The Town of Leesburg

Water Pollution Control Facility

The Town of Leesburg, Virginia
Water Pollution Control Division
Mission Statement

The Water Pollution Control Division (WPCD) is responsible for the safe and efficient treatment of all wastewater generated within the Leesburg Service Area, and the subsequent stabilization and disposal of the solid wastes produced, to ensure the protection of public health and the environment. This responsibility includes the operation of the Water Pollution Control Facility, Dechlorination/ Outfall Facility, remote wastewater pumping stations, management of the sludge application sites, and the two WPCD laboratories (a total of 36 buildings plus 73 treatment-unit structures). These responsibilities also include monitoring of WPCD personnel training requirements and compliance with numerous federal, state, and local regulations. Additional responsibilities include calibration and maintenance of all town portable gas meters; and response to environmental complaints or requests for assistance from town citizens and consultants.

Introduction

Welcome to the Town of Leesburg's Water Pollution Control Facility. The processes and equipment used to treat the town's wastewater are some of the most sophisticated state-of-the-art technology in the industry. The facility's design, construction, and operation meet the requirements of many regulatory agencies. To ensure compliance with all federal, state, and local regulations, permits for discharging treated effluent into the Potomac River, biosolids reuse, and air emissions from the operations of an emergency generator, a sludge dryer, a fired boiler, and a digester gas flare have been issued by the Virginia Department of Environmental Quality (DEQ). The result of maintaining regulatory compliance is a safe and clean environment for many future generations.

History

Influent Pump Station Screening Room

Reactor Basins (right)
Reactor Basin Being Serviced (above)

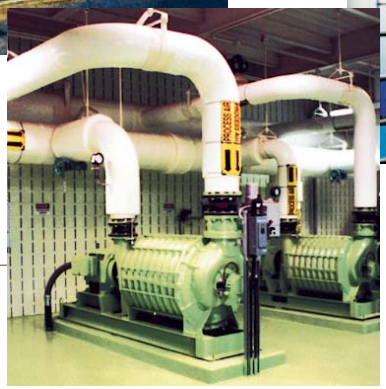
The Town of Leesburg has worked to reduce water pollution since the construction of its original wastewater treatment plant in 1939. That facility was located on Catoctin Circle and expanded once in 1955. The current facility was constructed in 1970 as a result of growth within the town. It was capable of treating 1.3 million gallons per day (mgd) of wastewater. The site along Market Street, State Route 7, adjacent to Tuscarora Creek was chosen as an ideal plant location. It was further downstream on Tuscarora Creek, which received the treated effluent, and would allow areas for town growth as well as for treatment plant expansion.

Over the years, the facility has undergone many upgrades and expansions. In 1974, a chemical-feed building was built. Ferric chloride and polymer were introduced into the treatment process for improvements in biochemical oxygen demand and removal of total suspended solids. In 1976, agricultural land application of stabilized sludge began. This method has proved to be a cost-effective and environmentally safe means of solids disposal. Because of growth and improvements made to the plant, a maintenance shop was constructed in 1980 to house the spare parts and equipment necessary for maintaining all of the complex equipment.

As the town continued to grow through the 1970s and early 1980s, the raw-wastewater collection system expanded proportionally. The Cattail Branch drainage basin, including a new Cattail Branch Pump Station; and the Sycolin Creek drainage basin, including the associated Airport Pump Station; were added to the town's sewage-collection system. A major plant upgrade and expansion was developed and approved by the town government to meet these increasing needs, provide capacity for continued growth into the 1990s, and improve system reliability and take advantage of improvements in process technology. In 1988, the

Methanol Facility

Chemical Storage Tank, Containment Basin, And Chemical Pump Feed System



Centrifugal Blower For Process Air

Water Pollution Control Facility was expanded to a capacity of 2.5mgd average flow under a 90-percent funded EPA grant. In addition to increased treatment capacity, the plant was outfitted with variable-speed influent pumps, gravity sand filters for a tertiary level of treatment, and a belt filter press for sludge processing when land application of liquid sludge is not feasible. Emergency storage basins and a diesel-powered emergency generator also were added to improve system reliability.

