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DELTA STEWARDSHIP COUNCIL

SHORE-BASED BALLAST WATER TREATMENT IN CALIFORNIA

TASK 7: PERMITTING AND LEGAL REQUIREMENTS

PREPARED FOR

DELTA STEWARDSHIP COUNCIL
SACRAMENTO, CALIFORNIA

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Revision History

Section	Rev	Description	Date	Approved
All	-	Released as final.	20 Feb 2018	KJR

References

1. *Shore-Based Ballast Water Treatment in California, Task 2: Assessment of Retrofitting Vessels,* Glosten, 4 August 2016.
2. *Shore-Based Ballast Water Treatment in California, Task 3: Assessment of Retrofitting Ports and Wharves,* KPFF Consulting Engineers, 4 August 2016.
3. *Shore-Based Ballast Water Treatment in California, Task 4: Assessment of Shore-Based Ballast Water Treatment Facilities,* Kennedy/Jenks Consultants, Rev. P0, 4 August 2016.
4. *Shore-Based Ballast Water Treatment in California, Task 5: Assessment of Treatment Technologies,* Kennedy/Jenks Consultants, 4 August 2016.
5. National Ballast Information Clearinghouse, Smithsonian Environmental Research Center & United States Coast Guard, http://invasions.si.edu/nbic/, accessed 11 April 2015.
6. *Considering Options for the Management & Funding of an Optimal Response System in the Aleutian Islands,* Nuka Research & Planning Group, LLC, September 2014.
7. *Shore-Based Ballast Water Treatment in California: Memorandum on Scale-up of Land-based and Barge-based Alternatives*, Glosten, 6 April 2017.
8. Panel Comments on *Memorandum on Scale-Up of Land-based and Barge-based Alternatives*, Delta Science Program Independent Review Panel for the Feasibility Study of Shore-Based Ballast Water Reception and Treatment Facilities in California, 4 May 2017.
9. *Vessels-VGP,* National Pollutant Discharge Elimination System (NPDES) website, United States Environmental Protection Agency, epa.gov/npdes/vessels-vgp, accessed 19 September 2017.
10. *Ship's Ballast Discharge Dispersion Benchmark Dye Tracer Test*, Glosten, File No. 03104, January 2005.

Executive Summary

Marine vessels currently discharge ballast water into California water while alongside docks during cargo operations, at anchorages, and while underway. As described in Task 13, a treatment barge network is proposed as a practical means for these vessels to meet California's Interim Ballast Water Discharge Performance Standards (CA Interim Standards). In this case, vessels will continue to discharge ballast water alongside docks and at anchorages. Underway discharges would no longer be practical. What will change is that the ballast water will now be discharged to treatment barges that will further process the ballast water before it is discharged into the receiving waters.

Marine vessels discharging ballast water in California will be required to meet the CA Interim Standards. This standard is one thousand times more stringent in the "<50 μm and ≥10 μm" size class as compared to the International Maritime Organization (IMO), US Coast Guard, and US EPA ballast water discharge standards. In the "≥50 μm" size class, the California standard is unique in allowing no detectable living organisms. It is also the most stringent for the indicator microbes *e.coli*, intestinal *enterococci*, and *vibrio cholera*.

Task 5 of this series identified shore-based technologies that can meet this California standard. However, these technologies require twenty times the footprint and six times the power of technologies used onboard marine vessels to treat ballast water to the IMO ballast water treatment standards. Given marine vessel space and power constraints, it is not generally practical to install such shore-based technologies on board the marine vessels themselves. Therefore, marine vessels cannot reliably meet the CA Interim Standards with onboard treatment systems alone.

Task 13 of this series proposes a network of land-based treatment barges as a technically feasible alternative that could receive ballast water from discharging marine vessels and treat it to the CA Interim Standards. The conceived series of barges would support the required tankage, machinery space footprint, and available power.

Once the ballast water is transferred to the treatment barge, it will likely be regulated as industrial wastewater under the National Pollution Discharge Elimination System (NPDES). The permitting process is expected to last between two and three years, and require significant study. Key issues include: solids management, outfalls, and seawater discharges into freshwater systems. Possible roles of regulatory agencies in this process are outlined in the table below.

Authority	**Legal and Permitting**
US Coast Guard and IMO	Ballast water transfer to a treatment barge is an acceptable alternative. Treatment barge must be NPDES permitted and meet USCG/IMO discharge standards.
State Lands Commission	Transfer to the treatment barge does not relieve the requirement to meet the CA Interim Standards.
US EPA	Each treatment barge will require an NPDES permit.
State Water Board	Regional Water Boards will issue, if suitable, permits for the barges operating within their boundaries, based on studies of impacts on those regions.

Practical implementation of a network of treatment barges requires outfitting marine vessels with a standardized ballast water transfer connection and ballast water transfer station. However, California may be preempted from regulating this vessel design aspect given established US Coast Guard efforts in this area. Alternatively, if California enforced the interim performance standards and treatment barges were the only practical solution, then such a standardized

connection would be a de facto requirement for marine vessels expecting to discharge ballast water into California waters.

The implementation of a shore-based network of treatment barges will face a significant permitting process. Risks include: freshwater ports do not receive the required discharge permits, required changes to outfalls and treatment plants result in schedule delays and cost overruns. That noted, there is a known permitting process and if diligently executed there is a reasonable expectation of success.

