amps

Installation Contractor's Responsibility:

Contractor to supply and distribute 120 Volt (230 Volt), single phase, 50 / 60 Hz power to the PDRs. Electrical work to be all encompassing and in accordance with local electrical codes.

MAINTENANCE RACK – By Trojan

One (1) Type 304 stainless steel maintenance rack(s) will be supplied to support modules during service or maintenance activities.

Approximate Weight: 50 pounds / 23 kilograms each

SPARE PARTS AND SAFETY EQUIPMENT – By Trojan

The following spare parts and safety equipment will be supplied with the Trojan UV system:

8	UV lamps
8	Quartz sleeves
8	Lamp holder seals
2	Operators Kit (including face shield, gloves)

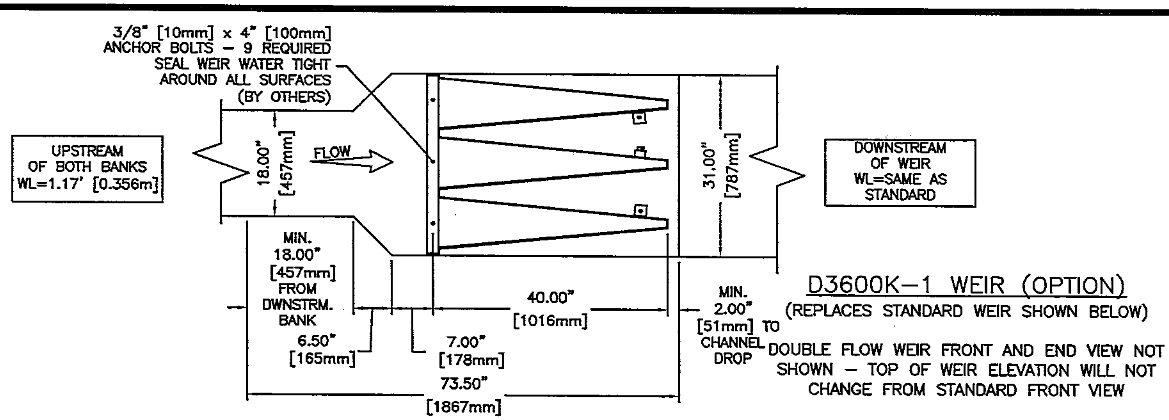
ADDITIONAL NOTES

Three (3) copies of submittal shop drawings will be provided 2-4 weeks after receipt of purchase order.
Equipment delivery 3-5 weeks after release for fabrication (approved Shop Drawings).
Three (3) copies of Standard O&M Manuals will be provided at time of equipment delivery.
UV System Start-up and Operator training will be provided by factory trained service personnel.
Trojan Technologies warrantees the UV equipment supplied for 12 months after substantial completion or 18 months after shipment, whichever comes first. UV lamps are warranted for 12,000 hours (non-prorated) or thirty-six (36) calendar months from shipment, whichever comes first.
Refer to attached Terms and Conditions for additional details.

TOTAL PRICE: $ 58,755

PAYMENT TERMS

95% upon delivery of equipment to site
5% due after system start-up
Net 30 Days or prior to system start-up, whichever comes first.
F.O.B Factory; Freight paid to jobsite (North America only- Air Transport extra)
Selling price does not include any duties or taxes, which may be applicable.



D3600K–1 WEIR (OPTION)

(REPLACES STANDARD WEIR SHOWN BELOW)