In an effort to make the plant as efficient as possible, more improvements were made from the 1980s into the 1990s. In 1989, the recently abandoned chlorine-contact tank was converted into a receiving station. Wastewater from sewer-line cleaning operations could quickly and easily be discharged and introduced into the plant influent by simply unloading at this structure. In addition, because of the plant's continuing expansion and an imminent second upgrade and expansion, a maintenance storage building was constructed in 1994 to house spare parts and equipment, allowing more room in the existing shop for performing maintenance and repairs.

As expected, the town continued to grow. The Big Springs drainage basin, including the Big Springs Pump Station, was added to the collection system. For reasons similar to those for the first upgrade and expansion, the town again decided to enlarge and improve the Water Pollution Control Facility. In 1995, new structures and systems that allow for treating 4.85-mgd average flow were initiated.

This upgrade included using many new technologies for improving the level of treatment, incorporating new management philosophies for economic and efficient plant operation, and increasing the personnel's safety. The improvements included adding nitrification capabilities and phosphorous-removal capabilities, replacing gaseous chemicals with liquid forms, constructing containment basins for all chemical-storage tanks, raising the elevations of structures in the 100-year floodplain to prevent flooding of these facilities, creating a central onsite stormwater-collection system and containment basin, providing a water-reuse system for onsite needs to save 350,000 gallons per day of potable water (thereby

Effluent Pump Station

Secondary Clarifiers

Plant Water Pump Station

increasing the capacity of the potable water treatment plant and the Water Pollution Control Facility), using oxidation-reduction potential to control disinfection, incorporating sophisticated process instrumentation and controls with monitoring capabilities through a plant-wide distributed control system, adding a 340,000-gallon sludge-storage tank, constructing a dewatered-sludge storage pad for dried-sludge storage, and many other improvements. One significant change to the wastewater treatment process was relocation of the plant-effluent discharge. A new pump station, pipeline, and outfall structure were constructed to allow effluent to discharge into the Potomac River downstream of the town's water treatment plant. This change moves the treated effluent discharge from Tuscarora Creek, which is part of the Dulles Area Watershed, directly to the Potomac River and thereby decreases in-water concentration from 100 percent to 0.8 percent.

The tremendous growth in Loudoun County through the 90's and at the turn of the century required town utility services to keep pace. New pump stations at Potomac Crossing, Old Waterford Knoll, Cattail Branch, and Goose Creek were constructed to accommodate new growth and development in those areas. Reuse of plant effluent is a sustainable and economical solution for improving the environment and gaining in popularity across the country. The town has taken advantage of this concept by supplying effluent water for irrigation of a local golf course. To assist in the cleanup and protection of the Potomac River and Chesapeake Bay, the town voluntarily entered an agreement with the Commonwealth of Virginia for a 50/50 cost sharing program to study, design and construct a plant upgrade that cost-effectively converted the treatment process to one with biological nitrogen removal (BNR) capabilities. This new process, completed in mid-2001, significantly reduces the concentration of nitrogen discharged into the environment, thus reducing the growth of algae and other undesirable aquatic vegetation. This upgrade, which added several new structures to the 30-year-old plant, is just another example of

Emergency Generator
and Fuel Storage Tank

Heat Drying Equipment

Soil Amendment
Storage Building

Discharge Permit Requirements

the town's commitment to a safe and clean environment.

Treated effluent is discharged into the Potomac River, under a discharge permit issued by the Virginia DEQ. The current discharge limits mandated by DEQ are as follows:

Flow	7.5 (mgd)
5-day Biological Oxygen Demand	10 (mg/L)
Total Suspended Solids	10 (mg/L)
Total Kjeldahl/Nitrogen as Nitrogen	3.0 (mg/L) (5/1 - 10/31 only)
Total Phosphorus	2.0 (mg/L)
Total Nitrogen	8.0 (mg/L)
E. Coli	200 (N/Cml)
TR Chlorine	Nondetectable (mg/L)
Dissolved Oxygen	5.0 (mg/L)
pH	6.5 - 8.5 (SU)

The discharge limits are met by treating the wastewater in a series of traditional and sophisticated treatment processes, briefly described below.

