

WATER & WASTEWATER

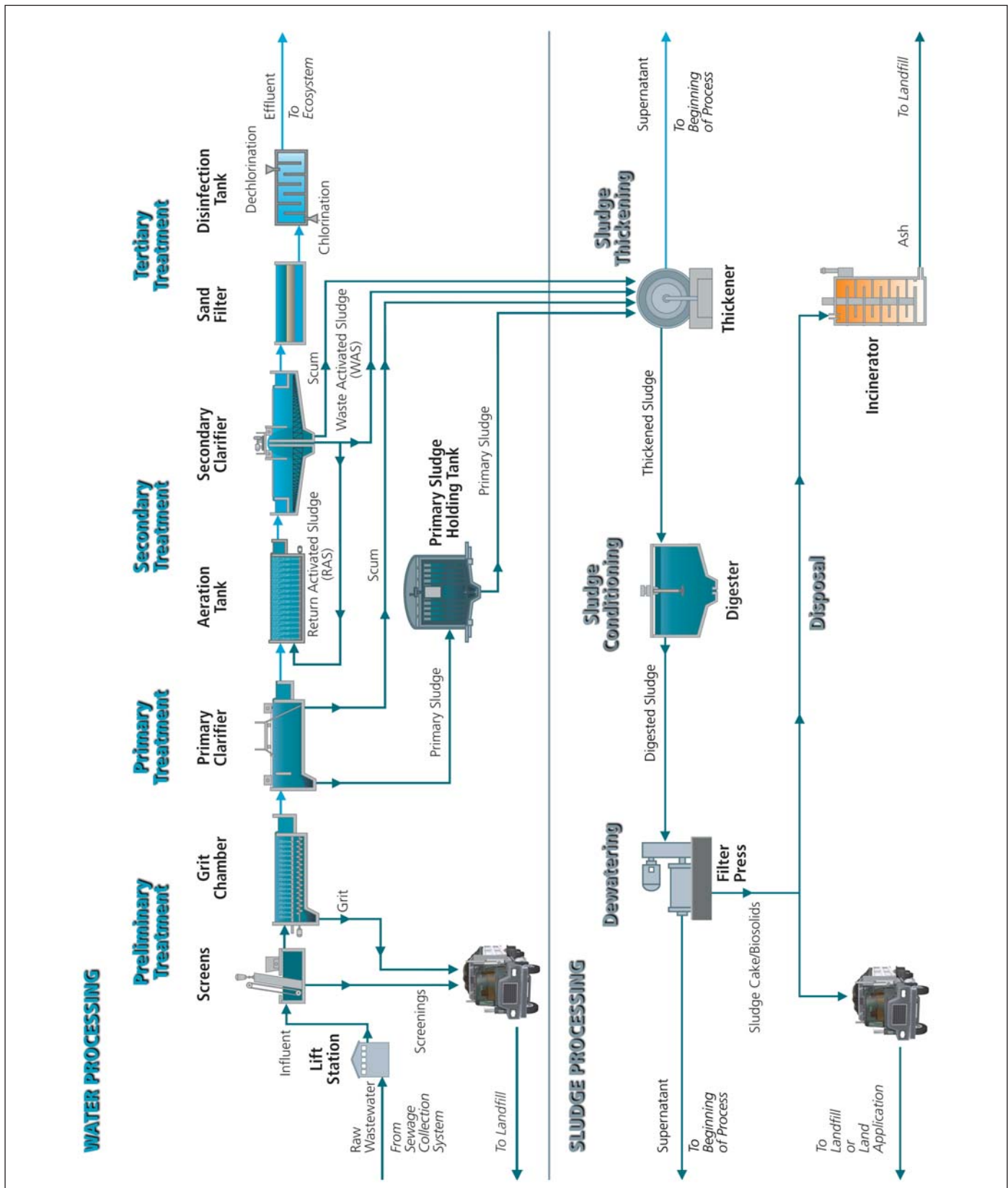
INDUSTRY SOLUTIONS



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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.

Today's business environment creates many challenges for the Water & Wastewater Industry. Reduced funding levels, increased regulatory compliance demands and increased energy and disposal costs create requirements that have never been experienced before in the industry and results in the need for technologically advanced **Total System Solutions** to drive efficiency, increase equipment reliability and lower operating and maintenance costs.

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 and plant personnel involved in running the process and producing the end product. True improvement only occurs when the entire system is addressed. Chesterton's ability to focus on the entire "system" utilizing our extensive product and technology portfolio, training capabilities and technical expertise offers the industry the greatest opportunity to achieve the financial results required in today's economy.

Chesterton is a leading provider of sealing devices, wear and corrosion reduction solutions for the Water & Wastewater Industry. Chesterton solutions have been implemented around the world with documented success and recognition. Increased equipment reliability, energy consumption optimization and technical support are what Chesterton offers to the industry with a portfolio of products and services unparalleled in the industry.

This portfolio includes:

