

WATER AND WASTEWATER SOLUTIONS

INDUSTRY GUIDE



Teaching Guide

This guide is intended to give our engineers and specialists an understanding of the water and wastewater treatment processes in a typical facility.

Understanding what happens through the various processing stages in a treatment facility will help the user in making the best recommendations for the plant and the customer.

For Chesterton® product line recommendations, see the Appendix Section of this guide.

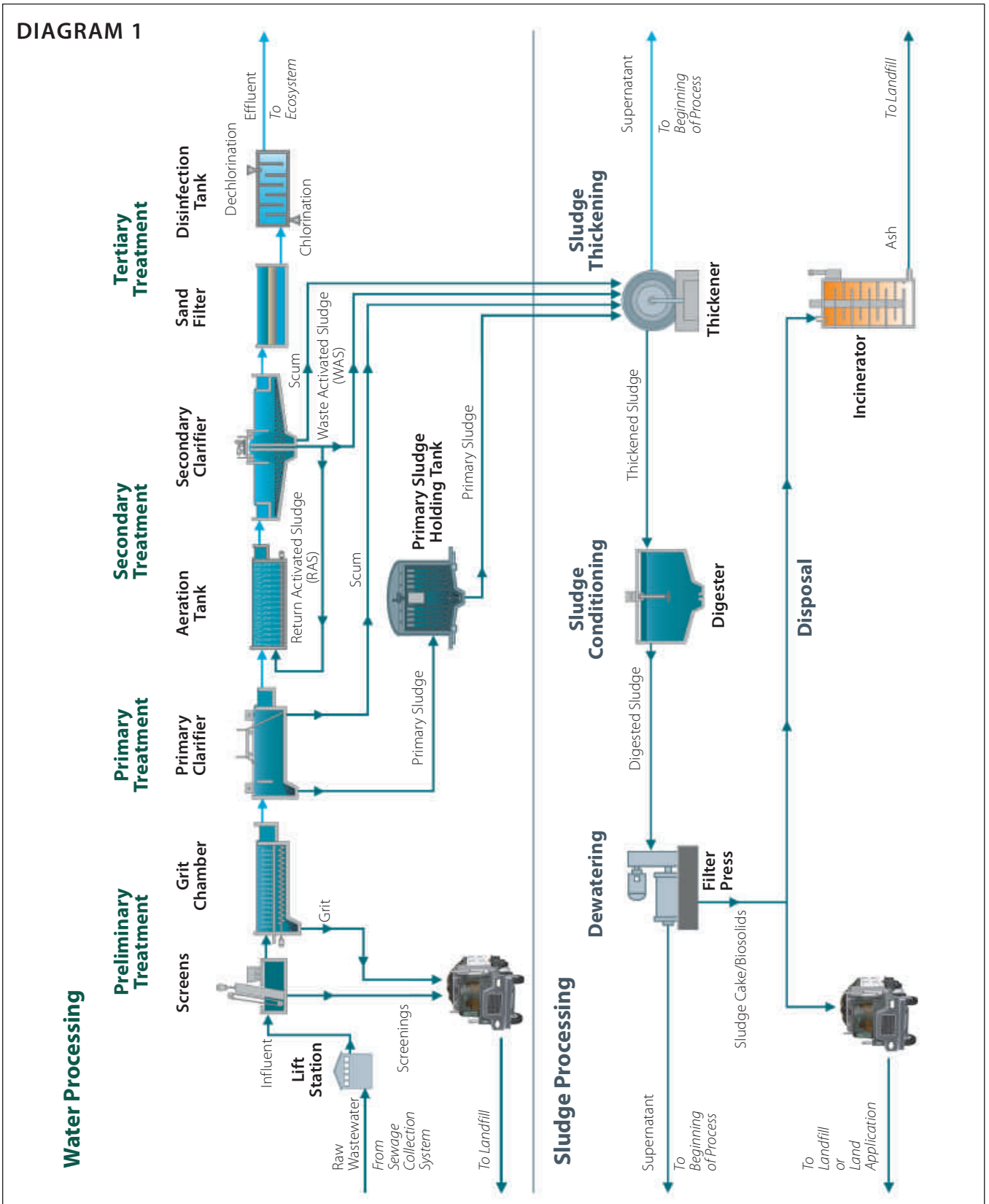




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Wastewater Treatment Plant Process



Introduction

It all starts with a basic requirement of life...water. Water is essential to life and although most of the world's surface is covered with water, only a small percentage is currently usable for human consumption.

We require water to sustain life. However, more potable water is used for other domestic, commercial, and industrial activities than is consumed by humans. The global increase in water consumption has placed significant pressure on communities to supply clean, safe, and inexpensive potable water. It has also significantly increased the scope and requirements of wastewater treatment and the disposal of its by-products to mitigate the negative effects on the environment and the health of humans and animals.

Water and wastewater treatment systems operators are faced with significant challenges. These include managing aging plants and infrastructure, energy conservation, managing maintenance costs, reducing plant water consumption, and most importantly, safety for plant and system employees. These challenges put a tremendous strain on municipalities to economically achieve regulatory compliance. Meeting this goal requires technologically advanced, value-driven Total System Solutions to drive efficiency and increase equipment reliability.

Total System Solutions

Reliability starts with the "system." Webster's Dictionary defines a system as "a regularly interacting or interdependent group of items forming a unified whole." In terms of water and wastewater treatment, this means the equipment, the structures, and plant personnel involved in running the process and producing the end product. True improvement only occurs when the entire system is addressed. Few suppliers match Chesterton's ability to focus on the entire "system," from influent to effluent, from raw water to tap water. Utilizing our extensive product and technology portfolio, training capabilities, and technical expertise, Chesterton provides the Water and Wastewater Industry indispensable tools to address these challenges.

Chesterton® sealing devices, wear and corrosion reduction solutions, and condition monitoring capabilities are recognized by end users, equipment manufacturers, and engineering firms throughout the Water and Wastewater Industry. They have been implemented around the world with documented success and recognition. Chesterton offers increased equipment reliability, energy and water consumption optimization, and technical support to the industry with an extensive portfolio of products and services.

This portfolio includes:

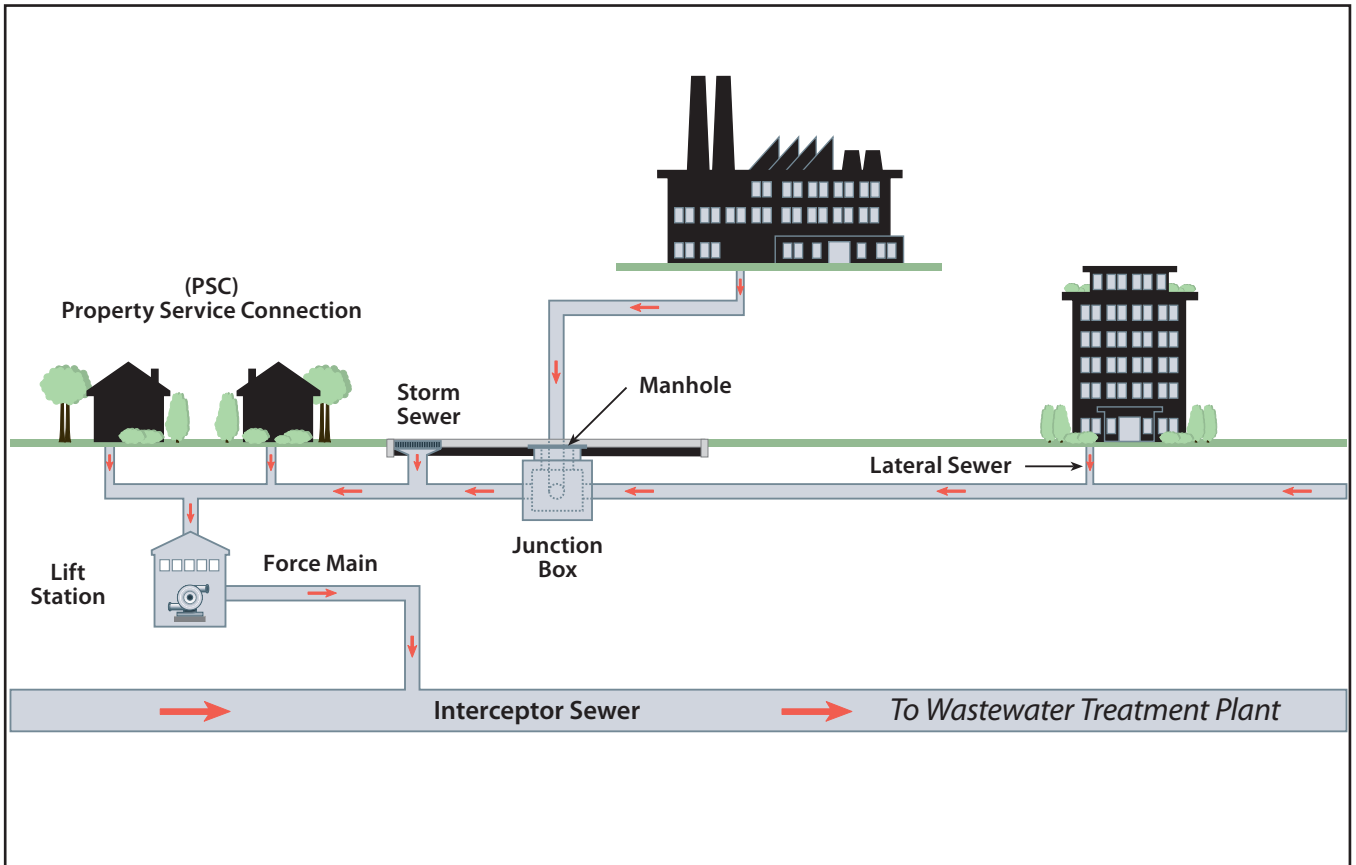
- **Mechanical Seals for pumps and agitators.**
- **Packings for pumps, valves, flanges, and other rotating equipment.**
- **ARC Industrial Coatings for corrosion and wear reduction/control of metal and concrete surfaces.**
- **MRO Chemicals for complete management of the plant's lubricants, degreasers, and solvents.**
- **Hydraulic/Pneumatic Sealing Devices for plunger pumps and other hydraulic and pneumatically actuated equipment and valves.**
- **IIoT Cloud-based condition monitoring of pumps, bearings, and motors.**

Please note that in water and wastewater treatment plants, there are alternate process methods to perform the same function. For example, to disinfect the processed water prior to discharge, wastewater treatment plants use different chemicals and processes. Plants can utilize chlorine, sodium hypochlorite, ultraviolet light, and other methods to kill microorganisms prior to discharge.

It is very important to remember that although the overall processes of water and wastewater treatment are largely similar from plant to plant, the way municipalities structure their staff and departments may differ. When a specialist is looking to develop a new water or wastewater customer, check the website of the municipality. In many instances the website will show how the departments are organized and provide their respective key contacts.

There will also be choices in sealing systems, corrosion and erosion repair materials, lubricants, and cleaners that will benefit and enhance performance at each water and wastewater treatment facility. This guide is intended to help you in selecting the best **Total System Solution** for your customer.

Wastewater Collection System



Wastewater Treatment Plant

Wastewater Characteristics

Wastewater, also referred to as sewage, is water that has been used in homes, industries, institutions, and businesses that is not for reuse and is generally collected in a sewage collection or drainage system. In general, raw wastewater is 99.9% water and 0.1% impurities.

However, the impurities in wastewater can cause damage to our environment, create odors, and pose significant risks to human health if the wastewater is not treated properly. Organic matter comprises approximately 75% of the impurities in wastewater; it is predominantly human and food waste.

Nitrogen, phosphorus, and trace levels of other nutrients are present in wastewater. Nutrients encourage plant growth that can generate excessive plant and algae growth in water and can be detrimental to the natural ecosystem. Therefore, it is essential that excessive nutrients be removed from the water source prior to disposal.

Industrial wastewater may have toxic elements that must be removed prior to discharge. The main concerns are heavy metals, organic compounds, oils and fats.

Heavy metals including arsenic, cadmium, cobalt, chromium, copper, iron, lead, manganese, nickel and zinc can be found in wastewater. Most of the metals are removed in the treatment process and end up in the solids. Therefore, most heavy metal concerns deal with the disposal or reuse of the sludge.

All wastewater contains microorganisms that are beneficial to wastewater processing and others that can be harmful. Aerobic and anaerobic bacteria carry out decomposition of the organic matter into more stable forms that are more easily disposed of in the environment.

Pathogens are microorganisms that can cause disease in plants, animals and humans. The processed water is disinfected prior to discharge to kill these microorganisms.

Wastewater Collection

The wastewater treatment process begins with the collection of waste streams from homes, businesses, and industrial complexes. There are three types of collection systems: sanitary sewers, storm sewers, and combined sewers. Sanitary sewers carry waste away from homes and businesses directly to the wastewater treatment plant and are designed to handle only human waste and easily degradable solids such as toilet paper or tissues. Storm sewers, also known as run-off or surface sewers, collect and carry rainwater, snowmelt, etc. into storm drains. These types of sewers convey the run-off directly to rivers, lakes, and other bodies of water without treatment at the wastewater treatment plant. In many older municipal systems, there are combined sewer systems which combine both sanitary and storm sewers. The combined sewer system has the potential for significant negative impact. During heavy rain events, the amount of run-off plus sanitary waste may exceed the capacity of the wastewater treatment plant. This can cause the system to back up into homes and/or overflow into the receiving waters with minimal or no treatment whatsoever. **Combined Sewer Overflows (CSO)** allow dangerous pathogens and pollutants to make their way into the environment.

The collection or sewer system is comprised of pipes, junction boxes, lift stations, and associated equipment that channel raw wastewater to the plant. Individual homes are connected to the collection system through a lateral sewer to the main sewer line. Sewer lines come together from

different directions into a junction box. Junction boxes combine the flow from main lines into a much larger flow heading towards the wastewater treatment plant.

