



WHERE TO FIND A CLOSED LOOP SYSTEM

There are very few closed loop system in operation in the UK. Here is a list of those in full operation that are known to The Green Blue:

SEALIFT 2

Sealift 2 is based in the River Medina in Cowes, on the Isle of Wight. Fresh water is used to pressure wash the vessels which is then filtered and returned to the foul sewer. As the system operates very close to the river water level, in our experience a small amount of wash down water does inevitable escape into the river. However, the system is a vast improvement on the majority of shore facilities.

www.sealift2.com



SEALIFT 2

WEYMOUTH AND PORTLAND NATIONAL SAILING ACADEMY

WPNSA is the UK's Olympic sailing venue and it boasts many environmental features. These include rainwater harvesting for use in the dinghy park and a large bank of solar panels. The boatlift at WPNSA moves boats to an area designed for pressure washing. Fresh water is used and waste water drains off into the foul sewer. All drain covers on-site are clearly marked to indicate whether they are discharge to sewers or surface waters.

www.wpnsa.org.uk

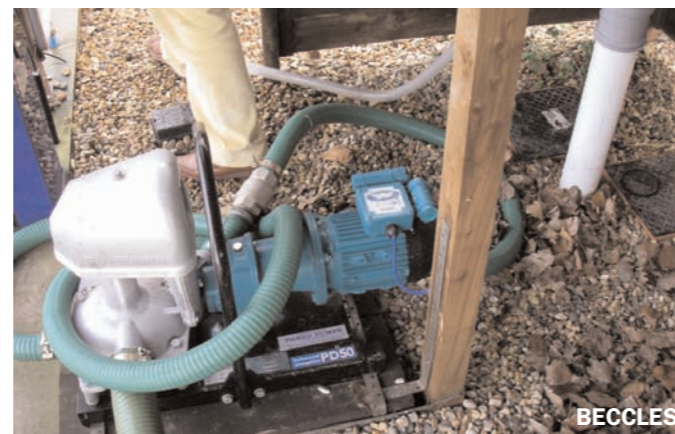


BECCLES

GALLEON STORAGE & MOORING AT BECCLES

The boatyard has installed a fully fledged closed loop system. Galleon received a grant from the Broads Authority's Sustainable Development Fund (SDF) and other marinas or sailing clubs wishing to install similar facilities could try the same route if they are located within an English National Park or AONB. Boats are washed down in a purpose built bay where the water runs off into a settlement tank. It then passes through a 'WashTek' filtration system which can remove up to 98% of contaminants. The clean water is then returned to the river.

<http://www.galleon-storage-and-mooring.co.uk/>



BECCLES

EUROPE - BRITISH KIEL YACHT CLUB

One of the few genuine closed loop systems that The Green Blue has found to date is actually based in Germany at the British Kiel Yacht Club. The wash down water is collected in a sump then passed through a series of filtration and settlement tanks. The clean water is then used again though the powerwash. We understand that this system is relatively cheap and easy to run, but obviously some land works would be required to install it newly on-site in the UK.

<http://www.bkyc.de/>



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THE GREEN BLUE is the environmental awareness initiative for the marine industry, and for sailors, boaters and watersports enthusiasts. It is run by British Marine Federation and the Royal Yachting Association with support from Defra, The Crown Estate and Marina Developments Ltd.

Details of the papers referenced in this fact sheet are available in the Green Blue's online database of scientific and regulatory papers which can be found at:

www.thegreenblue.org.uk/research/database.asp

THE GREEN BLUE, RYA House, Ensign Way, Hamble, Southampton, Hampshire SO31 4YA
Phone: 023 8060 4100 Fax: 023 8060 4294 E-mail: info@thegreenblue.org.uk



WHAT WE KNOW ABOUT...

CLOSED LOOP BOAT WASH DOWN SYSTEMS

This fact sheet examines ways of removing antifouling contamination from the waste water generated by pressure washing a boat hull.

INTRODUCTION

In the UK, boats are often pressure washed when they are hauled out, to clean the hull of biofouling such as weed, barnacles and algae. Fouling builds up whilst the boat is in the water and reduces the boat's speed, affects manoeuvrability and can even transfer alien species to new areas. Fouling builds up more rapidly in saltwater but can also occur in freshwater environments.

The majority of boat hulls are coated with self-eroding antifouling paint. Therefore the waste water following pressure washing (wash down) may contain antifouling residues. This fact sheet examines what systems exist to remove this antifouling residue from the wash down water.