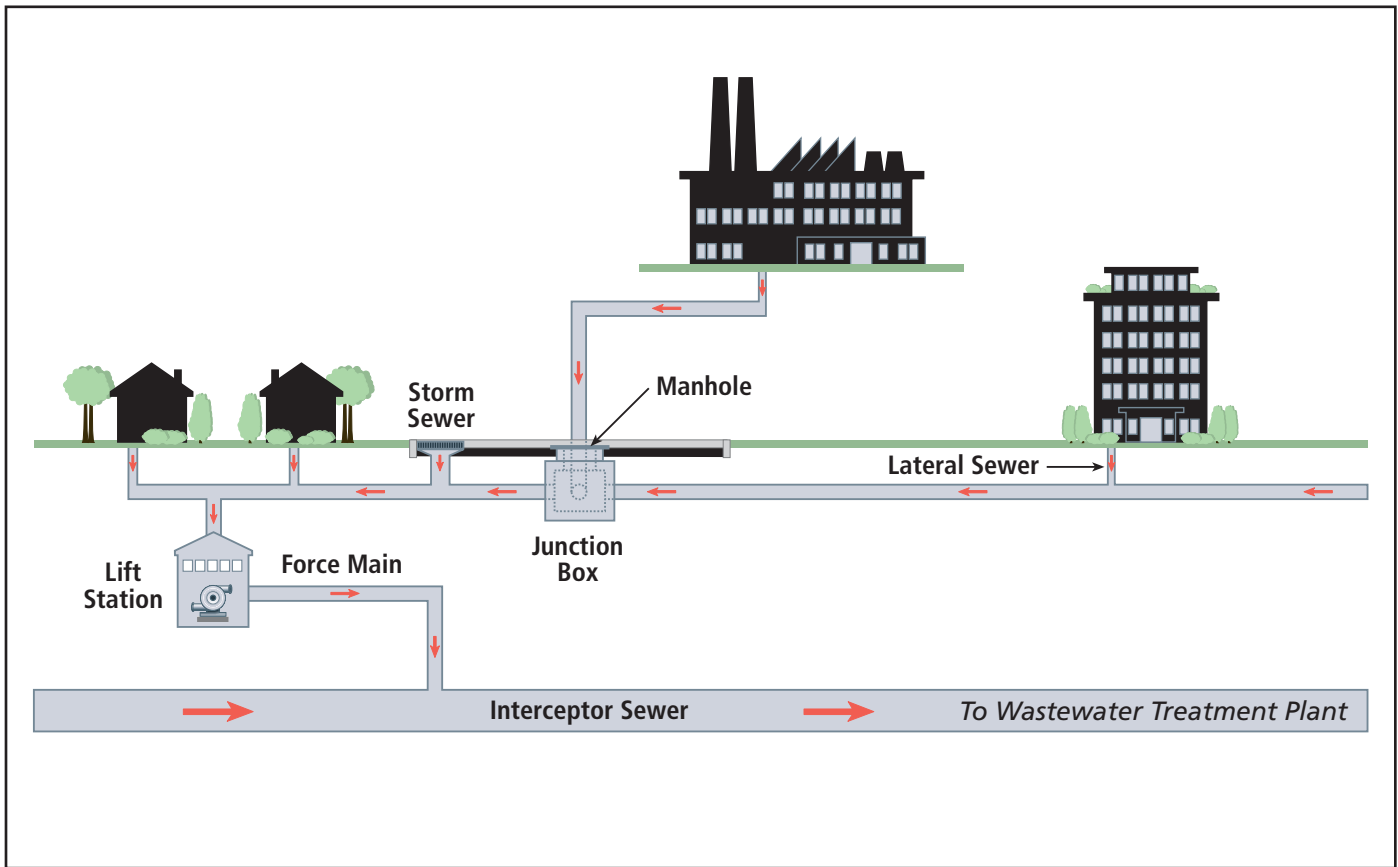
- **Mechanical Seals for pumps and agitators**
- **Mechanical Packings and Gaskets for pumps, valves, flanges and other rotating equipment**
- **ARC Engineered Surface Composites for corrosion and wear reduction/control of metal and concrete surfaces.**
- **Technical Maintenance Products offering complete management of the plant's lubricants, degreasers and solvents in an environmentally friendly system.**
- **Hydraulic/Pneumatic Sealing Devices for plunger pumps and other hydraulic and pneumatically actuated equipment and valves.**
- **Training to support the operation's most critical asset, its people.**

This guide is intended to give our engineers and specialists an understanding of the Water & Wastewater Treatment Plant and the various processes that exist in a typical facility. Understanding what happens through the various processing stages will give the user information that enables them to make the best recommendations for the plant and the customer.

In water and wastewater treatment plants, there are many various 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.

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

Wastewater Collection System



WASTEWATER TREATMENT PLANT

Wastewater Characteristics

Wastewater is 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 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 microorganisms that may be detrimental to the ecosystem.

Wastewater Collection

The wastewater treatment process begins with the collection of waste streams from homes, businesses and industrial complexes. These streams feed into what is known as the “collection” or “drainage” system which transports the wastewater to the wastewater treatment plant for processing. The collection system is typically operated as a separate department within the municipality.

The collection system is comprised of pipes, junction boxes, lift stations and associated equipment that channel raw wastewater to the plant. In many cases, the collection system will also serve to collect storm run off. Systems that convey storm run off and waste streams are known as combined sewer overflow (CSO) systems.

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,

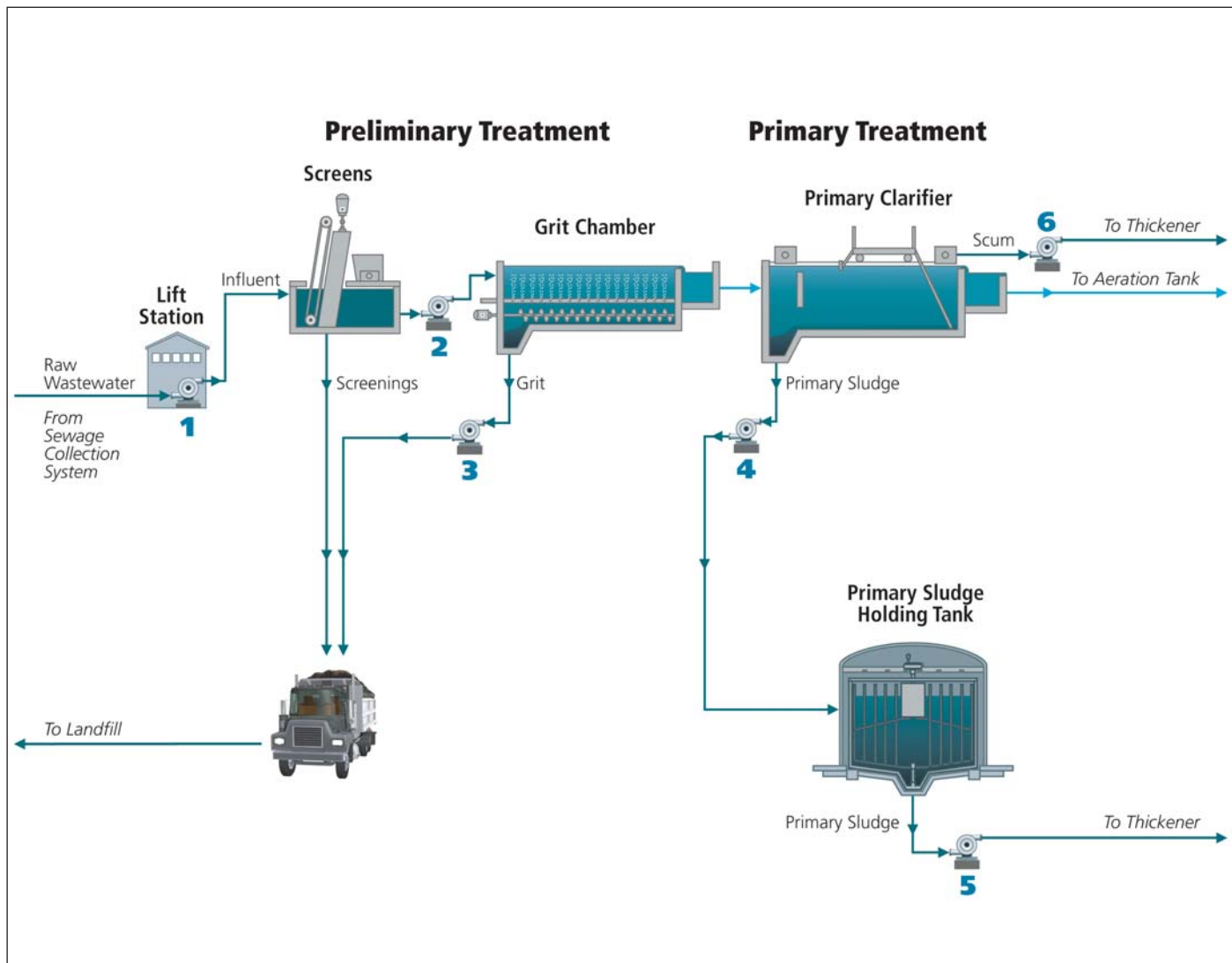
where this is not feasible, because of the municipality’s location, elevation changes and system design, lift stations will be used to pump the wastewater to the plant.