Preliminary Treatment: removes large objects and heavy inorganic matter (grit) from the wastewater.

Primary Treatment: uses physical and chemical processes to remove the majority of settleable and floatable organic matter.

Secondary Treatment: uses biological and physical treatment processes to reduce the amount of ammonia and of suspended and dissolved organic matter in the wastewater.

Advanced Secondary Treatment: uses a physical process to remove suspended solids from the wastewater.

Tertiary Treatment: uses a chemical process to remove phosphorous and biological and physical processes to remove nitrogen from the wastewater.

Final Treatment: a series of three processes—disinfection, dechlorination, and effluent aeration—that completes the treatment before the wastewater is discharged into the Potomac River.

Biosolids

Odor Control Biofilter

Solids Processing Building and Odor Control RTO

Odor Control Covers at Gravity Thickener

An organic by-product is generated during the wastewater treatment process. This biosolid material has been traditionally thickened and stabilized to meet regulated Class-B biosolids treatment standards. The treated biosolids were then applied in liquid form to local farmlands. At the end of 2001, the town completed a state-of-the-art facility, the first in Virginia, to heat-dry the solids and produce a Class-A, pathogen-free, granular product. The project that built the dryer system included facilities and equipment capable of thickening, dewatering, transporting, and storing the product. This biosolids product, can be hauled off in bulk form, in open commercial trucks, or sealed in 25- or 50-pound bags for convenient distribution and use by individuals. Because the pellets are organic, they are ideal for use on gardens, farms, lawns, etc. Leesburg's safe and creative reuse of biosolids is yet another example of the town's commitment to the environment and a business approach to government.

The waste solids are processed in several steps, which are described briefly in the following summaries:

Thickening:	increases the concentration of solids to improve anaerobic digestion, increase storage capacity, and reduce operating costs.
Digestion:	uses a biological treatment process to thicken and stabilize the sludge in a heated anaerobic environment so that it is safe for disposal.
Storage:	provides further thickening while the solids awaits dewatering or disposal.
Blending:	combines solids generated from various sources (i.e. digested and activated solids) to optimize handling and increase thickening.
Dewatering:	removes water from digested solids to prepare it for drying or storage on the solids-storage pad when the heat dryer equipment is not operating or land application of liquid sludge is not feasible.
Heat Drying:	dries the blended, dewatered solids at temperatures in excess of 1,200 degrees F to destroy all pathogenic organisms and improve material handling and storage.

After the biosolids have been stabilized, they are ready for reuse. The Virginia Department of Agriculture and Consumer Services (VDACs) and DEQ have approved a program allowing the use of this material through farmland application, distribution, or marketing.

In 2008, the Water Pollution Control Facility was expanded to a capacity of 7.5 mgd average flow. Many facilities have been constructed with future capabilities to facilitate an expansion to 10 mgd average flow, including a new influent pump station with a new influent receiving box, hydraulic operated fine bar screens with wash presses, and a new effluent pump station, each capable of handling the peak flows for a 10 mgd plant. In addition, two new BNR reactor basins, two new secondary clarifiers, a new diurnal flow splitter structure and one emergency storage tank were constructed. Modifications to Solids Processing included installation of a new gravity belt thickener, and replacement of existing belt filter press feed pumps and grinders.

The Water Pollution Control Facility now has a plant-wide approach to controlling odors from liquids and solids processes. An odor control system consisting of two built-in-place biofilters and one regenerative thermal oxidizer (RTO) were installed during the Upgrade and Expansion Project 7.5. Combined, the biofilters and the RTO, treat approximately 40,000 cfm of odorous air from 7 different sources. To minimize air emissions from the plant, a new and more efficient generator was installed to replace the two older less efficient generators. This generator also provides backup power generation for the plant's increased treatment capacity.

