Managing wastewater: storage, treatment and recycling options

by **Michael J. Danko** *and* **Mohammed R. Zaman, Ph.D., PE, LRSP**

Marinas and boatyards often use pressure washers to remove growth from boat bottoms. As a general rule, bottom cleaning is the first step in preparation for a fresh coat of bottom paint. However, the hull-wash wastewater generated from this activity can contain various levels of both particulates and dissolved metals (copper, zinc and lead), organic materials (barnacles, tube worms, bacteria and algae) and salts. If not handled properly, wastewater can have an adverse impact on the environment and create property management concerns, such as increased dredging costs and sites with high levels of contaminants near the wash area.

Many states have developed or are in the process of developing laws to address the discharge of vessel wash wastewater, such as New Jersey, which recently implemented a no discharge policy for vessel wash wastewater.

Solids and metals

Wastewater composition presents some unique challenges to marinas. Solids like paint chips and organic materials can be removed easily by installing dual-chambered sumps and holding tanks, which provide sufficient time for the solids to settle out of the wastewater.

However, studies have indicated that the metals commonly found in hull-wash wastewater prefer to bind to fine particles. These fine particles and bound metals can be difficult to remove through mechanical filtration alone and will accumulate over time if not addressed. In addition, the condition of the paint surface and facility practices, such as the use of hull cleaners, the amount of pressure used and washing sacrificial anodes, can increase the levels of solids and dissolved metals, potentially increasing disposal costs.

Wastewater from the pressure washing of boat bottoms can contain materials that are hazardous to the environment and should be managed properly with a storage or treatment system.

Management goals

Currently, marina operators have two options for dealing with hull-wash wastewater: cease the activity or install a wastewater collection system. A collection system will at a minimum consist of an impervious pad, temporary or permanent, that contains and directs the wastewater into a sump, which serves as temporary storage and provides an opportunity for solids to settle out of suspension. The water can then be disposed of as industrial wastewater or treated to remove the solids and contaminants with a water treatment system.

Marinas should establish wastewater management goals by assessing:

- the number of boats washed annually
- the average length of the vessels washed
- the estimated volume of freshwater used
- the expected volume of collected wastewater
- and any other water/sewer charges that may apply.

In a recent survey conducted by the New Jersey Sea Grant Consortium, marina operators reported the average time spent washing a boat bottom is 15 to 20 minutes, and the amount recovered can range from 25 to 80 gallons per boat. For planning purposes, it is recommended that marinas can expect to recover approximately 40 gallons per boat. However, many will find they recover much less, as the average length of the boats washed, the amount of growth and environmental conditions, such as cloud cover and wind, will vary widely. A marina washing 100 boats per year with an average length of 25 feet can expect to recover approximately 4,000 gallons.

Estimating the wastewater volume and water/sewer costs are critical in determining the most cost-effective wastewater management system. The following options are available:

- treating wastewater and then recycling, hauling away for off-site disposal or discharging to a sanitary sewer
- capturing wastewater in a large storage tank and hauling away for off-site disposal
- applying to the state for a permit to discharge the treated water to surface or ground waters, but permit fees and monitoring requirements generally make this option cost prohibitive.

In addition, contacting the local sewer authority in the early

This basket captures large solids prior to the wastewater entering a 1,000-gallon settling tank.

planning stages is crucial to determining a particular facility's criteria for accepting wastewater. Many sewer authorities have been willing to accept wastewater only after agreeing upon a treatment level.

Storage and off-site disposal without any pre-treatment may be a cost-effective option for very small marinas generating less than 2,000 gallons of wastewater in a typical operating season. Moderate to large marinas generating more than 4,000 gallons of wastewater in a typical operating season should consider installing treatment systems with secondary treatment capabilities, such as electro-coagulation, particularly if considering wash water recycling.

Project costs

The cost of installing or modifying a wash pad can vary widely for each facility, and therefore, consultation with a local concrete or asphalt contractor to develop specifications and establish costs is highly recommended.

If a facility plans to store the wastewater and have it hauled away once a set amount has accumulated, the entire cost for the project will be approximately $15,000. This includes a concrete/asphalt pad, sump, storage tank with close to a 2,000-gallon capacity, sump pump, piping and electric installation. The cost of the pad will vary, but the tank, pump and installation will average approximately $5,000. The cost for a licensed wastewater hauler will be approximately 65 cents per gallon, and there may be a transportation charge, which can be approximately $100.

This method can also be an excellent first step for marinas considering wastewater treatment. After one year the exact volume of water collected will be known, which can be used to determine if on-site treatment with or without the recycling option is cost-effective. The advantages of this approach are low equipment and installation costs and minimal maintenance; the one disadvantage is the disposal cost could be significant for high volume marinas.

Marinas that want to treat the wastewater must evaluate the acceptable level of treatment for recycling or on-site discharge. The following are examples of the common treatment systems available and the associated costs.