The size and pumping capacity of each lift station will be 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



Sealing Device Recommendations

FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
			PRIMARY			SECONDARY			PRIMARY		SECONDARY		
PUMP NUMBER	FLUID	% SOLIDS	SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
1	Raw Wastewater	≈ 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
2	Raw Wastewater	≈ 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
3	Water/Grit	≈ 0.5 - 2%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
4	Primary Sludge	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
5	Primary Sludge	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
6	Scum	≈ 0.5%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1

NOTES: 1 – Flush can be reduced with the use of a standard throat (restriction) bushing; reduced or eliminated with the use of a SpiralTrac™ Environmental Controller.
See Appendix for Sealing Device Recommendations Key.

Wastewater Processing

A **Wastewater Treatment Plant (WWTP)** 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.

Most facilities employ a combination of mechanical removal steps and bacterial decomposition to achieve the desired results. Chlorine is often added to discharges 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 flow chart. Raw wastewater is pumped to the wastewater treatment plant through lift or pumping stations. Lift stations are required when 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 WWTP.

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

The typical water processing steps include:

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

Preliminary Treatment

The headworks 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 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 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. 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 returned 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

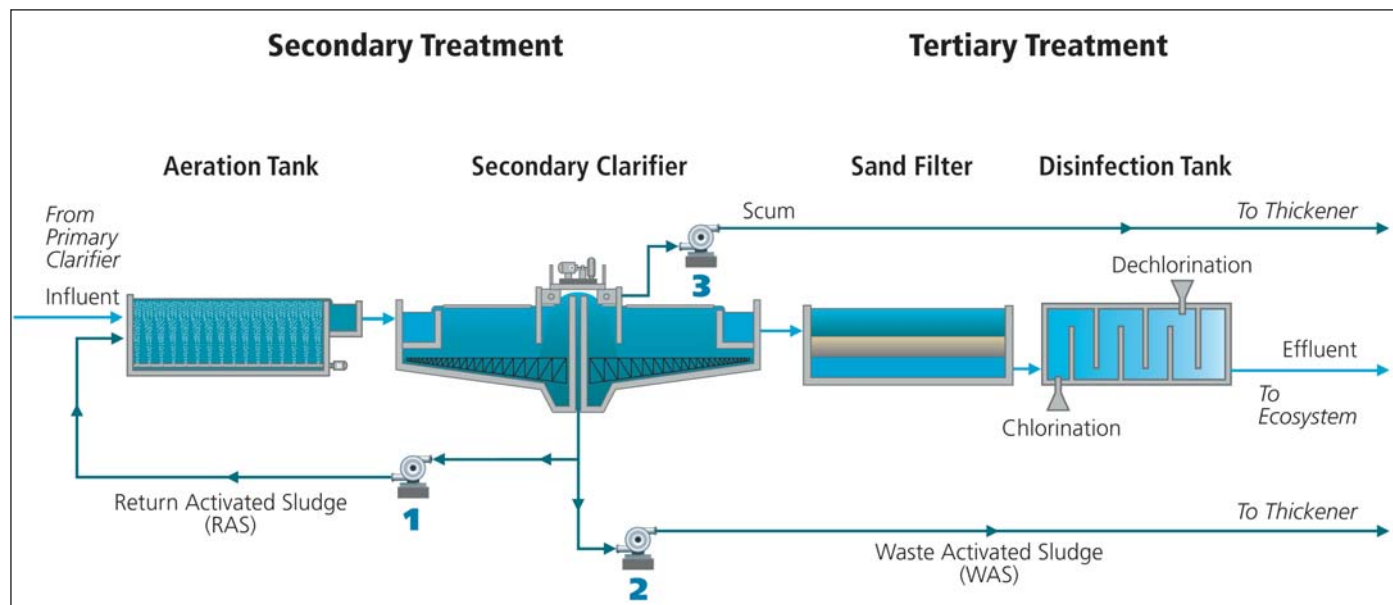
The tertiary treatment stage normally starts with the filtering of the clarified liquid that flows from the secondary clarifiers. The liquid is processed through a bed of sand or other filtering device that removes additional pollutants from the liquid. The water then moves to the disinfection tank.

