St. Jerome Creek, St. Mary's County, Maryland

Continuing Authorities Program - Section 107
Shallow Draft Navigation Project

Feasibility Report And
Integrated Environmental Assessment

DRAFT REPORT

MARCH 2015

US Army Corps
of Engineers
Baltimore District

FINDING OF NO SIGNIFICANT IMPACT
CONSTRUCTION OF BATTER PILE/VINYL SHEET PILE JETTIES
AND REALIGNMENT OF THE FEDERAL NAVIGATIONAL CHANNEL
ST. JEROME CREEK
ST. MARY'S COUNTY, MARYLAND

In compliance with the National Environmental Policy Act of 1969, as amended, the U.S. Army Corps of Engineers (USACE), Baltimore District has prepared an Environmental Assessment (EA) that evaluates and documents the potential environmental effects associated with the proposed navigation channel improvements in St. Jerome Creek, St. Mary's County, Maryland. The study area includes St. Jerome Creek and the existing Federal navigation project.

Typically within two years after maintenance dredging, the controlling depth is less than the authorized channel depth of 7ft. because of channel shoaling. Within five years, the controlling depth of the channel is 2 ft. or less and seriously impacts vessel movements within the channel. The shoaling restricts the ability of local watermen, recreational boaters, charter boat operators, and others to exit and enter the waterways during periods of low tide. A broad range of alternatives to the current condition was investigated to identify if there is a Federal interest in a Section 107 navigation improvement project. Section 107 of the River and Harbor Act of 1960 provides authority for USACE to improve navigation including dredging of channels, anchorage areas, and turning basins and construction of breakwaters, jetties and groins, through a partnership with non-Federal sponsor such as cities, counties, special chartered authorities (such as port authorities), or units of state government.

Based on technical analyses and economic studies, it was determined that the construction of two batter pile/vinyl sheet pile jetties held in place by vinyl covered piles at the entrance to St. Jerome Creek will provide adequate protection from shoaling at an economically feasible cost. The south jetty would be approximately 1,330 ft. in length and connect to the shoreline about 200 ft. south of the northern tip of Deep Point. The north jetty would be approximately 1,770 ft. in length and connect about 250 ft. east of the tip of the sand spit of St. Jerome Point. The existing entrance channel will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still possible. The purpose of the channel section realignment would be to make the channel more hydraulically efficient to reduce the potential for shoaling. The realigned channel will proceed straight through the inlet and intersect the channel section in St. Jerome Creek.

Potential impacts from the proposed action were assessed with regard to aesthetics; wetlands; fish and wildlife resources; cultural resources; land use; water and air quality; hazardous, toxic, and radioactive substances; threatened and endangered species; regional geology; environmental justice; and the general needs and welfare of the public. The EA documents the overall effects of the project. Water quality impacts will be minor and temporary in nature, while physical effects from jetty construction and stabilization of the inlet will be minor and permanent. There will be a permanent change to the location of the Federal channel and spur. The jetties will be a permanent addition to the viewshed.

USACE and MD SHPO have executed a Programmatic Agreement (PA), dated January 17, 2014, that stipulates USACE conduct Phase I submerged archaeological investigation prior to implementation of the project's proposed actions. USACE will conduct these investigations immediately at the beginning of the Design and Implementation (D&I) phase. If historic properties are located in the project area, they could be avoided. If avoidance is not feasible, mitigation measures could range from terminating the project (not likely, but possible), to recordation, research, excavation, altering the alignment of the recommended plan, or some combination thereof. The execution and implementation of this PA satisfies USACE responsibilities under Section 106 of the National Historic Preservation Act for the feasibility phase.

Upon reviewing the EA, I find that there would be no significant impacts to the resources considered and that an Environmental Impact Statement is not required for the proposed actions. In recognition that the cultural resource investigations are not complete; the recommended project design may need to be altered to account for any cultural resources identified within the project area. This statement has been prepared in accordance with the National Environmental Policy Act of 1969, as amended.

Construction is anticipated to be completed in a period of seven (7) months. The batter pile/vinyl sheet pile jetty structure will be built first followed by the dredging of the channel thru the spit and into St. Jerome Creek. This timeframe are approximate estimations based on previous experiences. The dates will also be affected by the construction windows that have been proposed due to environmental time-of-year restrictions on construction activities. No dredging is permitted between June 1 and September 30. No construction of any nature is permitted between November 15 and March 1.

J. Richard Jordan, III
Colonel, Corps of Engineers
District Engineer
Date: ___________________

St. Jerome Creek, St. Mary's County, Maryland

Feasibility Report

Executive Summary

The U.S. Army Corps of Engineers (USACE), Baltimore District, in partnership with St. Mary's County, Maryland, proposes to improve navigation in St. Jerome Creek. The project is located in St. Mary's County, Maryland, along the western shore of the Chesapeake Bay between St. Jerome Neck and Fresh Pond Neck. With the channel depth authorized at 7 ft., maintenance dredging has historically been performed about once every 10 years due to funding limitations; however, shoaling of the channel typically begins to occur within 2 years of completion of the maintenance dredging. Within 5 years of the maintenance dredging, the controlling depth in the channel is at 2 ft. or less. Littoral drift along the shore causes rapid shoaling at the channel entrance and just inside the mouth of the channel. This restricts the ability of watermen, charter boat operators, and local recreational boaters from using the waterway during periods of low tide. Boaters must wait until the tide raises enough to allow for safe passage. Damages to vessels have been directly linked to the shoaling problem.

The recommended alternative of this analysis consists of construction of two batter pile/vinyl sheet pile jetties at the entrance to St. Jerome Creek (Figure ES-1). The south jetty would be approximately 1,330 ft. in length and connect to the shoreline about 200 ft. south of the northern tip of Deep Point. The north jetty would be approximately 1,770 ft. in length and connect about 250 ft. east of the tip of the sand spit of St. Jerome Point. The existing entrance channel will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. The purpose of the realignment would be to make the channel more hydraulically efficient to reduce the potential for shoaling. The realigned channel will proceed straight through the inlet and intersect the channel in St. Jerome Creek.

The objective of the jetties would be to trap the longshore sediment transport and prevent it from entering the channel area. Based on hydrodynamic modeling, it is likely the jetties would have the least downdrift impacts (erosion/sand starvation) of the alternatives considered along the Deep Point and St. Jerome Point shorelines. The landward terminus of the north jetty would require stabilization along the sand spit shoreline to prevent the jetty from being flanked. The proposed crest elevation of the jetties would be + 5 ft. MLLW. Approximately 30,000 cubic yards of sand and some clay will be removed from the channel. Placement of the dredged material will be on land at the dredged material disposal site located near Buzz's Marina.

The project was economically justified at the 2012 Price Level with an annual benefit of $613,100 and a benefit to cost ratio (BCR) of 1.18. Project costs and benefits were updated to the December 2014 price level using the FY15 Federal interest rate of 3.375% and the Civil Works Construction Cost Index for Breakwaters and Seawalls (EGM 1110-2-1304, 30 September 2014). The cost of the project in FY15 dollars is $10,291,077, which including interest during 7 months of construction, amounts to $10,378,316. The annual cost of the project over the 50-year project life is $470,900 with annualized benefits of $613,100. The resulting

BCR of 1.30 supports the recommended project. St. Mary's County Government, the non-federal sponsor, fully supports the conclusions presented in this report and will provide a signed letter of intent to cost share in the construction of the project.

The batter pile/vinyl sheet pile jetty structure will be built first followed by the dredging of the channel thru the spit and into St. Jerome Creek. These dates are approximate estimations based on previous experience and on the current schedule for the review process. The dates will also be affected by the construction windows that have been proposed due to environmental time-of-year restrictions on construction activities. No dredging is permitted between June 1 and September 30. No construction of any nature is permitted between November 15 and March 1.

Figure ES-1


Dameron
Ridge
Airedele
Scotland
Federal Navigational Channel
Split Point
St Jerome Creek
St Jerome Point
Deep Point
Circle C Oyster Ranch
Drury's Marina
Buzz's Marina
Dredge Material Disposal Site
Chesapeake Bay
Northern Prong
Southern Prong
St Clarence Creek
Elizabeth Dr
Three Notch Rd
Trossbach Farm Ln
Diamond Ln
Wills Rd
Raley Rd
Holly Point Rd
Cedar Ln
Hawley Manor Rd
St Jeromes Neck Rd
Leonardtown Rd
Pine St
Airedele Rd
Curleys Rd
Bayne Rd
Point Lookout Rd
Harry James Rd
Fresh Pond Neck Rd
Hays Beach Rd
Murray Rd
235
5
PENNSYLVANIA
NEW JERSEY
MARYLAND
DELAWARE
DISTRICT OF COLUMBIA
VIRGINIA
Study Location
Legend
Capital Cities
Interstate Highways
Rivers
Lakes
Lake; Ocean
Land
State Boundaries
States
Neighboring Countries
St. Jerome Creek
CAP Section 107
0
1,250
2,500
5,000
Feet
N
S
E
W
US Army Corps of Engineers
Baltimore District

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St. Jerome Creek, St. Mary's County, Maryland
Section 107 Small Navigation Project

Feasibility Report

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Section 1.0 **STUDY INFORMATION**

St. Jerome Creek is located in St. Mary's County, Maryland, along the western shore of the Chesapeake Bay between St. Jerome Neck and Fresh Pond Neck. The study area includes St. Jerome Creek and the existing federal navigation project, which consists of a channel and turning basin 200 ft wide and 300 ft long opposite Airedele, in St. Jerome Creek. The study area is located approximately five (5) miles north of the mouth of the Potomac River and six (6) miles southeast of St. Mary's City. Typically within two years after maintenance dredging, the controlling depth is less than the authorized channel depth of 7ft. because of channel shoaling. Within five years the controlling depth is 2 ft or less and seriously impacts vessel movements within the channel. The shoaling restricts the ability of local watermen, recreational boaters, charter boat operators, and others to exit and enter the waterways during periods of low tide. Such delays result in loss of productive fishing time. Also, damages to recreational vessels have been directly linked to the shoaling problem.

1.1 PURPOSE OF STUDY

The purposes of this feasibility study are to examine the navigation-related problems affecting the local users of St. Jerome Creek, identify a solution that is economically feasible and minimizes potential impacts to the environment. The non-federal sponsor for the project is the St. Mary's County Government.

1.2 STUDY AUTHORITY

This study was conducted under the Continuing Authorities Program (CAP) of Section 107 of the River and Harbor Act of 1960, as amended, which states in part:

> a. "The Secretary of the Army is authorized to allot from any appropriations hereafter made for rivers and harbors not to exceed $35,000,000 for any fiscal year for construction of small river and harbor improvement projects not specifically authorized by Congress which will result in substantial benefits to navigation and which can be operated consistently with other purposes, when in the opinion of the Chief of Engineers such work is advisable, if benefits are in the excess of costs."
>
> b. "Not more than $10,000,000 shall be allocated for the construction of a project under this section at any single locality and the amount allocated shall be sufficient to complete the federal participation in the project under this section...subject to certain conditions of local cooperation."

1.3 STUDY AREA

St. Jerome Creek is located in St. Mary's County, Maryland (see Figure 1-1), along the western shore of the Chesapeake Bay between St. Jerome Neck and Fresh Pond Neck. The existing federal navigation channel in the creek is approximately five miles north of the mouth of the Potomac River and six miles southeast of St. Mary's City. In 2006, the project was maintained by hydraulic dredging to its authorized depth of 7 ft. plus 2 ft. of allowable overdepth. Based on a hydrographic survey done in 2009, the controlling depths in the channel ranged from -1.83 to -7.7 ft MLLW.

Figure 1-1 – Study Area

1.4 SCOPE OF STUDY

The feasibility study involved a detailed investigation to determine the best solution for reducing the rapid rate of shoaling occurring in the channel approach to the St. Jerome Creek Inlet. Meetings and interviews with residents and local officials helped to identify the existing problems. Data was collected through methods such as interviews, hydrographic surveys, soil borings, and hydraulic calculations including computer modeling.

The recommended plan identified in this report to address the navigation problems in St. Jerome Creek was selected through detailed comparison of plans, environmental impacts, and economic benefits. An environmental assessment (EA) is integrated within this report, and includes an existing conditions assessment and an assessment of the impacts of the recommended project on water quality; rare, threatened and endangered species; hazardous, toxic, and radioactive waste (HTRW); and other environmental resources. Cultural resources investigations are typically evaluated with the EA. However, in this case, cultural resources and the determination of potential impacts will be completed in the next project phase. Pending approval of this feasibility report by the North Atlantic Division (NAD), construction plans and specifications for the recommended plan including final drawings, construction schedule, and construction costs will be prepared.

1.5 REPORT AND STUDY PROCESS

The planning for this federal navigation project was accomplished in two phases: a reconnaissance phase and a feasibility phase. The reconnaissance phase was conducted at full federal expense. The cost of the feasibility phase is shared between the federal government and the non-federal sponsor. The Feasibility Cost Sharing Agreement (FCSA) was executed in September 2008.

The objectives of the reconnaissance phase were to assess the costs and benefits associated with a potential project in the interest of navigation within the St. Jerome Creek study area. The St. Jerome Creek, Section 107, Phase I Factsheet contains a summary of these investigations, results, conclusions, and recommendations of the reconnaissance phase, and was completed in December 2004. The recommended project in the reconnaissance study included a project that would involve construction of a jetty or jetties that protect the mouth of St. Jerome Creek. The jetties would be designed to trap sediment, keep the channel clear and reduce the dredging need from a two year cycle to a ten year cycle.

The purpose of this feasibility study is to undertake a more detailed examination of the alternative plans to address the navigation problems within the St. Jerome Creek study area. The objectives of the feasibility phase are:

1) to evaluate the specific engineering, environmental, and economic effects of the improvements, including a without-project alternative;
2) to identify the optimal project for the St. Jerome Creek users from both a federal and non-federal perspective; and

3) to recommend a project for construction, if economically justified and is supported by the non-federal sponsor. The product of the feasibility phase is a feasibility report, including the appropriate National Environmental Policy Act (NEPA) documentation, for submission to NAD for approval.

The EA describes existing conditions within the study area and evaluates anticipated impacts of the proposed alternatives. If no significant impacts are determined, a finding of no significant impact (FONSI) will be prepared. If the potential impacts are determined to be significant, a notice of intent will be published, leading to the preparation of an EIS. The feasibility report and integrated EA were prepared in accordance with NEPA, the Council on Environmental Quality regulations CFR 1500-1508, and the Engineering Regulation 200-2-2 “Procedures for Implementing NEPA”, and 33 CFR 230.

1.6 PRIOR STUDIES, REPORTS, AND EXISTING PROJECTS

USACE currently maintains a federal navigation channel in St. Jerome Creek. Dredging of the channel was originally authorized by the River and Harbors Act of 1881. The project was modified and re-authorized by the River and Harbor Act of August 26, 1937. The St. Jerome Creek project was completed in 1939 and provides for a channel 7 ft deep and 100 ft wide from deep water in the Chesapeake Bay to Airedele, then 7 ft deep and 60 ft wide to deep water in the creek, with a turning basin of the same depth, 200 ft wide and 300 ft long, opposite Airedele. The project length is 4,900 ft.

Section 2.0 EXISTING CONDITIONS

The following section contains a description of the existing conditions within the St. Jerome Creek, Maryland study area. The description provides a basis for measuring impacts associated with the construction and operation of a potential federal navigation project.

2.1 LAND USE

The area surrounding St. Jerome Creek is comprised primarily of residential and agricultural land use. In general, the area is rural with little development and only unincorporated small towns. St. Jerome Creek is navigated by recreational boaters, watermen, and charter boat operators.

The 11.1 acre site that is proposed to be used for dredged material placement was initially used for this purpose in 2006. Prior to 2006, the site was an agricultural field of the Orebaugh farm used for soybean production. The site is located about 550 ft. south of Buzz's Marina Way. In order to place materials at the site, an earthen dike, approximately 10 to 12 ft. high relative to the existing ground was constructed prior to dredging in 2006. Earthen materials available inside the placement site were used for dike construction. As of July 2009, material from the last dredge cycle (39,675 cy) in 2006 was still held at the facility. It is planned that the material currently held at the placement site would be removed to provide space for the newly dredged material at the start of the proposed project.

A commercial oyster farm, the Circle C Oyster Ranch, is located on Airedele Road across from the turning basin of the federal channel. Two marinas are located in the vicinity of the study area, Drury's Marina on Airedele Road on the Northern Prong of the creek and Buzz's Marina Way on Ridge Road on the Southern Prong of St. Jerome Creek (Figure 2-1).

2.2 PHYSICAL SETTING AND PROPERTIES

2.2.1 Location

St. Jerome Creek is located in St. Mary's County, Maryland. along the western shore of the Chesapeake Bay between St. Jerome Neck and Fresh Pond Neck and flow to the southeast into Chesapeake Bay. St. Mary's County is on a peninsula of land that is bounded by the Patuxent River to the north and the Potomac River to the south. The Potomac River is the most southern tributary on the western shore of the Chesapeake Bay in Maryland. St. Jerome Creek is situated approximately five miles north of the mouth of the Potomac River and six miles southeast of St. Mary's City. Leonardtown, the county seat, is roughly 50 miles southeast of Washington, D.C. 60 miles south of Annapolis, MD and approximately 20 miles northwest of St. Jerome Creek. St. Jerome Creek is shown on the U.S.G.S. Quadrangle titled "Point Lookout, MD".

2.2.2 Landscape and Aesthetics

The study area is a rural community offering the scenic beauty of gently rolling farmland, pine and oak forests, creeks and inlets stretching to the Chesapeake Bay. The largely rural character of the St. Jerome Creek study area, the vast expanse of the Chesapeake Bay, and the many miles of shoreline afford the project area great natural beauty. The area is perhaps best suited to recreational activities that appeal to the outdoor sportsman, including fishing, crabbing, and hunting.

2.2.3 Physiology, Geology and Topography

St. Mary's County is located in the Coastal Plain physiographic province. The Coastal Plain consists of layers of sediment with its origins from ancient marine, estuarine, and riverine environments tens of millions of years ago. These sedimentary deposits originated from changes in sea level over millions of years that allowed deposition of sediment when the area was flooded by ancient seas. Coastal Plain sediments form wedge-shaped layers which thicken in depth toward the east.

The geologic strata of St. Mary's County consist of unconsolidated sediments from the Quaternary and Tertiary periods (0 to 63 million years ago). The inland portions of the peninsula are underlain by Upland Deposits. Upland Deposits are gravel and sand with thickness ranging from 0 to 50 ft. A geologic gradient exists from upland to shoreline in St. Mary's County. Lowland Deposits are found throughout the entire county along the shoreline. Lowland Deposits are gravel, sand, silt and clay that contain estuarine to marine fauna in some areas and have thicknesses from 0 to 150 ft.