THE LEGAL FRAMEWORK

Several pieces of legislation affect boat wash down and maintenance facilities. Much of this comes under the Water Resources Act (1991) regulating any polluting matter entering controlled waters. The waste products of the wash down or boat maintenance may also be classified as hazardous depending on their concentration and will need to be disposed of as necessary under the appropriate waste regulations. The

facility provider has a duty of care to carry this out under the same regulations.

Run-off from hull cleaning operations at marinas, boatyards and sailing clubs is all classed as a trade effluent. As it may contain particles of the bottom paint and fragments of hull material. These particles and fragments can contain metals such as copper and other chemicals that impede marine growth

and should be classified as special (hazardous) waste. With the prior permission of the local water company or the consents unit of the Environment Agency, a licence may be granted to dispose of the run-off to the foul sewer. Where this is not possible, waste run-off should be contained on-site for off site disposal (in accordance with legislation) or on-site treatment and possible recirculation using a closed-loop system.

HOW CLOSED LOOP SYSTEMS WORK

To enable recirculation, waste water must undergo treatment incorporating settlement, filtration and further treatment, to remove particulate matter and recycle 'clean' water. This is often a three step process depending on the amount of pollutant removal required.

1. SETTLING

this process allows the contaminants to settle out of the wastewater as sediment by leaving it to stand undisturbed. It requires a sump to collect the wash down water and hold it in a containment facility. This method is the least expensive and easiest to design and construct. However, it is only moderately effective at removing contaminants because only the larger particles of antifouling drop out during settlement.

2. FILTRATION

passing the wash down water through one or more filters will screen out different sized particles. This can start at the pressure washing area with the installation of hay bales or a filtration cloth over the wash intake drain, which is effective at straining out visible particles. Additional filtration can be achieved by directing the water through a filter or series of filters with decreasing mesh size. However, it has proved difficult to remove all solid particles using this method, even with very small mesh sizes.

3. TREATMENT

using existing technologies from other industries the wastewater can be further treated and contaminants removed. Treatment can include the removal of oil and grease, metals, or other contaminants, depending on sophistication of the technology used. For instance, flocculation agents can be introduced into the wastewater that encapsulate metals and force them to settle out of solution. The wash down can also be passed through special filters that bond contaminants to them. This is the most sophisticated level of wastewater treatment.

The Green Blue has unearthed three types of treatment processes which are given as examples below.

FLOCCULATION

This involves adding a flocculating agent to the filtered water to cause particles suspended in water to aggregate into clumps or masses that then sink. This residue is collected, classified as hazardous or non-hazardous and disposed of at an appropriately licensed waste disposal facility. If companies are unsure of whether the waste is hazardous or not, independent analysis should be undertaken. The resulting water can then be re-circulated for wash down.

Marina Developments Ltd has trialled a system at Hamble Point Marina on the South Coast. A sump was installed under the boat wash down area into

which a pump was fitted. The boat wash down was collected and pumped to a series of two filtration sacks. Made of tough fibres with 10µm mesh, water drains through the sacks under gravity before draining into the river. In time, it is hoped that water can be captured and recycled to the pressure washer. Yard staff needed to be trained on when to switch on and off the pump to preserve its life and reduce energy costs, as operating the pump on a float switch proved difficult. After an evaluation of manual handling, a special trolley was used to remove sacks when full and dispose of the content. Sacks were reused after emptying, but needed to be handled carefully.



Unexpected challenges were thrown up, such as how to prevent bags from blocking up and managing the flow at peak times. Different mesh sizes were also tried to find which worked best. MDL managed to remove practically all the solid particles, which just left the dissolved copper, a very significant reduction. The system also had the advantage of cleaning the water of oil and grease and other contaminants. MDL is now considering the practicalities of implementing the system in its marinas.

'MDL recognises that the enjoyment of boating largely depends on clean water and a high quality environment,' says Marina Director Jon Eads. 'There are long-term benefits for the sector. If this process works, it could provide a template which can be rolled-out to all marinas.'



OZONE TREATMENT

Ozone Waste Water Treatment is growing in popularity, and requires the use of an ozone generator, which decontaminates the water as Ozone bubbles percolate through the tank.

Summerfield Boat Works in Florida is an older boat yard which installed a closed-loop wash down system and ozone treatment plant after regulations required the elimination of wash down discharge or a shut-down of bottom washing. The system includes a water filtering system and an ultra-violet light ozone generator to oxidise all the dissolved pollutants and erase all odour. By choosing ozone to treat the water, the Boat Works eliminated the need to use chemicals with their extra cost and hazards.

The Yard Superintendent said "Without the ozone treatment, the water would have gone bad and smelled. I urge anybody thinking about doing this to buy state-of-the-art equipment rather than making it themselves. By recycling, we are not discharging an estimated 24,000 gallons of wastewater into the river each year."

