

WE UNDERSTAND
WATER & WASTEWATER
TREATMENT TECHNOLOGIES



At Severn Trent Services we understand water. That's why we offer a range of innovative treatment technologies used the world over to help protect and preserve the world's most precious resource.

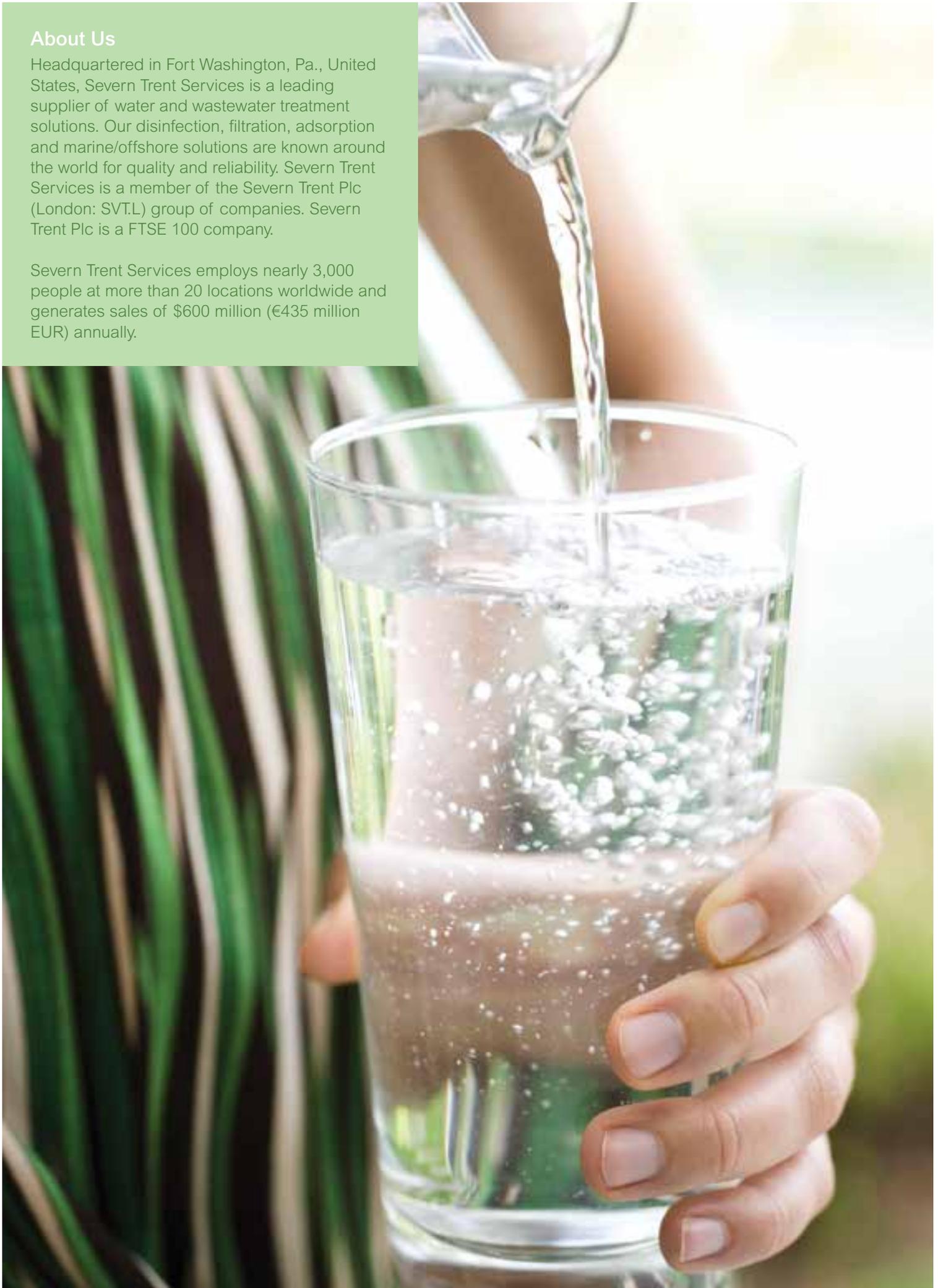
UNDERSTANDING
A VALUABLE RESOURCE

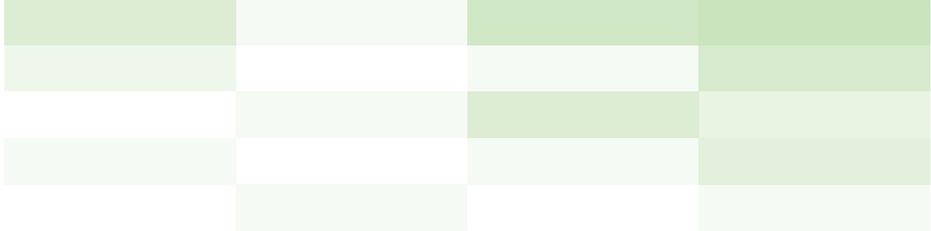


About Us

Headquartered in Fort Washington, Pa., United States, Severn Trent Services is a leading supplier of water and wastewater treatment solutions. Our disinfection, filtration, adsorption and marine/offshore solutions are known around the world for quality and reliability. Severn Trent Services is a member of the Severn Trent Plc (London: SVT.L) group of companies. Severn Trent Plc is a FTSE 100 company.