DOUBLE FLOW WEIR FRONT AND END VIEW NOT SHOWN – TOP OF WEIR ELEVATION WILL NOT CHANGE FROM STANDARD FRONT VIEW

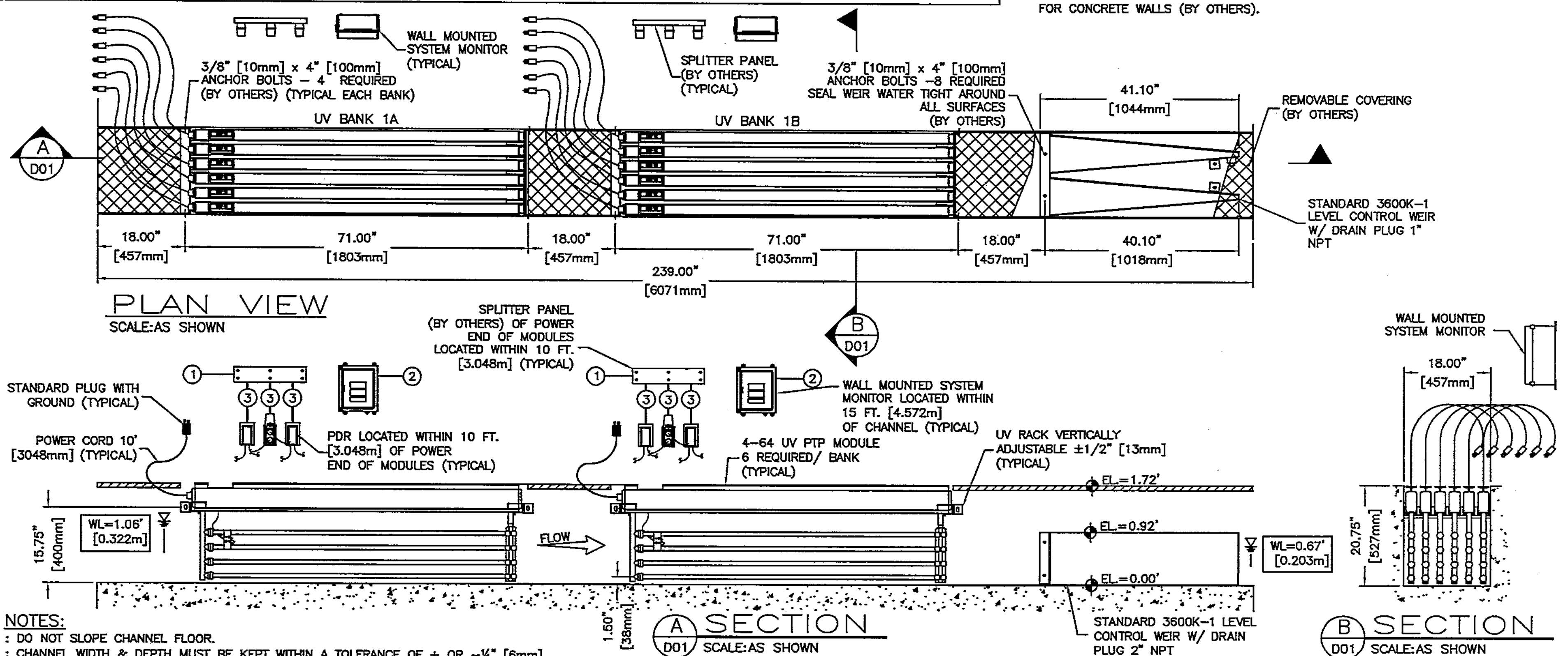
TROJAN UV3000™ PTP

EQUIPMENT INTERCONNECTIONS

No.	DESCRIPTION	FROM	TO
1	SPLITTER POWER SUPPLY 120V, 1 PHASE, 2 WIRE, ACTUAL DRAW 19.2 AMPS/SPLITTER PANEL	DISTRIBUTION PANEL (DP) (NOT SHOWN) (BY OTHERS)	SPLITTER PANEL (BY OTHERS)
2	SYSTEM MONITOR POWER SUPPLY 120V, 1 PHASE, 2 WIRE, 5 AMPS	DP (NOT SHOWN) (BY OTHERS)	SYSTEM MONITOR
3	POWER DISTRIBUTION RECEPTACLE (PDR) POWER SUPPLY 120V, 1 PHASE, 2 WIRE, ACTUAL DRAW 6.4 AMPS/PDR	SPLITTER PANEL (BY OTHERS)	PDR

MULTIPLE CHANNELS IN PARALLEL (OPTION):

: ADDITIONAL UNITS CAN BE INSTALLED PARALLEL TO THE UNIT SHOWN. DISTANCE BETWEEN THE UV CHANNELS IS LIMITED ONLY BY STRUCTURAL REQUIREMENTS FOR CONCRETE WALLS (BY OTHERS).



NOTES:

: DO NOT SLOPE CHANNEL FLOOR.
: CHANNEL WIDTH & DEPTH MUST BE KEPT WITHIN A TOLERANCE OF + OR –¼" [6mm].
: ANCHOR BOLTS ARE NOT SUPPLIED BY TROJAN TECHNOLOGIES INC.
: SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS & INTERCONNECTIONS BY OTHERS.
: ELECTRICAL REQUIREMENTS SHOWN ARE TO SUPPLY TROJAN UV EQUIPMENT ONLY. ELECTRICAL INRUSH FACTOR TO BE ADDED AS PER LOCAL CODE.
: ANY EXTRA OUTLETS NOT BEING USED BY TROJAN EQUIPMENT HAVE NOT BEEN INCLUDED IN THE INTERCONNECT AMPERAGE.
: CONTRACTOR TO REVIEW ALL TROJAN TECHNOLOGIES INC. INSTALLATION INSTRUCTIONS PRIOR TO EQUIPMENT INSTALLATION.
: ACCESS IS REQUIRED FOR MODULE REMOVAL – NOTE THE CHANNEL WIDTH AND ENSURE ADEQUATE ACCESS IS PROVIDED.

