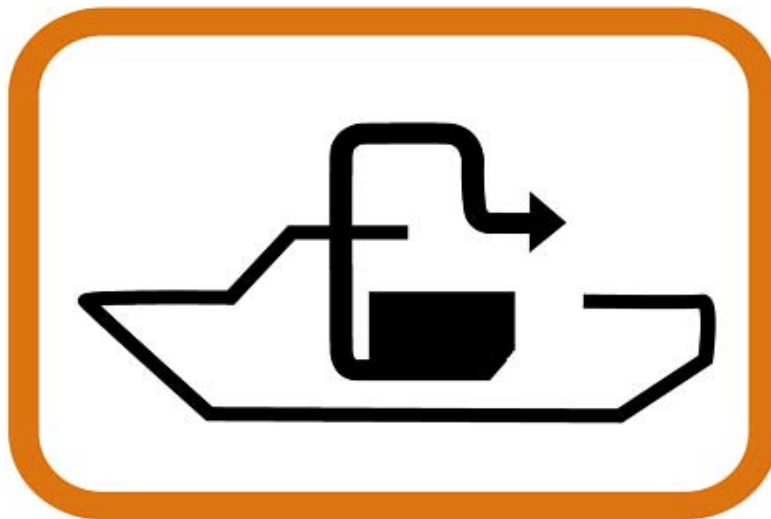

SEWAGE MANAGEMENT GUIDE FOR BOATING FACILITIES

San Francisco Estuary Partnership's Clean Vessel Act Program

Funded by the California State Parks Division of Boating and Waterways Clean Vessel Act Program




PARTNERS AND FUNDERS

The San Francisco Estuary Partnership would like to thank the time and support that has been heaped upon this project. A big thanks goes out to the California Department of Parks and Recreation's Division of Boating and Waterways (DBW) for providing funding and guidance throughout the development of this document. DBW has played a critical role in the environmental public outreach and education campaigns in California that work directly with boaters. Without DBW's ongoing support and commitment to protecting our waterways, this work would not be possible.

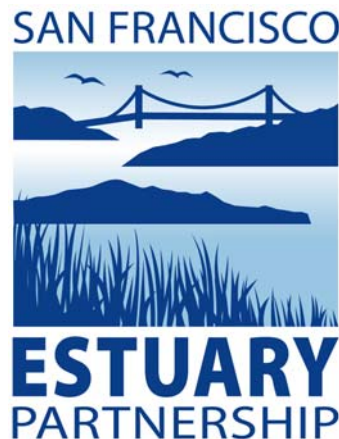
Also, we are incredibly grateful for all of the boating facilities and harbormasters that participated in the creation of this document. Many interviews, phone calls, surveys, and conversations were had with California harbormasters and marina managers to gather the information about the sewage prevention programs currently in place. These leaders are pioneers in their industry and their commitment to safeguarding the quality of the water boaters rely on to enjoy their passion is laudable.

And finally, we would like to thank the boaters. As the eyes, ears, and guardians of the waterways, boaters are the keystone in our mission to protect water quality. Without you, the Rivers, Bays, and Oceans wouldn't enjoy the robust advocacy they have today.

Sincerely,


James Muller

San Francisco Estuary Partnership



A LETTER TO BOATING FACILITIES

Recreational boating is a \$8.94 Billion industry supported by almost two million boaters in California alone. This sport, pastime, and way of life is a hallmark of the California coastline. From the San Francisco, Morro, and Monterey Bays to Santa Catalina and the Channel Islands and Santa Monica Bay in Southern California, we boast some of the best sailing and boating in the world. Our abundance of aquatic resources and nutrient rich ecosystems have given rise to complex food webs and chains that include the largest animal in the world, the farthest migrating bird in the world, and the largest toothed shark in the world. In California, a day on the water could lead to any number of brilliant interactions with the animal kingdom.

The medium that supports this vibrant community of life is one that is highly susceptible to being impacted by human activities both on and off the water. Oil, fuel, marine debris, invasive species, hazardous waste and sewage are all threats to the continued vitality of our ocean and its residents. Boaters are among the best wardens of our waterways due to their relationship with them. Unfortunately, not all boaters have the resources and knowledge needed to fill this protective roll. It is for this reason that marinas, harbors, yacht clubs and boating organizations are so important in enabling boaters to be good stewards of their environment. They provide a bank of knowledge and resources for boaters to draw upon to engage in their activities. Part of this bank should be firmly rooted in environmental management and protection.

It is our hope that this document and the research conducted to create it, will enable boating facilities across California and the Nation to more easily support boaters' efforts and intentions to protect our waterways and prevent sewage discharge. It is through continued commitment to our boaters and environmental protection that will provide us with opportunities to share these wonderful experiences with future generations.

Sincerely,

A handwritten signature in dark ink, appearing to read 'James Muller', is written over a horizontal line.

James Muller
San Francisco Estuary Partnership

INTRODUCTION



This guide is meant to be a resource to any marina, yacht harbor, port, or yacht club (boating facilities) that wishes to create and implement a sewage discharge prevention strategy. A sewage discharge prevention strategy is a combination of technologies, programs and policies meant to provide guest boaters and tenants with information, resources, and accountability for proper sewage disposal. These strategies, when implemented properly, will serve to curb current and future discharges of treated and untreated sewage, protecting the vessels, aesthetic beauty, water quality, and ecosystem of a boating facility.

The information within this guide has been gathered through research and interviews of boating facility owners and operators. Much of the information provided in this guide is not novel, but has been in existence and prolifically used throughout the US. This guide is meant to serve as residence for known and vetted best management practices, gathered from reliable sources, that boating facility owner and operators can utilize to implement or improve sewage prevention strategies at their location. The authors have attempted to organize the information in a manner that provides the reader with comprehensive insight to the issues and solutions and also to provide an easy method of selecting a strategy. After selecting a desired strategy, boating facilities should consult with local clean marina programs and fellow boating facilities to ensure the strategy is properly adapted for the boating facility's specific needs.

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Use these guides to
navigate this manual

Technologies

Management

Program Plans

Sample Language

CVA Info

Appendix

TECHNOLOGIES

This section will review the different types of pumpout systems and their benefits and limitations. We have also provided researched estimates of what these systems can cost. These estimates are highly variable and depend on a number of specifications including your piping distance, the relative distance of your motor, hose stand and discharge point, and the motor size. We have also included an estimate of yearly costs related to the use and maintenance of these systems. It is important to keep in mind that by applying for Clean Vessel Act Grants, with the California Department of Parks and Recreation Division of Boating and Waterways, 75% of these costs can be funded by the state, making these technologies a very affordable option to manage sewage discharge.

Each technology has ratings for its effectiveness and its cost. These ratings are relative and estimated costs can be found in the Best Management Practices - Sample Plans section. The effectiveness ratings are combined with management practices to provide the overall effectiveness of each plan in its ability to proactively curb sewage discharge. The more dollar signs there are, the more expensive the technology is. Likewise, the more check marks there are, the more effective the system is at preventing sewage discharge into boating facilities.

Dockside Pumpouts

This is the most common sewage discharge prevention technology used in California and is a critical part of a comprehensive sewage discharge prevention strategy. While these units are important, they are most effective when coupled with programmatic efforts to reduce discharge. Alone, these systems are only as effective as the proportion of boaters that choose to use them.

Sewage pumpout systems remove sewage from vessels on the water and move the material into sewer or septic systems. These pumpout systems are typically a stand-alone feature within boating facilities and are commonly paired with other services like fuel pumps. They are typically located on their own dock or have designated space on a guest/fuel dock so that there is sufficient space for a boater to tie-up and not affect access to other services. When planning a pumpout system installation, the expected use (daily and seasonal peaks) and size of the vessels anticipated at the facility should be considered.

Boating facilities situated in or near urban areas typically configure their system to discharge into existing, permitted lines that run to the municipal sewer system, but it is not uncommon for new systems to require a new connection to a municipal sewer line. The latter may include more permits but can be independent of all other sewage systems. Boating facilities in rural or isolated areas or on islands may not be able to tap into a municipal sewer line. These facilities will require a septic system; either a tank that must be pumped out or a leach field. These systems are likely to require more permits than the lines leading directly to sewer systems.

