STATEMENTS OF INTEREST

CHESAPEAKE WATERSHED CESU

W912HZ-18-SOI-0006

PROJECT TO BE INITIATED IN 2018

Project Title: Monitoring Oyster Restoration Reef(s) in the Great Wicomico, Piankatank and Lynnhaven Rivers

Responses to this Request for Statements of Interest will be used to identify potential investigators for a project to be funded by the U.S. Army Corps of Engineers (USACE) Norfolk District. Approximately $195,000.00 is expected to be available to support this project for one (1) year.

I. BACKGROUND INFORMATION

Oysters and their habitat have been severely depleted in Chesapeake Bay, as in many other regions of the world (Beck et al. 2011). Current populations in the Bay are estimated at approximately 1% and while a limited recovery of the wild fishery is occurring at present, the overall recovery of the oyster stocks, fishery and associated reef habitat will be limited by poor habitat quality, low stock and continued low recruitment when compared to historical levels (Schulte 2017) unless an aggressive restoration effort is undertaken. Such an effort has been initiated, as part of a larger commitment to protect and restore the ecology of Chesapeake Bay (Obama 2009). For oysters, more specific goals have been established with the 2014 Chesapeake Bay Agreement, which requires 10 tributary rivers be restored by 2025. The Chesapeake Bay Program Goal Implementation Team (GIT) has established standard reef location, abundance and biomass metrics to be applied at reef sites to monitor their status and assess their success over time. The USACE is a member of the GIT and has adopted the GIT standard metrics to assess the status of natural and constructed reefs.

A large-scale, multi-agency team involving both federal and state agencies as well as academia is currently undertaking various large-scale oyster restoration projects in both Maryland and Virginia waters of the Bay and its tributaries. Tributaries were prioritized according to their chance for success of a large-scale project in them. Goals include: significant stock enhancement, expansion of oyster reef habitat, enhanced oyster recruitment, establishment of a network of sanctuary oyster reefs free from oyster fishing pressure, improvements to local ecology including secondary production, SAV expansion and water quality improvement, and enhancing the oyster fishery on areas set aside for the fishery. As part of the Chesapeake Bay Oyster Native Oyster Recovery Project, the U.S. Army Corps of Engineers (USACE) has constructed a subtidal granite reef at the Piankatank River (Figure 1) and subtidal shell reefs at the Lynnhaven River (Figure 2)

and the Great Wicomico River (Figure 3).

To determine restoration status relative to established targets for individual tributaries, monitoring surveys are needed. To assess the success of constructed reefs, monitoring is necessary per the GIT metrics at one, three, and six years post-construction. Monitoring of potential restoration sites in the Piankatank is also needed by the USACE (Figure 1). Additional monitoring at the discretion of the USACE might be desired, especially if any restored, constructed reefs are not meeting the GIT metrics for any reason, including but not limited to poaching, anoxic events, HABs (harmful algal blooms) and/or cow nose ray or other predation.

II. BRIEF DESCRIPTION OF ANTICIPATED WORK

Pursuant to the GIT requirements to monitor reefs to determine the status of natural reefs and the success of constructed oyster reef(s), the description of this action is to monitor the status of the following:

- Potential restoration sites and the USACE constructed subtidal reef in the Piankatank River;
- Constructed USACE subtidal reefs in the Lynnhaven River; and
- Constructed USACE subtidal reefs in the Great Wicomico River.

Monitoring objectives include assessing abundance and biomass (using regression curves, which will be provided), oyster demographics (live and dead) including age classes on the habitat at each of the project sites, as well as shell accretion rates on the restored sites. Fitness for restoration will be evaluated at the potential restoration sties.

All work shall be performed in accordance with applicable local, state, and federal regulations.