TROJAN UV

DESCRIPTION: LAYOUT, UV3000PTP–3600K–1 1 CHANNEL 2 BANKS 4 LAMPS WEIR		DWG. NO. 3M0319
DRAWN BY : QGP/CMS/SMC/LZ	DATE : 05SE13	PROJECT NO. N/A
CHECKED BY : LQ	DATE : 06MY17	
APPROVED BY : JLM	DATE : 06MY18	DWG NO. D01 / REV. C
SCALE (11x17) : NOT TO SCALE	LOG NUMBER : N/A	

TROJANUV3000™PTP | TROJANUV3000™B

WASTEWATER DISINFECTION

TROJANUV3000™PTP | TROJANUV3000™B

Simple, Dependable UV Solutions

Proven, chemical-free disinfection from the industry leader

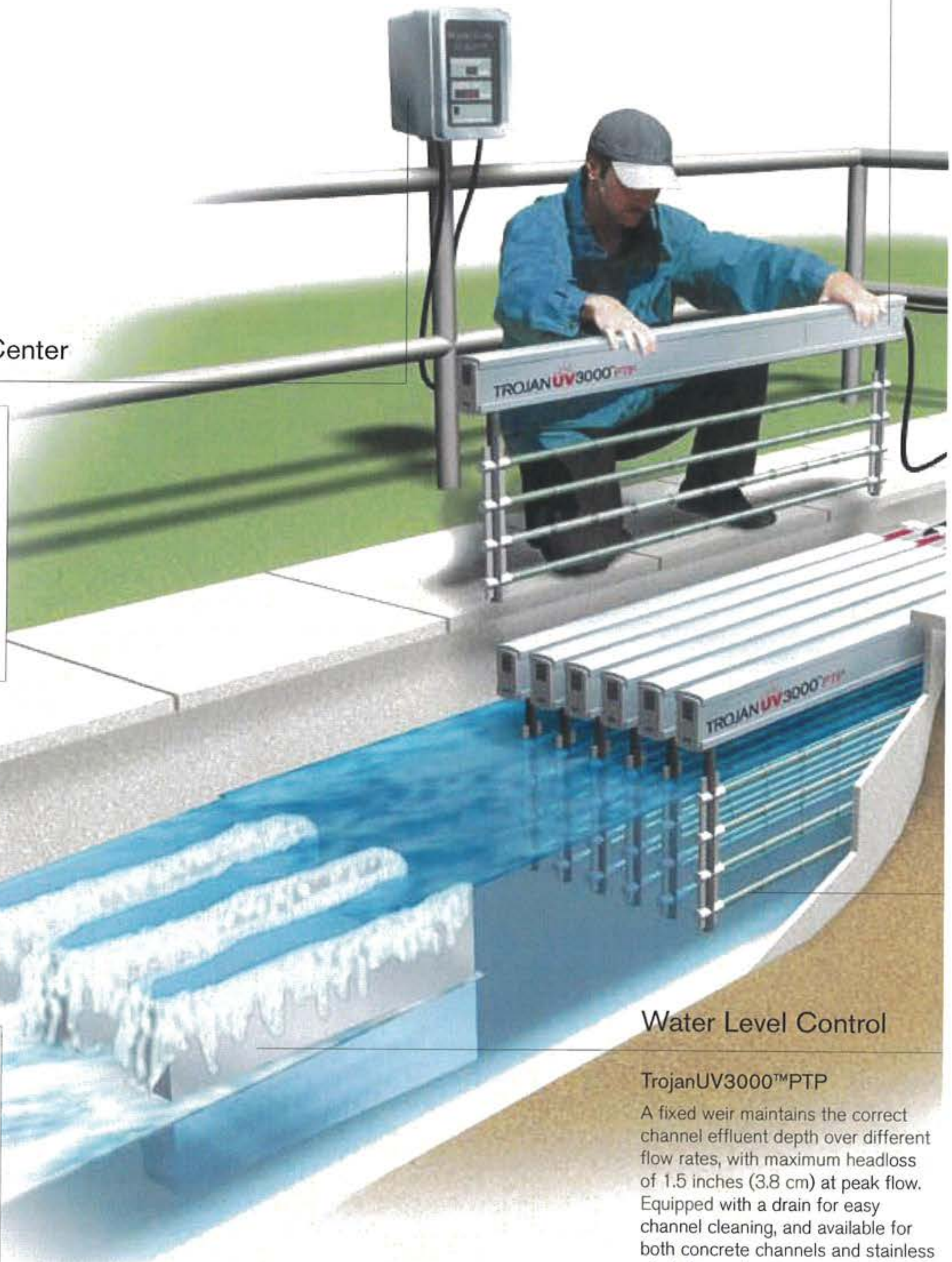
Trojan Technologies is an ISO 9001: 2000 registered company that has set the standard for proven UV technology and ongoing innovation for more than 30 years. With unmatched scientific and technical expertise, and a global network of water treatment specialists, representatives and technicians, Trojan is trusted more than any other firm as the best choice for municipal UV solutions. Trojan has the largest UV installation base – over 6,000 municipal installations worldwide.

In North America alone, almost one in five wastewater treatment plants rely on our proven, chemical-free disinfection solutions.