A wastewater collection and treatment system that provides primary treatment, such as mechanical filtration, cyclonic action or other similar means to remove solids, costs approximately $25,000. This includes a concrete/asphalt pad, treatment system, sump, sump pump, piping and electric installation, and shed. The cost of the basic treatment system will average $12,000 but will increase if treatment options are added.

The advantages of these systems are the moderate cost of providing primary treatment and the option of recycling the wastewater. The disadvantages are the potential for high maintenance costs. Contaminant levels need to be monitored, and recycled wastewater in the system may need to be purged periodically.

A wastewater collection and treatment system that uses advanced treatment, such as electro-coagulation or similar methods of removing dissolved and solid metals, will cost approximately $32,000. This includes a concrete/asphalt pad, treatment system, sump, sump pump, piping and electric installation, and shed. Advanced treatment systems will average $17,000. The advantages of these systems are that they provide secondary treatment at a moderate cost; the wastewater can be recycled; periodically purging the system, other than for winterizing, is not necessary; the wastewater will meet the requirements for discharge to a sanitary sewer in most instances; and maintenance costs will be moderate. The disadvantages are the higher initial purchase price and skilled operation and maintenance requirements.

System design considerations

To capture wastewater, a wash pad, constructed of an impervious material and designed to direct the wastewater into a sump, is a critical first step. The wash pad should be of sufficient length and width to capture as much wash water as possible to prevent anything from landing on pervious areas around the pad.

A multi-chamber sump capable of holding 300 gallons is highly recommended and will provide the holding time necessary for solids to drop out of suspension. New Jersey recognized that the cost and space required to use these systems needs to be kept to a minimum and has found that a 300-gallon dual chamber sump will be sufficient in most instances. In an effort to further reduce solids from the storage tank or treatment system, the sump pump should be located at least 18 inches above the bottom of the sump.

Marinas that wash a small number of boats may want to consider temporary pads and locating the sump aboveground in storage tanks. Marinas that have permanent pads already in place with or without a sump can work with local concrete or asphalt contractors to design a modification that will help the meet their collection and sump storage needs. The underground sump should be greater than or equal to the expected volume of wastewater to be collected on an average operation day.

In addition, marinas will need to incorporate a method of diverting stormwater into the pad design. This can be as simple as a cover to prevent rainwater from entering the sump or diverting the water away from the system through additional valves and piping. It is recommended that facilities check state regulations to determine the legal disposal methods for stormwater.

Marinas utilizing simple mechanical filtration, cyclonic action or other similar means can improve efficiency by adding a

temporary storage tank capable of holding between 300 to 500 gallons in between the sump and the system.

Best management practices (BMPs)

- Purge systems that use mechanical filtration, cyclonic action or other similar means as the primary method of removing metals. Frequent purging is needed to prevent dissolved metals from building up to potentially toxic levels, which can occur over time if not addressed. It is recommended that purging be conducted every two to three weeks or according to the amount of wastewater collected.
- Establish baseline characteristics of the wastewater by contracting with a laboratory for biweekly pH and bacterial analysis at least through one complete operating season. Purging and treatment levels should be adjusted based on the water sample results.
- Contract with a licensed wastewater hauler for proper disposal of any wastewater remaining in the system at the end of the season.
- Remove or cover all sacrificial anodes when pressure washing, which helps prevent other contaminants, such as zinc and lead, from entering the wastewater. Wastewater with elevated levels of metals is more difficult to treat and may be classified as hazardous waste and result in increased disposal costs.
- The use of chemicals designed to remove growth on the hull and water line can adversely affect the pH in wastewater. If a neutral pH level is not maintained, dissolved metals in the recycled wastewater may increase with time and create possible health and safety concerns. If the treatment system does not automatically monitor pH, a hand-held pH meter can be used and an acid or base be added to maintain as near a neutral pH as possible.
- Bacterial growth should also be monitored, and the water sanitized as needed. Marina owners should check with the system manufacturers to see if sanitization options are available.

Complying with new regulations and increasing pressures to reduce environmental impacts by the marina industry does not have to be devastating to a facility's bottom line. To avoid purchasing and installing a system that does not meet the needs of the marina, operators must invest the necessary time to determine wastewater management goals for the operation. Careful planning is crucial to keeping the purchase, installation, and operation and maintenance costs to a minimum. For more information on wastewater characterization and system options, visit *www.NJSeaGrant.org/MIE.html*. ⚓

Michael J. Danko is marine recreation agent for the New Jersey Sea Grant Consortium. He can be reached via phone at 732/872-1300, ext. 29. Mohammad R. Zaman, Ph.D., PE, LSRP, is senior environmental engineer/project manager at Najarian Associates in Eatontown, N.J. He can be reached via phone at 732/389-0220, ext. 241.