Soils within the St. Jerome Creek study area consist of the St. Mary Formation located between the Upland and Lowland Deposits in the St. Mary's River watershed. The St. Mary Formation consists of greenish-blue to yellowish-gray sandy clays and fine-grained sand with thicknesses from 0 to 80 ft.

The topography of the St. Jerome Creek study area consists of a series of terraces that were formed during higher sea levels in the geologic past. These terraces can be considered to consist of upland and lower-lying upland or lower terrace. The lower terrace borders the Chesapeake Bay and rivers and consists of broad stretches of flat land. The lower terrace elevations range from 0 to 45 ft above mean sea level (MSL); upland terraces have elevations greater than 60 ft. St. Jerome Point, Deep Point and Split Point all reach maximum elevations of about 5 ft above MSL. Elevations about 2 miles northwest of St. Jerome Point reach 100 ft.

2.2.4 Climate

The Appalachian Mountains, Chesapeake Bay and Atlantic Ocean influence weather in the study area. A more temperate climate exists in the study area compared with points farther inland at the same latitude in the United States due to the net effect of the mountains to the west and the Chesapeake Bay and Atlantic Ocean to the east.

Winters are cool to cold, with mean daily temperatures averaging 37.4ºF. Summers are hot and humid. Mean daily temperatures in the summer average 74.4ºF. The freeze-free period is approximately l99 days.

Average precipitation for St. Mary's County is 47.5 inches. Rainfall during the growing season occurs principally from thunderstorms. The greatest rainfall intensities occur in summer and early fall, the season for severe thunderstorms and part of the hurricane season. St. Mary's

County receives 17.8 inches of snowfall per year. On average snow accumulations of one inch or greater happen only about five days annually.

2.2.5 Tidal Data, Currents, Wave Action, Salinity and Water Temperature

Normal water level variations in the St. Jerome Creek area are generally dominated by astronomical tides, although wind effects can be important. Astronomical tides in the area are semi-diurnal tides, with a period of approximately 12.5 hours, resulting in two high tides and two low tides each day. Mean Lower Low Water (MLLW) is selected as the datum for this project. The Mean Tide Level (MTL) is 0.74 ft. above MLLW with a mean tide range of 1.33 ft.

St. Jerome Creek is susceptible to storm surge from the Chesapeake Bay. Storm surges are 4.6 and 5.3 ft at the 50- and 100-year return interval, respectively. Cove Point is the closest station location to St. Jerome Creek study area.

Climatological data from the Patuxent Naval Air Station for the period of 1945 to 1995 was obtained from the National Climatic Center in Asheville, North Carolina. Based on this information, winds from the south (S) and northwest (NW) directions are the most frequent. The wave approach directions (fetches) for St. Jerome Creek range 0.09 mi from the north (N) to 26.36 mi from the southeast (SE) with average depths over these fetches of 18.7 ft. The strongest winds (measured as one minute average wind speed) blow for the east (E), west (W), NW, west northwest (WNW), and north northwest (NNW).

The land features north and south of the entrance (St. Jerome Point and Deep Point) to St. Jerome Creek are stable. The sand spit inside the north side of the entrance is a longstanding feature that provides wave protection to properties adjacent to St. Jerome Creek.

Salinity just east of the study area in the Chesapeake Bay Mainstem near Point No Point, typically varies between 7.49 and 21.76 parts per thousand (ppt). The mean annual salinity (from 1985 through 2008) ranges between 15 and 17 ppt (Maryland Department of Natural Resources (MDNR) September 2009). Water temperatures have been monitored just east of the Creek and range from roughly 34° Fahrenheit (F) in the winter to 80° F in the summer months, (MDNR October 2009).

2.2.6 Sediments

To the north and south of St. Jerome Creek, the Chesapeake Bay shoreline consist of low lying beaches, with various homeowner shoreline stabilization measures (e.g., small revetments, home-made seawalls, and groins made from well rings).

Littoral drift and shoaling is evident throughout the entrance to the federal channel and moving along the Chesapeake shoreline to the north and south into the mouth of St. Jerome Creek. Sand shoals are more evident during periods of low tide.

Historic studies indicate a net longshore transport rate of about -30,000 cubic yards per year (cy/yr). A more recent study conducted by Andrews Miller & Associates (AMA) for the Tanner's Creek area (about a mile south of St. Jerome Creek) indicates the potential longshore sediment transport rate to be on the order of 10,000 cy/yr from the north of the project area and

26,000 cy/yr from the south of the area with the gross transport equal to about 36,000 cy/yr. The past dredging events are summarized in Table 2-1. The frequencing of maintenance dredging has been largely driven by available funding.

Table 2-1 - Past Maintenance Dredging Quantities

PAST MAINTENANCE DREDGING QUANTITIES & COSTS	
YEAR: 1991	YEAR: 2006
Dredge Quantity: 21,630 CY Contract Cost: $183,195	Dredge Quantity: 39,675 CY Contract Cost: $937,100 Method: Hydraulic

Sediment was analyzed for grain size in three locations in 2004, prior to the last dredging cycle. Samples from the eastern and central portions of the channel were approximately 95- to 97-percent sand. The sample from the western portion of the channel was approximately 33-percent sand. The sediment summary of the sampling is provided in Table 2-2.

Table 2-2 – Sediment Summary

St. Jerome Creek Sediment Summary	
SJI (Chesapeake Bay – Station 4+500)	$_{d}50$ = 0.13 mm
SJ2 (Turning Basin – Station 2+200)	$_{d}50$ = 0.66 mm
SJ3 (Interior Channel – Station 0+300)	$_{d}50$ = 0.04 mm

As part of the feasibility study, USACE collected sediment borings within the study area. Results from evaluations of the sediment borings are available in Appendix C. Sediment in the project area is typically sand in the top feet overlaying silt or silty sand and is clay in bottom depths. The transition to clay typically occurs between 10 and 20 ft., but sometimes is at shallower depths in the cores.

A geotechnical investigation for the proposed channel re-alignment and jetty construction areas has been conducted by the Baltimore District to evaluate the foundation material. The geotechnical plan, as shown in Figure 2-1(a larger map is included in Appendix C, Section C-3), included drilling and sampling eleven (11) borings to a minimum depth of 30 ft in accordance with ASTM D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals (2.5 ft), samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. split spoon sampler. The number of blows required to drive the sampler the final foot of each SPT 1.5 foot drive to determine the Standard Penetration Resistance, were recorded and used to determine the index of the soil's strength, density and behavior under applied loads.

Figure 2-1 - Geotechnical Investigation Plan

In addition, eight (8) grab samples of material within the existing and proposed realigned channel were taken. Each sample was obtained from the elevation of the existing bottom to -7 ft MLLW (proposed dredge depth).

Following the completion of the field investigation, an evaluation of the foundation conditions was conducted. This evaluation indicated that the majority of the borings had a range of weight of rod (WOR) to very low blows per 0.5 ft.

A decision was made to hold off on any additional testing or geotechnical engineering/report due to the extremely soft material encountered. The additional drilling will be done in the initial stages of Preconstruction, Engineering, and Design (PED) to further evaluate the foundation conditions and complete the design.

2.2.7 Soils

Shoreline soils within the proposed project area of St. Jerome Point and Deep Point are predominantly classified as beaches (Be) that are composed of sand and are poorly drained. Wetland (hydric) soils are mapped within St. Jerome Creek and include Be, Ek (Elkton silt loam), Ot (Othello fine sandy loam), and Tm (Tidal Marsh). Figure 2-2 identifies hydric soils within St. Jerome Creek. There is the potential for wetland soils to be in the waterway as a result of erosion.

The dredged material placement site is mapped as part of the Othello-Matapeake-Mattapex Association. These soils range from well-drained to poorly-drained and are moderate to fine in texture (silt loam and fine sandy loam). The placement site was used during the last dredge cycle and all of the material still remains, which is composed primarily of sand.

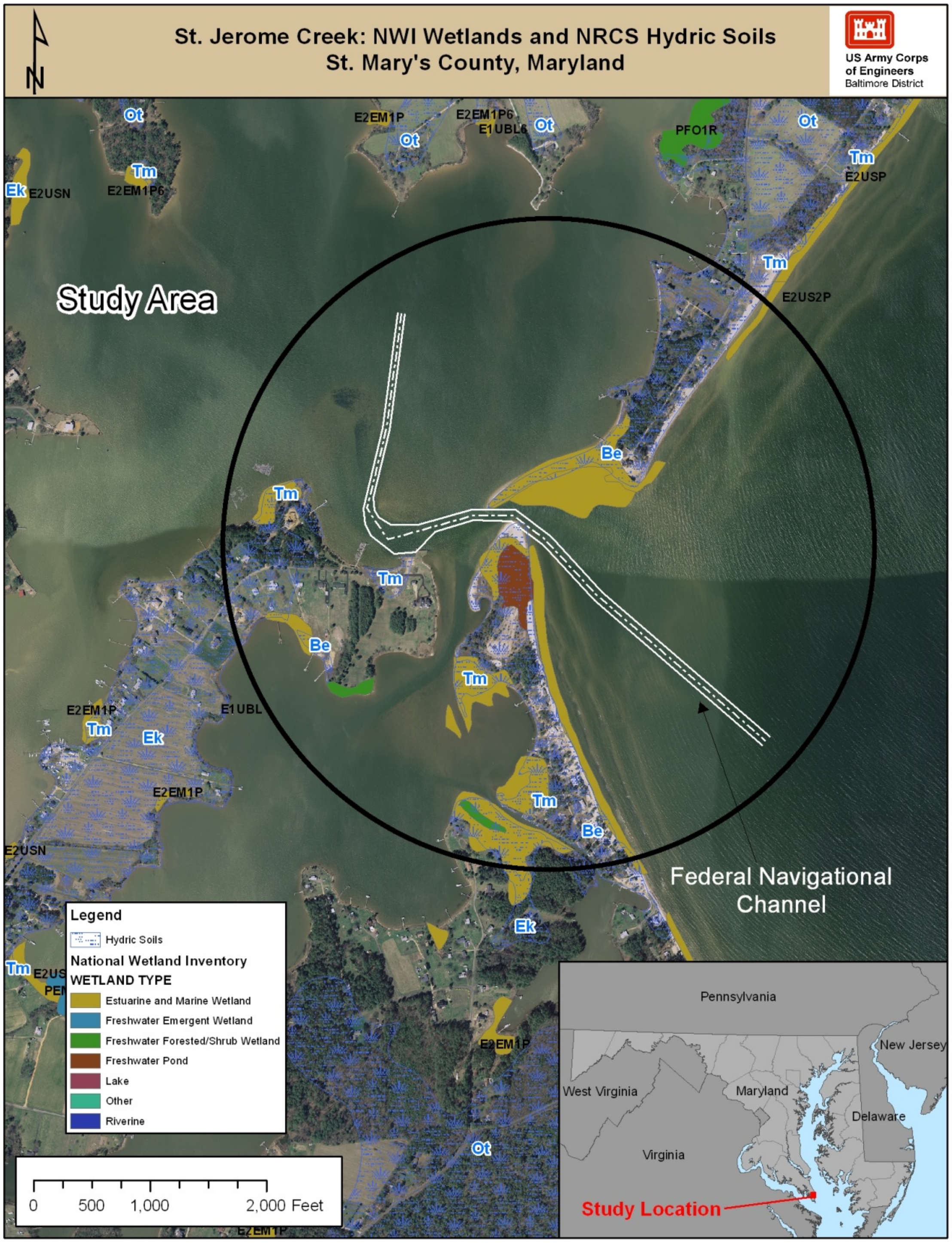


Figure 2-2- Hydric soils and NWI wetlands.

2.2.8 Prime and Other Important Farmlands

Both Matapeake and Mattapex soil types are located in the designated dredged material placement area for the St. Jerome Creek. They are listed as prime farmland soils. Othello soil types are also found in the designated dredged material placement area and are considered farmland of statewide importance (USDA NRCS, 2009).

2.2.9 Wild and Scenic Rivers

The St. Jerome Creek is not listed as a Wild and Scenic or American Heritage River.

2.2.10 Air Quality

The study area is located within the Northeast Ozone Transport Region attainment area as defined by guidance published pursuant to the Clean Air Act Amendments. St. Mary's County is classified as in attainment by the EPA for all criteria (carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulfur dioxide). There are no ozone monitoring stations in St. Mary's County, but neighboring Charles and Calvert Counties each have a daily ozone monitoring station. The federal one-hour standard for ground level ozone is 125 parts per billion. Since its installation in 1996, there have been no exceedences reported at the Calvert County station. The Charles County monitor has been operational since 1984. Exceedences have been measured 25 times since installation, but only 5 times in the past 10 years.

2.2.11 Water Quality

St. Jerome Creek is located within the Lower Chesapeake Bay watershed (SWSUB8, MD DNR 1998). This watershed has been listed as impaired water, due to habitat loss, excessive nutrients (nitrates and phosphates), heavy bacterial load, and reduced dissolved oxygen (DO). In a six-week (October and November) study focused on investigating how sedimentation impacted oyster growth, a team of St. Mary's College students measured DO concentrations in St. Jerome Creek between 6 and 7.5 mg/L (Ghonda-King et al. 2009). St. Jerome Creek DO was comparable to concentrations at five St. Mary's River sites ranging from 2 to 9 mg/L.

St. Jerome Creek is a turbid creek. The St. Mary's College study also found that Secchi depths were lower in St. Jerome Creek than at five monitoring stations within St. Mary's River (Ghonda-King et al. 2009). St. Jerome Creek Secchi depths varied between 40 and 80 cm compared to a range of 60 to 190 cm at five St. Mary's River sites. The Chesapeake Bay Program (CBP) sets an acceptable Secchi depth greater than 0.65 to 2 m for the water clarity goal (CBP 2011). The available measurements straddle the lower goal limit of 0.65 m. The St. Mary's College measurements were taken in the Fall when water clarity is typically at its best. Therefore, it is likely that St. Jerome Creek would have poorer water clarity in the spring and summer when biological activity is greatest, not meeting the CBP goal.

Currently, a portion of the St. Jerome Creek mainstem as well as all of its tributaries; including South Prong, North Prong, Taylor Cove, and Malone Bay, are classified as 'restricted' (MDE 2012). Figure 2-3 depicts the 'restricted' areas (MDE 2012). A 'restricted' designation closes an area to harvest due to the presence of disease-causing bacteria in the water column. If shellfish are harvested from waters which MDE has restricted (closed) and eaten raw or partially cooked, they have the potential to make people sick (MDE 2009). The closure does not apply to swimming, fishing or crabbing in these areas.

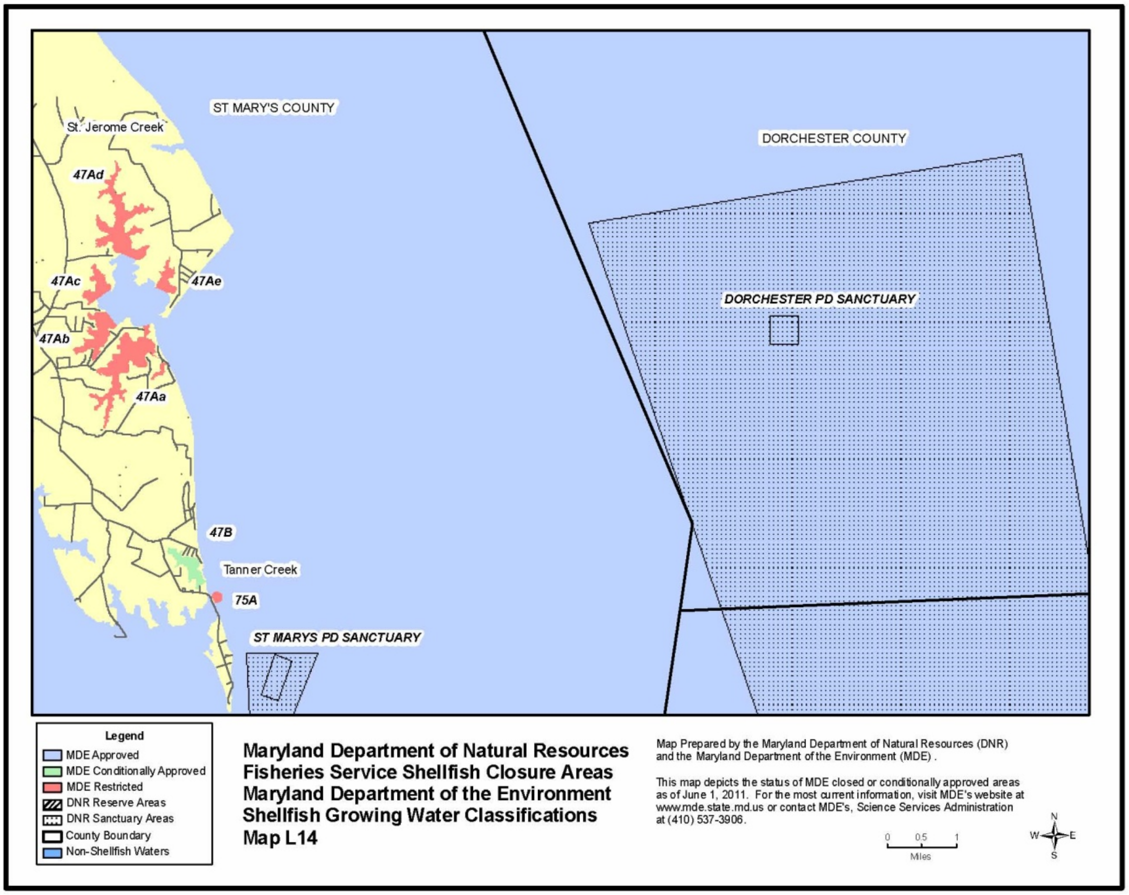


Figure 2-3- MDE Shellfish Restrictions (Image from MDE).

There are three seafood industry-related businesses in the vicinity of St. Jerome Creek that had surface water permits that are now expired. The most recent expired in 2005 and the other two expired in 1987 and 1991.

2.3 SOCIAL AND ECONOMIC SETTING

St. Jerome Creek provides moorings for both commercial and recreational boats. However, as the channel at the mouth becomes smaller in width and depth, larger commercial vessels and sailboats will no longer be able to use the river. Damages and delays will undoubtedly continue to occur at a rate that will depend upon the speed of shoaling. It is likely that some vessel owners may relocate to other, safer harbors in the future. Economic rationale suggests that some may even leave the industry completely, if damages and delays become too costly in relation to income.