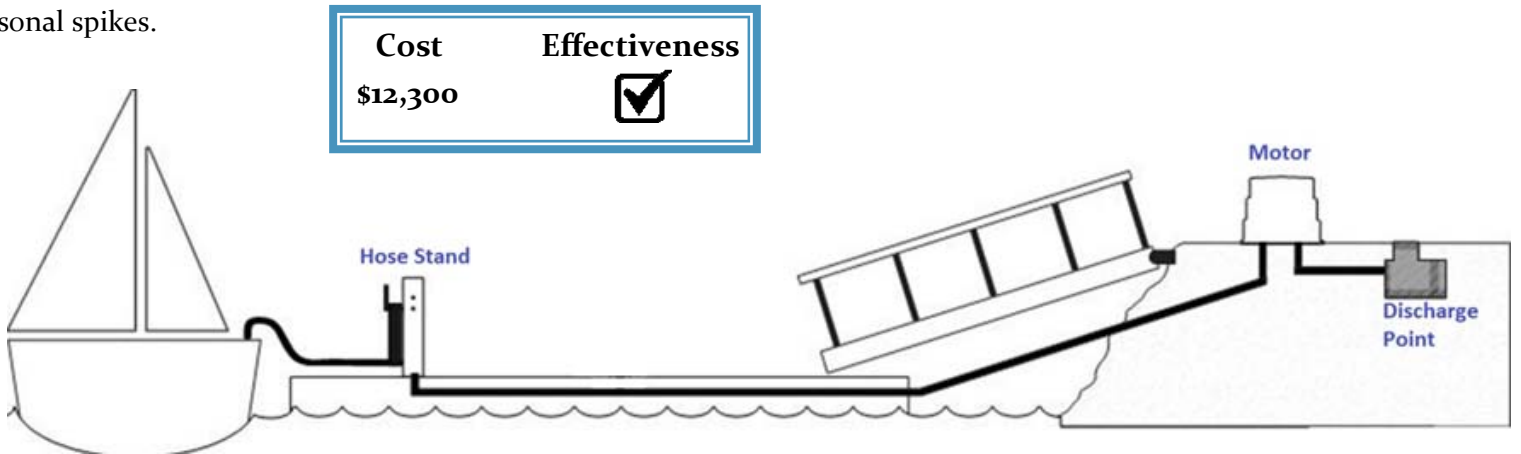


Dock-Side Pumpout Systems

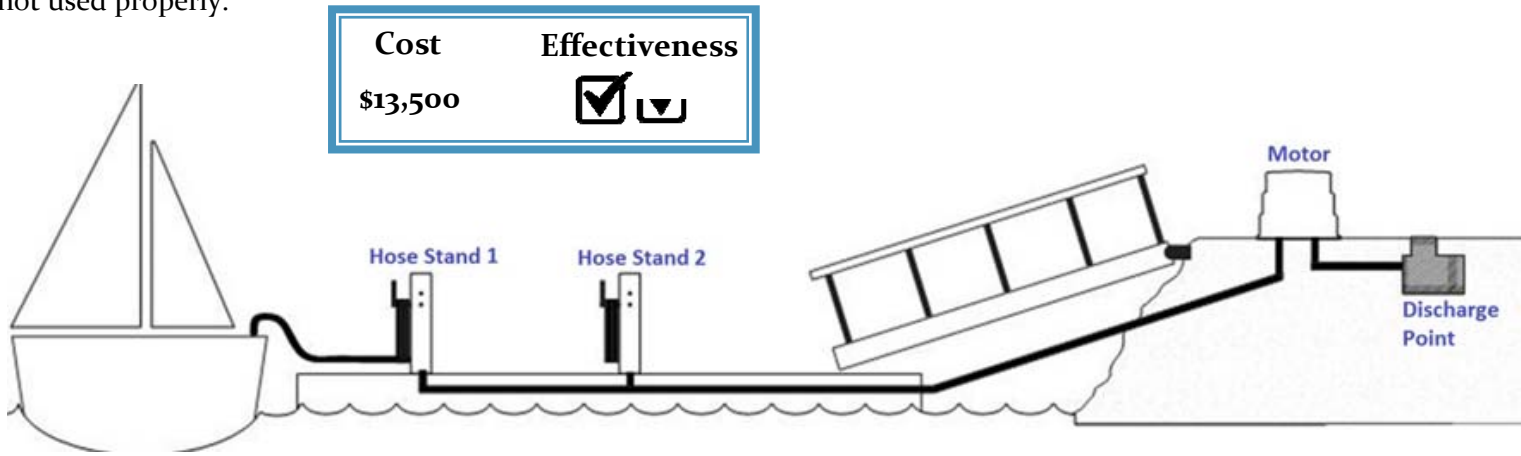
All systems require a motor and a hose stand that is plumbed to a discharge point. Depending on the needs, services offered, and layout of the boating facility installing the pumpout the orientation of the system will vary between boating facilities. The primary concern with the placement of any pumpout station is convenience. Boaters will not use a pumpout that is difficult to get to or frequently crowded. Placement of the hose rack/control station (hose rack) is critical to ensure the system is used. Boating Facilities should avoid placing the pumpout access in the back of a boating facility or tucked away in a small slip or berth. The pumpout should be located so that there is plenty of maneuvering room in front of the dock on which it is placed and in a location that is easy to get too such as an end-tie or adjacent to a channel.

Please see the *Pumpout Installation and Technology Guide* in the appendix for more information on layout variants and considerations.

Single Point – This system has a single motor and a single hose stand and is the most widely used configuration. The single point layout avoids vacuum issues sometimes encountered in multiple hose variants, but can only service a single boater at a time. It is the preferred system for smaller and medium sized facilities that don’t experience large seasonal spikes.



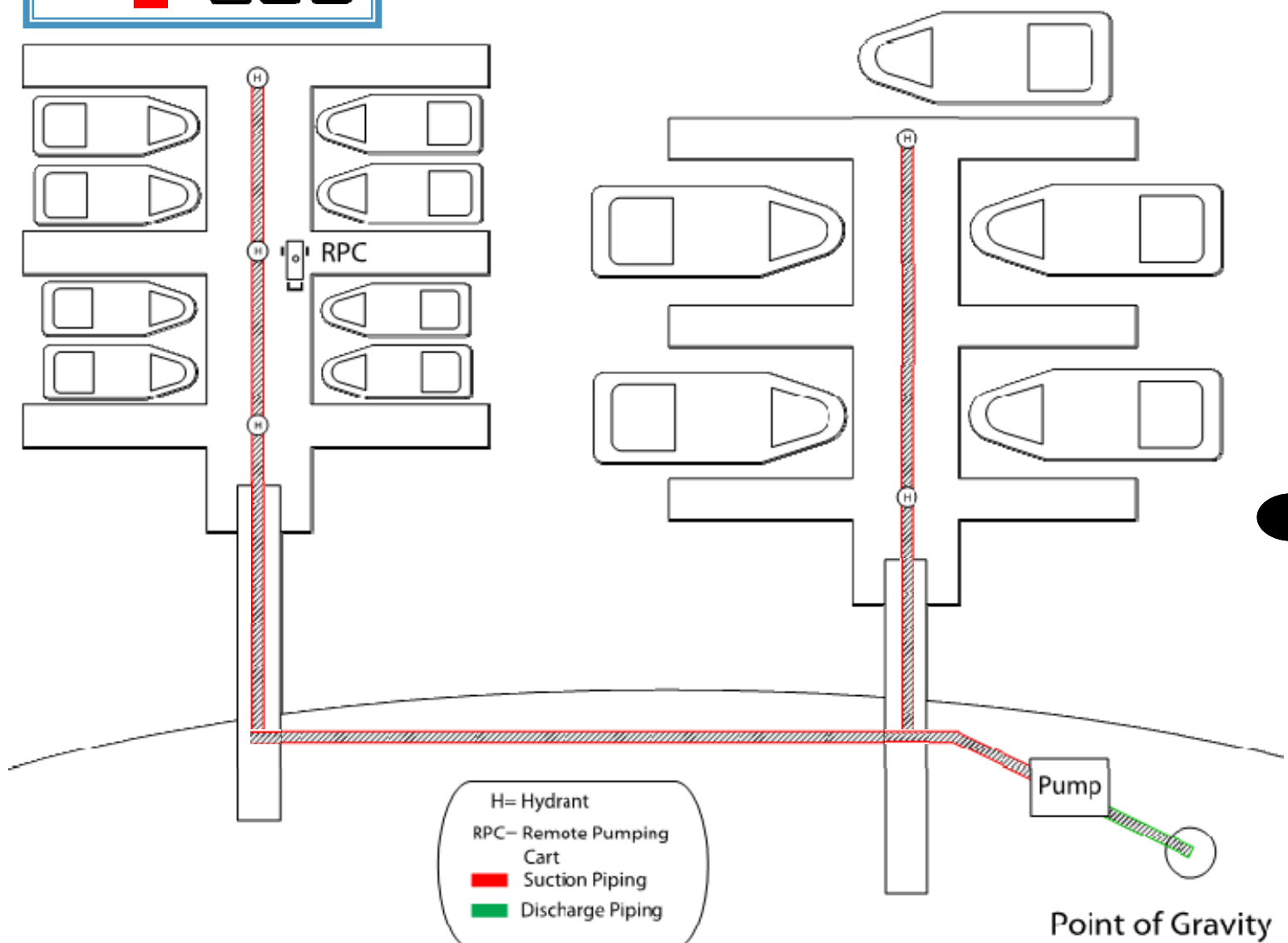
Multiple Hose – This layout has a single motor with more than one hose stand. Typically, two hose stands are installed on the same dock to allow more boaters access. These systems are advantageous for larger boating facilities and those that experience large spikes in seasonal use. Vacuum issues can occasionally be encountered if the system not used properly.



In Slip System – This system is, by far, the most comprehensive land based pumpout system available to boating facilities to date. It allows boaters to pumpout without ever having to move their boat. The process of navigating vessels to landside pumpouts from slips has been cited as one of the most inconvenient factors of dock side pumpout systems. This system completely removes this hurdle from the equation. It consists of piping that runs down each dock and has vertical hydrants every two to four slips. A lightweight hose rack on wheels is then carted to the boat needing a pumpout where one end is connected to the hydrant and the other is used to pumpout the vessel. Wireless on/off switches are located on the hose rack for easy operation. This entire system is connected to a motor capable of creating vacuum on the entire line. A facility designing this system will need to ensure that the distance between the hydrants and length of hose on the rack is appropriate to reach all vessels. If two vessels are housed in each slip it may be necessary for hydrants to be placed at the junction of each set of fingers (see image to left below). However, if each slip houses one vessel, the distance between the hydrants should be twice the width of the widest slip on the dock or every other slip.



Cost	Effectiveness
\$14,150 + ■	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>



Mobile Pumpout Options

Pumpout Boats—In many areas of California, boaters can have their sewage removed by a mobile service. These vessels have been retrofitted to hold a large quantity of sewage and can typically pump out dozens of vessels before having to discharge into a dockside pumpout system. This service can be provided by boating facilities either by contracting with a pumpout company, by operating their own vessel on site, or simply allowing mobile companies on premises as a service solicited by boaters individually.



There are benefits and drawbacks to each of these setups, but the benefits of mobile pumpouts are very clear. One of the largest obstacles boaters site when asked about their sewage discharge is convenience. The act of moving a vessel from it’s slip, navigating the waterways to the dockside system, and back takes time and is not necessarily an easy task in confined waters. If a pumpout is already being used, or there is a line, it is likely that boaters won’t bother to wait for the system in favor of coming back another day or possibly discharging overboard. Mobile pumpouts are a great solution as they can be provided when boaters are not at the facility. This hands free option is relatively inexpensive and can be a very attractive addition to a boating facilities compendium of services.

Contracted Services

Cost	Effectiveness
Negotiated	✓✓✓

Marina Operated

Cost	Effectiveness
Vessel + staff time	✓✓✓

Boater Solicited Services

Cost	Effectiveness
\$0	✓

Mobile Tanks— These systems are completely self contained and are composed of a 20—40 gallon tank, a motor, and a hose. These systems are mounted to hand trucks, carts, or other devices to assist users in moving them to their vessels by way of the dock. These mobile tanks must be complimented with a disposal system for the stored material. This could include either a dockside pumpout or a larger, land based tank that is serviced by sewage hauling trucks.



These systems are ideal for smaller facilities. If mobile vessels aren’t available in your region or the number of vessels in your facility doesn’t justify the expense of a large system, this is a viable alternative. However, these systems are not recommended for facilities that have unsteady or narrow docks. It is recommended that the boaters using them receive training before using them as they can be difficult to maneuver and use.

Cost	Effectiveness
\$6,000—\$10,000	✓✓

MANAGEMENT

This section explores the management measures that boating facilities can employ to curb sewage discharge. These are meant to be implemented to supplement the technologies in the previous sections. This combination will work to increase the overall effectiveness of your sewage management plan. These management measures will typically require staff time to develop and get started but take little time to implement once your system is up and running. It is important to work with your tenants closely to prepare them for any major changes to your current operating procedures. This is especially important if you plan on implementing an inspection program. This rating system uses staff time instead of estimated cost.

Orientation

This is the most basic programmatic step a boating facility can take to curb sewage discharge. New tenants are typically offered a brief orientation of boating facilities before or after signing a contract for a slip. During this orientation, information can be included on the facility's pumpout system or ones that are close by if there is not one on site. Ideally, a demonstration of the system and information including maps of local pumpout stations should be included. This program can be integrated in the facility walk-through and new tenant packages with little to no cost. Informational resources can be obtained through local non-profits and boating agencies.

Time Required	Effectiveness
30 min per Boater	<input checked="" type="checkbox"/>

Waste Disposal Tracking

This program is meant to compliment dockside pumpout systems and is used by boating facilities to ensure liveaboards comply with no discharge laws within the facility. Compliance assistance requires some staff time, but can be implemented at little cost. Simply put, liveaboards are asked to choose any of the three options listed below to log their method of sewage disposal.

1. Use a mobile pumpout service and either supply receipts or have the mobile pumpout company supply documentation for proof of service
2. Call the front office when using the pumpout
3. Allow the harbor master to place a dye tablet in the holding tank monthly
4. Require an annual inspection of the Y-Valve and secure it in the off position using a non-releasable, numbered zip tie.

