High-Capacity Car Wash Water Reclaim Systems: Comparative Analysis

By Michael Gordon

Introduction

Water reclamation is essential for modern high-throughput car wash tunnels to reduce freshwater consumption, meet environmental regulations, and manage operating costs. In a 135-foot conveyor tunnel processing ~150 cars per hour, each vehicle may use ~145 gallons of water per wash. Without recycling, this would equate to over 26,000 gallons/hour of usage. To minimize waste, a reclaim system must capture **100% of the wash water** runoff (excluding carry-off) for treatment and reuse. Given an estimated 5% carry-off (≈7 gallons per car), roughly 20,700 gallons/hour must be collected, treated, and stored for reuse. The design must handle this volume and deliver recycled water of sufficient quality – **specifically turbidity below 50 NTU** (nephelometric turbidity units) – to be used in most wash processes without affecting wash quality.

This report examines reclaim separator tank systems from **SoBrite**, **PurClean** (PurWater), **Aqua Bio**, **Velocity** (Sonny's Car Wash Water), and **ConServ**, focusing on their collection (mud) and separation tank designs. We compare their features, performance, and limitations. Each reclaim separator tank from the five leading suppliers of car wash reclaim water solutions will then be mapped for optimal performance through the implementation of **BioTech Solutions** application of advanced microbial digestion microbes, combined with our industry specific nanobubble cavitation and electro-ionization (The Shaft) technology to further the breakdown complex organic materials for reducing biomass clogging of filters, pressure nozzle clogging and improved water turbidity, which will lead to greatly improved odor control of wash water.

System Requirements for a High-Capacity Tunnel Car Wash **(500 to 1,500 cpd)**

For a high-capacity tunnel (50 to 150 cars/hour), the water reclaim system must be engineered to handle large flows and recovered water loadings. Key requirements include:

- **Adequate Hydraulic Capacity:** The system should support peak flow rates on the order of 150–200 GPM (gallons per minute) or more, ensuring that all water sprayed in the tunnel is simultaneously collected and processed. This typically means powerful pumps (e.g. 5–15 HP) and possibly multiple pumps or parallel treatment lines to avoid bottlenecks.
- **Large Settling Volume:** In-ground concrete tanks (**pits**) provide the primary separation stage of water clarification via gravity separation. For a facility of these sizes, multiple precast concrete tanks (totaling 4,500 to 6,000 gallons in volume) are recommended to capture and hold surge flows and allow sedimentation. In the three-pit system the tanks

are placed in series, each tank capable of holding 1,500 to 2,000 gallons, with baffle wall, Tank 1 is divided into two 1,000 gallon holding tanks separated by a baffle wall. Tanks 2 and 3 are baffled as well for improved hydrological water flow. Each side holding 750 to 1,000 gallon of each tanks 1,500 to 2,000 gallon capacity. All Tanks are set at the same elevation. The first tanks is commonly called a "mud" tank, which traps heavy grit and sand; subsequent tanks provide secondary settling, oil separation, and serve as the suction source for reclaim pumps.

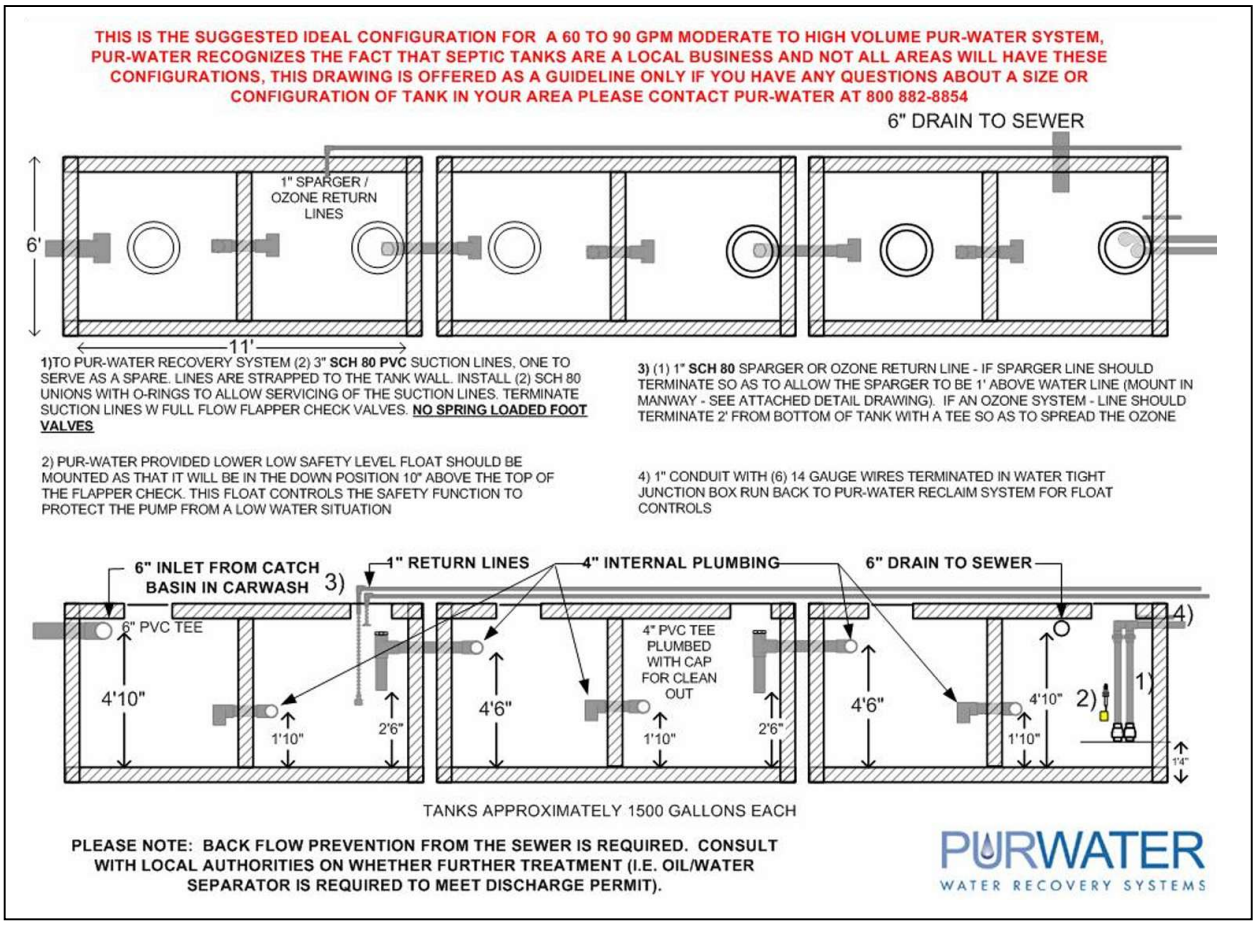
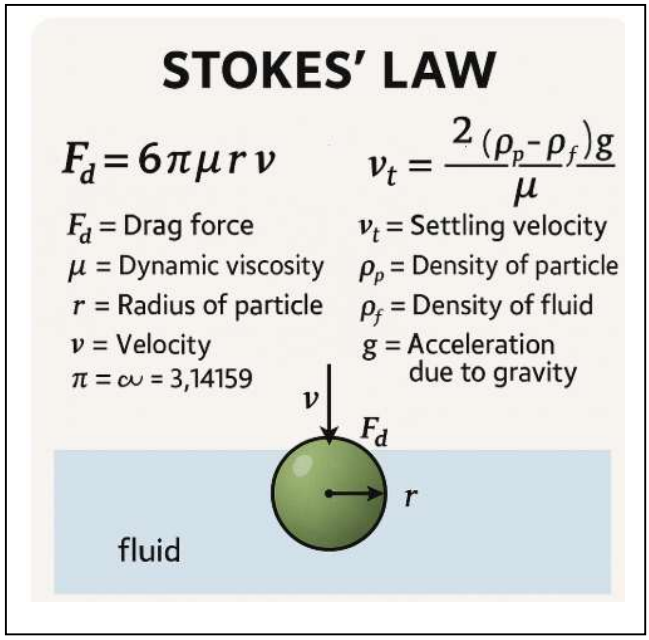


Figure 1 – Pure Water Separator Tank Design

- **Efficient Solids Separation:** Beyond passive settling, the system should remove finer suspended solids that do not settle quickly. **Hydrocyclone Separators** (centrifugal units) are widely used to spin out particles down to ~5 microns. This protects pumps and nozzles from abrasive wear and prevents clogging by fine grit. Any separated sludge from these cyclones should be returned to a collection tank (often the first pit) for periodic clean-out. The goal is to reduce Total Suspended Solids (TSS) to a low level (on the order of tens of ppm) before reuse.
- **Oil and Floatables Removal:** The separator pit system must capture oils, waxes, and floating debris. Typically, one of the pit compartments acts as an **oil-water separator**, or a smaller pony tank is added for isolating and collecting these light materials which are then skim off floating oil/grease. This prevents oily films and odors in the recycled water.