Severn Trent Services employs nearly 3,000 people at more than 20 locations worldwide and generates sales of \$600 million (€435 million EUR) annually.





OUR EXPERIENCE

Water Purification Capability

We have the experience of more than 50 years across every continent, and the satisfaction of tens of thousands of utility, industrial, commercial and government customers. Our localized field and factory service personnel are well trained to support Severn Trent Services' disinfection, instrumentation, and membrane and filtration products.

Disinfection

- Installed more than 3,000 electrochlorination systems producing over 3.0 million lb/day (56 thousand kg/hr) of sodium hypochlorite.
- Offers the only microwave-powered UV disinfection system.
- The leading supplier of gas disinfection systems in the world with more than 40 years experience.
- Supplies more than 65 percent of the worldwide installed base of on-site generated hypochlorite (brine electrochlorination).

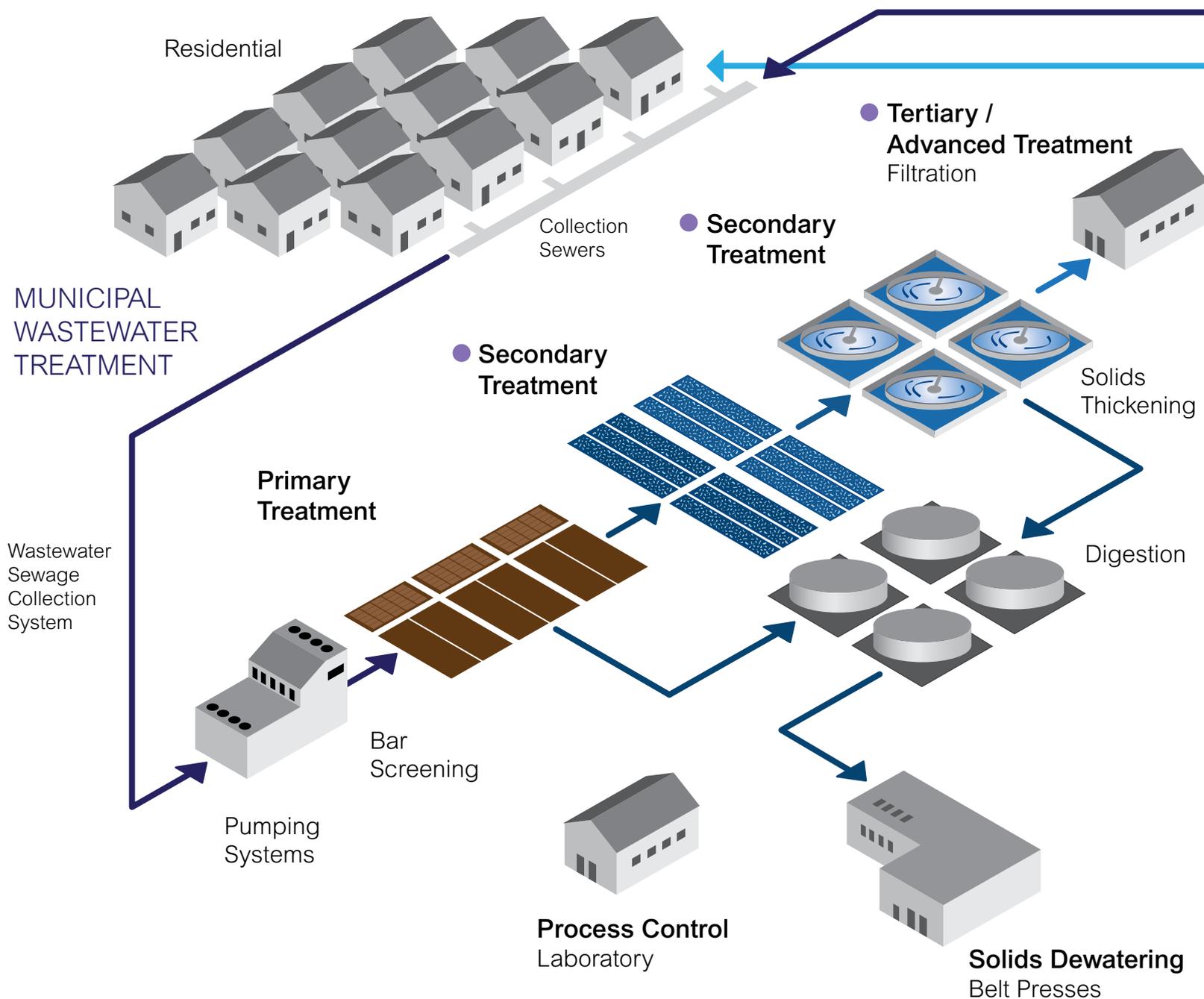
Filtration

- More than 35 percent of all Florida reuse water goes through TETRA® filters.
- Bayoxide® E33 arsenic removal media is permitted and operating in more than 40 US states.
- TETRA DeepBed™ tertiary filters now treat over 1,000,000 m³/d in Europe.
- The TETRA Denite® denitrification process is the single biggest contributor in the restoration of Tampa Bay. An average of 52 MGD (197 MGL) have nitrogen removed using Severn Trent Services' process.
- Severn Trent Services supplied TETRA Denite biological denitrification filters for Stage 1A of the Bundamba Advanced Water Treatment Plant. The project is the largest recycled water scheme of its kind to be constructed in Australia.
- More than 70 percent of US steel manufacturers requiring filtration employ TETRA DeepBed™ Pressure Filters.
- Manufacturing desalination systems for high salinity applications for more than 20 years.
- Installing filtration systems for pre-treatment at desalination plants in Europe and the Middle East including some of the largest works in the world.
- Supplying TETRA filtration solutions in China including the largest CoOX biological treatment works in the world.