The TrojanUV3000™PTP (Packaged Treatment Plant) and TrojanUV3000™B are two of the reasons why. These simple, robust, and operator-friendly systems have demonstrated their effective, reliable performance in over 2,000 installations around the world. The TrojanUV3000™PTP is pre-engineered for quick, inexpensive installation with pipe runs using pre-fabricated, flanged stainless steel channels, or into existing chlorine contact basins and effluent channels. The TrojanUV3000™B offers increased capacity and is available with a controller that enables flow pacing to maximize operating efficiency and extend lamp life. The system turns UV lamp banks on and off automatically to ensure the required dose is met using the fewest lamps and least electricity.

TROJANUV3000™PTP | TROJANUV3000™B

Robust, operator-friendly solutions designed for economical disinfection



System Monitor/Control Center

TrojanUV3000™PTP – Optional

The optional System Monitor includes a submersible UV sensor, and provides digital output of UV intensity at each bank. Elapsed time display provides continuous readout of actual hours of operation (lamp hours). A dry contact enables a remote low UV intensity alarm.

TrojanUV3000™B

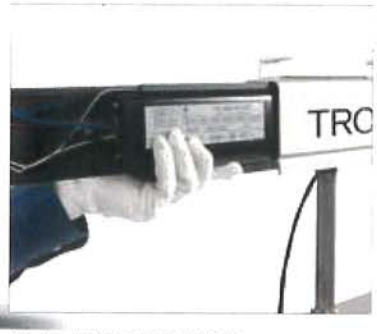
The System Control Center (SCC) provides control of all UV functions, tracks lamp hours, and uses a submersible UV sensor (one per bank) to monitor UV intensity. The SCC is capable of "flow pacing" – automatically turning banks of UV lamps off or on in response to changes in the flow rate in order to conserve power and prolong lamp life.

Water Level Control

TrojanUV3000™PTP

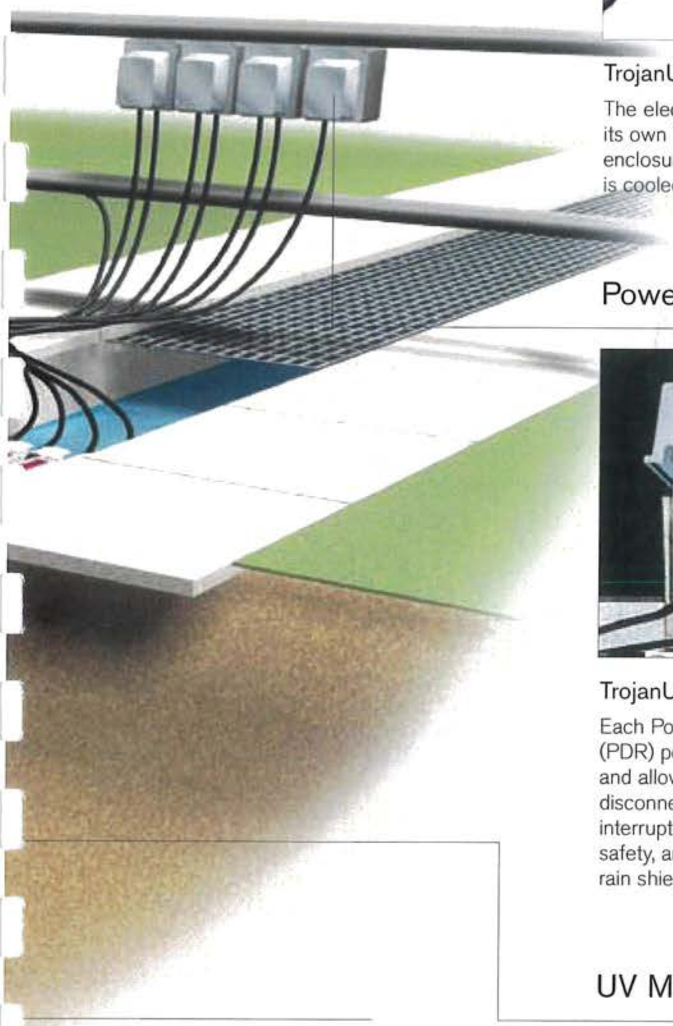
A fixed weir maintains the correct channel effluent depth over different flow rates, with maximum headloss of 1.5 inches (3.8 cm) at peak flow. Equipped with a drain for easy channel cleaning, and available for both concrete channels and stainless steel channel option.

Electronic Ballast

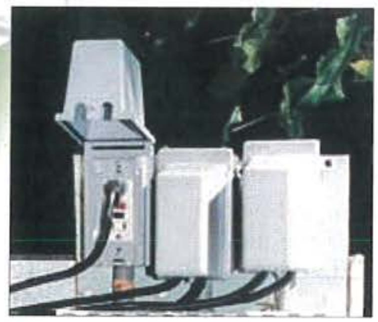


TrojanUV3000™PTP/B

The electronic ballast is mounted within its own TYPE 6P (IP67)-rated watertight enclosure within the module frame, and is cooled by convection.



