Glosten

Feasibility, Costs, Next Steps: SHORE-BASED BALLAST WATER RECEPTION AND TREATMENT IN CALIFORNIA

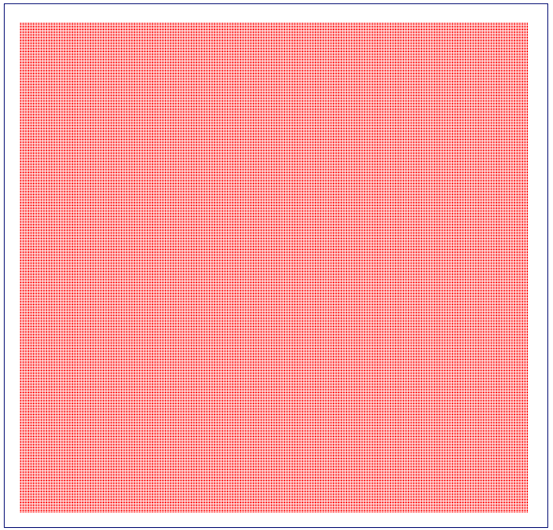
26 SEPTEMBER 2018

PREVENTION FIRST, 13TH BIENNIAL

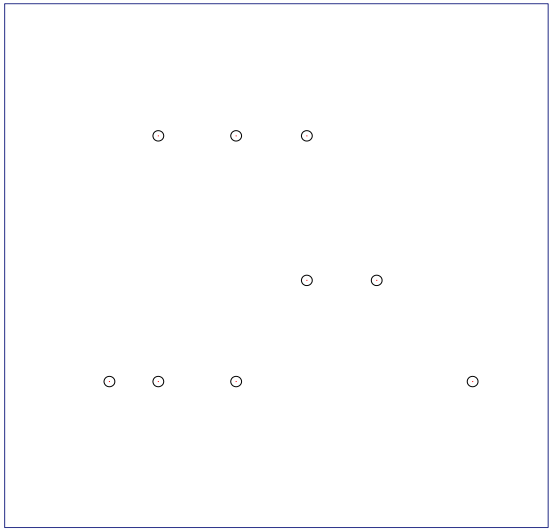
LONG BEACH, CA

Challenge

California Interim Ballast Water Performance Standards



Challenge Water
>100,000 / m3



US Coast Guard
≤10 / m3

California Interim
Non-detectable

Illustration for >50 micron size class.
1 cubic meter example.

Challenge

		Container ships	Bulkers	Tankers	Passenger	Car Carrier	Others	California
Ballast Water Discharges	*(#/year)*	223	375	570	167	10	210	**1,556**
Volume, Average per Discharge	*(metric tons/event)*	3,680	15,313	10,605	816	853	9,771	

Case Studies

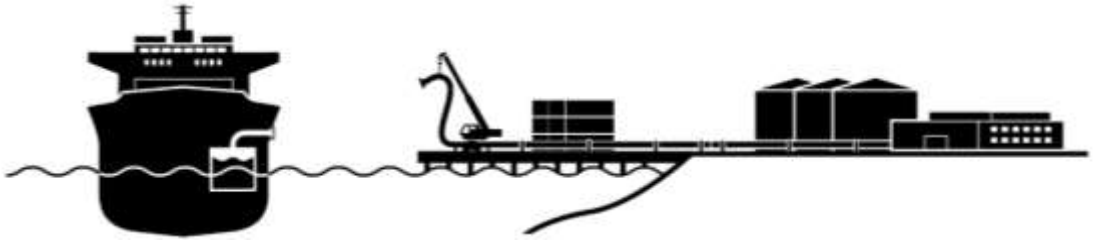
Ports Studied
Stockton, Oakland, Port Hueneme, El Segundo, LA/LB

Marine Vessel Refitting
$151,400 to $425,900 per ship

Reception & Treatment
LA/LB life cycle cost
- Land-based $1,783M
- Barge-based $326M

