Overview

Whether at self-service or full-service car washes, or as part of gas stations or vehicle service facilities, there are three types of vehicle-washing technologies: conveyor, in-bay, and self-service. These technologies incorporate some or all of the following steps, as defined by the International Carwash Association:[75]

- Pre-soak: An automated nozzle or handheld spray.
- Wash: A high-pressure spray or brushes with a detergent solution.
- Rocker panel/undercarriage: Brushes or high-pressure sprays on the sides and bottom of the vehicle.
- First rinse: A high-pressure rinse.
- Wax and sealers: An optional surface finish that is sprayed on the vehicle.
- Final rinse: A low-pressure rinse with fresh or membrane-filtered water.
- Air blowers: Air blown over the vehicle to remove water and assist drying.
- Hand drying: Wiping down the vehicle with towels or chamois cloths, which are often laundered in onsite washing machines. See *Section 3.6: Laundry Equipment* for information on using water efficiently in commercial laundry systems.

Many commercial vehicle wash facilities have adopted water reclamation technology, which treats wash and rinse water from previous wash cycles for use during the next vehicle wash in an effort to reduce overall water use. There are several other opportunities for these facilities to minimize water use. In fact, efficient vehicle wash systems can use less water on average per vehicle than washing a car at home.[76]

Conveyor Systems

Conveyor vehicle wash systems use a conveyor belt to pull vehicles through a washing tunnel, which consists of a series of spray arches and/or washing cloths. Vehicle washing can be conducted with the customer inside the vehicle during the wash process, or the customer can wait outside the vehicle as both the interior and exterior are cleaned. In some states, the driver and passengers are required to wait outside the vehicle during washing.

Conveyor facilities employ two different methods of washing: friction or frictionless. During friction washing, the wash equipment (e.g., a cloth curtain) makes contact with the vehicle. Frictionless, or touch-free, washing relies on high-pressure nozzles to clean the vehicle. Conveyors with friction wash cycles use less water per vehicle,

[75] Brown, Chris. 2000. *Water Conservation in the Professional Car Wash Industry*. Prepared for the International Carwash Association.™ Page 10. www.carwash.org/operatorinformation/research/Pages/EnvironmentalReports.aspx.
[76] Alliance for Water Efficiency. Vehicle Wash Introduction. www.allianceforwaterefficiency.org/Vehicle_Wash_Introduction.aspx.

because the cloth brushes or curtains collect water and detergent from previous washes and require less re-wetting.[77]

Conveyor vehicle wash facilities are good candidates for installing reclamation systems because the tunnel length allows for wash wastewater to be easily separated from rinse water of higher quality. Without reclamation, conveyor vehicle washing can use 65.8 gallons per vehicle (gpv) of fresh water during friction washing and 85.3 gpv of fresh water during frictionless washing. A reclamation system can reduce freshwater consumption to as low as 7.8 gpv during friction washing and 16.8 gpv during frictionless washing.[78]

In-Bay Systems

In-bay vehicle washes can be found at many gas stations or similar facilities where vehicle washing is a secondary service option. For in-bay vehicle washing, the vehicle remains stationary while the washing process occurs. Like conveyor vehicle washing, a series of nozzles and/or brushes is used to complete either a friction or frictionless wash process. One set of nozzles is typically used to perform all wash cycles.

In-bay vehicle washing facilities can also benefit from the use of a water reclamation system. However, because there is typically only one wastewater collection pit, an in-bay water reclamation system must be properly designed to separate contaminated water from cleaner water. A water reclamation system can reduce average in-bay water use from 60.0 gpv to as low as 8.0 gpv.[79]

Self-Service Car Washes

Self-service car washes allow customers to wash vehicles themselves, using a hand-held nozzle to perform all washing processes. In some cases, there could be a brush available for the wash cycle. The pricing structure for a self-service car wash is typically set up so that the customer pays for a base amount of time of water use and can make additional payments for each additional time increment.

Of the three types of vehicle washing, self-service vehicle washing tends to use the least amount of water—15.0 gpv, on average.[80] While self-service vehicle washing typically uses the smallest amount of water per vehicle, water reclamation systems are often not feasible for use with a self-service washing facility, because it is difficult to collect and separate the wastewater. Coupled with the fact that water use in these facilities is driven by user behavior, self-service vehicle washing offers the least potential for water savings through retrofit or replacement.