III. SCOPE OF SERVICES

1. **Reports** – The Contractor shall record and create datasets of the required data for reef surveys, and analyze the data. Draft and final reports of the reef surveys will be prepared by the contractor and submitted to the USACE. Datasets and a data dictionary will be provided to USACE as a MS Excel, MS Word file and ArcMap, which will include descriptions and latitude and longitude coordinates taken in the field, respectively. The contractor shall have available expertise to analyze and evaluate the data sets created for oyster monitoring for the following: oyster reef biomass over time on reefs, spat (< 35mm oyster) survival, cultch quality (shell and/or stone) and live shell volume, numbers and size classes of oysters and predation to the extent practicable, for all rivers monitored.

   Each reef survey monitoring report will include a general description of the oyster reef site(s), site maps identifying photo stations, and all raw data from all samples taken separated and analyzed by river, in addition to the following elements:

- Summary of activities completed during the monitoring year;
- Description of monitoring methods;
- Observations of aquatic wildlife or signs of wildlife observed at the site;
- Number and location of samples;
- Properly labeled photographs of reefs and samples;
- Oyster biomass for each reef monitored as a total and on a per square meter basis;
- Total biomass on all restored reefs, estimated by use of raw oyster demographics and regression models for mass at a given shell length, for each river system monitored;
- Description of how data was used to calculate biomass metrics, which rely on standard length/weight curves developed for different sub-estuaries of Chesapeake Bay;
- Standard error of the mean (SE) calculations based on monitoring data;
- Number of oysters from samples in each size class (divided into 5 mm size class bins); spat (young-of-the-year) oysters are considered to be all those < 35 mm in length.
- Volume and weight of oxic shell, which includes all live oysters as well as recently dead oysters and any associated shell that is clearly above the mud line and available for larval attachment, volume will be described in liters/m^2 for each reef, weight in kg/m^2, and a total for each reef and a total for the river system if multiple reefs are examined will be provided. For stone reefs, the amount of stone by volume bearing oysters will also be calculated.
- Listing of additional species observed;
- Discussion of data collected, methods, results and conclusions to support the number of samples necessary for next monitoring cycle;
- Comparison of site conditions from the previous monitoring year (when possible).

2. **Monitoring and Sampling Methods -** Monitoring will involve taking sufficient samples at each reef site to estimate oyster number and biomass. Any reef(s) built by the USACE in the Great Wicomico, Piankatank and Lynnhaven Rivers will be sampled using a survey of randomly selected points over the reef surface with sufficient samples to minimize the standard error of the mean (SE), an estimate of sampling precision, so that the estimate of oyster biomass on the reefs is accurate. The SE should be no greater than 15% of the mean, 10% or less being preferred. SE larger than 15% of the mean indicates the precision is poor and additional samples should be taken in order to have a high degree of confidence in the population estimate derived from the survey. For a reef of this size in the Piankatank (approximately 25 acres), it is expected that at least 30 samples will be needed to accomplish this, and it may take approximately 50 to achieve the desired SE. For the potential restoration sites in the Piankatank River, 100 samples will be needed. For

the Great Wicomico and Lynnhaven Rivers, the reefs consist of two distinct strata, high and low. Each strata will be monitored, and for the Great Wicomico 35 samples per strata, for the Lynnhaven, 35 samples per strata. A ten meter square grid will be drawn by the USACE over the entire reef area and assigned numbers. A random number generator computer application will be used by the USACE to produce the random samples for each monitoring event. All sampling point coordinates will be provided by the USACE, as well as sampling maps with the reefs sub-divided into 10X10 m^2 grids. Random samples will be taken from within the randomly selected 10X10 m^2 areas as indicated by the USACE. GPS will be used during monitoring to ensure samples are taken from these points, and the exact GPS location of each sample will be recorded.

A. Metrics

Metrics that will be determined from the sampling are:

1) Oyster biomass (biomass, spat on shell survival (where seeding was done as applicable), cultch quality and live shell volume;
2) Condition of oyster reef as area covered and amount of oxic shell/m^2
3) Oyster population demographics (numbers and size classes of oysters) and,
4) Associated secondary production by other marine life colonizing the reef as described below:

Animals other than oysters will be identified, counted, and their biomass per unit reef area estimated. This productivity can be significant, and it is expected that it will contribute towards secondary production of the reefs on a randomly selected sub-set of 6 samples, to provide information on total secondary production. For this subset of 6 samples, one such subset will be taken from each river where there is an USACE project (Piankatank, Great Wicomico, and Lynnhaven), for a total of 18 such samples.