These options are not time consuming for boaters and will provide management with the information needed to detect possible overboard discharge. Boating facilities can use the sample form in the appendix to track the methods used by liveaboards to dispose of their sewage.

Time Required	Effectiveness
3 hours per Year	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

Inspections

Inspection programs are one of the most thorough of the programmatic options listed in this section and are one of the most effective ways to combat overboard discharge, both accidental and otherwise. They require careful initial implementation. It is suggested that if a boating facility wishes to implement an inspection program that they give boaters plenty of notice through meetings, newsletters, and emails. By involving your boaters in the development of this program and explaining its necessity, buy-in is much easier to obtain.

Some boating facilities only inspect liveaboards, while others have chosen to inspect all boats with a holding tank. If the latter option is chosen, it is suggested that the implementation be phased, initially starting with liveaboards and then moving on to recreational boaters. This phased approach will give the managers a chance to test their program out on a smaller group of boaters before ramping up to the entire facility. It will also allow your recreational boaters to see how the program is implemented and become more comfortable with the process before they are asked to participate.

The following list of steps is a good framework to start with but can be adapted to a facility’s specific needs by adding or altering the elements. Boating facilities can choose to hire a contractor that has the skillset to inspect MSD systems or, if the facility has trained staff, they can conduct the inspections themselves.

- 1. Inspect all new tenants – this will introduce the new berther to the program and will normalize the process.
- 2. Inspect the Y-valves and MSD systems annually to ensure they are not configured to discharge overboard
- 3. Once the system is found to be correctly configured, use a numbered zip tie or other trackable, durable mechanism to secure the Y-Valve in the off position.
- 4. If a boat leaves the area and wishes to remove the numbered zip tie or other durable mechanism, ask them to let the boating facility office know so that it can be replaced upon return.

Some facilities have even asked liveaboards to leave their slip and travel to an appointed location, a guest dock for example, to ensure that they are capable of getting underway in case of an emergency. This is one of many examples of how an inspection program can be tied into other aspects of normal operations. Please refer to the appendix for examples of forms that other facilities currently use to inspect their vessels

Time Required	Effectiveness
1 hr. per Vessel	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

Contracting Mobile Pumpout Services

This option relies on contracted mobile pumpout services to service berthers and is very effective at ensuring sewage is not discharged by your tenants. Pumpout companies typically rely on direct one on one interaction with boaters to conduct business. Many boating facilities have found it more effective to offer the service to boaters (at no cost per use) and contract directly with these companies. This allows boaters full access to these services on a regular basis that can be marketed by facilities as an alluring feature. In addition, if facilities without pumpout systems are reluctant to install them, this is an effective alternative to having a physical pumpout on site.

There are several ways to finance this service and this program can be scaled to meet your facility’s needs. By working directly with these companies to offer pumpouts to a large number of boaters, facilities have negotiating power over prices. Boating facilities can pay for the service directly if their revenue streams are ample enough to do so, or they can alter slip fees to offset some of the cost of the new, convenient service.

Time Required	Effectiveness
8 Hours per Year	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

IMPLEMENTING A PROGRAM

Technology + Management

This section explores the combination of technologies and management practices that have been employed at boating facilities throughout California. This is meant to be a guide for managers to easily select a plan that can be implemented at their facility with the resources available to them. These plans include the approximate cost of the program with and without grant funding. They also include a guide that indicates the plan's relative potential to proactively prevent sewage discharge successfully. This section is meant to give you enough information to make an informed decision without overwhelming the reader with detail. For more information, please see the above sections or the associated appendices.

Pumpout and Orientation

This is the most basic approach a boating facility can take to curb sewage discharge. Almost all other plans mentioned in this section rely on this first step. It is also the least expensive and requires less time to implement than plans that include a programmatic approach. This is a great first step for a facility that currently has no plan in place to address sewage discharge. Depending on the size of the facility, one or more pumpouts may be appropriate. Smaller locations may prefer contracting mobile pumpout services in stead of installing this infrastructure if dock space is an issue.

These pumpouts can be maintained with minimal effort by including inspections with weekly or monthly meter readings for power and electricity, or with other standard boating facility practices. A brief, 20 minute inspection once or twice a month will allow managers to detect early problems including drops in vacuum and pumping speed. Clean Vessel Act maintenance and repair grants are available in addition to installation grants and can help offset most of the cost associated with keeping pumpouts up and running for boaters.

	System Cost	Yearly Maintenance Cost		Staff Time Required
Without Grant	\$8,000 — \$12,000	\$500 — \$1,000		
With CVA Funds	\$2,000 — \$3000	\$125—\$250	Orientation	30 minutes per new boater



Pumpout with Inspections

This option is similar to the one above but includes the inspection of vessels at your facility. These inspections should occur yearly and, depending on the extent of your program, can be limited to liveaboards or can include all vessels with toilets on board. Inspections take time and funding to complete but is an excellent tool in detecting bad actors and addressing overboard discharge within your facility.

	System Cost	Yearly Maintenance Cost		Cost for Inspections	Staff Time Required
Without Grant	\$8,000 — \$12,000	\$500 — \$1,000	In house	Staff Time	1 hour per vessel per year
With CVA Funds	\$2,000 — \$3000	\$125—\$250	Contracted	\$60-\$100 per vessel	8 hours for contracting



Pumpout with Tracking

This plan can be used to impose some of the responsibility on the boaters themselves rather than relying solely on marina staff. This requires that boaters report to the boating facility office when they are using a pumpout or when they have been serviced by a mobile pumpout vessel. If the boater chooses not to do either, they can opt for a monthly dye tablet or a yearly Y-valve inspection. This plan requires management to keep a tracking sheet but requires little time to actually implement as most boat owners will opt to inform the office when they dispose of their sewage. This option can be limited to just liveaboard populations or it can be expanded to the entire facility.


	System Cost	Yearly Maintenance Cost
Without Grant	\$8,000 — \$12,000	\$500 — \$1,000
With CVA Funds	\$2,000 — \$3,000	\$125—\$250



	Staff Time Required
Tracking	15 minutes per month

Contracting with Mobile Services


This is one of the best options for marinas that have limited time to manage their programs or for those facilities that do not have space for sewage pumpouts. Contracting with a mobile pumpout service will allow you to obtain pumpouts at a discounted rate that can be partially or fully paid for by slip fees. This can also be marketed as an attractive amenity. Imagine being able to tell prospective berthers that they will never have to deal with sewage disposal again if they decide to join your boating facility!



	Number of Pumpouts per month	Rate
Liveaboards	2-4	The prices are regionally dependent. In CA, these prices range from \$20 per pumpout to \$60 in more rural areas. Negotiate for best bulk rate.
Recreational	0-2	

In-Slip System with Orientation

Although this alternative almost exclusively relies on technology accompanied with an explanation, it is incredibly effective and is unobtrusive to the boaters. These systems need to be accompanied with an orientation as they are relatively unique but do not require a significant amount of staff time afterwards. Due to their size, these systems may need to undergo more maintenance per year. These maintenance costs are greatly reduced if CVA grant funds are used.



	System Cost (Pumpout motor serves up)	Additional cost (Piping and	Yearly Maintenance Cost		Staff Time Required
Without Grant	\$14,150	\$6.90/ft	\$500 — \$1,000	Tracking	30 Minutes per new boater
With CVA Funds	\$3,540	\$1.72/ft	\$125—\$250		

SAMPLE CONTRACT LANGUAGE

There are a number of places a marina can use language to inform boaters that sewage discharge within the marina is against the law and against marina policy. Notification boards and installed signage are very visible ways to remind boaters of these policies, but this language should be memorialized in the facility rules and regulations and wharfing agreements. This section has some sample language that marinas can include in their administrative documents that will allow them to build a solid platform of protective policy meant to protect water quality. This language is meant to provide a starting point for facilities to address sewage discharge and is not meant to be universally comprehensive. Additionally, if a marine facility has implemented management measures meant to proactively address sewage discharge as described in this document or otherwise, those programs should be described in the facility rules and regulations. It should be noted that this language should be included, where appropriate, in agreements with vendors operating within boating facilities.

All marine facilities should ensure their berthing language and their associated rules and regulations comply with all federal and state requirements. Any underlined language is subject to change depending on local and state regulations and facility amenities.

Sample Language: Facility Rules and Wharfing Agreements

The following rules are for the safety and comfort of everyone, and are mostly restatements of government ordinances. The Harbor reserves the right to update lease rates as well as revoke permission to enter the facility at any time. This applies to members, guests and visitors.

Owner agrees to comply with all applicable laws, ordinances, rules, regulations and instructions of the U.S. Coast Guard and other Federal, State and Local authorities. "Owner" includes any person associated with the owner of a Vessel including family members, invitees, agents, employees and licensees on Harbor premises. We are concerned about the local marine environment and remind you that there are numerous Federal, State and Local regulations regarding discharge of any material into the water, including treated and non-treated sewage. Any vessel found to have caused an improper discharge into the Bay will be asked to leave the facility.

No solid or liquid material may be thrown, discharged or deposited from any vessel. This includes refuse matter, oily bilges, and flammable liquid or sewage waste materials. Battery acid, hydraulic fluids, oil, paint and thinners, and anti-freeze are considered hazardous materials, and may not be placed in or around the dumpsters. Disposal of these items may be facilitated by the Harbormaster, and in all cases is the berther's responsibility.

Federal, State and local regulations prohibit the discharge of treated or non-treated sewage into the waters of the marina.

All sewage systems on vessels must be US Coast Guard approved and secured to prevent discharge. Marine toilets on vessels without holding tanks or equivalent devices must be rendered inoperable at all times when moored at the Marina. Boats with marine toilets equipped with an adequate holding tank, incinerator recirculation device or other equivalent approved device must be operated so as to preclude discharge of sewage or chemicals into the waters of the Marina. These wastes must be discharged into a sanitary sewer system or mobile pumpout vessel for proper disposal. The owner shall allow the Harbormaster to inspect sanitary systems from time-to-time upon demand to ensure the vessel is in compliance with facility, local, state, and federal rules and regulations.

This facility enforces local, state and federal regulations pertaining to marine sanitation devices and the illegal discharge of boat sewage. Pumpout facilities are provided for the convenience of our boaters. If you need instructions on use, please contact the harbor office. There are also mobile pumpout services available at our marina. If you need the contact information for such companies, please contact the harbor office. There shall be no illegal discharging into the harbor waters. Anyone discharging boat sewage into the harbor will be asked to leave. The owner may also be reported to appropriate regulatory authorities.

Location of Sewage Pumpout(s): _____

Hours of Operation: _____

Cost: _____

Number to report problems or get assistance: _____

FUNDING ASSISTANCE

Clean Vessel Act Grant

In 1992, Congress passed the Clean Vessel Act to help reduce pollution from vessel sewage discharges into U.S. waters. State Clean Vessel Act Grant Programs (CVA) across the nation provide boating facilities with funding for the construction, renovation, operation, and maintenance of pumpout and dump stations to service recreational vessels. These CVA grants will fund up to 75% of project costs associated with the actions listed above. The other 25% of project costs must be funded by the facility by way of materials, staff time, or payments for equipment or contractors. Please read below for more information. If you have any questions regarding this program, contact your state CVA administrator. You can find a list of state contacts at the State's Organization for Boating Access website: <http://www.sobaus.org/resources/resources.html>.

Who

Both public and private boating facilities are eligible to receive these funds so long as their facilities are open to the public.