2.3.1 Population

The 2010 U.S. Census records the county's population as 105,151 (U.S. Census Bureau 2012a), and represents a 21.9 percent increase from 86,232 in 2000. The 2010 census recorded the population of Census Tract 8762 to be 7,119. This tract encompasses the southeastern portion of St. Mary’s County, south of Lexington Park and east of St. Mary’s River (US Census Bureau 2012c).

2.3.2 Education

St. Mary’s County maintains seventeen elementary schools, four middle schools, and three high schools. There are approximately 17,000 students enrolled in St. Mary’s County public schools. Within the project area, there is one elementary school serving approximately 260 students between Pre-kindergarten and Grade 5, one middle school with an enrollment of approximately 770, and one high school with an enrollment of approximately 1,750. Within St. Mary’s County, 85.3-percent of persons 25 years and over have a high school education or higher, and 22.6-percent have a bachelor’s degree or higher.

2.3.3 Employment and Income

The recreational and commercial watermen of St. Mary’s County are principally engaged in the harvesting of shellfish and finfish, which are plentiful in the waters surrounding St. Mary’s County and are integral to the local economy and culture. Blue crabs, oysters, and menhaden are found in the County’s estuaries, and are important sources of employment and revenue. Agriculture also remains an important part of the local economy.

According to the 2010 U.S. Census Bureau data, 5.8% of persons over 16 years old are unemployed compared to 10.8% nationally (U.S. Census Bureau 2012a). The majority of workers are in the “public administration”, “educational services, and health care and social assistance”, and “professional, scientific, and management, and administrative and waste management services”.

The location of St. Mary’s County allows for easy access to major metropolitan areas while offering residents a high quality of life and affordable lifestyles. St. Mary's County's 1,911 businesses employ approximately 28.070 workers (US Census Bureau 2012c); an estimated 38 of these businesses have 100 or more workers. Businesses include BAE Systems, Boeing, Lockheed Martin, L-3, Northrop Grumman, Wyle and many others. Non-defense employers include the Paul Hall Center for Maritime Training and Education, St. Mary's Hospital and St. Mary's College of Maryland. The Lexington Park area has been designated a State Enterprise Zone, affording a number of incentives for expanding businesses.

The Naval Air Station Patuxent River, employing 22,200 military, civilians and defense contractors, is home to the U.S. Naval Air Systems Command (NAVAIR), including the Naval Air Warfare Center Aircraft Division (NAWCAD). With over 200 high-tech aerospace and defense contractors, the county has emerged as a world-class center for maritime aviation research, development, testing and evaluation.

In 2010, St. Mary’s County had a per capita personal income (PCPI) of $43,448, compared to the state and national averages of $49,023 and $39,937 respectively (BEA 2012, UNM 2012).

2.3.4 Fleet and Boating Infrastructure and Commercial Activity

Over 700 vessels use the St. Jerome Creek on an annual basis, including commercial, charter, and recreational power and sail boats. There are two commercial marinas which offer approximately 300 slips and moorings; 60 of which are used permanently by commercial watermen and charter boats which harvest crabs, oysters and finfish from St. Jerome Creek and the Chesapeake Bay.

St. Jerome Creek serves a critical role as safe harbor for vessels seeking shelter from dangerous sea and wind conditions. It is the only possible point of refuge between Solomon's Island Harbor located approximately 15.5 miles north by water, and Point Lookout located approximately 11 miles south on the Potomac side of the point. Point Lookout can only accommodate shallow draft vessels while vessels drafting more than 4 ft would have to navigate around the point to Smith Creek, located approximately 13.8 miles to the north on the St. Mary's River.

St. Jerome Creek also harbors a fireboat for the St. Mary's County Volunteer Fire Department located in the Town of Ridge. The 28 ft vessel is used for fire and rescue on water as well as for fighting fires on shorefront properties.

2.3.4.1 Economic Setting

St. Jerome Creek is a small rural area dependent upon recreational boating and commercial fishing of crabs, oysters and finfish for employment and earning opportunities. Data from the 2008 US Census Bureau County Business Patterns show latest available employment and payroll statistics for industries related to commercial fishing and recreational boating. Data is shown in Table 2-3 for the entire St. Mary's County, which includes the towns of Airedele and Ridge. The data shown likely understate the true impacts of industries dependent on navigation, since most fishermen are self employed, and data from small employers are left out for confidentiality reasons.

Table 2-3 - Navigation Dependent Industries
St. Mary's County, Maryland 2008 County Business Patterns

NAICS Sector	Sector Name	Number of Employees	Annual Payroll	Number of Establishments
424460	Fish & Seafood Wholesalers	<19	NOT AVAILABLE	1
445220	Fish & Seafood Markets	<19	$306,000	5
441222	Boat Dealers	<19	NOT AVAILABLE	2
713930	Marinas	26	$746,000	6

Source: http://censtats.census.gov/cbpnaic/cbpnaic.shtml

Latest available data from National Marine Fisheries Service (NMFS) show overall economic impact of the fishing industry for the Maryland portion of the Chesapeake Bay was over $76 Million in 2009 and $104.9M in 2010. It is estimated that St. Jerome Creek contributes approximately 2% of the overall catch; valued at approximately $1.25M and $2.4M in 2010. Table 2-4 shows the species distribution of the commercial catch in pounds and dollars for the past two years for both Maryland Chesapeake Bay and St. Jerome Creek.

Table 2-4 - Commercial Fish Catch

YEAR	2009				2010			
Species	MD Chesapeake Pounds	MD Chesapeake Dollars ($)	St. Jerome Pounds	St. Jerome Dollars ($)	MD Chesapeake Pounds	MD Chesapeake Dollars ($)	St. Jerome Pounds	St. Jerome Dollars ($)
OYSTERS	497,971	$3,849,002	12,449	$96,225	430,004	4,361,465	10,750	$109,037
SCALLOPS	521,140	$3,160,118	13,029	$79,003	152,835	1,186,903	3,821	$29,673
OTHER SHELLFISH	6,423,137	$4,788,567	160,578	$119,714	7,579,957	5,910,519	189,499	$147,763
AMERICAN LOBSTER	30,988	$120,691	0	$0	30,005	134,021	0	$0
CRAB, BLUE	40,283,899	$52,019,502	1,007,097	$1,300,488	66,611,021	79,511,983	1,665,276	$1,987,800
CRAB, BLUE, SOFT	16	$72	0	$2	50,401	292,822	1,260	$7,321
CRAB, JONAH	11,657	$13,500	291	$338	18,046	24,026	451	$601
CRAB, OTHER	474,805	$196,526	11,870	$4,913	0	0	0	$0
STRIPED BASS	2,812,686	$5,181,282	5,625	$10,363	2,548,794	5,530,837	5,098	$11,062
FLOUNDER	332,057	883,025	8,301	$22,076	309,680	635,626	7,742	$15,891
PERCH, WHITE	1,301,146	$943,046	32,529	$23,576	1,704,584	1,157,794	42,615	$28,945
PERCH, YELLOW	53,605	$59,010	1,340	$1,475	63,019	71,243	1,575	$1,781
CROAKER, ATLANTIC	597,102	$444,132	14,928	$11,103	661,304	534,568	16,533	$13,364
BLUEFISH	163,329	$57,506	4,083	$1,438	125,857	61,740	3,146	$1,544
SPOT	528,625	$420,381	13,216	$10,510	598,416	399,555	14,960	$9,989
OTHER FINFISH	13,682,407	$3,493,023	0	$0	21,328,303	4,661,070	0	$0
MISC. CATCH	598,385	$427,734	0	$0	699,094	$402,640	0	$0
TOTAL LANDINGS	**68,312,955**	**$76,057,117**	**1,285,338**	**1,681,222**	**102,911,320**	**104,876,812**	**1,962,726**	**2,364,768**

Source for MD Chesapeake:
http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html
* St. Jerome Estimate based on MD DNR data

2.3.5 Vessel Delays

The Chesapeake Bay shoreline to the north and south of St. Jerome Creek is characterized by low-lying sandy beaches. Littoral drift along the shoreline causes rapid shoaling at the channel entrance and just inside the mouth of the channel. Maintenance dredging of St. Jerome Creek has historically been performed once every 10 to 15 years. However, current shoaling rates indicate that shoaling begins to occur within two years of completion of maintenance dredging.

It is important to determine the typical time required for the channel to shoal after a dredging event to a controlling depth that restricts navigation because it only takes one location in the channel to shoal and restrict the usage of the entire channel. Based on current knowledge, the channel controlling depth is reduced to less than -2.0 ft. MLLW and is no longer viable by the fifth year after dredging. Table 2-5 provides channel shoaling history. The most recent dredging to the authorized depth of -7 ft MLLW was performed at the end of May 2006. A survey performed by USACE in December 2008 showed depths in the channel had been reduced to only -2 ft MLLW in many areas. Maneuvering around the shoals severely restricts the ability of vessels to leave or enter the creek during periods of low tide. Boaters must wait until the tide has raised enough for safe passage. With a mean diurnal tidal range of 1.5 ft, vessels drafting greater than 5.5 ft become shoaled in as the controlling depth falls below -2 ft MLLW.

Table 2-5 – Channel Shoaling History

	Total Shoaling Volume (cy)	Average Shoaling Rate (cy/yr)
1995 to 1999	12157	3039
1999 to 2001	13960	6980
2001 to 2004	4990	1663
2004 to 2005	5852	5852
2005 to 2006 Pre-Dredge	1000	1000
2006 Pre to 2006 Post-Dredge	-50765	NA
2006 Post-Dredge to 2009	20419	6806
Avg shoaling 1995 to 2006		3451
Avg. shoaling 2006 to 2009		6806

2.3.6 Recreation

St. Mary's County has over 500 miles of shoreline on the Chesapeake Bay, Patuxent River, Potomac River, and other rivers and creeks. The county offers a variety of recreational activities including boating, fishing, camping, hiking, golf courses and three motor sports venues. Public facilities include twenty public parks, a year-round pool, boat ramps, beaches, fishing piers, tennis courts and sports fields, picnic facilities, playgrounds and a skate park. The county is also home to four state parks: Point Lookout, St. Mary's River, St. Clements Island and Greenwell State Parks.

The County has fourteen public boat landings and several marinas, including two marinas in St. Jerome Creek along with numerous private piers. The two marinas provide mooring spaces and services to many of the recreational vessels that utilize the St. Jerome Creek channel.

Recreation in St. Jerome Creek would be typical of other uses as described for the county. Within St. Jerome Creek, primary recreational uses are water-based including fishing and boating.

2.4 INFRASTRUCTURE

2.4.1 Traffic and Transportation

Access to St. Jerome Point is provided via Route 235 on St. Jeromes Neck Road. Split Point can be reached via Route 5 from Airedele Road and Deep Point can be accessed via Route 5 from Fresh Pond Neck Road to Murray Road.

Major port facilities are approximately 100 miles north at the Port of Baltimore. St. Jerome Creek enters the Chesapeake Bay roughly 5 miles north of the confluence of the Potomac River with the Chesapeake bay. Hundreds of boats per year operate in and out of the creek destined for seafood buying businesses, seafood packaging plants, the marinas, public or private oyster grounds, or private piers.

2.4.2 Utilities

St. Mary’s County electricity is supplied by Southern Maryland Electric Cooperative. Customers of investor-owned utilities and major cooperatives may choose their electric supplier. Natural gas is available from Washington Gas. The majority of households and businesses in the study area use septic tank and drainfield systems.

No utilities are located within St. Jerome Creek where a recommended project would be constructed.

2.5 BIOLOGICAL RESOURCES

2.5.1 Phytoplankton

Phytoplankton are microscopic plants that form the basis of aquatic system food webs. Phytoplankton production, accumulation and subsequent decomposition govern the productivity at higher trophic levels, as well as nutrient and dissolved oxygen concentrations in the Bay and its tributaries. Zooplankton are microscopic animals that feed directly upon phytoplankton and provide the bulk of the forage prey for most larval and juvenile fish as well as many other estuarine organisms. Because plankton is a food source for many organisms, they are a valuable component of the St. Jerome Creek food web. Based on MDNR data, planktonic levels typical of eutrophic waters are assumed to exist.

2.5.2 Benthic Community

Coordination with Maryland DNR for the 1991dredging cycle indicated that several species of benthic macroinvertibrates, in nine phyla, are likely to exist in the St. Jerome Creek channel (USACE 2004). The dominant species include one bryozoans (“moss” animal), sevenpolychaetes (segmented bristle worms), three amphipods (sand hoppers), five bivalves (clams and macomae), and one nemertid (ribbon worm) (USACE 2004). Although, no recent characterization is available, the current community is expected to be similar and to reflect that of an eutrophic environment.

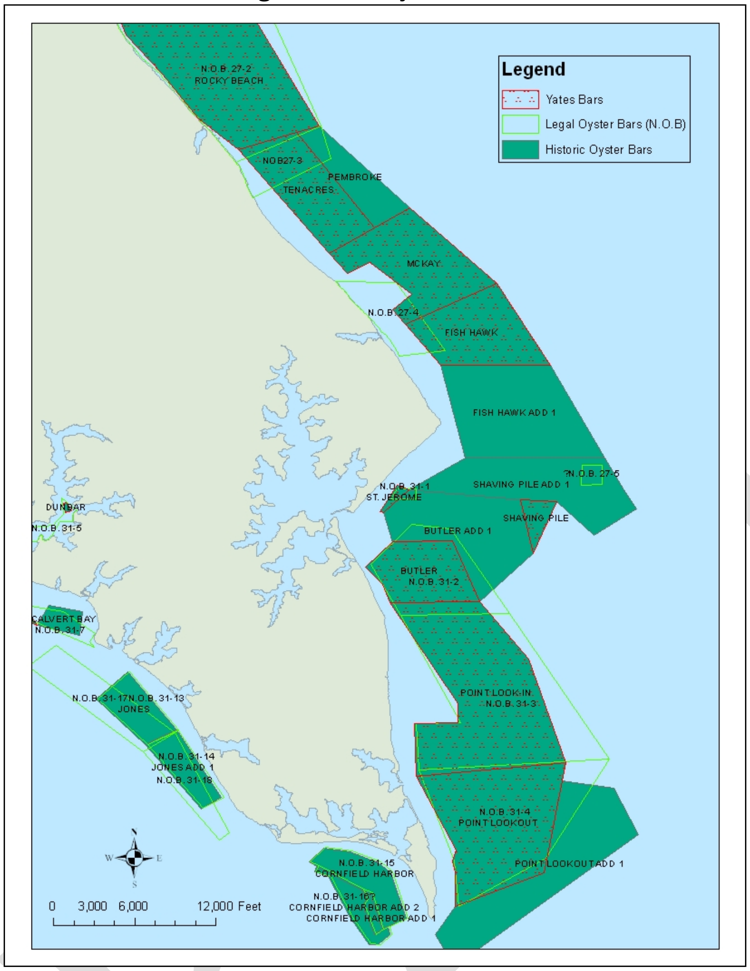
2.5.3 Oyster Bars and Shellfish

The St. Jerome Creek area is known as a good growing area for oysters (*Crassostrea virginica*) and blue crabs (*Callinectes sapidus)*.

A chartered natural oyster bar (NOB 31-2) is located 2400 ft. southeast of the eastern terminus of the federal channel (Figure 2-4). NOB 31-2 is 805 acres and includes parts of the Butler and Butler Addition 1 bars. NOB 31-1 is 22 acres and is approximately 3,000 ft. from the north jetty. These bars are in the public fishery.

Lippson and Lippson (1997) identify St. Jerome Creek and the shoreline outside the Creek as soft clam habitat. Old charts represent the area as clam habitat, but populations do shift around and there is no population or harvest data available for the area.

Figure 2-4 – Oyster Bars



2.5.4 Fish and Wildlife

Numerous species of waterfowl utilize the area for breeding, nesting, and feeding. St. Jerome Creek is a known waterfowl concentration area for wintering and migrating birds. Winter 1990 aerial surveys by the Maryland Department of Natural Resources indicate the presence of bufflehead (*Bucephala albeola*), canvasback (*Aythya valisineria*), red-breasted merganser (*Mergus serrator*), tundra swan (*Olor columbianus*) and common merganser (*Mergus merganser*). Terrestrial wildlife may include white tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Eastern cottontail rabbits (*Sylvilagus floridanus*), North American opossum (*Didelphis virginiana*), Eastern box turtles (*Terrapene carolina)*, field mice, and snakes. Fishery species documented in the St. Jerome Creek and adjacent waters of the Chesapeake Bay include striped bass (*Morone saxatilus*), menhaden (*Brevoortia tyrannus*), sea trout (*Cynoscion regalis*), bluefish (*Pomatomus saltatrix*), croaker (*Micropogonias undulatus*), summer flounder (*Paralichthys dentatus*), and red drum (*Sciaenops occelatus*). St. Jerome Creek does not sustain any significant spawning runs of anadromous fish due to relatively high salinity levels.

St. Jerome Creek and the Chesapeake Bay are designated as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS) for several fish species. EFH refers to both the water column and the underlying surface of a particular area. Areas designated as EFH contain habitat essential to the long-term survival and health of fish populations. Certain properties of the water column such as temperature, nutrients, or salinity are essential to various species. Some species may require certain bottom types such as sandy or rocky bottoms, vegetation, or structurally complex coral or oyster reefs. EFH includes habitats that support the different life stages of each managed species. A single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions.

In correspondence dated September 17, 2009 (Appendix E), NMFS recommended referring to the EFH Designation for the primary tributary closest to the project area with similar salinity regime. In this case, it is the Potomac River estuary EFH Designation (http://www.nero.noaa.gov/hcd/md6.html). NMFS also stated that Maryland bay tributary designations are not accurate relative to the presence of certain federal species based on species ecology and salinity tolerances. According to NMFS, for the Potomac River designation, only bluefish *(Pomatomus salatrix*), summer flounder (*Paralichthys dentatus*), and Spanish mackerel (*Scomberomorus maculates)* for juvenile and adult life stages and juvenile red drum (*Sciaenops occelatus*) are expected to be in the project area of St. Jerome Creek. An EFH assessment for these fish species has been developed and is located in Appendix G of this report.

2.5.5 Commercial and Recreational Fishery

NOB 31-2 and 31-3 are in the public fishery. In the 2009-2010 season, 141 bushels were taken from Butler using a power dredge. A 2009 fall survey identified 19 market-sized oysters, 24 small oysters, and 1 spat at Butler. Mortality rates were 9.5-percent per year for markets, and 7.7-percent for smalls. Average sizes were 80 mm for markets, 69 mm for smalls, and 37 mm for spat.