B. Sampling Method

A stone reef will be sampled by placing a 0.5 meter square PVC marker over the survey area (once within each randomly selected 10X10 square meter grid) and excavating all stone and associated live shell material from the survey plot. All live and dead oysters and associated shell will be scraped from the rocks with hand scrapers. Remaining stone shall be measured for volume to the nearest 0.1 liter, then returned to the water. This measurement can be done by placing the stone into a bucket marked in 0.1 liter increments and measuring the amount of water displaced. Shell volume can be calculated the same way, either in the field or in the lab. All shell material will be collected in mesh and/or freezer bags, transported to the respective lab via truck, stored in freezers and processed at a later date. All shell will have weights and volume determined. The intent is to obtain a shell weight that can be used to estimate live shell volumes and accretion rates more accurately than

the “brown” or “oxic” and black or “anoxic” shell measurements in liters used today, though these will also be recorded. Note that only stone in the first 6-8 inches should be removed, deeper stone is assumed to not have any live oysters on it and can remain in place on the reef during the sampling event. This assumption needs to be checked in the field visually (ROV and/or divers) as it is possible live oysters may be growing deeper in the stone reef matrix and these would need to be sampled and counted. During initial (the first 6) samples, a visual check as to proper sampling depth will be made to ensure all live oysters within a sample plot are counted and none left behind. This information is to be included in the report under sampling methods.

When a shell reef is sampled, all shell with either live or recently dead oysters attached to it, as well as the oysters themselves, will be assessed for live shell volume. Shell reefs can be sampled by either divers or oyster patent tongs. In either case, a 0.5 square meter sample will be taken (the middle half of a patent tong sample, or if divers are used, a 0.5 square meter sample). Similar to sampling on a stone reef, the sample will be taken from within a 10X10 m^2 grid that has been randomly selected for sampling.

Reef samples will be acquired by a combination of patent tongs (where applicable), and/or SCUBA diver collection. Small vessels able to operate in depths as shallow as 4 feet (MLW) of water will be used for transportation to the reefs for sampling.

For sampling the potential restoration sites in the Piankatank River, a bottom probe (auger, ponar grab) is recommended, though divers could be used. A patent tong could also be used, but only if it suspected that extensive shell is present at or near the surface at a given site. Patent tongs are unable to collect a sample of softer bottom material. Bottom conditions at these sites should be recorded in detail, noting the bottom sediment composition at the surface and for a distance of at least one foot below the sediment/water interface, presence of any oyster shell (and live oysters) at the surface, as well as sub-bottom stability (with an auger, at least one foot of depth into the sub-sediment should be probed, two feet is preferable). These samples require no further processing and it is not expected that most of these sites will have oysters present.

Basic water quality data will be collected one time at each site using YSI, Hydrolab, or similar equipment before all oyster biomass sampling. This will include measurements of temperature, salinity, clarity (TSS and or/secchi disk) and dissolved oxygen.

C. Biomass Calculation Method

Dry mass (DM) will be calculated for the oysters using standard regression curves specific to each river system. These curves will be provided by the USACE for use in the estimations of biomass/m^2, by reef and by river system. Dry mass (DM) will be calculated using standard curves relative to each river, fitted to the raw demographic data, to gather data equivalent to GIT oyster metrics which will be recorded as this is now the main goal metric as seen in Table 1.