[77] East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages 37-39, WASH1-6. www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook.
[78] Brown, Chris, *op. cit.*, Page 16.
[79] *Ibid.*
[80] *Ibid.*

Operation, Maintenance, and User Education

For optimal vehicle wash system efficiency, consider the following:

- Conduct routine inspections for leaks and train appropriate custodial and cleaning personnel and users to identify and report leaks.
- Ensure that the main shut-off valve is in proper working order.
- If possible, use a friction washing component in all cycles, especially if water is not reused.
- Sweep all driveways and impervious surfaces instead of washing.
- Minimize pump head pressures based on manufacturer recommendations.

Consider participating in the International Carwash Association™ (ICA) WaterSavers® recognition program, which requires participants to meet certain water usage and quality standards. For more information on the program, refer to the WaterSavers website.[81]

For further vehicle washing efficiency, follow the operating and maintenance tips specific to each type of vehicle wash system described below.

Conveyor Systems

For optimal conveyor system efficiency, consider the following:

- Make sure conveyors are properly calibrated by timing spray nozzles to activate only as the vehicle reaches the spray arch.
- Align spray nozzles properly; they should be oriented parallel to the spray arch.
- If using a water reclamation system, orient blowers so that water is sent back to the water reclamation pit for reuse. Create a dwell time after the final rinse to allow for water to flow back into the reclamation pit.
- Maximize conveyor speed based on manufacturer recommendations.

In-Bay Systems

For optimal in-bay system efficiency, consider the following:

- Align spray nozzles properly; they should be oriented parallel to the spray arch.
- If using sensors that detect when a vehicle is present, make sure they are properly calibrated. Sensors should activate the spray nozzles only as the vehicle reaches the spray arch.

[81] WaterSavers.® washwithwatersavers.com/.

- If using a reclaim system, create a five-second dwell time before the vehicle exits the bay to allow for water runoff to be collected.
- Maximize wash and rinse cycle speeds based on manufacturer recommendations.

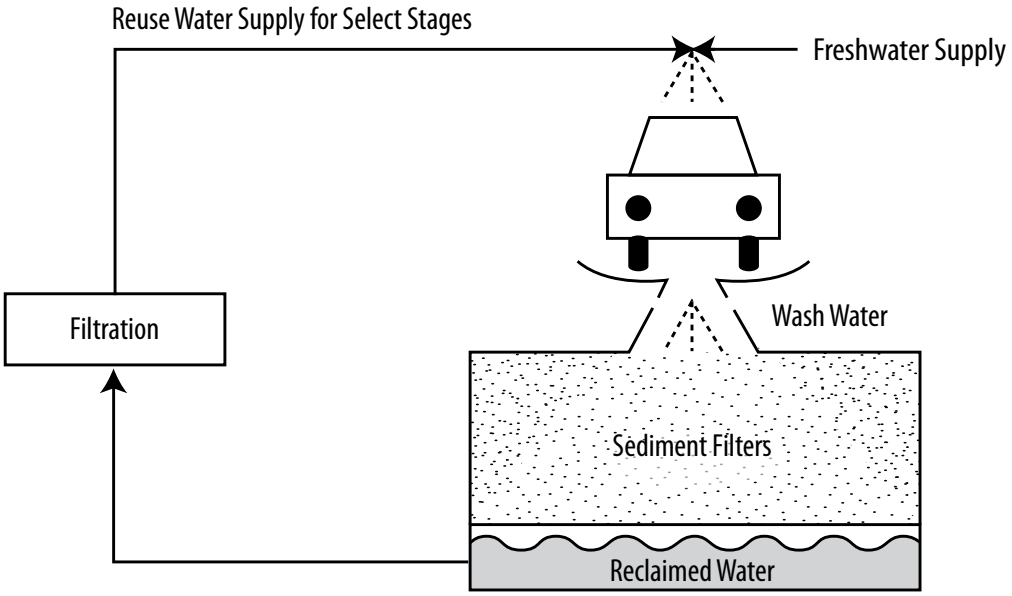
Self-Service Car Washes

For optimal self-service car wash efficiency, educate customers on how to efficiently wash their vehicles using less water.