Marine Disinfection

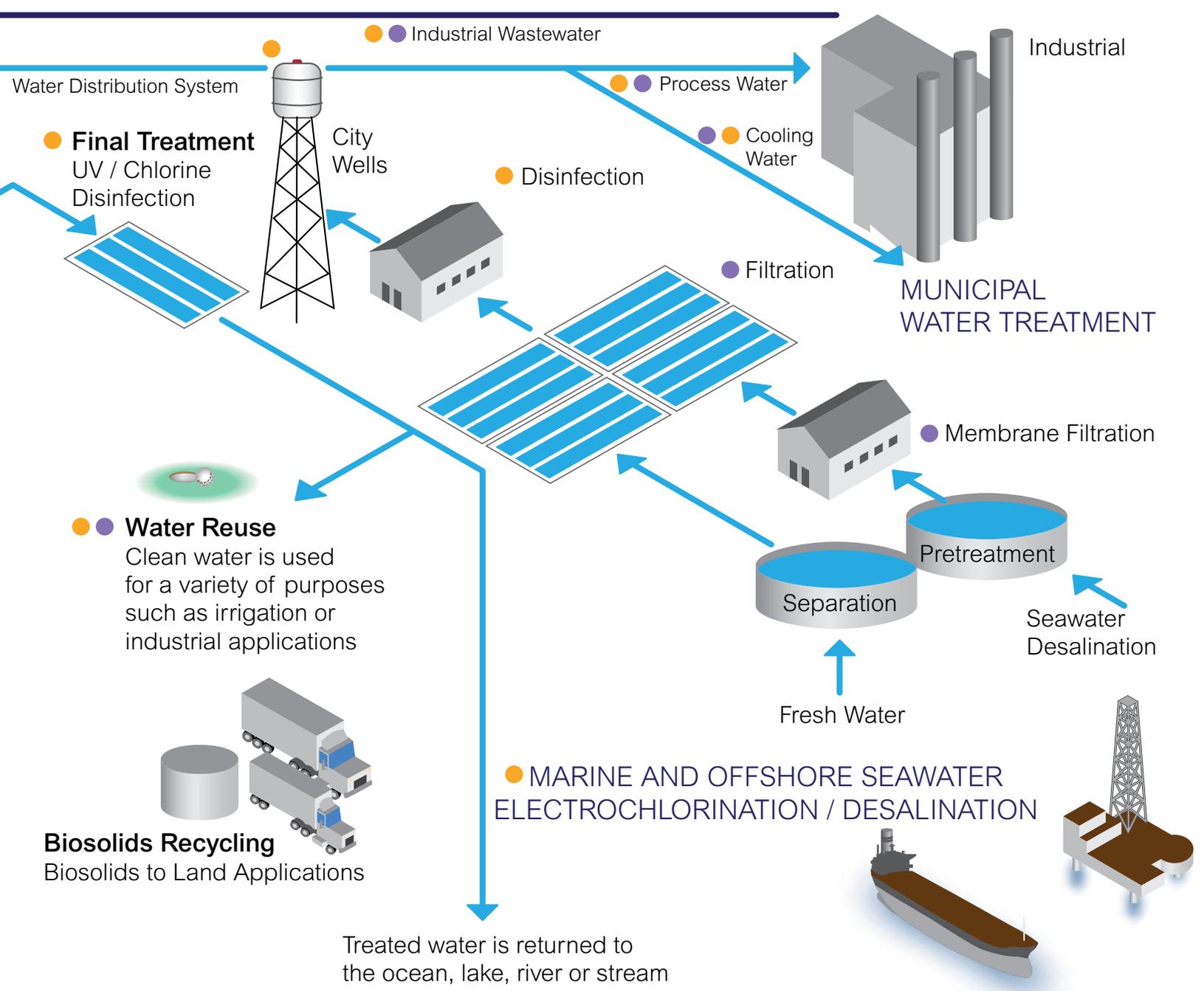
- More than 1,500 electrochlorination systems installed worldwide in marine, offshore, power and desalination applications.
- Offers the only marine sewage treatment systems that oxidize sewage in the electrochemical cell.
- BALPURE® ballast water treatment system is patented and Type-Approved, providing an effective and economical solution to the threat of aquatic invasive species.

At Severn Trent Services we understand water and wastewater treatment. We provide innovative filtration and disinfection solutions to meet your specific needs. We build long-term relationships by understanding our customers' needs, delivering value and behaving with integrity in everything we do.