Table 1. Oyster Reef Biomass Over Time on Reefs (dry weight in g/m^2)

Year	Oyster Biomass	Non-Oyster Biomass	Total Biomass
0	5	3	8
1	10	6	16
2	20	12	32
3	30	18	48
4	40	24	64
5	50[1]	30	80

1- Sustained Population level, to be maintained over time as evidence reef is viable

Most of this biomass should be from the oysters, and USACE has adopted the Goal Implementation Team (GIT) team goal of 15-50 grams of oyster biomass as the oyster-specific goal. So, for the 80 grams of biomass per square meter of reef, at least 50 of it (62.5%) should consist of oysters by year 5 post-construction. Thirty grams of it (37.5%) can consist of other organisms typically found on reefs, such as mussels, barnacles, and gobies, other reef dependent fish (such as oyster toadfish) and crabs (blue, mud, spider and others). Biomass of oysters will be estimated and recorded in the report, as will the biomass of other benthos on a subset of samples. Organisms other than oysters will be identified, counted and weighed on a subset (6) of the overall samples to ensure the macro and meiofauna typically found on a mature oyster reef are present. These samples shall be brought back whole and unwashed to the lab for processing, as washing the samples will remove many of the smaller organisms.

D. Cultch Quality and Live Shell Volume

Live oysters, boxes and recently disarticulated shells, along with any attached shell material, will be measured to the nearest 0.1 L as “live” shell volume. All samples taken from the reefs will be measured for live volume, to determine shell live volume. Weight will also be determined and recorded.

E. Numbers and size classes of oysters
From the samples collected, a size/frequency distribution will be created. This will define the numbers of oysters per unit reef area as well as the numbers of oysters within each 5mm size increment.

F. Predation
Predation will be monitored incidentally during other monitoring survey work. For example, the presence (or lack) of oyster drills, crab predation (chipped shell edges or a crab claw point-sized hole punched through the shell, or cow-nose ray predation (completely crushed shells in pieces + ray tooth plate pieces) will be noted, though precise counts will not be needed.

3. Tasks – Contractor shall visit the reef(s) to record and collect oyster monitoring data. Contractor shall have ability to obtain equipment and personnel capable of sampling at oyster reefs site(s) consisting of stone, stone/shell mix or shell only.

Task 1 – Sampling Plan: The Contractor will develop a sampling plan on how the data will be recorded and analyzed prior to performing monitoring, as well as a description of all procedures to conduct the actual monitoring (methods used to gather the samples). Factors to consider in sampling plan will be the number of samples performed for each reef, and location (random or selected). Time of year of the sampling must also be specified, the USACE requires the sampling to occur during the time of October 1-April 15. The sampling plan will be provided to the Norfolk District, USACE for approval.

Task 2 – Data collection: The Contractor shall collect and record oyster monitoring data. Data collection methods and calculations shall follow the guidelines previously noted.

Task 3 – Report and Analysis of Findings: The Contractor shall prepare and provide draft and final monitoring reports to submit to the Norfolk District, USACE as the deliverable for this project. Following the draft report the USACE will review the report and provide comments to the Contractor. The reports shall contain the results and findings of the reef survey.

4. REPORTING REQUIREMENTS AND DELIVERABLES

1. Work Plan. A comprehensive monitoring work plan shall be prepared and submitted for approval by USACE, in accordance with the submittal schedule. The work plan will function as a blueprint for all fieldwork to be performed. The work plan shall include the methods of sampling procedures and transportation, and a description of all sampled sites. It will provide a schedule of the sequence of operations, sampling locations, sampling methodology, a Quality Control Plan and copies of all licenses and permits required by Federal, State, and Local regulations.

2. Report of Findings: A draft of the reef survey report shall be provided to the USACE for review and comment within 90 days after completing sampling in the field. Raw data files should be provided. Any peer-review scientific publications written using the data obtained under this contract should be provided to USACE.

3. Deliverables on Electronic Files. The Contractor shall provide any electronic files in a form that is compatible with USACE's software (e.g., MS Word 2007, MS Excel 2007, and MS PowerPoint 2007 (or later versions), Adobe Acrobat).