The remaining oyster bars within St. Jerome Creek are considered to be ‘riparian’, a designation for areas where the creek is less than 100 yards wide at the mouth. As a result of the ‘riparian’ designation, the ownership of the shellfish on the bottom belongs to the riparian property owners. As such, there are likely to be additional productive shellfish beds surrounding the creek, adjacent to the water (personal communication with Louis Wright of MDNR on July 29, 2009), that are not well documented.

There is currently one leased aquaculture facility in St. Jerome Creek in the vicinity of Split Point. There is another proposed lease submitted to MD DNR in St. Jerome Creek that will not impact the project.

Blue crab (*Callinectes sapidus*) occurs in the study area and supports a substantial commercial and recreational fishery in the area.

In addition to the blue crab (*Callinectes sapidus*) and oyster (*Crassostrea virginica*) harvesting, substantial commercial fishing activity occurs in the Chesapeake Bay near the mouth of St. Jerome Creek. Pound netting and anchor gill netting are the primary fishing methods (Figure 2-5). Species caught include striped bass, menhaden, sea trout, bluefish, spot, and croaker.

Figure 2-5 - Pound net sites in the vicinity of St. Jerome Creek

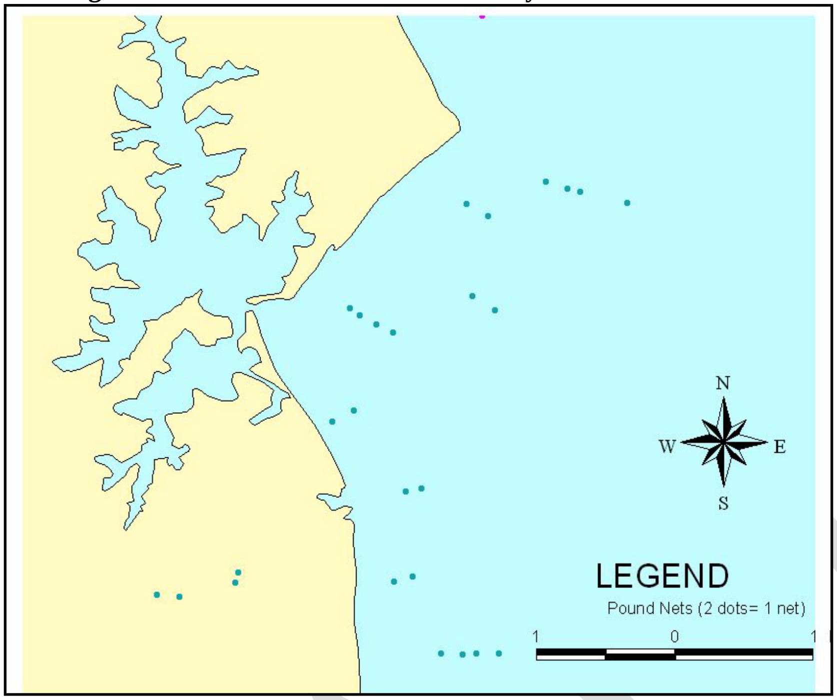


Image provided by DNR.

2.5.6 Wetlands

As an embayment off of the Chesapeake Bay, the St. Jerome Creek area, including the northern and southern prong, is geologically suited to wetland areas. Estuarine and marine marshes have been mapped along St. Jerome and Deep Point and freshwater wetlands have been identified adjacent to the dredged material placement site, as shown in the National Wetlands Inventory (NWI) mapping presented in Figure 2-2. The NWI map identifies estuarine and marine wetlands at the inlet of St. Jerome Creek on St. Jerome Point and Deep Point. The wetlands on St. Jerome Point are classified as E2USP and E2USN on the NWI map. E2US2P is defined as intertidal estuarine unconsolidated sand shores that are irregularly flooded. E2USN is defined as intertidal estuarine unconsolidated shores that are typically unvegetated and regularly flooded. The wetlands on Deep Point are identified at E2US2P. These wetlands are unconsolidated sand beaches, not vegetated wetlands. The interior of the southern shoreline also has an area identified as PUBHh or pond. PUBHh is definined as palustrine, unconsolidated bottom, permanently flooded, diked/impounded wetland.

The definition of wetlands utilized by the USFWS NWI requires that sites meet hydrologic (wetness) and substrate (soil) criteria but does not require that sites be capable of supporting plant growth. Under the USFWS definition, unvegetated intertidal flats and beaches are mapped as wetlands. In contrast, the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) definition requires that a site be capable of supporting wetlands vegetation to qualify as a wetland. Consequently, intertidal flats and beaches are not considered regulated wetlands by USACE or USEPA.

2.5.7 Submerged Aquatic Vegetation (SAV)

The project area is located within the U.S. Geological Survey Point Lookout, MD, and Point No Point, MD Quadrangle maps. Based on the 2008 SAV survey conducted by the Virginia Institute of Marine Science (VIMS) for the Maryland Coastal Bay Program, SAV does not exist in the area. Since 1971, there has only been one year, 1985, when SAV was identified in St. Jerome Creek (VIMS 2011). Less than 10 acres of low density beds were identified in the northern half of St. Jerome Creek in 1985. In a letter dated June 30, 2009, the USFWS indicated that SAV is not known to exist in the proposed project area (Appendix E). Although SAV has only been documented in the area once to date, potential suitable habitat may exist. In the immediate proposed project area, direct wave action from the Chesapeake Bay and boats, and erosion due to long shore transport may hinder the establishment of SAV.

2.5.8 Upland Vegetation

A variety of vegetation exists in St. Mary's County. Within the study area of St. Jerome Creek, mature trees and scrub-shrub vegetation exist along the north and south shorelines (Figure 2-6).

Figure 2-6 - Vegetation along Deep Point (looking south from the mouth of St. Jerome Creek)

2.5.9 Threatened or Endangered Species

The USFWS stated in a letter dated June 30, 2009, that their preliminary review of the project location has not revealed any serious environmental resource issues such as the presence of federally-listed threatened or endangered species. A letter from MD DNR dated July 23, 2009, stated that no state or federal records for rare, threatened or endangered species within the boundaries of the project site were found, but stressed that the lack of documentation does not mean that such species are definitively not present. Copies of these letters can be found in Appendix E.

NMFS has indicated that four species of federally threatened and endangered sea turtles may be found in the project area as well as the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) (letter dated March 7, 2011). NMFS is currently reviewing whether Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchhus*) should be listed as threatened or endangered under the ESA. On October 6, 2010, NMFS published two rules proposing to list four distinct population segments (DPS) of Atlantic sturgeon as endangered, including one for the Chesapeake Bay. St. Jerome Creek lies within the Atlantic sturgeon's habitat range, but the species has not been documented in St. Jerome Creek. NMFS requested that the study consider the potential use of the project area by Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*).

Sea turtle presence in the Chesapeake Bay is tied to water temperatures. Sea turtles are present in the Chesapeake Bay once water temperatures warm to greater than approximately 50°F, typically in April and exit the Bay by late November when temperatures drop. Water temperatures in St. Jerome Creek and are expected follow the same temporal pattern as those of the larger Chesapeake Bay. The long-term average April temperature is 52.67°F with a range of 49.55°F to 57.02°F (MDNR 2009). However, annual trends do vary. The average 2011 April temperature was 49.82°F while the average 2012 April temperature was 57.74°F. The long-term average November temperature is 56.02°F, with a range of 50.72°F to 61.34°F.

The sea turtles potentially found in the project area are typically small juveniles with the most abundant being the federally threatened loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Federally endangered green sea turtles (*Chelonia mydas*) and federally endangered leatherback sea turtles (*Dermochelys coriacea*) also occur seasonally in the Chesapeake Bay. Figure 2-7 shows the location of dead sea turtle strandings in the project area in the past five years.

Sea turtles are transient to the Chesapeake Bay and the project vicinity. Kemp's ridley and loggerhead turtles are the most frequent visitors to the Chesapeake Bay. Leatherback sea turtles typically continue migrating north past the Chesapeake Bay and prefer nesting on the high wave energy beaches of the eastern seaboard. No nesting by sea turtle species has yet been recorded in the Chesapeake Bay (Evans et al. 1997).

Shortnose sturgeons (*Acipenser brevirostrum)* are an estuarine species most prevalent in the upper Chesapeake Bay and within the Potomac River whereas, Atlantic sturgeon, primarily a marine species, is found throughout the tidal waters of the Chesapeake Bay. Figure 2-8 shows all wild Atlantic sturgeon and shortnose sturgeon capture sites reported to the Maryland Sturgeon Reward Program since 1996. The Reward Program provides a monetary reward to commercial fisherman for capture of sturgeon between October 1 and May 31. The reports come almost entirely from commercial fishermen so this is not an inclusive map of the areas where sturgeon might occur and the data is strongly influenced by the placement of fishing gear. Just because an area does not report captures does not indicate that sturgeon are absent. It could mean that there is simply no commercial fishing activity in that area.

The ten year review of the program documented 1,395 captures of wild Atlantic sturgeon with 81 of these sturgeon captured multiple times, 566 captures of hatchery-reared Atlantic sturgeon with 104 of these sturgeon captured multiple times, and 75 captures of the endangered shortnose sturgeon with two of these sturgeon captured multiple times (USFWS 2007). The total program results from 1996 through 2010 have documented 1,664 wild Atlantic sturgeon reports and 562 hatchery-origin Atlantic sturgeon reports with some of these multiple recaptures of individual fish [email from DNR (Richardson) May 4, 2011].

There is no data to suggest the presence of either of the sturgeon species within St. Jerome Creek and no information to suggest shortnose sturgeon presence in the project area. However, there are occasional reports of shortnose sturgeons (*Acipenser brevirostrum)* near the mouth of the

Potomac River, which is adjacent to the project area. Of the 99 shortnose sturgeon reports, four were found at the mouth of the Potomac River site (Figure 2-8). Although no wild Atlantic sturgeon have been reported from the mouth of St. Jerome Creek, there was one hatchery fish reported from that area in 1997 (hatchery fish are not displayed on Figure 2-8 that was caught in a pound net.) Therefore, it is possible that Atlantic sturgeon could be present near the mouth of St. Jerome Creek. However, it is likely that they are uncommon in the area. Pound net sites are frequently fished every year. If sturgeon were common, then there would be more reports. The project area does not produce many reward program capture reports.

Figure 2-7 - Sea Turtles

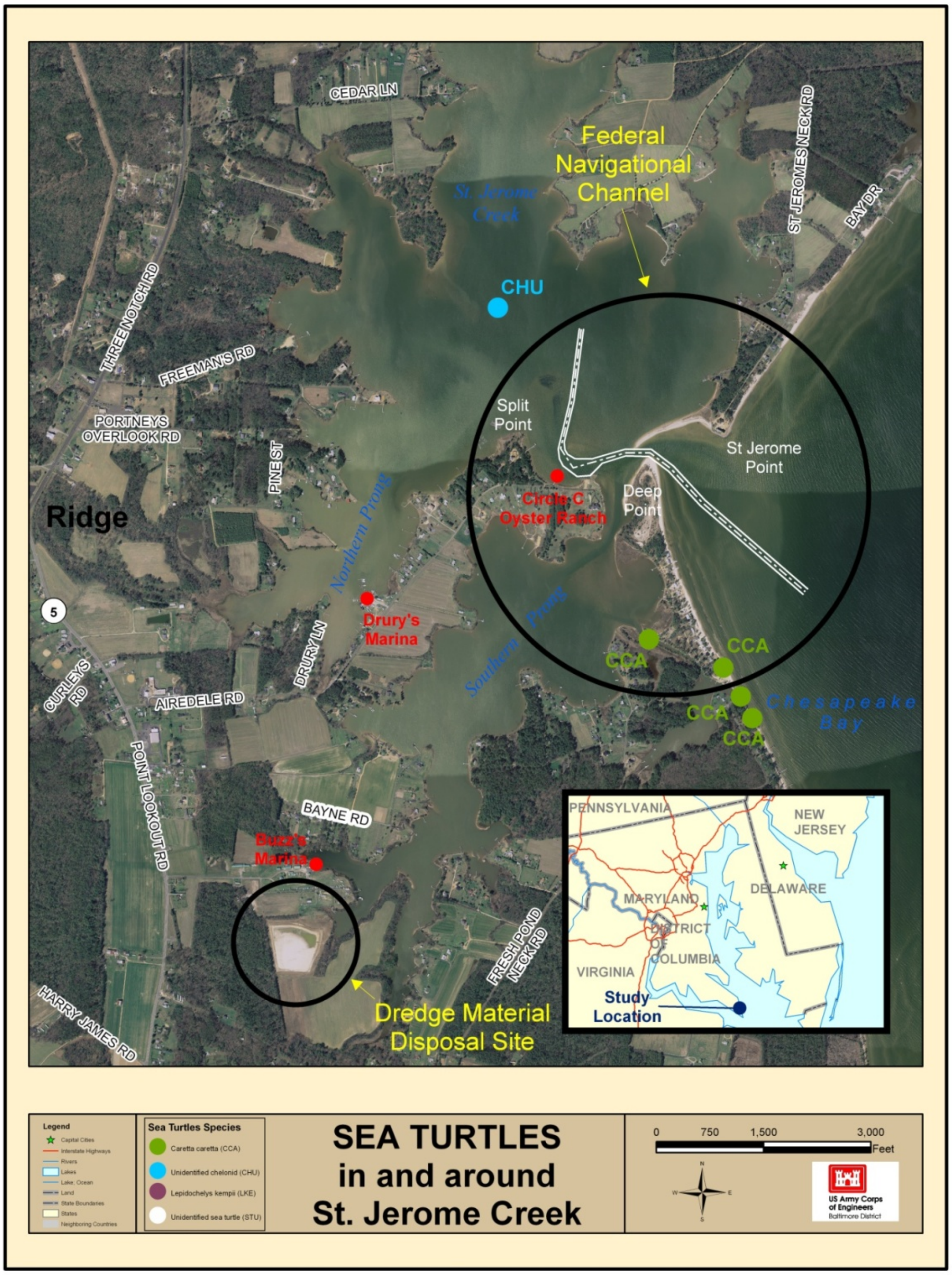


Figure 2-8 - Maryland Sturgeon Reward Capture Locations since 1996

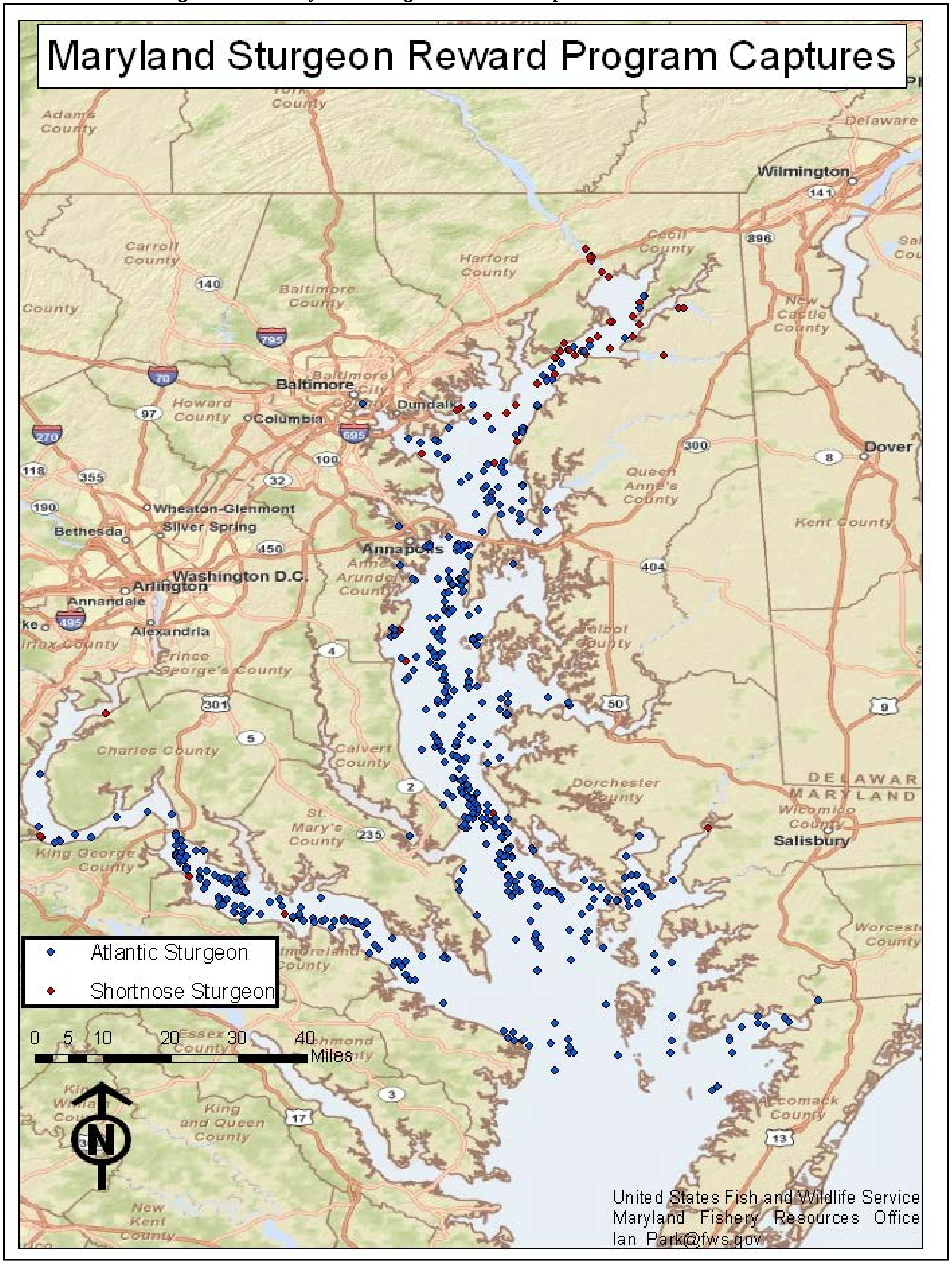


Image provided by DNR.