- **Odor and Organic Control:** Stagnant wash water can develop odor from anaerobic bacteria digesting trapped dirt and chemicals. To ensure **odor-free operation** and reduce organic contaminants (soaps, waxes, etc.), the design should include an **aeration, biological or oxidation stage**. Common approaches are bubbling air into the tanks (to maintain aerobic conditions) or injecting ozone gas or other treatments to break down odorous compounds. Some advanced systems use biological treatment (microbes that consume residual organics) to further "**polish**" the water.
- **Water Clarity and Quality:** The reclaimed water should be **clear (＜50 NTU)** and lower in residual organics so it can be reused for most wash steps (all high-pressure and low-pressure wash cycles, undercarriage, soaps, rinses prior to final rinse). Most systems target particle filtration to ~5 µm and may achieve reclaim effluent TSS on the order of 15–100 ppm with BOD (biological oxygen demand) around 15–50 ppm. While not potable, this quality is generally suitable for all wash uses except the final spot-free rinse (which still uses RO purified water).
- **Robust Construction and Maintenance:** Given the high throughput, the reclaim system (pumps, separators, filters) should be heavy-duty with **continuous operation ratings** and protections like low-water shutoffs and automatic fresh water bypasses. The concrete tanks must be designed for traffic loading (if under drive lanes) and have accessible manways for sludge clean-out every few months. Automated self-cleaning filters or purge valves, and proper controls (float switches, alarms, VFDs for pumps) are desirable for reliability.
- **Water Settlement** is determined by Stoke Law: describes how particles settle through a fluid under gravity and is directly applicable to car wash separator tanks, which rely on gravity-driven sedimentation to remove suspended solids (like grit, waxes, and road dirt) from reclaim water. Implications for Separator Design:



1. **Flow Control**: Tanks use baffles, weirs, or multi-chamber designs to slow water flow and create quiescent zones.
2. **Retention Time**: Stokes' Law assumes particles settle under steady, low turbulence—so the **hydraulic retention time** (HRT) must be long enough.
3. **Tank Dimensions**: Must be wide and deep enough so particles have time to settle before being carried out with the effluent.

h these requirements in mind, we will no examine how each manufacturer's system is designed and how it meets the needs of a high-capacity car wash.

Reclaim Separator Tank System Designs by Manufacturer

SoBrite Technologies – Easy Reclaim System (ERS)

SoBrite's reclaim systems have been industry staples since the 1970s, emphasizing simplicity, odor control, and low maintenance. The **SoBrite ERS (Easy Reclaim System)** is a skid-mounted reclaim unit offered in capacities of 50, 100, and 150 GPM. The ERS is designed to integrate with a standard three-pit concrete tank setup. A typical SoBrite installation uses **three 2,000-gallon in-ground tanks** in series, all at equal elevation

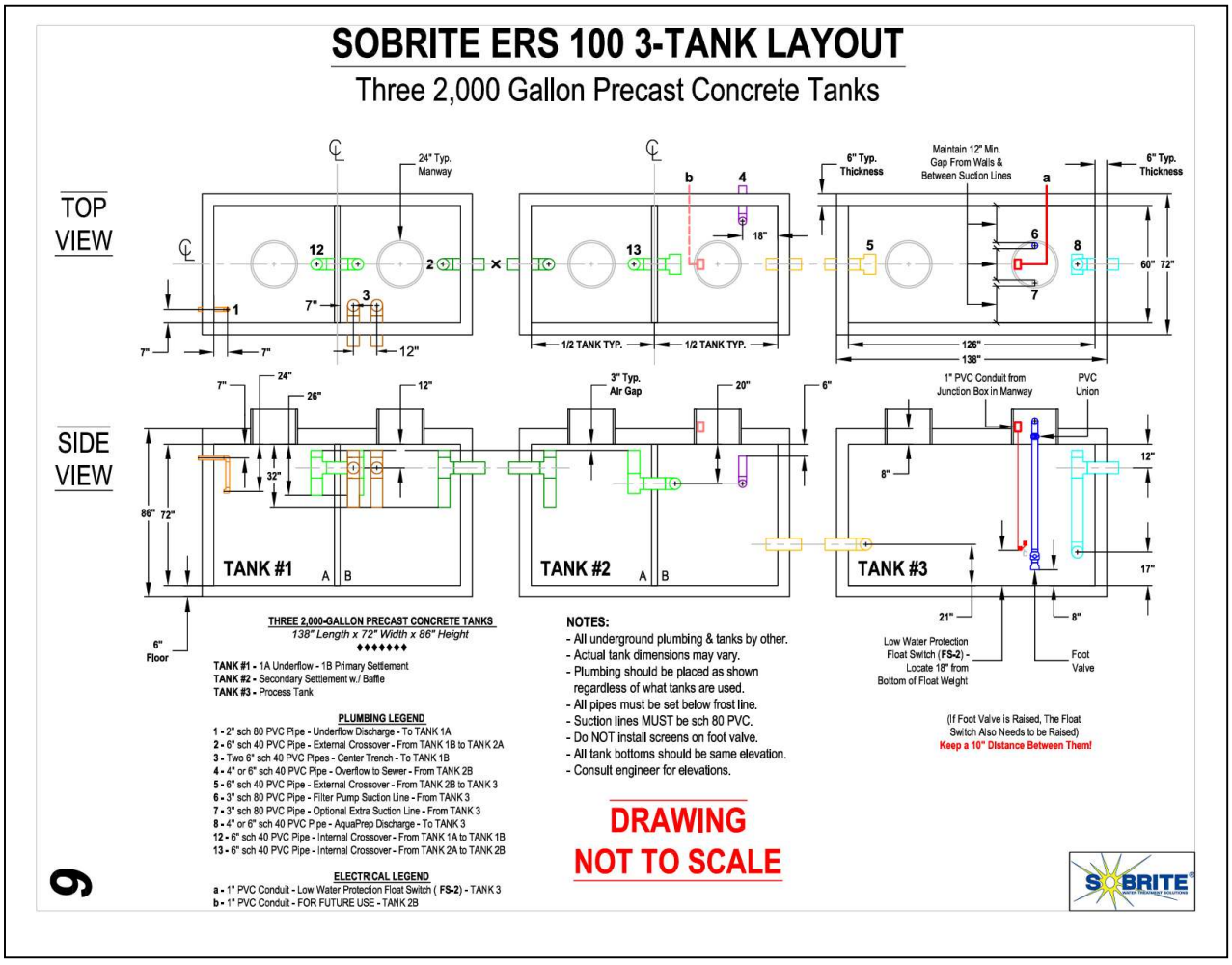


Figure 2- SoBrite Separator Tank Drawing

- **Tank #1 (Collection/Mud Pit):** The first tank is divided by an *underflow baffle* into two chambers (1A and 1B). Wash water enters here (from floor trench drains) so that heavy solids (sand, mud, grit) settle in chamber 1A. The baffle forces water to flow under it into chamber 1B, trapping floating oils and trash in 1A. This primary settlement tank (1a) captures the bulk of sediments (preventing them from entering additional separator tanks and equipment pumps).

- **Tank #2 (Secondary Settling & Oil Separation):** Water flows into the second pit, which provides additional quiescent volume for finer particles to settle out. Tank #2 is divided into 2a and 2b by a baffle as well, and often acts as an **oil-water separator** – any remaining oil/foam rises and is retained here. **An overflow** from this tank to sewer is installed at a high level (see #4) for emergency bypass or excess rain input.
- **Tank #3 (Pump/Process Tank):** The third pit holds the clarified water ready for reuse. This is where the **ERS skid draws suction**. SoBrite's ERS uses a **self-priming centrifugal pump** (TEFC motor) to pull water from Tank #3 and feed it through its treatment loop.

On the skid, **hydrocyclonic separators** swirl the water to remove fine solids down to ~5 microns. The cyclones' underflow (concentrated sediment) is automatically purged back to the collection tank (Tank #1) via an "AquaPurge" discharge line. The cleaned water from the cyclones is then delivered for reuse (to the wash manifold). When there is no active demand from the car wash, the ERS recirculates water in a loop – pumping it back into tank 2b for continuously aerate and filtering of the recovered wash water. The system includes a fresh-water bypass solenoid so that if reclaim supply is ever low (or an alarm condition occurs), city water will supplement the wash.

A signature feature of SoBrite's reclaim technology is its integrated odor control system. The ERS skid incorporates SoBrite's patented AquaPrep™ system for odor and bacteria suppression. Unlike many competitors that rely on direct ozone injections, AquaPrep utilizes UV-irradiated air to deliver oxidizing power. The system operates by circulating a side-stream of 25–50 GPM while injecting air into a specialized UV chamber. Within this chamber, the air is exposed to UV light at wavelengths of both 185 nm and 254 nm. The 185 nm wavelength generates ozone by splitting oxygen molecules, while the 254 nm wavelength provides germicidal effects.

This treated air, now enriched with ozone and other reactive oxygen species, is then injected back into the reclaim tanks. Here, it oxidizes odor-causing compounds such as hydrogen sulfide and helps suppress anaerobic bacteria responsible for the "rotten egg" smell. This process effectively maintains up to 4,000–8,000 gallons of reclaim water in an oxygenated and bacteria-free state.