STS Applications Legend

- STS Disinfection Solutions
- STS Filtration Solutions
- Contract Operations for all or parts of process cycle.**



WE UNDERSTAND
DRINKING WATER FILTRATION
& DESALINATION PRE-TREATMENT



TETRA® LP Block™ Dual Parallel Lateral Underdrain Filters

Severn Trent Services has more than 50 years of experience providing filtration treatment solutions to municipal, industrial and commercial markets.

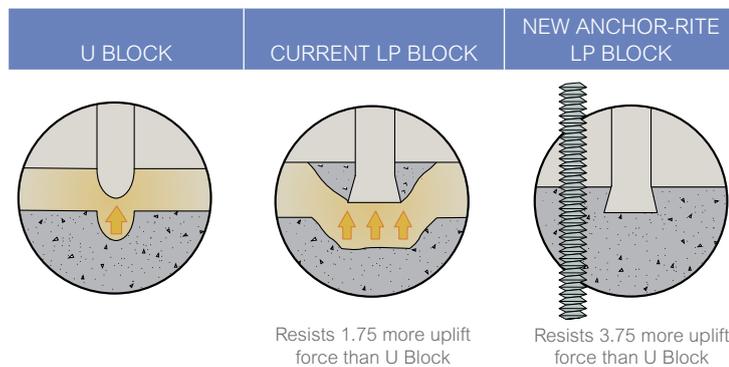
Drinking Water Underdrains

In gravity filters, the underdrain is one of the most important components contributing to overall system performance and operation — whether a new filter design or retrofitting of an existing filter. Severn Trent Services offers **TETRA® LP Blocks™** and **TETRA U Blocks™** dual parallel lateral underdrains for drinking water and desalination pre-treatment applications.

- Effective removal of solids
- Equal distribution of backwash air/water
- Low headloss
- Exceptional installation strength, integrity and maintenance-free life with no moving or wearing parts
- Reduced volume of dirty backwash water produced and lower operating costs
- GroutGrip™ and Anchor-Rite® designs resist uplift from the filter floor and eliminate uncertainty from grout installation
- Wide, low-profile design reduces installation cost
- Our desalination systems are suitable for high salinity water applications
- Easy assembly



Desalination Plant During Construction



TETRA® LP Block™ dual parallel lateral underdrain

WE UNDERSTAND
MEMBRANE FILTRATION



UAT™ Membrane Filtration Solutions

Severn Trent Services offers Membrane Filtration Systems to meet any tap, brackish or seawater application need. Using high quality components, the systems are engineered to effectively produce treated water, free of particulate matter or contaminants.

Membrane Filtration Systems

Severn Trent Services offers the **UAT™ Reverse Osmosis (RO)**, **Ultrafiltration (UF)**, **Nanofiltration** and **Electrodeionization (EDI)** systems for a variety of municipal, commercial and industrial applications.

- UAT RO membrane filtration systems range in standard output capacities up to 10 MGD
- UAT UF systems range up to 10 MGD
- UAT EDI systems are available with a maximum permeate flow rate of 2.2 m³/h–104 m³/h (10 GPM–460 GPM)



UAT™ Reverse Osmosis System



UAT™ Reverse Osmosis System



UAT™ Electrodeionization System



UAT™ Ultrafiltration and Reverse Osmosis Systems

WE UNDERSTAND
CONTAMINANT REMOVAL



SORB® Inorganic Removal

Contaminants in drinking water affect public health. As a result, they should be treated, limited or removed from drinking water supplies. Severn Trent Services has a variety of proven treatment solutions.

Arsenic Removal Systems

The **SORB 33**[®] arsenic removal process is proven to effectively and economically reduce arsenic below 4 ppb. The system works in conjunction with a robust and proprietary ferric oxide media, **Bayoxide**[®] **E33**.

- Simple installation and operation
- Pre-engineered systems range from 1.1–2.1 m (3.5–7 ft) diameter to treat 17–204 m³/hr (75–900 GPM)
- Cost-effective treatment solution for arsenic removal

Arsenic Removal Media

Bayoxide granular ferric oxide media has been successfully removing arsenic from drinking water treatment systems since 1999.

- Removes As (III) and As (V) to < 4 ppb
- High capacity for arsenic
- Long media life under continuous operation
- Very low residual (backwash) effluents: <0.1% of water treated
- No chemicals for regeneration
- Small footprint
- Dry media, NSF Standard 61 approved

Fluoride Removal

Severn Trent Services offers the **SORB 09**[™] fluoride removal system, a fixed-bed adsorption process for the removal of fluoride onto solid activated alumina.

Iron & Manganese Removal

The **Omni-SORB**[™] filter system is designed for iron and manganese removal applications and for combined arsenic/iron/manganese removal where iron levels are high enough to affect arsenic removal.

- Lower water losses — <50% than greensand systems
- Reduces operational and maintenance expenses
- Ensures removal of contaminants
- No need to use permanganate for oxidation
- Pre-engineered systems range from 1.1–2.1 m (3.5–7 ft) diameter to treat 19–240 m³/hr (85–1,050 GPM)

Nitrate Removal

The **SORB 07**[™] nitrate removal system is an ideal solution to treat nitrate contamination in ground water supplies.