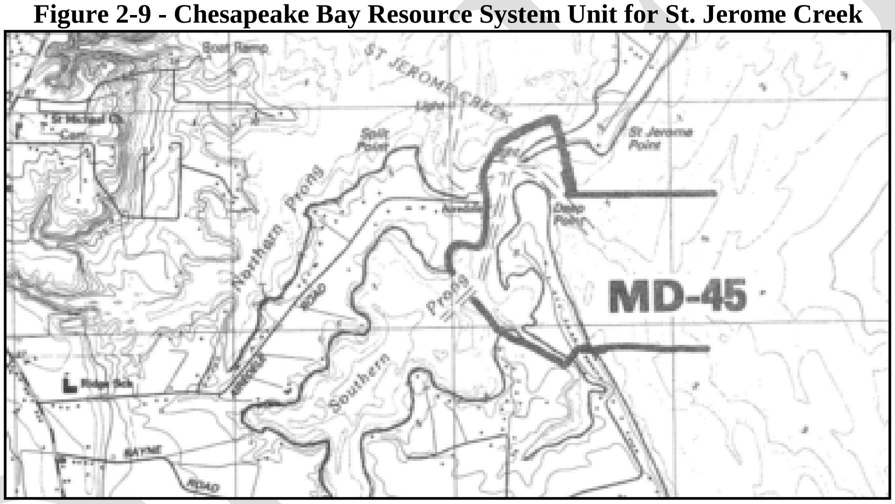
2.6 ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

2.6.1 Coastal Barriers

Coastal barriers are unique land forms that provide protection for diverse aquatic habitats and serve as the mainland's first line of defense against the impacts of severe coastal storms and erosion. In recognition of the importance of natural barriers protecting the Atlantic, Gulf, and Great Lakes coasts, the Coastal Barrier Resources Act (CBRA) of 1982 designated undeveloped private coastal barrier lands and associated aquatic habitats as part of the Coastal Barrier Resource System (CBRS). These areas are subject to federal funding prohibitions, as specified in the CBRA, to discourage development or modifications to coastal barriers. Federal monies can be spent within the CBRS for certain exempted activities, after consultation with the USFWS.

Land formations at the mouth of St. Jerome Creek are included in the CBRS Unit MD-45 as illustrated in Figure 2-9 below. Therefore, further consultation with USFWS was undertaken.

Figure 2-9 - Chesapeake Bay Resource System Unit for St. Jerome Creek



Source: USFWS, http://www.fws.gov/habitatconservation/coastal_barrier.html

2.6.2 Maryland Critical Areas

In response to concerns about the quality and productivity of the Chesapeake Bay, the Maryland General Assembly enacted a comprehensive resource protection program for the Bay and its tributaries. This program, the Critical Area Act, passed in 1984, seeks to bring state and local governments together to address the impacts of land development on habitat and aquatic resources.

The Critical Area Act defines the Critical Area of Maryland as all land within 1,000 ft of the Mean High Water Line (MHWL) of tidal waters or the landward edge of tidal wetlands and all waters of and lands under the Chesapeake Bay and its tributaries. Additionally, a Critical Area Buffer is defined as the land immediately adjacent to tidal waters, tidal wetlands, and tributary streams. The minimum Buffer is 100 ft. The law created a statewide Critical Area Commission to oversee the development and implementation of local land use programs directed towards the Critical Area that met the following goals:

- Minimize adverse impacts on water quality that result from pollutants that are discharged from structures or conveyances or that have run off from surrounding lands;
- Conserve fish, wildlife, and plant habitat in the Critical Area; and
- Establish land use policies for development in the Critical Area which accommodate growth and also address the fact that, even if pollution is controlled, the number, movement, and activities of persons in the Critical Area can create adverse environmental impacts.

Since its inception, the Critical Area Commission has developed criteria that used by local jurisdictions to develop individual Critical Area programs and amend local comprehensive plans, zoning ordinances, and subdivision regulations. The programs that have subsequently been adopted by local governments are designed to address the unique characteristics and needs of each county and municipality while preserving and protecting the Chesapeake Bay.

Based on mapping and previous coordination with MDNR, the proposed dredged material placement area, which has been used during previous dredging cycles, is within the 1,000-foot Critical Area.

2.6.3 Coastal Zone Management

St. Jerome Creek is within the coastal zone, which is managed under MDNR's Coastal Zone Management Program. The Coastal Zone Management Program is a federal-state partnership established by the Coastal Zone Management Act of 1972. The goal of the Coastal Zone Management Act is to "preserve, protect, develop and, where possible, to restore and enhance the resources of the nation's coastal zone for this and succeeding generations." The partnership established by the Act provides an avenue for consultation between local, state, and federal governments as they work on complex resource management problems (MDNR 2002).

The State of Maryland's Coastal Zone Management Program consists of laws and policies that work to achieve a balance between development and coastal zone protection. Approximately two-thirds of Maryland's land is included in the coastal zone area, which consists of the Chesapeake Bay, coastal bays, Atlantic Ocean, and any towns, cities, and counties that contain or help govern the coastline. MDNR is the lead agency for the state Coastal Zone Management Program. The three "themes" of the Maryland Coastal Zone Management Program are sustaining coastal ecosystems, sustaining coastal communities, and promoting government efficiency. Each theme consists of the following supporting goals:

- Sustaining coastal ecosystems;
- Sustain and improve coastal water quality,
- Protect restore and enhance coastal land and water habitats,
- Sustaining coastal communities;
- Reduce threats and losses from coastal hazards,
- Sustain, develop, and revitalize ports, harbors, marinas, and urban waterfronts,
- Provide public access to coast,
- Provide appropriate sites for coastal dependent uses,
- Preserve historic, cultural, and aesthetic coastal features,
- Improving government efficiency;

- Ensure federal and state consistency with state policies,
- Simplify permit processes,
- Consider the national interest in the coasts, and provide orderly, predictable facility siting,
- Provide for local government and public participation.

2.6.4 Hazardous, Toxic, and Radioactive Waste

There is no evidence that hazardous or toxic contaminants exist in the vicinity of the study area. The 2004 EA, which was completed for maintenance dredging purposes, identified no hazardous waste sites. Based on the historical uses of the study area, there is no reason to indicate that releases of contaminated material to the land or water may have occurred. Based upon a review of the U.S. Environmental Protection Agency (USEPA) records [Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), Resource Conservation and Recovery Act Information System (RCRAInfo), National Priorities List (NPL), and Toxic Release Information System (TRIS)] there are no known sources for hazardous, toxic and radioactive wastes in the proposed project area (USEPA, 2009).

The proposed dredged material has not been tested for any potential contaminant content because prior dredging has not indicated the presence of toxic contaminants.

2.6.5 Noise

Ambient noise levels are low. Daily noise levels are expected to be typical of a rural community (i.e., recreational boating and commercial fisheries activities and local residents). The majority of noise in the proposed project vicinity can be attributed to boat traffic on the St. Jerome Creek or Chesapeake Bay.

2.6.6 Environmental Justice

On February 11, 1994, President Clinton issued Executive Order (E.O.) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.” The E.O. requires federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

As defined by the “Draft Guidance For Addressing Environmental Justice Under NEPA” (CEQ, 1996), “minority” includes persons who identify themselves as Asian or Pacific Islander, Native American or Alaskan Native, black (not of Hispanic origin) or Hispanic. A minority population exists where the percentage of minorities in an affected area either exceeds 50-percent or is meaningfully greater than in the general population. Low-income populations are identified using the Census Bureau’s statistical poverty threshold, which is based on income and family size. The Census Bureau defines a “poverty area” as a Census tract with 20-percent or more of its residents below the poverty threshold and an “extreme poverty area” as one with 40-percent or more below the poverty level (Census Bureau 1995).

As of 2010, the minority populations in St. Mary’s County represent 21.4-percent of the population, with 14.3-percent of the population representing the black population, 2.5-percent of Asian origin, and 3.2-percent being of two or more races The 2010 U.S. Census data shows the median household income at $88,444. The percentage of persons below poverty is 5.2-percent, compared with a national average of 15.3-percent (US Census Bureau 2012).

2.6.7 Children's Safety

On April 21, 1997, the President Clinton issued E.O. 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which recognizes that a growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health and safety risks. This E.O. requires federal agencies, to the extent permitted by law and mission, to identify and assess such environmental health and safety risks.

Based on the 2010 U.S. Census Bureau, 7.2-percent of persons living in St. Mary's County are under 5 years old and 23.3-percent of the total population is under 16, compared to 6.5-percent and 21.2-percent nationally (U.S. Census Bureau 2012a).

2.7 CULTURAL RESOURCES

As part of this feasibility study, the Baltimore District conducted an initial information needs assessment for compliance with Section 106 of the National Historic Preservation Act (NHPA). This information assessment consisted of the review of existing site location documentation and consultation with the Maryland State Historic Preservation Office (MD SHPO). The Maryland SHPO indicated that there is the potential for submerged cultural resources to be located in the project area. A more detailed description of the cultural resources Phase I survey that will be conducted in the Pre-Engineering and Design phase is included in Section 6 of this document.

2.8 SEA LEVEL RISE

NOAA maintains a gage at Solomons Island (approximately 24 miles from St. Jerome Creek) that has collected data on sea level for over 70 years. Based on that data, the historic sea level change trend at Solomons Island is a rise of 3.41 mm/year. That rate is a combination of the global sea level rise and local vertical land movement. Numerous analyses have been conducted and reports prepared on the potential for larger changes in sea level and overall climate change in the future as a result of greenhouse gases and other variables. Most studies agree that the effects will differ by location. But the scientific opinions vary substantially on what those changes may be for a given location.

USACE, per EC 1165-2-212, is required to consider a continuation of the historic rate of sea level rise, as well as forecast accelerated sea-level rise at intermediate and high global rates developed by the National Research Council. The global forecasts are adjusted as necessary to consider additional factors that affect the rate of sea-level rise locally. The accelerated rates would increase future sea levels over what continuation of historic rates would produce. A continuation of the historic trend for the 50-year period of analysis would produce a sea level 0.56 foot higher in St Jerome Creek in 2064 than it is at present. Accelerated rise rates would result in an increase in a sea level of 1.515 ft mean sea level MSL (intermediate) and 2.108 ft MSL (high) by 2064

Appendix I describe the results of the detailed analyses that USACE performed concerning various sea level rise scenarios. Section 6.8 of this document also addresses the effects of possible changes in sea level.

Section 3.0 PROBLEM IDENTIFICATION

3.1 MEANS BY WHICH PROBLEMS WERE IDENTIFIED

The problems, needs, and opportunities considered in the study were identified through meetings with representatives from St. Mary's County, discussions with public and private stakeholders, and site visits by USACE personnel. A study initiation letter was sent at the beginning of the feasibility phase to solicit input from federal, state and local agencies and other interested parties (Appendix E). Input was received in the form of background information, data, as well as environmental and social concerns. Telephone conversations and on-site meetings with local stakeholders were held to identify navigation-related problems and potential project benefits in the study area.

A questionnaire was used to gather information on the specific problems encountered in the St. Jerome Creek study area. In 2009, the survey was delivered to approximately 100 local watermen whose boats are permanently based out of St. Jerome Creek. Thirty-eight percent (38%) of the surveys were returned and used to form the basis of this analysis. Additional information was obtained from officials at the St. Mary's County Department of Public Works and Transportation (DPWT).

3.2 PROBLEMS, NEEDS, AND OPPORTUNITIES

The problem to be addressed by this investigation is the rapid shoaling of the federal channel in St. Jerome Creek and the subsequent problems caused by the restricted use of the channel.

Maintenance dredging for St. Jerome Creek has historically been performed about once every ten years due to funding limitations; however, shoaling of the channel typically begins to occur within two years of completion of the maintenance dredging. Within five years of the maintenance dredging, the controlling depth in the channel is less than the authorized channel depth. Littoral drift along the shore causes rapid shoaling at the channel entrance and just inside the mouth of the channel. This restricts the ability of watermen, charter boat operators, and local recreational boaters from using the waterway during periods of low tide. Boaters must wait until the tide has raised enough to allow for safe passage. Damages to vessels have been directly linked to the shoaling problem. In 2006, 39,675 cy of material consisting primarily of sand were dredged to restore the authorized channel dimensions.

Based on field observations and analysis conducted, it is evident that the sediment that is shoaling the entrance channel is being transported to the channel from both north and south of the channel. Analysis indicates that in 1849, the entrance in the St. Jerome Creek area was completely open to the Chesapeake Bay exposure to the southeast. Between 1849 and 1942 (93 yrs), the southern shoreline migrated northward about 1500 ft to the general location of the existing entrance channel. Between 1942 and 1955 (13 years), this shoreline accreted bayward. Between 1955 and 1993, this shoreline continued to accrete bayward at a slower rate. The significant northern migration of this shoreline indicates a significant rate of longshore sand transport from the south to the north. The source of this transport appears to be the erosion of the shoreline south of this area.

In 1849, on the north side of the entrance channel, a sand spit existed which would have essentially blocked the current entrance into St. Jerome Creek. Between 1849 and 1942, this spit eroded. In between 1942 to 1955, this spit reformed into the St. Jerome Creek area in the general location of the current spit. Between 1944 and 1993, the spit remained in the same general location. The reformation of the spit from 1942 to 1955 to 1993 indicates a significant rate of longshore sand transport from the north to the south (Figure 3-1). The source of this transport appears to be the erosion of the north shoreline during this period. The average shoreline change rates for the Chesapeake Bay shoreline segments, south and north of the entrance into St. Jerome Creek are provided in Table 3-1.

Table 3-1 - Historical Shoreline Change Rates

	Southern Shoreline (ft/yr)	Northern Shoreline (ft/yr)
1942-1955	5.9	-2.2
1955-1993	0.3	-1.1

As determined by the GENEralized Model for SImulating Shoreline Change (GENESIS) model (see Appendix C), the net transport of sand along the shoreline north of the channel entrance is approximately 4,200 cy per year from north to south towards the channel entrance. The net transport of sand along the shoreline south of the channel entrance is approximately 13,300 cy per year from south to north towards the channel entrance.

The foremost need and opportunity is to identify alternatives to the existing federal channel at St. Jerome Creek that will reduce the rapid rate of shoal formation in the navigational channel and enhance navigation.

Figure 3-1 - St. Jerome Creek Shoreline Changes from 1849 to 2007

3.2.1 Nature of Damages

St. Jerome Creek is a small rural area dependent upon recreational boating and commercial fishing of crabs, oysters and finfish for employment and earning opportunities. Damages and delays incurred from the shoaling channel threaten watermen's economic well being and safety. Based on results from the 2009 questionnaire, the local watermen reported that channel shoaling impedes navigation of larger boats within a year following maintenance dredging, and commercial watermen continue to experience navigation problems and operating inefficiencies. Tidal delays, grounding damages, and operating inefficiencies will continue to increase as channel depths decrease. Shoaling is projected to decrease the controlling depth in the channel to -2 ft or less within 5 years of maintenance dredging, requiring a shortened dredge cycle to maintain minimal channel depths for navigation.

3.2.2 Damages by Category

For the purpose of this study, damages experienced by the users of the St. Jerome Creek Inlet due to shallow water depths were broken into six categories that are further described below: 1) lost labor due to tidal delays, 2) vessel damages, 3) increased ordinary maintenance, 4) additional fuel consumption, 5) decreased recreational quality, and 6) maintenance dredging costs and frequency. Damages are based on the assumption of a five year shoaling rate that reduces the controlling depth from -7 to -2 ft, requiring maintenance dredging every five years.

3.2.2.1 Lost Labor due to Tidal Delays

Tidal delays are currently experienced to some extent by all vessels, but most significantly by the larger charter vessels and workboats based in the harbor. The extent of tidal delays was calculated using a mean tide chart developed for St. Jerome Creek and the current distribution of commercial fishing vessels in the harbor, based on the current fleet list and vessel draft. An under-keel clearance of 1 Ft. was assumed. The fishing vessels make an average of 180 trips per year, have an average crew size of 3 per boat, and are all day boats. When shoaling reaches the point where the highest tides no longer provide adequate depth for safe passage in the channel, the larger boats must relocate to a new harbor with adequate depth. The 17 vessels drafting 5-6 Ft. will experience almost an hour of delay when the channel controlling depth reaches 6 Ft. When the controlling depth reaches 5 Ft. the delay increases to approximately 4 hrs and 20 minutes for these boats while vessels drafting 4 to 4.9 Ft. will start experiencing delays of approximately one hour. When the channel shoals to 4 Ft. controlling depth, the largest vessels can no longer gain sufficient depth by waiting for the tide and must move to a deeper harbor. If maintenance dredging is not performed, this pattern of delays will continue until only the smallest vessels are left in the harbor.

To calculate the overall cost of delays, the value of watermen's time is estimated using the current average wage for Farming, Fishing and Forestry workers in southern Maryland. The November 2010 average wage was $14.75 according to the Maryland Department of Labor, Licensing and Regulation; Office of Workforce Information & Performance, Occupational Employment Statistics Program is available at http://www.dllr.state.md.us/lmi/wages/PAGE0398.HTM (accessed 4/26/2011). Calculations of lost labor at each controlling depth for vessels remaining at St Jerome Creek are presented in Table 3-2 below.

Table 3-2 - Lost Labor Due to Tidal Delays

channel controlling depth	vessel draft	mid-point draft (Ft.)	# vessels	channel depth required	tidal height required	avg. delay per trip (hrs)	trips/yr	avg. hours delayed per year	cost/hr ($)	crew/ boat	annual cost of lost labor due to delays
6 FT	5-6'	5.5	17	6.5	0.5	0.90	180	162	14.75	3	$121,991
	4-4.9'	4.5	15	5.5	-0.5	0.00	180	0	14.75	3	$0
	3-3.9'	3.5	15	4.5	-1.5	0.00	180	0	14.75	3	$0
	2-2.9'	2.5	14	3.5	-2.5	0.00	180	0	14.75	3	$0
	Total		61					162			$121,991
5 FT	5-6'	5.5	17	6.5	1.5	4.29	180	773	14.75	3	$581,240
	4-4.9'	4.5	15	5.5	0.5	0.90	180	162	14.75	3	$107,640
	3-3.9'	3.5	15	4.5	-0.5	0.00	180	0	14.75	3	$0
	2-2.9'	2.5	14	3.5	-1.5	0.00	180	0	14.75	3	$0
	Total		61					170			$688,880
4 FT	5-6'	5.5	17	6.5	2.5	0.00	180	0	14.75	3	$0
	4-4.9'	4.5	15	5.5	1.5	4.29	180	773	14.75	3	$512,859
	3-3.9'	3.5	15	4.5	0.5	0.90	180	162	14.75	3	$107,640
	2-2.9'	2.5	14	3.5	-0.5	0.00	180	0	14.75	3	$0
	Total		61					935			$620,498
3 FT	5-6'	5.5	17	6.5	3.5	0.00	180	0	14.75	3	$0
	4-4.9'	4.5	15	5.5	2.5	0.00	180	0	14.75	3	$0
	3-3.9'	3.5	15	4.5	1.5	4.29	180	773	14.75	3	$512,859
	2-2.9'	2.5	14	3.5	0.5	0.90	180	162	14.75	3	$100,464
	Total		61					935			$613,322
2 FT	5-6'	5.5	17	6.5	4.5	0.00	180	0	14.75	3	$0
	4-4.9'	4.5	15	5.5	3.5	0.00	180	0	14.75	3	$0
	3-3.9'	3.5	15	4.5	2.5	0.00	180	0	14.75	3	$0
	2-2.9'	2.5	14	3.5	1.5	4.29	180	773	14.75	3	$478,668
	Total		61					773			$478,668

A summary of Lost Labor Costs, rounded to the nearest hundred, is provided in Table 3-3 below.