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

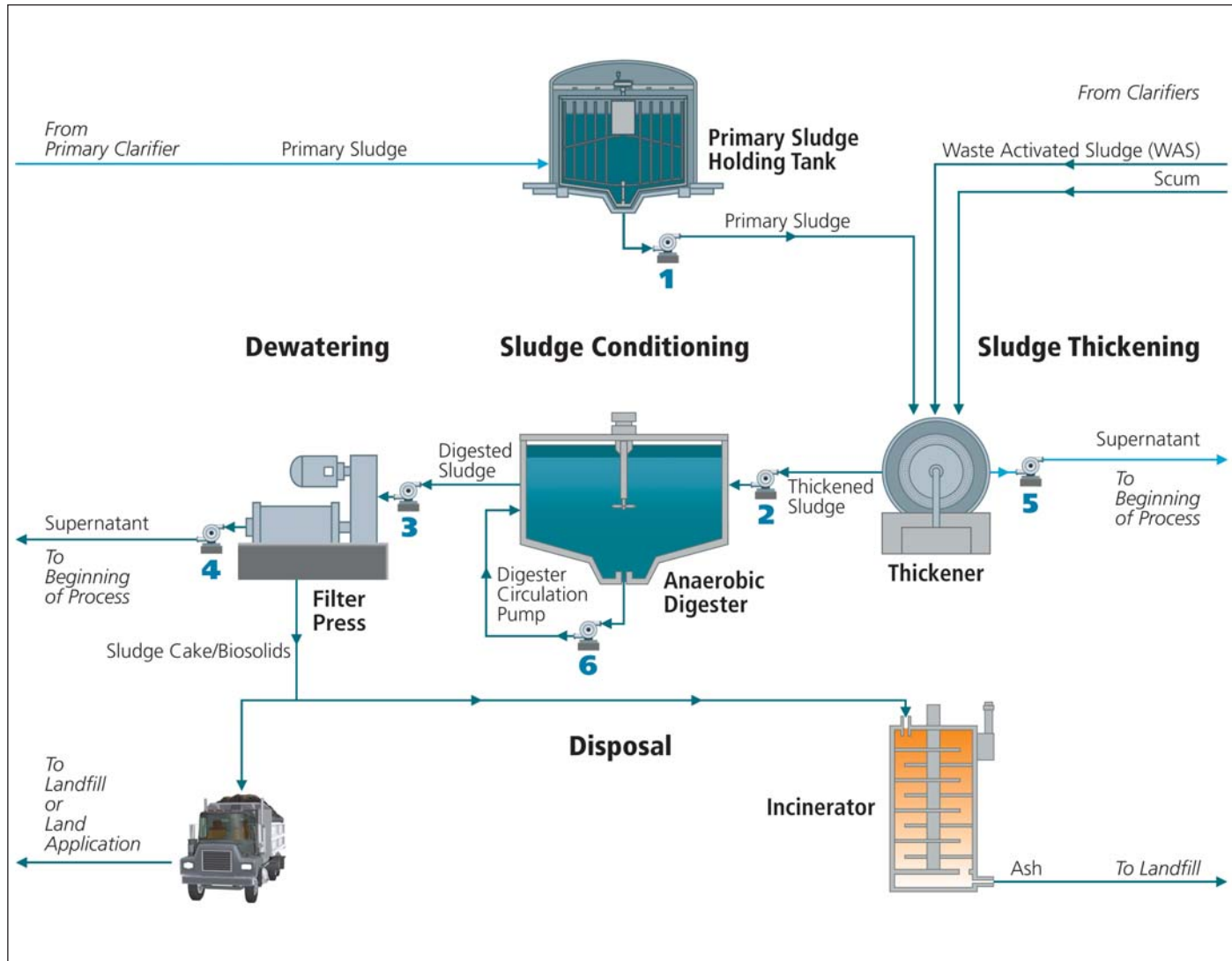


Sealing Device Recommendations

FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
			PRIMARY			SECONDARY			PRIMARY		SECONDARY		
PUMP NUMBER	FLUID	% SOLIDS	SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
1	Return Activated Sludge (RAS)	≈ 1 - 3%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
2	Waste Activated Sludge (WAS)	≈ 1 - 3%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
3	Scum	≈ 0.5%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1

NOTES: 1 - Flush can be reduced with the use of a standard throat (restriction) bushing; reduced or eliminated with the use of a SpiralTrac™ Environmental Controller.
See Appendix for Sealing Device Recommendations Key.

Sludge Processing Flowchart



Sealing Device Recommendations

FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
			PRIMARY			SECONDARY			PRIMARY		SECONDARY		
PUMP NUMBER	FLUID	% SOLIDS	SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
1	Primary Sludge	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
2	Thickened Sludge	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
3	Digested Sludge	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
4	Supernatant	≈ 1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
5	Supernatant	≈ 1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
6	Primary Sludgae	≈ 4 - 6%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1

NOTES: 1 – Flush can be reduced with the use of a standard throat (restriction) bushing; reduced or eliminated with the use of a SpiralTrac™ Environmental Controller.
See Appendix for Sealing Device Recommendations Key.

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 4 – 6%. Sludge processing reduces the solids content of this sludge through biological processes and removes more of the liquid content of 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 treatment 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 be dependent 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.

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 flowchart.

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.

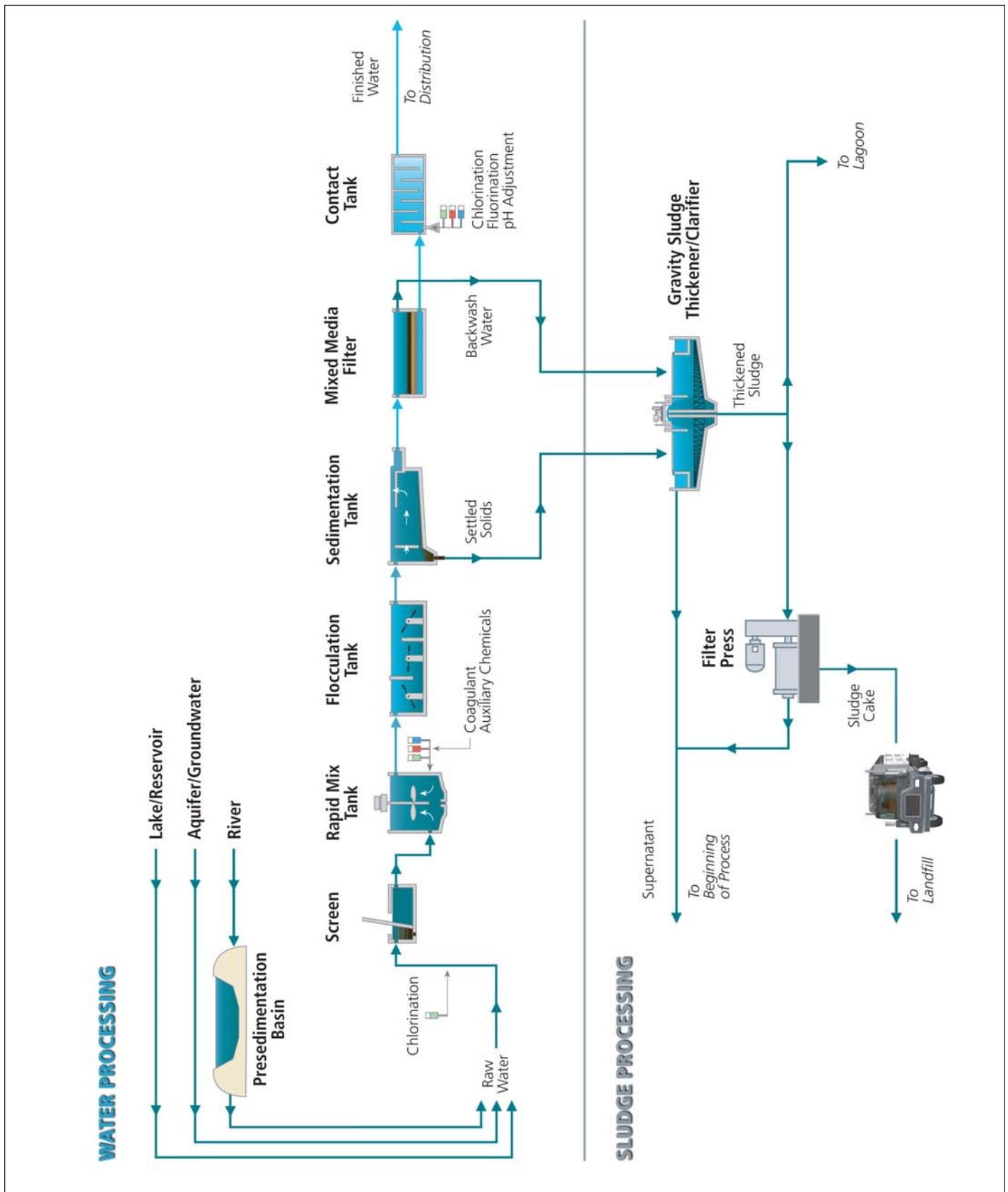
Any supernatant that is removed in the dewatering process is returned to the beginning of the treatment plant for reprocessing.