Introduction

This report is part of an overall coordinated study evaluating the feasibility of using shore-based mobile or permanent ballast water treatment facilities to meet California's Interim Ballast Water Discharge Performance Standards (CA Interim Standards). This report is presented to the Delta Stewardship Council to meet the objectives of Task 7 – Summarize pertinent permitting and legal requirements. Description of the overall study can be found in Appendix A, along with definitions for terms used in this study.

This report (Task 7) summarizes applicable existing environmental, water quality, and ballast water management laws (state, federal, and international) and implications for the regulation of ballast water transfers between marine vessels, and subsequent discharges of treated ballast water from mobile treatment barges.

This report was researched through review of regulations and direct contact with applicable state and federal regulatory agencies. These agencies confirmed that the assessment is sound, however final conclusions can only be determined through the actual permitting process.

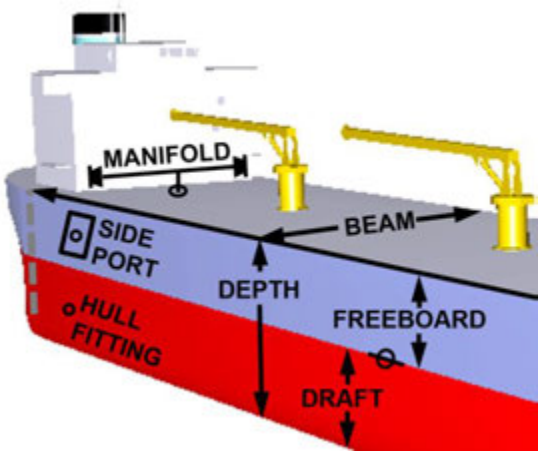
Background

This section provides background helpful in assessing the new material presented in later sections.

Marine Vessel Ballast Transfer Station

Task 2 provides a detailed overview on the connection between a vessel's ballast system and shore-based treatment facilities. The table below outlines connection options suitable for a treatment barge.

Table 1 Ship connection options

Representative Image	Concept
	**Concept Locations for Connection** This image, repeated from the Summary section, identifies possible locations for capturing ballast water discharges from marine vessels. A **deck manifold** connection is the more obvious location for oil tankers, bulk carriers, containerships, and ATBs. A **side port** connection is likely for car carriers and passenger cruise ships that already use such locations for fuel oil bunkering operations. The direct use of **existing hull fittings** for capturing ballast water would avoid the need to modify the marine vessels. However, this has been eliminated as experimental and difficult to prevent leakage of ballast water in making and breaking the connection.
	**Deck Manifold – Use of Hoses** This image shows a small fuel oil bunker hose connected between a barge and a ship. A new deck connection for ballast water would be required on the marine vessels. Hoses are widely used for transfer of liquids between marine vessels and to shore facilities. This image likely shows a DIN100 hose transferring fuel oil bunkers. The hose is supported by a boom crane that is lifted high above the hose, in order to relieve stress of the hose fittings and to compensate for relative motions between the two vessels.
	**Side Port Connection** This image shows a side port on a vehicle carrier engaged in fuel-oil bunkering operations. Side ports for fire, sewage, and fuel oil bunker connections commonly exist on passenger cruise ships and vehicle carriers. However, it is on a case-by-case basis if there is adequate room to add an additional connection. Existing lines would need to be refitted to accommodate the additional ballast water connection, or a new side port would be required.

Treatment Barge, Design

Task 13 of this study conceives a treatment barge network. The main particulars and a concept sketch are provided below.

Table 2 Standardized barge designs for service in California

BWTB Design	Small Barge	Medium Barge	Large Barge
Service Capacity			
Ballast Volume	10,000 m^3	20,000 m^3	35,000 m^3
Particulars			
Length	200 ft	240 ft	280 ft
Breadth	62 ft	74 ft	84 ft
Summary Totals			
Treatment Plant, Rate	721 m^3/hr	1,450 m^3/hr	2,570 m^3/hr
Surge Capacity, Volume	2,789 m^3	5,502 m^3	9,297 m^3