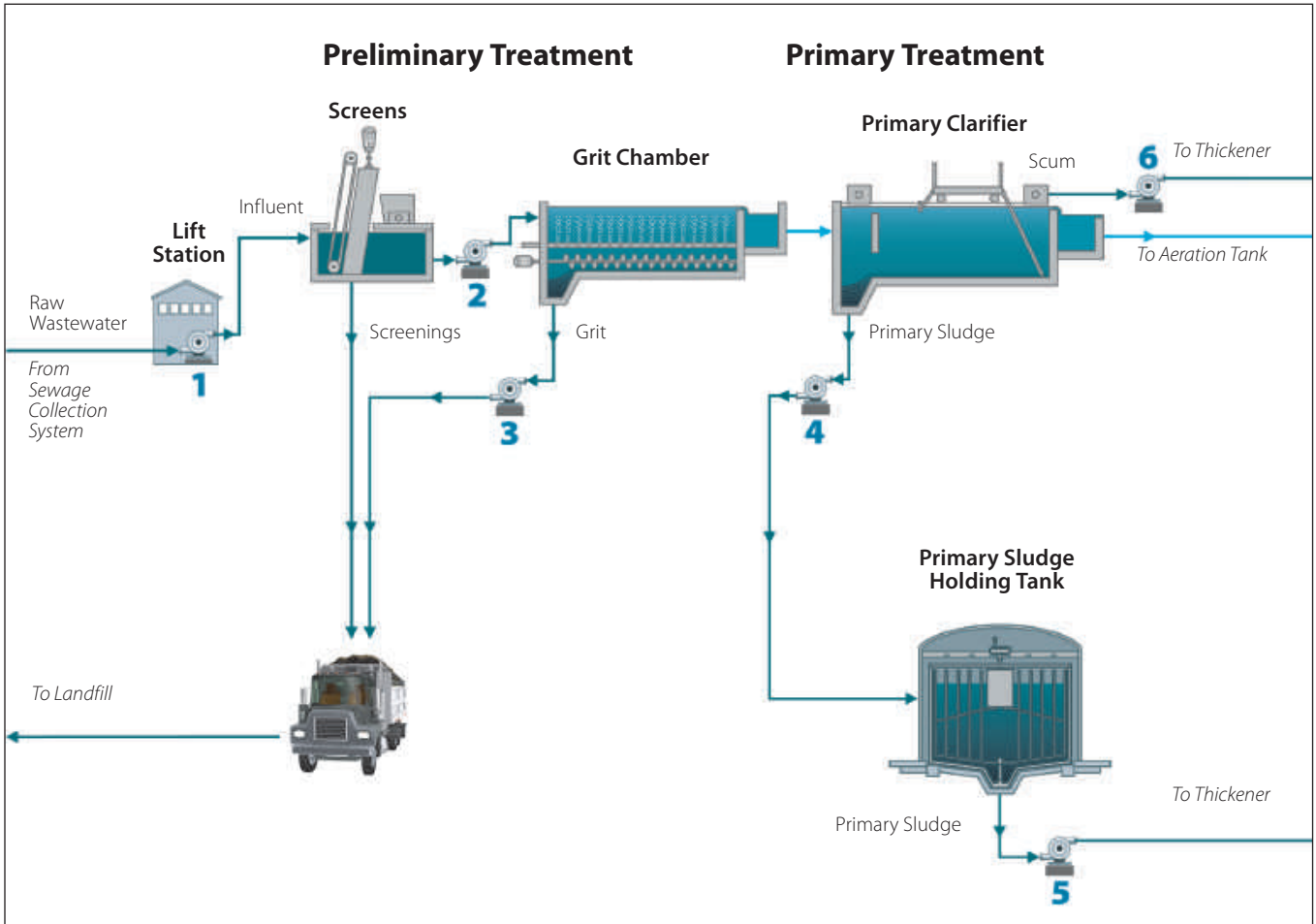
Wherever possible, the design of the collection system and the location of the facility will utilize gravity to move the wastewater to the wastewater treatment plant. However, where this is not feasible due to the municipality's location, elevation changes, and system design, lift stations will be used to pump the wastewater to the plant.

The size and pumping capacity of each lift station is dependent on the maximum estimated flow rates at each station. Where flow rates are relatively low, lift stations are quite small and will typically have two small submersible pumps to move the stream. As the collection system gets closer to the treatment plant, flow rates will increase. Lift stations closer to the plant can become quite large, requiring several large capacity pumps to provide adequate flow capacity.

All lift station designs must consider flow rate changes due to demand variations, such as the time of day and storm surges. People take showers in the early morning, which corresponds with the highest daily flow rates a treatment facility experiences. If the collection system is configured for CSO, there may be a series of large auxiliary storm pumps in these pumping stations.

From the collection system, the wastewater enters the **Wastewater Treatment Plant**.

Preliminary and Primary Treatment Processing Flowchart



Key		
1 – Lift Station Pump	3 – Grit Pump	5 – Primary Sludge Pump
2 – Influent Pump	4 – Primary Sludge Pump	6 – Scum Pump

Wastewater Processing

A Wastewater Treatment Plant is a facility designed to receive the wastewater from primarily domestic, commercial, and industrial sources and to remove materials that damage water quality and threaten public health and safety when discharged into receiving streams or bodies of water. This involves a combination of physical, biological, and chemical processes to remove organic matter and solids from solution.

Most facilities employ a combination of mechanical removal steps and bacterial decomposition to achieve the desired results. Chemicals or ultraviolet light are often added to effluent from the plants to reduce the danger of spreading disease by the release of pathogenic bacteria.

Diagram 1 (Page 2) illustrates the processes of a typical wastewater treatment plant. The top half illustrates the Water Processing flows. Raw wastewater is pumped to the wastewater treatment plant through lift or pumping stations. Lift stations are required where a sewage system serves a community or area lower than the plant, where an uphill shortcut will significantly decrease the total length of pipe required to tie into the plant, or where existing structures or other constraints require an uphill route to the wastewater treatment plant.

The wastewater enters the plant at the headworks where processing starts.

The typical wastewater processing steps include:

- Preliminary Treatment
- Primary Treatment
- Secondary Treatment
- Tertiary Treatment

Preliminary Treatment

The headworks of the plant include the influent channel, coarse and fine screens, and aerated grit chambers where preliminary treatment occurs. Flow measurement, screening, pumping, and grit removal are the typical steps in preliminary treatment.

Wastewater enters the influent channel into the coarse screens. The screens remove large debris that enters the sewage collection system such as rags, tramp metal, sticks, broken glass, rocks, sand, and the vast variety of other materials. Screens are utilized early in the wastewater treatment process to minimize pump and equipment damage within the facility. In many wastewater treatment plants, fine screens are utilized to remove smaller debris. All screened debris is removed and disposed as landfill.

The wastewater is then pumped into grit removal chambers. Air is introduced into the chamber to scour the organic materials from the grit before the grit settles to the bottom of the chamber. The settled grit or sand is delivered, typically by a screw conveyor to a pit at one end of the chamber. From

there, it is pumped by a grit pump to a grit/water separator. This debris is also disposed as landfill. Liquid separated from the grit is returned to the grit chamber. Wastewater from the grit chamber then flows to the primary clarifiers.

Primary Treatment

The primary treatment process physically reduces the solids content of wastewater through sedimentation. Wastewater slowly flows into large tanks called primary clarifiers where heavier particles are allowed to settle at the bottom of the clarifier. Scrapers move the settled solids (primary sludge) to sumps at one end of the clarifier. From there, the primary sludge is pumped into a holding tank where solids processing commences.

Solids lighter than water float to the top and are skimmed from the top of the primary clarifier and pumped to a thickener for solids processing. The greases and fats skimmed from the top of the clarifier are called scum. Primary treatment removes approximately 30 – 50% of the suspended solids. The remaining clarified liquid, containing mostly dissolved materials, flows to the secondary treatment stage.

Secondary Treatment

During secondary treatment, organic material is removed through biological treatment. The most widely used biological treatment method is the activated sludge process. The activated sludge process requires an aerated tank containing bacteria that break down the organic materials in the wastewater stream. The bacteria use the organic material in the liquid and clump together to form a microbial floc, which is also known as activated sludge. This liquid flows into the secondary clarifiers where the activated sludge is allowed to settle. In some wastewater treatment plants, ferric chloride is added after biological treatment to cause precipitation of phosphate materials remaining in the liquid.

Flow enters the clarifiers from the bottom of the tank through a pipe located at the center of the tank. The clarifiers are designed to direct the flow from the center of the clarifier in a downward direction to encourage the solids to settle. The activated sludge settles at the bottom of the secondary clarifier.

Some of the settled activated sludge is collected and is pumped back to the aeration tank to insure sufficient bacteria and organic waste supply to maintain the biological process. This material is called **Return Activated Sludge (RAS)**. The activated sludge not needed for the biological process is called **Waste Activated Sludge (WAS)** and will be pumped to the sludge conditioning stage for further processing.

The clarified liquid, with over 95% of the organic materials removed, flows to the tertiary treatment stage. Scum, formed on the top of secondary clarifiers, is sent to a thickener for solids processing.

Tertiary Treatment

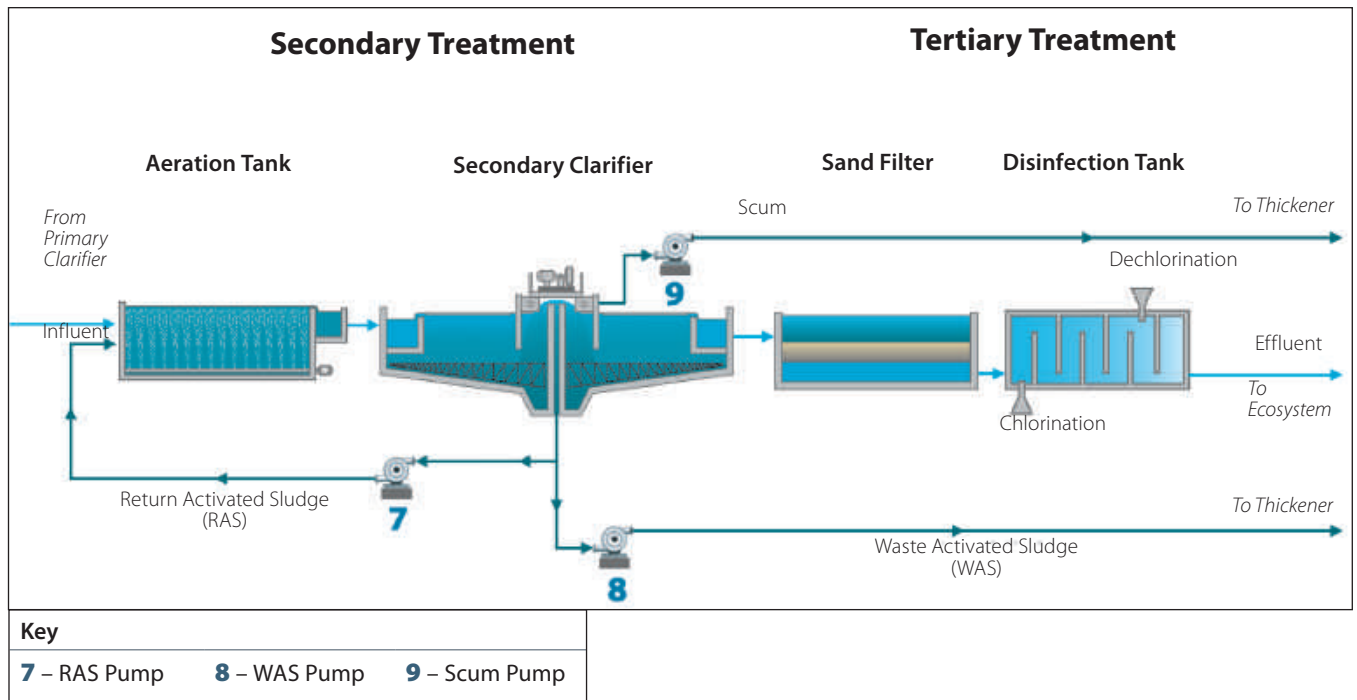
The tertiary treatment stage normally starts with the filtering of the clarified liquid that flows from the secondary clarifiers. The liquid is processed through a bed of sand or other filtering device that removes additional pollutants from the liquid. The water then moves to the disinfection tank.

Water enters the disinfection tank where chlorine gas or sodium hypochlorite is metered in the tank. The water slowly moves through the tank to enable the chlorine to kill the microorganisms remaining in the wastewater that may be harmful to fish life. The disinfected water is then passed on to a dechlorination stage to remove the chlorinated materials that also could be harmful to fish life. Sulfur dioxide or sodium metabisulfate are the most cost effective chemicals utilized to neutralize chlorine.