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 (WTP)** 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 14) illustrates a typical water treatment plant with the typical 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. We illustrate all of the major processes so that you get an understanding of the various steps that are or maybe 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 a screen 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. Treatment

processes that occur prior to the water entering the plant are part of Preliminary Treatment.

Primary Treatment

Water flows from the screening process to the first step of primary treatment – rapid mixing, where coagulants and auxiliary chemicals are added to the water to aid in particulate removal. 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.

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. The process of developing these solid masses is called flocculation.

The water with floc masses slowly flow to the sedimentation tank where the larger, heavier, floc particles settle to the bottom. The water is retained in the tank so that the floc particles have time to drop to the bottom. The solids are collected at the bottom of the tank and are pumped to a clarifier to further collect solids. The water flows to a filter tank to filter out any of the floc that is not removed in the sedimentation process.

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.

Post Treatment

After filtration, chlorine or other disinfectants are added to the water to 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.

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. The distribution system brings the water to consumers.

The bottom half of **Diagram 2** (Page 14) illustrates a typical water sludge processing plant.

The typical sludge processing steps include:

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

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

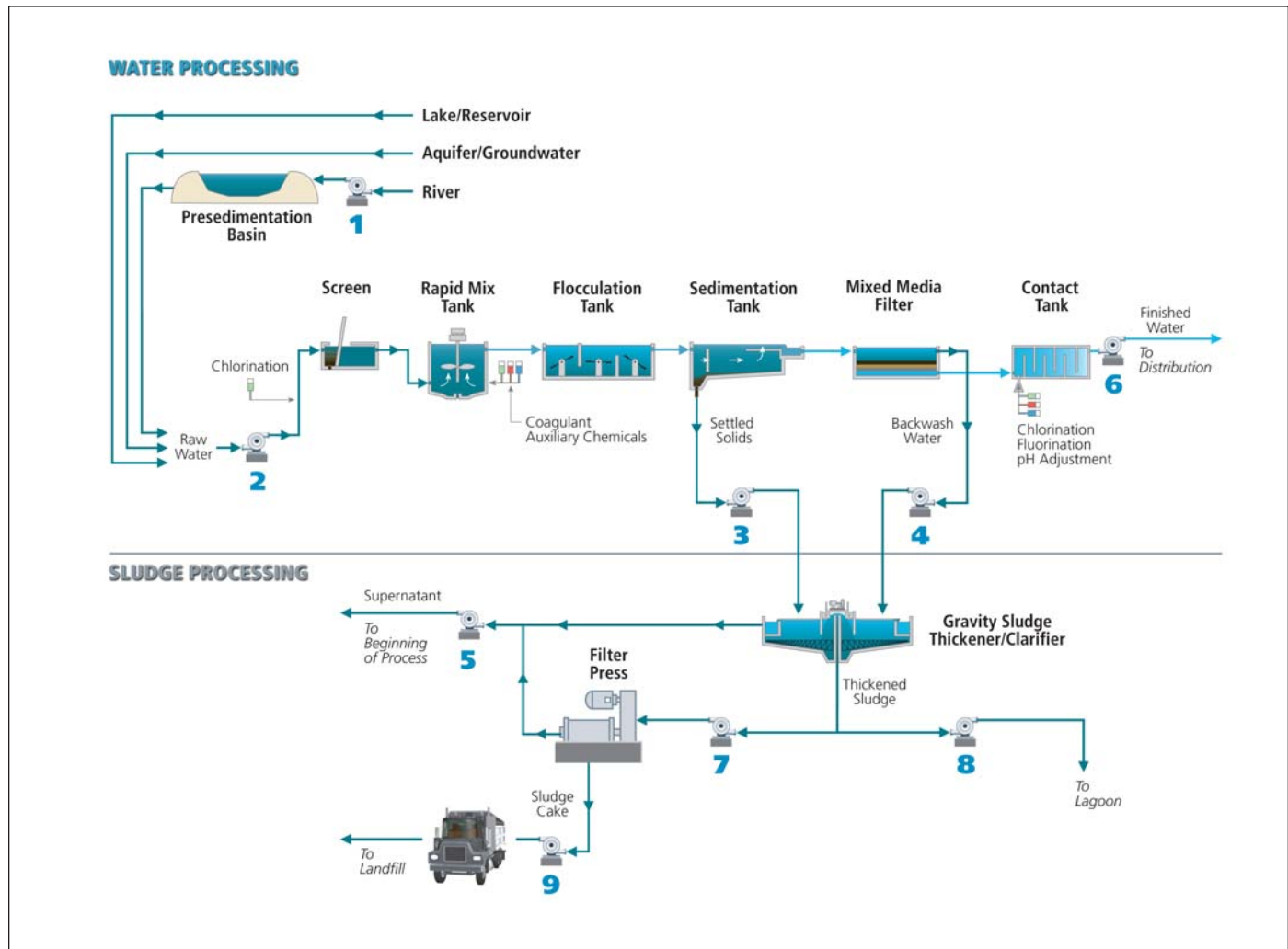
Dewatering is the final stage prior to sludge disposal. As in a wastewater treatment plant, the goal is to economically remove as much liquid as possible from the sludge prior to disposal. The two most common methods of dewatering in a water treatment plant are centrifugation and pressure filtration. 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 Processing Flowchart



Water Treatment Plant – Sealing Device Recommendations

FLUID INFORMATION			MECHANICAL SEAL RECOMMENDATIONS						PACKING RECOMMENDATIONS				NOTES
			PRIMARY			SECONDARY			PRIMARY		SECONDARY		
PUMP NUMBER	FLUID	% SOLIDS	SEAL	MATERIAL	PIPING PLAN	SEAL	MATERIAL	PIPING PLAN	PACKING	PIPING PLAN	PACKING	PIPING PLAN	
1	Raw Water	< 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
2	Raw Water	< 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
3	Settled Solids	≈ 0.2-2%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
4	Backwash Water	< 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
5	Supernatant	< 0.1%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
6	Finished Water	0%	442	RSC/CB-S-EPDM	32	S10	SC/CB-S-EPDM	32	1730	32	1830	32	1
7	Thickened Sludge	≈ 10-15%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
8	Thickened Sludge	≈ 10-15%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1
9	Sludge Cake	≈ 10-25%	442	RSC/RSC-S-EPDM	32	180	SC/TC-S-EPDM	32	1730	32	1830	32	1

NOTES: 1 – Flush can be reduced with the use of a standard throat (restriction) bushing; reduced or eliminated with the use of a SpiralTrac™ Environmental Controller.

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. Our experience and sealing knowledge 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 regarding the process conditions and user preferences; the better the sealing device recommendation you will make for that specific application.