By targeting anaerobic microbes in the water, the system prevents unpleasant odors and aids in breaking down organic soap residues. SoBrite claims this process produces "good re-use water that does not smell," with minimal chemical additives. Routine maintenance is straightforward, involving UV lamp replacements as needed and an annual service typically under $350, aside from periodic pit clean-out.

Performance: SoBrite ERS systems deliver up to 150 GPM of filtered water. The output water, while not potable, is adequately filtered for all wash stages except final spot-free rinse. With up to 5 µm particle separation (d5) with an average particle size of 75 µm (d98). Odor control uses both aeration and ozone generated by UV lights, the recycled water is typically between 50 to 120 NTU (appearing slightly cloudy to light brown) and Odor control is better in low turbidity wash operations as turbidity increases the **AquaPrep™** system for odor elimination becomes less reliable for removal of foul odor or biofilm build up. SoBrite emphasizes low operating costs

– the stainless-steel cyclones have no consumable media, and the system's fully automated controls minimize manual intervention. The robust design (UL-listed panel, continuous-duty pump) and adaptable plumbing make it suitable for high-volume tunnels, as evidenced by the ERS being used in busy Midwest car washes. **One limitation to note** is that UV-based systems require relatively clear water to function optimally (high turbidity can reduce UV effectiveness). Thus, maintaining the pits (especially Tank #1 sludge levels) is important. Overall, SoBrite provides a **simple and effective three-stage** reclaim process: gravity separation → hydrocyclonic filtration → UV/air treatment, yielding reliable reuse water quality.

Conclusion: SoBrite ERS Reclaim System Performance

The SoBrite reclaim system, featuring the **AquaPrep™** UV and aeration module, offers a low-maintenance and chemical-free approach to microbial odor control in reclaim water. Its use of ultraviolet irradiation and aeration effectively reduces pathogenic microorganisms and prevents anaerobic conditions that lead to hydrogen sulfide ("rotten egg") odors. However, as UV light is less effective in turbid water and does not oxidize difficult-to-degrade organics, dyes, or residual surfactants, its performance is limited in high-load reclaim environments.

Unlike ozone-based systems, which can break down a wider range of complex compounds but require high operating costs and maintenance, **AquaPrep™** is a cost-effective option when paired with biological treatment and enhanced oxygenation technologies. In systems where microbiological digestion and nanobubble oxygenation are utilized, **AquaPrep™** can complement the process by sterilizing pathogens and maintaining aerobic conditions.

For best results, SoBrite is best positioned in reclaim setups with moderate organic loading and where biologics are already in use to manage solids and chemical residue. When properly integrated, **AquaPrep™** can help maintain reclaim water quality without the need for aggressive chemical oxidation or ozone injection

Summary Report: Effect of Sludge Accumulation on Particle Separation in SoBrite's 2,000-Gallon Settling Tank Design

Objective: To evaluate the impact of sludge accumulation on particle separation efficiency and water clarity (turbidity) in a typical SoBrite-style 2,000-gallon car wash reclaim tank operating at varying flow rates, and to emphasize the importance of tank maintenance for optimal solids removal.

Tank Overview:

- **Tank Capacity:** 2,000 gallons
- **Design:** Concrete rectangular pit with baffle-separated compartments
- **Normal Settling Depth:** 5 feet (1.524 meters)
- **Operational Flow Rate Scenario:** 120 cars/hour @ 120 gal/car = 240 GPM

Analysis Summary: At 120 cars per hour, each 2,000-gallon tank has a total retention time of approximately **8.3 minutes**, which allows settling of particles down to ~33.6 microns under clean conditions.

When sludge accumulates in the bottom 2 feet of the tank, the effective settling depth is reduced to 3 feet, decreasing separation efficiency and increasing turbidity.

Impact of Sludge on Particle Removal and Turbidity

Condition	Effective Depth	Retention Time	d50 Particle Size Settled (Microns)	Estimated Turbidity (NTU)
Clean Tank (5 ft depth)	1.524 m	8.3 min	33.6 µm	33 NTU
2 ft Sludge (3 ft depth)	0.914 m	8.3 min	55.0 µm	55 NTU

Key Insights:

- A **reduction in settling depth** results in fewer fine particles being removed.
- Water turbidity increases by **~66%** with 2 feet of sludge present.
- **Regular tank cleaning** is critical to maintain separation of particles below 40 microns and ensure water clarity below 50 NTU.
- Systems relying solely on gravity separation (like SoBrite) are **especially sensitive** to sludge accumulation.

Recommendations:

- Maintain tanks at **full depth** by scheduling sludge removal when accumulation exceeds 12".
- Consider supplemental clarification (e.g., polishing filters or nanobubbles) if vehicle volume exceeds 120 cars/hour.
- Monitor turbidity monthly and correlate to sludge depth to develop proactive maintenance schedules.

Maximum flow Rate - 529 gallons per minute (GPM)

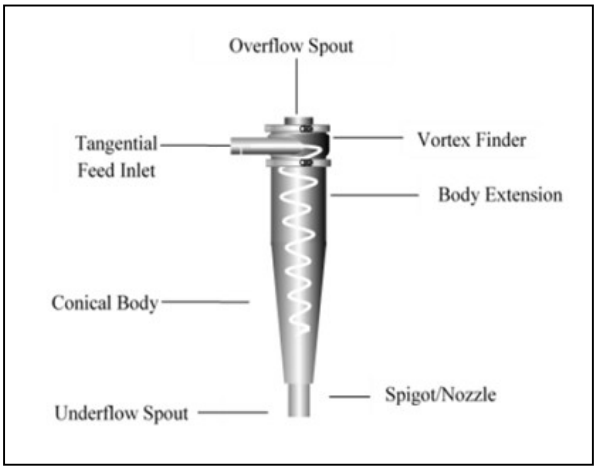
This allows your 3-tank reclaim separator system to comfortably handle up to **~220 cars/hour** (at 120 gal/car), assuming proper baffling and no major short-circuiting.

Appendix

1.0 Cyclonic (hydrocyclone) filters: Are gauged for particle separation based on **cut point**, **separation efficiency**, and **flow characteristics**. Here's how they're evaluated:

1.1 Cut Point (d_{50} or D_{98})

- The **cut point** is the particle size at which the cyclone removes **50%** of particles from the feed.
  - **d_{50} = 5 µm** means 50% of 5 µm particles are removed.
  - Some manufacturers also cite **D_{98}** – the size above which 98% of particles are removed.
- Typical cut points for reclaim systems:
  - **Standard car wash cyclones:** 5–15 µm d_{50}.



1.2 Separation Efficiency Curve

- Cyclone performance is represented by a **cumulative efficiency curve**:
  - **X-axis:** particle diameter (µm)
  - **Y-axis:** % removal
- It shows how removal improves with increasing particle size. Example:
  - 2 µm: ~10–30% removal
  - 5 µm: ~50–80%
  - 10 µm+: 90–98%
- These curves depend on:
  - Inlet pressure/velocity (ideal: **30–70 psi**)
  - Cyclone geometry (cone angle, vortex finder)
  - 1.Specific gravity of particles

1.3 Manufacturer Ratings

- Manufacturers provide specs like:
  - "Removes particles down to **5 microns**"
  - "99% of sand >74 µm"
  - "80% of solids >10 µm"
- Often shown as:
  - **Micron rating (nominal)**: e.g. "10 micron nominal"
  - **Efficiency rating**: "98% efficiency at 40 psi"

1.4 Key Factors That Affect Performance

- **Pressure & flow rate**: Higher inlet pressure increases centrifugal force, improving separation.
- **Particle density**: Heavier particles (e.g. grit, sand) are separated more efficiently.
- **Fluid viscosity**: More viscous water (e.g. with waxes or soaps) reduces efficiency for fine particles.

1.5 Hydrocyclone Filters are great for hard particles (sand, rust) but less effective for soft or buoyant particles (oil, wax, and organics)—which is why **aeration, filters, or ozone** are used in combination.

TSS Vs NTU Field Reference Table

	TSS (mg/L)	Approx. NTU	Water Appearance	Typical System Stage
1	0–10	<5 NTU	Crystal clear	Final filtration (e.g., polishing filters, RO)
2	10–30	5–15 NTU	Very clear	Advanced reclaim with filtration (e.g., Aqua Bio, Con-Serv)
3	30–50	15–30 NTU	Slight haze	Cyclonic + ozone (e.g., SoBrite, PurClean)
4	50–100	30–50 NTU	Cloudy, no visible particles	Post-cyclone, no final polishing
5	100–250	50–100 NTU	Murky	After settling pits, before filtration
6	250–500	>100 NTU	Very turbid, visible solids	Raw water directly from collection pits

TSS vs NTU Field Reference Table – shows how suspended solids levels correlate with water clarity and typical system stages. This can help you visually evaluate water quality in your reclaim system and match it to treatment performance. Prepared by:

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PurClean / PurWater (NCS) – Advanced Cyclonic Reclaim

PurClean (also branded as PurWater by NCS) is another widely used reclaim system, known for its high-efficiency cyclonic separation and multi-faceted approach to water quality. PurClean systems also utilize an in-ground three-tank configuration similar to SoBrite, with a first-stage pit for heavy solids and subsequent clarifier tanks. In a typical PurClean setup, the first tank is around 1,500 gallons and captures the majority of total suspended solids by gravity settling. An oil-water separator (often integrated as a baffle or separate chamber in the second tank) removes floating oils and grease during this initial stage. From the last pit, water is drawn into the above-ground PurClean unit for further treatment.