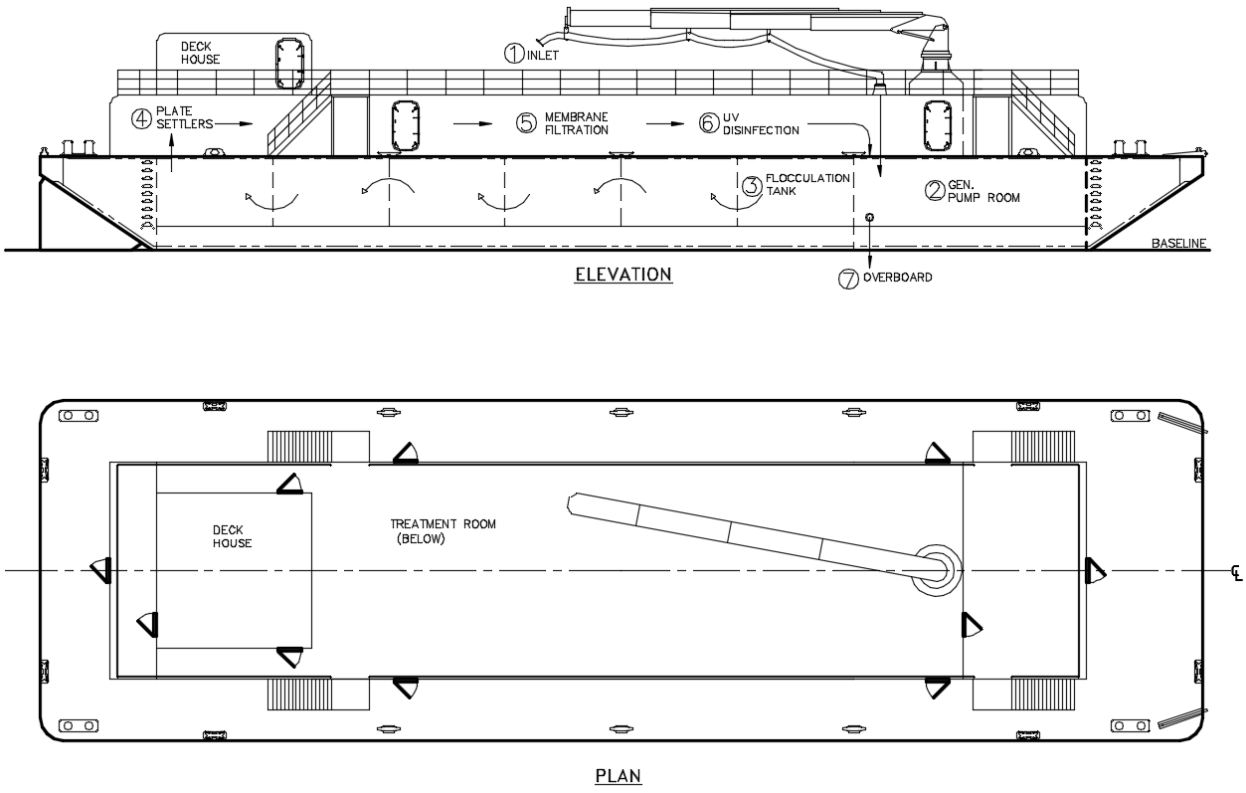


Figure 1 Notional barge design

Treatment Barge, Network

Task 13 presents a treatment barge network. This is only one example arrangement of zones. This example aligns zones based on ballast water discharges and physical distances. A different concept would be to align the zones with the California Water Board districts. The below table and figures outline the currently conceived zones.

Table 3 BWTB zone summary

Zone Designation	Service Area	Small Barges (10,000 m^3 service)	Medium Barges (20,000 m^3 service)	Large Barges (35,000 m^3 service)	Total Barges
Zone 1	San Francisco Bay (North Part) and Humboldt Bay	1	1	2	4
Zone 3	Carquinez Strait and Suisan Bay	1	1	2	4
Zone 5	Los Angeles/Long Beach and Vicinity	3	1	3	7
TOTALS		**9**	**4**	**11**	**24**

Zone boundaries are shown in Figure 2 and Figure 3.