Retrofit Options

Water reclamation systems that treat wash and rinse water from previous wash cycles for use during the next vehicle wash offer the greatest potential water savings for vehicle wash systems (see Figure 5-4 for an example of a vehicle wash with a water reclamation system). The degree of water treatment needed depends upon which vehicle washing steps use the reclaimed water. At a minimum, water reclaim systems should separate grit, oil, and grease from wash water. This level of water treatment is enough to use reclaimed water during the rocker/undercarriage wash stage. Additional treatment, such as oxidation, filtration, membrane filtration, and deionization, might be necessary for use of reclaimed water during additional vehicle-washing steps. Table 5-4 outlines the recommended level of water treatment for reclaimed water use during each phase.[82]

Figure 5-4. Vehicle Wash Water Reclamation System



[82] Created from analyzing data in: Brown, Chris, *op. cit.*, Page 29.

Table 5-4. Recommended Level of Treatment for Reclaim Systems

Wash Stage	Self-Service	In-Bay	Conveyor	
			Friction	Frictionless
Pre-Soak	N/A*	N/A	Filtration, reverse osmosis or deionization	Reverse osmosis or deionization
Wash	N/A	Filtration	Separation, filtration	N/A
Rocker Panel/ Undercarriage	N/A	Filtration	Separation, filtration	Separation, filtration
First Rinse	N/A	Filtration	Filtration	Filtration
Wax and Sealers	Reverse osmosis	Reverse osmosis	Reverse osmosis or deionization	Reverse osmosis or deionization
Final Rinse	Reverse osmosis	Reverse osmosis	Reverse osmosis or deionization	Reverse osmosis or deionization

*N/A: not applicable

If considering a water reclamation retrofit, be sure to evaluate the feasibility of the installation. The ability to install additional piping and water treatment equipment will determine whether a reclamation system retrofit is appropriate. Industry experts recommend taking the following into account when designing a reclamation system:[83]

- Nature of the contamination to be treated
- Concentration of the contaminants
- Volume of water used per day
- Flow rate per minute of different processes in the professional car wash
- Chemicals and procedures used in the wash or rinse process
- Discharge limits (if applicable)
- Intended use of the reclaimed water and the desired quality for its use

Water reclamation systems require additional maintenance to clean filters and other system components. Cleaning and finish products should be compatible with the system operation.[84]

Water reclamation systems can be retrofitted with existing conveyor or in-bay vehicle washing systems, but they are not recommended for retrofit with self-service vehicle washing.

For additional retrofit options to reduce water use, consider the following retrofit options for each washing type.

[83] *Ibid*. Page 21.
[84] Koeller and Company and Chris Brown Consulting. October 2006. *Evaluation of Potential Best Management Practices—Vehicle Wash Systems*. Prepared for The California Urban Water Conservation Council. Page 23. www.cuwcc.org/products/pbmp-reports.aspx.

Conveyor Systems

When retrofitting a conveyor system, consider the following:

- Limit freshwater consumption to 40.0 gpv, as recommended by ICA's WaterSavers recognition program.[85]
- For conveyor systems that utilize frictionless washing, consider installing friction washing components to use during the wash cycles.
- If a reverse osmosis treatment system is installed for use with a water reclamation system or to supply spot-free rinse water, capture reject water and reuse during wash cycles.
- Install check valves to prevent backflow wherever possible.

In-Bay Systems

When retrofitting in-bay systems, consider the following:

- Limit freshwater consumption to 40.0 gpv, as recommended by ICA's WaterSavers recognition program.[86]
- For in-bay systems that utilize frictionless washing, consider installing friction washing components to use during the wash cycles.
- If a reverse osmosis treatment system is installed for use with a reclaim system or to supply spot-free rinse water, capture reject water and reuse during wash cycles.
- Install check valves to prevent backflow wherever possible.
- Install laser sensors to evaluate the length of the vehicle being washed and adjust the washing procedure to the specific length of the vehicle.
- Limit water consumption during the rocker panel/undercarriage cycle to 12.0 gallons per cycle.