Power Distribution



TrojanUV3000™PTP

Each Power Distribution Receptacle (PDR) powers two (2) UV modules and allows for quick and safe electrical disconnect. The duplex ground fault interrupter receptacles ensure operator safety, and are mounted inside Type 3R rain shield boxes.

TrojanUV3000™B

The Power Distribution Center (PDC) is constructed of stainless steel and is mounted across the channel. The PDC distributes power to individual modules and allows electrical isolation of each module for easy service.

TrojanUV3000™B

Available with a fixed weir or Automatic Level Control (ALC) gate in the channel to maintain the appropriate water level over the lamps. Trojan engineers will work with you to select the appropriate level control device for your application.

UV Modules

TrojanUV3000™PTP/B

UV lamps are mounted on stainless steel frames. Lamps are enclosed in quartz sleeves, and submerged horizontally and parallel to water flow. A bank is made up of multiple modules placed in parallel positions. All wiring, from ballasts to lamps, runs inside the module frame. A display showing individual lamp status is provided on top of each module.

Stainless Steel Effluent Channel

TrojanUV3000™PTP - Optional

An optional Type 304 stainless steel channel, complete with UV Module Support Rack, can be used. Channel can be installed as a freestanding structure connected to flanged pipes using the optional transition boxes.

Key Benefits

TrojanUV3000™PTP / TrojanUV3000™B

Increased operator, community and environmental safety.
The TrojanUV3000™PTP and TrojanUV3000™B use environmentally friendly ultraviolet light – the safest alternative for wastewater disinfection. No disinfection by-products are created, and no chlorine compounds must be transported, stored or handled by plant staff.

Proven disinfection based on actual dose delivery testing (bioassay validation), and over 2,000 TrojanUV3000™PTP and TrojanUV3000™B installations worldwide. Verified field performance data eliminates sizing assumptions resulting from theoretical dose calculations.

Reduced engineering and installation costs. The TrojanUV3000™PTP can be equipped with pre-fabricated stainless steel channels and transition boxes for in-line integration with existing flanged piping – thus minimizing engineering and installation costs. Both systems can be easily retrofitted into existing chlorine contact tanks and effluent channels, and come pre-tested, pre-assembled and pre-wired to minimize installation costs.

Designed for simplicity and reliability. Using Trojan's most proven, modular design and robust components, including low-pressure lamps, these systems are straightforward to operate and require minimal operator involvement.

Operator-friendly maintenance. Trojan lamps are guaranteed for 12,000 hours (15 months) of operation, and can be replaced, without tools, in less than three minutes per lamp. Modules are electrically separate, allowing a single module to be removed without disrupting flow or taking the system off-line.

Outdoor installation flexibility. All components of the TrojanUV3000™PTP and TrojanUV3000™B systems can be installed outdoors, eliminating the need and costs of a building, shelter, and air conditioning for ballast cooling.

Well suited to changing regulations. Trojan UV systems do not have any negative impact on receiving waters, making them a strategic, long-term choice as regulations become increasingly stringent.

Guaranteed performance and comprehensive warranty. Trojan UV systems include a Lifetime Disinfection Performance Guarantee, the best lamp warranty in the industry, and offer lamps from multiple approved suppliers. Ask for details.

Advanced, Self-Contained UV Modules

Compact footprint simplifies installation and eliminates air conditioning costs

Benefits:

- Space-saving, electronic ballasts are housed right in the modules, not in separate external cabinets, to minimize footprint size, installation time and costs
- Convection cooling of the ballast eliminates costs associated with air conditioning or forced-air cooling
- Lamps are protected in a fully-submersible, Type 316 stainless steel frame
- All wiring and cables are safely enclosed inside the waterproof module frame – fully protecting them from effluent and UV light
- Modules are electrically separated from each other, allowing them to be individually removed for maintenance and a spare module quickly inserted to maintain maximum performance

The advanced, self-contained modules of the TrojanUV3000™PTP and TrojanUV3000™B incorporate convection-cooled ballasts and feature a UV lamp status indicator (below) for at-a-glance confirmation that all lamps are operating.

- Streamlined module minimizes headloss and prevents build-up of debris on the lamps
- All module wiring is pre-installed and factory-tested

Trojan's Innovative Ballasts and Enclosures Provide Significant Advantages	
Module-Mounted Ballasts	• Take up less space and reduce footprint, minimizing installation time and costs
Convection Cooling	• Housing the ballasts in the module allows for natural convection cooling to dissipate the heat of the ballasts into the air • The ballasts are kept sealed and protected • No air conditioning or forced-air cooling required
Clean, Water-Tight Protection	• Some suppliers use external cabinets with forced-air cooling. This introduces dust and moisture onto circuit boards and other electronic components, greatly reducing the life of these components • Internal housing in Trojan's sealed module keeps all components dry and clean
Internal Cabling	• All lamp-ballast wiring is contained within the module frame. This configuration protects wires and cables from exposure to effluent, debris fouling and UV light • Internal cabling allows all electrical connections within the module to be factory-tested