Port Hueneme life cycle cost
- Land-based $166M
- Barge-based $27M

Conclusion
Barge-based most cost effective and practical alternative

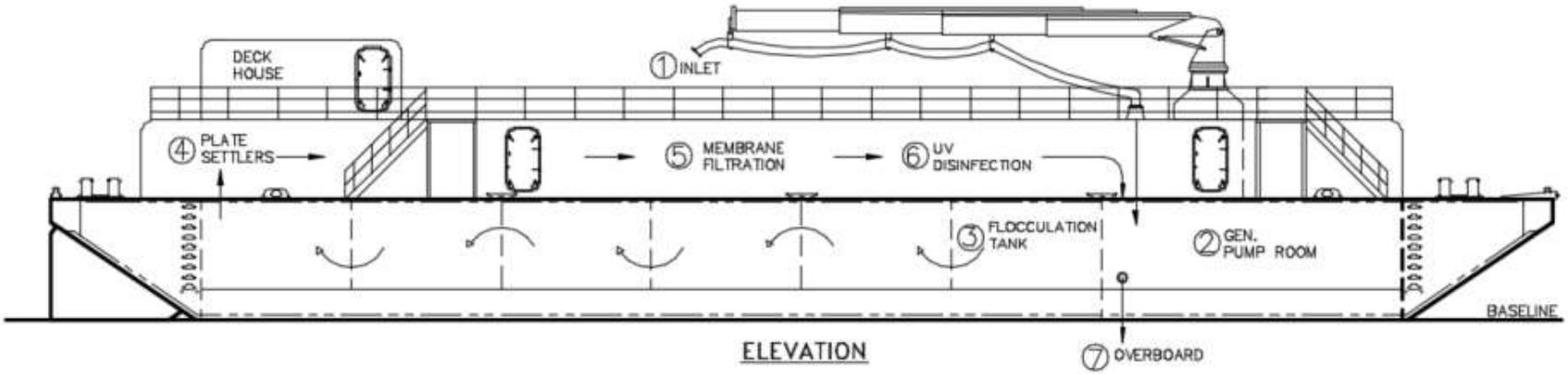


Marine Vessel Retrofitting ***Ports and Wharves Retrofitting*** ***Treatment Facilities***

Technology

Analysis indicates existing technology can meet CA Interim Standard
Scale-up requires three years of prototyping and pilot projects

Reception from Ship → Flocculation Plate Settlers → Membrane Filtration → UV Disinfection → Discharge Overboard



State-wide Network

Six zones, each with a group of barges
Twenty-four (24) new treatment barges statewide

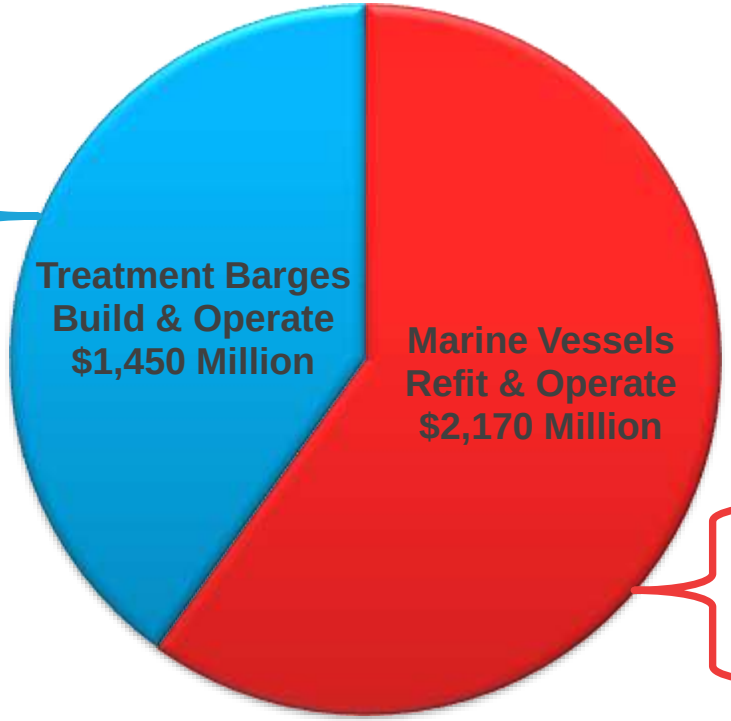
Zone Designation	Barge Service Area	Small (10,000 m³)	Medium (20,000 m³)	Large (35,000 m³)	Total Barges
Zone 1	San Francisco Bay (North Part) and Humboldt Bay	1	1	2	**4**
Zone 2	San Francisco Bay (South Part) and Monterey Bay	2	-	2	**4**
Zone 3	Carquinez Strait and Suisun Bay	1	1	2	**4**
Zone 4	Stockton	-	1	2	**3**
Zone 5	Los Angeles/Long Beach and Vicinity	3	1	3	**7**
Zone 6	San Diego	2	-	-	**2**
TOTALS		9	4	11	**24**