As the Town of Leesburg expands, it will continue being a responsible steward of public health and the environment.

Stewardship

1939 ORIGINAL WATER POLLUTION CONTROL FACILITY

Design Engineer:	The Rust Engineering Company		
Construction Contractor:	W.C. Spratt Contractors		

1970 WATER POLLUTION CONTROL FACILITY AND TUSCARORA INTERCEPTOR

Design Engineer:	Johnson & Williams	Treatment Capacity:	1.3 mgd
Construction Manager:	Johnson & Williams	Project Cost:	$1.3 million
Construction Contractor:	English Construction		

1988 UPGRADE AND EXPANSION

Design Engineer:	Betz-Converse-Murdoch	Treatment Capacity:	2.5 mgd
Construction Manager:	Camp, Dresser & McKee	Project Cost:	$9.7 million
Construction Contractor:	R. F. Kline		

1995 EXPANSION AND EFFLUENT PIPELINE

Design Engineer:	CH2M HILL	Treatment Capacity:	4.85 mgd
Construction Manager:	CH2M HILL	Project Cost:	$17.2 million
Construction Contractor:	M. A. Bongiovanni		

2001 BNR AND BIOSOLIDS UPGRADE

Design Engineer:	CH2M HILL	Treatment Capacity:	4.85 mgd
Construction Manager:	CH2M HILL	Project Cost:	$17.5 million
Construction Contractor:	Bearing Construction		

UPGRADE AND EXPANSION 7.5

Design Engineer:	CH2M HILL	Treatment Capacity:	7.5 mgd
Construction Manager:	CH2M HILL	Project Cost:	$37.5 million
Construction Contractor:	Ulliman Schutte Construction		

LIQUID TREATMENT

FLOWS

Average Day:	7.50 MGD = 5208 Gal/MIN
Maximum Month:	9.00 MGD = 6250 Gal/MIN
Peak Hydraulic Capacity:	18.75 MGD = 13021 Gal/MIN

PRELIMINARY TREATMENT

Mechanical Screens:	2 Units
Capacity:	45 MGD Each
Opening Size:	3/8 Inch
Raw Sewage Pumps:	
Submersible:	6 Variable Speed
Capacity:	4 @ 6,000 GPM Each 2 @ 3,000 GPM Each
Horsepower:	84-168 HP Each
Emergency Storage Basins:	2 Units
Capacity:	1.25 MG Each
Emergency Storage Tank:	1 Unit
Capacity:	1.8 MG

PRIMARY TREATMENT

Primary Clarifiers:	3 Units
60 Ft Diameter	211,385 Gals Each
10 Ft SW Depth	634,150 Gals Total
Primary Scum System:	2 Units

SECONDARY TREATMENT

Recycle Equalization Basin	1 Unit
60 Ft Diameter	169,100 Gals Each
8 Ft SW Depth	507,300 Gals Total
Retention Basins A/B:	2 Units
24 Ft x 120 Ft	473,900 Gals Each
22 Ft SW Depth	947,800 Gals Total
Membrane Diffusers	482 Per Basin
Mixers	3 Per Basin
Internal Recycle Pumps	2 Per Basin
Retention Basins C/D:	2 Units
70 Ft x 165 Ft	814,500 Gals Each
22 Ft SW Depth	1,629,000 Gals Total
Membrane Diffusers	914 Per Basin
Mixers	3 Per Basin
Internal Recycle Pumps	2 Per Basin
Retention Basins E/F:	2 Units
24 Ft x 165 Ft	6,250,000 Gals Each
22 Ft x SW Depth	1,250,000 Gals Total
Membrane Diffusers:	731 Per Basin
Mixers	3 Per Basin
Internal Recycle Pumps	2 Per Basin
Secondary Clarifiers:	4 Units
40 Ft x 160 Ft	765,950 Gals Each
16 Ft SW Depth	3,000,000 Gals Total