PurClean's reclaim unit employs **high-efficiency hydrocyclone separators** to centrifuge out fine particles down to ~5 µm. The system is designed so that the **"clean" water from the cyclones can be delivered to the wash**, while the concentrate (containing the separated dirt) is automatically returned to the first pit, where those solids accumulate for periodic pumping. This continuous removal of fine grit means the recycle water is largely free of sediment that could harm pumps or scratch vehicles. According to the manufacturer, the combination of gravity pits and cyclonic filtering yields reclaimed water with **TSS typically in the 15–100 ppm range** (a turbidity on the order of tens of NTU) and particle sizes effectively limited to very fine silt at most.

To maximize water reuse, PurClean systems incorporate robust **odor and bacteria control** measures. **Air injection and ozone** are standard components on PurClean reclaim units. In practice, the system continuously recirculates a portion of the water back into the holding tanks through an air sparger (a diffuser) to aerate the water when the wash is idle. This keeps the water oxygen-rich and discourages anaerobic bacterial growth. Additionally, an **ozone generator** feeds ozone gas into the water stream, either in the tanks or in a contact chamber. Ozone is a powerful oxidizer that neutralizes odors and breaks down organic chemicals in the water. The combined effect is a significant reduction in BOD (biochemical oxygen demand) and elimination of nuisance smells. In fact, PurClean notes that its systems "digest organic material" to keep the reclaim water **"healthy with no adverse bacterial growth and foul smelling water"**. Enzyme additives are another option PurClean has offered – some systems can periodically dose an enzyme or bio-catalyst to consume organic matter, though ozone and air are more common in high-capacity setups.

Controls and operation: A PurClean reclaim unit typically features a **VFD-controlled pump** for variable output, a PLC or HMI for system status, and safety interlocks. Dual suction lines are used in the tank to ensure adequate flow and a backup in case of partial blockage. An automatic freshwater bypass is included to supply city water if reclaim supply is insufficient. PurClean systems are available in sizes like 120 GPM (5 HP pump) and 160 GPM (7.5 HP) to match different tunnel speeds. They are often integrated into new car wash installations by major vendors.

Performance: PurClean is regarded as producing high-quality reclaimed water suitable for even high-pressure nozzles and most wash applications. The water is filtered to 5 microns and has been **"proven to provide effluent qualities"** around 15–50 ppm BOD and low oil content (10–25 ppm FOG), which corresponds to clear, odorless water. Typically 60–85% of the total water used in the wash can be recycled by such a system, with only about 10–15 gallons per car of excess (carry-off and purge) sent to the sewer. In practical terms, this means a busy site can save thousands of gallons of fresh water per day. Regular maintenance involves pumping out the sludge from the pits every 3–6 months (which removes the concentrated dirt and any accumulated salts/soils), and servicing the ozone generator and air filters. PurClean's limitation is primarily the complexity – the use of ozone requires careful control (to avoid off-gassing or degradation of materials), and more sensors/electrical components means a bit more oversight. However, the benefit is a **highly automated, comprehensive treatment** that consistently yields <50 NTU water and reduces chemical oxygen demand so that water can be reused many times over before discharge. PurClean systems have been deployed in "high end, environmentally

conscious car washes" and even in regions with strict water restrictions, demonstrating their effectiveness in high-capacity scenarios.

Aqua Bio Technologies – Bio Complete and Pro Series

Aqua Bio takes a unique **biological approach** to car wash water recycling, aiming to **restore water quality to near city-water standards** using natural processes. Their systems are designed to function without ozone, UV, or added chemicals for odor control – instead, they rely on aeration and beneficial microbes ("only nature"). Aqua Bio offers several models, with the **"Pro Limited"** and **"Pro Air"** being more conventional reclaim units, and the flagship **"Bio Complete Water Restoration System"** being a multi-stage biological treatment system.

All Aqua Bio systems start with **standard settling tanks** for primary treatment. The configuration is similar (multiple in-ground concrete tanks) to capture 100% of the wash runoff. Heavy solids settle out and oils rise to the top in these initial tanks, as in any reclaim setup. After this gravity separation, Aqua Bio systems direct the water through further stages:

- **Aeration (Air Flotation/Air Mixing):** Next, the water enters an **aeration chamber** where it is vigorously aerated. Injecting air serves two purposes: it **emulsifies and strips some chemicals** (like volatile compounds) and ensures the resident bacteria shift to an aerobic mode. By maintaining dissolved oxygen, the system prevents the growth of odor-causing anaerobes. This is essentially Aqua Bio's method of odor control – a continuous supply of air to keep the biology "sweet" (no sulfide production). The aeration also starts to biologically **degrade surfactants**: native microbes in the water begin consuming any biodegradable soap and oil residues when oxygen is present.
- **Hydrocyclone Separation:** After aeration, the water is **pumped through hydro-cyclonic separators** to remove fine particles down to 5 microns. Aqua Bio uses high-speed cyclones just like PurClean/SoBrite, so the physical separation capability (for grit, sand, etc.) is equivalent – leaving only colloidal or dissolved solids remaining in the water. The separated solids are discharged out of the cyclone underflow to waste (often back to a settling tank for later removal). At this point, most turbidity-causing solids have been eliminated.
- **Biological Filtration (Bio Reactor):** The distinguishing step in Aqua Bio's advanced systems is the **biological treatment chamber**. In the **Bio Complete** system, after cyclonic separation, water flows into a dedicated bio-reactor tank filled with special media (e.g. plastic bio-carriers) that support colonies of aerobic bacteria. These microbes actively **consume the remaining chemicals** in the water – detergents, waxes, and other organic contaminants – as their food source. By metabolizing these substances, the bacteria convert them into harmless byproducts (primarily carbon dioxide and water). This process can greatly reduce COD/BOD and even remove troublesome residues that would otherwise cause foaming or interference in reuse. Essentially, the bio chamber **restores the water's chemistry**, not just the clarity. Aqua Bio notes that after this stage, the water is often only ~100 ppm higher in TDS (total dissolved solids) than the incoming city water, indicating most contaminants have been removed.
- **Clarification and Polishing:** Following the bio-reactor, the flow enters a **clarification chamber** where any biomass (sloughed bacteria, bio-sludge) can settle out. This is akin

to a settling tank specifically to remove biological solids produced in the bio chamber. A small amount of this bio-sludge is automatically pumped to the sewer or a waste storage once a day (removing excess bacteria and the consumed pollutants now embodied in that sludge). The clarified water then overflows by gravity into a **"clean water" holding tank**. This final tank stores the treated water, which is now highly clarified and substantially free of odor and chemicals. The system continuously recirculates between these stages to keep the bacteria active and ensure consistent quality.

Performance: Aqua Bio's **Bio Complete** system can reclaim **100% of the used wash water for reuse** (in practice, they reuse ~90–95% in the wash, only excluding the spot-free final rinse). The water quality achieved is exceptional for a reclaim system – it is described as "as near city water quality as biologically possible," with only a slight mineral increase. Turbidity is typically very low (the water is clear enough for all high-pressure nozzles and even low-pressure applications like soap arches without concern). Because the organics are largely eaten by the bacteria, the reclaimed water is also much less likely to cause wash bay odor or biofilm issues downstream. Importantly, **no ozone or chemical additives are used** in these systems, which some operators prefer to avoid the handling of. Odor control is purely by aerobic treatment – as evidenced by many Aqua Bio installations running "no odor" reclaim operations. The trade-off is that the Bio Complete system is **more complex and costly** – it essentially includes a mini waste-water treatment plant (aeration, bioreactor, clarifier) on site. It requires careful balance of the biological process (e.g. ensuring the bacteria remain healthy, which might mean maintaining temperature in colder climates, and not using chemicals that could poison the microbes). Maintenance involves periodic sludge removal and possibly replenishing bio-media or microbial populations if needed. Aqua Bio does have simpler models too: the **Pro Limited** system, for example, might omit the dedicated bio chamber and only include aeration + cyclonic filtration, yielding water quality suitable for "90% of the wash" except the most critical final phases. Another model, **Pro Air**, likely focuses on aeration for odor control in basic reclaim pits (for sites that just need an odor fix). There's also **Bio Softreat** which may integrate reclaim with water softening or advanced filters. In summary, Aqua Bio's approach excels in **turbidity reduction and especially chemical reduction**, making it possible to reuse water in nearly all wash steps and even approach **zero discharge** operation in some cases. For a high-capacity tunnel, the Bio Complete system can handle the load (sized appropriately with pumps and multiple cyclones) but requires sufficient space for the additional underground chambers or equipment. Operators who choose Aqua Bio are often those facing very high water costs or discharge limits – the payoff is extremely clean reclaimed water and minimal environmental impact.