5. PUBLIC BENEFIT

Restoring oysters from their present, severely depleted population and degraded remaining habitat to a vibrant presence in the Bay will restore a suite of ecological services oysters once provided, but has now been largely lost. These services include water filtration, provision of hard reef habitat, secondary production, a restored benthic-pelagic coupling of the Bay ecosystem, clearer water for SAV, and improved fisheries including the one for oysters themselves. Oysters are considered a vital ecosystem engineer as well as the main filter feeder for Chesapeake Bay. We cannot have a truly healthy Chesapeake Bay without a much larger population of oysters on a much more extensive and robust reef network than at present.

6. OBJECTIVES

The monitoring program will accomplish the following:

It will support adaptive management decisions by providing data on critical stages in the development of the reefs that can guide any potential next steps. This monitoring will answer crucial questions that affect future management decisions. For example: Did sufficient numbers of transplanted spat-on-shell (if any were planted) survive and spawn to support continued reef development? Is cultch (shell or alternative material) quality sufficient to support a second year's recruitment? Is cow-nose ray predation a major source of oyster mortality?

It will evaluate intermediate conditions that help to track progress toward the final goals. For instance, are enhanced abundances of new recruits (0-5mm) observed on the reefs? How is mortality impacting population abundance and demographics on the constructed reefs? It will measure specific elements necessary to evaluate success criteria established for the project, such as number and size classes of oysters.

It will aid in identifying unexpected stresses, environmental conditions, and/or ecological interactions that can affect the overall success of the project. For example, water quality can be affected by a very wide range of factors and could potentially impact oyster reefs. While a specific water quality monitoring element is not identified in this plan, weather induced events like freshets and spring/summer algal blooms and associated anoxia may impact reefs and should

be noted and compared to other monitoring data. To the extent information is available about these unexpected environmental stresses, it will be considered in evaluating and monitoring the long-term success of the project. Red tides, if persistent long enough during summer months, can be a source of oyster mortality.

It will determine the fitness of potential restoration sites for restoration reef construction.

7. SITE LOCATION

Please see attached figures. All are tributaries of Chesapeake Bay in waters of Virginia, the Great Wicomico is the first major tributary on the western shore of the Bay south of the Potomac River, the Piankatank River lies south of the Great Wicomico River, and the Lynnhaven River is located within the City of Virginia Beach on the most southeastern shore of Chesapeake Bay near the confluence with the Atlantic ocean.

8. VENDOR REQUIREMENTS:

Vendor must be a non-federal partner of the Chesapeake Watershed CESU Unit willing to accept the negotiated CESU indirect cost rate of 17.5%. Successful applicants should have expert knowledge and work experience in the Chesapeake Bay oyster ecosystem, particularly in restoration efforts. The candidates should have prior experience with inventory and monitoring of oyster reef features within these systems including mapping, data collection/surveying and statistical analysis. The candidates will also be required to submit three (1) draft report and one (1) final report each year of the cooperative agreement when monitoring of any of the rivers covered in this SOI takes place. A final objective will be to publish the reports, modified as needed, in a peer-review science journal for the widest dissemination of the results throughout the practicing restoration community as possible.

9. GOVERNMENT PARTICIPATION:

The Government will work cooperatively with the investigator to identify issues the protocol must address, develop field procedures, and assist the awardee with field activities, provide maps with coordinates for sample locations, and other maps as needed. The Government may also assist in data analysis review, and will review/provide comment to draft reports. Government personnel may also assist the contractor in rendering the report(s) into appropriate format for publication in a peer-review scientific journal.

10. MATERIALS REQUESTED FOR STATEMENT OF INTEREST/QUALIFICATIONS

Please provide the following via e-mail attachment to: Deberay.R.Carmichael@usace.army.mil Maximum length: 2 pages, single-spaced 12 pt. font).

1. Name, Organization and Contact Information

2. Brief Statement of Qualifications (including):
    a. Biographical Sketch,
    b. Relevant past projects and clients with brief descriptions of these projects,
    c. Staff, faculty or students available to work on this project and their areas of expertise,
    d. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.).

Note: A proposed budget is NOT requested at this time.