TERTIARY TREATMENT

Nitrification:	Performed in Activated Sludge System
Phosphorous Removal:	Performed with FeCl3 in Primary Clarifiers
Gravity Sand Filtration:	2 Units
26,000 Gals Each	11 inches of 0.58 MM sand
54,000 Gals Total	4.85 MGD Capacity

POTOMAC RIVER DISCHARGE SYSTEM

Effluent Pumps:	6 Variable Speed
Capacity	2600-3500 GPM Each
Horsepower	250 HP Each
Non-Potable Pumps:	6 Variable Speed
Capacity	325 GPM Each
Effluent Pipeline:	
17,000 Feet Pipe	534,000 Gals
Detention Time	7.5 MGD = 95 MIN 18.75 MGD = 38 MIN
Outfall Structure:	2 Cascades 46 Ft Vertical Drop

SOLIDS TREATMENT

SCREENING

Primary Sludge Screen	1 Unit
Capacity	500 GPM

THICKENING

Gravity Thickeners:	2 Units
22 Ft Diameter	30,000 Gals Each
10 Ft SW Depth	60,000 Gals Total
WAS Thickening Centrifuge:	1 Unit
Capacity	100 GPM
WAS Gravity Belt Thickener:	2 Units/2 Reactors
Capacity	600 GPM

STABILIZATION

Anaerobic Digesters:	4 Units
30 Ft Diameter	112,400 Gals Each
25 Ft SW Depth	449,600 Gals Total

STORAGE

Sludge Storage Tank:	2 Units
42 Ft Diameter, 33 Ft SWD:	300,000 Gals

DEWATERING

Sludge Holding Tank:	2 Units
Capacity:	1,600 LBS Dry Solids/HR
Belt Filter Press:	2 Units
2 Meter:	200 GPM
Sludge Storage Pad:	1 Unit
140 Ft x 60 Ft	90 Days Storage
Heat Drying:	1 Unit
Evaporation Capacity	2,000 kk H_20/HR
Pellet Storage Silos	7 Silos/4,000 FT^2 Each

DISPOSAL

Field Gymmy:	1,600 Gals Capacity
Sludge Tanker:	6,000 Gals Capacity
14 Sites on 2 Farms:	285 Acres Total

CHEMICAL SYSTEMS

Ferric Chloride System:	2 Tanks
Primary Clarifier Influent:	5,000 Gal Each
Secondary Clarifier Influent:	
Sodium Hydroxide System:	2 Tanks
Aeration Basin Influent	5,000 Gal Each
Gravity Filter Influent	
Sodium Hypochlorite System:	2 Tanks
Raw Influent	5,000 Gal Each
RAS Wet Well	
Secondary Scum Wet Well	
Gravity Filter Splitter Box	
Sodium Bisulfite System:	1 Tank
Final Effluent	5,000 Gal
Anionic Polymer System:	2 Units
Primary Clarifier Influent	Emulsion Feeders
Secondary Clarifier Influent	
Gravity Filter Influent	
Cationic Polymer Systems:	3 Units
Gravity Thickener Influent	Solution Feeder
WAS Thickening Centrifuge	Emulsion Feeder
Belt Filter Press	Solution Feeder
Methanol System:	2 Tanks
Reactor Basin Influent	3,000 Gal Each

ODOR CONTROL SYSTEMS

Biofilter:	2 Units
Capacity:	15,700-18,600 CFM
EBRT:	45 Seconds
RTO:	1 Unit
Capacity:	10,000 CFM

Leesburg Water Pollution Control Facility

Photograph by Photo Works

"The Town of Leesburg in Virginia" looking north at intersection of King Street (U.S. Route 15) and the Route 7 and 15 bypass

This brochure developed jointly by The Town of Leesburg staff and CH2M HILL, Chantilly, Virginia