Velocity (Sonny's CarWash Water) – VRC Series and Turbo

Velocity is the reclaim system line offered by Sonny's Enterprises (branded as "Sonny's CarWash Water" equipment). The Velocity systems are designed to be **modular and high-throughput**, matching Sonny's focus on heavy-duty tunnel car washes. A typical model is the **Velocity VRC-100**, a 100 GPM reclaim unit for tunnel washes, and larger models (e.g. VRC-150) are available for 150 GPM or more throughput. The general design of Velocity reclaim systems closely follows industry best practices: they use a multi-stage interceptor tank setup for primary treatment, followed by mechanical filtration and optional polishing steps for higher water quality.

In the standard configuration, Velocity units utilize the familiar **3-pit concrete tank layout** (collection pit, settling pit, process pit) to capture and pre-treat the wash water. From the final pit, the reclaim pump skid draws water and sends it through a series of **hydro-cyclone separators** to remove fine particles (clay, silt, etc.). These **cyclonic separators** operate on the same principle noted earlier – spinning the water to sling out solids – and can typically filter out particulate matter down to around 5 microns. The separated solids are purged back to the pits (or to a waste drain), while the clarified water continues on. Velocity's system then employs additional treatment to ensure the recycled water is clean and odor-free. In most installations, an **ozone injection system** is integrated to oxidize organic contaminants and eliminate odor, much like PurClean's approach. An air blower or sparger may also be used in the pits to keep them aerobic. Sonny's emphasizes that their reclaim systems **"reduce the odors normally associated with water recovery"**, indicating a robust odor control strategy (likely ozone plus aeration).

One of the standout options of the Velocity line is the **"Reclaim Turbo System."** The Turbo is an advanced add-on filtration module that further polishes the already cyclone water. It consists of **dual high-capacity filters** installed as a side-stream or post-treatment loop. These are self-cleaning filter units that continuously cycle, allowing one filter to backwash while the other provides flow, thus giving *continuous filtration* without downtime. The filters are typically stainless steel media or screen filters capable of trapping even finer particles (and possibly adsorbing some chemical impurities) beyond the cyclones' ability. By removing "more particulates and chemistry," the Turbo system produces **higher-quality reclaim water that can be used in a wider range of applications** than standard reclaim alone. In effect, it pushes the water quality closer to that of Aqua Bio's output but via physical filtration rather than biological means. The Turbo module requires either a dedicated storage tank or can be plumbed inline; in new builds, it is fully integrated with the reclaim system (with a side-flow from the main reclaim loop circulating water through the Turbo filters continuously and returning it to a clean water tank). In retrofit scenarios, the Turbo can be added after the reclaim unit, filtering water on its way to the wash.

Performance: The base Velocity VRC systems (without Turbo) produce water on par with other cyclone-based reclaims – typically suitable for all prep and washing stages, high-pressure pumps, etc., but with some remaining turbidity and dissolved substances that might preclude use for final rinsing. The addition of ozone ensures that bacteria and odor are kept in check, even with frequent use. Sonny's notes that using reclaim can save ~15–20 gallons of fresh water per car, and with the Turbo system enhancing water quality, even more of each wash can be done with reclaim instead of fresh. For a 150 cars/hour tunnel, a Velocity VRC-150 with Turbo could realistically allow over 90% of the water (excluding only final spot-free rinse) to be recycled each pass. The **dual-filter Turbo system** provides continuous self-cleaning, meaning maintenance is simplified to occasional inspection of the filter elements and normal pit clean-out. The modular design (you can start with the base reclaim and add Turbo later) offers flexibility depending on water quality needs or local restrictions. One limitation might be the initial cost – adding advanced filtration and ozone drives the system cost toward the higher end (comparable to Aqua Bio's high-end systems or Con-Serv's big systems). Also, like other mechanical systems, the performance is tied to regular maintenance: ozone generators need upkeep, and filters (even self-cleaning ones) eventually require service. Nonetheless, Velocity systems are built specifically for **high-volume tunnels** – heavy-duty pumps, corrosion-resistant piping, UL-

rated controls – and backed by a major car wash equipment supplier. They are a strong choice when seeking a **turnkey reclaim solution** that can scale from basic recycling to near-total water reuse with the Turbo upgrade.

Con-Serv Manufacturing – Combination & Big Boy Series

Con-Serv has over 30 years of experience in car wash water recovery, offering a broad range of reclaim equipment from simple filters to large custom systems. Con-Serv's approach is notable for its focus on **mechanical filtration** options and flexibility to tailor systems with various technologies. They provide everything from particulate separators (hydrocyclones) to bag and screen filters, self-cleaning filters, ozone units, and even biological dosing, which can be assembled in different combinations to meet specific needs. For a high-capacity tunnel (150 cars/hour), Con-Serv's **Free Standing Combination Series** or **"Big Boy"** systems would be most applicable.

All Con-Serv systems still rely on the groundwork of **proper settling tanks** to remove bulk solids and equalize flows. They emphasize that effective reclaim starts with the underground interceptor doing its job (Stokes' Law of sedimentation is even cited in their materials to size tanks for settling velocity). So, a 3-pit concrete tank setup is assumed: large solids drop out in the pits, and an oil separation happens naturally in the quiet zone of the first or second pit. From there, Con-Serv's equipment takes over:

- **Particle Separation:** Many Con-Serv systems include a **vortex centrifugal separator** (hydrocyclone) as a first filtration step. This centrifugal separator (sometimes called a "pump protector") spins out sand and grit to a collection drain. It is often paired with Con-Serv's reclaim pumps on a skid. Removing these abrasives early protects subsequent filter elements from clogging.
- **Media or Screen Filtration:** Con-Serv offers several filter types. For example, their **Standard Slim (YS) series** uses **washable cartridge filters** that can remove fine particles but require manual cleaning. More advanced are the **Self-Cleaning Filters (SCF)** – stainless steel filters with an automatic backwash mechanism. The SCF units can flush out captured debris on a timer or differential pressure trigger, allowing continuous operation. Con-Serv often packages a pump and an SCF filter together in a **Free-Standing Combination (FS Comb) unit**. This compact skid will pull water from the reclaim tanks, push it through the self-cleaning filter (which might filter down to 25–50 micron absolute), and then send the water to reuse. The FS Combination Series I and II are noted for using a **3 HP or 5 HP pump with VFD** and a "zero-maintenance" stainless filter element. They also incorporate a feature called **Pump Guard Advisor** to monitor pump health and warn of any issues.
- **Odor and Bio Control:** Con-Serv acknowledges that if no other pretreatment like ozone or enzymes is used, adding **Mass Air Injection (sparging)** is beneficial to control odor in the storage tanks. Their combination systems can include an air injection system for tank aeration. Moreover, their higher-tier systems (Series III) have provisions for **ozone and bio-additive dosing** integrated. The **Combination Series III** effectively includes all bells and whistles: dual self-cleaning filters for uninterrupted flow, plus an ozone generator and a metering pump to dose enzymes or nutrients to promote biological

breakdown of organics. This ensures odor is handled both chemically (ozone oxidation) and biologically (enhancing good bacteria) while maintaining filtration. Con-Serv even has a product named **BioZone** which likely encapsulates this combined approach of ozone + bio treatment.

- **High-Flow Systems:** For very large washes, Con-Serv's **K-BW "Big Boy" Series** is designed to deliver up to 200 GPM of recycled water. The Big Boy skid includes **twin 5 HP pumps** and **twin self-cleaning filter units** in parallel. The filter elements are rated **25 micron absolute**, meaning virtually all grit and particles larger than 25 µm are removed from the water. Because there are two filter housings, the system can alternate backwashing between them to provide continuous flow (similar concept to Sonny's Turbo). The entire assembly is built on a sturdy stainless steel platform with all corrosion-resistant components. With 200 GPM capacity, this is well-suited for a 150 car/hour operation even under heavy usage, ensuring no shortage of reclaim supply.