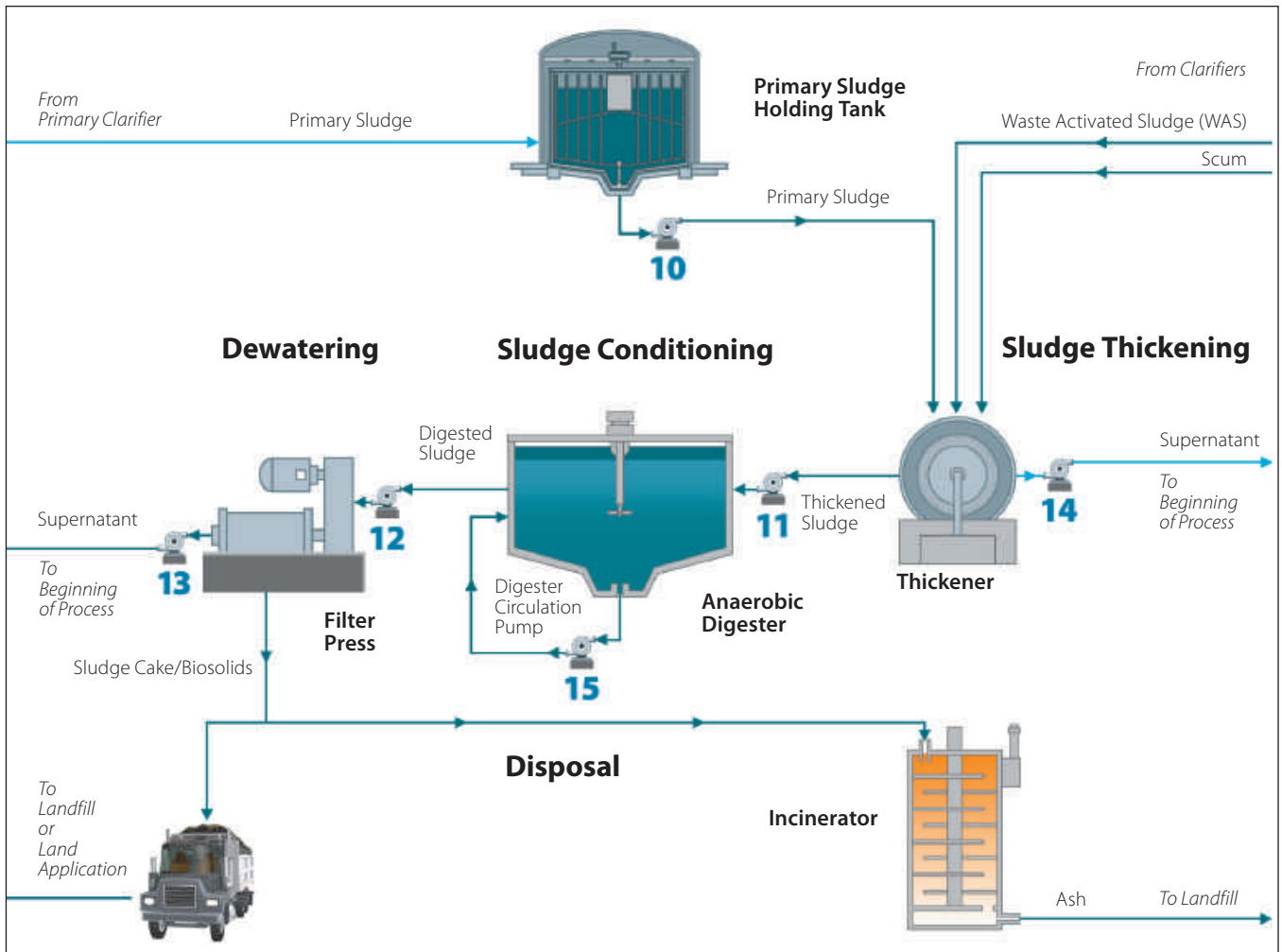
Another disinfection method that eliminates a dechlorination stage is called ultraviolet disinfection. Ultraviolet light sources are submerged in a holding tank. The ultraviolet lamps emit radiation that penetrates the cell wall of the microorganism and is absorbed by cellular materials, which either prevents replication or causes death of the cell. As a result, pathogenic microorganisms are almost entirely inactivated or killed. The UV light disinfection technology is considered to have no adverse environmental impact.

The water or effluent can now be discharged into the ecosystem.

Secondary and Tertiary Treatment Processing Flowchart



Sludge Processing Flowchart



Key		
10 – Primary Sludge Pump	12 – Digested Sludge Pump	14 – Supernatant Pump
11 – Thickened Sludge Pump	13 – Supernatant Pump	15 – Digester Circulation Pump

Sludge Processing

The purpose of primary and secondary treatment is to remove as much organic solids from the liquid as possible while concentrating solids in a much smaller volume for ease of handling and disposal. Primary sludge has a typical solids content of 2 – 8%. Solids concentrations of secondary treatment sludge can range from 0.4% to as much as 4% depending on the secondary process. Sludge processing further reduces the solids content of this sludge through biological processes and removes more of the liquid content from it prior to disposal.

The overall sludge processing investment cost at the typical wastewater treatment plant is about one-third of the total investment in the plant. However, based on the individual wastewater treatment plant's processing system, operating expenses in sludge processing typically amount to even a larger portion of the total plant operating costs. To reduce plant operating costs, it is essential to have a properly designed and efficiently operated sludge processing stage.

The design options for each process will depend on the type, size, and location of the wastewater treatment plant, and the solid disposal options available. The design must be able to handle the amount of sludge produced and converted economically to a product that is environmentally acceptable for disposal or re-use as fertilizer.

As with water processing, sludge process methods will be determined by the specific constraints and requirements of the individual wastewater treatment plant. Our schematic covers the general processing steps found in a typical plant. There will be many plant-to-plant variations that are not illustrated in our guide. Diagram 1 (Page 2) highlights the processes of a typical wastewater treatment plant. The bottom half illustrates the Sludge Processing flows.

The typical sludge processing steps include:

- **Sludge Thickening**
- **Sludge Conditioning**
- **Dewatering**
- **Disposal**

Sludge Thickening

To optimize the sludge conditioning stage, it is important to maximize the solids content of the materials decanted from the water processing stages. The waste activated sludge, scum, and primary sludge can be thickened to reduce the liquid content prior to sludge conditioning. Due to the varying physical nature and liquid content of these materials, facilities may use different thickening processes and equipment for these three materials. In some cases, the primary sludge may not even be thickened and will be pumped directly to sludge conditioning.

The intent is to optimize the downstream processing capabilities. The four most common thickening methods include gravity settling, gravity belt thickening, dissolved air flotation, and centrifuge thickening.

The recovered liquid or supernatant from thickening is pumped back into the aeration tank or to the beginning of the water processing stage and is reprocessed.

Sludge Conditioning

Sludge conditioning is a key stage in the reduction of solids prior to disposal. Based on the size and location of the facility five common methods are typically utilized: chemical treatment, anaerobic digestion stabilization, aerobic digestion stabilization, lagoon storage, and heat treatment.

Many facilities will have some type of aerobic or anaerobic digestion stage prior to dewatering. The purpose of sludge digestion is to convert bulky odorous sludge into a relatively inert material that can be rapidly dewatered without obnoxious odors.

Thickened waste activated sludge, scum, and primary sludge are pumped into the digester. In anaerobic digestion, the digester uses the naturally occurring anaerobic microorganisms to break down organic materials into methane and carbon dioxide gases. The sludge is heated to 37°C (100°F) and agitated continuously in the digester to improve the rate of digestion. There are two different anaerobic processes, single stage and two-stage. Single stage digesters utilize one digester (tank) to digest the sludge, capture methane gas, and store the sludge until it is transferred to the dewatering process.

Two-stage anaerobic digestion uses a primary and secondary digester. The primary digester is heated and utilizes mixers to completely agitate the sludge, which maximizes sludge digestion. The secondary digester is not agitated and is utilized for gravity thickening and storage of the digested sludge. The secondary digester typically incorporates a floating gas dome for methane gas collection and supernatant is pumped out to increase solids content.

Anaerobic digestion is a biological process that breaks down a significant amount of organic solids in the sludge and produces methane gas that is utilized as a fuel for the plant. Consequently, the volume of final sludge is greatly reduced, which in turn reduces the cost for sludge disposal.

The process also reduces the level of pathogenic microorganisms enabling digested sludge to be classified as biosolids that can be utilized as a soil conditioner or fertilizer.

Sludge can also be stabilized by long-term aeration that biologically destroys volatile solids. An aerobic digester is normally operated by continuously feeding raw sludge with intermittent supernatant and digested sludge withdrawals. The digested sludge is continuously aerated during filling and for the specified digestion period after the tank is full. Aeration is then discontinued to allow the stabilized solids to settle by gravity. Supernatant is decanted and returned to the head of the treatment plant, and a portion of the gravity-thickened sludge is removed for dewatering.

The next step for the stabilized sludge is dewatering.

Dewatering

Dewatering is the final stage prior to sludge disposal. The goal is to economically remove as much liquid as possible from the sludge or digested sludge prior to disposal. The most common method of dewatering utilizes a belt filter press. The belt filter press has two continuous porous belts that pass over a series of rollers to squeeze water out of the sludge that is compressed between the two belts. Polymers are typically added to the process to enhance dewatering capabilities. Centrifuges are also used for dewatering, typically, in larger wastewater treatment plants.

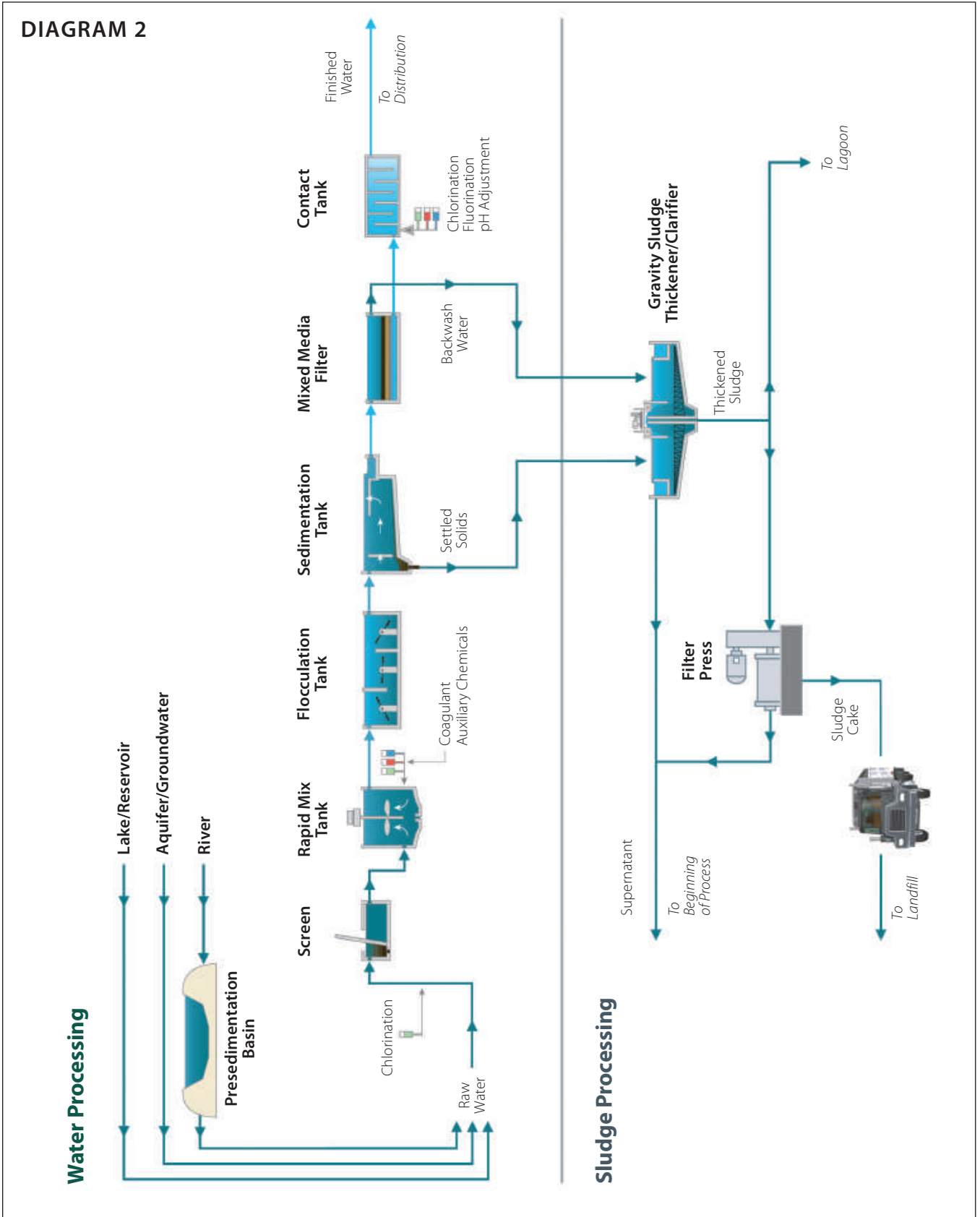
Any supernatant that is removed in the dewatering process is returned to the beginning of the treatment plant for reprocessing.

Disposal

Digested sludge that is processed into biosolids can be used to spread on farmland as a soil conditioner or can be further processed as fertilizer. It can also be disposed as landfill.

Sludge can also be incinerated and the remaining ash is disposed as landfill. Economics and environmental regulations will be the primary drivers in what disposal method an individual wastewater treatment plant uses.

Water Treatment Plant Process



Water Treatment Plant – Potable Water

Raw Water Characteristics

Water treatment plants normally take raw water from various surface and groundwater sources to provide clean potable water for the community. The finished water, the treated water after it leaves the water treatment facility, must be chemically and microbiologically safe and also free from any tastes, color, odors, or particulate matter. Water quality is usually regulated by local, state, and federal agencies to protect the health and well-being of the constituency. The water treatment process necessary to meet these standards will be predicated on the extent of the regulatory requirements, climatic conditions, environmental conditions, and the source or sources of the raw water the community has available to it.

Major sources of surface water include rivers, lakes, and reservoirs; groundwater supplies are obtained from deep wells and shallow wells. Surface water sources are subject to more variability than groundwater and typically require more treatment processes than groundwater sources. Flows and conditions of surface water will be affected by the time of year, amount of rainfall, pollution, location of the water source, and many other variables. Periods of high rainfall or snow melt will cause a much greater flow rate and river height that will bring more silt and organic matter into the water treatment facility.

Water Processing

A Water Treatment Plant must be designed to accommodate the raw water source variability over the climatic seasons, as well as the seasonal demand fluctuations of the community. Their challenge is to consistently process raw water streams to produce safe, clean and good-tasting water.

Diagram 2 (Page 12) illustrates a typical water treatment plant with the standard processes required at the plant. The raw water source will determine how many of these typical processes or stages will be necessary to produce finished water. The illustration includes all of the major processes to provide a better understanding of the various steps that are or may be taken. The top half illustrates the Water Processing flows.

The typical water processing steps include:

- Preliminary Treatment
- Primary Treatment
- Post Treatment

Preliminary Treatment

Raw water is pumped from its source. Prior to entering the plant, the raw water is passed through screens (coarse and fine) to remove large debris such as sticks, leaves, plants, aquatic life, and other large objects. Chlorine is typically added to the water prior to entering the plant to eliminate disease causing microorganisms and to prevent microorganisms and algae from growing in the plant during water treatment. This chlorination also oxidizes taste and odor causing compounds. Treatment processes that occur prior to the water entering the plant are part of Preliminary Treatment.