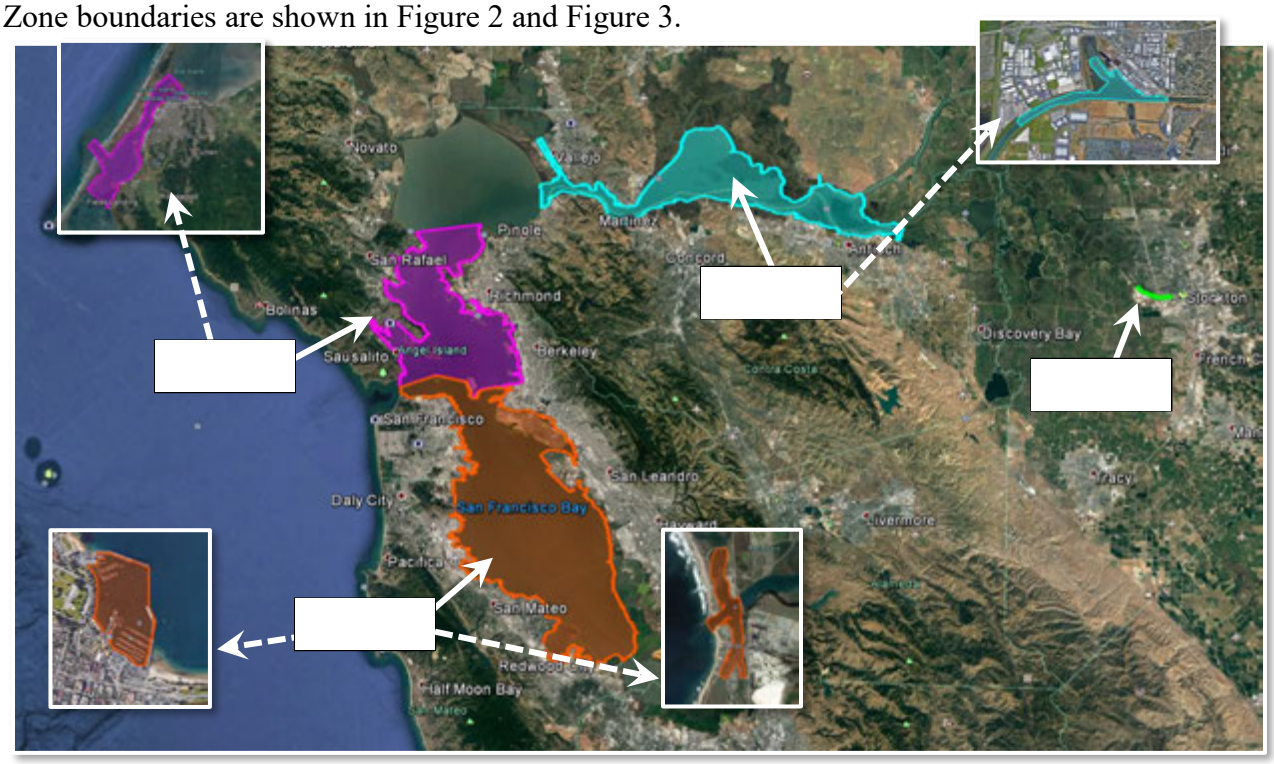


Figure 2 Google Earth capture showing barge network Zones 1-4, with their respective "satellite" areas overlaid

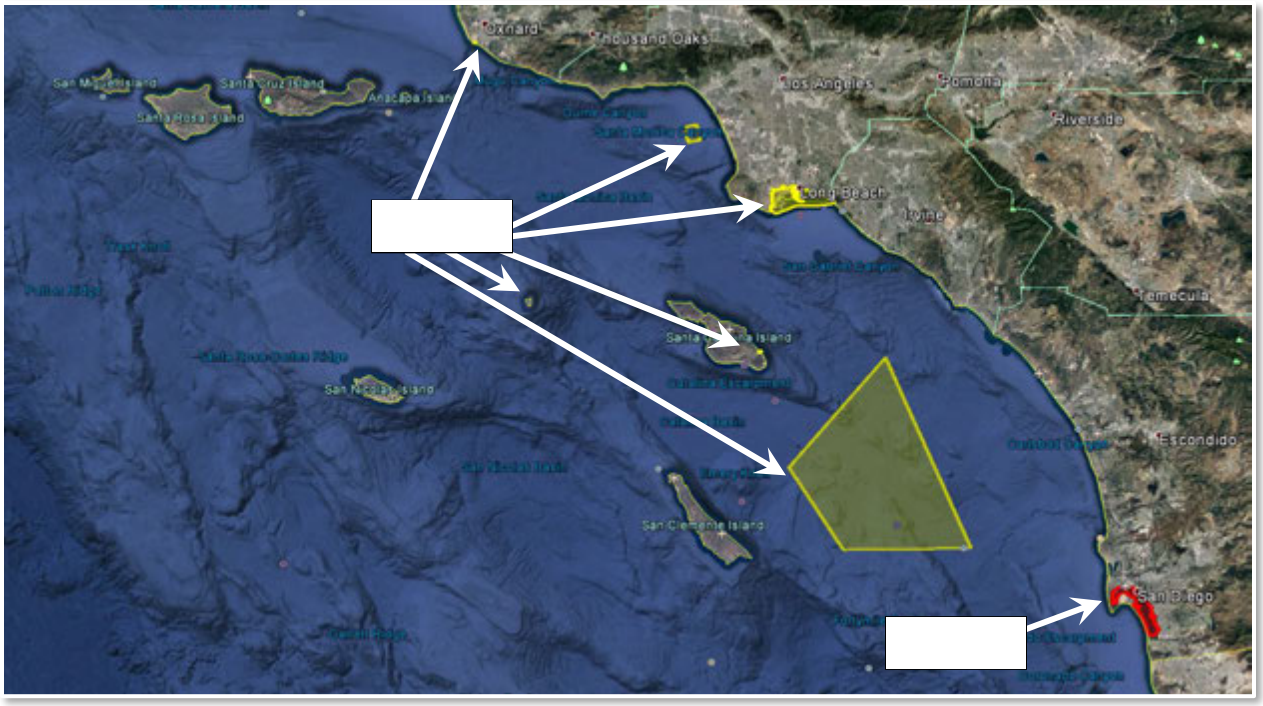


Figure 3 Google Earth capture showing barge network Zones 5 and 6

Regulatory Framework

International Maritime Organization

The International Maritime Organization (IMO) is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by marine vessels.

The IMO Ballast Water Convention, 2004, was adopted and ratified by member states, and entered into force on 8 September 2017. Regulation B-3 of the convention is that which invokes the IMO standard for ballast water discharges. For example, it invokes the D-2 discharge treatment for certain vessels. Part 6 of this regulation specifically exempts vessels that discharge to ballast water reception facilities that meet reception facility guidelines.

The IMO G5 Guidelines (*MEPC 153(55) Guidelines for ballast water reception facilities (G5)*) provide non-binding guidance for ballast water reception facilities. Section 5.3 suggests that discharges of received ballast water should in fact meet the performance standard specified in Regulation D-2 of the Ballast Water Convention, 2004.

Indirectly related to the IMO, the International Standards Organization (ISO) is currently in development of a standardized ballast water reception design. The purpose of this effort is to offer ship owners a universally accepted set of dimensions and particulars to enable connection to any reception facility around the world.