Performance: Con-Serv systems can produce very consistent water quality because of their emphasis on actual filtration (not just cyclonic separation). With a properly sized self-cleaning filter, the turbidity of reclaim water can be brought down to or below the target 50 NTU reliably, and even finer filtration (25 µm absolute roughly correlates to perhaps <20 NTU in many cases). The combination of filters and optional carbon or media (they mention carbonized peat or other media can be used in some filter housings) means the system can also reduce some dissolved organics and odors. However, without the use of ozone or bio-additives, purely mechanical systems might not address all dissolved chemicals – Con-Serv recognizes this and thus offers ozone and enzyme dosing as part of their packages for a more holistic solution. A key advantage of Con-Serv is **modularity and upgradeability**. One could start with a simpler bag filter system (low upfront cost, but more manual maintenance) and later upgrade to an automatic self-cleaning unit as the need arises. Their equipment is also often sold as components, meaning a savvy engineer can integrate a Con-Serv filter with another brand's pump or vice versa. For a high-capacity car wash focused on reliability, the **Big Boy 200 GPM system** with dual filters and built-in monitoring would offer peace of mind that water demand is met with minimal downtime. The trade-off is that such a system is quite sophisticated: it involves more plumbing (backwash return lines, etc.), electrical control for the filters, and possibly a larger equipment footprint. Additionally, any filter-based system requires the pit solids to be managed; if not, an overload of solids can blind even a self-cleaning filter. Con-Serv's literature stresses the importance of monitoring filters for blinding and periodically replacing washable elements, which implies a bit more hands-on maintenance compared to purely cyclonic systems. Nonetheless, Con-Serv's solutions are known for **maximizing water re-use and quality** – with options to reach up to 200 GPM and filter down to very fine levels, they can ensure even a busy wash recycles water effectively without risk to equipment or wash results.

Comparative Analysis of Manufacturer Systems

The five systems discussed all achieve the fundamental goal of recycling wash water, but they vary in methods and complexity. Below is a comparative overview of how each addresses the key aspects:

- **Gravity Collection & Pre-Filtering:** *All* manufacturers rely on in-ground **concrete settling tanks** as the first line of defense. Typically, a 2–3 tank clarifier is common across the board【17†image】. SoBrite, PurClean, Velocity, and Aqua Bio explicitly design around three-stage pits with baffles for mud and oil separation. Con-Serv likewise expects a catch basin and interceptor configuration. Thus, in terms of **collection/mud tank design**, there is consensus: multiple large tanks, with the first being a deep sump for heavy solids and the second/third for additional settling and as pump intake. Minor differences include the use of integrated oil separators – PurClean mentions an oil-water separator as part of its system (could be a coalescing plate pack in a tank), whereas others rely on simple baffle separation which generally is sufficient for car wash effluent.
- **Solids Separation Technology:** Every system uses **hydrocyclonic separators** for fine particle removal, except that Con-Serv can alternatively use other filter types. SoBrite ERS, PurClean, Aqua Bio, and Velocity all include banks of hydro-cyclones that remove solids in roughly the 5–30 µm range. This centrifugal step is critical for high-flow recycling because it's rapid and has no filter media to clog. The effectiveness is similar among these – they all claim ~5 micron separation, which significantly reduces turbidity and protects downstream nozzles. Con-Serv's approach might pair a cyclone with a **self-cleaning screen filter** for even finer filtration (e.g. 25 µm absolute in Big Boy), exceeding the others in particle removal at the cost of more complexity. If **maximum solids removal** is the priority (to achieve the lowest turbidity), Con-Serv's dual-filter or Sonny's Turbo module provide a polishing step beyond cyclones, capturing fine and colloidal particles that cyclones can miss. However, those require backwashing and produce a small waste stream (backwash water) that goes to drain or back to pits.
- **Water Quality (Clarity & Reuse Extent):** In terms of turbidity and overall clarity, Aqua Bio's **Bio Complete** likely produces the best water (approaching potable quality) – it can be used in 90–95% of the wash including most rinses. The trade-off is the large, multi-stage nature of the system. PurClean and Velocity (with ozone) produce very clear water as well, typically suitable for all high-pressure and low-pressure washing equipment (usually only excluding final spot-free rinse to avoid water-spotting from dissolved minerals). SoBrite and basic Aqua Bio (Pro Limited) produce water of similar clarity to PurClean – all using 5 µm cyclone filtration which results in some very fine turbidity remaining but generally under the 50 NTU threshold. If one were to rank purely on expected **NTU of output**: Bio Complete (lowest NTU, near-city quality), then PurClean/Velocity with advanced filtration or Con-Serv with Big Boy (able to get consistently low NTU around 20–40 or better), followed by standard cyclone-only systems (SoBrite ERS, basic PurClean, basic Aqua Bio) which might be in the 30–50 NTU range typically – still quite acceptable for most uses. All systems ensure **no visible heavy solids** remain in suspension; the differences are in how polished the water looks and how free of dissolved organics it is.
- **Odor and Organic Waste Management:** Here the philosophies diverge:
    - **SoBrite** uses a **UV/Air system (AquaPrep)** to kill bacteria and control odor. This is unique in that no ozone or chemicals are used; it's effective as long as water clarity is decent (UV needs light penetration). It's very good at preventing sulfur odors and slime growth. It doesn't directly remove dissolved chemicals but by preventing anaerobic decay, it avoids creation of new odorous compounds.

- **PurClean & Velocity** rely on **ozone and aeration**. Ozone is highly effective at oxidizing many organics (reducing chemical oxygen demand) and kills microorganisms that cause odor. Aeration keeps the pits oxygenated in between washes. This dual approach works quickly (ozone acts in minutes) and tends to keep reclaim water fresh; however, ozone equipment adds cost and needs dry air feed, etc. These systems can **digest a lot of organic material** – for example PurClean reports much lower BOD in effluent due to ozone oxidation.
- **Aqua Bio** uses **biological oxidation** – by maintaining aerobic bacteria, the organics are consumed naturally and odors are prevented at the source. This is very effective if tuned properly; it actually removes the organics (not just masks odor). The downside is it's a slower process and can be sensitive to chemical upsets (e.g. if a toxic cleaner enters the system). Aqua Bio avoids any chemical additions entirely, which appeals to operators wanting a "green" solution.
- **Con-Serv** offers a mix: one can incorporate **ozone, air, and even enzyme dosing** as needed. Their high-end setups include ozone + bio (enzyme) for maximum odor and waste reduction. In practice, a Con-Serv system can be configured to be as simple or as comprehensive as the user requires (for example, one could run just a filter with no odor control, but that would risk smell – so Con-Serv would advise adding at least an air sparger or their "Biozone" kit).

In summary, **odor control** is addressed by every manufacturer: none of these modern systems leave you with rotten egg smell if operated correctly. SoBrite and Aqua Bio lean on aerobic methods, while PurClean, Velocity, and many Con-Serv setups lean on ozone (plus air). Ozone has the added benefit of breaking down soaps and waxes, which can reduce foaming issues in recycle water. Aqua Bio's bio-treatment has the benefit of actually **removing** chemicals from the water (consuming them), leading to less contaminant build-up.

- **Capacity and Scalability:** For a 150 cars/hour operation (~150–200 GPM needed), all manufacturers have a suitable model. SoBrite ERS maxes at 150 GPM (one unit); PurClean offers 160 GPM units (and could parallel units if needed); Aqua Bio can scale by custom sizing pumps and multiple cyclones – Bio Complete can be built to handle high flows (with multiple aeration and bio tanks as necessary); Velocity's standard line goes to ~150 GPM per unit, and Sonny's could likely furnish larger custom systems or multiple units for very high volumes. Con-Serv specifically advertises up to 200 GPM with their Big Boy skid, and they could build even larger by using additional modules (twin Big Boys, etc.). In short, **high throughput** is achievable by all, but Con-Serv and Velocity (Sonny's) explicitly target the large tunnel market with off-the-shelf 150–200 GPM solutions.
- **Maintenance and Reliability:** SoBrite touts very low maintenance (no filters to replace, minimal moving parts beyond the pump). PurClean and Velocity, while automated, do have ozone units and more complex controls – maintenance is moderate but manageable with regular service (monthly checks, replace ozone destruct media annually, etc.). Aqua Bio's biological system requires oversight like a small water treatment plant – checking blower operation, sludge pumps, etc., but Aqua Bio provides training and service to keep it running smoothly. Con-Serv's filter systems require one to monitor filter condition –

e.g. backwashing, cleaning strainers, etc. – so it can be slightly more hands-on unless well-automated. All systems require periodic pit clean-out (that's unavoidable, since mud and settled matter must be vacuumed out every so often). This typically is every few months depending on dirt load. All include safety features such as low-water shutoffs to protect pumps and fresh water bypasses to ensure the car wash is never starved of water.