Primary Treatment

Primary treatment consists of the following steps:

- Coagulation
- Flocculation
- Sedimentation
- Filtration

Water flows from the screening process to the first step of primary treatment, Coagulation. Coagulants and auxiliary chemicals are added to the water in a rapid mixing tank to aid in the removal of finer particles suspended in water. In the rapid mix tank, the coagulants and other chemicals are rapidly mixed in the water to evenly distribute these materials. The coagulant breaks down repelling forces between small suspended particles and allows these particles to group together.

The next step in primary treatment is Flocculation. Water moves from the rapid mix tank to the flocculation tank. The flocculation tank has paddles or other means to mix the water very slowly. During the slow mix, the suspended particles begin to form larger groups of solids called floc. The formation of floc creates masses that can be separated from the base water.

In Sedimentation, the water with floc masses slowly flow to a tank where the water is retained for several hours. The larger, heavier floc particles settle to the bottom. The solids, called sludge, are collected at the bottom of the tank and are pumped to a clarifier to further collect solids.

Solids that are not separated in sedimentation are removed during Filtration. The filter media used in the filter tank will be dependent on the raw water being processed. Typically multiple layers of charcoal, gravel, and sand are utilized;

charcoal to improve the taste characteristics, gravel and sand to remove particles. A water treatment plant typically operates continuously and the filter is back washed to remove the particulate embedded in the filter media. The backwash water is pumped to a clarifier for solids separation or pumped back to the water source.

Post Treatment

After filtration, chlorine or other disinfectants are added to the water to eliminate any remaining pathogenic micro-organisms and keep the piping system and storage reservoirs free from pathogens and to maintain a residual to the tap. In many communities, the water is fluorinated for dental health considerations.

Sludge Processing

The solids content of processed raw water is much less than the wastewater solids stream. There are also less environmental concerns with the processing and disposal of solids accumulated at a water treatment plant. The two primary sources of waste solids are from the sedimentation tank, where chemical coagulation or softening generate solids that are a mix of the process chemicals, and the suspended solids from the raw water; backwash water from the media filter is the second source.

The solid materials generated are highly variable in composition due to the variety of chemicals utilized to treat the raw water and the raw water source itself. As there are a multitude of ways of treating water, there are also many ways of processing or discharging the waste materials generated in water treatment. Many water treatment plants will not treat or process their waste stream at all, but pump them to a wastewater treatment facility for disposal. Other facilities will separate the solids content as economically as feasible and dispose of the residuals in lagoons, where the water is allowed to evaporate from the retained solids. Dried solids are then removed for disposal at a landfill site.

Where there is insufficient land area for lagoons, the water treatment facility must remove as much water from its wastes as possible to make it economically feasible to transport and dispose of the solid wastes at a landfill site. Because of the unique characteristics of each plant's waste stream, there isn't a standard process method utilized. Each plant will have its individual process method to deal with the waste stream.

The bottom half of **Diagram 2** (Page 12) illustrates a typical water solids (sludge) processing plant.

The typical sludge processing steps include:

- **Sludge Thickening**
- **Dewatering**
- **Disposal**

Chemicals are also added to adjust the pH and buffer the finished water to make it less corrosive to the piping system. Many of the older piping systems contain lead pipes that will leach lead compounds into the water if the pH level is too low.

Post treatment chemicals can be added to a contact tank that allows the materials to evenly mix into the finished water or can be metered into the water directly using metering pumps. The finished water is now ready to be consumed and is pumped to reservoirs and storage tanks. Low pressure in a water main can also be a health hazard. Adequate pressure, along with residual chlorine keeps contaminated water from infiltrating water mains, reaching homes and businesses. The distribution system uses pumps and elevated storage tanks to maintain requisite pressure. Typical pressure ranges between 40 and 60 psi.

Sludge Thickening

Settled solids from the sedimentation tank are pumped to a gravity sludge thickener or clarifier where solids are allowed to settle out of the liquid. In many facilities, thickening agents or polymers are added to facilitate the solids separation process. The supernatant or process water flows into weirs at the top of the clarifier and are pumped back to the beginning of water processing, where it is reprocessed. The thickened sludge is either pumped out to a lagoon for drying or to an additional dewatering process to remove additional water prior to transporting the solids or sludge to landfill.

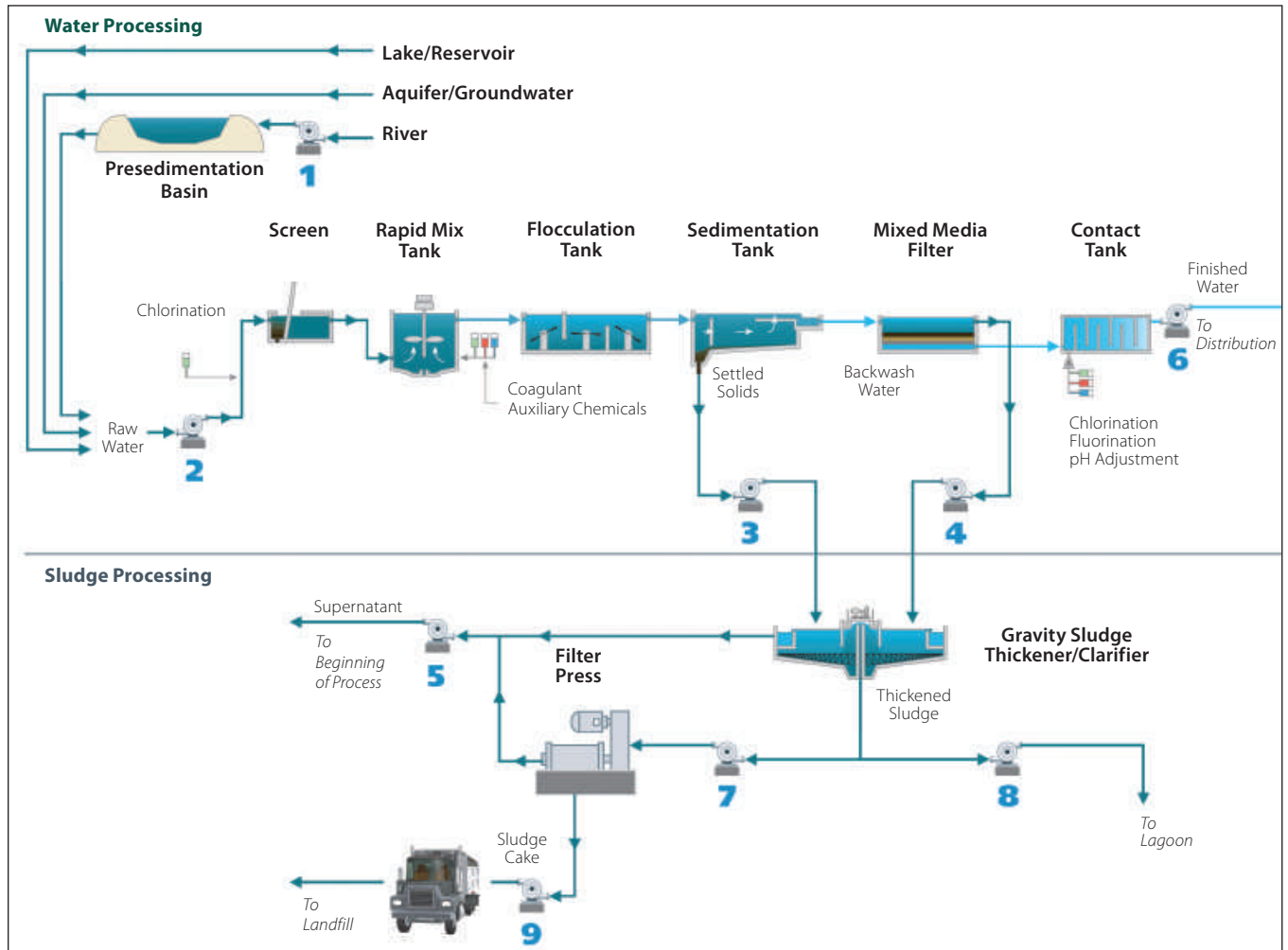
Dewatering

Dewatering is the final stage prior to sludge disposal. As in a wastewater treatment plant, the goal is to economically remove as much liquid as possible from the sludge prior to disposal. The two most common methods of dewatering in a water treatment plant are centrifugation and pressure filtration. Polymers can be added to the process to enhance dewatering capabilities. Supernatant that is removed in the dewatering process is returned to the beginning of the treatment plant for reprocessing.

Disposal

Sludge is generally disposed as landfill. It can also be incinerated and the remaining ash disposed as landfill. Economics and environmental regulations will be the primary drivers in what disposal method an individual water treatment plant uses.

Water Treatment Plant Process Flowchart



Key

- | | | |
|---------------------------------|---------------------------------|-----------------------------------|
| 1 – Raw Water Pumps | 4 – Backwash Water Pumps | 7 – Thickened Sludge Pumps |
| 2 – Low Lift Pumps | 5 – Supernatant Pumps | 8 – Thickened Sludge Pumps |
| 3 – Settled Solids Pumps | 6 – High Lift Pumps | 9 – Sludge Cake Pumps |

Appendix

Sealing Device Recommendation Key

Primary and Secondary Type

We have presented a primary and secondary recommendation to simplify mechanical seal and packing selection for your process. This does not mean other sealing device types are unacceptable. From our experience and sealing knowledge, we have determined that the primary and secondary recommendations will perform in the specific application and are the types most often used for the application under typical operating and equipment conditions.

Other variables may exist that will require a different sealing device option. This could be based on equipment type and size, fluid properties, associated hazards, customer preference, sealing device standardization, etc. The better understanding one has of the process conditions and user preferences, the better the sealing device recommendation you will make for that specific application.

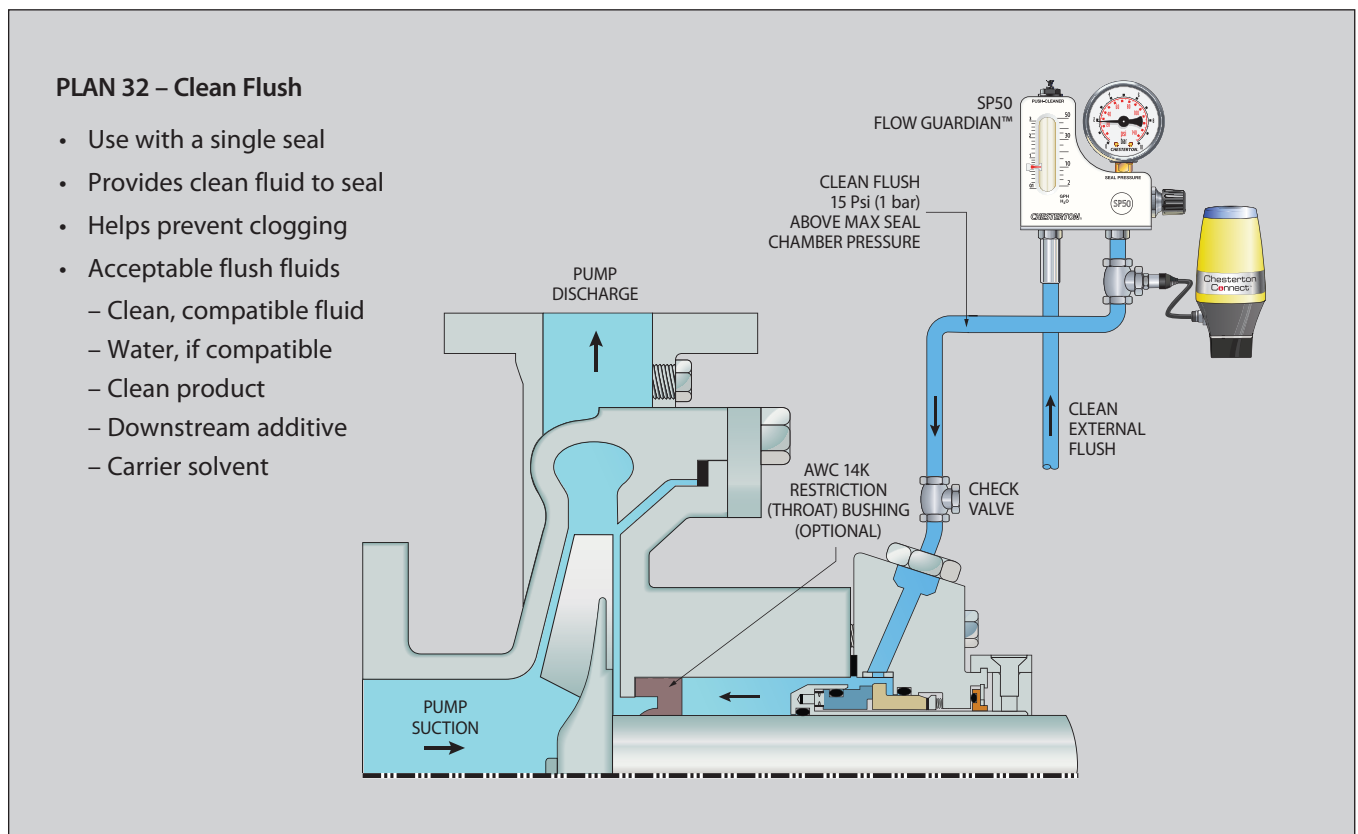
Piping Plan

The recommended piping plan to be utilized to enhance sealing device life and performance based on the API Auxiliary Piping Systems is listed for both mechanical seal and packing selection. A piping plan is not designated for applications that typically do not require one.

The most commonly utilized piping plan in a water and wastewater treatment plant is Plan 32 – Clean Flush.

Flow Guardian™ and Chesterton Connect™ have been depicted as optional devices to enhance Plan 32 effectiveness and reliability.

Please see the diagram below.