IMO continues to develop guidance to the Convention, including contingency measures in the case that treatment systems on board ships have failures. Shore-based solutions are a part of those discussions, with it being possible that additional guidance could result.

In summary, the IMO convention supports transfer of ballast water from a marine vessel to shore-based reception facilities. In such situations, the convention specifically exempts the marine vessel from needing to meet the treatment discharge standard. However, the reception facility guidelines require that the shore-based facility does meet that discharge standard. The expectation is that the treatment barges would be considered as similar to shore-based facilities. Since the treatment barges are being designed to meet a higher standard than the IMO discharge standard, then there are no obvious permitting or legal concerns for international vessels calling in California.

US Coast Guard

The US Coast Guard issued its Final Rule (*33 CFR Part 151, 46 CFR Part 162, Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters; Final Rule*) in March 2012. This includes a ballast water discharge standard (BWDS) that is quite close to the IMO D-2 discharge standard. Also included is a specific discussion on the applicability of these rules to barge-based reception facilities, repeated here in its entirety.

> *Two commenters urged the Coast Guard to consider the use of land-based or vessel/barge-based reception/ treatment facilities. The Coast Guard agrees that use of shore-based or barge-based treatment might become a valid option for some vessels and has provided for this in the final rule. We have done so by revising the language in the regulations to make it clear that the BWDS only applies to those vessels falling within the rule's applicability thresholds (vessels that also discharge ballast water into waters of the United States). Those vessels discharging to land-based or vessel/barge-based reception/treatment facilities would not fall within this defined group, and therefore*

would not be required to install a BWMS that meets the BWDS. Any reception/treatment facilities used under this option would be subject to applicable state and local laws, as well as NPDES permitting if the treated water is discharged to waters of U.S.

This provides confirmation that there are no permitting or legal restrictions from US Coast Guard on the transfer of ballast water from a marine vessel to barge-based reception facilities. A subsequent section in the Final Rule makes it clear that the barge-based reception facility is not subject to US Coast Guard rules. It also confirms that it is subject to NPDES permitting. This section is also repeated in its entirety.

Once Ballast water is pumped to an on shore treatment facility or a treatment vessel it would not be subject to 33 CFR part 151 subpart C or D. However, under the CWA any resulting discharges from these on-shore treatment facilities or treatment vessels are subject to the National Pollutant Discharge Elimination System (NPDES) program. Companies that intend to provide these services will be responsible for complying with these and other local, state, and Federal laws and regulations.

Table 4 Additional US Coast Guard regulatory citations relevant to reception facilities

33 CFR Part 151	Citation
151.2025 Ballast Water Management Requirements.	(5) Discharge to a facility onshore or to another vessel for purposes of treatment. Any vessel owner/operator discharging ballast water to a facility onshore or to another vessel must ensure that all vessel piping and supporting infrastructure up to the last manifold or valve immediately before the dock manifold connection of the receiving facility or similar appurtenance on a reception vessel prevents untreated ballast water from being discharged into waters of the United States.
151.2050 Additional requirements nonindigenous species reduction practices.	(i) When discharging ballast water to a reception facility in the United States, discharge only to reception facilities that have an NPDES permit to discharge ballast water.

US Environmental Protection Agency

"EPA first issued the Vessel General Permit (VGP) in 2008 and subsequently reissued it in 2013. The VGP provides for NPDES permit coverage for incidental discharges into waters of the United States from commercial vessels greater than 79 feet in length and for ballast water from commercial vessels of all sizes. EPA estimates that approximately 61,000 domestically flagged commercial vessels and approximately 8,000 foreign flagged vessels require VGP permit coverage for such incidental discharges." (Reference 9)

EPA and US Coast Guard requirements relative to barge-based reception facilities are closely aligned. EPA covers this subject in the 2013 VGP Section 2.2.3.5.1.2, Onshore Treatment of Ballast Water. The matching provisions include requirements that no leaks during the transfer are permitted and the lack of reception availability does not allow a vessel to discharge non-compliant ballast water.

The 2013 VGP does provide some additional clarification, confirming that treatment barges could be considered "on-shore treatment," that the VGP would not apply to such treatment barges, and that an NPDES permit is required. From 2013 VGP, 2.2.3.5.1.2:

EPA notes that transferring ballast water to a treatment barge for eventual treatment and discharge could constitute "on-shore treatment" for purposes of Part 2.2.3.5.1.2. The discharge of treated ballast water (transferred from other vessels) from a treatment barge is not eligible for coverage under the VGP as this is a discharge from an industrial operation, not a discharge incidental to the normal operation of a vessel. Instead, these vessels must apply for individual NPDES permit coverage from the appropriate NPDES permitting authority, generally the State in which they are operating.

California State Lands Commission

The State Lands Commission funded this shore-based ballast water treatment study through the Delta Stewardship Council.

California's Marine Invasive Species Act is administered by the Marine Invasive Species Program (MISP) within the State Lands Commission. MISP administers California's ballast water management program, including "Assessments of the Efficacy, Availability, and Environmental Impacts of Ballast Water Treatment Technologies for Use in California Waters."