The following table summarizes the features, performance, and limitations of each manufacturer's system for easy comparison:

Comparison Table of Reclaim Systems

Manufacturer	Key Design Features	Performance & Output Water Quality	Notable Limitations
SoBrite ERS (Easy Reclaim System)	• Uses 3 in-ground concrete tanks (with underflow baffles) for primary mud separation【17†image】. • **Hydro-cyclonic separators** remove fine solids to ~5 µm. • Patented **AquaPrep™ UV + air** odor control system integrated (no ozone). • Self-priming pump and UL-listed controls; compact skid (48″×30″). • Models for 50, 100, 150 GPM flow rates (expandable by parallel units).	• **TSS removal:** majority of solids settle in Tank #1; cyclones handle remaining fines (5 µm). • Output water is clear (low turbidity, usually <50 NTU) and **odor-free** – UV sterilization prevents sulfur odors. • Suitable for all wash stages except spot-free rinse (contains no significant solids, but not deionized). Consistent wash quality maintained. • **Reuse fraction:** Typically allows 60–70% water reuse (higher if no final rinse) – e.g. 100+ gallons per car reclaim in high-capacity tunnels (rest is carry-off and small discharge).	• **UV system** requires relatively clear water and bulb maintenance (UV lamps need periodic replacement). • No chemical treatment – does not actively break down soaps; some surfactants remain (water is visibly clean but not chemically "restored"). • Pits must be kept clean on schedule; excessive sludge can reduce effectiveness (AquaPrep sized for up to ~8000 gal pits, larger pits may need multiple units). • Limited to 150 GPM per skid – very large flows would need multiple systems.
PurClean / PurWater (NCS Reclaim System)	• Standard 2–3 concrete tank clarifier (first tank ~1500 gal for heavy solids, built-in oil separator). • **High-efficiency cyclones** eliminate particles down to 5 µm; underflow solids returned to pit. • **Ozone**	• **Solids/Turbidity:** Cyclones + settling reduce TSS to ~15–100 ppm range (water appears slightly hazy but no visible particles). 5 µm filtration protects nozzles – no clogging issues. • **Organics/Odor:** Ozone + oxygenation yields **BOD**	• Ozone system adds complexity – needs dry air supply and maintenance (ozone cells, checking ORP if applicable). Potential ozone off-gas safety considerations. • Requires reliable power and control – more electrical components

Manufacturer	Key Design Features	Performance & Output Water Quality	Notable Limitations
	injection system and air sparging for odor control and organic breakdown (option for enzyme dosing instead of ozone). • Continuous recirculation loop with VFD pump – returns water to tank when no demand (keeping biology aerobic). • Touch-screen HMI and alarms; dual 3″ suction lines for reliability. Available in ~120 GPM (5 HP) and 160 GPM (7.5 HP) sizes.	**~15–50 ppm** and eliminates odors. Reclaimed water is odorless and biologically stable (no slime). • **Reuse fraction:** 60–85% of total water can be recycled. Fresh water use as low as ~10 gal/car (mostly final rinse) with proper chemical balance. • **Quality:** Water is suitable for high-pressure pumps, mitter/dilution, and even pre-rinse. Not used for final spot-free rinse due to remaining minerals.	(sensors, floats, ORP meter) that must be maintained. • Regular pit sludge removal required 3–6 months – if neglected, can diminish performance (like any system). • Enzyme option (if used) means ongoing purchase of enzyme solution; ozone is typically preferred for ease.
Aqua Bio (Pro Limited & Bio Complete Systems)	• Multi-stage **biological treatment** process, all usually installed underground in concrete chambers. Standard settling tanks first (solids, oil removal by gravity). • **Aeration chamber:** infuses air to keep water aerobic and start emulsifying contaminants. • **Hydrocyclone filtration** to 5 µm removes suspended solids. • **Bio-reactor chamber:** huge surface media with aerobic microbes that **consume soaps, waxes, chemicals** (no ozone or chemicals added – uses "only nature" microbes). • **Clarifier & clean-water tank:**	• **Water quality:** Exceptionally high – restored water is typically only ~100 mg/L TDS above city water. **Turbidity is very low** (nearly as clear as tap water); can be used in 90–95% of the wash including rinse cycles. Virtually no odor (aerobic bio = no H_2S). • **Chemical reduction:** Actively biodegrades detergents and wax polymers, significantly lowering COD/BOD. Byproducts are CO_2 and water. Prevents accumulation of organics in water – ideal for **closed-loop** reuse or zero discharge setups. • **Reuse fraction:** Can recycle nearly all water except what's lost to carry-off or a small daily sludge	• More **complex biology** to manage – requires oversight to ensure bacteria health (e.g. consistent flow of nutrients, avoiding toxic shock from wrong chemicals). Typically needs professional start-up support and possibly more operator training. • Equipment footprint can be larger – multiple chambers and possibly external blowers or pumps. Retrofitting into existing pits might be challenging without construction. • Slower response to changes – if something goes off (e.g. dead bacteria), it can take time to regrow. Redundancies (like backup blowers) are needed for reliability. • Higher initial

Manufacturer	Key Design Features	Performance & Output Water Quality	Notable Limitations
	settles out biomass; clear, odor-free water flows to final storage for reuse. Continuous circulation keeps bacteria alive. Systems available for various flows (custom-engineered for high volume sites).	purge. Some sites achieve **zero sewer discharge** aside from sludge (especially if coupled with RO for final rinse). • **High throughput:** Systems can be scaled; e.g. multiple parallel cyclones or larger blowers for big flows. Many high-volume washes run Aqua Bio successfully (with proper design).	cost – essentially a mini wastewater plant. However, operating cost is low (just blowers and minimal chemical use) and water savings long-term are maximal.
Velocity (Sonny's) (VRC Reclaim and Turbo)	• In-ground 3-pit configuration (similar clarifier setup) for solids/oil separation. • **Cyclonic separator units** to remove fine solids (~5 µm); heavy slurry returned to pits. • **Ozone generator and aeration** standard for odor/organics control (Sonny's "CarWash Water" systems target odor-free reclaim). Possibly uses venturi injection to ozonate water en route to storage. • Sturdy pump systems (5–15 HP) with **VFD**; PLC controls and safety interlocks. Designed for continuous heavy-duty use. • **Turbo System (optional add-on):** Twin self-cleaning filters for continuous **polishing filtration** of reclaim water. Removes additional fine particulates and even some emulsified	• **Baseline performance:** Cyclone + ozone-treated water of high clarity (sub-50 NTU easily) and no odor. Suitable for all washing and high-pressure rinsing equipment (typically ~70–80% of water use can be reclaim without Turbo). • **Turbo performance:** Produces **"highest quality reclaim water"** for use throughout the wash. Filtered water can be used in low-pressure rinses and possibly in more sensitive steps; effectively allows replacing an extra 10–20 gal of fresh water per car with reclaim. Continuous dual filter design means no downtime – always delivering clean water.. • **Capacity:** VRC series available in ~35 GPM (for IBA) up to 150 GPM (for large tunnels) per unit. Turbo is sized to match (~150 GPM) and water can be recirculated through it	• Without Turbo, very fine colloids or dissolved solids remain – water though clear might still have a slight tint or chemical residue (common to all cyclone-only systems). Turbo mitigates this but adds cost. • Ozone equipment must be maintained; loss of ozone or air could lead to odor if wash is idle for extended periods (backup air pumps or timers may be needed to periodically recirculate water). • Requires a separate **clean water tank** if Turbo is used in side-flow mode (to store polished water) – space considerations. • Being a proprietary system, replacement parts (ozone generator, filters) typically must be sourced through Sonny's network.

Manufacturer	Key Design Features	Performance & Output Water Quality	Notable Limitations
	matter, improving water quality for broader reuse. Integrates with reclaim loop and separate clean water tank.	to improve quality over time. For extreme flow, multiple units can operate in parallel. • Highly automated; user-friendly interface. Maintenance is mainly occasional filter inspection and ozone system service (plus pit cleaning).	
Con-Serv (Combination & Big Boy Systems)	• Flexible design – components (cyclones, filters, pumps, ozone) can be configured as needed. Standard approach uses a **pre-filter separator** (vortex or strainer) plus a **main filtration unit** (bag, cartridge, or self-cleaning screen filter). • Often paired with existing clarifier pits; Mass Air **sparging in tanks** used for odor if no chemical stage. Higher models integrate **ozone and enzyme dosing** ("BioZone") for odor and organic control. • **Self-cleaning filter technology:** e.g. stainless steel screen filters that automatically backwash. Combination Series II/III and Big Boy have these to achieve fine filtration (25–50 µm) with minimal labor. • **High-flow capability:** Big Boy series handles	• **Particle removal:** Can achieve **25 µm absolute filtration** in Big Boy (much finer than cyclones). Delivers very low turbidity water consistently, even under varying loads, because filters will catch what cyclones can't. • **Water quality:** With Series III (ozone+bio), water is comparable to PurClean/Velocity quality – clear and odorless. If carbon or specialty media is used in filters, some removal of oils or chemicals can occur (e.g. Con-Serv units can use carbonized media for odor/organics adsorption). Overall, can meet <50 NTU easily; often ~20–40 NTU output when filters are clean. • **Flow and reuse:** Systems are sized to client needs. 150+ GPM is readily achieved with Big Boy, enabling >80% recycle rates in large tunnels. The automatic backwash means performance stays consistent (no plugging) –	• **Maintenance:** While "automatic," filters still require periodic checks – e.g. flush valves functioning, filter screens eventually wear or need cleaning of sticky residue. Not as "hands-off" as pure cyclonic systems; an operator should keep an eye on pressure gauges and clean strainers. • If not using ozone or bio, purely filtered water could still develop odor in stagnant periods – air sparging should be run as recommended. If ozone is added, that's extra equipment to maintain (similar to others). • Bag filters (in lower-end models) need daily-to-weekly changing when dirty, which is labor intensive. Thus, upgrading to self-cleaning is almost a necessity for high-volume use. • Highly customizable – which can be a pro, but also means ensuring all pieces are integrated properly. It may require more design/installation

Manufacturer	Key Design Features	Performance & Output Water Quality	Notable Limitations
	up to 200 GPM with twin 5 HP pumps and dual filters. VFD drives standard for energy saving and adapting flow. • Skid-based modular units, e.g., **Series I** (economical, basic filters), **Series II** (VFD, zero-maintenance filters, ozone optional), **Series III** (dual filters + ozone + bio dosing).	important for continuous 100+ GPM demands. • **Reliability:** Mechanical components (pumps, motors) are industrial-grade; control panels monitor pressure to trigger backwash before flow drops. Redundant pump option (twin pumps) provides backup in Big Boy.	effort to "dial in" the system compared to plug-and-play units from other brands.