Preliminary and Primary Treatment Processing - Sealing Device Recommendations

Wastewater Treatment Plant

PAGE NUMBER	FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						
	PUMP NUMBER	FLUID	% SOLIDS	PRIMARY			SECONDARY			
				SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	NOTES
6	1	Raw Wastewater	≈ 0.1%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
6	2	Raw Wastewater	≈ 0.1%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
6	3	Water/Grit	≈ 0.5 - 2%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
6	4	Primary Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	2, 4
6	5	Primary Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	1, 2, 4
6	6	Scum	≈ 0.5%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4

Secondary and Tertiary Treatment Processing - Sealing Device Recommendations

PAGE NUMBER	FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						
	PUMP NUMBER	FLUID	% SOLIDS	PROBLEM			SECONDARY			
				MECHANICAL SEAL	MATERIAL	PIPING PLAN	MECHANICAL SEAL	MATERIAL	PIPING PLAN	NOTES
8	7	Return Activated Sludge (RAS)	≈ 1 - 3%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
8	8	Waste Activated Sludge (WAS)	≈ 1 - 3%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
8	9	Scum	≈ 0.50%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 4
-	Not shown	Effluent	≈ 0.003%	442/442C	RSC/CB-S-EPDM	11	1510	RSC/CB-S-EPDM	11	2, 4

Sludge Processing - Sealing Device Recommendations

PAGE NUMBER	FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						
	PUMP NUMBER	FLUID	% SOLIDS	PRIMARY			SECONDARY			
				SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	NOTES
9	10	Primary Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	2, 4
9	11	Thickened Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	2, 4
9	12	Digested Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	1, 2, 3, 4
9	13	Supernatant	≈ 1%	442/442C	RSC/CB-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 3, 4
9	14	Supernatant	≈ 1%	442/442C	RSC/CB-S-EPDM	32	1510	SC/TC-S-EPDM	32	
9	15	Digested Sludge	≈ 4 - 6%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	-	1, 2, 3, 4

Mechanical Seal Notes:

1. Flush can be reduced with the use of a standard throat (restriction bushing); reduced or eliminated with the use of SpiralTrac® Environmental Controller.
2. Utilize API Plan 13 for all vertically oriented pumps when mechanical seals are specified.
3. Specification may require potable water standards (e.g., NSF 61, ACS, WRAS, KIWA, DVGW, KTW, 4MS) depending on country/region.
4. Optional use of Chesterton Connect™ for condition monitoring of pump and seal (Seal Chamber pressure/temperature, surface temperature, and 3 Axis Vibration)..

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Water Processing - Water Treatment Plant - Sealing Device Recommendations

PAGE NUMBER	FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						NOTES
	PUMP NUMBER	FLUID	% SOLIDS	PRIMARY			SECONDARY			
				SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	
15	1	Raw Water	< 0.1%	442/442C	RSC/CB-S-EPDM	32	1510	SC/CB-S-EPDM	32	1, 2, 3, 4
15	2	Raw Water	<0.1%	442/442C	RSC/CB-S-EPDM	32	1510	SC/CB-S-EPDM	32	1, 2, 3, 4
15	3	Settled Solids	≈ 0.2 – 2%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 3, 4
15	4	Backwash Water	≈ 0.1%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 3, 4
15	5	Supernatant	≈ 0.1%	442/442C	RSC/RSC-S-EPDM	32	1510	SC/TC-S-EPDM	32	1, 2, 3, 4
15	6	Finished Water	0%	442/442C	RSC/CB-S-EPDM	32	1510	SC/CB-S-EPDM	32	1, 2, 3, 4
15	7 & 8	Thickened Sludge	≈ 10 – 15%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	32	2, 4
15	9	Sludge Cake	≈ 10 – 15%	442/442C	RSC/RSC-S-EPDM	32	170	SC/TC-S-EPDM	32	2, 4

Preliminary and Primary Treatment Processing - Packing Recommendations Wastewater Treatment Plant

PAGE NUMBER	FLUID INFORMATION			PRIMARY		SECONDARY		NOTES
	PUMP NUMBER	FLUID	% SOLIDS	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
6	1	Raw Wastewater	≈ 0.1%	DualPac® 2212	32	1730	32	5
6	2	Raw Wastewater	≈ 0.1%	DualPac® 2212	32	1730	32	5
6	3	Water/Grit	≈ 0.5 - 2%	DualPac® 2212	32	1730	32	5
6	4	Primary Sludge	≈ 4 – 6%	DualPac® 2212	32	1730	32	5
6	5	Primary Sludge	≈ 4 – 6%	DualPac® 2212	32	1730	32	5
6	6	Scum	≈ 0.5%	DualPac® 2212	32	1730	32	5

Mechanical Seal Notes:

1. Flush can be reduced with the use of a standard throat (restriction bushing); reduced or eliminated with the use of SpiralTrac® Environmental Controller.
2. Utilize API Plan 13 for all vertically oriented pumps when mechanical seals are specified.
3. Specification may require potable water standards (e.g., NSF 61, ACS, WRAS, KIWA, DVGW, KTW, 4MS) depending on country/region.
4. Optional use of Chesterton Connect™ for condition monitoring of pump and seal (Seal Chamber pressure/temperature, surface temperature, and 3 Axis Vibration).

Packing Notes:

5. Flush can be significantly reduced using recommended packing types and Version P SpiralTrac (Supersets).

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Secondary and Tertiary Treatment Processing - Packing Recommendations

PAGE NUMBER	FLUID INFORMATION			PRIMARY		SECONDARY		NOTES
	PUMP NUMBER	FLUID	% SOLIDS	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
8	7	Return Activated Sludge (RAS)	≈ 1 – 3%	DualPac® 2212	32	1730*	32	5
8	8	Waste Activated Sludge (WAS)	≈ 1 – 3%	DualPac® 2212	32	1730*	32	5
8	9	Scum	≈ 0.50%	DualPac® 2212	32	1730*	32	5
–	Not shown	Effluent	≈ 0.003%	DualPac® 2212	32	1730*	32	5

Sludge Processing - Packing Recommendations

	FLUID INFORMATION			PRIMARY		SECONDARY		NOTES
	PUMP NUMBER	FLUID	% SOLIDS	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
9	10	Primary Sludge	≈ 4 – 6%	DualPac® 2212	32	1730*	32	5
9	11	Thickened Sludge	≈ 4 – 6%	DualPac® 2212	32	1730*	32	5
9	12	Digested Sludge	≈ 4 – 6%	DualPac® 2212	32	1730*	32	5
9	13	Supernatant	≈ 1%	DualPac® 2212	32	1730*	32	5
9	14	Supernatant	≈ 1%	DualPac® 2212	32	1730*	32	5
9	15	Digested Sludge	≈ 4 – 6%	DualPac® 2212	32	1730*	32	5

Water Processing - Water Treatment Plant - Packing Recommendations

	FLUID INFORMATION			PRIMARY		SECONDARY		NOTES
	PUMP NUMBER	FLUID	% SOLIDS	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
15	1	Raw Water	< 0.1%	DualPac® 2212	32	1730*	32	3, 4, 5
15	2	Raw Water	<0.1%	DualPac® 2212	32	1730*	32	3, 4, 5
15	3	Settled Solids	≈ 0.2 – 2%	DualPac® 2212	32	1730*	32	4, 5
15	4	Backwash Water	≈ 0.1%	DualPac® 2212	32	1730*	32	3, 4, 5
15	5	Supernatant	≈ 0.1%	DualPac® 2212	32	1730*	32	3, 4, 5
15	6	Finished Water	0%	DualPac® 2212	32	1730*	32	3, 4, 5
15	7 & 8	Thickened Sludge	≈ 10 – 15%	DualPac® 2212	32	1730*	32	4, 5
15	9	Sludge Cake	≈ 10 – 15%	DualPac® 2212	32	1730*	32	4, 5

Mechanical Seal Notes:

1. Flush can be reduced with the use of a standard throat (restriction bushing); reduced or eliminated with the use of SpiralTrac® Environmental Controller.
2. Utilize API Plan 13 for all vertically oriented pumps when mechanical seals are specified.
3. Specification may require potable water standards (e.g., NSF 61, ACS, WRAS, KIWA, DVGW, KTW, 4MS) depending on country/region.
4. Optional use of Chesterton Connect™ for condition monitoring of pump and seal (Seal Chamber pressure/temperature, surface temperature, and 3 Axis Vibration).

Packing Notes:

5. Flush can be significantly reduced using recommended packing types and Version P SpiralTrac (Supersets).

* Where NSF 61, ACS standard required, use 1725A. If WRAS, use 1935.

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SpiralTrac® Environmental Controller Recommendations

Wastewater Treatment Plant

PAGE NUMBER	PUMP NUMBER	FLUID INFORMATION		MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
				PRIMARY			SECONDARY			PRIMARY/SECONDARY				
		FLUID	% SOLIDS	SEAL	SPIRALTRAC® VERSION / TYPE	PIPING PLAN	SEAL	SPIRALTRAC® VERSION / TYPE	PIPING PLAN	PACKING	SPIRALTRAC® VERSION	SPIRALTRAC® TYPE	PIPING PLAN	
6	1	Raw Wastewater	≈ 0.1%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
6	2	Raw Wastewater	≈ 0.1%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2211/1730	P	S	32	1, 2
6	3	Water/Grit	≈ 0.5 – 2%	442/442C	F/S, N/I	32	1510	N/I	32	DualPac® 2212/1730	P	S	32	1, 2
6	4	Primary Sludge	≈ 4 – 6%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
6	5	Primary Sludge	≈ 4 – 6%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
6	6	Scum	≈ 0.5%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
8	7	Return Activated Sludge (RAS)	≈ 1 – 3%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
8	8	Waste Activated Sludge (WAS)	≈ 1 – 3%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
8	9	Scum	≈ 0.5%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
9	10	Primary Sludge	≈ 4 – 6%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
9	11	Thickened Sludge	≈ 4 – 6%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
9	12	Digested Sludge	≈ 4 – 6%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
9	13 & 14	Supernatant	≈ 1%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2211/1730	P	S	32	1, 2

Water Treatment Plant

PAGE NUMBER	PUMP NUMBER	FLUID INFORMATION		MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
				PRIMARY			SECONDARY			PRIMARY/SECONDARY				
		FLUID	% SOLIDS	SEAL	SPIRALTRAC® VERSION / TYPE	PIPING PLAN	SEAL	SPIRALTRAC® VERSION / TYPE	PIPING PLAN	PACKING	SPIRALTRAC® VERSION	SPIRALTRAC® TYPE	PIPING PLAN	
15	1	Raw Wastewater	< 0.1%	442/442C	F/S, D/I	32	1510	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	3	Settled Solids	≈ 0.2 – 2%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	4	Backwash Water	≈ 0.1%	442/442C	F/S, D/I	32	442/442C	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	5	Supernatant	≈ 0.1%	442/442C	F/S, D/I	32	442/442C	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	6	Finished Water	0	442/442C	F/S, D/I	32	442/442C	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	7 & 8	Thickened Sludge	≈ 10 – 15%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2
15	9	Sludge Cake	≈ 10 – 25%	442/442C	F/S, D/I	32	170	F/S, D/I	32	DualPac® 2212/1730	P	S	32	1, 2

Notes:

1: SpiralTrac D/I, N/I may be used without a flush in specific applications; contact Applications Engineering for details.

2: Where NSF 61, ACS is required, use 1725A. If WRAS, use 1935.

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SpiralTrac® Selecting Versions and Types – Device Application

Version F

Flush only, split

- Used only with flush typically 5 – 8 gph (0.3 – 0.51 pm).
- Version F is always specified with split types. Since split devices are intended for installation with the pump in place, the pump cannot be modified to incorporate the air vent or exit groove extension required for flush free operation.

Version N

Small/no flush, non-fibrous application

- Used with a small flush or no flush in non-fibrous applications. Should be the version specified for seals whenever non-fibrous contaminants are handled and the equipment will be disassembled for installation.

Version D

Small/no flush, fibrous applications

- Used in fibrous (paper stock, wastewater) applications with a small flush, 5 – 8 gph (0.3 – 0.51 pm), if the product is aerated and single seals are used, or with no flush. (If uncertain, start the pump with the flush and decrease slowly. If the gland heats up the stock is aerated, turn the flush back on.)
- Available in 316/416SS, ESC (Carbon-graphite, ceramic-filled PTFE).

Version P

Packing

- Used with packing to reduce: flush, leakage, wear, and maintenance costs.

Installation Configuration

SpiralTrac® device must fit into each pump configuration and therefore, must be available in several basic shapes to fit the majority of chambers. In each case, whether flush is necessary or not is dependent upon the nature of the product, whether there is air in the product, and if the air vent and exit groove are extended through to the impeller.

Type I

This is the favored installation for open or taper bore pumps, or where machining can be done. The SpiralTrac device is simply pressed into position from the impeller side for flush free capability if the fluid is not aerated. The exit groove and air vent are integral to the device, only a simple upgrade is necessary for installation.

Type S

The Type S designates a design that is axially split for mounting into the chamber without disassembling the equipment. This would be used when a split seal is to be changed, or installed to replace packing, while the pump still in place. Because no air vent or exit groove extension can be incorporated while the pump is in place, a small flush is required. The Version P, which is also available split, is used to replace the bottom rings of packing and the lantern ring. With both, it is necessary to ensure that the size of contaminant expected in the flush will pass under the cast in throat. (If the equipment is to be disassembled to mount a split seal, the use of installation Types I, A, or E are recommended for the increased flexibility and security.)