Proven Performance, Components and Design

Validated through regulatory-endorsed bioassay testing and over 1,000 installations worldwide

Benefits:

- Performance data is generated from actual field testing (bioassay validation) over a range of flow rates, effluent quality and UVTs
- Provides regulatory-endorsed, physical verification that systems will perform as expected – ensuring public and environmental safety
- Most accurate assessment of system sizing needs
- Low-pressure lamps and ballasts have proven their outstanding reliability in thousands of installations
- Open-channel design allows cost-effective installation into existing effluent channels & chlorine contact basins
- Systems can be installed outdoors to reduce building capital costs
- Modular design is scalable for precise sizing, and expandable to meet new regulatory or capacity requirements

The TrojanUV3000™PTP and TrojanUV3000™B feature a gravity-fed, open-channel design that delivers cost savings at installation through simple retrofits into existing effluent channels and chlorine contact tanks. Rugged, proven components make operation and maintenance extremely cost-effective.

Designed & Built for Easy Maintenance

User-friendly design requires minimal service and operator involvement

Benefits:

- Trojan lamps are warranted for 12,000 hours (15 months)
- Routine maintenance can be scheduled and completed without disrupting disinfection
- Replacement of UV lamps can be completed without tools and requires less than 3 minutes per lamp

Lightweight, self-contained modules are operator-friendly and make routine maintenance quick and easy. Modules can be individually removed for periodic sleeve cleaning and lamp replacement after 12,000 hours (15 months). An optional, mobile cleaning rack simplifies maintenance procedures.

Highly Flexible Installation Configurations

TrojanUV3000™PTP is pre-engineered for cost-effective integration with piping or channels

Benefits:

- Systems are pre-designed to meet disinfection requirements with minimal engineering costs
- Systems can be installed in series to treat higher flows or provide additional redundancy
- Pre-engineered stainless steel channels with built-in weirs are installed as a freestanding structure
- Stainless steel channels are easily integrated with existing flanged piping using Trojan's highly flexible transition boxes (Figure 1)
- Optional turn boxes minimize system footprint by connecting stainless steel channels and allowing two banks in series to be installed side-by-side (Figure 2)
- Transition boxes allow flanged pipe connection on any of three sides for flexible integration (Figure 3)

Figure 1: Banks in Series – Side View

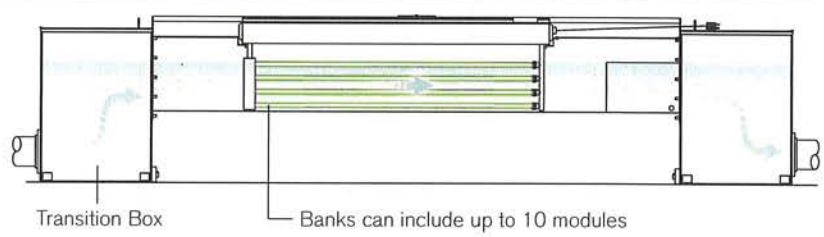


Figure 2: Banks in Series With Turn Box – Overhead View

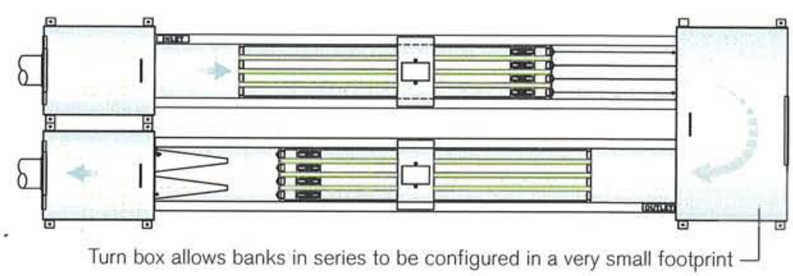
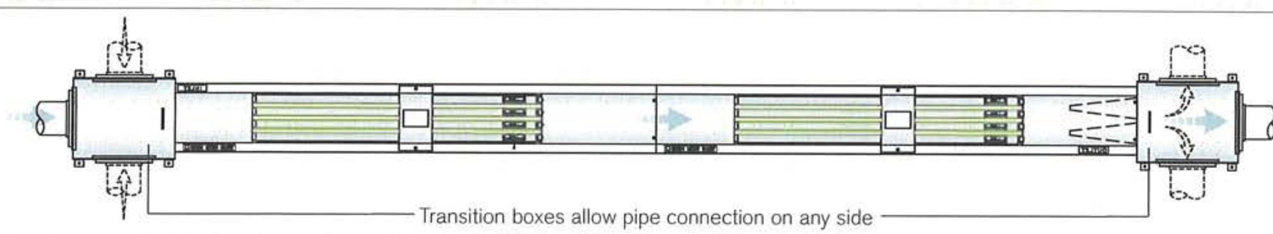


Figure 3: Banks in Series – Overhead View



The TrojanUV3000™PTP is pre-engineered for simple, effective, low cost wastewater disinfection. The optional 304 stainless steel channels feature a UV module support rack, and can be installed as a freestanding unit. Trojan turn boxes and transition boxes allow systems to be incorporated with maximum flexibility and minimal footprint.