Costs

$3.62 billion for 30 year life cycle

One Ballast Discharge
Pay for Barge Service
$36,751 to $118,321

Unit Costs
$2.18 per ton grain or oil
$18.68 per shipping container
$11.30 per automobile
$46.38 per passenger



Single Ship
Refit for offloading ballast
$151,400 to $425,900

Market Implications

Disproportionate impact on small/remote ports and exports

One Ballast Discharge
Pay for Barge Service
$36,751 to $118,321

Bulk ship calling Stockton costs ~$118,000 per day. More economical to divert cargo to another port.

Decrease pool of available vessels for spot trade cargo

Unit Costs
$2.18 per ton grain or oil
$18.68 per shipping container
$11.30 per automobile
$46.38 per passenger

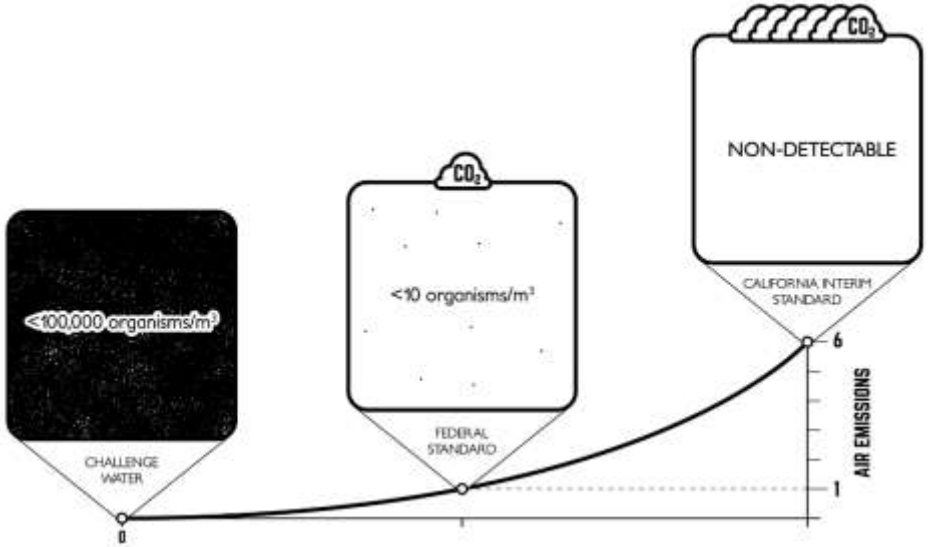
$46.38 per passenger
~5.6% increase in cost
~5.6% decrease in use