Table 3-3 - Lost Labor Cost Due to Tidal Delays (Summary)

YEAR	CHANNEL DEPTH (Feet)	COST OF LOST LABOR DUE TO VESSEL DELAYS
1	6	$121,991
2	5	$688,880
3	4	$620,498
4	3	$613,322
5	2	$478,668

Tidal delays to commercial watermen under existing conditions are valued at $122,000 and would worsen to a projected $479,000 by year five as shoaling in the harbor continues. After maintenance dredging in year 5, tidal delays would be reduced to $122,000 and would worsen again to $479,000 by year 10. This pattern would continue through the 50 year period of analysis. With the project, these tidal delays would be prevented.

3.2.2.2 Vessel Damages

Twenty-six out of 40 survey respondents reported vessel damages from striking shoals or running aground. The same percentage of vessels reporting damages was applied to the entire fleet to derive the number of vessels damaged at each draft. Table 3-4 below shows the distribution of vessels by draft and the estimated number of vessels incurring damages as the channel shoals.

Table 3-4 – Number of Vessels Damaged

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
Vessel draft (Ft.)	# boats by draft that responded to survey	# boats reporting damage on survey	Damaged boats as percent of fleet	Number of Vessels in fleet	Estimated # boats damaged
			Col 3 ÷ Col 2		Col 4 x Col 5
5-6'	11	8	73%	17	12
4-4.9'	10	7	70%	15	11
3-3.9'	10	3	30%	15	5
2-2.9'	9	8	89%	14	12
Total	40	26		61	40

Survey response indicates average annual repair costs for wheel and rudder damage due to striking a shoal are $2,000. Damages are calculated based on channel depths being reduced to 2 Ft. by year 5 of the dredge cycle. It is assumed that only the largest vessels drafting over 5 ft. (12 vessels from Col 6 above) are likely to incur damages in the first year. The second year assumes vessels drafting between 4 and 6 ft. (12+11= 23) are likely to incur damages. In year 3, only 16 vessels drafting between 3 and 4.9 ft. (11 + 5) will experience damages because the larger boats will relocate to deeper harbors. When the channel shoals to a controlling depth of 3 ft., 17 vessels drafting between 2 and 3.9 ft. (12 + 5) will experience damages. When the depth is reduced to 2 ft., only the smallest vessels left in the harbor are expected to incur damages. A summary of vessel damages incurred throughout a single dredging cycle, rounded to the nearest hundred, is provided in Table 3-5 below. This pattern would continue through the 50 year period of analysis. These damages would be prevented with the project. Figure 3-2 shows a boat that ran aground in November of 2009 while attempting to navigate the creek.

Table 3-5 – Vessel Damage Cost

YEAR	Channel Depth (Ft.)	DAMAGE COST PER VESSEL	# VESSELS DAMAGED	ANNUAL DAMAGE COST
1	6	$2,000	12	$24,000
2	5	$2,000	23	$46,000
3	4	$2,000	16	$32,000
4	3	$2,000	17	$34,000
5	2	$2,000	12	$24,000

Figure 3-2 – Vessel Run Aground on St. Jerome Point Attempting to Navigate Channel

3.2.2.3 Increased Ordinary Maintenance Prevented

Watermen report that maneuvering around shoals, scraping the bottom, stopping to assist other boats grounded in the channel, and waiting for adequate tidal range to re-enter the harbor have a direct impact on ordinary vessel maintenance. This is in line with other economic analyses performed in the Chesapeake Bay area. Costs are increased by sand in intake screens, filters and impellers leading to additional maintenance on the engine and electronic systems. The estimated average increase in cost per vessel for an ordinary maintenance event is $3,000 based on survey response data. The estimated cost associated with increased ordinary maintenance for 61 boats is calculated based on channel depths and a 5-year dredge cycle the same as for vessel damages. A summary of increased ordinary maintenance, rounded to the nearest hundred, is provided in Table 3-6. These damages would be prevented with the project.

Table 3-6 – Increased Ordinary Maintenance Cost

YEAR	COST PER MAINTENANCE EVENT	ADDITIONAL MAINT. EVENTS	INCREASED MAINTENANCE COST
1	$3,000	12	$36,000
2	$3,000	23	$69,000
3	$3,000	16	$48,000
4	$3,000	17	$51,000
5	$3,000	12	$36,000

3.2.2.4 Additional Fuel Consumption Prevented

Additional fuel cost is related to the time spent by watermen waiting for the tide to shift to avoid the shoals in the channel upon leaving or re-entering the creek. Restricted depth also causes delays when encountering other vessels in the channel as there is insufficient depth to maneuver. The rate of fuel consumption is based on the average hours of delays experienced annually, calculated from the mean tide chart developed for St. Jerome Creek. When shoaling reaches the point where the highest tides no longer provide adequate depth for safe passage in the channel, the larger boats must re-locate to a deeper harbor.

The average rate of fuel consumption at low speed used while in the harbor or waiting outside the mouth of the channel is reported to be 4.0 gallons per hour. The price per gallon is $4.27

based on the May 2011 retail prices of diesel fuel provided by the U.S. Dept. of Energy. A summary of additional fuel costs, rounded to the nearest hundred, is provided in Table 3-7.

Table 3-7 – Additional Fuel Consumption Cost

YEAR	ADDITIONAL GALLONS FUEL	COST PER GALLON	ADDITIONAL FUEL COST
1	649	$4.27	$2,800
2	3739	$4.27	$16,000
3	3739	$4.27	$16,000
4	3739	$4.27	$16,000
5	3091	$4.27	$13,200

3.2.2.5 Relocation Costs Prevented

If current shoaling conditions continue at St. Jerome Creek, the channel will no longer be viable for many vessels and they will have to relocate to a deeper harbor. The closest harbor with enough depth and space to accommodate commercial and charter vessels is Solomon's Island Harbor, located 41 miles to the north of St. Jerome Creek. The full expense incurred by watermen to move their vessels to a new harbor may include additional over-land travel and possibly relocating entire families. These expenses are beyond the scope of this analysis and are replaced by the estimated expense presented in Table 3-8 below. The additional cost of relocation was calculated by determining the number of boats with drafts greater than the channel depth that would be forced to leave the harbor. (Col 5 from Table 3-4 above) The number of additional miles per fishing trip was used to determine additional fuel and labor based on average speeds of 30 miles per hour and a fuel consumption rate of 4 miles per gallon. The pattern of boats leaving is repeated through the 50-year project life because it is assumed that after the channel is dredged, some vessels will return or new vessels will come in.

Table 3-8 – Vessel Relocation Cost

Channel Depth	Number of Boats leaving	Additional miles to fishing grounds	Average number of fishing trips per year	Total Additional miles traveled	Fuel cost per gallon	Additional Fuel Cost @ 4 MPG	Additional hours to fishing grounds @ 30 MPH	Crew per vessel not including captain	Average Labor Rate per Hour *(MD Dept. of Labor)	Additional Labor Cost @ $14.75/Hr	Total Additional Cost for vessel relocation
6	0	41	180	0	$ 4.27	$ -	0	3	$ 14.75	$ -	$ -
5	0	41	180	0	$ 4.27	$ -	0	3	$ 14.75	$ -	$ -
4	17	41	180	126,684	$ 4.27	$ 135,235	4,223	3	$ 14.75	$ 186,859	$ 322,094
3	15	41	180	111,780	$ 4.27	$ 119,325	3,726	3	$ 14.75	$ 164,876	$ 284,201
2	15	41	180	111,780	$ 4.27	$ 119,325	3,726	3	$ 14.75	$ 164,876	$ 284,201
				350,244		$ 373,885	11,675			$ 516,610	$ 890,495

3.2.2.6 Decreased Recreational Quality

The current channel conditions decrease the quality of recreational boating on the creek. Many recreational vessels utilize St. Jerome Creek during the 6-month recreational boating season, 640 of which are moored in the creek. These boaters encounter the same navigation issues as commercial waterman as the channel shoals in over time. As the channel depth decreases, groundings of recreational vessels resulting in damages and costly repairs may occur. In addition, if channel depths are not adequate for safe passage, users must wait for high tide.

With the federal navigation project, recreational users of the harbor will experience increased accessibility and improved safety. As the harbor shoals in over time, the difference between the quality of the recreational experience with and without the project will increase. Without the project, the recreational quality of the harbor will be impacted by year five of the period of analysis, after which time, maintenance dredging would need to be performed and the recreational quality will return to existing conditions. With the project, boaters will be able to safely and easily navigate in and out of the harbor over the 50-year period of analysis.

To estimate the value of this improvement in the recreational quality with the project, the Unit Day Value method was used. The Unit Day Value method was developed by the Corps of Engineers to evaluate changes in the value of recreational quality. Recreational activities are evaluated based on five criteria that characterize the quality of the recreational experience. Point values for the existing conditions and for the with-project condition are compared. Since the depths in the harbor are currently at or near the projected without-project depths, the point values for the Existing Condition and the Future Shoaled Condition are the same. Total point values are converted to dollar values based on current Corps guidance as contained in EGM #12-03 Fiscal Year 2012 (latest available). The Unit Day Value analysis for St. Jerome Creek is shown in Table 3-9 below.

The figures shown in Table 3-9 are used to create an average annualized value for improved recreational quality that would exist due to completion of the project. For the without-project condition, recreational values are calculated based on shoaling and reduced channel depth within five years of dredging carried out over the 50-year analysis period. With 640 recreational boats in the harbor, assuming an average of 78 boating days per summer season (April – September @ 3 days/week) and an average of 3 people per boat, the value for recreational quality is calculated as follows:

(640 boats) x (78 days/year) x (3 users/boat) x ($ Value/user/day) = Value of Recreational Quality

The maximum recreational value for the future shoaled condition is $1.2 M versus an estimated value of $1.4M for the improved condition. The value of recreational experience is greatest in the year when dredging is performed and decreases as the channel shoals in. Benefits accrued to the project equal the difference between the future with-project condition and the shoaled, without-project condition. Based on historical dredging events which have occurred approximately every 10 years, the average recreational benefits in the with-project condition amount to $174,300 annually over the 50-year period of analysis. These benefits would increase if maintenance dredging occurred more frequently.

Table 3-9 – Unit Day Value Analysis

UDV CRITERIA	POINT RANGE	Without Project POINTS	With Project POINTS
Recreation Experience[1]	0 - 30	4	13
Availability of Opportunity	0 - 18	2	4
Carry Capacity	0 - 14	5	14
Accessibility[2]	0 - 18	16	16
Environmental Aestetic	0 - 20	20	20
		47	**67**
$ Value/User/Day Hard-Keyed		$8.36	$9.60
Number of Days		78	78
Number of Users		3	3
Number of Boats		640	640
		$1,251,994	**$1,437,696**

3.2.2.7 Maintenance Dredging Costs and Frequency

Dredging costs are estimated at $702,780 per dredge event. Under current conditions, a shortened dredge cycle is required to maintain the minimal depths required to keep the harbor viable. For this analysis it is assumed dredging is required every five years at an annualized cost of $129,800 over the 50-year project life.

3.3 FUTURE WITHOUT-PROJECT CONDITIONS

Without navigation improvements to St. Jerome Creek, shoaling will continue to impede navigation of larger boats within a year following maintenance dredging, and commercial watermen will continue to experience navigation problems and operating inefficiencies. Without dredging, tidal delays, grounding damages, and operating inefficiencies will increase as depths in the harbor decrease. For the without-project condition, it is projected that shoaling will continue to decrease the controlling depth in the harbor to two - three ft. within five years of maintenance dredging, requiring a shortened dredge cycle to maintain the minimal depths required to keep the harbor viable.

Section 4.0 **PLAN FORMULATION**

During the feasibility phase, planning efforts were directed toward formulating feasible alternatives and selecting a recommended plan to slow the sediment transport that has led to rapid shoaling of the navigational channel at St. Jerome Creek, Maryland, while minimizing the impact of construction on the natural environment.

4.1 FEDERAL OBJECTIVE

The federal objective of water and related land resources planning is to contribute to the National Economic Development (NED) consistent with protecting the Nation's environment pursuant to national environmental statues, applicable executive orders, and other federal planning requirements. Resource planning must incorporate a multi-objective planning process wherein economic, social, and environmental considerations must be equally weighted. During the formulation process associated with this study, alternative plans were devised that would alleviate the identified problems along the navigation channel of St. Jerome Creek in ways that contribute to both the federal objective and the desires of the local sponsor. This approach is in compliance with the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, dated March 1983.

Generally, several alternative plans are formulated to address a particular set of water resource problems. The alternative plan that maximizes the net contribution (amount by which annual benefits exceed annual costs) to the NED objectives, consistent with environment laws and policies, is defined as the NED plan.

4.2 PLANNING CRITERIA

4.2.1 Plan Formulation

Alternative plans should be formulated to address the study objectives and adhere to study criteria. Each alternative plan shall be formulated in consideration of four criteria: completeness, efficiency, effectiveness, and acceptability (Table 4-1). Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other federal and non-federal entities. Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives. Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Mitigation of adverse effects shall be an integral component of each alternative plan.

4.2.2 Engineering Criteria

Analyze the current alignment of the navigational channel within and exiting St. Jerome Creek. This will determine the recommended alignment of the channel and necessary structural features (jetties, breakwaters, etc.) or non-structural measures to protect against shoaling in the proposed channel to address the navigation problems from insufficient depths within five years or less. Any structural designs will evaluate measures for protecting against erosion of adjacent/nearby shorelines and extending the dredging frequency to 10 years. Alternative plans should be adequately sized to accommodate present and future user needs and should not adversely affect the safe and continued usage of the channel. The plans must also be feasible from an engineering standpoint and capable of being economically justified.

4.2.3 Economic Criteria

Principles and guidelines for federal water resources planning require a plan to be identified that produces the greatest contribution to the NED. The NED plan is defined as the plan providing the greatest net benefits as determined by subtracting annual costs from annual benefits. The Corps of Engineers' policy requires recommendation of the NED plan unless there is adequate justification to do otherwise.

Alternatives considered should be presented in quantitative terms where possible. Benefits attributed to a plan must be expressed in terms of a time value of money and must exceed equivalent economic costs for the project. To be economically feasible each separate portion or purpose of the plan must provide benefits at least equal to the cost of that unit. The scope of development must be such that benefits exceed project costs to the maximum extent possible.

4.2.4 Environmental Criteria

Environmental considerations include identifying aquatic life and wildlife that might be impacted by a plan's implementation, minimizing adverse impacts to water circulation, cultural resources, natural resources and minimizing the area impacted by the project, both physically and aesthetically.

4.2.5 Social Criteria

Plans considered must minimize adverse social impacts and must be consistent with state, regional, and local land use and development plans, both public and private. The selected plan must be workable and viable to the non-federal sponsor.

4.3 DESCRIPTION OF ALTERNATIVE PLANS

Preliminary concept plan alternatives were developed to determine the most efficient and feasible plan to protect against navigation channel shoaling and beach erosion. The objective was to develop a reasonable list of possible alternatives and then to select the best alternatives along with the no-action alternative for further evaluation.

Given the layout of the entrance into St. Jerome Creek, there are a number of preliminary design solutions and preliminary alternative plans that could be implemented to reduce the shoaling in the St. Jerome Creek navigation channel.

All alternatives will have to deal with the ability to reuse the existing dredged placement site on the Orebaugh farm, located about 550 ft. south of Buzz's Marina Way. The material currently held at the placement site would be removed by the sponsor to provide space for the newly dredged material. It is anticipated that the placement area would be in use for approximately one to two years for the dewatering of the dredged material. Upon the completion of this activity, the material would be hauled off-site and the placement area would be re-graded. At this time there are no other local potential placement sites available.

The 2004 EA that covered the 2006 maintenance dredging of St. Jerome Creek did evaluate another alternative location for dredged material placement. At that time, placement of material at the agricultural upland placement on Airedele Road, just southwest of the dredging activities in the St. Jerome Creek, was evaluated; however, the non-federal sponsor chose not to use this site since it is smaller than the other site. Therefore, this alternative was not selected. Previous dredging in 1991 and 1982 placed dredged material at a diked upland facility on Deep Point.

The most practical alternatives are discussed in the following paragraphs.

4.3.1 No Action

Without navigation improvements to St. Jerome Creek, shoaling will continue to impede navigation of larger boats within a year following maintenance dredging, and commercial watermen will continue to experience navigation problems and operating inefficiencies. Without dredging, tidal delays, grounding damages, and operating inefficiencies will increase as depths in the harbor decrease. For the without-project condition, it is projected that shoaling will continue to decrease the controlling depth in the harbor to 2 - 3 ft. within 5 years of maintenance dredging, requiring a shortened dredge cycle to maintain the minimal depths required to keep the harbor viable.

4.3.2 Increased Maintenance

Historically, the federal channel at St. Jerome Creek has been dredged approximately every 10-15 years. Since the initial dredging, the channel has shoaled so quickly that boats have experienced damages attempting to navigate the channel after only 2 years. A more frequent dredging cycle would alleviate the problem, but this would require maintenance every 5 years, which is not feasible over the 50-year project life. Consequently, this alternative was not selected for further evaluation.

4.3.3 Alternative 1

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-1. The south jetty would connect to the shoreline about 400 ft. south of the northern tip of Deep Point and would have a length of 1,400 ft., including a 200 foot breakwater section at its bayward end. A second 200 foot breakwater segment would also be constructed with a 200 foot gap from the first breakwater section. The objective of this jetty would be to trap the northerly longshore transport and prevent bypassing of the transport around the jetty. The landward terminus of the jetty is located to minimize potential downdrift impacts (erosion/sand starvation) along the Deep Point shoreline. The purpose of the breakwater segments would be to increase the sediment storage capacity landward of the jetty. The north jetty would connect to the shoreline about 200 ft. west of the southern tip of St. Jerome Point and would have a length of 1,300 ft. The objective of this jetty would be to trap the southerly longshore transport and prevent bypassing of the transport around the jetty. The proposed crest elevation of the jetties and breakwaters would be +4 ft. to + 5 ft. Mean Lower Low Water (MLLW).