Self-Service Car Washes

When retrofitting self-service car washes, consider the following:

- Limit nozzle flow rate to 3.0 gallons per minute (gpm), as recommended by ICA's WaterSavers recognition program.[87]
- Install check valves to prevent backflow wherever possible.
- If towel ringers are installed, use a positive shut-off valve.

[85] International Carwash Association (ICA). WaterSavers Criteria. www.carwash.org/industryinformation/watersavers/Pages/default.aspx.
[86] *Ibid.*
[87] *Ibid.*

Replacement Options

Due to the high capital costs involved with replacing a vehicle wash system, first implement all efficient operation and maintenance procedures and perform any retrofits available to optimize the efficiency of the system. Retrofitting an existing vehicle wash system with a water reclamation system can yield the most potential for water and operational cost savings.

Water reclamation systems are appropriate for conveyor and in-bay vehicle washing. When designing a new vehicle washing facility, consider one that incorporates the features described in the earlier "Retrofit Options" section.

Savings Potential

Water savings can be achieved by installing a water reclamation system for conveyor or in-bay vehicle wash facilities. A study by ICA found that facilities using reclamation systems were able to fulfill 51 percent of their water needs, on average, from reclaimed water.[88]

To calculate facility-specific water savings and payback, use the following information.

Current Water Use

To estimate the current water use of an existing vehicle wash system, identify the following information and use Equation 5-1:

- Water use per vehicle. This can be determined based on metered water use. If the facility does not have a meter, ICA found that conveyor and in-bay washes use an average of 75.0 gpv and 55.0 gpv of fresh water, respectively.[89]
- Number of vehicles washed per day.
- Days of facility operation per year.

Equation 5-1. Water Use of Vehicle Wash (gallons per year)

= Water Use per Vehicle x Vehicles Washed x Days of Facility Operation

Where:

- Water Use per Vehicle (gallons per vehicle)
- Vehicles Washed (number of vehicles washed per day)
- Days of Facility Operation (days per year)

[88] Brown, Chris. 2000, *op. cit.*
[89] *Ibid.* Page 16.

Water Savings

According to the ICA's study, vehicle wash facilities can reduce their freshwater use by approximately 50 percent by using a water reclamation system. To calculate water savings that can be achieved from retrofitting an existing vehicle wash system, identify the current water use (as calculated using Equation 5-1) and use Equation 5-2.

Equation 5-2. Water Savings From Vehicle Wash System Retrofit (gallons per year)

= Current Water Use of Vehicle Wash System x Savings (0.5)

Where:

- Current Water Use of Vehicle Wash System (gallons per year)
- Savings (percent)

Payback

To calculate the simple payback from the water savings associated with the vehicle wash system retrofit, consider the equipment and installation cost of the retrofit water reclamation system, the water savings as calculated using Equation 5-2, and the facility-specific cost of water and wastewater. Water reclamation systems might cost $35,000 for equipment and installation.[90]

Additional Resources

Alliance for Water Efficiency. Vehicle Wash Introduction. www.allianceforwaterefficiency.org/Vehicle_Wash_Introduction.aspx.

Brown, Chris. 2000. *Water Conservation in the Professional Car Wash Industry*. Prepared for the International Carwash Association (ICA). www.carwash.org/operatorinformation/research/Pages/EnvironmentalReports.aspx.

Brown, Chris. 2002. *Water Use in the Professional Car Wash Industry*. Prepared for ICA. www.carwash.org/operatorinformation/research/Pages/EnvironmentalReports.aspx.

East Bay Municipal Utility District. 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Pages 37-39, WASH1-6. www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook.

ICA. WaterSavers Environmental Reports. www.carwash.org/industryinformation/WaterSavers/Pages/WaterSaversEnvironmentalReports.aspx.

Koeller and Company and Chris Brown Consulting. October 2006. *Evaluation of Potential Best Management Practices—Vehicle Wash Systems*. Prepared for the California Urban Water Conservation Council. www.cuwcc.org/products/pbmp-reports.aspx.

[90] Brown, Chris. September 2002. *Water Use in the Professional Car Wash Industry*. Prepared for ICA. Page 43. www.carwash.org/operatorinformation/research/Pages/EnvironmentalReports.aspx.