Piping Plan

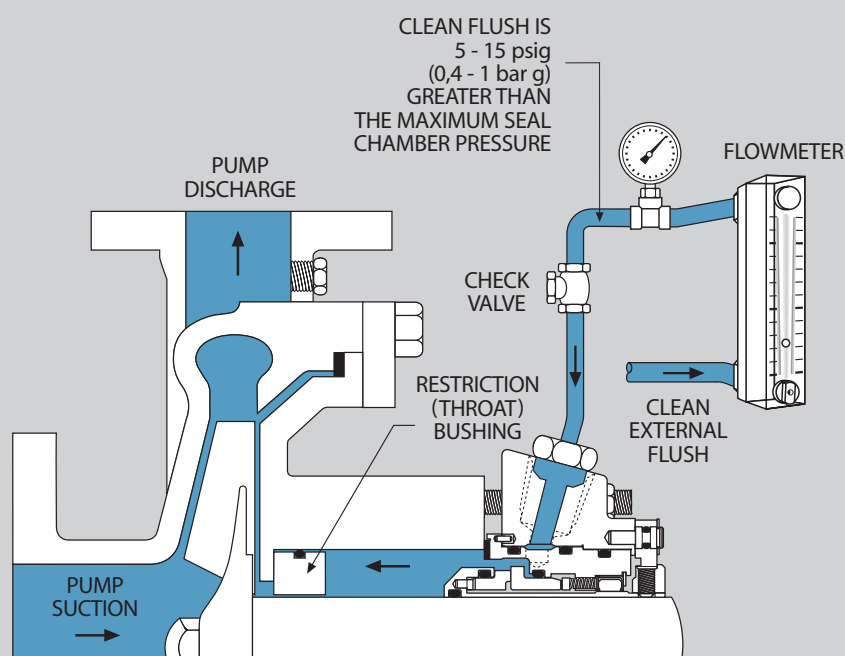
The recommended piping plan to be utilized to enhance sealing device life and performance based on the API Auxiliary Piping Systems is listed for both mechanical seal and packing recommendations. A piping plan is not designated for applications that typically do not require one.

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

Please see the diagram below.

PLAN 32 – Clean Flush

- Use with a single seal
- Provides clean fluid to seal
- Prevents clogging
- Acceptable flush fluids
 - Clean, compatible fluid
 - Water, if compatible
 - Clean product
 - Downstream additive
 - Carrier solvent



SpiralTrac™ Environmental Controller Recommendations

Wastewater Treatment Plant

FLUID INFORMATION		MECHANICAL SEAL RECOMMENDATIONS								PACKING RECOMMENDATIONS				NOTES
		PRIMARY				SECONDARY				PRIMARY/SECONDARY				
FLUID	% SOLIDS	SEAL	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	SEAL	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	PACKING	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	
Digested Sludge	≈ 4-6%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Primary Sludge	≈ 4-6%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Raw Wastewater	≈ 0.1%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Return Activated Sludge (RAS)	≈ 1-3%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Scum	≈ 0.5%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Supernatant	≈ 1%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Thickened Sludge	≈ 4-6%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Waste Activated Sludge (WAS)	≈ 1-3%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Water/Grit	≈ 0.5-2%	442	F	S	32	180	N	I	32	1730 / 1830	P	S	32	1

Water Treatment Plant

FLUID INFORMATION		MECHANICAL SEAL RECOMMENDATIONS								PACKING RECOMMENDATIONS				NOTES
		PRIMARY				SECONDARY				PRIMARY/SECONDARY				
FLUID	% SOLIDS	SEAL	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	SEAL	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	PACKING	SPIRALTRAC™ VERSION	SPIRALTRAC™ TYPE	PIPING PLAN	
Raw Water	< 0.1%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Settled Solids	≈ 0.2-2%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Backwash Water	< 0.1%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Supernatant	< 0.1%	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Finished Water	0	442	F	S	32	S10	D	I	32	1730 / 1830	P	S	32	1
Thickened Sludge	≈ 10-15%	442	F	S	32	180	D	I	32	1730 / 1830	P	S	32	1
Sludge Cake	≈ 10-25%	442	F	S	32	180	N	I	32	1730 / 1830	P	S	32	1

NOTES: 1– Version D, Type I may be used without a flush in specific applications; contact Application Engineering for details.

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.
- In Pulp and Paper – acids, caustics, liquors, etc. normally in 316SS.
- In Mining – slurries, chemicals, water intakes, etc.

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 C

Small/no flush, chemical applications

- Used with a small flush or no flush in chemical service applications.
- Unique drain machined in bottom to effectively drain seal cavity.
- Available in Type I only.

Version P

Packing

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

Installation Configuration

SpiralTrac™ 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 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 B

In applications with flush... simply press the SpiralTrac Type B through the chamber to rest against the throat. It will draw abrasives away from the bore and seal, and present them at the shaft, where the flush can push them under the throat (if they will fit). Installation Types I and A, are favored for flush free operation, because of the difficulty in extending the exit groove through the cast in throat with Type B.

Type A

SpiralTrac Type A is used to replace existing removable bushings. Simply remove the existing bushing, drill a 5/32" (4 mm) air release hole at the top of the partial throat, and insert the SpiralTrac by pressing through the chamber. An optional design fits under a very small counter bore step (throat), and incorporates the air vent within its outside surface.