What

The Clean Vessel Act Grant, administered by the Division of Boating and Waterways, **covers up to 75%** of new pumpout installations or 75% of the maintenance and repair costs of existing pumpouts.

Funding

Grant funds – 75%

Once grant funds are awarded through the application process, boating facilities can request reimbursement for project expenses including new equipment, or the renovation of existing equipment, as well as necessary pumps, piping, lift stations, on-site holding tanks, pier or dock modifications, signs, permits, and other miscellaneous equipment needed for a complete and efficient station. The Grant will not pay for restroom facilities, sewage treatment plants, septic tanks, leach fields, private and municipal plants, or other special treatment devices.

Boating Facilities – 25%

The facility applying for the funds will be responsible for 25% of the total project costs. This “match” can be contributed in staff time, in kind, or cash. For example, if a facility has staff on site that can install the new system, the hours the staff person works on this system can count towards this match requirement. Additionally, if a facility has piping on hand that they can use to install the system, these materials’ value can be considered “in kind” match. It is encouraged that applicants work with DBW to explore opportunities for match before beginning the application Process

Grantee Responsibilities

1. All recreational vessels must have access to the pumpout and dump stations funded under this grant program. The grant recipient shall guarantee that the facilities will be operated, maintained, and be accessible to all recreational vessels for the full period of their useful life (seven years).
2. A sign depicting the national pumpout symbol shall be installed so as to be clearly visible to boaters. You can include this cost in your total project cost estimate in your application!
3. An informational sign shall be installed at pumpout and dump stations. The sign information should specify the fees, restrictions, hours of operations, operating instructions, and a contact name and telephone number to call if the facility is inoperable. The sign shall also acknowledge that the facility was constructed or improved with funds from the Sport Fish Restoration Program, through the California State Parks Division of Boating and Waterways.

APPENDIX



Pumpout Installation and Technology Guide

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Introduction:

This report is meant to provide CVA grant managers with information regarding pumpout system selection and installation. Diagrams have been included where pertinent and a glossary of terms is included at the end of this document for your convenience.

This document is intended to provide a basic understanding about the different types of pumpout systems and the considerations that need to be taken into account when planning facilities for recreational vessels. This is not meant to be an exhaustive installation guide nor is it meant to provide the technical specifications of the various pumpout systems. The guidance here is applicable to most makes of pumpouts and technical specifications provided by the manufacturer should be integrated into any pumpout system installation planning process.

General considerations:

Use

The first parameter to consider when planning a pumpout system installation is the expected use and size of the vessels anticipated at the facility¹. Everyday use and seasonal peak use need to both be considered.

Placement and System Design

The primary concern with the placement of any pumpout station is convenience. Boaters will not use a pumpout that is difficult to get to or frequently crowded. Placement of the hose rack/control station (hose rack) is critical to ensure the system is used. Marinas should avoid placing the pumpout access in the back of a marina or tucked away in a small slip or berth. The pumpout should be located so that there is plenty of maneuvering room in front of the dock on which it is placed and in a location that is easy to get too such as an end-tie or adjacent to a channel.

Begin by considering the location of the essential system parts (Hose rack/control station(s), pump, piping, etc.), and the point of sewage discharge. The distance (both horizontally and vertically) between the various components of the system will also need to be determined. This will provide the necessary information to help size the required pump, motor, and piping to meet the site conditions.

There are a host of site specific considerations to take into account when designing a pumpout system including vertical and horizontal distance between main components,

¹ For the intent of this document a recreational vessel's sewage holding tank capacity is assumed to range from approximately 10 – 60 gallons. Commercial vessels, mega-yachts, and large houseboats are often equipped with holding tanks that can store hundreds and even thousands of gallons of waste. Facilities to handle these capacities will require special design considerations that are beyond the scope of this document.

friction loss, tidal variation, and discharge requirements to name a few. If the marina or program manager is not experienced in designing pumpout systems it is recommended to work with someone experienced in doing so or with a pumpout equipment manufacturer directly to design your system. Most manufactures will design a system for you.

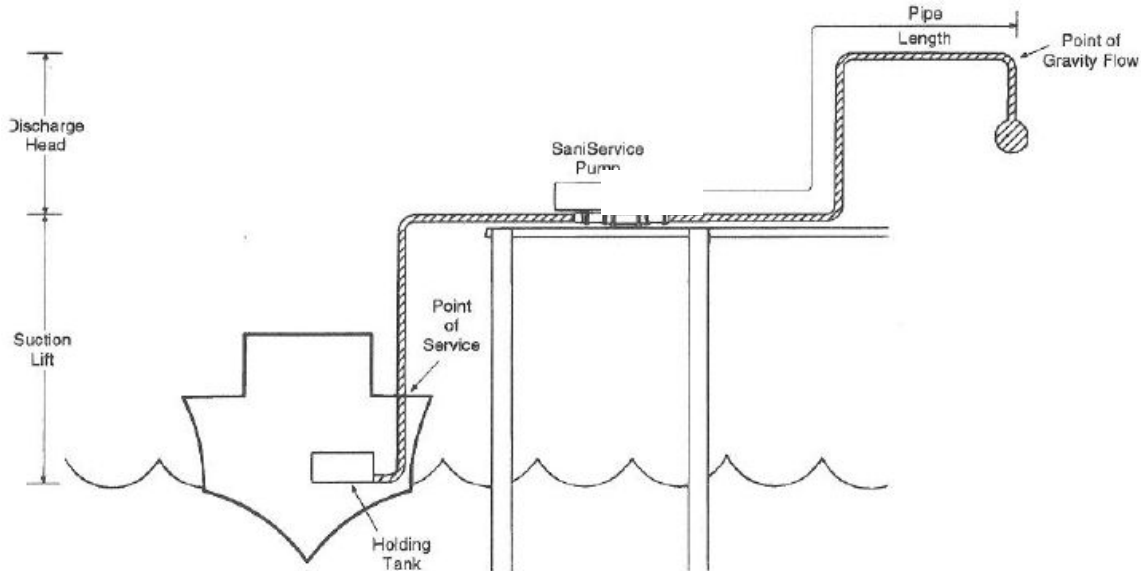


Figure 1 - Example of Required Design Information

Pumpout System Options

Pumpout systems are typically sited as a stand-alone feature within a marina. They are located on their own dock so that there is sufficient space for a boater to tie-up to and not affect other boaters around them.

Single Point Pumpout System

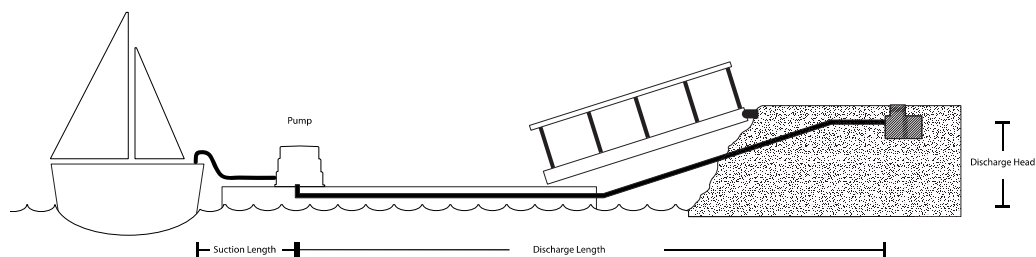


Figure 2 – This diagram shows the pump system (hose station and pump) as one unit, at the point of service.

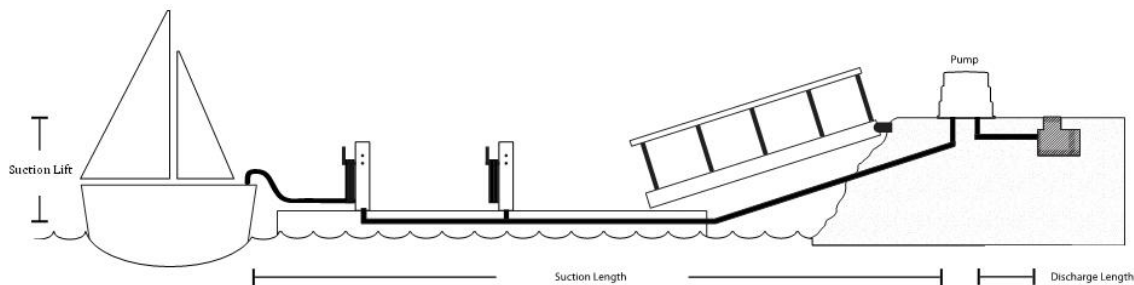


Figure 3 – This diagram shows the pump as two separate entities. The hose rack is at the point of service while the pump is set apart, either at the end of the dock or it can be located landside.

Pumpout stations can also be paired with other amenities to save space and/or provide the added convenience of several services in one location. By utilizing the same dock for several services, boaters have a one stop shop for their needs and are more likely to use them.

This is a very common arrangement as the marinas can increase services without increasing space requirements (dock and water footprint). When pairing different systems at one location it is important to provide sufficient dock space between the different uses so that one boater doesn't interfere with the availability of both facilities at one time.

Pairing gas dispensers with pumpouts further encourages boaters to use the resource. When combining the fuel dispensers and pumpout equipment on the same dock the marina operator should be aware that the area around a fuel dispenser is considered a hazardous area as defined by the National Electric Code (NEC). Follow the National Electric Code (NEC) requirements for explosion proof motors and controls for equipment within specified distances from the fueling equipment.

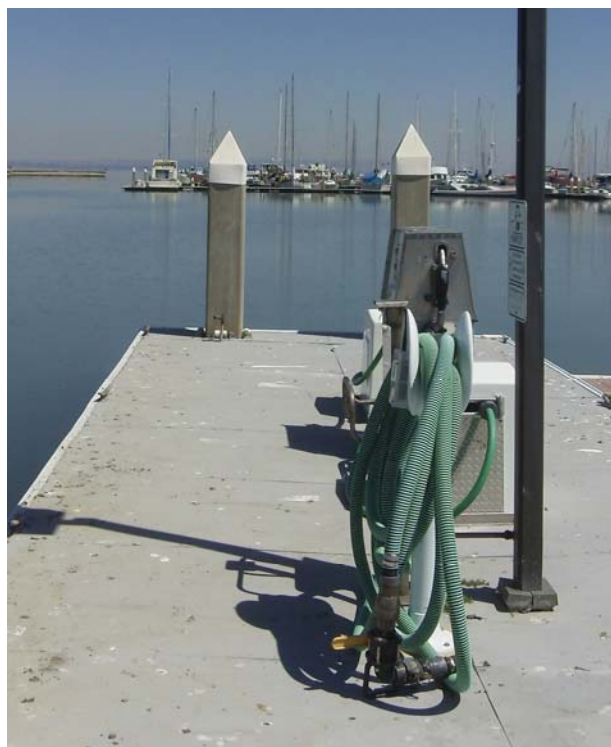


Figure 4 – Combined pumpout station and fuel pump dock. The space around this pump dock allows boaters to easily use both facilities.