- Capacity ranges from 100 to 3000 GPM
- Small footprint
- Regenerative process extends resin life

Ion Exchange Systems

TETRA Higgin's Loop[™] ion exchange system is a continuous countercurrent ion exchange contactor for liquid phase separations of ionic components using solid exchange resins. The TETRA Higgin's Loop ion exchange system is a great enhancement for ion exchange applications when compared with fixed bed and fluid bed systems. The Higgin's Loop system efficiently utilizes the resin capacity, uses less regenerant and less fresh water, generates consistent product quality and minimizes wastewater volumes.

pH Adjustment

The **TETRApHix**[™] advanced CO₂ pH adjustment system is ideal for use in drinking water applications requiring CO₂ addition for lime softening or recarbonization or the control of pH.

- Increases gas efficiency
- Low maintenance and reduced operational costs
- Smaller footprint compared to conventional carbon dioxide pH adjustment systems



TETRA[®] Higgins Loop Ion Exchange



Bayoxide[®] E33 Media

WE UNDERSTAND

BIOLOGICAL WASTEWATER TREATMENT



Combined TETRA® SAF and DeepBed™ Filter

For biological treatment and tertiary wastewater treatment, Severn Trent Services has it covered. The proven TETRA® design is used for applications that require treatment including removal of BOD, ammonia, suspended solids, phosphorus and nitrate-nitrogen.

Biological Wastewater Treatment Systems

Severn Trent Services offers **TETRA®** biological aerated filter systems for the removal of contaminants from municipal and industrial wastewater

TETRA® Submerged Aerated Filters (SAF)

A simple process for the biological oxidation of ammonia-nitrogen ($\text{NH}_3\text{-N}$) and BOD for both municipal and industrial wastewaters.

- Effluent qualities of 5 BOD and 1 $\text{NH}_3\text{-N}$ (mg/L)
- Effluent $\text{NH}_3\text{-N}$ of less than 0.5 mg/L
- Exceptional performance and flexibility
- Low operating and maintenance costs
- Small footprint
- Can be used for either secondary treatment (SAF/cSAF) or as a tertiary (nitrification) stage (NSAF)

TETRA® CoIOX™

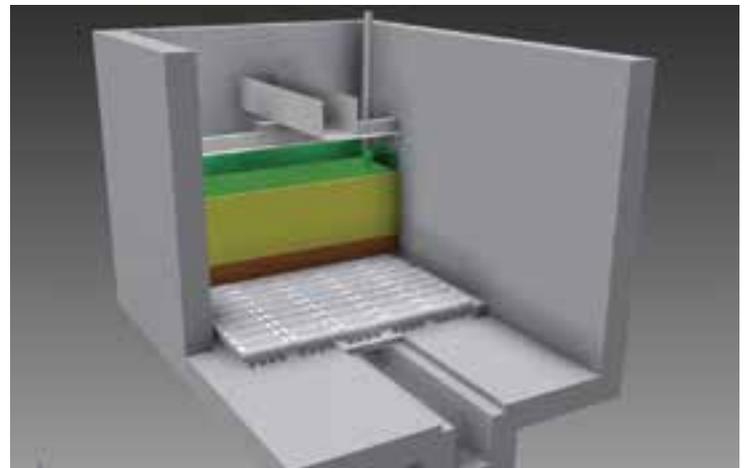
TETRA® CoIOX™ is an advanced aerobic biological treatment system which combines a solids removal and biological treatment process with innovative design features to achieve superior performance.

- Nitrifies ammonia nitrogen
- Achieves superior BOD removal
- Removes suspended solids
- Offers greater efficiency and operational reliability than other aerobic biological treatment processes

TETRA® Amphidrome™

The TETRA® Amphidrome™ process is a biological fixed film sequencing batch filter that provides simultaneous removal of BOD, ammonia, suspended solids, phosphorus, and nitrate-nitrogen. The performance of the deep bed Amphidrome is guaranteed to produce an effluent which meets or surpasses regulatory standards.

- Nitrifies ammonia nitrogen
- Achieves superior BOD removal
- Removes suspended solids
- Offers greater efficiency and operational reliability than other aerobic biological treatment processes