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

SpiralTrac™ Selecting Versions and Types – Device Application

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

ARC Product Recommendations for Wastewater Treatment Plant

WASTEWATER TREATMENT PLANT		PROBLEM						PRODUCT SELECTION	
PROCESS	EQUIPMENT/AREA	ABRASION	CHEMICAL	CORROSION	EROSION	FOULING	SLIP HAZARD	REBUILDING	CORROSION COATING
Collection System	Junction Boxes			•	•			791	S1*
Collection System	Manholes			•				791	S1*
Collection System	Sewer Pipes			•				791	S1*
Lift Station	Lift Chamber	•		•				791	S1*
Lift Station	Lift Pump	•		•				890	S2
Lift Station	Valves			•				858	855
Preliminary Treatment	Bar Screen	•		•				858	S2
Preliminary Treatment	Bar Screen Chamber			•				791	S1*
Preliminary Treatment	Bar Screen Isolation Valve	•		•				890	855
Preliminary Treatment	Bar Screen Rake	•		•				858	S2
Preliminary Treatment	Cyclonic Comminuator	•						897	855
Preliminary Treatment	Dump Bin	•		•				890	855
Preliminary Treatment	Effluent Trough			•	•			2300 LS	S1*
Preliminary Treatment	Grit Chamber	•		•	•			2300 LS	S1*
Preliminary Treatment	Grit Pump	•		•	•			890	855
Preliminary Treatment	Grit Screen	•		•	•			858	S2
Preliminary Treatment	Lift Pump	•		•	•			890	S2
Primary Treatment	Primary Clarifier Rake Arm			•	•			858	S2
Primary Treatment	Primary Clarifier Weir Gate			•		•		858	S2
Primary Treatment	Primary Clarifier Weir Trough		•		•			2300 LS	S1*
Primary Treatment	Sludge Pump	•						897	855
Secondary Treatment	Aeration Tank – Concrete Internal Surfaces			•				791	CS2
Secondary Treatment	Aeration Tank – Metal Internal Surfaces			•				858	S2
Secondary Treatment	Aeration Tank – External Surfaces			•					1400 CS
Secondary Treatment	Agitators			•	•			858	S2
Secondary Treatment	Polymer Storage/Mix Room						•	2300 LS	3100 FS
Secondary Treatment	Return Activated Sludge Pump	•						897	SD4i
Secondary Treatment	Secondary Clarifier Rake Arm			•	•			858	S1
Secondary Treatment	Secondary Clarifier Weir Gate			•		•		858	S1
Secondary Treatment	Secondary Clarifier Weir Trough			•	•			791	S1*
Tertiary Treatment	Chemical Transfer Station – Concrete Surfaces		•					988	CS4
Tertiary Treatment	Chemical Transfer Station – Metal Surfaces		•					858	S4+
Tertiary Treatment	Disinfection Tank – Concrete Surfaces		•					791	S1*
Tertiary Treatment	Disinfection Tank – Metal Surfaces		•					858	S1
Tertiary Treatment	Lift Screw Pump			•	•			858	S2
Tertiary Treatment	Screw Pump Trough	•						791	CS2
Tertiary Treatment	Sand Filter					•		858	CS2
Sludge Thickening	Primary Sludge Pump	•						890	855
Sludge Thickening	Primary Sludge Thickeners – Concrete	•						2300 LS	CS2
Sludge Thickening	Primary Sludge Thickeners – Metal	•						897	S1
Sludge Thickening	Sludge Mix Tank	•						897	SD4i
Sludge Thickening	Waste Activated Sludge Pump	•		•				897	SD4i
Sludge Conditioning	Primary/Secondary Digester – Concrete Surfaces		•					988	CS4
Sludge Conditioning	Primary/Secondary Digester – Metal Surfaces		•					858	SD4i
Dewatering	Filter Presses			•				858	S1
Dewatering	Thickener – Centrifugal/Vacuum	•		•				897	S2
Disposal	Incinerator		•					858	S4+
Utilities	Blowers			•	•			858	S2
Utilities	Floors		•					3100 FS	CS2
Utilities	Heat Exchanges			•				858	S2
Utilities	Structural Steel Pipe Racks			•					S1/1400 CS
Utilities	Walls, Floors & Ceilings			•				Fibercoat	CS2

* S1HB is a high build version of S1 and can be used for this application. Consult Application Engineering.

ARC Product Recommendations for Water Treatment Plant

WATER TREATMENT PLANT		PROBLEM						PRODUCT SELECTION	
PROCESS	EQUIPMENT/AREA	ABRASION	CHEMICAL	CORROSION	EROSION	FOULING	SLIP HAZARD	REBUILDING	CORROSION COATING
Screening	Pumps – Lift	•		•	•			858	855
Screening	Screens			•					S1PW
Presedimentation	Pumps – Lift	•		•	•			858	855
Presedimentation	Valves			•	•			858	855
Presedimentation	Settling Basin-Metal			•				858	S1PW*
Presedimentation	Settling Basin-Concrete			•				2300 LS	S1PW*
Presedimentation	Weir			•	•			858	S1PW*
Presedimentation	Scraper Arms			•				858	S1PW*
Presedimentation	Carrying Rings/Rails	•						2300 LS	
Presedimentation	Sludge Pumps			•				858	S1PW*
Rapid Mix/Coagulation	Tanks			•	•			858	S1PW*
Rapid Mix/Coagulation	Agitators	•		•				858	855
Rapid Mix/Coagulation	Rotary Feeders	•						858	855
Chemical Bulk Storage	Caustic Tanks		•					858	S1
Chemical Bulk Storage	Caustic Pumps		•					858	S1
Chemical Bulk Storage	Caustic Containment		•					791	CS2
Chemical Bulk Storage	Acid Tanks		•					858	S4+
Chemical Bulk Storage	Acid Pumps		•					858	S4+
Chemical Bulk Storage	Acid Containment		•					988	CS4
Chemical Bulk Storage	Polymer Storage Mix Room						•	2300 LS	3100 FS
Flocculation	Tanks			•	•			858	S1PW*
Flocculation	Rake Arms			•	•			858	S1PW*
Flocculation	Mixer Paddles			•	•			858	S1PW*
Flocculation	Carrying Rings/Rails			•	•			2300 LS	
Settling/Sedimentation	Tanks			•				858	S1PW*
Settling/Sedimentation	Weirs			•	•			858	S1PW*
Settling/Sedimentation	Sludge Scrappers	•						858	855
Settling/Sedimentation	Sludge Pumps	•						858	855
Filtering	Tanks				•			791	S1PW*
Filtering	Pumps – Filtrate			•	•			858	S1PW*
Filtering	Pumps – Backwash			•	•			858	S1PW*
Filtering	Overflow Channels			•	•			791	S1PW*
Filtering	Valves			•	•			858	S1PW*
Post Treatment	In Line Chemical Injection		•						855
Distribution/Storage	Pumps			•	•			858	855
Distribution/Storage	Pipes			•				858	S1PW
Distribution/Storage	Valves			•	•			858	855
Distribution/Storage	Tanks			•				858	S1PW*
Distribution/Storage	Reservoirs			•				791	S1PW*
Sludge Handling	Sludge Pumps	•						858	SD4i
Sludge Handling	Sludge Thickeners	•						858	SD4i
Sludge Handling	Sludge Mix Tank	•						858	SD4i
Sludge Handling	Agitators	•						858	SD4i
Dewatering	Filter Presses	•						858	SD4i
Dewatering	Centrifuges	•						858	SD4i
Dewatering	Screw Conveyor	•						897	855

* S1PW-HB is a high build version of S1HB and can be used for this application. Consult Application Engineering.