Single Ship
Refit for offloading ballast
$151,400 to $425,900

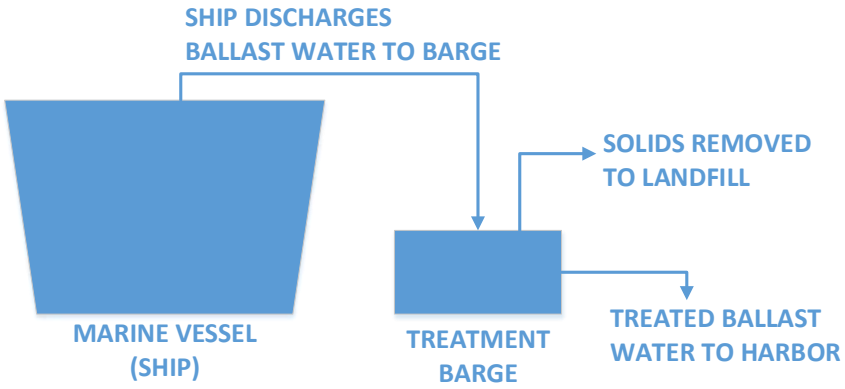
Emissions Impacts

Air emissions would increase six-fold
Harbor craft emissions will increase by 2.6% to 5.1%

South Coast Basin Example		CO	NOx+HC	PM
Harbor craft, total	(MT)	486.6	828.5	26.7
Shore-based ballast treatment	(MT)	24.80	28.77	0.69
Contribution	(%)	**5.10%**	**3.47%**	**2.60%**