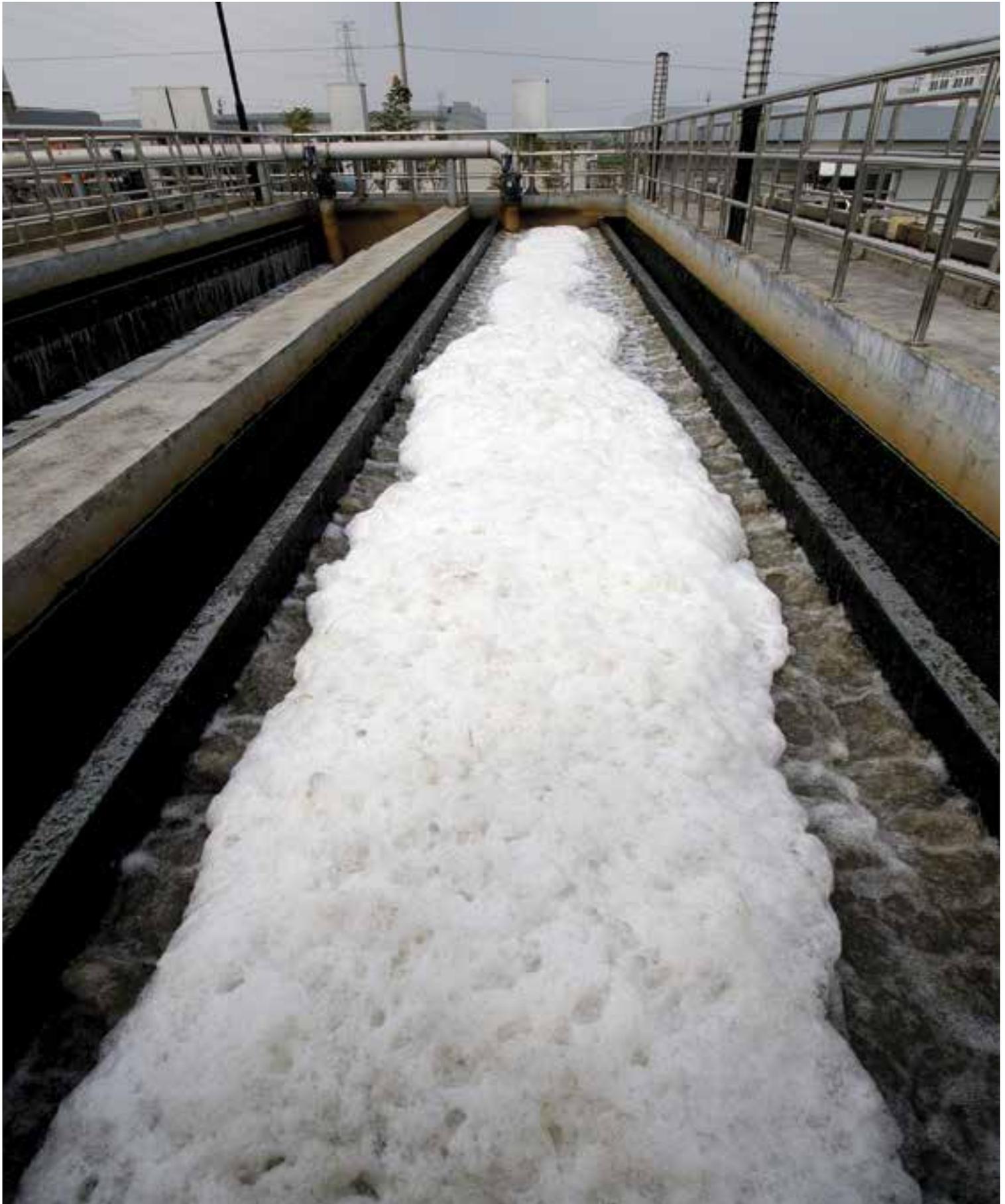


TETRA® Wastewater Filter Construction



TETRA® CoIOX™ at East Greenwich

WE UNDERSTAND TERTIARY WASTEWATER TREATMENT



TETRA® SDF at Jiashan, China

Severn Trent Services' Tertiary and Advanced Wastewater Treatment technologies produce cost effective wastewater effluent that is safe for direct discharge or reuse.

Tertiary and Wastewater Treatment Systems

Severn Trent Services' **TETRA®** filters produce high quality advanced wastewater treatment plant effluent. The complete product line includes application-specific engineered gravity, pressure and modular filters and pre-assembled gravity deep bed filters.

TETRA® SNAP T® Block

The TETRA® SNAP T® Block underdrain is a proven design of filter underdrain.

- Offers superior distribution of both backwash air and water, concurrently
- High loading capacity
- Ensures improved backwashing distribution
- Used in >10% of the world's water reuse capacity

TETRA® DeepBed™

The TETRA® DeepBed™ tertiary gravity filtration system is an economical solution for the removal of total suspended solids (TSS).

- Superior total phosphorus (TP) removal to below 0.2 mg/L
- No moving parts to clog or wear
- <4% backwater water return (2% typical)
- Easily converted into denitrification mode



TETRA® SNAP T® Blocks



TETRA® Denite®

Industrial Pressure Filters

TETRA DeepBed pressure filters combine a nozzleless filter bottom and spherical monomedia for industrial markets. Systems offer automatic filtration and backwashing cycles, with the filter as a standalone operation. These systems are fully automated and provide excellent removal of TSS, oil and grease.

TETRA® Denite®

Severn Trent Services offers the TETRA® Denite® system that combines the denitrification and filtration process for the removal of nitrate-nitrogen (NO₃-N) and suspended solids in a single treatment step.

- Fixed-film biological denitrification process
- Integrates with other processes for superior total nitrogen (TN) and phosphorus removal
- Reduces NO₃-N to low levels (<1.0 mg/L)
- Effluent total phosphorous concentrations <0.3 mg/L are consistently achieved
- Can easily meet <2 NTU or <5 mg/L TSS (<2 mg/L TSS typical)
- Capable of denitrifying to low NO₃-N concentrations at low wastewater temperatures
- TETRAPace® automatic dosing control saves up to 30 percent in carbon consumption
- SpeedBump® operation removes accumulated gas without removing the reactor from service

Systems are available as bespoke designs or in TETRA Modular DeepBed filter package plants.