ARC Product Descriptions

PRODUCT	TYPE	DESCRIPTION
ARC 791	TROWELABLE – Multi-functional quartz reinforced epoxy composite.	General service chemically resistant trowel down concrete coating
ARC 855	BRUSHABLE – Multi-functional thin film ceramic reinforced epoxy composite.	Moderate service chemical and erosion resistant thin film coating, NSF 61 certified
ARC 858	TROWELABLE – Multi-functional high build ceramic reinforced epoxy composite.	Moderate service chemical and erosion resistant metal rebuilding compound
ARC 890	TROWELABLE – Multi-functional high build ceramic reinforced epoxy composite.	Severe service corrosion and abrasion resistant thick film coating
ARC 897	TROWELABLE – Multi-functional high build ceramic reinforced epoxy composite.	Moderate service corrosion and abrasion resistant thick film coating
ARC 988	TROWELABLE – Novalac quartz reinforced epoxy composite.	Extreme service chemically resistant trowel down concrete coating
ARC CS2	SPRAYABLE – Multi-functional mineral flake reinforced epoxy composite.	General service chemically resistant thin film concrete coating
ARC CS4	SPRAYABLE – Novalac based thin film mineral flake reinforced epoxy composite.	Severe service acid attack and corrosion thin film concrete coating
ARC S1	SPRAYABLE – Multi-functional mineral flake reinforced epoxy composite.	Moderate service corrosion resistant thin film coating
ARC S1HB	SPRAYABLE – Multi-functional high build mineral flake reinforced epoxy composite.	Moderate service chemically resistant thick film coating
ARC S1PW	SPRAYABLE – Multi-functional high build mineral flake reinforced epoxy composite.	Moderate service corrosion resistant thin film coating, NSF 61 certified
ARC S1PW-HB	SPRAYABLE – Multi-functional high build mineral flake reinforced epoxy composite.	Moderate service corrosion resistant thick film coating, NSF 61 certified
ARC S2	SPRAYABLE – Multi-functional thin film ceramic reinforced epoxy composite.	Moderate service chemical and erosion resistant thin film coating
ARC S4+	SPRAYABLE – Novalac based thin film mineral flake reinforced epoxy composite.	Severe service acid attack and corrosion thin film coating
ARC SD4i	SPRAYABLE – Multi-functional thin film ceramic reinforced epoxy composite.	Moderate chemical and aggressive erosion resistant thin film coating
ARC 1400 CS	SPRAYABLE – Thin film, aliphatic polyester urethane coating.	Moderate service chemical, erosion and UV resistant thin film atmospheric coating
ARC 2300 LS	TROWELABLE – Reinforced high build epoxy composite.	General service chemically resistant trowel down concrete coating
ARC 3100 FS	SLURRY/BROADCAST – Multi-functional quartz reinforced epoxy composite.	General service slip resistant traffic surface
ARC Fibercoat	SPRAYABLE – Medium build film ceramic fiber reinforced epoxy composite.	Moderate service chemical and erosion resistant medium film concrete coating

Technical Maintenance Product Recommendations

Wastewater Treatment Plant						
Specific Equipment & Area Use	Cleaners		Lubricants	Greases	Coatings	Corrosion Protection
	Water Based	Solvent Based				
Lift Station	360	292	601	615	415	740
Screens (Coarse & Fine)	360		601 & 715G	615		
Screen Frames (Coarse & Fine)	360				752 & 421	740
Rake Chains	360		601 & 715G			
Grit Chamber	360					
Grit Chamber Pump		292		615		
Primary Clarifier Weir	360				415	
Aeration Tank	360				415	
Secondary Clarifier	360				415	
Thickeners/ Filter Presses	360			615		740
Sludge Pumps - Belt Driven		292				730
Digester Room	235			615		
Polymer Storage Mix Room	235/360*	278				
Mixers/Agitators				615		
Trickle Filter	360				415	
Blowers and Fans		292		615		
Compressor Room	820	292			415	
Water Treatment Plant						
Lift Station, Pumps & Controls	820	292	601	615	415	740
Mixers/Agitators				615		
Thickeners/Clarifiers & Filter Presses	235	292		615	415	
Sludge Pumps - Belt Driven		292				730
Polymer Storage Mix Room	235/360*	278				
Filter Belt Presses	235			615		
Blowers and Fans		292		615		
Chemical Room	820				415	752
Distribution Pumps				615		

* Note: Either product a good choice for cleaning polymer room. We recommend a trial test to determine which product is more effective for the application.

† DuPont registered trademark

Technical Maintenance Product Recommendations

Water & Wastewater Solutions for General Maintenance Applications

Equipment	Recommendation
Bearing Protection/Lubrication	610, 615
Chain Lubrication	601, 610, 715G
Corrosion Prevention - Metals	740, 752, 775
Electrical Protection	276, 296, 421, 775
Flange & Valve Sealing	860, 3500
Metal Cutting/Tapping	388, 389, 390
Pneumatic System Lubrication/Repair	652, 860
Pump Packing Lubrication	622
Threaded Assemblies	723, 785, 800, 900
Valve Lubrication - Control Valves	615, 652

Technical Maintenance Product Descriptions

PRODUCT	TYPE	DESCRIPTION
235 SSC	Water Based Cleaner – Alkali	Steam cleaning equipment cleaner
274 Industrial Degreaser	Solvent Based – Petroleum	Hard surface degreaser for industrial and marine environments
278 Super Solv	Solvent Based – Petroleum	Solvent based degreaser for cleaning additives, uncured epoxies, tars and gums
292 Precision Degreasing Solvent	Solvent Based – Petroleum	Industrial strength solvent blend cleaner
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
388 Synthetic Tapping Fluid	Metal Working Fluid	Synthetic metal working fluid for high speed and feed rates
389 Synthetic Tapping Compound	Metal Working Fluid	Synthetic heat-dissipating metal working fluid
390 Cutting Oil	Metal Working Fluid	High viscosity, oil-based lubricant for heavy duty machining applications
415 Concrete Sealer	Coating	Polymer coating seals and protects new concrete, brick, rock, wood, and metal
421 Clear Protective Coating (CPC)	Coating	Acrylic coating – a clear, impermeable, flexible film
601 Chain Drive Pin & Bushing Lubricant	Lubricant	Premium quality light oil
610 Synthetic Lubricating Fluid	Lubricant	100% synthetic fluid lubricant
615 High Temperature Grease	Grease – High Temperature	Corrosion inhibited grease has extreme pressure capabilities and resists water washout
622 White Grease	Grease	H1 food grade, pure mineral oil, Teflon [†] fortified grease
652 Pneumatic Lubricant & Conditioner	Lubricant	High performance, low viscosity lubricant reduces up to 90% in pneumatic maintenance costs
715 Spraflex Gold®	Lubricant	Non-staining lubricant for chain drives, open gears and wire rope
723 Sprasolve®	Lubricant	Penetrating oil in a convenient, non-flammable propellant aerosol can
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
775 Moisture Shield	Coating	Clear, moisture displacing and anti-corrosion protective film
785 Parting Lubricant	Assembly Lubricant	Anti-seize compound of ultrafine, inorganic solid lubricants in a non-carbonizing, ashless synthetic carrier
800 GoldEnd® Tape	Sealing- PTFE	Heavy duty, high density, tear resistant, moldable, dry PTFE sealant tape
820 KPC	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	Moldable Teflon [†] thread sealant and lubricant paste
3500 Valvelon®	Sealing-PTFE	Valve packing and flange gasketing

[†] DuPont registered trademark

Glossary of Terms

Acid

A substance that has a pH of less than 7, 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.

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.

Evaporation

The process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snow fields, but not from leaf surfaces. See transpiration

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 waters 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.

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. (ex., 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 ground-water 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.

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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