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of the breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the potential need to stabilize the bayside shorelines of the sand spits due to the reduction in the sediment supply to these shorelines following jetty construction.
5. the preliminary project construction cost is$2,784,000.
6. <u>major factor(s) for not being selected for concept design</u> – cost of project and north jetty will only provide medium term containment of southerly sand transport.

Figure 4-1 – Alternative 1

4.3.4 Alternative 2

Alternative 2 consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-2. The south jetty is the same as Alternative 1. The north jetty would connect to the shoreline at the southern tip of St. Jerome Point and would be perpendicular to the shoreline to the north. A stone sill will also be placed along the south side of the sand spit shoreline of St. Jerome Point. The objective of this jetty would be to trap the southerly longshore transport and prevent bypassing of the transport around the jetty. The jetty would have a length of 700 ft. and a proposed crest elevation of +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of the breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition into the channel. The north jetty is probably more susceptible to sand bypassing in this alternative vs: Alternative 1 since the structure is shorter and any sand bypassing the jetty would be transported to the large open low velocity entrance channel area which would be conducive to deposition.
4. the exposure of the existing sand spits to Southeast wave energy and accelerated erosion as the sand supply to these spits would be reduced with the construction of the jetties. Stabilization of these spits with a low crested stone sill or stone headland breakwaters may be required.
5. the preliminary project construction cost is $2,748,000.
6. <u>major factor(s) for not being selected for concept design</u> – cost of project and north jetty will only provide short term containment of southerly sand transport.

Figure 4-2 – Alternative 2

4.3.5 Alternative 3

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-3. The south jetty would connect to the shoreline about 1,200 ft. south of the northern tip of Deep Point and would have a length of 1,100 ft. The objective of this jetty would be to trap the northerly longshore transport and prevent bypassing of the transport around the jetty. The landward terminus of the jetty is located further to the south and would potentially result in downdrift impacts along the Deep Point shoreline. The north jetty would connect to the shoreline about 200 ft. west of the southern tip of St. Jerome Point and would have a length of 1,300 ft. The north jetty is the same as Alternative 1.The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the potential need to stabilize the bayside shorelines of the sand spits due to the reduction in the sediment supply to these shorelines following jetty construction.
5. the preliminary project construction cost is $2,304,000.
6. <u>major factor(s) for not being selected for concept design</u> – north jetty will only provide medium term containment of southerly sand transport.

Figure 4-3 – Alternative 3

4.3.6 Alternative 3A

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-4. The south jetty is the same as Alternative 3. The north jetty is a modification of Alternative 3 with the north jetty connecting to the shoreline about 450 ft. west of the southern tip of St. Jerome Point with a length of 1,600 ft. These modifications would increase the sand storage capacity of the north jetty as well as locate the landward terminus of the jetty further away from the private residence on the point. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the potential need to stabilize the bayside shorelines of the sand spits due to the reduction in the sediment supply to these shorelines following jetty construction.
5. the preliminary project construction cost is $2,592,000.
6. <u>major factor(s) for not being selected for concept design</u> – cost of project and north jetty will only provide medium term containment of southerly sand transport.

Figure 4-4 – Alternative 3A

4.3.7 Alternative 4

This alternative is a variation of Alternative 3 and consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-5. The south jetty would connect to the shoreline about 500 ft. south of the northern tip of Deep Point and would have a length of 985 ft. The location of the landward terminus of this jetty would reduce potential downdrift impact (erosion) along the Deep Point shoreline. The north jetty connects to the shoreline about 200 ft. west of the southern tip of St. Jerome Point with a length of 1,300 ft. These modifications would also decrease the construction cost of the project. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Incorporation of breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the potential need to stabilize the bayside shorelines of the sand spits due to the reduction in the sediment supply to these shorelines following jetty construction.
5. the preliminary project construction cost is $2,198,400.
6. <u>this alternative will be considered for concept design because of cost and potential functionality, approximately only 2300 ft. of jetty structures is required</u>.

Figure 4-5 – Alternative 4

4.3.8 Alternative 5

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-6. The south jetty would connect to the shoreline about 1,050 ft. south of the northern tip of Deep Point and would have a length of 800 ft. Three (3) offshore breakwaters, 300 ft. each, are located south of the south jetty to help stabilize the shoreline north of the jetty due to the downdrift impacts of the jetty. The north jetty connects to the shoreline about 200 ft. west of the southern tip of St. Jerome Point with a length of 1,200 ft. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the preliminary project construction cost is $2,568,000.
5. <u>major factor(s) for not being selected for concept design</u> – cost of project and north jetty will only provide short to medium term containment of southerly sand transport.

Figure 4-6 – Alternative 5

4.3.9 Alternative 6

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-7. The south jetty would connect to the shoreline about 1,700 ft. south of the northern tip of Deep Point and would have a length of 700 ft. The objective of the south jetty would be to trap the northerly longshore transport along the south side of the jetty. Three (3) offshore breakwaters, 200 ft. each, are located north of the south jetty to help stabilize the shoreline north of the jetty due to the downdrift impacts of the jetty. The north jetty would connect to the shoreline about 200 ft. west of the southern tip of St. Jerome Point and would have a length of 1,300 ft. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Incorporation of breakwater segments would increase the storage capacity of the system as well as reduce the downdrift impacts of the jetty.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the storage capacity of the north jetty and the ability of the north jetty to prevent sand bypassing the jetty and deposition in the channel.
4. the potential need to stabilize the bayside shorelines of the sand spits due to the reduction in the sediment supply to these shorelines following jetty construction.
5. the preliminary project construction cost is $2,352,000.
6. <u>major factor(s) for not being selected for concept design</u> –north jetty will only provide short to medium term containment of southerly sand transport.

Figure 4-7 – Alternative 6

4.3.10 Alternative 7

This alternative consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-8. The south jetty would connect to the shoreline about 200 ft. south of the northern tip of Deep Point and would have a length of 1,330 ft. The north jetty would connect about 250 ft. east of the tip of the sand spit and would have a length of 1,770 ft. The objective of the jetties would be to trap the longshore transport and prevent it from entering the channel area. These jetties would probably have the least downdrift impacts along the Deep Point and St. Jerome Point shorelines. The landward terminus of the north jetty would probably require stabilization along the sand spit shoreline to prevent the jetty from being flanked. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. Incorporation of breakwater segments would increase the storage capacity of the system as well as reduce the downdrift impacts of the jetty.
2. the ability of the tidal current velocity in the channel to prevent deposition of the sediment in the channel.
3. the preliminary project construction cost is $2,550,000.
4. <u>this alternative will be considered for concept design because the north jetty fillet will provide long term containment of sand transport and the channel will be self-scouring between jetties along its entire length.</u>

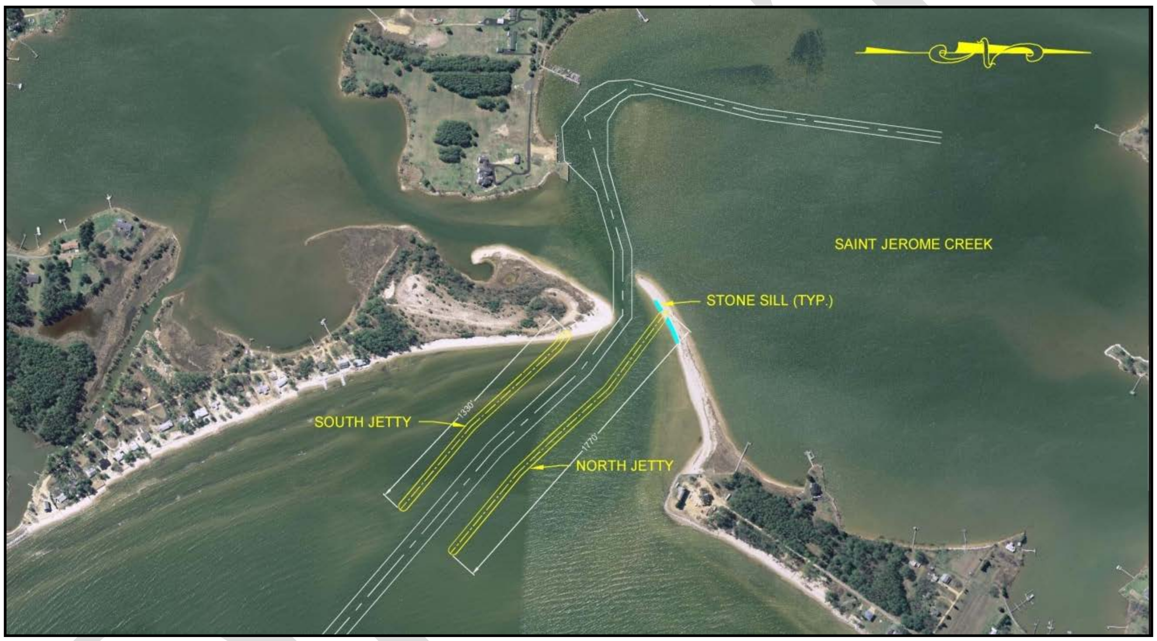


Figure 4-8 – Alternative 7

4.3.11 Alternative 8

This alternative consists of the construction of one jetty south of the entrance to St. Jerome Creek as shown in Figure 4-9. The south jetty would connect to the shoreline about 1,050 ft. south of the northern tip of Deep Point and would have a length of 800 ft. Three offshore breakwaters would be constructed south of the jetty to increase the sediment storage capacity of the jetty. The proposed crest elevation of the jetty/breakwaters would be +4 ft. to + 5 ft. MLLW. This is a modification of Alternative 5 without a north jetty. Its feasibility will depend on a comparison of project costs without the north jetty and more shoaling from the north versus project costs with the north jetty and reduced shoaling from the north over the project economic life.

In addition, the channel is relocated straight into St. Jerome Creek and a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction. Depending on the transport rate, at some point, the longshore transport may start to bypass the jetty and move into the channel entrance. The incorporation of breakwater segments would increase the storage capacity of the system.
2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the impacts of sand bypassing from the north on deposition in the channel.
4. the preliminary project construction cost is $2,020,000.
5. <u>major factor(s) for not being selected for concept design</u> – no channel protection for southernly directed longshore transport

Figure 4-9 – Alternative 8

4.3.12 Alternative 9

This alternative is a modification of Alternative 5 with offshore breakwaters on the north side of the entrance channel instead of a north jetty as shown in Figure 4-10. The feasibility will also depend on a comparison of project costs. Also, the ability of the breakwaters to reduce/eliminate the shoaling from the north will have to be evaluated as well as the consequences of eliminating the breakwaters on the south side. In addition, the channel is relocated straight into St. Jerome Creek and a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. This alternative will have the same economic issues as Alternative 8.

Key issues to be considered with this plan include:

1. the storage capacity of the south jetty as the jetty traps the northerly directed longshore transport and the sand fillet grows in the offshore and southerly direction.

2. the ability of the tidal current velocity in the channel to prevent deposition of sediment in the channel.
3. the impacts of sand bypassing from the north on deposition in the channel.
4. the preliminary project construction cost is $2,020,000.
5. <u>major factor(s) for not being selected for concept design</u> – minimal channel protection for southerly directed longshore transport

Figure 4-10 - Alternative 9

4.4 SELECTION OF CONCEPT PLANS FOR FURTHER ANALYSIS

The various alternatives in Section 4.3 were screened based on the key issues identified below each alternative. Table 4.1 summarizes concept plan comparisons.

Table 4-1 – Concept Plans

	No Action	Increased Maintenance	Alt. 1	Alt. 2	Alt. 3	Alt. 3A	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	Alt. 9
Completeness	-	-	x	x	x	x	**X**	x	x	**X**	x	x
Effectiveness	-	-	-	-	-	-	**X**	-	-	**X**	-	-
Efficiency	-	-	x	x	x	x	**X**	x	x	**X**	x	x
Acceptability	x	x	x	x	x	x	**X**	x	x	**X**	-	-

x = alternative meets criteria
- = alternative does not meet criteria

The advantages and disadvantages of each of the preliminary alternatives were evaluated by the Project Delivery Team (PDT) and contractors (Offshore & Coastal Technologies, Incorporated (OCTI-E) and Andrew Millers and Associates {AMA}) during monthly conference calls. These conference calls centered on the key issues to be considered for each preliminary alternative, along with the AMA’s similar project experience and input from the PDT to identify the best alternatives to evaluate further. Based on the information and discussions, two (2) concept plans were selected for further evaluation, Alternative 4 and Alternative 7. In addition, two variations of Alternative 7 were formulated which resulted in four plans for more detailed evaluation. These plans are described below along with the rationale for their selection.

4.4.1 Alternative 4

Alternative 4 (Figure 4-11) consists of the construction of two jetties at the entrance to St. Jerome Creek. The south jetty would connect to the shoreline about 500 ft. south of the northern tip of Deep Point and would have a length of 985 ft. The north jetty connects to the shoreline about 200 ft. west of the southern tip of St. Jerome Point with a length of 1,305 ft. The objective of the jetties would be to trap the longshore transport and prevent it from entering the channel area. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

This alternative was selected for further evaluation based on a comparison with the range of alternative plans developed. The general parameters considered which resulted in the selection of this alternative for further evaluation are as follows:

- Increased tidal current velocities in the inlet (particularly ebb currents) with the configuration of the north and south jetties
- Average sediment storage capacity along the updrift sides of the jetties; potential increase in capacity by adding offshore breakwaters
- Good protection of the existing spits from wave induced erosion
- Less downdrift shoreline erosion potential
- Less potential for sand bypassing from the north shoreline

Figure 4-11 – Concept Alternative 4

4.4.2 Alternative 7

This alternative (Figure 4-12) consists of the construction of two jetties at the entrance to St. Jerome Creek. The south jetty would connect to the shoreline about 200 ft. south of the northern tip of Deep Point and would have a length of 1,330 ft. The north jetty would connect about 250 east of the tip of the sand spit would have a length of 1,770 ft. The objective of the jetties would be to trap the longshore transport and prevent it from entering the channel area. These jetties would probably have the least downdrift impacts along the Deep Point and St. Jerome Point shorelines. The landward terminus of the north jetty would probably require stabilization along the sand spit shoreline to prevent the jetty from being flanked. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

The general parameters considered which resulted in the selection of this alternative for further evaluation are as follows:

- Significantly increased tidal current velocities in the inlet (particularly ebb currents) with the configuration of the north and south jetties
- High sediment storage capacity along the updrift side of the north jetty
- Very good protection of the existing spits from wave induced erosion
- Minimal downdrift shoreline erosion potential
- Least potential for sand bypassing from the north shoreline

Figure 4-12 – Concept Alternative 7 w/ and w/o Realigned Channel

4.4.3 Alternative 7 – w/ Realigned Channel

This alternative (Figure 4-12) is the same as Alternative 7 except the existing channel within the inlet will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. The purpose of the channel section realignment would be to make the channel more hydraulically efficient to reduce shoaling potential. The realigned channel will proceed straight through the inlet and intersect the channel section in St. Jerome Creek. Stone scour protection will be required around the north jetty landward terminus.

The general parameters considered which resulted in the selection of this alternative for further evaluation are the same as Alternative 7 with the addition of:

- The potential of decreasing the shoaling in the St. Jerome Creek section of the channel by re-aligning the channel straight through the inlet

4.4.4 Alternative 7A

This alternative was added after the PDT evaluated the advantages and disadvantages of each preliminary alternative during monthly conference calls. The team felt that we needed to see an alternative that took into account a realignment of the entrance channel and the modeling results that came with it. Alternative 7A (Figure 4-13) consists of a realigned entrance channel headed directly east and the construction of two jetties on the north and south of the St. Jerome Creek navigational channel. The south jetty would connect to the shoreline about 100 ft. south of the northern tip of Deep Point and would have a length of 2,040 ft. The north jetty would connect at the tip of St. Jerome Point and would have a length of 1,100 ft. The objective of the jetties would be to trap the longshore transport and prevent it from entering the channel area. The south jetty would have little downdrift impact along the Deep Point shoreline. The north jetty would some potential downdrift impact along the sand spit shoreline east of St. Jerome Point due to the reduction in sediment transport to the shoreline. The proposed crest elevation of the jetties would be +4 ft. to + 5 ft. MLLW.

The general parameters considered which resulted in the selection of this alternative for further evaluation are as follows:

- Significantly increased tidal current velocities in the inlet (particularly ebb currents) with the configuration of the north and south jetties
- High sediment storage capacity along the updrift side of the south jetty
- Least potential for sand bypassing from the south shoreline
- Minimal downdrift shoreline erosion potential along Deep Point shoreline

Figure 4-13 - Concept Alternative 7A

4.5 EVALUATION OF CONCEPT PLANS

Following the selection of the concept plans, an evaluation of the ability of each plan to reduce the shoaling in the entrance channel and decrease the frequency and volume of maintenance dredging was conducted. This evaluation is discussed in the following sections.

4.5.1 Numerical Modeling of Jetty Alternatives

4.5.1.1 Introduction

Numerical modeling was conducted to analyze the current alignment of the navigation channel exiting St. Jerome Creek and the proposed concept plans to assess the efficiency and performance of the plans with regard to currents and shoaling in the entrance channel. Details of this modeling are presented in Section C-2 of Appendix C. The dimensions and the layout of the structures were determined in the concept design phase of the study as presented in Figures 16–18 of Appendix C.

4.5.1.2 Description of Action Alternatives

The concept plans were used to accurately delineate the locations of jetty structures, the channel, shoreline armoring, and other features that are required to be represented in the model. Model representations of Alternatives 4, 7, 7 with realigned channel, and 7A are shown in Section C-2 of Appendix C.

4.5.1.3 Modeling Approach

Modeling of the St. Jerome Creek study area was conducted by a multi-level approach involving application of three models. The two-dimensional finite element model ADCIRC was applied over a regional scale to calculate tidal water levels, which were then provided to a separate circulation model, CMS-Flow, as boundary conditions. CMS-Flow is a two-dimensional finite volume circulation and sediment transport model that was operated on a local scale. Waves were computed on a local scale by application of the model CMS-Wave, which computed detailed wave properties at the study area. The wave, circulation and sediment transport models were coupled so that the wave model would receive updated tide, depth, and current information, and the circulation and sediment transport model would be provided with updated wave properties. This approach allowed each model to respond to changes in the physical system.

Development of the numerical model grids used bathymetric data including surveys performed by the Baltimore District in 2008, the National Ocean Service (NOS) GEODAS and bathymetry obtained from the regional ADCIRC mesh.