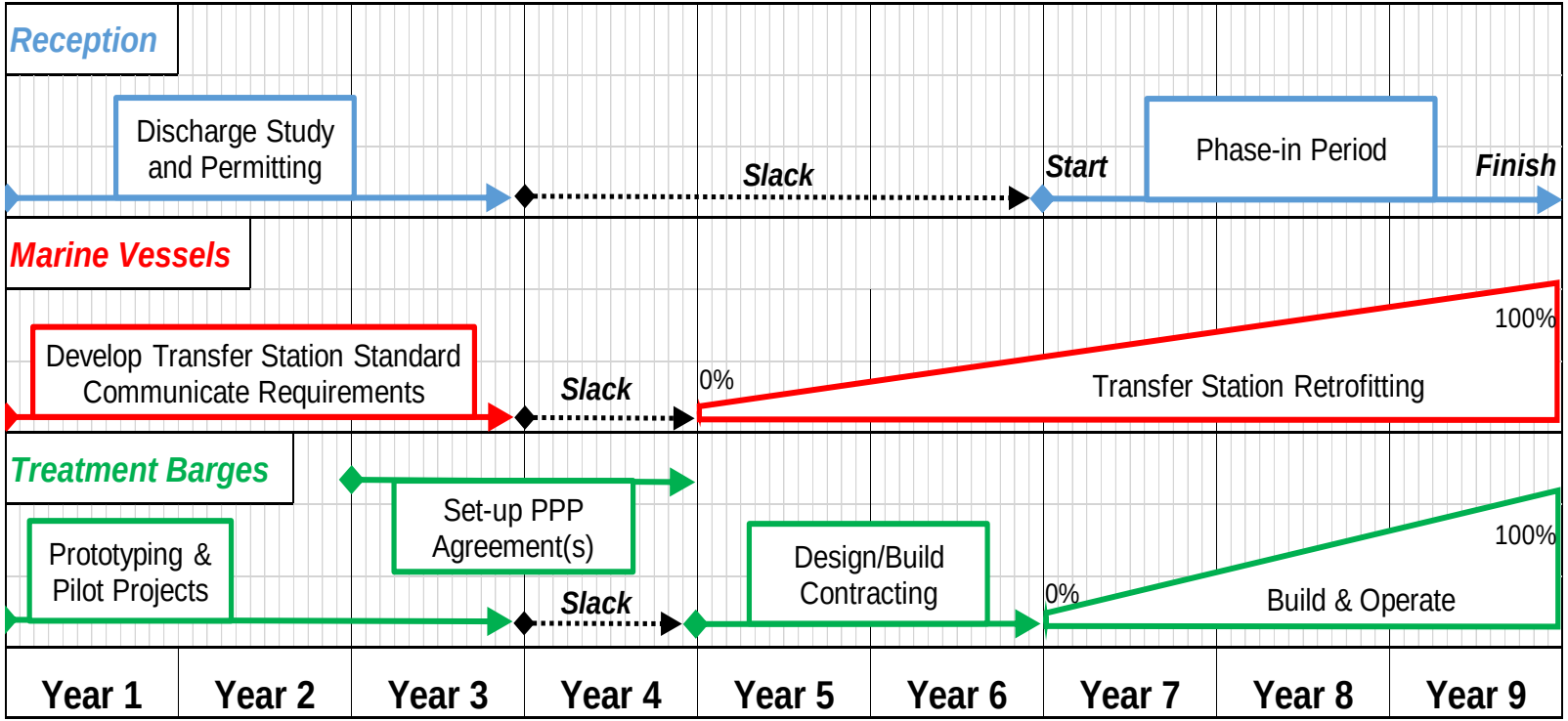
Permitting and Legal



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 California interim standard.
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.

Implementation Timeline

Three years for permitting, prototyping and pilot projects
Phase-in starting in year seven
Nine years to complete implementation



Summary

Practicality
A barge-based network can practically service the 1,556 annual ballast water discharges
Existing technology should be able to meet the CA Interim Standard, but requires prototyping and pilot projects

Cost
$3.52 billion life cycle cost over 30 year period mostly borne directly by shipping industry
Barge network requires $552 million investment

Impacts
Primary impact on discretionary cargo, cargo exports, and remote and small ports
Harbor craft emissions increase 2.6% to 5.1%

Schedule
Nine years for implementation

Additional Slides

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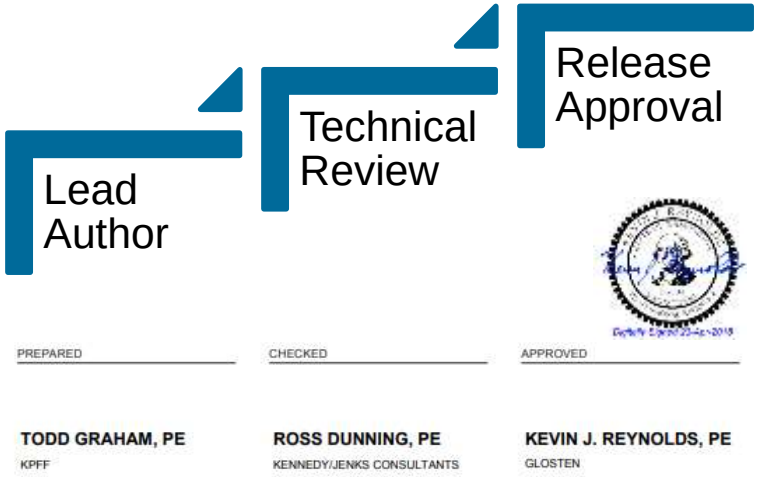
ADDITIONAL SLIDES FOR QUESTIONS

Review and Approval Process

Team Discussion on Approach → Lead Draft w/ Team Review → Public Presentation of Draft → Panel/Public Comments → Revision, Check, and Approval → Delta Stewardship Approval

Role	Lead
Ship/Barge Design	Glosten
Ports and Wharves	KPFF
Waste Water Treatment	Kennedy Jenks
Permitting	ODIC Environmental
Marine Biology	Welschmeyer, Ph.D.
Economics	King and Associates



Pilot Project
Estimates Not Peer Reviewed

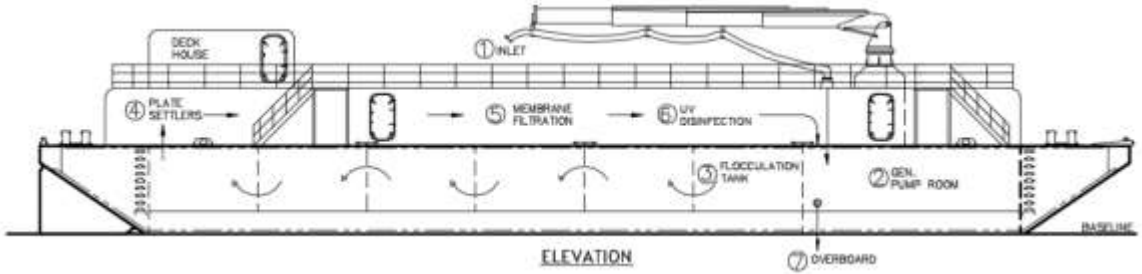
Treatment Plant Prototype
$3M analysis and bench scale
$18M full-scale, small pilot plant
$42M full-scale, large pilot plant

Trial Marine Vessel Refits
$1.5M engineering, refits (two)

Testing and Verification
$3M operations and support
$3M third party testing, evaluation

Analysis and Permitting
$2.5M analysis, submittals

Totals – Three Years
Small only $28.5M
Small and Large $73M



Example Connections

Marcus Bengtsson, wikicommons

Blogspot.com

Tow Masters

Barge-based compared to Land-based solutions

Port	Alternative	CAPEX Cost ($) one-time	OPEX Cost ($) annual	Life-cycle Cost ($) 30 years
LA/LB	Port-based	$1,547.7M	$25.2M	$1,783.2M
	Barge-based	$139.3M	$13.2M	$326.2M
Humboldt Bay	Port-based	$156.0M	$1.7M	$166.3M
	Barge-based	$29.4M	$0.3M	$27.3M

Panel "concurs with the concept of focusing on barge based systems"

- Barge-based less Capital and Operating Expense
- Barge-based less Technical Uncertainty

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. (2013 EPA Vessel General Permit)

Costs

$3.62B Life Cycle Cost

Most is marine vessel refitting

California $552M investment

Ballast Discharge $152k to $309k

$19 per container, $46 per passenger, $11 per car

Costs highly varied, with significant impacts at remote and small ports. Impact focused on cargo exports.

Perspective	Metrics
Shipping Industry	$2.17 billion 30 year lifecycle cost $127 million annual investment in outfitting marine vessels $7.6 million annual operating costs on marine vessels themselves *Excludes fees from treatment barge operator
Treatment Barge Operators	$1.45 billion 30 year lifecycle cost $552 million to invest in treatment barges $55.3 million annual operating costs for treatment barges, including tugs *Excludes treatment barge profit
Ship Operator, Single Marine Vessel	$151,400 to $425,000 one-time cost to outfit ballast transfer station $36,751 to $118,321 cost for barge per ballast water discharge event 10 to 20 hours of personnel time per ballast water discharge event *Excludes treatment barge profit
Cargo Shipment	$2.18 cost per metric ton of bulk cargo, such as grain or petroleum $18.68 per shipping container TEU $11.30 per automobile $46.38 per passenger *Excludes shipping industry costs *Excludes treatment barge profit

Market Implications

Range of Impacts

None, Reduction, Diversion, No shipment

Primary Impacts

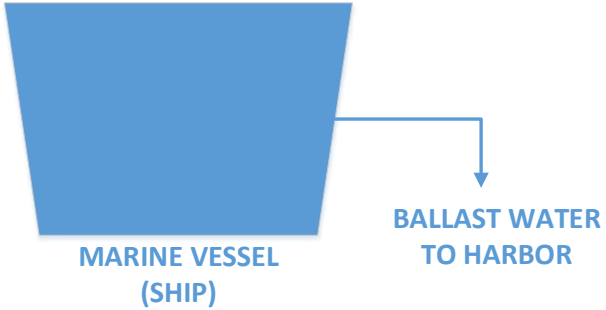
Discretionary cargo
Cargo exports
Remote and small ports

Unit Cargo Basis		Ballast Cost	Cargo Value	Percentage	Market Impact
		($)	($)	(%)	
Automobile	(CEU)	11.30	35,000	0.03%	Low
Container	(TEU)	18.68	100,000	0.02%	None
Passenger	(trip)	46.38	800	5.80%	Moderate
Wheat	(m.ton)	2.18	440	0.50%	Low
Crude Oil	(m.ton)	2.18	390	0.56%	Low