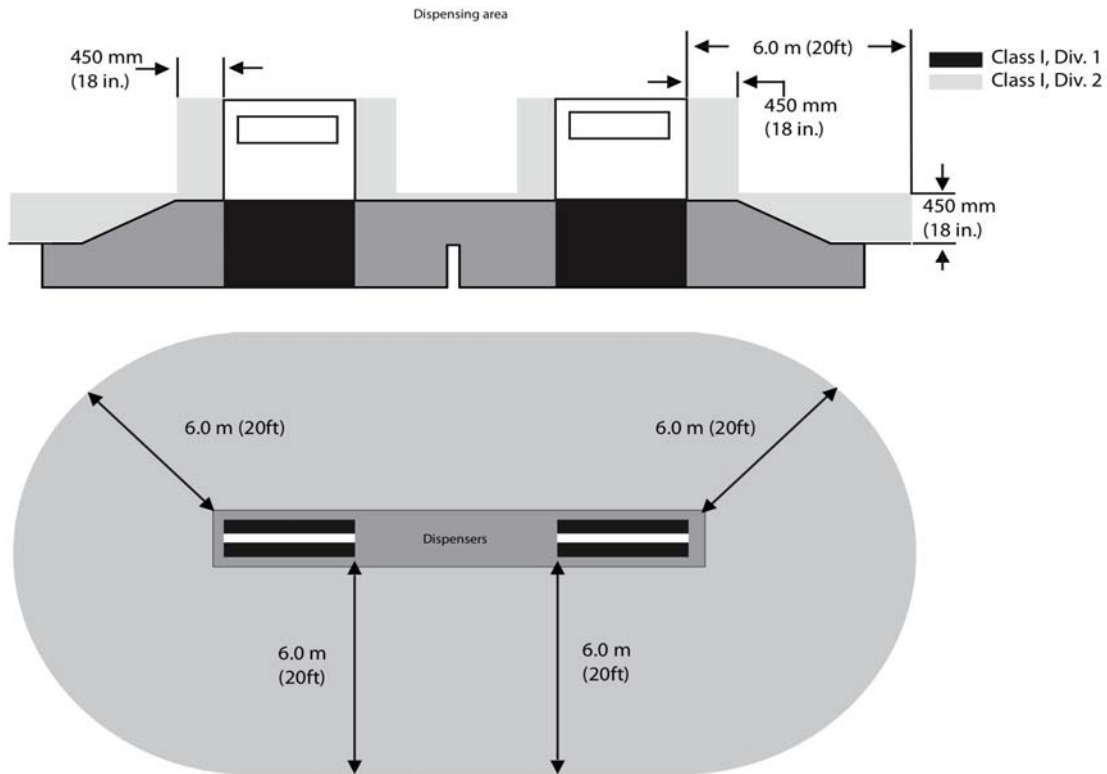


Figure 5 – Hazardous zone surrounding fuel pump dispensers per NEC

Multiple Hose Stations

A single pumpout unit can also be plumbed to multiple hose stations; either located together on one dock or located at several different locations within the marina. This can provide easier access to the pumpout system, especially during busy boating periods. There are limitations to multiple hose station configurations. It is very important to work with the manufacturers when designing such a system so that the final installation performs at an acceptable level.

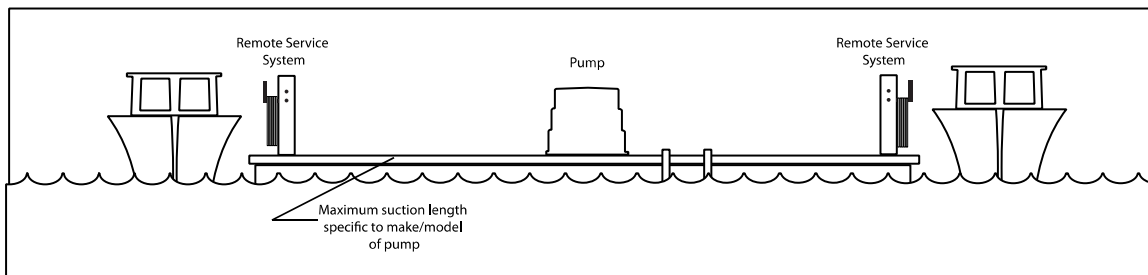


Figure 6 – Multiple Hose Station Layout

In-Slip Pumpout Options

Another option available to marinas includes in-slip pumpout systems. There are several variations to this type of system. Examples include:

Option 1: The marina installs a centralized pumpout station with multiple pumpout ports/hydrants located thru-out the marina, and spaced (approximately 40ft - 60ft apart) so that a portable hose can reach from the hydrant to each nearby vessel. The pumpout hose is then mounted on a mobile cart. The cart with the hose is then wheeled to each boat as it needs pumpout servicing. The hose is unreeled and connected to both the hydrant and boat to be serviced. The pumpout station is then activated and produces the required vacuum to empty the boats holding tank. Wireless transmitters are also available that allow convenient on-off operation without the need for someone to run back to the pump each time it needs activating.

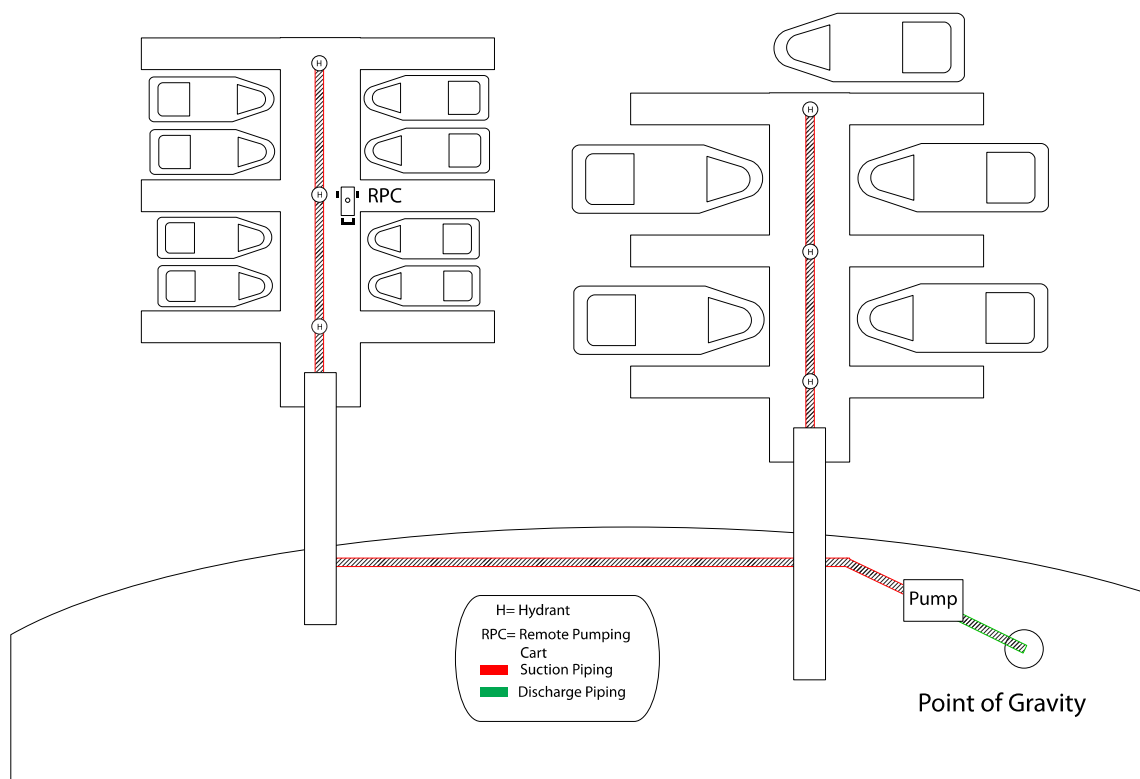


Figure 7 – Shows two fingers of a dock that have an in-slip pumpout system. The hydrants are plumbed together underneath the docks and hook into the pump system. A mobile hose cart* is wheeled to the hydrant closest to the slip that houses the vessel needing a pumpout. The hose on the cart is hooked into the system through the hydrant and is then used to pump out the contents of the vessel using a wireless on/off switch to activate the pump. *[The cart may be equipped with a pump/hose combination or just a pumpout hose. See Options 1 and 2.]

Option 2: The marina installs multiple pumpout ports/hydrants thru-out the marina, and spaced so that a portable hose can reach from the hydrant to each nearby vessel. A mobile cart containing both a sewage pump and hose is then wheeled to each boat as it needs pumpout servicing. The hose is unreeled and connected to both the hydrant and boat to be serviced. The sewage pump is then activated and uses the hydrant and piping system to discharge the boats holding tank contents.

Option 3: The marina uses a mobile cart that is equipped with a sewage pump and small holding tank (typ. 20-40 gals). This cart is located on the docks and is wheeled to each boat as it needs pumpout servicing. The cart, now loaded with sewage is then wheeled to a hydrant located somewhere on the docks and the pump is now used to discharge the sewage landside for disposal and/or treatment.

This type of system is strongly discouraged due to the hazards and added liability placed upon the marina with such a system. This system requires a trained individual to operate the equipment and the loaded cart can weigh 300-500 hundred pounds. Extreme care needs to be exercised while maneuvering the cart along the docks.

Disadvantages:

- a. Requires trained personnel to operate.
- b. Dock and finger widths must be sufficiently wide to allow safe passage of cart.
- c. Loaded cart is heavy and can be difficult to maneuver safely.
- d. The possibility of the cart falling into waterways increases liability.
- e. Requires double handling of sewage.

Sewage Discharge / Treatment

Once the sewage is removed from the boat it is typically transported through the dock piping system landside for final treatment and/or disposal. In most metropolitan areas the sewage discharge piping will be tapped into the municipal sewer conveyance system and no further action is required on the part of the marina operator.

In areas that are more rural, final disposal of the boater generated waste is typically handled by one of the following methods:

- a. Discharge to a holding tank: Used to temporarily store large volumes of pumped waste for later removal and transport by a licensed sewage hauler to a treatment facility. (Eligible for CVA Grant funding.)
- b. On site treatment: Typically used because of there is no proximal wastewater treatment facility and/or transport of waste is prohibitively expensive.

Before deciding on a system, state and local codes, ordinances and regulations must be reviewed to ensure the suite of options are lawful. In addition, the volume of sewage generated, sewage characteristics, and hydro-geologic characteristics including soil types and ground water flows should be considered. Typical options include:

- 1) On site treatment plants with subsequent discharge to the land or local waters. A NPDES permit is required. NPDES permits can be very costly and permit heavy. Costs are not allowable under CVA grant rules.
- 2) Septic systems: Typically requires a state or local permit depending on jurisdiction. Costs are not allowable under CVA grant rules.

Pumpout System Costs

Costs will vary dramatically based on the pump type selected and the specific site conditions. To ballpark the system costs, it is helpful to begin the process in house. The harbormaster or other qualified staff should assess the possible locations for the pumpout station, hose rack, and the system's discharge point. This will allow the marina to provide a general project layout that includes the estimated feet of piping needed, vertical elevation differences, and the final sewage discharge condition. From here the marina should work with a qualified pumpout equipment installer or manufacturer to generate a project estimate. It is suggested that all estimates build in a 10-20% contingency cost.

Pump Types:

The pump types listed below are commonly found in the pumpout station equipment available from the various pumpout manufacturers.

Peristaltic Pumps

A peristaltic pump is a type of positive displacement pump used for pumping a variety of fluids. These pumps consist of a rotor equipped with a number of rollers or lobes, and a flexible tube fitted inside a circular pump casing. As the rotor turns, a part of the tube is pinched closed and forces the fluid inside to move through the tube in front of the roller. As the rotor rotates, each roller continues to pinch the tube and move more fluid through the pump.