The CA Interim Standards are currently due to go into effect on 1 January 2020 for newly constructed vessels, and as of a vessel's first scheduled drydocking on or after 1 January 2020. Vessels are permitted several options for compliance including: retaining all ballast water on board, using an approved treatment system, and discharging to a reception facility. The Marine Invasive Species Act (71204.3) requires that any such reception facility must be approved by the State Lands Commission.

Discussions with MISP confirmed that discharges to reception facilities would still need to meet MISP administered treatment standards, as transferring to a reception facility to meet a lower biological efficacy standard would be "an uncreative way to circumvent the law."

California State Water Resources Control Board

The California State Water Resources Control Board (Water Board) is responsible for NPDES permitting in California. As found in US Coast Guard and EPA regulations, a ballast water treatment barge will require this permit.

The Water Board is divided into nine Regional Boards. It is possible that the treatment barges can be regulated through a statewide General NPDES Permit that would be issued by the State Water Board if it is determined that the water quality effects can be similar throughout the state based on the characterization of the discharge and the type of receiving water.

The permitting process is expected to take between two and three years. The following steps are expected:

- Research and study to understand the impact of treated water discharges on the receiving waters.

- Drafting of the permit by the Water Board.
- Issuance of the permit by the Water Board, including public hearing on the permit terms.

A likely issue for the Water Board will be the impact of seawater ballast discharges into fresh receiving waters. For example, ballast water being discharged by a marine vessel may have 35 parts per thousand of salt. This compares to 0.7 and 0.1 maximum allowable discharge standards for certain public utilities. However, it is not practical for a treatment barge to desalinate ballast water, as even the treatment barge has space and power limitations.

There is a risk that port locations such as Stockton and Sacramento would not be permitted due to high salinity ballast water discharges. However, it is possible that a variation on the following argument could be found acceptable:

Alternative	***Biological Efficacy***	***Water Quality***	***Discussion***
Ship Discharges to VGP	Biological efficacy is not as high as compared to shore-based barges, i.e. more live organisms discharged.	Would discharge total dissolved solids (TDS) levels as per uptake location, i.e. salty water into local fresh waters. This would be no change as compared to current ship discharges.	This is business as currently planned, ship is meeting USCG/EPA ballast water VGP standards.
Ship Discharges to Barges, No TDS Requirement	Higher biological efficacy as compared to ships, i.e. meets CA Interim Standards, i.e. fewer live organisms discharged.	Barge would treat and discharge in place, no difference than current ship discharges in terms of TDS/ salinity.	This allows higher biological efficacy, and no change in water quality from current practice.
Ship Discharges to Barges, TDS Requirements Stand	Higher biological efficacy as compared to ships, i.e. meets CA Interim Standards, i.e. fewer live organisms discharged.	Barge would need to receive 100% of the ballast water, and shift to marine waters. For Stockton, this would be three very large barges.	This would approximately triple the cost of shore-based treatment, reducing feasibility of the solution.

Permitting Process Summary

Federal regulations make it very clear that ballast water once shifted to a shore-based reception facility must be permitted under the NPDES process. Discussions with the state have identified that a statewide general NPDES permit could be that practical implementation. Task 6, Outfalls, outlines this process including study, monitoring, and logistics.

Legal Framework

This section has been developed from the perspective of the marine vessel designer informed by discussions with regulatory agencies and industry trade organizations. No legal counsel was engaged to develop or review this discussion.

This section is written with regards to transferring ballast water from a marine vessel to a shore-based treatment barge for treatment and overboard discharge. While the treatment barge has some surge capacity, a few hours of marine vessel ballast water discharge, the system is arranged to discharge ballast water at the same location in which it is received. The barges are not practically configured to serve as floating reception and storage facilities.

United States v. Locke

Practical implementation of a network of treatment barges requires outfitting marine vessels with a standardized ballast water transfer connection. However, California may be preempted from regulating this vessel design aspect given established US Coast Guard efforts in this area.

United States v. Locke (529 U.S. 89, 120 S.Ct. 1135 (2000)) found that Washington State could not regulate certain aspects of marine vessels, including design standards. Such regulations were preempted by the US Coast Guard who had been regulating those aspects of marine vessels before the state. "The State of Washington has enacted legislation in an area where the federal interest has been manifest since the beginning of our Republic and is now well established," wrote Justice Kennedy for the Court's majority opinion.

While the state could make an argument that this would not apply to ballast water reception facilities, such an argument may not be needed. If California enforced the interim performance standards and treatment barges were the only practical solution, then such a standardized connection would be a de facto requirement for marine vessels expecting to discharge ballast water into California waters. Justice Kennedy did note that States may regulate their own ports and waterways provided that the rules are based on "the peculiarities of local waters" and are not in conflict with federal regulation.

Ballast Water Transfer Liability

The transfer of ballast water includes the transfer of significant liability and risk. Some of these liability and risk areas are discussed in the following sub-sections.

Hose Handling

The transfer of the hose between the barge and the marine vessel can be a dangerous operation, specifically due to the relative motions of the barge and the marine vessel. In particular, stormy weather may compromise the ability to make a connection safely or at all. Responsibility for these safe operations is shared by both parties, with each party responsible for their own actions and the equipment that they provide.

Explosive Gases

Ballast water from tankers is often considered gas hazardous, in the case that cargo may have leaked into the ballast water. When servicing such ballast water, the treatment barge must assume that hazardous gases are present. This should be discussed during the pre-transfer conference between the tanker and the treatment barge.