Review of Statements Received: Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements will be evaluated based on the investigator's specific experience and capabilities in areas related to the study requirements. Additionally, the evaluation method and selection criteria for research and development awards must be: (1) The Technical merits of the proposed research and development; and (2) Potential relationship of the proposed research and development to the Department of Defense missions.

Please send responses or direct questions to:
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ERDC Contracting Office (ECO)
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Timeline for Review of Statements of Interest: Review of Statements of Interest will begin after the SOI has been posted on the CESU website for 10 working days.

11. REFERENCES

Beck, M. W., Brumbaugh, R. D., Airoldi, L., Carranza, A., Coen, L. D., Crawford, C., and Lenihan, H. S. (2011). Oyster reefs at risk and recommendations for conservation, restoration, and management. Bioscience, 61(2), 107-116.

Obama, B. H. (2009). Executive Order 13508. Chesapeake Bay Protection and Restoration.

Schulte, D. M. (2017). History of the Virginia Oyster Fishery, Chesapeake Bay, USA. Frontiers in Marine Science, 4, 127.

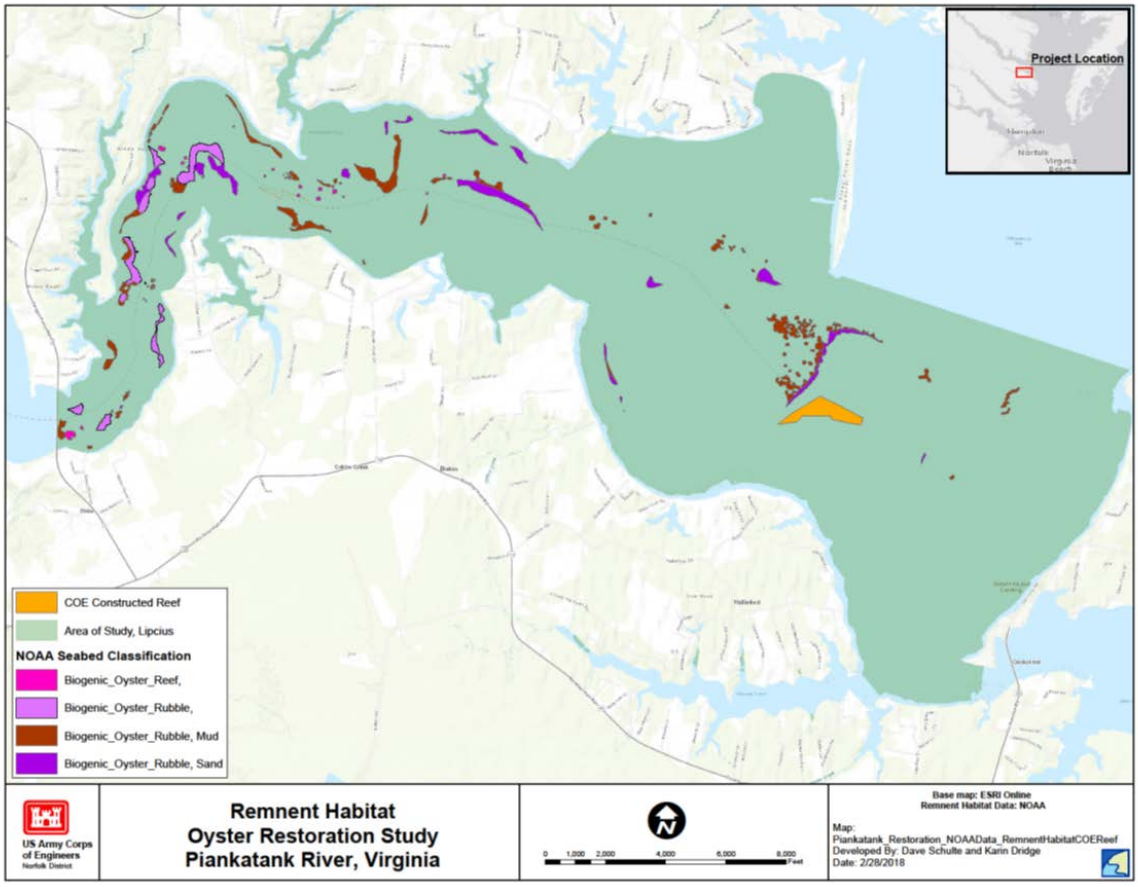

Figure 1. Piankatank River showing COE reef and potential restoration sites.