There are two main variations of this system. One has thicker, more elastic tubing while the other has reduced hose thickness coupled with a vacuum inside the casing to encourage hose reconstitution after the roller passes over. These variations have their own benefits and drawbacks that should be considered by marinas assessing pumpout options.

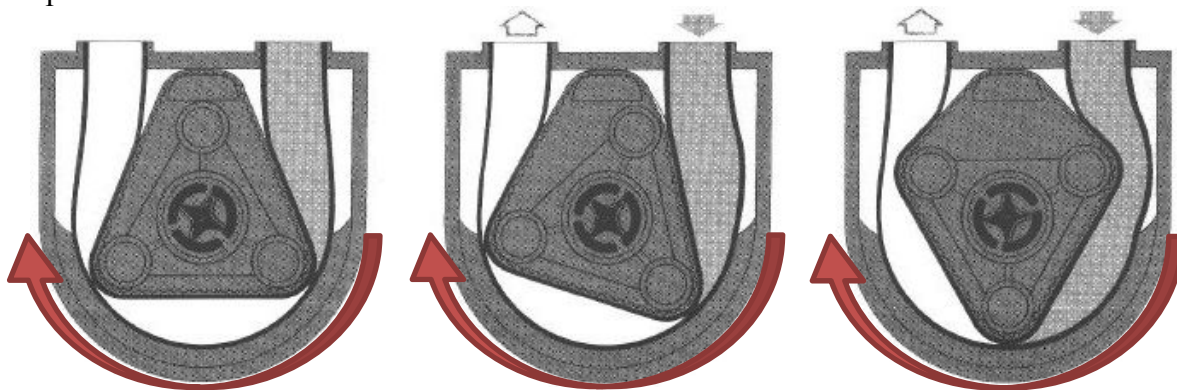


Figure 8 - Shows the peristaltic pump operation. The sequence shows the rollers rotating in a clockwise fashion, moving the material from the right, inlet, to the left, discharge.

General Statistics (approximate)

Dry suction lift: 20 ft. maximum

Discharge Height: 120 ft. (greater discharge heights can be obtained but will require upgraded piping materials.)

Average pumping rate: 20 – 40 gpm. (Greater flow rates are available.)

- **Pros -**

- Very durable
- Long life
- Can pump distances of up to several thousand feet and can accommodate 600 ft. of vertical head. This distance requires special piping and connections.
- Can be placed landside or dockside
- No suction or pressure valves that can get stuck by trash and other unexpected materials
- No moveable seals to the outside
- Insensitive against liquids interspersed with solids or aggressive, abrasive, and long fibered mediums
- Easy to clean – the peristaltic hose is the only part in contact with the pumped medium

- **Cons**

- Higher initial cost compared with some other types of equipment
- Greater power requirements compared to other equipment.
- Existing marina power panels may limit new power requirements
- Higher maintenance costs

Diaphragm Pumps:

The diaphragm style pumping system is a positive displacement pump that uses a diaphragm and two opposed check valves to move liquid. The diaphragm is composed of a pliable material, typically rubber that is connected to a piston. As the piston pumps up and down, vacuum and pressure are alternately created. Respectively, this opens the intake valve to introduce sewage into the chamber and then pumps the material through the second check valve into the piping leading to the point of gravity flow. Refer to figure 9 for detailed operation.

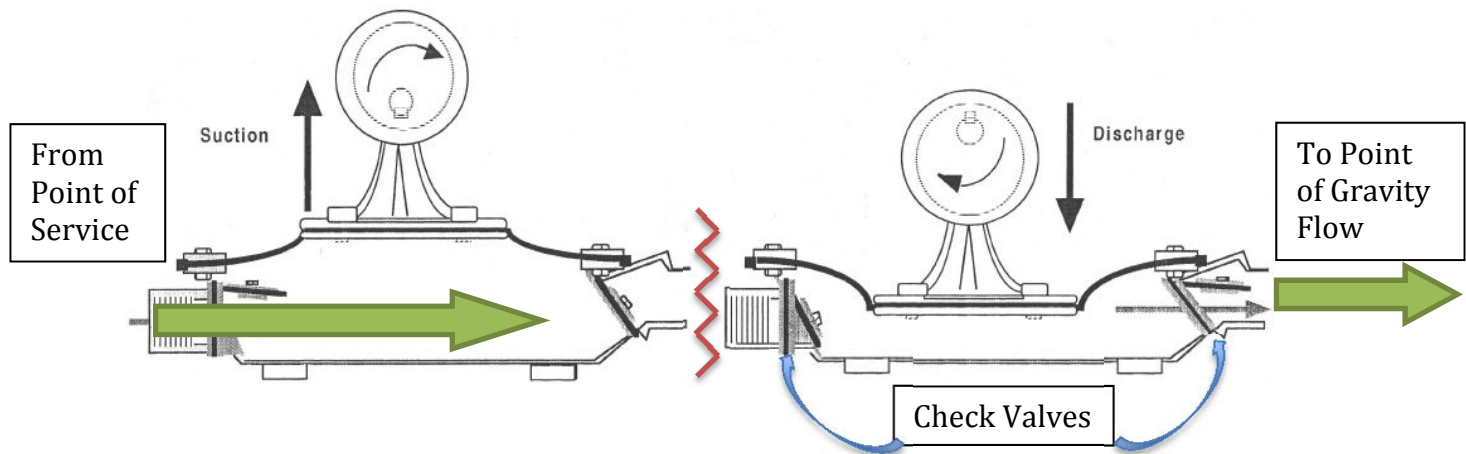


Figure 9 - Shows the diaphragm operating cycles. The left side shows the pump as the diaphragm is raised by the motor which creates a vacuum within the pump. This in turn draws the sewage into the pump. The right view shows the same pump in the discharge position. As the motor forces the diaphragm down the sewage is forced out of the opposite side of the pump and into the discharge piping. Notice the check valves do not allow material to flow in the opposite direction.

General Statistics (approximate)

Suction lift – 20 ft. maximum

Discharge Height – 30 ft. maximum

Average pumping rate: 15 – 30 gpm.

- Pros
 - Low initial pump cost.
 - Can be placed landside or dockside.
 - Can run dry without damage to the pump.
 - Self-priming from dry starts.
- Cons
 - These pumps can handle larger suction lifts but are not well suited for large discharge heads.
 - Generally less durable than the Peristaltic systems.
 - Requires frequent maintenance.
 - Valves can get stuck in the open position easily by trash and other debris, leading to system failure when these materials are introduced.
 - System usually takes longer to pump material.
 - The higher the discharge head, the more frequently the check valves must be replaced.

Vacuum Pumps:

These systems use an air compressor to generate vacuum to the hose that discharges into a temporary holding tank. The system then reverses, creating pressure to expel the waste out of the holding tank and into a sewer or septic system. These systems have many pros and cons and can be used in some circumstances to overcome unique barriers such as long distances to discharge points or large vertical draw requirements.

Considerations

The farther the pump is located from the point of service, the more vacuum will accumulate in the piping system. This leads to quicker pumping times but can also result in an intense physical shock that is transmitted into the pipe system each revolution of the pump. When installing piping, this shock needs to be accounted for with additional pipe hangers, and the use of flexible transitions instead of rigid bends when able.

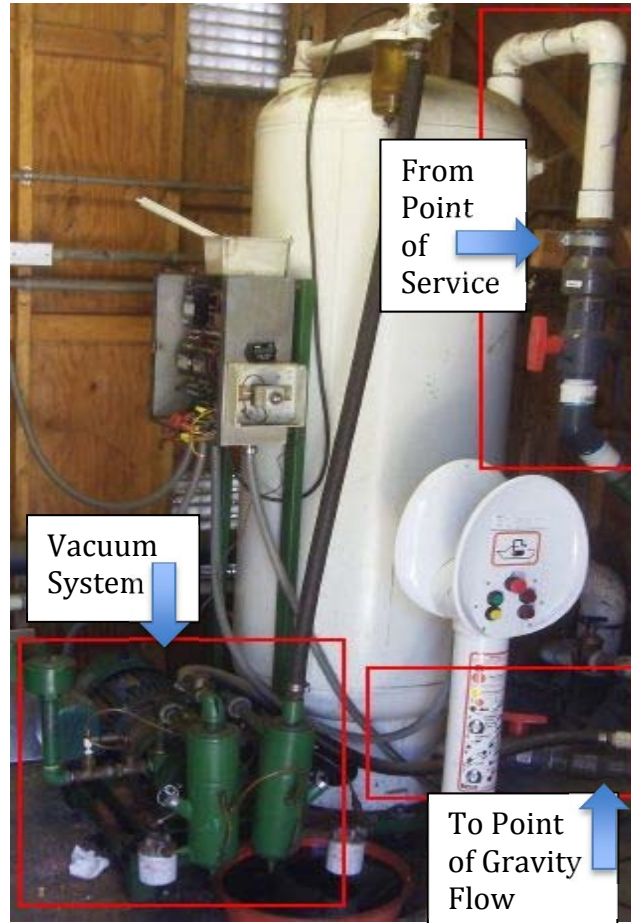


Figure 10: Typical Vacuum Tank system. Tank size varies with manufacturer and site requirements.

General Statistics (approximate)

Dry suction lift #?

Maximum rate (2" hose/piping) #?

Minimum rate (2" hose/piping) #?

- **Pros**

- Can move material over long distances and can accommodate more vertical head.
- Few moving parts to replace inside the pump itself.
- Can remove sewage very quickly.

- **Cons**

- Typically requires a larger footprint or area to house the system in.
- Pump mechanisms have very tight tolerances and can become stuck if not used frequently.
- Difficult to track flow or volume of material moved with meters.

- Lead time on generating vacuum can mean longer waits at pump outs depending on the frequency of use and system specs.
- Has the capacity to collapse boat holding tanks due to large vacuum pressures if used improperly or if boats holding tank vents are clogged.

Pumpout System Piping:

PIPING LAYOUT AND DETAILS:

The most common type of piping used in marina installations is PVC pipe (polyvinyl chloride). PVC piping is readily available, cheap, and appreciated for its durability, longevity, and resistance to wear and tear, rust and rot. PVC pipe is ideal for sewer lines, water systems and underground plumbing. PVC pipe also is impermeable to harmful bacteria and correctly installed can provide many years of satisfactory service.

Other types of piping found in marina installations are HDPE (high density polyethylene), steel, and copper, it is not uncommon to have a piping system that utilizes more than one type of pipe due to the different strengths and weakness of each type.

Always follow the pumpout manufacturer's recommendations for minimum piping sizes and other requirements.

The following sections describe various piping details that should be considered when designing a pumpout system.

Pipe Selection: 2 to 2-1/2 inch schedule 80 PVC pipe is recommended for most installations. Schedule 80 pipe withstands higher internal and external pressures and can be used with either socket (glued) or threaded fittings (can be threaded up to 4 inch size). Schedule 80 pipe does have a smaller internal diameter and consequently greater friction loss than schedule 40 pipe in the same nominal diameter, but this is negligible in most installations. Schedule 40 pipe cannot be threaded and can only be used with socket fittings.