For more information, visit www.epa.gov/owow/nps/marinas/index.html

CYCLONIC FILTRATION

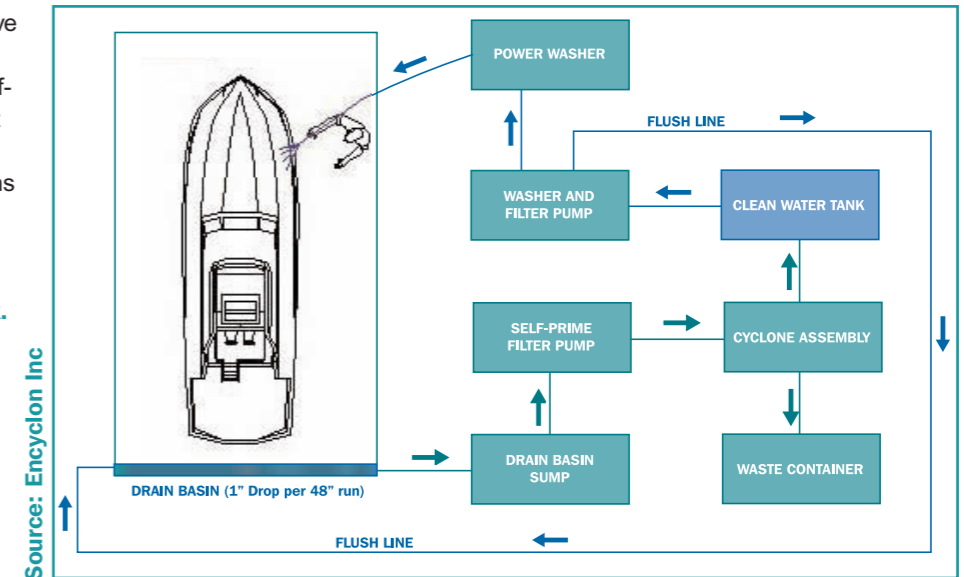
Cyclonic separation is a method of removing particulates from waste water, without the use of filters, through vortex separation. Rotational effects and gravity are used to separate mixtures of solids and fluids. The clean water can then be recycled into the pressure washer creating a completely closed loop system.

The United States Environment Protection Agency has highlighted a design by Encyclon as suitable for use in the marine industry. The Encyclon solution is a closed-loop cyclonic filtration system designed to remove particulate matter from the wash water. Wash water contaminants are removed down to 5-microns with a 98% efficiency rate, on the first pass. The waste or is

automatically discharged from the unit into a separate container. The system uses long lasting cyclonic filtration cones.

The performance of the self-prime marina system has a 98% efficiency rating on the first pass through the filter cones. Since the water is continually re-used and never discharged this is more than adequate for the performance of an average pressure washer. Due to the centrifugal force generated during cyclonic filtration, heavier items filter at a more efficient rate. This means that lead, copper, and other heavy metals filter exceptionally well.

A typical recycling system can be broken down into three basic components: drain basin, pumps and filter as shown in the diagram below.



CONCLUSIONS

The Green Blue believes that if antifouling residue from maintenance activities and, specifically, from pressure washing boats can be kept out of rivers and estuaries, this would benefit the habitats and natural environments that we all enjoy sailing in. Sailing and boating is

not the only contributor of contaminants like copper into the water, nevertheless we should minimise our impact.

All new marinas should seriously consider introducing a closed loop system. Existing facilities should

examine their operations to assess how they discharge wash down water and whether they are in legal compliance. It is possible that grants may help. If situated within an English National Park or AONB an application for SDF funding could be made.

MORE INFORMATION

1. BMF & RYA's Environmental Code of Practice provides a legal framework and good practice guide for marina operators, boatyards, clubs and mooring providers. www.ecop.org.uk
2. The Green Blue's online database contains scientific and regulatory papers on all aspects of antifouling boats. <http://www.thegreenblue.org.uk/research/database.asp>
3. The RYA's Rough Guide to Antifouling. www.thegreenblue.org.uk/tradetalk/antifoulingpaints.asp
4. The Environment Agency: Pollution Prevention Guidelines PPG14: Marinas and Craft. www.environment-agency.gov.uk
5. Summerfield Boat Works wash down system. www.epa.gov/owow/nps/marinas/index.html
6. Encyclon Marine Pressure System www.cleanmarinapressurewash.com
7. Summary of the AINA Annual Conference 2007: The Water Framework Directive - what it means for inland waterways www.aina.org.uk/work_programme/water_framework.htm
8. The Green Blue's 2008 Wall Calendar contains a number of useful hints and tips to reduce your environmental impact when applying antifouling paint. Ask for your free copy via our website.