Type E

The Type E is configured to fit into horizontal split case pumps to replace the OEM bushings often found in these type of pumps. They usually incorporate an external flange to match a corresponding groove in the pump casing. The air vent and exit groove are normally contained within the SpiralTrac design, but depending upon the configuration of the pump, a hole may have to be drilled. The exit groove normally extends completely through to the impeller side

Chesterton Connect™ System Application Recommendations for Water and Wastewater Treatment

WASTEWATER TREATMENT	APPLICATION	CHESTERTON CONNECT			
		PROCESS TEMP	PROCESS PRESSURE	SURFACE TEMP	VIBRATION
Lift Station	Lift Pump	•	•	•	•
Lift Station	Lift Pump (Submersible)				•
Lift Station	Valves	•	•	•	•
Preliminary Treatment	Raw Sewage / Influent Pump	•	•	•	•
Preliminary Treatment	Grit Pump	•	•	•	•
Primary Treatment	Primary Sludge Pump	•	•	•	•
Primary Treatment	Primary Sludge Pump - Belt Driven	•	•	•	•
Secondary Treatment	Agitators	•	•	•	•
Secondary Treatment	Return Activated Sludge Pump	•	•	•	•
Secondary Treatment	Return Activated Sludge Pump - Belt Driven	•	•	•	•
Secondary Treatment	Waste Activated Sludge Pump	•	•	•	•
Secondary Treatment	Waste Activated Sludge Pump - Belt Driven	•	•	•	•
Secondary Treatment	Scum Pump	•	•	•	•
Tertiary Treatment	Lift Screw Pump	•	•	•	•
Tertiary Treatment	Effluent Pump	•	•	•	•
Solids Treatment	Sludge Mix Tank Agitator			•	•
Solids Treatment	Thickened Sludge Pump	•	•	•	•
Solids Treatment	Digested Sludge Circulation Pump	•	•	•	•
Solids Treatment	Filter Presses				•
Solids Treatment	Thickener - Centrifugal/Vacuum				•
Utilities	Blowers / Fans				•
Utilities	Heat Exchangers	•			

WATER TREATMENT	APPLICATION	CHESTERTON CONNECT			
		PROCESS TEMP	PROCESS PRESSURE	SURFACE TEMP	VIBRATION
PRELIMINARY	EQUIPMENT / AREA	PROCESS TEMP	PROCESS PRESSURE	SURFACE TEMP	VIBRATION
Preliminary	Raw Water Pumps	•	•	•	•
Preliminary	Low Lift Pumps	•	•	•	•
Presedimentation	Valves		•		
Presedimentation	Sludge Pumps	•	•	•	•
Rapid Mix/Coagulation	Agitators	•	•	•	•
Chemical Bulk Storage	Caustic Pumps	•	•	•	•
Chemical Bulk Storage	Acid Pumps	•	•	•	•
Settling/Sedimentation	Sludge Pumps	•	•	•	•
Settling/Sedimentation	Sludge Pumps - belt driven	•	•	•	•
Filtering	Pumps - Filtrate	•	•	•	•
Filtering	Pumps - Backwash	•	•	•	•
Filtering	Valves		•		
Distribution/Storage	High Lift Pumps	•	•	•	•
Distribution/Storage	Valves	•	•	•	•
Sludge Handling	Sludge Pumps	•	•	•	•
Sludge Handling	Sludge Pumps - Belt Driven	•	•	•	•
Sludge Handling	Sludge Thickeners				•
Sludge Handling	Agitators	•	•	•	•
Dewatering	Centrifuges			•	•
Dewatering	Screw Conveyor			•	•

ARC Product Recommendations for Wastewater Treatment Plant

WASTEWATER TREATMENT PLANT		PROBLEM					ARC PRODUCT SELECTION		
PROCESS	EQUIPMENT/AREA	ABRASION	CHEMICAL	CORROSION	EROSION	FOULING	SLIP HAZARD	REBUILDING	CORROSION COATING
Collection System	Junction Boxes			•	•			EG-1	S1HB, 791
Collection System	Manholes			•				EG-1	S1HB, 791
Collection System	Sewer Pipes			•				EG-1, 858	S1HB, 791
Lift Station	Lift Chamber	•		•				EG-1	S1HB, 791
Lift Station	Lift Pump	•		•				858, BX2	S2, SD4i
Lift Station	Valves			•				858, BX2	S2, SD4i
Preliminary Treatment	Bar Screen	•		•				858	S2, SD4i
Preliminary Treatment	Bar Screen Chamber			•				EG-1, 791	S1HB, 791
Preliminary Treatment	Bar Screen Isolation Valve	•		•				858, BX2	S2, SD4i
Preliminary Treatment	Bar Screen Rake	•		•				858	SD4i
Preliminary Treatment	Cyclonic Comminuator	•						1 BX1	SD4i
Preliminary Treatment	Dump Bin	•		•				1 BX1	SD4i
Preliminary Treatment	Effluent Trough			•	•			EG-1	S1HB, 791
Preliminary Treatment	Grit Chamber	•		•	•			EG-1	S1HB, 791
Preliminary Treatment	Grit Pump	•		•	•			858, BX2,	S2, SD4i
Preliminary Treatment	Grit Screen	•		•	•			858	SD4i
Preliminary Treatment	Lift Pump	•		•	•			858, BX2,	S2
Primary Treatment	Primary Clarifier Rake Arm			•	•			858	S2, SD4i
Primary Treatment	Primary Clarifier Weir Gate			•		•		858	S2, SD4i
Primary Treatment	Primary Clarifier Weir Trough		•		•			EG-1	S1HB, 791
Primary Treatment	Sludge Pump	•						BX2, BX1	S2, SD4i
Secondary Treatment	Aeration Tank - Concrete Tank - Concrete Internal Surfaces			•				EG-1	CS2
Secondary Treatment	Aeration Tank - Metal Internal Surfaces			•				858	S1HB, S2
Secondary Treatment	Aeration Tank - External Tank - External Surfaces			•				858	S1PW
Secondary Treatment	Agitators			•	•			858, BX2	S2, SD4i
Secondary Treatment	Polymer Storage/Mix Room					•		EG-1	SL-E, 791
Secondary Treatment	Return Activated Sludge Pump	•						858, BX2	S2, SD4i
Secondary Treatment	Secondary Clarifier Rake Arm			•	•			858	S2, SD4i
Secondary Treatment	Secondary Clarifier Weir Gate			•		•		858	S2, SD4i
Secondary Treatment	Secondary Clarifier Weir Trough			•	•			EG-1	S1HB, 791
Tertiary Treatment	Chemical Transfer Station Concrete		•					EG-1	CS2, CS4, NVE VC
Tertiary Treatment	Chemical Transfer Station Metal		•					858	S4+, S7
Tertiary Treatment	Disinfection Tank - Concrete Surfaces		•					NVE VC	NVE VC
Tertiary Treatment	Disinfection Tank - Metal Surfaces		•					S7	S7
Tertiary Treatment	Lift Screw Pump			•	•			858, BX2	S2, SD4i
Tertiary Treatment	Screw Pump Trough	•						EG-1	SD4i, 791
Tertiary Treatment	Sand Filter					•		858, BX2	S2, SD4i
Sludge Thickening	Primary Sludge Pump	•						BX1, BX2	S2, SD4i
Sludge Thickening	Primary Sludge Thickeners - Concrete	•						EG-1	S1HB, 791
Sludge Thickening	Primary Sludge Thickeners - Metal	•						858, BX2	S2, SD4i
Sludge Thickening	Sludge Mix Tank	•						BX1, BX2	S2, SD4i
Sludge Thickening	Waste Activated Sludge Pump	•		•				858, BX2	S2, SD4i
Sludge Thickening	Primary/Secondary Digester - Concrete Surfaces		•					EG-1	CS2, S1HB, 791
Sludge Thickening	Primary/Secondary Digester - Metal Surfaces		•					858	S2, SD4i
Dewatering	Filter Presses			•				858	S2, SD4i
Dewatering	Thickener - Centrifugal/Vacuum	•		•				858, BX2	S2, SD4i
Disposal	Incinerator		•					HT-T	S4+, S7
Utilities	Blowers			•	•			858	S2, SD4i
Utilities	Floors		•					EG-1	SL-E, CS2, 791
Utilities	Heat Exchanges			•				858	S2
Utilities	Structural Steel Pipe Racks			•				858	S1HB
Utilities	Walls, Floors and Ceilings			•				-	SL-E, CS2

ARC Product Recommendations for Water Treatment Plant

WASTEWATER TREATMENT PLANT		PROBLEM						ARC PRODUCT SELECTION	
PROCESS	EQUIPMENT/AREA	ABRASION	CHEMICAL	CORROSION	EROSION	FOULING	SLIP HAZARD	REBUILDING	**CORROSION COATING
Screening	Pumps - Lift	•		•	•			858, BX2	S1PW*, S2**
Screening	Screens			•				858	S1PW*, S2**
Presedimentation	Pumps - Lift	•		•	•			858, BX2	S1PW*, S2**
Presedimentation	Valves			•	•			858	S1PW*, S2**
Presedimentation	Settling Basin-Metal			•				858	S1PW*, S2**
Presedimentation	Settling Basin-Concrete			•				EG-1	S1PW*, S2**
Presedimentation	Weir			•	•			858	S1PW*, S2**
Presedimentation	Scraper Arms			•				858	S1PW*, S2**
Presedimentation	Carrying Rings/Rails	•						EG-1	791
Presedimentation	Sludge Pumps			•				858	S1PW*, S2**
Rapid Mix/Coagulation	Tanks			•	•			858	S1PW*, S2**
Rapid Mix/Coagulation	Agitators	•		•				858	S1PW*, S2**
Rapid Mix/Coagulation	Rotary Feeders	•						858	S1PW*, S2**
Chemical Bulk Storage	Caustic Tanks		•					858	S1PW*, S2**
Chemical Bulk Storage	Caustic Pumps		•					858	S1PW*, S2**
Chemical Bulk Storage	Caustic Containment		•					EG-1	CS2, 791
Chemical Bulk Storage	Acid Tanks		•					858	S4+, S7
Chemical Bulk Storage	Acid Pumps		•					858	S4+
Chemical Bulk Storage	Acid Containment		•					EG-1	CS4, NVE VC
Chemical Bulk Storage	Polymer Storage Mix Room						•	EG-1	SL-E, CS2, 791
Flocculation	Tanks			•	•			858	S1PW*, S2**
Flocculation	Rake Arms			•	•			858	S1PW*, S2**
Flocculation	Mixer Paddles			•	•			858	S1PW*, S2**
Flocculation	Carrying Rings/Rails			•	•			EG-1	791
Settling/Sedimentation	Tanks			•				858	S1PW*, S2**
Settling/Sedimentation	Weirs			•	•			858	S1PW*, S2**
Settling/Sedimentation	Sludge Scrappers	•						858	S1PW*, S2**
Settling/Sedimentation	Sludge Pumps	•						858, BX2, BX1	S1PW*, S2**
Filtering	Tanks				•			EG-1	S1PW*
Filtering	Pumps - Filtrate			•	•			858, BX2	S1PW*, S2**
Filtering	Pumps - Backwash			•	•			858, BX2	S1PW*, S2**
Filtering	Overflow Channels			•	•			EG-1	S1PW*, S2**
Filtering	Valves			•	•			858	S1PW*, S2**
Post Treatment	In Line Chemical Injection		•					858	S4+, S7
Distribution/Storage	Pumps			•	•			858	S1PW*, S2**
Distribution/Storage	Pipes			•				858	S1PW*, S2**
Distribution/Storage	Valves			•	•			858	S1PW*, S2**
Distribution/Storage	Tanks			•				NA	S1PW*
Distribution/Storage	Reservoirs			•				NA	S1PW*
Sludge Handling	Sludge Pumps	•						BX2	S2**, SD4i
Sludge Handling	Sludge Thickeners	•						858	S2**, SD4i
Sludge Handling	Sludge Mix Tank	•						858	S2**, SD4i
Sludge Handling	Agitators	•						858, BX2	S2**, SD4i
Dewatering	Filter Presses	•						858	S2**, SD4i
Dewatering	Centrifuges	•						858	S2**, SD4i
Dewatering	Screw Conveyor	•						BX2	S2**, SD4i

* NSF 61 cold water certified

** WRAS cold water certified

ARC Product Descriptions



ARC PRODUCT	TYPE	DESCRIPTION
791	TROWELABLE – Multi-functional quartz reinforced epoxy composite	General service chemically resistant trowel down concrete coating
855	BRUSHABLE – Multi-functional thin film ceramic reinforced epoxy composite	Moderate service corrosion resistant thin film coating for potable water services
858	TROWELABLE – Multi-functional high build ceramic reinforced epoxy rebuilding composite	Moderate service chemical and erosion resistant metal rebuilding compound
BX1	TROWELABLE – Multi-functional high build ceramic reinforced epoxy wear composite	Severe service corrosion and abrasion resistant thick film coating
BX2	TROWELABLE – Multi-functional high build ceramic reinforced epoxy wear composite	Moderate service corrosion and abrasion resistant thick film coating
988	TROWELABLE – Novalac resin quartz reinforced epoxy concrete composite	Extreme service chemically resistant trowel down concrete coating
CS2	SPRAYABLE – Multi-functional mineral flake reinforced epoxy composite	General service chemically resistant thin film concrete coating
CS4	SPRAYABLE – Novalac based thin film mineral flake reinforced epoxy composite	Severe service acid attack and corrosion thin film concrete coating
I BX1	TROWELABLE – Multi-functional high build impact resistant ceramic reinforced epoxy wear composite	Severe impact and abrasion resistant thick film coating
NVE	TROWELABLE – Novolac vinyl ester resin quartz reinforced concrete composite	Extreme service chemically resistant trowel down concrete coating
NVE VC	SPRAYABLE – Novolac vinyl ester composite	Severe service acid attack and corrosion thin film concrete coating
S1PW	SPRAYABLE – Multi-functional aluminum oxide reinforced epoxy composite	Moderate service corrosion resistant thin film coating for mild chemical protection and potable water services
S1HB	SPRAYABLE – Multi-functional high build mineral flake reinforced epoxy composite	Moderate service chemically resistant thick film coating
S2	SPRAYABLE – Multi-functional thin film ceramic reinforced epoxy composite	Moderate service corrosion resistant thin film coating for potable water services
S4+	SPRAYABLE – Novalac based thin film mineral flake reinforced epoxy composite	Severe service acid attack and corrosion thin film coating
S7	SPRAYABLE – Novolac vinyl ester composite	Severe service acid attack and corrosion thin film metal coating
SD4i	SPRAYABLE – Multi-functional thin film ceramic reinforced epoxy composite	Moderate chemical and aggressive erosion resistant thin film coating