The maximum working pressure is marked on the PVC piping. These pressures are reduced as ambient temperatures increase. The working pressure at 70oF is reduced by 50% at 100oF. Make sure that the operation pressure for your pumpout equipment will not exceed the allowable pipe pressures for your given area and temperatures. In applications where ambient temperatures may exceed 140oF, iron pipe, galvanized steel or equivalent materials should be considered. Pipe Sizing: Pipe sizing for typical applications is shown in the following table:

Pipe Size Recommendations		
Segment	Normal Size	Metric Equivalent
Suction Hose	1-1/2 in.	40 mm
Suction Piping	2 in.	50 mm
Discharge Piping*	2, 2-1/2, 3 in.	50, 65, 80 mm
* Preferred discharge pipe size is 2-1/2., but may be reduced to 2 in. if utilizing existing pipe, or 3 in. If needed to comply with local code requirements.		

Elbows and Bends: Use only long sweep bends and elbows in the piping system. Avoid street ells or other sharp bend fittings wherever possible.

Pump Isolation: Some pumps can produce a low frequency vibration in the piping system due to the pulsating outflow. It is recommended that a segment of flexible hose (PVC or rubber) be installed between the pump and the rigid piping system to absorb normal pump pulsations. Follow the manufacturer's recommendations.

Pipe Support: 2-1/2 inch pipe should be supported every six feet; however, some codes require hangers every four feet. Supports should not be clamped in such a way that will restrain the normal axial movement of the pipe which occurs due to thermal expansion and contraction. Concentrated loads in the pipe system, such as valves, must be supported separately.

Thermal Expansion: Plastic pipe undergoes dimensional changes as a result of temperature variations above and below the temperature at installation. A 2-1/2 inch PVC pipe will expand over one inch per 100 feet every 30°F above the temperature during installation. Conversely, the piping will contract proportionately when temperatures drop 30°F. Temperature variations should be allowed for in initial designs and expansions joints should be inserted if necessary.

Shut-off Valves: A shut-off valve must be installed between the dockside pump and the discharge piping to allow maintenance on the pump. Shut-off valves must be full-flow and approximately sized; ball valves are preferred. Shut-off valves should also be located on the discharge side of any flexible hoses or joints, or other system components which may require replacement or repairs.

Pipe Location: Pump-out discharge lines on docks should be located below water distribution lines if possible. Water and sewer line separation, and sewage line and water source separation requirements are usually set forth in local Health Department Regulations.

Clean Out and Inspection Points: Clean out points provide access to the piping system for maintenance, inspection and removing common obstructions. Clean outs should be

the same size as the pipe and installed at the following locations:

- a.) at the point where the pump connects to the rigid discharge pipe.
- b.) at every change of direction greater than 45°.
- c.) at a maximum of 50 feet in level pipe.
- d.) at the pump side of gangway transition hoses.
- e.) at the base of all vertical runs.

Flexible Transitions: All piping transitions from rigid to floating structures or between two floating structures must use high pressure rubber hose (Goodyear Plicord 150 or equivalent). Hose should be long enough to allow for any tidal swings.

Suction Hose: The ribbed and flexible suction hose that is standard on most pumpout stations creates very high in-line friction losses. Suction hose lengths should be kept as short as possible. An extension hose section can be ordered with lever-operated, quick-disconnect couplings to handle an occasional need for longer service runs.

In-line Check Valves: With very high suction lifts, the hose may trap liquid after the holding tank is empty as a result of run back. In-line check valves may be required to prevent this liquid from filling the suction hose and resulting in excessive weight and cumbersome hose handling. In-line check valves should allow full flow and be designed for handling sewage.

Credits: James Muller, San Francisco Estuary Project
Kevin Atkinson, CA State Parks, Division of Boating & Waterways
Andrew Bleier, KECO Pump and Equipment

List of Pumpout Manufacturers (Appendix?)

Glossary

- **Recreational Vessel** – Watercraft manufactured for operation, or operated primarily for pleasure. This includes any watercraft leased, rented, or chartered to another for the latter's purpose. For the intent of this document a recreational vessel's sewage holding tank is limited in size from approximately 10 – 60 gallons.
[Commercial vessels, Mega-yachts, and large houseboats whose holding tanks exceed the above limits require special design considerations that are beyond the scope of this document.]
- **Discharge/Static Head** – Vertical distance (not total pipe length) from the pumpout outlet to the point of gravity flow.
- **Friction Loss** – Reduction in flow due to friction within the piping and fittings. Pipe sizing considers this parameter. Total Friction loss is referred to as **friction head**.
- **Point of Gravity Flow** – The point in the discharge piping where the pump discharges by gravity flow into a treatment or conveyance system (septic tank, municipal sewer treatment system, etc.)
- **Point of Service** – Where the hose connects to the boat (deck waste fitting)
- **Suction Lift** – The vertical distance from the holding tank on board the vessel to the pump inlet.

Appendix A - Diagrams

Friction Loss

Pipe diameter and roughness will affect the performance of the system. Pump specifications will have a maximum suction lift height, discharge head and pipe length. These design specification are based on the power of the selected motor. Smaller diameters, rougher piping, and 90° angle fittings (as opposed to two 45° angle fittings) will all increase the friction, making your pump work harder to move material. This extra demand on the system will in turn reduce the maximum suction lift, discharge head and pipe length allowable.

When planning a system, a friction loss worksheet should be completed to ensure the system falls within operable parameters.

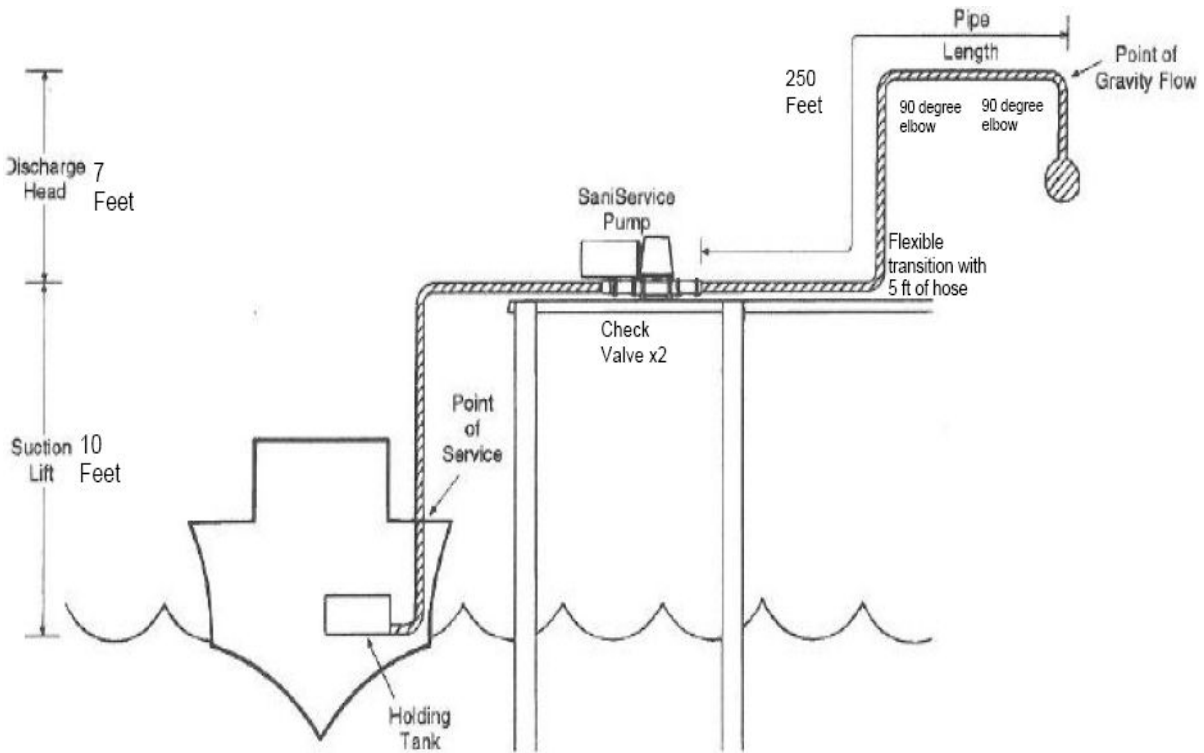
Table I – Example of a friction loss worktable. Refer to Appendix B for a situational example.

Friction Loss Worksheet					
		Friction Loss Factors			
		2 in.	2.5 in.	3 in.	
Friction	Quantity	ft.	ft.	ft.	Equivalent Pipe Length
90° Elbow Standard		5.5	6.2	7.7	
90° Elbow Long Radius		4.3	5.1	6.3	
45° Elbow Standard		2.8	3.3	4.1	
Check Valves		17	21	26	
Cleanout Tee		4.3	5.1	6.3	
Coupling/Quick Disconnect		2	3	4	
Gate Valve or Ball Valve		1.4	1.7	2	
Dock Mounting Hydrant		31.9	31.9	31.9	
Flexible Transition*		12.3+	17.1+	22.3+	
Gangway Hose*		23.3+	29.5+	37.7+	
Total pipe length to be subtracted from max specs					
The loss is measured in pipe length and should be subtracted from the design specs to determine maximum					
* Add an additional one foot in the pipe length lost for each foot of hose					

If the total pipe required is greater than the maximum recommended for the make and model selected, an additional pump or lift station may need to be considered.

Appendix B - Friction Loss Example Worksheet

This is meant to give practitioners an example of how to calculate friction loss and what its implications are on an installation project.



Pipe System Scenario:

All piping is 2.5 inch diameter

1. Pump: Diaphragm (2 check valves)
2. 90 degree fittings: 2 ea. (2.5 in.)
3. Pipe length: 250 ft.
4. Hypothetical Max Pipe length: 500 ft. (Maximum allowable distance. Depends on the type and size of the pump chosen. Obtain from pump manufacturer)

Appendix B - Friction Loss Example Worksheet (continued)

Friction Loss Worksheet					
		Friction Loss Factors			Equivalent Pipe Length
		2 in.	2.5 in.	3 in.	
Friction	Quantity	ft.	ft.	ft.	
90° Elbow Standard	2	5.5	6.2	7.7	12.4
90° Elbow Long Radius		4.3	5.1	6.3	
45° Elbow Standard		2.8	3.3	4.1	
Check Valves	2	17	21	26	42
Cleanout Tee		4.3	5.1	6.3	
Coupling/Quick Disconnect		2	3	4	
Gate Valve or Ball Valve		1.4	1.7	2	
Dock Mounting Hydrant		31.9	31.9	31.9	
Flexible Transition*	1 (5 ft.)	12.3+	17.1+	22.3+	22.1
Gangway Hose*		23.3+	29.5+	37.7+	
Total pipe length to be subtracted from max specs					76.5 ft
The loss is measured in pipe length and should be subtracted from the design specs to determine maximum allowable pipe length.					
* Add an additional one foot in the pipe length lost for each foot of hose					

Example: 500 ft. - 76.5 ft. = 423.5 ft ← New maximum allowable pipe length

The existing pipe length is only 250 ft, putting it well under the maximum pipe length adjusted to include friction loss.