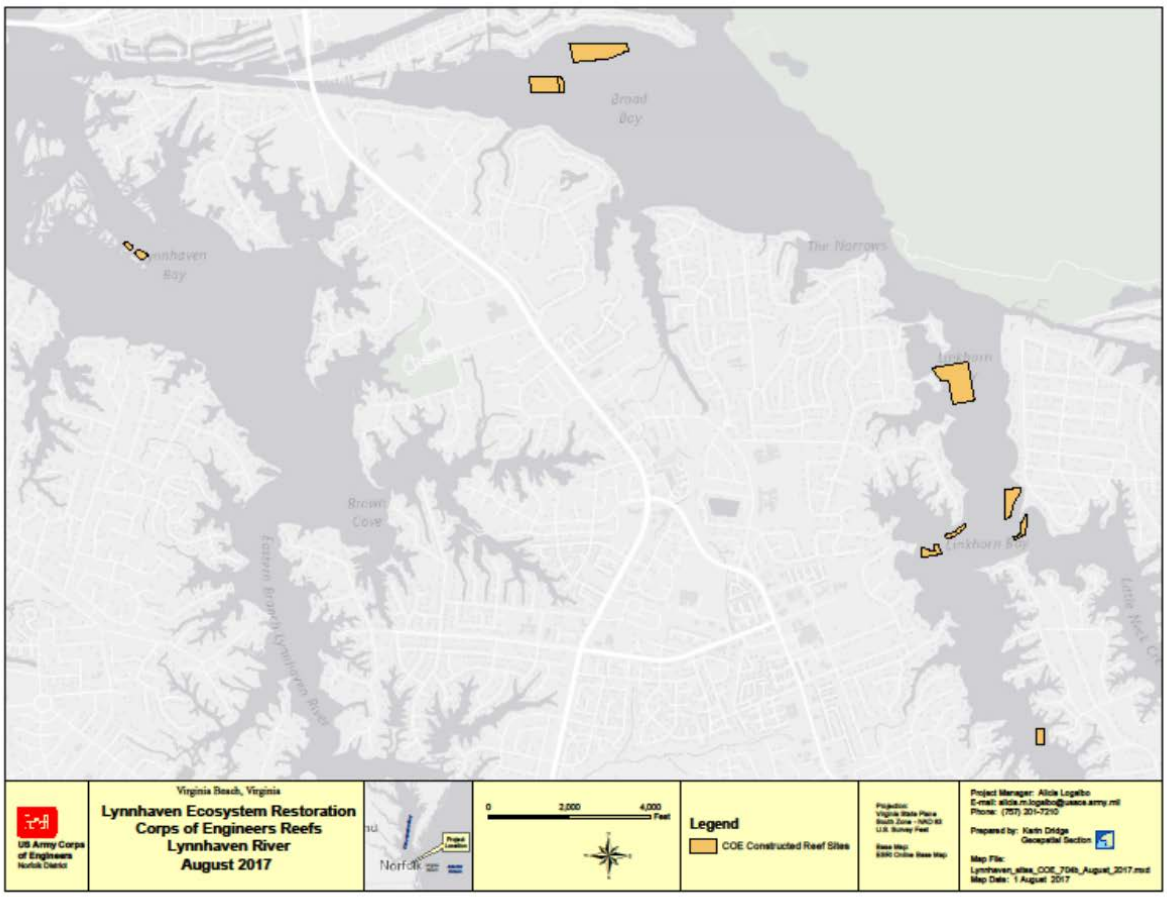

Figure 2. Lynnhaven River showing COE reef sites.