As seen above, each system has strengths: SoBrite is simple and low-maintenance, PurClean/Velocity are high-tech with proven cyclone+ozone combos, Aqua Bio achieves unparalleled removal of chemicals via biology, and Con-Serv offers fine filtration and tailored solutions.

Optimized Reclaim Separator Tank Design Proposal

Considering the best features from all systems, an **optimized reclaim separator tank design** for the high-capacity 150 CPH (cars per hour) tunnel can be proposed as follows:

1. Enhanced Three-Stage Concrete Tank System: Begin with a robust in-ground pretreatment system. Use **three large concrete tanks in series (e.g. 3× 2,500 gallon)** to handle surge flows and ensure 100% of used water is captured. Tank #1 should have an underflow baffle to create a dedicated **mud settling chamber** up front (for heavy grit) and an oil retention zone on top【17†image】. This tank will catch tire dirt, sand, and debris – preventing rapid sediment accumulation in downstream units. Tank #2 should include a combination of overflow and underflow baffle (for secondary settling and oil separation). Incorporate **coalescing media** or an oil skimmer in Tank #2 to improve oil removal (many modern separators use polypropylene coalescing plates to attract oil droplets). Tank #3 will serve as the **process (pump) tank**, from which water is drawn for recycling. All tanks should be at same invert elevation and sized such that the **combined detention time is at least 5–10 minutes at peak flow** – this gives solids time to fall out by gravity. The tanks should be outfitted with **sludge cones or sumps** at the bottom (if possible) and accessible manholes so that vacuum trucks can remove settled sludge and oils every few months. By over-sizing the pits slightly (total ~7,500 gal in this proposal), the system gains more buffer capacity and improves separation (Stokes' law benefits from larger, calmer volumes).

2. Dual-Stage Solid Separation: For pumped treatment, use a **two-stage solids separation system**: first a **vortex hydrocyclone bank**, then a **polishing filter**. Water from Tank #3 will be pumped at up to ~150–180 GPM through a set of **high-efficiency hydrocyclones** (multiple cyclones in parallel to handle the flow). These separators will remove the bulk of remaining suspended solids down to ~5 µm. The cyclone underflow (sludge concentrate) should be piped back to Tank #1, directly into the mud section, so all separated dirt ends up where it can be collected. Next, the cyclone overflow (relatively clear water) goes through a **self-cleaning screen filter** rated around 25 µm absolute. This could be a stainless steel disc or screen filter with an automatic backwash (similar to Con-Serv's or Sonny's Turbo designs). By doing so, any fine silt or even some precipitated wax/chemical particles that escaped the cyclone will be captured, ensuring turbidity consistently stays low (likely well under 50 NTU). The filter's backwash output (a small volume of concentrated dirty water) can also be returned to Tank #1 or a drain. A duplex filter arrangement (two filters alternating) would allow continuous flow during backwash cycles. This dual-stage approach maximizes solids removal: gravity takes the heavy load, cyclones take the medium-fines, and the screen filter polishes the rest.

3. Integrated Odor and Organic Treatment: To tackle odor and residual organics, use a **hybrid aeration and ozone system**. Install an air blower with diffusers in Tank #2 or #3 to provide continuous **aeration** whenever the system is idle (or on a schedule). This keeps the water moving and oxygenated, preventing anaerobic zones. Additionally, include an **ozone injection unit** on the recirculation loop. Ozone can be injected via a venturi on the pump discharge or in a side-stream reaction tank. A dose of ~20–30 g/hr ozone (as used in PurClean/Velocity systems) is sufficient for a 150 GPM system. The ozone will oxidize organics: breaking down oils, surfactants, and killing bacteria, which together will reduce BOD and eliminate odors. To enhance the effect, the design can route a portion of ozone-treated water back into Tank #1 or #2 (this "AquaPurge" concept has ozone-rich water contact the incoming dirty water, nipping odors early). By combining aeration (from air blower) and ozone, we get the benefits of both: **immediate deodorization and ongoing biological stability**. An ORP (oxidation-reduction potential) sensor can monitor the water to modulate ozone dosing, avoiding overuse. If further chemical breakdown is desired (to minimize discharge loading), a **bio-augmentation program** can be added: dosing a small amount of enzyme or cultured bacteria periodically (as Con-Serv's enzyme feed or Aqua Bio's microbes). This would help consume any remaining detergents in the tanks. However, with ozone in place, the need for added bacteria is minimal (ozone will already degrade many organics).

4. Storage and Delivery: After treatment, the clean water should be stored in a **"reclaim water tank"** or directly in Tank #3 if volume permits. Often, for large systems, it's wise to have an above-ground (or underground) clean water reservoir (e.g. a 1,000-gallon poly or fiberglass tank) that holds filtered water ready to be pumped to the wash. In this design, since Tank #3 is already serving as a reservoir, it might suffice – but including a small extra tank after the filters (especially if using the polishing filters that might prefer a constant flow) can ensure a steady supply for the booster pumps of the wash. The output from the reclaim system can be tied into the tunnel's water distribution with appropriate controls: e.g. a reclaim water usage priority, and an automatic city water bypass valve that opens whenever reclaim supply is low or if quality falls below setpoint (some systems have turbidity or conductivity sensors to divert water if too dirty). The reclaim pump should be on a **VFD (variable frequency drive)** to ramp flow according to

demand signals from the car wash (this prevents pressure spikes and saves energy during low use). Multiple demand points (underbody, foamy brushes, high-pressure rinse, etc.) can all draw from the reclaim supply as needed. The design goal is to use reclaimed water for all washing and rinsing stages **except the final spot-free rinse** (which uses RO water by necessity of spotting). That means potentially over 90% of the water used on each car is recycled water. Given the turbidity is under 50 NTU and largely free of organics (thanks to ozone), the quality is adequate for even the intermediate rinses and certainly for presoak, soap foam, and high-pressure cleaning. Any **foam or surfactant buildup** in the recycle water is mitigated by ozone and dilution with fresh water over time (and can be monitored, adjusting chemical dosages in the wash if needed to be reclaim-friendly).

5. Discharge Management: Ensure there is a controlled way to remove waste from the system. This optimized design will produce a small continuous waste stream from filter backwashing and possibly an ozone destructor water bleed; route these to a waste **holding sump or the sewer connection via an oil/water separator** (if required by code). Also, plan for **regular sludge haul** from Tank #1 (and bio-sludge from any bio-process, if used). Since 100% of domestic water is captured, all dissolved solids (salts from road grime, etc.) will concentrate in the system; a **bleed-off** of a few percent is advisable to purge those. For example, bleeding ~5–10 gallons per car to the sewer (which is about 5–7% of 175 gal) matches the carry-off loss, keeping the water circuit in balance. This ensures that hardness, chloride, or other contaminants do not accumulate indefinitely. The bleed can simply be the overflow from Tank #3 once it exceeds a certain level (fresh water makeup can be tied to the same level control).

By integrating these elements, the proposed design achieves **maximum efficiency in solids separation** (gravity + cyclonic + filtration), **excellent turbidity reduction** (multiple stages yield very clear water), and meaningful **reduction in organic/chemical waste** (ozone oxidation and optional bio-treatment cut down contaminants). It cherry-picks proven components from each manufacturer: SoBrite's reliable pits and simple layout, PurClean/Velocity's ozone and controls, Aqua Bio's aeration principle (but using quicker ozone rather than large bioreactors for practicality), and Con-Serv/Sonny's Turbo style filtration for extra clarity. The result is a hybrid system capable of processing ~150 GPM continuously, supplying high-quality recycled water for a 150-car/hour tunnel, and capturing essentially all wash water with only a small deliberate waste purge. This means substantial water savings (on the order of 75% or more reduction in fresh water use) and compliance with even stringent city reuse mandates, all while keeping the car wash running smoothly with no odors or quality issues.

In conclusion, high-capacity car wash reclaim systems benefit from a **multi-barrier design**: large concrete separator tanks, efficient centrifugal solids removal, advanced filtration, and oxidative treatment for organics. The comparative analysis shows that manufacturers have evolved different paths to the same goals. By combining the best practices – generous settling volume, cyclonic separation, continuous self-cleaning filters, and ozone-enhanced bio-treatment – an optimized system can be built to meet the toughest demands. Such a system will deliver **recycled water under 50 NTU turbidity, free of objectionable odor, and minimized in contaminants**, allowing maximum water reuse and environmentally responsible operation of the car wash.