Appendix C – Sample Pumpout Station Specifications

MINIMUM SPECIFICATIONS FOR DIAPHRAGM PUMPOUT STATIONS

PUMPOUT STATION- Diaphragm Type

- A. PUMP** - The pump diaphragm shall be constructed of Nitrile. The pump body shall be constructed of marine grade bronze or epoxy coated aluminum. The drive rod shall be stainless steel and be connected to the diaphragm plate by a stainless steel bolt and locking washer. The pump shall provide a minimum flow-rate of 10 GPM with 30 feet of pumpout hose (see below) plus 6 feet of suction lift and 10 feet of discharge head. Discharge side of the pump out shall be a minimum of 1-1/2 inch nominal inside diameter.

The pump shall be operated by: (a) one green “ON” push button with a 10 minute automatic shut-off timer and one red “OFF” push button. The automatic timer shall be preset at 5 minutes. Or (b) one large mushroom head on-off push button with an automatic 10 minute shut-off timer. The automatic timer shall be preset at 5 minutes.

- B. MOTOR** - The motor shall be totally enclosed, fan cooled, minimum 3/4 HP, 110 volt, 1 phase. Explosion proof where required.
- C. FRAME** - The frame shall be made of one of the following: (a) Series 300 stainless steel, (b) Structural steel, hot dipped galvanized or epoxy coated after fabrication, (c) marine grade aluminum alloy.
- D. ENCLOSURE** - The enclosure shall be easily removable for component servicing and shall be constructed of minimum 18 gage Series 300 brushed stainless steel, marine grade aluminum, or reinforced fiberglass. The reinforced fiberglass shall be UV and ozone stable, fade resistant, and shatter proof. The enclosure must be able to with stand a point load of 200 pounds without failure or stress cracks. The enclosure shall not enclose the pumpout hose.
- E. HOSE HANGER** - An external hose hanger shall be provided. The hanger may be an integral part of the enclosure or bolted securely to the enclosure. The hose hanger shall be able to hold 30 feet of 1-1/2 inch diameter suction hose. The hose hanger shall be made of stainless steel, aluminum, hot dipped galvanized steel, or fiberglass.
- F. PUMPOUT HOSE** - The pumpout hose shall be of minimum 1-1/2 inch nominal inside diameter, 30 feet in length, reinforced flexible hose. The hose shall be able to withstand a full vacuum of 29 inches of mercury, a maximum working pressure of 20 psi, and an operating temperature range of -40° to 140° F. The hose shall have a smooth interior to prevent the collection of solids and be non-kinking,

collapse proof and flexible. The hose shall have excellent ozone, UV, sewage, seawater, and petroleum resistance.

The pumpout hose shall be equipped with a heavy duty vandal resistant nozzle assembly. The assembly shall include the following: hose adapter, cam action coupling, ball valve, universal suction nozzle, and a clear plastic site tube.

- G. HOUR METER** - The pumpout station shall come equipped with an hour meter which records the accumulative usage of the pumpout station. Capacity of the hour meter shall be a minimum 9999.9 hours. The hour meter shall be mounted so that it is easily readable without removal of the enclosure.
- H. MONITORING SYSTEM** - All pump-out systems shall be provided with a cellular-based, real time monitoring, data collection and reporting system. The monitoring system shall be (1) MarineSync MS1 - Plug & Play Package w/2-Year Data Plan (p/n MSO101.002). MarineSync Corporation, (888) 988-7962; (2) PumpWatcher Co. [(727) 641-1936] Monitoring System #PW-RS1 w/2-Year Data Plan or approved equal.

Monitoring systems shall be factory installed by the pump-out manufacturer. The monitoring system shall be fastened directly to the pump-out frame, enclosure or exterior support post and installed in compliance with the National Electric Code (NEC).

Appendix C – Sample Pumpout Station Specifications

MINIMUM SPECIFICATIONS FOR VACUUM TYPE PUMPOUT STATIONS

PUMPOUT STATION- Vacuum Type

- A. VACUUM PUMP** - The pump body shall be constructed of cast iron and may be of oil-less or oil lubricated operation. The pump shall be capable of a minimum sewage flow rate of 10 GPM with 30 feet of pumpout hose (see below) plus 6 feet of suction lift and 10 feet of discharge head. Discharge side of the pump out shall be a minimum of 1-1/2 inch nominal inside diameter.
- B. MOTOR** - The motor shall be totally enclosed, fan cooled, with thermal overload protection, minimum 1/3 HP, 110 volt, 1 phase. Explosion proof where required.
- C. CONTROLS** - Vacuum systems intended to be operated by the general boating public (ie. no attendant) shall be controlled by : (a) An ON-Off push button with a 10 minute automatic shut-off timer and a keyed manual discharge switch. The automatic timer shall be preset at 5 minutes, or (b) a two-position toggle on-off switch with an automatic 10 minute shut-off timer and a keyed manual discharge switch. The automatic timer shall be preset at 5 minutes. The switches shall be labeled ON and OFF in the appropriate positions.

For installations that require a remote stanchion or station, the controls on the remote station shall be an on-off push-button or toggle switch style as described above, the keyed manual discharge switch shall be optional.

- D. ENCLOSURE** - The enclosure shall be easily removable for component servicing and shall be constructed of minimum 18 gage Series 300 brushed stainless steel, marine grade aluminum alloy, galvanized steel, or reinforced fiberglass. The reinforced fiberglass shall be UV and ozone stable, fade resistant, and shatter proof. The enclosure must be able to withstand a point load of 200 pounds without failure or stress cracks. The enclosure shall completely enclose all gages, switches, pumps and other appendages.
- E. TANKS** - The vacuum system tank shall be constructed of: (a) Stainless steel, (b) Structural steel, hot dipped galvanized after fabrication. All tanks shall be designed and constructed in accordance with ASME Pressure and Boiler Vessel Codes.
- F. FRAME** - The frame shall be made of one of the following: (a) Series 300 stainless steel, (b) Structural steel, hot dipped galvanized or epoxy coated after fabrication, (c) marine grade aluminum alloy.

- G. HOSE HANGER** - An external hose hanger shall be provided. The hanger may be an integral part of the enclosure or bolted securely to the enclosure. The hose hanger shall be able to hold 30 feet of 1- 1/2 inch diameter suction hose. The hose hanger shall be made of stainless steel, aluminum, hot dipped galvanized steel, or fiberglass.
- H. PUMPOUT HOSE** - The pumpout hose shall be of minimum 1-1/2 inch nominal inside diameter, 30 feet in length, reinforced flexible hose. The hose shall be able to withstand a full vacuum of 29 inches of mercury, a maximum working pressure of 20 psi, and an operating temperature range of -40° to 140° F. The hose shall have a smooth interior to prevent the collection of solids and be non-kinking, collapse proof and flexible. The hose shall have excellent ozone, UV, sewage, seawater, and petroleum resistance.

The pumpout hose shall be equipped with a heavy duty vandal resistant nozzle assembly. The assembly shall include the following: hose adapter, cam action coupling, ball valve, universal suction nozzle, and a clear plastic site tube.

- I. HOUR METER** - The pumpout station shall come equipped with an hour meter which records the accumulative usage of the pumpout station. Capacity of the hour meter shall be a minimum of 9999.9 hours. The hour meter shall be mounted so that it is easily readable without removal of the enclosure.
- J. MONITORING SYSTEM** - All pump-out systems shall be provided with a cellular-based, real time monitoring, data collection and reporting system. The monitoring system shall be (1) MarineSync MS1 - Plug & Play Package w/2-Year Data Plan (p/n MSO101.002). MarineSync Corporation, (888) 988-7962; (2) PumpWatcher Co. [(727) 641-1936] Monitoring System #PW-RS1 w/2-Year Data Plan or approved equal.

Monitoring systems shall be factory installed by the pump-out manufacturer. The monitoring system shall be fastened directly to the pump-out frame, enclosure or exterior support post and installed in compliance with the National Electric Code (NEC).

Appendix C – Sample Pumpout Station Specifications

MINIMUM SPECIFICATIONS FOR PERISTALTIC PUMPOUT STATIONS

PUMPOUT STATION- Peristaltic Type

- A. PUMP** - The pump body shall be constructed of marine grade aluminum. The pump shall be capable of a minimum flow rate of 10 GPM with 30 feet of pumpout hose (see below) plus 6 feet of suction lift and 10 feet of discharge head. Discharge side of the pump out shall be a minimum of 1-1/4 inch nominal inside diameter.

The pump shall be operated by: (a) one green “ON” push button with a 10 minute automatic shut-off timer and one red “OFF” push button. The automatic timer shall be preset at 5 minutes. Or (b) one large mushroom head on-off push button with an automatic 10 minute shut-off timer. The automatic timer shall be preset at 5 minutes. Or (c) An on-off switch with an automatic 10 minute shut off timer. The automatic timer shall be preset at 5 minutes.

- B. MOTOR** - The motor shall be totally enclosed, fan cooled, minimum 1 HP, 110 volt, 1 phase. Explosion proof where required.
- C. FRAME** - The frame shall be made of one of the following: (a) Series 300 stainless steel, (b) Structural steel, hot dipped galvanized or epoxy coated after fabrication, (c) marine grade aluminum alloy.
- D. ENCLOSURE** - The enclosure shall be easily removable for component servicing and shall be constructed of minimum 18 gage Series 300 brushed stainless steel, marine grade aluminum alloy, reinforced fiberglass, or PVC. The reinforced fiberglass and PVC shall be UV and ozone stable, fade resistant, and shatter proof. The enclosure shall be securely mounted to the frame and shall be able to withstand a point load of 200 pounds without failure or stress cracks. The enclosure shall completely enclose all pump and components. The enclosure shall not enclose the pumpout hose.
- E. HOSE HANGER** - An external hose hanger shall be provided. The hanger may be an integral part of the enclosure or bolted securely to the enclosure. The hose hanger shall be able to hold 30 feet of 1-1/2 inch diameter suction hose. The hose hanger shall be made of stainless steel, aluminum, hot dipped galvanized steel, or fiberglass.
- F. PUMPOUT HOSE** - The pumpout hose shall be of minimum 1-1/4 inch nominal inside diameter, 30 feet in length, reinforced flexible hose. The hose shall be able to withstand a full vacuum of 29 inches of mercury, a maximum working pressure of 20 psi, and an operating temperature range of -40° to 140° F. The hose shall have a smooth interior to prevent the collection of solids and be non-kinking,

collapse proof and flexible. The hose shall have excellent ozone, UV, sewage, seawater, and petroleum resistance.

The pumpout hose shall be equipped with a heavy duty vandal resistant nozzle assembly. The assembly shall include the following: hose adapter, cam action coupling, ball valve, universal suction nozzle, and a clear plastic site tube.

- G. HOUR METER** - The pump out station shall come equipped with an hour meter which records the accumulative usage of the pumpout station. Capacity of the hour meter shall be 9999.9 hours. The hour meter shall be mounted so that it is easily readable without removal of the enclosure.
- H. MONITORING SYSTEM** - All pump-out systems shall be provided with a cellular-based, real time monitoring, data collection and reporting system. The monitoring system shall be (1) MarineSync MS1 - Plug & Play Package w/2-Year Data Plan (p/n MSO101.002). MarineSync Corporation, (888) 988-7962; (2) PumpWatcher Co. [(727) 641-1936] Monitoring System #PW-RS1 w/2-Year Data Plan or approved equal.

Monitoring systems shall be factory installed by the pump-out manufacturer. The monitoring system shall be fastened directly to the pump-out frame, enclosure or exterior support post and installed in compliance with the National Electric Code (NEC).