Oil Leaks

Similar to explosive gases, oil tankers carry the risk of leaking oil into the ballast water. This has the risk that the treatment barge, following ballast water processing, may discharge oily water overboard resulting in a pollution incident. More likely is that the oil will either be contained within the flocculation process, or might foul the plate settlers.

Contaminated Ballast Water

Whereas explosive gas and oil leaks are detectable, there are many contaminants that are not readily detectable. This can include oxidative chemicals and heavy metals. The treatment barge NPDES permit is likely to not allow discharge of such contaminants. Inadvertent collection of such contaminants is a significant risk to the treatment barge operator.

Reception of Other Effluents

The treatment barge could be arranged at moderate additional expense for processing of other effluents from marine vessels. The treatment processes would remain similar, requiring moderate adjustments to materials and in the case of oily water, an additional process.

Shipboard equipment and retention strategies currently serve marine vessels with these effluents. As such, it is not expected that such services will significantly reduce the costs of operating a ballast water treatment barge or other shore-based reception. The savings would generally be to displace the occasional vacuum truck that might receive 1,000 gallons of gray and black water.

Gray and Black Water

Gray (lavatories and showers) and black (sewage) water treatment could be readily fit into the treatment barge processes, and would simply require additional flocculation and settling before the membrane filters. Marine vessels vary significantly on amount of this waste stream generated – a small bulk carrier generates a fraction of that produced on a large passenger ship.

Oily Water

Oily water refers to water collected in the bilge or wetted area of vessel machinery spaces. Such machinery might drip small amounts of oil into the otherwise non-oily water. Marine vessels typically generate only small amounts of such oily water, ~5 metric tons per month. Due to the small volume, a separate treatment process dedicated to this waste stream could be developed and installed on the treatment barges.

Deck Run-off

Deck run-off is that water which collects on the deck of the marine vessel from seas, spray, or precipitation. Typically, such run-off is sent directly overboard provided that the vessel performs best management practices to prevent run-off of paint chips and metal contaminants. If this run-off was able to be captured and stored, it could be pumped off to the treatment barge.

Appendix A Study Overview and Definitions

Study Overview

Marine vessels routinely uptake ambient sea or harbor water as ballast, transit to another port, and then discharge that ballast water. Unfortunately, the resulting ballast water discharges have been linked to the introduction of aquatic invasive species and harmful pathogens. In an effort to reduce or possibly eliminate further introductions, marine vessels are being required to manage ballast water discharges by a myriad of international, federal, and regional guidelines and rules. Vessels discharging in California will be required to meet an interim standard that is more stringent than international and US federal standards.

In response, there has been significant development work and commercial installations of ballast water management systems (BWMS) onboard marine vessels themselves. However, there is a lack of data to determine if shipboard BWMS are capable of meeting the CA Interim Standards. Therefore, shore-based ballast water reception and treatment is under consideration as an approach to meet the CA Interim Standards.

This study evaluates the feasibility of shore-based ballast water reception and treatment in 13 separate tasks, beginning with a review of shore-based treatment research, followed by a series of detailed analyses, including: permitting and legal requirements, detailed cost estimates, timeline to implementation, and market implications.

Tasks Overview

Tasks 6 through 13 are submitted together to discuss the practical implementation of shore-based ballast water reception and treatment throughout California state waters, accomplished by a "network" of six (6) independently operating fleets of mobile treatment barges (see Table A-1).

During the course of this study, following completion of Tasks 2-5 and the comparative scale-up exercise described in Reference 7, this approach was deemed most technically, operationally, and financially feasible of the five approaches that were evaluated (i.e. new onsite treatment facility, new offsite treatment facility, existing wastewater treatment facility, shore-side mobile treatment, mobile marine vessel-based treatment).

Table A-1 Tasks 6 through 13

Task	Description
6	Assessment of construction related to outfalls for treated ballast water discharges, and provision for disposal of solids as needed.
7	Summarize pertinent permitting and legal requirements.
8	Comparative review of shipboard vs. barge-based ballast water management operations.
9	Assessment of current practices related to ballast water discharges in California.
10	Cost analysis.
11	Implementation timeline.
12	Market implications.
13	Other analysis and findings. Introduces the concept of a statewide network of mobile treatment barges for the provision of ballast water reception and treatment services across the state, and forms the basis for assessments and analyses in Tasks 6-12.