IL/MRO Chemical Product Recommendations

Wastewater Treatment Plant

SPECIFIC EQUIPMENT AND AREA USE	CLEANERS		LUBRICANTS		CORROSION PROTECTION	SPECIALTY
	WATER BASED	SOLVENT BASED	FLUID LUBRICANTS	GREASE	COATINGS	PASTES, SEALANTS AND COMPOUNDS
Lift Station, Pumps and Controls	360	274/292	650 AML/601	615	752/740	783/785 FG
Screens (Course and Fine)	803	–	650 AML+720 CCG/601+715 Gold	615	–	–
Screen Frames (Course and Fine)	803	–	–	–	752/740	–
Rake Chains	803	–	650 AML+720 CCG/601+715 Gold	630-220	740	–
Grit Chamber	803/235	–	–	–	–	–
Grit Chamber Pump	–	274/292	–	625/630	–	723 and 783/785 FG
Primary/Secondary Clarifier Weir	360	–	–	–	–	–
Clarifier/Aeration Tanks	360/235/803	–	–	–	–	–
Primary/Secondary Clarifier	–	–	–	630-220/615-460	740/775	–
Thickeners/ Filter Presses	803/235	–	–	630-220, 615-460	–	740/775
Sludge Pumps – Belt Driven	803	274/292	–	630-220, 615-460	763/740	730
Digester	803/235	–	–	615/625/630	–	–
Polymer Storage Mix Room	235	274/292	–	–	–	–
Mixers/Agitators	–	–	–	630-220/615-460	–	860 MG
Trickle Filter	360/235	–	–	–	–	–
Blowers and Fans	–	274/292	–	–	–	730
Compressor Room	KPC 820	274/292	–	–	–	–
Electric Motors	–	273/292	–	638 EMG/ Lubri-Cup	775	–

Water and Wastewater Solutions for General Maintenance Applications

EQUIPMENT	RECOMMENDATION
Equipment Bearing Lubrication	625/630 SXCF 220#1, Lubri-Cup [†]
Electric Motor Bearing Lubrication	638 EMG, Lubri-Cup Electric Motor Kit
Belt Conveyor Bearing Lubrication	630 SXCF 220#1/615 HTG 460, Lubri-Cup
Mixer/Agitator Bearing Lubrication	630 SXCF 220#1/615 HTG 460, Lubri-Cup
Chain Lubrication - Grit Screen	650 AML+720 CCG/601+715 Gold
Corrosion Control – Metals	740, 752, 763,775
Electrical Protection	276, 296, 421
Leak Sealing - Threaded	800, 900
Leak sealing - Flange	860, 3500
Leak Sealing - Gearboxes	860 MPG
Pneumatic System	650 AML, 652
Pump Packing Grease	630-220, 622
Threaded Assemblies	723 FG/785 FG, 723/783
Metal Cutting/Tapping	388, 390
MOV-Valve Lubrication	615#1, 630-220
Manual Valves - Stem	787, 785 FG
Conveyor Gear Drives	630 SXCF 220#1/720 CCG
Clarifier Drives	630 SXCF 220#1/720 CCG
Belt Drives - V Belts	730
Metal Cutting/Tapping	388, 390

[†] Lubri-Cup™ Dispensers: full line of automatic, single point, and multi-point lubricators.

IL/MRO Chemical Product Recommendations

Wastewater Treatment Plant

SPECIFIC EQUIPMENT AND AREA USE	CLEANERS		LUBRICANTS		CORROSION PROTECTION	SPECIALTY
	WATER BASED	SOLVENT BASED	FLUID LUBRICANTS	GREASE	COATINGS	PASTES, SEALANTS AND COMPOUNDS
Lift Stations, Pumps and Controls	360	274/292	650 AML/601	615	752/740	783/785 FG
Mixers/Agitators	–	–	–	630-220/615-460	–	860 MG
Thickeners/Carifiers and Filter Presses	803/235	–	–	630-220/615-460	740/775	–
Sludge Pumps - Belt Driven	803	274/292	–	630-220/615-460	–	–
Polymer Storage Mix Room	235	274/292	–	–	–	–
Filter Belt Presses	803/235	–	–	630-220/615-460	740/775	–
Blowers and Fans	–	274/292	–	630/635	–	730
Chemical Room	KPC 820	–	–	615	–	–
Distribution Pumps	–	–	–	–	–	–
Electric Motors	–	273/292	–	638 EMG/Lubri-Cup	775	–

IL/MRO Chemicals Product Descriptions

PRODUCT	TYPE	DESCRIPTION
274 Industrial Degreaser	Solvent Based – Petroleum	Hard surface degreaser for industrial and marine environments.
276 Electronic Component Cleaner	Solvent Based – Petroleum	High performance, solvent based degreaser.
292 Precision Degreasing Solvent	Solvent Based – Petroleum	Industrial strength solvent blend cleaner. Controlled evaporation rate. Effective. Safe on all metals and most plastics.
294 Critical Surface Degreaser	Solvent Based – Petroleum	Industrial strength solvent blend cleaner. Fast acting. Removes resins, adhesives, and sticky residues.
296 Electro Contact Cleaner	Solvent Based – Non-Flammable	Precision cleaning solvent designed to replace CFC-113, HCFC-141b.
360 Phosphate-Free Cleaner	Water Based Cleaner – Alkali	Cleaner for environmentally sensitive areas. Ideal for Lift Stations.
388 Synthetic Tapping Fluid	Metal Working Fluid	Synthetic metal working fluid for high speed and feed rates.
390 Cutting Oil	Metal Working Fluid	High viscosity, oil-based lubricant for heavy duty machining applications.
421 Clear Protective Coating (CPC)	Coating	Acrylic coating – a clear, impermeable, flexible film.
650 AML	Lubricant	Biodegradable lubricant, synthetic ester, plant based.
601 Chain Drive Pin and Bushing Lubricant	Lubricant	Premium quality light oil.
610 Plus, 610 MT Plus, 610 HT Synthetic Lubricating Fluid	Lubricant	100% synthetic fluid lubricant. Pure Ester based fluid. Low evaporation rate. Biodegradable.
615 HTG #1, #2, #2-460	Grease	Corrosion inhibited grease has extreme pressure capabilities and resists water washout.
622 White Grease	Grease	H1 food grade, pure mineral oil, PTFE fortified grease. Waterproof, non staining.
625 CXF	Grease	Mineral oil based, NSF Registered H1. High Performance grease for bearings, motors, mixers.
630 SXCF	Grease	Synthetic based, NSF Registered H1. High Performance grease for bearings, motors, mixers.
630 SXCF 220 #1	Grease	Synthetic based, NSF Registered H1. High Performance grease for bearings in mixers agitator, conveyors.
633 SXCM	Grease	High performance, low viscosity lubricant reducing up to 90% in pneumatic maintenance costs.
638 EMG	Grease	Synthetic high performing electric motor grease.
635 SXC	Grease	Synthetic base oil. High Performance grease for applications exposed to heat, water, and chemical vapor.
652 Pneumatic Lubricant and Conditioner	Lubricant	High performance, low viscosity lubricant reduces up to 90% in pneumatic maintenance costs.
690 FG Lubricant	Lubricant	Pure, white oil, non staining lubricant for chains, pneumatics and bearings.
715 Spraflex®	Lubricant	Surface lubricant for chain drives, open gears, and wire rope.
715G Spraflex® Gold	Lubricant	Non-Staining lubricant for chain drives, open gears, and wire rope.
723/ 723 FG Sprasolvo™	Lubricant	Penetrating oil in a convenient, non-flammable propellant aerosol can.
725 Nickel Anti-Seize Compound	Anti-Seize	Nickel based anti-seize, temperatures up to 1425°C (2597°F).
730 Spragrip®	Lubricant	Energy efficient belt dressing in a convenient aerosol package.
740 Heavy Duty Rust Guard	Coating	Long-term, corrosion preventative coating.
752 Cold Galvanizing Compound	Coating	One part system zinc rich primer or protective topcoat.
763 Rust Transformer™	Coating-Corrosion	Natural acid based product, electrochemically transforms rust into a corrosion-inhibiting surface.
775 Moisture Shield	Coating	Clear, moisture displacing and anti-corrosion protective film.
783 ACR	Assembly Lubricant	Anti-seize compound of ultrafine, inorganic solid lubricants in a non-carbonizing, ashless synthetic carrier.
785/ 785 FG Parting Lubricant	Assembly Lubricant	Anti-seize compound of ultrafine, inorganic solid lubricants in a non-carbonizing, ashless synthetic carrier.
787 Sliding Paste	Assembly Lubricant	Semi-solid, pure synthetic base, high temperature, extreme pressure lubricant. Contains Graphite and Moly.
800 GoldEnd® Tape	Sealing – PTFE	Heavy duty, high density, tear resistant, moldable, dry PTFE sealant tape.
803 Industrial and Marine Solvent II	Water Based Cleaner – Alkali	Steam cleaning equipment cleaner. Ideal for pressure washing, steam cleaning of Digesters, Clarifiers, Filter Presses equipment rooms.
KPC 820N	Water Based Cleaner – Alkali	Environmentally compliant water based cleaner – Super concentrate.
860 Moldable Polymer Gasketing	Sealing – Gasketing	Two-part, moldable gasketing material creates ultra-thin gaskets in any size, any shape.
900 GoldEnd® Paste	Assembly Paste	PTFE thread sealant and lubricant paste. Ideal for stainless steel.

Polymer Seals Product Recommendation

WASTEWATER TREATMENT				ROTARY SEALS BEARING AND GEARBOX PROTECTION				STUFFING BOX - THROAT BUSHING
FLOWCHART PAGE	PUMP	APPLICATION	FLUID	LABYRINTH SEALS	SPLIT SEAL	LIP SEAL	LIP/ SPLIT SEAL	LIP SEAL
PG 6	1	Lift Station Pump	Raw Wastewater	Polymer Labyrinth Seal (PLS)	Matrix Seal, Split Polymer Labyrinth Seal (SPLS)	30K	33K	14K
PG 6	2	Influent Pump	Raw Wastewater	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 6	3	Grit Pump	Water/Grit	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 6	4	Primary Sludge Pump	Primary Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 6	5	Primary Sludge Pump	Primary Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 6	6	Scum Pump	Scum	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 8	1	RAS Pump	Return Activated Sludge (RAS)	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 8	2	WAS Pump	Waste Activated Sludge (WAS)	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 8	3	Scum Pump	Scum	PLS	Matrix Seal, SPLS	30K	33K	14K
Not Shown		Effluent Pump	Effluent	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	10	Primary Sludge Pump	Primary Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	11	Thickened Sludge Pump	Thickened Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	12	Digested Sludge Pump	Digested Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	13	Supernatant Pump	Supernatant	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	14	Supernatant Pump	Supernatant	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 9	15	Digester Circulation Pump	Digested Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
WATER TREATMENT				ROTARY SEALS BEARING AND GEARBOX PROTECTION				STUFFING BOX - THROAT BUSHING
FLOWCHART PAGE	PUMP	APPLICATION	FLUID	LABYRINTH SEALS	SPLIT SEAL	LIP SEAL	LIP/ SPLIT SEAL	LIP SEAL
PG 15	1	Raw Water Pump	Raw Water	Polymer Labyrinth Seal (PLS)	Matrix Seal, Split Polymer Labyrinth Seal (SPLS)	30K	33K	14K
PG 15	2	Low lift Pump	Raw Water	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	3	Settled Solids Pump	Water/ Solids	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	4	Backwash Pump	Backwash Water	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	5	Supernatant Pump	Supernatant	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	6	High Lift Pump	Finished Water	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	7	Thickened Sludge Pump	Thickened Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	8	Thickened Sludge Pump	Thickened Sludge	PLS	Matrix Seal, SPLS	30K	33K	14K
PG 15	9	Sludge Cake Pump	Sludge Cake	PLS	Matrix Seal, SPLS	30K	33K	14K

Glossary of Terms

Acid

A substance that has a pH of less than seven, which is neutral. Specifically, an acid has more free hydrogen ions (H+) than hydroxyl ions (OH-).

Activated Sludge

Sludge that leaves the aeration tank is known as Activated Sludge because bacteria have begun acting on it to break it down and stabilize it for further biosolids processing.

Aeration

The mixing of air with the wastewater providing oxygen for the growth of aerobic bacteria to begin the process of breaking down the sludge.

Alkaline

Sometimes water or soils contain an amount of alkali (strongly basic) substances sufficient to raise the pH value above 7.0 and be harmful to the growth of crops.

Alkalinity

The capacity of water for neutralizing an acid solution.

Aerobic Bacteria

Bacteria requiring oxygen to live.

Anaerobic Bacteria

Bacteria that live in the absence of oxygen.

Aqueous

Containing water; watery.

Anaerobic Digester

Large enclosed tanks in which thickened sludge is digested by anaerobic bacteria and converted into a mixture of gases including methane, carbon dioxide and hydrogen sulfide.

Aquifer

A geologic formation that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses.

Artificial Recharge

A process where water is put back into ground water storage from surface water supplies such as irrigation, or induced infiltration from streams or wells.

BOD (Biochemical Oxygen Demand)

A measure of the amount of oxygen consumed by microorganisms in water that are consuming organic matter. If the BOD level is too high in the effluent, there will not be sufficient oxygen present in the water to support aquatic life. Waste treatment plants must monitor this level and take corrective action if it becomes too high.

Backwashing

Reversing the flow of water through a filter device or membrane to clean and remove deposits accumulated in the filter media/membrane.

Bar Screens

As the wastewater enters the headworks, it passes through a Bar Screen, which removes any large objects such as rocks, wood, tree limbs or other large items that make their way into the sewer system.

Base

A substance that has a pH of more than 7, which is neutral. A base has less free hydrogen ions (H+) than hydroxyl ions (OH-).

Biological Treatment

The breakdown of organic matter using naturally occurring microorganisms present in wastewater.

Biosolids

A nutrient rich, organic byproduct of the waste treatment process derived from the treated sludge. Depending on the classification of the sludge, it may be land applied to agricultural fields or further refined and manufactured into a fertilizer product sold to consumers.

Biosolids, Class A

Biosolids that have met the Class "A" pathogen reduction requirements in accordance with Federal Regulations 40 CFR 503. Typical processes which produce Class "A" biosolids include composting, heat drying, heat treatment, thermophilic aerobic digestions, beta or gamma ray irradiation and pasteurization .