Flow Pacing Reduces O&M Costs

TrojanUV3000™B system controller offers flow-pacing for increased operating efficiency

Benefits:

- The System Control Center (SCC) provides monitoring and control of all UV functions
- The SCC provides digital display of bank status, lamp hours, and UV intensity (mW/cm^2)
- The SCC allows the TrojanUV3000™B to be flow paced – meaning the UV lamps of individual banks are turned on and off automatically in response to variations in flow rate (based on a flow meter signal)
- Flow pacing maximizes operating efficiency by matching UV output to disinfection requirements, and reducing electrical consumption during periods of low flow by turning lamps off (Figures 1 & 2)
- Flow pacing also increases the operating life of UV lamps, thereby reducing the frequency, expense and labor required for lamp replacement

The System Control Center of the TrojanUV3000™B monitors lamp hours and uses a submerged UV Sensor to feed accurate data on UV intensity for at-a-glance system status. The SCC also allows flow pacing to minimize operating and maintenance costs by turning banks on and off based on flow requirements

Flow Pacing Optimizes System Efficiency

Figure 1: Operation During Periods of High Flow

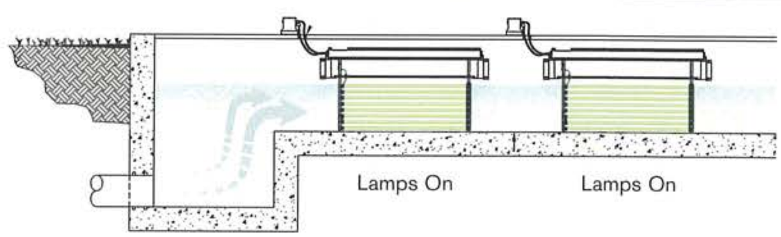
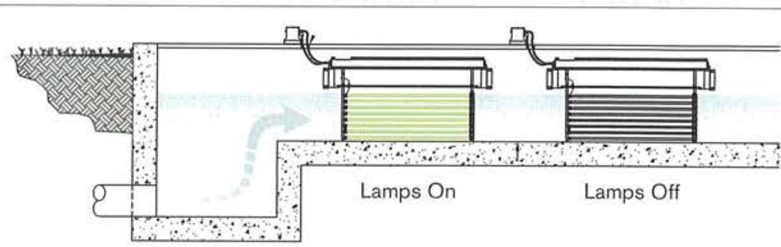


Figure 2: Operation During Periods of Low Flow



TROJANUV3000™PTP | TROJANUV3000™B

System Specifications

System Characteristics	TrojanUV3000™PTP	TrojanUV3000™B
Typical Applications	Up to 3 MGD (473 m^3/hr)	1 – 5 MGD (158 – 789 m^3/hr)
Lamp Type	Low-pressure	
Ballast Type	Electronic; non-variable	
Input Power Per Lamp	45 or 87.5 Watts	87.5 Watts
Lamp Configuration	Horizontal, parallel to flow	
Module Configuration	2 or 4 lamps per module	4, 6 or 8 lamps per module
Bank Configuration	Up to 10 modules per bank	Up to 20 modules per bank
Channel Configurations		
Lamp Banks in Series	Up to 2	Up to 3
Channel Options	Stainless Steel (Trojan option) or Concrete (by others)	Concrete (by others)
Flanged Transition Connections	Optional for stainless steel channels	—
U-Turn Connector Box	Optional for stainless steel channels	—
Level Control Device Options	Fixed weir	ALC gate or fixed weir
Enclosure Ratings		
System Monitor/Control Center	304 stainless steel	
Ballast Enclosure	TYPE 6P (IP67)	
Ballast Cooling Method	Convection; no air conditioning or forced air required	
Installation Location	Indoor or outdoor	
System Monitoring & Controls		
Controller	Optional; Monitoring only	Monitoring and bank control
UV Intensity Monitoring	Optional	Optional
Flow Pacing	—	Optional
Inputs Required	None	4-20 mA flow signal for Flow Pacing
Local Status Indication	Lamp Age (hours) UV Intensity (mW/cm^2) Bank Status (on/off) Low Intensity Alarm Lamp Failure Alarm	
Remote Alarms	UV Intensity (4-20 mA) Common Alarm (discrete)	
Location	Indoor or outdoor	
Maximum Distance from UV Channel	15 ft. (4.5 m)	20 ft. (6 m)
Electrical Requirements		
Power Distribution	Individual GFI Receptacles	Power Distribution Centre
Quantity Required	1 receptacle per 2 modules	1 PDC per bank
Power Input	120V, single phase	120V, single phase 208V, 3-phase 240V, single phase

Find out how your wastewater treatment plant can benefit from the TrojanUV3000™PTP or TrojanUV3000™B – call us today.