Definitions

ABS	American Bureau of Shipping
ANSI	American National Standards Institute
ASTM	An international standards organization.
ATB	Articulated Tug Barge
AWL	Height Above Waterline
AWWA	American Water Works Association
Ballast Water	Water taken on by a ship to maintain stability in transit.
Ballast Water Exchange	The process of exchanging a vessel's coastal ballast water with mid-ocean water to reduce concentration of non-native species in accordance with regulatory guidelines.
Ballast Water Management	The entire process of treatment and handling of a ship's ballast water to meet regulatory requirements and prevent spread of non-native species.
BMPF	Ballast Manifold Presentation Flange
Booster Pump	Pump, typically centrifugal, that adds additional pumping force to a line that is already being pumped.
BWDS	Ballast Water Discharge Standards
BWE	Ballast Water Exchange
BWM	Ballast Water Management
BWMS	Ballast Water Management System
BWTP	Ballast Water Treatment Plant
BWTB, BWT Barge	Ballast Water Treatment Barge
BWTS	Ballast Water Treatment System
Capture	Capture is the method by which ballast water is transferred onto or off a marine vessel.
CD	Chart Datum
CFU	Colony Forming Units
CMSA	California Marine Sanitation Agency
DAF	Dissolved Air Floatation
DIN	Deutches Institut für Normung (German Institute for Standardization)
Discharge	Discharge of ballast water is the method by which post-treatment ballast water is disposed of in compliance with applicable standards and regulations.
DOC	Dissolved Organic Carbon
DWT	Deadweight Tonnage
EPA	Environmental Protection Agency (US, unless otherwise noted)
Filtrate	Water that has been separated from any particulate matter (used to clean ballast water treatment filters).

GA	General Arrangement
GM	Metacentric height (a measure of a ship's stability).
gpm	Gallons per minute. Any measurements quoted in gallons of ballast water per minute will also be shown in MT of ballast water per hour, or MT/h.
HDPE	High-density Polyethylene
IMO	International Maritime Organization
ISO	International Organization for Standardization
JIS	Japanese Industrial Standards (organization)
L	Liter
Lift Station	Means of receiving a liquid, typically from a drain or low-pressure piping, and 'lifting' it with pump(s) to a different location such as a remote tank.
Lightering	Cargo transfer between vessels, commonly practiced to reduce a vessel's draft before entering port.
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
MARPOL	International Convention for the Prevention of Pollution from Ships
MF	Microfiltration
mg	Milligram
MG	Millions of gallons. Any measurements quoted in MG of ballast water will also be shown in MT of ballast water.
MGD	Millions of Gallons/Day
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MPA	Megapascal (unit of pressure)
MSL	Mean Sea Level
MT	Metric tons. One cubic meter of seawater is roughly equivalent to 1.025 MT, but this value varies depending on temperature and salinity of the water. In this report, conversions between volume and weight of seawater are merely approximate and assume 1 m3 of seawater has a mass of roughly 1 MT, for convenience.
Navy Mole	A man-made peninsula in the Port of Long Beach that flanks entrance to the middle and inner harbor
NBIC	National Ballast Information Clearinghouse
NOM	Natural Organic Matter
Non-native Species	Species that are not indigenous to a particular region. Non-native species can be introduced to marine ecosystems through a ship's ballast water. "Invasive" species are non-native species with the potential to cause harm to the environment or human health.
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NYSERDA	New York State Energy Research and Development Authority

O&M	Operations and Maintenance (cost)
OCIMF	Oil Companies International Marine Forum
POTW	Publicly Owned [Wastewater] Treatment Works
PSU	Practical salinity units.
Residuals	Particulate matter collected from cleaning ballast water treatment filters.
ROM	Rough Order of Magnitude (cost)
Ro-ro	Roll-on/roll-off (vessels designed to carry wheeled cargo such as car, trucks, trailers, and equipment)
RWCF	Regional Wastewater Control Facility (e.g. City of Stockton, CA)
Shipboard Ballast Water Treatment	Ballast water management approaches that do not require support from shore-based infrastructure and are conducted entirely by a vessel's crew.
Shore-Based Ballast Water Management	Ballast water management approaches that require support from shore-based infrastructure in order to meet ballast water management requirements. Such infrastructure may include: means of transferring ballast water to a land-based or another marine vessel facility for storage and/or processing, deployment of shore-based equipment and personnel for onboard treatment approaches, etc.
Slurry	Mixture of filtrate and filter residuals resulting from cleaning ballast water treatment filters.
Slurry Handling	Slurry handling includes activities related to the storage, treatment, and discharge of filtrate and residuals collected from cleaning ballast water treatment filters.
SOLAS	International Convention for Safety of Life at Sea
Storage	Storage of ballast water includes provision of space and containment for ballast water, either pre-or post-treatment.
STS	Ship-to-Ship. Transfer from one marine vessel to another.
TDS	Total Dissolved Solids
TEU	Twenty-foot Equivalent Unit
TOC	Total Organic Carbon
Transfer	Ballast water transfer considers the logistics and equipment required to capture the ballast water from the marine vessel and transport to a reception and treatment facility.
Transport	Transport is the method by which ballast water is moved post-capture from marine vessels to remote, non-mobile reception and treatment facilities – either land-based or otherwise.
Treatment	Treatment includes the various methods to process ballast water such that it is suitable for discharge in compliance with applicable standards and regulations.
Treatment Approach	A general method for implementing ballast water treatment. Treatment approaches may include mobile systems, land-based facilities, shipboard systems, etc.

Treatment Technology	Specific techniques for removal or inactivation of organisms in ballast water (e.g., UV disinfection, filtration, ozonation, etc.)
TRO	Total Residual Oxidant
TSS	Total Suspended Solids
UF	Ultrafiltration
UKC	Underkeel Clearance
UL	A global independent safety consulting and certification company (formerly Underwriters Laboratories).
USCG	United States Coast Guard
UV	Ultraviolet Light
UVT	UV Transmittance
VLCC	Very Large Crude Carrier
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant