Great Lakes Ballast Water Research and Development Plan – Research Area 1, Project 3:
Shipboard Evaluation of the Effectiveness of IMO Compliant and U.S. Coast Guard Type Approved Ballast Water Management Systems in Great Lakes Water – Year One and Two

The Lake Superior Research Institute (LSRI) - Great Waters Research Collaborative (GWRC), in collaboration with the U.S. Department of Transportation Maritime Administration (MARAD), is issuing this Request for Proposals (RFP) for shipboard platforms and ballast water management system (BWMS) manufacturers interested in partnering to determine the biological and operational effectiveness of market-ready and type-approved BWMS onboard vessels operating within the Great Lakes System.

Solicitation Opening Date: 12 November 2020
Solicitation Closing Date: 11 February 2021

I. BACKGROUND/INTRODUCTION

The Vessel Incidental Discharge Act of 2018 (VIDA) established the Great Lakes and Lake Champlain Invasive Species Program (GLLCISP). The GLLCISP has several stated purposes related to ballast water management including developing, achieving type approval for, and piloting shipboard BWMS applicable to commercial vessels operating solely within the Great Lakes and Lake Champlain Systems. The GLLCISP is administered by the U.S. Environmental Protection Agency's Office of Water and Great Lakes National Program Office.

The GWRC, in collaboration with MARAD, has prepared a *Great Lakes Ballast Water Research and Development Plan* (*R&D Plan*) for the GLLCISP Administrators. There are five research areas and a total of 21 projects outlined in the *R&D Plan*. Per GLLCISP, the primary goal of the *R&D Plan* is to identify approaches, methods, and best available technologies that are effective at reducing propagules in Great Lakes ballast water, thereby decreasing the environmental risk associated with the ballast water vector from vessels operating within the Great Lakes System. In many cases, environmental risk (i.e., reduction of propagules) associated with the ballast water vector can be substantially reduced through installation and operation of a BWMS, with the perceived protective effect established globally through a numeric discharge standard (2013 VGP, 33 CFR Part 151, IMO D-2 Standard). However, Great Lakes water quality (e.g., low salinity, low temperature, high turbidity) and the unique operations of Laker vessels (e.g., high ballast flow rates, large ballast volumes, short voyage times) have proven difficult obstacles to overcome in the development of effective and practicable BWMSs for use on Laker vessels. Further, a substantial portion of the vessels operating exclusively within the Great Lakes System are uniquely constructed, unlike seagoing ships of similar size, making installation and operation of a BWMS more complicated. Given these realities and in the context of the *R&D Plan*, an important first question is whether existing type approved BWMS can treat Great Lakes ballast water effectively to meet the current discharge standard, either using existing test methods or a method adjusted to reflect the different environmental conditions of the Great Lakes and the operational realities of Laker vessels.

Research Area 1 – Project 3 of the *R&D Plan* describes the project *Shipboard Evaluation of the*

Effectiveness of IMO Compliant and U.S. Coast Guard Type Approved BWMS in Great Lakes Water (*Shipboard BWMS Evaluation Project*). The *Shipboard BWMS Evaluation Project* is a five-year project as described in the *R&D Plan*. A total of $1,825,000 is available for applicants to this RFP, and additional funding for subsequent years is currently being pursued. The first year of this project allows for selection of applicants and engineering/BWMS acquisition. BWMS installation will be completed in Year Two. Following installation, Years Two and Three are designed to gather data on the operational and biological effectiveness of market-available BWMS under normal vessel operating conditions using existing test methods (i.e., *Generic Protocol for the Verification of Ballast Water Treatment Technology (ETV Protocol)*; U.S. Environmental Protection Agency, 2010). Biological efficacy will be measured against the current U.S. ballast water discharge standard. All BWMS will be evaluated by GWRC staff during a maximum of five test trials conducted over two Great Lakes shipping seasons. Data gathered during the first three years of *R&D Plan* implementation may lead to the formation of a Great Lakes-adapted protocol for verification of BWMS. Years Four and Five of the *Shipboard BWMS Evaluation Project* would utilize the Great Lakes-adapted testing protocol to evaluate only those technologies tested in Years Two and Three for which further evaluation is warranted based on operational and biological performance outcomes. Biological efficacy in this case will be determined as a reduction in propagules over a maximum of five test trials (conducted over two Great Lakes shipping seasons), in addition to comparison to a national discharge standard.

II. PROJECT GOALS

To date, there have been very few land-based and shipboard regulatory test trials of BWMS conducted within the Great Lakes System (Mueller & Dooley, 2017; Cangelosi et al. 2017 and 2018). This lack of data begs the question of whether market-available, type-approved BWMS have been tested under relevant conditions, and would successfully treat Great Lakes ballast water to the regulatory discharge standard. Evaluation of BWMS in the Great Lakes System must be conducted to answer this important question. ***The goal of* Shipboard BWMS Evaluation Project *(Research Area 1 – Project 3) is to increase the publicly-available data on BWMS performance under real-world operational conditions and in a variety of Great Lakes commercial ports.*** The key research question for the work to be conducted under this RFP is:

- Are there existing BWMS available on the global market (either type-approved under the Administrations that are party to IMO Convention or by the U.S. Coast Guard) that can treat Great Lakes ballast water effectively to meet the current discharge standards using existing test methods (i.e., *ETV Protocol*; U.S. Environmental Protection Agency, 2010)?

The research objectives associated with this RFP are:

1. Determine operational and biological efficacy of market-available BWMS onboard vessels trading exclusively within the Great Lakes System under normal operating conditions using the *ETV Protocol*.

2. Evaluate the impact of BWMS operation on vessel operations (e.g., cargo loading/off-loading operations).
3. Evaluate the impact of targeted water quality parameters on BWMS operation.
4. Characterize biology and water quality conditions in Great Lakes commercial ports for inclusion in a publicly-available Great Lakes Port Conditions Database.

The work conducted under this RFP will begin approximately March 2021. Test trials onboard selected shipboard platforms will not begin until March 2022, allowing one year for BWMS acquisition, planning/engineering, and BWMS installation. This RFP provides funding ($1,825,000 total) to incentivize a project partnership between willing research platforms (e.g., Great Lakes vessels) and manufacturers of market-available, type-approved BWMS. Interested vessel owner/operators and BWMS manufacturers are asked to apply together, and funding will be awarded to selected applicant pairs.

Pending available funding, applicants may receive additional awards to offset the costs associated with this project in subsequent years.

A. Scope of Work, Project Timeline, and Deliverables

Each BWMS will be evaluated according to the methods outlined in the *ETV Protocol*. Table 1 outlines the major project milestones associated with the work being funded under this RFP.

Table 1. Major Project Milestones and Anticipated Timeline for Great Lakes Shipboard Evaluation of Market-Available Ballast Water Management Systems (Research Area 1, Project 3). Note: Timeline assumes vessels do not have a BWMS installed; this timeline would be accelerated for vessels with installed BWMS.

Project Milestone	Projected Timing
Final Selection of Award Recipients	February - March 2021
Funding Awarded to Applicant(s)	March - June 2021
Engineering and BWMS Acquisition	June - October 2021
Development of Test/Quality Assurance Plan	September - November 2021
BWMS Installation	October 2021 – March 2022
Trial #1 ETV Protocol	March – May 2022
Trial #2 ETV Protocol	May – July 2022
Trial #3 ETV Protocol	July – September 2022

1. BWMS Installation

Temporary BWMS installation is accepted as part of this project, however, the vessel owner/operator must commit to installation for a five-year duration (ending approximately 30 September 2025). The BWMS does not need to treat the entire vessel's ballast volume, however, installation must be done in such a way to ensure isolation of treated ballast from untreated ballast to avoid contamination. Installation must allow for at least 10% of the total ballast capacity of the vessel to be treated. As part the partnership, the BWMS manufacturer is expected to support and confirm proper installation of the BWMS, and either operate or train the vessel crew on operation of the BWMS for purposes of the test trials. The vessel owner/operator and crew must commit to installation of sample ports within the ballasting system that will allow for connection to GWRC's shipboard sampling system, and importantly, continuous operation of the BWMS during shipboard trials at both ballast uptake and discharge ports.

2. GWRC Shipboard Sampling and Analysis

Ballast water sample collection and analysis will be conducted by GWRC staff, at no expense to the vessel owner/operator, and with minimal disruption of normal vessel operations (total GWRC time onboard vessel will be less than four hours at each port).

- During Year 2, a maximum of three shipboard trials of the applicant BWMS will be conducted during a single Great Lakes shipping season (i.e., approximately March – September 2022; Table 1)
- Depending upon the applicant vessel's voyage route, each trial will be conducted using water taken on the vessel during cargo off-loading in as many different ports as possible
- Each trial will include:
    - Uptake sample collection and analysis
    - Retention during voyage
    - Discharge sample collection and analysis
- Sampling will be conducted on a portion of the ballast water that is taken on/discharged during cargo off-loading/loading operations
    - One GWRC staff member will need to observe the sounding measurements in the control room during uptake and discharge sampling
    - Two GWRC staff members will need to be present in the engine room during sample collection

3. Deliverables

The data from this project will be published and will be publicly-available. This project will produce data on the operational and biological efficacy of two market-available BWMS used during normal Great Lakes vessel operations. Drafting of the publication will be a collaborative process, and applicants will be asked to provide feedback on potential (Great Lakes-specific) technology improvements, lessons learned, cost/benefit of technology, etc. for inclusion in the publication.

III. AWARD INFORMATION

Estimated Number of Awards: Maximum of 2
Funding Amount: $1,825,000 total

MARAD and LSRI-GWRC are seeking a maximum of two vessel-BWMS applicant pairs under this RFP. The total amount of funding awarded to applicant pairs under this RFP will not exceed $1,825,000. The LSRI-GWRC and MARAD acknowledge that the funding amount will likely be insufficient to cover all of the costs associated with BWMS procurement, installation, and operation. In-kind contribution from the vessel owner/operator and BWMS manufacturer will likely be necessary. Successful implementation of this project hinges on the partnership that will be formed between LSRI-GWRC, MARAD, vessel owner/operator, and BWMS manufacturer. The LSRI-GWRC and MARAD will work with selected applicants to ensure the data needs of this project are met, while also addressing any data needs that the applicant pair may have above and beyond the scope of this project.

A. Eligibility for Funds

A collaborative partnership between vessel owner/operator and BWMS manufacturer is required, and must be established prior to submitting a proposal. It is the intention of LSRI-GWRC and MARAD that the funding available for this project be awarded to the U.S.-flag industry. Vessels serving as shipboard platforms must be commercial vessels that have a cargo-carrying capacity of greater than 1,600 gross registered tons and trading within the Great Lakes System, defined in the U.S. Clean Water Act §118(a)(3) to mean all streams, rivers, lakes, and other bodies of water within the drainage basin of the Great Lakes. “Great Lakes” means Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, and Lake Superior, and the connecting channels (St. Mary’s River, St. Clair River, Detroit River, Niagara River, and St. Lawrence River; Clean Water Act, 2002). Vessels serving as shipboard platforms must have a BWMS installed or commit to installation of a BWMS installed prior to March 2022 (i.e., when the first shipboard trial is planned), be willing to allow GWRC scientists on board during test trials, and be willing to have water quality monitoring technology installed to automatically monitor key parameters during uptake of ballast water on all voyages. Vessels of opportunity may include those accepted into the U.S. Coast Guard’s Shipboard Technology Evaluation Program (STEP) but participation in STEP is not required for award consideration.

IV. CONFIDENTIALITY

Applicants are responsible for providing any confidentiality or non-disclosure agreement desired prior to planning the test design. LSRI-GWRC will maintain confidentiality of any declared proprietary information relative to the technology subject to testing, and will work with award recipients to ensure that proprietary technologies are referred to in a generic and categorical way in all planning and reporting documents.

This project is being conducted under the GLLCISP, and the data generated will be made available to the public and will add to existing shipboard research and development data obtained by other

organizations. LSRI-GWRC will publish findings in peer-reviewed scientific or technical journals, and other publications or reports as deemed appropriate. Publication will be completed in collaboration with the applicants, and no declared proprietary information about the technology will ever be reported by LSRI-GWRC in publically-available documents.

V. APPLICATION PREPARATION AND SUBMISSION

Proposals will be accepted until 5:00 pm CST on Wednesday, 11 February 2021. Proposals must be submitted via electronic mail to gwrc@uwsuper.edu. Proposals received after the deadline will not be considered for award.

Proposals must be collaborative in nature; submitted jointly by the vessel owner/operator-BWMS manufacturer applicant pair. Proposals are limited to ten pages, not including the cover page, and must include the following information:

I. **Cover Page**
PDF-fillable form provided by LSRI-GWRC that includes applicant contact information and other information required for administration of funds.

II. **Applicant Team, Scope of Partnership, and Roles in the Project**
Brief introduction of each member of the applicant team, explanation of their role in the project, and any past experience with shipboard evaluation of BWMS (research and development testing or regulatory testing).

III. **Vessel Description and Trade Pattern/Routes**
Vessel operational characteristics and typical/historical trade route.

IV. **Ballast Water Management System Description**
Model and operational characteristics, description of any previous testing (either research and development or regulatory) performed in freshwater (not limited to the Great Lakes System).

V. **Project Design**
Timeline and plan for installation of BWMS or description of BWMS location within vessel (if already installed), project milestones, plan for operation of BWMS (continuous operation or operation only during test trials), plan for maintenance of BWMS, crew training plan (if BWMS will be operated by vessel crew).

VI. **Budget**
Itemized budget describing how the funding will be used, including but not limited to, engineering support, BWMS acquisition, BWMS installation, and/or BWMS/vessel operational costs. In-kind costs and other contributions from the vessel owner/operator and/or BWMS manufacturer must be described.

VII. **Referenced Documents**
List documents cited in proposal.

We encourage technology manufacturers NOT to include any proprietary information that the

manufacturer wishes to keep confidential. If there is a need for such information in the application materials, the manufacturer must request that the application reviewers complete a confidentiality or non-disclosure agreement. Applicants are responsible for providing any confidentiality or non-disclosure agreement desired to LSRI-GWRC prior to uploading the application materials.

VI. APPLICATION EVALUATION AND REVIEW PROCESS

Solicitation Closing Date: 11 February 2021
Awards Announced On/By: 17 March 2021

Completed proposals will be reviewed by a MARAD-convened panel consisting of MARAD staff, GWRC staff, and designated members of the GLLCISP Stakeholder Group within four weeks of receipt. Review criteria are, in order of priority:

- Application completeness;
- Anticipated vessel trade route;
- Readiness of the vessel and BWMS for Great Lakes shipboard evaluation;
- Demonstrated partnership of project participants, including applicant team experience and roles in project;
- Feasibility of shipboard evaluation;
- Budget and cost sharing;
- Compatibility of project design and overall timeline with stated goals;
- Technology training and operation plan;

Any questions that come up during this review will be transmitted to the applicant for feedback by electronic mail. After the four-week review period, GWRC will transmit an email indicating outcomes of the review.

If funding is awarded, GWRC will forward a *Participation Agreement for Shipboard Evaluation of Ballast Water Management System* for applicant review, revision, and countersignature. Next, GWRC will develop a Test/Quality Assurance Plan (TQAP) tailored to the vessel, technology, and testing objectives, also for applicant review, revision, and countersignature.

VII. FUNDING CONTACTS

For any questions relating to the technical or programmatic aspects of this RFP, please contact Kelsey Prihoda, GWRC Program Manager, at kprihoda@uwsuper.edu or +1(715)394-8422.

For any questions about the administration of this funding opportunity, please contact Matthew TenEyck, LSRI Director, at mteneyck@uwsuper.edu or +1(715)394-8160.

VIII. REFERENCED LITERATURE

Cangelosi, A., Aliff, M., Anders, O., Balcer, M., Beesley, K., Estepp, L., Fanberg, L., Gebhard, S., Mays, N., Polkinghorne, C., Prihoda, K., Reavie, E., Regan, D., Ruzycki, E., Saillard, H., Schaefer, H., Schwerdt, T., TenEyck, M., … Wilczewski, S. (2017). *Outcomes of United States Coast Guard Certification Testing of the JFE Engineering Corporation BallastAce® (Algorithm v.2 48H) Ballast Water Management System at the Shipboard Scale* (p. 37) [Technical]. Great Waters Research Collaborative.

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Frank Lobiondo Coast Guard Authorization Act of 2018, Pub. L. No. 115–282, 176 (2018).

International Maritime Organization. (2004). *Regulation D-2 Ballast Water Performance Standard*. International Convention for the Control and Management of Ships' Ballast Water and Sediments. London, United Kingdom.

Mueller, J., & Dooley, J. P. (2017). *Technical Engineering Analysis & Economic Feasibility Study for Ballast Water Management System (BWMS) Installation and Operation on Board U.S. Flag Great Lakes Fleet (Lakers)* (Lake Carriers' Association No. 014766, v.2; p. 134).

U.S. Environmental Protection Agency. (2010). *Generic Protocol for the Verification of Ballast Water Treatment Technology,* EPA/600/R-10/146. Environmental Technology Verification Program.

U.S. Environmental Protection Agency. (2013). Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (VGP), Clean Water Act.