Head Office (Canada)
3020 Gore Road
London, Ontario
Canada N5V 4T7
Telephone: (519) 457-3400
Fax: (519) 457-3030

www.trojanuv.com

Trojan UV Technologies UK Limited (UK): +44 1905 77 11 17
Trojan Technologies (The Netherlands): +31 70 391 3020
Trojan Technologies (France): +33 442 53 18 21
Trojan Technologies Italia (Italy): +39 02 39231431
Trojan Technologies Espana (Spain): +34 91 564 5757
Trojan Technologies Deutschland GmbH (Germany): +49 6024 634 75 80
Hach/Trojan Technologies (China): 86-10-65150290

MWW-004 (0311)

TROJANUV
WATER CONFIDENCE™

Appendix E
Economic Analysis of Sludge Dewatering

COVINGTON SLUDGE PRODUCTION

Avg Raw Sewage Flow	230,000	gpd	2012	basis
Avg Raw Sewage TSS	240	mg/L	460	ppd
Avg Raw Sewage cBOD5	320	mg/L	614	ppd
Primary Solids capture	50	% (est)		
Primary Sludge Produced	**230**	**ppd**		
Primary-cBOD Removal	30	% (est)	184	ppd
T. Filter cBOD Removal	40	% (est)	172	ppd
cBOD to Aeration	258	lb/day		
Solids Yield	0.7	lb solids/lb cBOD (est)		
Secondary Sludge Produced	**180**	**lb/day**		
Total Sludge Produced	**411**	**ppd**	co-thickened in primary tanks	
	75	dry ton/year		
Volume Sludge Produced	**4,924**	**gpd @ 1% solids**		
	2,462	**gpd @ 2% solids**		
	1,641	**gpd @ 3% solids**		
	1,231	**gpd @ 4% solids**		

SLUDGE BAG DEWATERING-HAUL TO LANDFILL

Dewatering bag capacity	20	cy (US Fabrics 1-800-518-2290)
Max volume in bag	16	cy (assume 80% of capacity)
Sludge Production Rate	0.34	cy/day @ 45lb/cf)
Days to bag capacity	47	days
Estimated Landfill Hauls	8	per year
Polymer Dosage	10	lb/dry ton (est)
Dewatering bag cost		
20 cy polypropylene	$500	US Fabrics/CIN
30 cy polypropylene	$650	US Fabrics/CIN
Dewatering bag delivery cost		
20 cy polypropylene	$50	UPS
30 cy polypropylene	$125	UPS
Roll-off Rental	$60	per month
Hauling Cost to Landfill-container	$350	per pull
Hauling Cost to Landfill-sludge	$35	per ton
Polymer cost	$5	per lb
Sludge Bag Dewatering Cost		
Roll-off container rental	$720	per year (1 container)
Roll-off container pull	$2,698.58	per year
Sludge hauling	$13,115.08	per year @ 20% solids
Sludge bag cost	$4,240.62	per year
Polymer cost	$3,747	per year
Total Cost	$24,521	per year
Unit Cost	$0.16	per lb solids

Current sludge hauling rate	4,500	gal/week
	1,501	lb/week @ 4% solids (est.)
Current hauling cost	$47,000	per yr (from Village records)
Unit cost	$0.60	per lb solids

SLUDGE BAG DEWATERING-HAUL TO TRANSFER STATION

Dewatering bag capacity	20	cy (US Fabrics 1-800-518-2290)
Max volume in bag	16	cy (assume 80% of capacity)
Sludge Production Rate	0.34	cy/day @ 45lb/cf)
Days to bag capacity	47	days
Estimated Landfill Hauls	8	per year
Polymer Dosage	10	lb/dry ton (est)
Dewatering bag cost		
20 cy polypropylene	$500	US Fabrics/CIN
30 cy polypropylene	$650	US Fabrics/CIN
Dewatering bag delivery cost		
20 cy polypropylene	$50	UPS
30 cy polypropylene	$125	UPS
Roll-off Rental	$60	per month
Hauling Cost to Transfer Sta-container	$225	per pull
Hauling Cost to Transfer Sta-sludge	$61.80	per ton
Polymer cost	$5	per lb
Sludge Bag Dewatering Cost		
Roll-off container rental	$720	per year (1 container)
Roll-off container pull	$1,734.80	per year
Sludge hauling	$23,157.48	per year @ 20% solids
Sludge bag cost	$4,240.62	per year
Polymer cost	$3,747	per year
Total Cost	$33,600	per year
Unit Cost	$0.22	per lb solids

Current sludge hauling rate	4,500	gal/week
	1,501	lb/week @ 4% solids (est.)
Current hauling cost	$47,000	per yr (from Village records)
Unit cost	$0.60	per lb solids