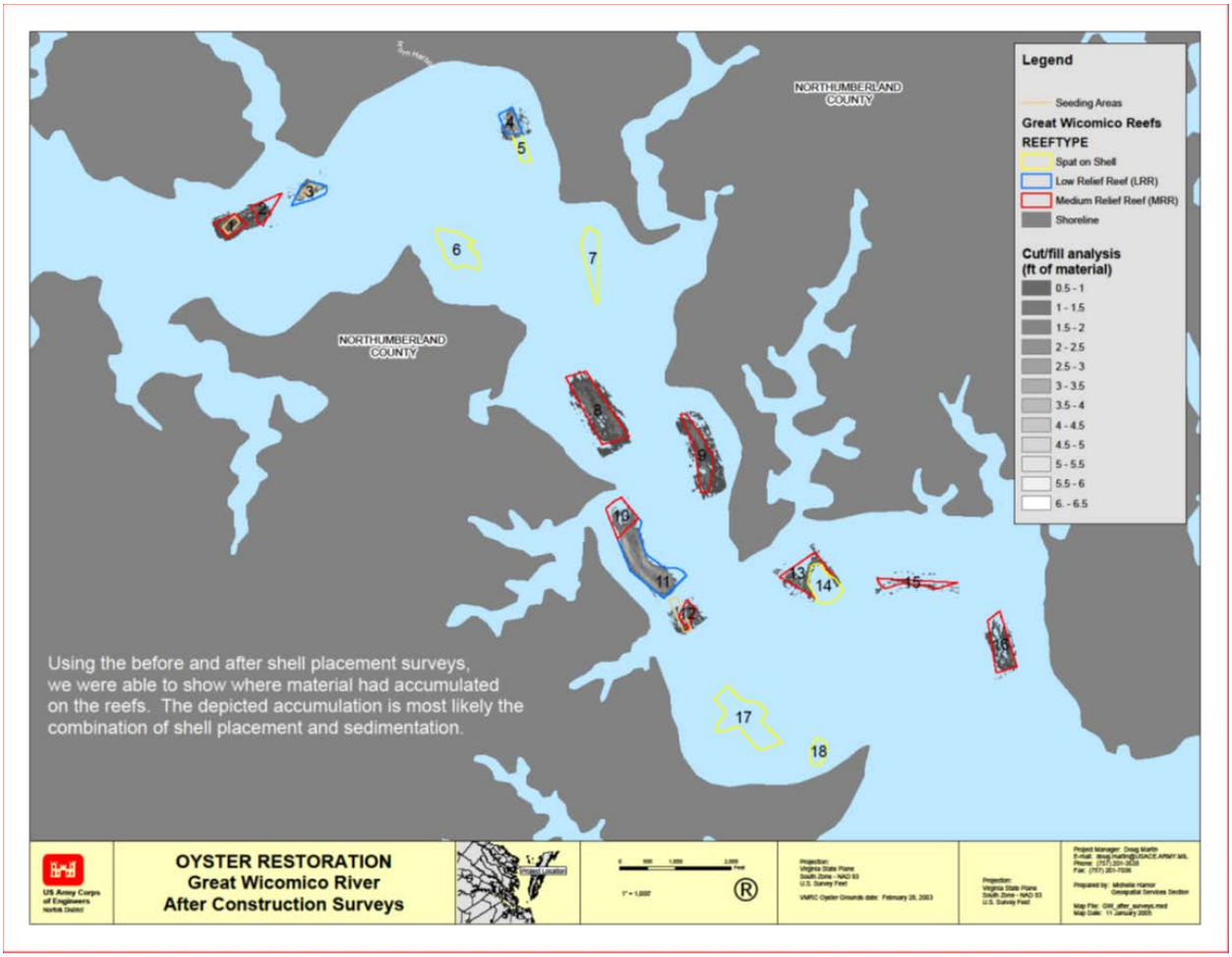

Figure 3. Great Wicomico River showing COE reef sites.