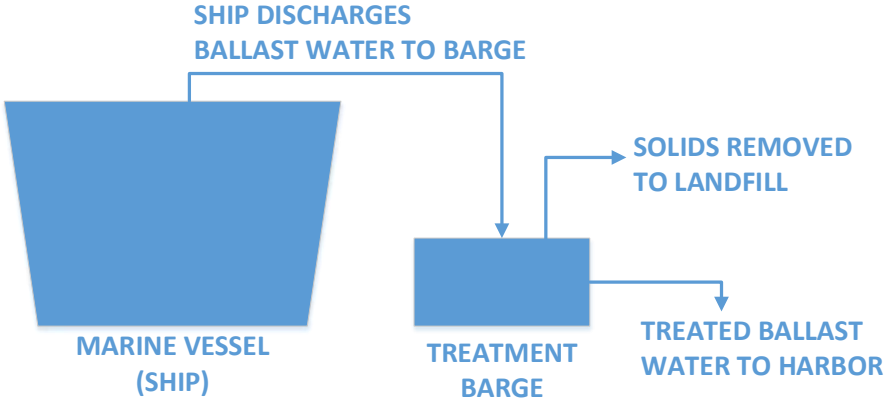
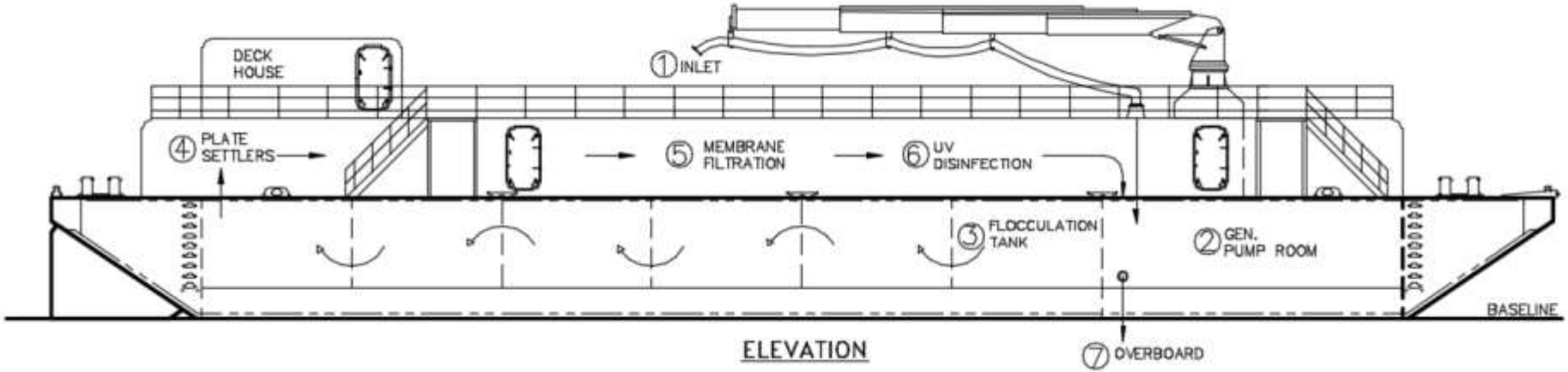
Ship Call Basis		Ballast Cost	Day Rate	Divert Option	Market Impact
Vessel Type	Zone	($/call)	($/day)	(days)	
Car Carrier	San Fran	60,295	35,000	1.7	Low/None
Car Carrier	San Diego	118,321	35,000	3.4	Moderate
Container	San Fran	61,593	35,000	1.8	Low
Container	LA/LB	36,751	35,000	1.1	None likely
Cruiseship	LA/LB	36,751	120,000	0.3	None likely
Bulker	Stockton	116,414	12,000	9.7	High
Bulker	LA/LB	36,751	12,000	3.1	Moderate
Tanker	Suisun	62,282	16,000	3.9	Mixed
Tanker	LA/LB	36,751	16,000	2.3	Mixed

OUTFALL METHODS
CURRENT

OUTFALL METHODS



Current Outfalls



Outfalls with Treatment Barges