Biosolids, Class B

Biosolids that have met the Class "B" pathogen reduction requirements in accordance with Federal Regulation 40 CFR 503. Typical processes that produce this class of biosolids include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Biosolids Processing

Several different techniques are used to further breakdown the sludge and create a stable biosolid that can be disposed of in the environment. These techniques include: anaerobic digestion, composting, incineration/drying or the use of large lagoons in which the sludge is allowed to settle and further breakdown over time.

Biosolids/Sludge Dewatering

The process of removing water from the biosolids to produce a cake that contains 20 percent or higher percentage of dry solids. Typically either filter presses or centrifuges are used to dewater the biosolids.

Coagulant

The terms coagulant and flocculant are sometimes used interchangeably, but it is more accurate to use the term coagulant for a chemical that contributes to molecular aggregation. Usually dissolved substances are aggregated into microscopic particles by a coagulant and then these particles may be flocculated into a macroscopic floc with a flocculant.

Coagulation

In water treatment, the use of chemicals to make suspended solids gather or group together into small flocs.

Combined Sewer

A sewer carrying both wastewater and storm water run off.

Commercial Water Use

Water used for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. Water for commercial uses comes both from public-supplied sources, such as a county water department, and self-supplied sources, such as local wells.

Condensation

The process of water vapor in the air turning into liquid water. Water drops on the outside of a cold glass of water are condensed water. Condensation is the opposite process of evaporation.

Desalinization

The removal of salts from saline water to provide freshwater. This method is becoming a more popular way of providing freshwater to populations.

Digestion

The biological decomposition of organic matter in sludge, resulting in partial gasification, liquefaction, and mineralization.

Disinfection

The process of destroying pathogenic and other microorganisms in wastewater, typically through application of chlorine compounds, ultraviolet light, iodine, and the like.

Domestic Water Use

Water used for household purposes, such as drinking, food preparation, bathing, washing clothes, dishes, and dogs, flushing toilets, and watering lawns and gardens. About 85% of domestic water is delivered to homes by a public-supply facility, such as a county water department. About 15% of the Nation's population supply their own water, mainly from wells.

Glossary of Terms

Drainage Basin

Land area where precipitation runs off into streams, rivers, lakes, and reservoirs. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large drainage basins, like the area that drains into the Mississippi River contain thousands of smaller drainage basins. Also called a “watershed.”

Drawdown

A lowering of the groundwater surface caused by pumping.

Dry Well

A pit in which equipment such as pumps are installed. Typically the Dry Well will be located next to a wet well. Pumps located in this area are called “Dry Well Pumps”.

Effluent

The treated water returned to the environment from the wastewater treatment plant. Most effluent is cleaner than the water it is discharged into.

Estuary

A place where fresh and salt water mix, such as a bay, salt marsh, or where a river enters an ocean.

Evapotranspiration

Combination of evaporation and transpiration of water into the atmosphere from living plants and soil.

Filtration

The mechanical process which removes particulate matter by separating water from solid material, usually by passing it through sand or a mixed media bed.

Fine Screens

Fine screens are located after the bar screens in a wastewater treatment plant and remove smaller objects such as plastic, rope and rags that can pass through larger the bar screen openings.

Finished Water

Water is “finished” when it has passed through all the processes in a water treatment plant and is ready to be delivered to consumers.

Floc

Small masses formed that comes out of solution during the process of flocculation.

Flocculant

Flocculants, or flocculating agents, are chemicals that are used to promote flocculation by causing colloids and other suspended particles in liquids to aggregate, forming a floc. Flocculants are used in water treatment processes to improve the sedimentation or filterability of small particles.

Flocculation

Flocculation is the process of causing small, suspended materials to stick to each other to form “flocs”. These flocs more readily settle out compared to the individual particles. Flocculation is widely employed in the purification of drinking water as well as sewage treatment and treatment of other industrial wastewater streams.

Flowing Well/Spring

A well or spring that taps ground water under pressure so that water rises without pumping. If the water rises above the surface, it is known as a flowing well.

Force Main

A pipeline leading from a lift or pumping station that transports wastewater under pressure.

Grit Chamber

After the wastewater passes through the Fine Screen, it enters the Grit Chamber where the water velocity is reduced so the heavier inorganic materials such as sand and small rocks can settle out.

Grit Pump

The grit pump is located by the grit chamber. It pumps the collected grit (sand and rock) out of the chamber for disposal, typically by truck to a landfill.

Greywater

Wastewater from clothes washing machines, showers, bathtubs, hand washing, lavatories, and sinks.

Groundwater

(1) Water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table. (2) Water stored underground in rock crevices and in the pores of geologic materials that make up the Earth’s crust.

Hardness

A water quality indication of the concentration of alkaline salts in water, mainly calcium and magnesium. If the water you use is “hard” then more soap, detergent or shampoo is necessary to raise lather.

Headworks

This is the initial entry point for the raw wastewater (Influent) to enter the treatment plant. Within this area of the plant are screens, which remove large objects from the wastewater, pumps that move it into the plant and the grit chambers.

Hydrologic Cycle

The cyclic transfer of water vapor from the Earth’s surface via evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth, and through runoff into streams, rivers, and lakes, and ultimately into the oceans.

Industrial Water Use

Water used for industrial purposes in such industries as steel, chemical, paper, and petroleum refining. Nationally, water for industrial uses comes mainly (80%) from self-supplied sources, such as local wells or withdrawal points in a river, but some water comes from public-supplied sources, such as the county/city water department.

Influent

The fluid flowing into a treatment plant or other process.

Interceptor Sewer

The portion of a collection system that connects main and trunk sewers with the wastewater treatment plant, thereby controlling the flow into the plant.

Junction Box

A structure with a manhole or access point to a wastewater sewer system where individual sewer line flows can merge.

Lagoon

A shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater. Lagoons are typically used for the storage of wastewaters, sludges, or liquid wastes.

Lateral Sewer

Pipes that receive sewage from homes and businesses and transport that sewage to trunks and mains.

Leaching

The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Lentic Waters

Ponds or lakes (standing water).

Levee

A natural or manmade earthen barrier along the edge of a stream, lake, or river. Land alongside rivers can be protected from flooding by levees.

Glossary of Terms

Lift Station

A point in the sewer system where the Raw Sewage is collected and pumped towards the waste treatment plant. At this point in the process, the total solids in the wastewater are less than 0.5%.

Lotic Waters

Flowing waters, as in streams and rivers.

MGD (Million Gallons per Day)

The typical measure of the size of a potable water or wastewater treatment facility located in the United States. In Europe, the unit of measure for treatment plant capacity is the number of persons (population size) the plant is capable of handling treatment for.

Main Sewer

A larger pipe in which smaller branch and submain sewers are connected. It may also be called a trunk sewer.

Manhole

A vertical shaft covered by a lid at ground level that provides access for maintenance of an underground pipe.

Municipal Water System

A water system that has at least five service connections or which regularly serves 25 individuals for 60 days; also called a public water system.

Non-Point Source (NPS) Pollution

Pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Non-point source pollution is contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up soil particles and pollutants, such as nutrients and pesticides.

Organic Matter

Plant and animal residues, or substances made by living organisms. All are based upon carbon compounds.

pH

Numeric value that describes the intensity of the acid or basic (alkaline) conditions of a solution. The pH scale is from 0 to 14, with the neutral point at 7.0. Values lower than 7 indicate the presence of acids and greater than 7.0 the presence of alkalis (bases).

Pathogenic

Causing disease; commonly applied to microorganisms that cause infectious diseases.

Precipitate

A solid which has come out of an aqueous solution (e.g., iron from groundwater precipitates to a rust colored solid when exposed to air).

Point-Source Pollution

Water pollution coming from a single point, such as a sewage-outflow pipe.

Polymer

Chemical added to the biosolids or water sludge to improve the efficiency of the dewatering process.

Potable Water

Water of a quality suitable for drinking.

Precipitation

Rain, snow, hail, sleet, dew, and frost.

Primary Sludge

Solids collected in the primary treatment process through sedimentation in a wastewater treatment plant. Typically, primary sludge has a solids content of approximately 4 to 6%.

Primary Treatment/Clarification

The first step in the wastewater treatment process where organic solids are removed by settling or flotation. Solids that float (scum) are removed and thickened for solids processing or otherwise disposed. Heavier solids are removed and sent to sludge thickening. At this point in the process, the sludge (primary sludge) is approximately 4 to 6 percent total solids.

Public Supply

Water withdrawn by public governments and agencies, such as a county water department, and by private companies that is then delivered to users. Public suppliers provide water for domestic, commercial, thermoelectric power, industrial and public water users. A public water supplier delivers most people's household water. The systems have at least 15 service connections (such as households, businesses, or schools) or regularly serve at least 25 individuals daily for at least 60 days out of the year.

Raw Water

(1) Water in its natural state, prior to any treatment. (2) Usually the water entering the first treatment process of a water treatment plant.

Recycled Water

Water that is used more than one time before it passes back into the natural hydrologic system.

Reservoir

A pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

Return Activated Sludge (RAS)

A portion of the activated sludge that is removed from the secondary clarifier and returned to the aeration tank to repopulate the aerobic bacteria to keep the biologic process going.

Reverse Osmosis

(1) (Desalination) The process of removing salts from water using a membrane. With reverse osmosis, the product water passes through a fine membrane that the salts are unable to pass through, while the salt waste (brine) is removed and disposed. This process differs from electrodialysis, where the salts are extracted from the feedwater by using a membrane with an electrical current to separate the ions. The positive ions go through one membrane, while the negative ions flow through a different membrane, leaving the end product of freshwater. (2) (Water Quality) An advanced method of water or wastewater treatment that relies on a semi-permeable membrane to separate waters from pollutants. An external force is used to reverse the normal osmotic process resulting in the solvent moving from a solution of higher concentration to one of lower concentration.

River

A natural stream of water of considerable volume, larger than a brook or creek.

Runoff

(1) That part of the precipitation, snow melt, or irrigation water that appears in uncontrolled surface streams, rivers, drains or sewers. Runoff may be classified according to speed of appearance after rainfall or melting snow as direct runoff or base runoff, and according to source as surface runoff, storm interflow, or groundwater runoff. (2) The total discharge described in 1 above, during a specified period of time. (3) Also defined as the depth to which a drainage area would be covered if all of the runoff for a given period of time were uniformly distributed over it.

Sanitary Sewer

A sewer containing only wastewater from homes or industry.

Screenings

Materials that are collected in the screening process including such things as rags, tramp metal, sticks, broken glass, rocks, sand and the vast variety of other materials that can enter the sewage collection system.

Glossary of Terms

Scum

Oils, greases and other solids that float to the top of primary and secondary clarifiers.

Secondary Treatment/Clarification

The second step in the wastewater treatment process is called Secondary Treatment. Here, bacteria are used to oxidize or breakdown the organic matter (sludge) that is not removed during primary treatment.

Sediment

Usually applied to material in suspension in water or recently deposited from suspension. In the plural the word is applied to all kinds of deposits from the waters of streams, lakes, or seas.

Settling Pond

An open lagoon into which wastewater contaminated with solid pollutants is placed and allowed to stand. The solid pollutants suspended in the water sink to the bottom of the lagoon and the liquid is allowed to overflow out of the enclosure.

Sludge Thickening

Sludge removed from both the primary and secondary clarifiers is mixed and concentrated utilizing either centrifuges or gravity belt thickeners. The activated sludge concentration is increased from approximately 1 to 4 percent solids.

Stream

A general term for a body of flowing water; natural water course containing water at least part of the year. In hydrology, it is generally applied to the water flowing in a natural channel as distinct from a canal.

Storm Sewer

A system of pipes, separate from sanitary sewers, that carry only water runoff from building and land surfaces.

Supernatant

The liquid (water) that is forced out of the sludge during thickening and dewatering.

Surface Water

Water that is on the Earth's surface, such as in a stream, river, lake, or reservoir.

Suspended Sediment

Very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom. Such material remains in suspension due to the upward components of turbulence and currents and/or by suspension.

Suspended Solids

Solids that are not in true solution and that can be removed by filtration. Such suspended solids usually contribute directly to turbidity. Defined in waste management, these are small particles of solid pollutants that resist separation by conventional methods.

Tertiary Treatment/Clarification

The third and final step in the process of treating the wastewater. This includes filtration and disinfection resulting in the removal of up to 99.999% of pathogens and suspended solids.

TP (Total Phosphorus)

A measure of the amount of phosphorus present in the effluent. If phosphorus levels are too high, it will cause excessive weed and algae growth in rivers and streams.

Transpiration

Process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores. See evapotranspiration.

Trunk Sewer

A larger pipe in which smaller branch and submain sewers are connected. It may also be called a main sewer.

TSS (Total Suspended Solids)

A measure of solids present in the effluent water. Specific limits are specified that each treatment plant must meet prior to discharging effluent water into the environment.

Turbidity

The amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Thus, turbidity makes the water cloudy or even opaque in extreme cases. Turbidity is measured in nephelometric turbidity units (NTU).

Waste Activated Sludge (WAS)

The remaining portion of activated sludge that is sent to sludge thickening for further biosolids processing.

Wastewater

Another term for sewage; water that has been used in homes, industries, institutions, and businesses that is not for reuse and is generally collected in a sewage collection system.

Water Cycle

The circuit of water movement from the oceans to the atmosphere and to the Earth and return to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transportation.

Water Quality

A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Watershed

The land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

Well

An artificial excavation put down by any method for the purposes of withdrawing water from the underground aquifers. A bored, drilled, or driven shaft or a dug hole whose depth is greater than the largest surface dimension and whose purpose is to reach underground water supplies or oil, or to store or bury fluids below ground.

Wet Well

The wastewater collection pit in the lift station. Submersible pumps may be used in this area and are called "Wet Well Pumps".

Wet Ton

The unit of measure used to describe the weight of the combination of water and solids being disposed of. If the dewatered biosolid cake is 20% solids, then 80% of each ton is water. Therefore, in every wet ton, there are 400 pounds of solids and 1600 pounds of water.

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