TETRA® Denite® at Village Creek WWTW

WE UNDERSTAND
ULTRAVIOLET DISINFECTION



MicroDynamics® OCS 660 Open Channel Microwave UV Disinfection at Kent County, Delaware, USA

Severn Trent Services offers MicroDynamics® and UltraDynamics® ultraviolet disinfection systems for use in a complete spectrum of applications.

Ultraviolet Disinfection Systems

MicroDynamics® Microwave UV Disinfection Systems

The revolutionary MicroDynamics microwave ultraviolet disinfection technology uses microwaves to energize low-pressure, high-output electrodeless lamps for water and wastewater disinfection.

- Ultra-long lamp life warranted for three years
- Cost-effective design offering significant operating cost savings
- Reliable and accurate control with MicroPace™ technology
- Unlimited start/stop of system with instantaneous output
- Operation in dry channel(s)
- Simplified maintenance and improved safety
- Open Channel systems are bioassay validated for wastewater treatment and CV02 Closed Vessel system validated to treat *Cryptosporidium* to the latest United States Environmental Protection Standards
- Available in modular open channel or closed vessel designs
- New OCS721 Open Channel Wastewater System offers even greater disinfection capability in a smaller footprint for wastewater disinfection and water reuse



MicroDynamics® OCS721 Open Channel Microwave UV Disinfection

UltraDynamics® UV Disinfection Systems

UltraDynamics ultraviolet disinfection systems are available in closed vessel horizontal configurations for drinking water applications.

- Drinking water systems are designed to treat up to 315 m³/hr or 2 MGD per system
- Wastewater systems designed to treat up to 4 MGD or 631 m³/hr per system



UltraDynamics® UV Disinfection



MicroDynamics® CV02 Closed Vessel Microwave UV Disinfection

WE UNDERSTAND ELECTROCHLORINATION



ClorTec® Brine Electrochlorination Systems

Severn Trent Services is a world leader in the supply of seawater and brine water electrochlorination with 3,000+ installations in more than 60 countries. Electrochlorination is a proven, cost-effective, reliable and safe method for generating sodium hypochlorite on-site.

Seawater Electrochlorination

SANILEC® Seawater Electrochlorination Systems

SANILEC® systems are the standard and preferred electrochlorination system for biofouling control in offshore and marine as well as power and coastal applications.

- Systems range in capacity from 2.8–47,620 lb/day (1.2–21,600 kg/day), per train
- Minimal operation and maintenance requirements
- Once-through flow design eliminating recycle requirements
- Use of corrosion-resistant materials of construction
- Customized layout and supply to meet site-specific requirements
- Low power consumption

SEACLOR® Seawater Electrochlorination Systems

SEACLOR® systems are used for biofouling control in power plants, cooling towers, liquefied natural gas (LNG) terminals and desalination facilities, as well as coastal installations using seawater for cooling or other process needs all over the world.

- Designed for continuous and unattended operation and require only periodic monitoring
- Eliminates storage, handling and purchase of hazardous chemicals
- Supplied pre-assembled or pre-fabricated to the maximum possible extent
- Systems range in capacity from 500–50,000 lb/day (10–900 kg/hr), per train



SEACLOR® Seawater Electrochlorination Systems

Brine Electrochlorination

ClorTec® Brine Electrochlorination Systems

ClorTec® systems generate a 0.8% sodium hypochlorite disinfection solution, a chlorine equivalent, using three common consumables: salt, water and electricity.

- Reduces carbon footprint and salt consumption by as much as 20 percent
- Reduces Health and Safety risks
- Reduced by-products
- Capacity ranges from 2–3000+ lb/day (1–1,360 kg/day)



ClorTec® Brine Electrochlorination Systems



SANILEC® Seawater Electrochlorination Systems

WE UNDERSTAND
MARINE DISINFECTION



Severn Trent Services has distinguished itself as the market leader for the design and manufacture of electrolytic disinfection systems for seawater and marine applications.

Ballast Water Treatment

The Type-Approved and patented **BALPURE®** ballast water treatment system is a simple, reliable and flexible electrolytic disinfection treatment solution to meet the most stringent ballast water discharge requirements. Using a slip stream approach, the BALPURE system can be remotely mounted away from the ballast lines and split into small sub-assemblies to minimize other equipment relocation and additional engineering/ship re-designs.

- Easy to install
- Easy to operate
- Low capital cost
- Low operating cost
- Non-corrosive
- Operator safe
- Suitable for hazardous cargo area installations
- Surpasses IMO D-2 standards by ten-fold



BALPURE® Installed Onboard Bulk Carrier



MARINER OMNIPURE® Series M55 Marine Sewage Treatment Systems

Marine Sewage Treatment

MARINER OMNIPURE® Series M55

The compact, MARINER OMNIPURE sewage treatment system features a bulkhead mounted arrangement that maintains the use of your vessel's installed sewage and seawater pumps and in-place collection/holding tanks. The systems accommodate crew complements up to 25 persons (black and gray water).

- Accommodates varying crew complements
- BV Certification and USCG Certificate of Approval to IMO Resolution MEPC.159(55)
- Easy to install, start up, operate and service
- Eliminates storage, handling and purchase of hazardous chemicals
- No pre-treatment of raw inlet sewage stream
- Small footprint and weight

OMNIPURE™ Series 55

OMNIPURE™ Series 55 sewage treatment systems are the only marine sewage treatment system to oxidize sewage through an electrolytic process as well as generating sodium hypochlorite for the disinfection of the sewage streams. The systems accommodate treatment capacities up to 197 persons (black and gray water).

- BV Certification and USCG Certificate of Approval to IMO Resolution MEPC.159(55)
- Easy to install, operate and service
- Lightweight package
- Minimal maintenance
- No additional tanks or filtration equipment required
- Operates on-demand, instantaneous on-off operation
- Operator-safe solids handling system
- Small equipment footprint



OMNIPURE™ Marine Sewage Treatment Systems

WE UNDERSTAND GAS FEED DISINFECTION



Capital Controls® Gas Feed Disinfection Systems

Severn Trent Services offers a range of world-leading gas feed disinfection systems, instrumentation and associated safety systems.

Gas Feed Systems

The **Capital Controls**[®] line of gas feed disinfection equipment includes chlorination, dechlorination/sulfonation, ammoniation and recarbonation equipment.

- Vacuum Gas Feeders (Manual/Automatic) up to 200 kg/h (10,000 lb/day)
- Pressure Gas Feeders (Manual/Automatic) up to 20 kg/h (1,000 lb/day)
- Automatic Gas Control Valves
- Vaporizers up to 200 kg/h (10,000 lb/day)
- Custom Engineered Systems
- Accessories and mixing systems

Scrubbers

EST[™] municipal and industrial scrubbing systems include both wet and dry scrubbers for emergency gas abatement, odor scrubbers and particulate scrubbers.

Vent Exhaust Gas Arrestor

The **Capital Controls Type VEGA**[™] is a disposable chlorinator vacuum regulator vent gas arrestor designed to treat occasional chlorine gas vent releases that normally accompany chlorine container changeovers.



Capital Controls[®] Gas Feed Disinfection Systems



EST[™] Gas Scrubber System

WE UNDERSTAND CHLORINE DIOXIDE GENERATION



Capital Controls® G4000 Chlorine Dioxide Generator — Dubai, UAE

Severn Trent Services' chlorine dioxide is a versatile disinfection treatment chemical that aids in the prevention of trihalomethane formation, a chlorinated organic by-product, by oxidizing the precursors that cause THMs.

Chlorine Dioxide Generation Systems

Severn Trent Services offers the **Capital Controls®** chlorine dioxide generators to produce the disinfectant chemical using reagents in either commercially available or diluted concentrations.

- Efficient gas production
- Precise solution feeding
- Low maintenance
- Dependable operation
- Ranges from up to 2 g/day to 10 kg/hr (up to 529 lb/day)
- Consistent product yield greater than 95%
- Largest installed base in Italy

Water Storage Management System

Severn Trent Services developed the **ClorTec® RMS™** water storage management system as an economical solution for varying municipal, commercial and industrial applications.



Capital Controls® GS4000 Mini Chlorine Dioxide Generator



Capital Controls® Chlorine Dioxide Generators

WE UNDERSTAND

ANALYZERS, CONTROLLERS & GAS DETECTORS

Water Quality Analyzers

Severn Trent Services has been a leader in continuous analysis for over twenty years. Our offering of residual analyzers are designed to continuously monitor chlorine and other parameters in drinking water, wastewater, cooling water and other process water applications.

Severn Trent Services' analyzers include

- **MicroChem[®]2** analyzer and controller measures up to three of the following parameters: pH, ORP, Dissolved Oxygen, Chlorine, Chlorine Dioxide, Conductivity, 4-20mA and Temperature
- **Capital Controls Series 1870E and 1770** chlorine analyzers
- **Capital Controls CI500 and CI1000** residual chlorine analyzers
- **Capital Controls CI1000B and DVU** bufferless chlorine analyzers

Water Quality Controllers

The **Capital Controls CAPTROL Series 1450 and 1451** controllers can read a chlorine residual signal, a flow signal, or both to effect excellent, smooth and responsive control of chlorine dosing. Additionally, "before and after" chlorine analyzers can be used in conjunction with a flow input to provide very refined control of the chlorination process.



MicroChem[®]2 Controller/Analyzer/Transmitter

Gas Detectors

Severn Trent Services' gas and leak detectors provide continuous detection of chlorine gas and sulfur dioxide gas in a normally clean air environment in up to eight distinct locations, protecting personnel and property wherever chlorine is unloaded, stored or used. Highly sensitive, the detectors monitor gas levels below U.S. OSHA requirements.



Capital Controls[®] ADVANCE Series 1610 Single Point Gas detector



Capital Controls[®] CAPTROL Series 1451 Controller



Global Locations

Abu Dhabi, United Arab Emirates

Barcelona, Spain

Bogota, Colombia

Colmar, Pennsylvania USA

Fort Washington, Pennsylvania USA (HQ)

Milan, Italy

Pittsburgh, Pennsylvania USA

Shanghai, China

Singapore

Sugar Land, Texas USA

Tampa, Florida USA

Tamworth, United Kingdom

Los Angeles, California USA

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