4.5.1.4 Modeling Results

The primary objective of the study is to examine shoaling patterns and rates in the navigation channel. The existing-condition model was run for a time period of 10.5 days and the sediment transport coefficient was set such that this time period would be equivalent to a much longer time period of sedimentation. The model result was compared to historic dredging data (described in the main report) and the 10.5-day simulation was found to be equivalent to a real-world sediment transport time period of 2.5 months. The model reproduced the locations of sediment deposition, as shown in Figure 9 of Section C-2 in Appendix C. The three primary areas of historic shoaling are in the back creek area (station 18-28), just seaward of the creek entrance (station 32-36), and where the channel crosses the offshore sediment bypassing bar (station 48-55). The model results in Figure 9 of Section C-2 in Appendix C (yellow is accretion, blue is erosion) correlate well with the historic areas of shoaling in the channel.

4.5.1.5 Predicted Shoaling Rates and Controlling Depths

The model was then used to simulate shoaling patterns and shoaling rates in the navigation channel for each of the concept plans. Computational grids for each alternative were developed by incorporating the alternative design into the existing condition grid. Model representations of Alternatives 4, 7, 7 with realigned channel, and 7A are shown in Figures 10-13, respectively, in Section C-2 of Appendix C.

The shoaling volume computed by the model for the existing without project condition was compared to the shoaling volume computed by the model for each concept plan for a 2.5 month simulation to produce a scaling ratio between the existing condition shoaling rate and the concept plans shoaling rates. This scaling ratio was then applied to historic deposition rates to determine the predicted change in the shoaling rate for each alternative (Figure 4-14). These results are shown in Figure 19 and Table 9 in Section C-2 of Appendix C. Alternative 7 with the realigned channel exhibits the lowest shoaling rate, indicating that it could provide the most long term reduction in dredging.

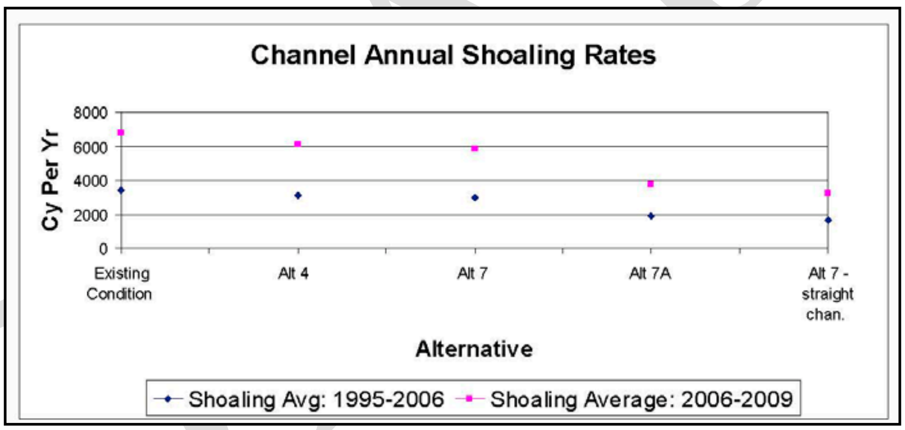


Figure 4-14 – Channel Annual Shoaling Rates

Using the shoaling ratios between the existing without project and with project conditions shown in Table 4-2, for purposes of the model an estimate of the time required for the dredged channel in each concept plan to shoal to a controlling depth of -4.0 ft. MLLW or less was made. The procedure to develop this estimate assumes that under existing without project conditions, the navigation channel shoals to a controlling depth of -4.0 ft. MLLW or less in five years. To maintain unrestricted navigation in the channel, dredging would be required every five years. The dredge quantity would be on the order of five times the historic annual channel shoaling rate, 5,100 cubic yards per year or 25,500 cubic yards. The modeling results indicate that the shoaling rate in the channel is reduced with the implementation of each concept plan alternative. With reduced shoaling rates, it is assumed that the time required to reach a controlling depth of -4.0 ft. MLLW would be increased as compared to the without project condition. To estimate the time required for each of the concept plans to reach the limiting controlling depth, the shoaling ratios in Table 4-2 were used to determine the dredging frequency. It is assumed that the without project condition (shoaling ratio =1.00) will result in a dredging frequency of five years (5 yrs./1.00 = 5.0 yrs.). For Concept Alternative 4 with a lower shoaling ratio (0.89), the dredging frequency would be 5.6 years (5 yrs /0.89 = 5.6 yrs.). The dredging frequency required for each concept plan alternative and the total dredging volume for a 50-year project life was determined, as shown in Table 4-3.

Concept Plan Alternative	Shoaled Volume From Modeling 2.5 Mo. Simulation	W/ Project Shoaling Ratio Compared To W/O Project	Predicted Shoaling Based On Historic Shoaling 1995-2009
W/O Project	1607 cy	100.00%	5100 cy/yr
Alt 4	1446 cy	89.99%	4590 cy/yr
Alt 7	1389 cy	86.41%	4407 cy/yr
Alt 7A	889 cy	55.32%	2821 cy/yr
Alt 7 - Realigned Channel	765 cy	47.60%	2428 cy/yr

Table 4-2 - W/O and W/ Project Shoaling Rates

Concept Plan Alternative	W/ Project Shoaling Ratio Compared To W/O Project	Predicted Shoaling Based On Historic Shoaling 1995-2009	Dredging Frequency (25,500 cy Ea. Event)	Dredging Volume Per 50 Yr. Life (No. Events)
W/O Project	100.00%	5100 cy/yr	5 yrs	255000 cy (10)
Alt 4	89.99%	4590 cy/yr	5.6 yrs	229500 cy (9)
Alt 7	86.41%	4407 cy/yr	5.8 yrs	229500 cy (9)
Alt 7A	55.32%	2821 cy/yr	9.0 yrs	153000 cy (6)
Alt 7 - Realigned Channel	47.60%	2428 cy/yr	10.5 yrs	127500 cy (5)

Table 4-3 - Maintenance Dredging Requirements

4.5.1.6 <u>Numerical Modeling Conclusions</u>

The implementation of numerical tidal and wave models provides a method of consistently comparing possible alternatives for reducing future dredging requirements at the entrance to St. Jerome Creek. The results indicate that Concept Plan Alternative 7 with the realigned interior channel section is the most effective in reducing channel shoaling. This alternative does involve the establishment of a new entrance to the creek, possibly requiring some added maintenance dredging during its equilibration period.

4.6 ESTIMATE OF CONCEPT DESIGN COST

Quantities and cost estimates were developed for the concept design plans with suitable assumptions as necessary for cost estimating at the concept design level. The construction cost estimates are based on AMA's experience with similar projects and includes estimates for mobilization/demobilization, construction and dredging.

The project construction cost (including mobilization/demobilization and dredging), along with the Cost Benefit analysis and Benefit to Cost Ratios for the concept design alternatives are presented in Tables 4-4.

Table 4-4 – Concept Design Cost Benefit Analysis

Annualized Cost Calculation	**Alt 4**	**Alt 7**	**Alt 7 w/ Realignment**	**Alt 7a**
Scheduled Dredge Cycle	**5.6 Yrs**	**5.8 Yrs**	**10.5 Yrs**	**9 Yrs**
Project Construction Cost	$3,208,000	$3,720,000	$4,572,000	$4,442,700
Interest During Construction	$32,259	$37,407	$45,975	$44,675
Total Investment Cost	$3,240,259	$3,757,407	$4,617,975	$4,487,375
Capital Recovery Factor (CRF) =	0.0466	0.0466	0.0466	0.0466
Average Annual Cost	$150,800	$174,900	$215,000	$208,900
Operation & Maintenance Cost	$113,500	$111,600	$64,700	$76,700
Total Annual Cost of Alternatives	$264,300	$286,500	$279,700	$285,600
Calculation of NED Annual Benefits	**Alt 4**	**Alt 7**	**Alt 7 w/ Realignment**	**Alt 7a**
Scheduled Dredge Cycle	**5.6 Yrs**	**5.8 Yrs**	**10.5 Yrs**	**9 Yrs**
Annual Costs of Without-Project Condition	$763,700	$763,700	$763,700	$763,700
Less: Annual Costs Prevented with Project	($306,100)	($266,300)	($324,900)	($304,200)
Net Annual Benefits for With-Project Alternatives	$457,600	$497,400	$438,800	$459,500
Plus: Benefits for Recreational Quality Enhancement	$174,300	$174,300	$174,300	$174,300
Total Annual Benefits of Alternatives	$631,900	$671,700	$613,100	$633,800
Benefit to Cost Ratio				
Annual Benefits of Alternatives	$631,900	$671,700	$613,100	$633,800
Annual Costs	$264,300	$286,500	$279,700	$285,600
Annual Net Benefits	$367,600	$385,200	$333,400	$348,200
Benefit to Cost Ratio	**2.39**	**2.34**	**2.19**	**2.22**

Each concept plan was preliminarily formulated in consideration of the planning criteria: completeness, efficiency, effectiveness, and acceptability, and compared again at a more detailed stage (Table 4-5).

Table 4-5 - Concept Plans - Refined

	Alternative 4	Alternative 7	Alternative 7 w/ Realigned Channel	Alternative 7A
Completeness	x	x	**X**	x
Effectiveness	-	-	**X**	-
Efficiency	x	x	**X**	x
Acceptability	x	x	**U**	x

x = alternative meets criteria

- = alternative does not meet criteria

u = undetermined if alternative meets criteria

4.7 INITIAL CONCEPT LEVEL PLAN SELECTION

Based on the field investigations conducted, review of existing data, coastal engineering design investigations and numerical modeling investigations, the Concept Plan selected for feasibility level design is Alternative 7 w/ Realigned Channel. This alternative is not considered the NED Plan per the Concept Design Cost Benefit Analysis in Table 4-4; however, through modeling results that predict shoaling rates and controlling depths, Alternative 7 w/ Realigned Channel is justified incurring the extra cost on the basis of other valued trade-offs. Further justification of this selection can be found in the paragraphs below.

Concept Alternatives 4, 7 and 7a do not meet the Engineering Criteria objective to provide for a 10 year dredging frequency laid out in Section 4.2.2. Alternatives 4, 7 and 7a have dredging frequencies of 5.6, 5.8 and 9 (Table 4-3) years, respectively. By choosing one of these alternatives, the navigational inefficiencies and damages now experienced by the fleet within St. Jerome Creek will persist and the total net benefits specific to each alternative would not be realized assuming the historical frequency of federal Operation and Maintenance (O&M) of the channel continues. Therefore, Alternative 4, 7, and 7A were determined to not meet the effectiveness criteria

Alternative 7 w/ Realigned Channel is also advantageous in providing excellent protection of the existing spits from wave induced erosion compared to Alternatives 4, 7 & 7a. Considering the 20% contingency range of the estimated concept design project costs along with minimal variation in annual net benefits, all alternatives could be considered as the NED plan at this time. However, due to reasons discussed in the paragraphs above, Alternative 7 w/ Realigned Channel has been selected for further evaluation in lieu of the acceptability criteria being considered undetermined at this time because the Maryland Historical Trust (MHT) has revealed that the realigned channel area has potential for containing National Register eligible historic shipwrecks. USACE will conduct a Phase 1 submerged archaeological investigation immediately beginning the PED phase to comply with the MHT's request.

The proposed concept design plan consists of the construction of two jetties at the entrance to St. Jerome Creek as shown in Figure 4-15. The south jetty would connect to the shoreline about 200 ft. south of the northern tip of Deep Point and would have a length of 1,330 ft. The north jetty would connect about 250 ft. east of the tip of the sand spit and would have a length of 1,770 ft. The existing channel within the inlet will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. The purpose of the channel section realignment would be to make the channel more hydraulically efficient to reduce shoaling potential. The realigned channel will proceed straight through the inlet and intersect the channel section in St. Jerome Creek.

The objective of the jetties would be to trap the longshore transport and prevent it from entering the channel area. These jetties would probably have the least downdrift impacts along the Deep Point and St. Jerome Point shorelines. The landward terminus of the north jetty will require stabilization along the sand spit shoreline to prevent the jetty from being flanked. The proposed crest elevation of the jetties would be + 5 ft. MLLW.

The general parameters considered which resulted in the selection of this alternative as the Recommended Concept Plan for further evaluation are as follows:

- Most significant decrease in channel shoaling rate
- Longest interval between future maintenance dredging events
- Significantly increased tidal current velocities in the inlet (particularly ebb currents) with the configuration of the north and south jetties
- Best potential for decreasing the shoaling in the St. Jerome Creek section of the channel by realigning the channel straight through the inlet
- High sediment storage capacity along the updrift side of the north jetty
- Least potential for sand bypassing from the north shoreline
- Minimal downdrift shoreline erosion potential
- Best protection for the existing shorelines and spits from wave induced erosion

Figure 4-15 – Initial Plan Selection

4.8 CONCEPT LEVEL DESIGN

The structural design level for the proposed jetties at the entrance to St. Jerome Creek is the 50 yr. storm event (with the statistical design level per Corps guidance resulting in designing for the 73 yr. design wave). The concept design wave height for this event is H_{73} Yr. = 7.0 ft. (breaking wave conditions).

4.8.1 Determination of Stones Sizes

Hudson's stability formula was used to determine the required armor stone size using the ACES

1.07 breakwater design module with the following equation:

$$\mathbf{W} = \frac{\mathbf{W_r\ H^3}}{\mathbf{K_D\ (S_r - 1)^3\ COT@}}$$

where:

W = weight (lb.) of individual armor unit in the primary cover layer
$\mathbf{W_r}$ = unit weight of armor rock (165 lb/cubic ft)
H = design wave height (7.0 ft.)
$\mathbf{S_r}$ = specific gravity of armor unit relative to water (2.58)
COT@ = angle of structure side slope measured from the horizontal (degrees); cot@ = 1.5
$\mathbf{K_D}$ = stability coefficient that varies primarily with the shape of the armor units, roughness of the armor unit surface, sharpness of edges, and degree of interlocking obtained in placement. K_D values are selected for a breaking wave condition based on depths and slopes at the structure; K_D = 2.0

Based on a design wave height of H_{73} Yr. = 7.0 ft. for the 73 year return period, the required armor stone weight is calculated to be 4,800 pounds. The range of armor stone was determined using guidance in the SPM 1984 and was determined to be 3,600 pounds to 6,000 pounds with at least 50% of the stones weighing more than 4,800 pounds. The intermediate stone would be W/10 = 360 to 600 pounds.

4.8.2 Crest Elevation

The primary function of the proposed jetties at St. Jerome Creek is to eliminate and/or reduce the channel shoaling problem and the shoreline erosion problems along the shorelines at the entrance to St. Jerome Creek. The required crest height selected for the jetties is +5.0 ft. MLLW.

4.8.3 Crest Width

The crest width of the recommended breakwater section was calculated using ACES 107 – Breakwater Design Using Hudson and Related Equations. The equation used in ACES 107 is:

$$\mathbf{B = nK_d(W_a/W_r)^{1/3}}$$

where:

B = crest width (ft)
n = number of stones (3)
$\mathbf{K_d}$ = layer thickness coefficient (1.0)
$\mathbf{W_a}$ = weight of armor unit in primary cover layer (4,800 lbs)
$\mathbf{W_r}$ = density of armor unit (165 lb./cubic foot)

The minimum crest width was selected to be 9.0 ft.

4.8.4 Armor Thickness

The thickness of the armor layer was computed using ACES 107 – Breakwater Design Using Hudson and Related Equations. The equation used in ACES 107 is:

$$\mathbf{r = nK_d(W_a/W_r)^{1/3}}$$

where:

- $\mathbf{r}$ = average thickness (ft)
- $\mathbf{n}$ = number of layers (2)
- $\mathbf{W_a}$ = weight of the individual armor unit (4,800 lbs.)
- $\mathbf{W_r}$ = unit weight of the armor unit (165 lb./cubic foot)
- $\mathbf{K_d}$ = layer thickness coefficient (1.0)

The armor layer thickness was selected to be 6.0 ft., or 3.0 ft. per individual armor unit.

4.8.5 Jetty Cross-Section

A typical cross-section of the jetty is shown in Figure 4-16.

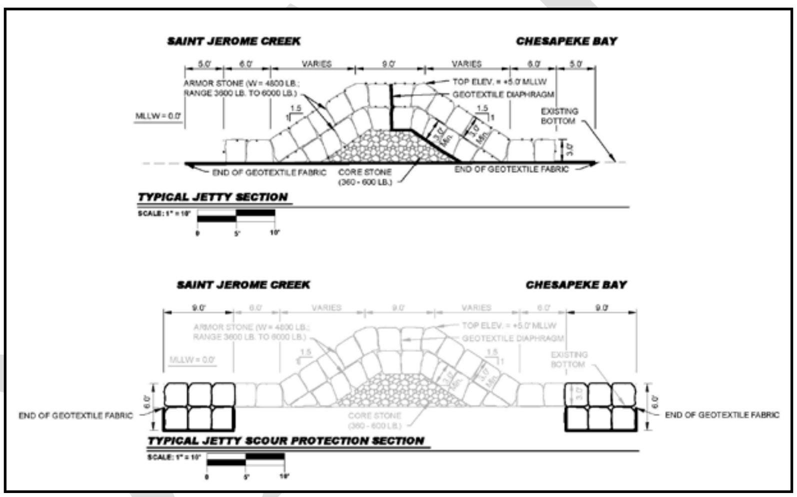


Figure 4-16 – Jetty Cross-Section

4.9 GEOTECHNICAL INVESTIGATION

After selection of the concept design plan, a geotechnical investigation was conducted to evaluate the foundation conditions in the design plan location. The geotechnical plan, as shown on the plan entitled "Recommended Alternative 7 w/ and w/o Realigned Channel", in Section C-3 of Appendix C, included drilling and sampling a minimum of eleven (11) borings to a minimum depth of 30 ft. in accordance with ASTM D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals (2.5'), samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. split spoon sampler. The number of blows required to drive the sampler the final foot of each 1.5 foot of SPT drive to determine the Standard Penetration Resistance, were recorded and used to determine the index of the soil's strength, density and behavior under applied loads.

In addition, eight (8) grab samples of material within the existing and proposed realigned channel were taken. Each sample was obtained from the elevation of the existing bottom to -7’ MLLW (proposed dredge depth).

Following the completion of the field investigation, an evaluation of the foundation conditions was conducted. This evaluation indicated that the majority of the borings had a range of weight of rod (WOR) to very low blows per 0.5 ft which indicates that the soil would not support the load of the proposed jetties. Numerous discussions with USACE Geotechnical Engineers concluded that constructing jetties in the proposed location would result in extreme settlement of the structure and possibly failure of the underlying foundation. Since the proposed locations of the jetties were determined to be the optimum location to reduce the shoaling in the navigation channel (based on the hydrodynamics analysis), consideration of an alternative structured design was initiated.

4.10 SHEET-PILE JETTY ALTERNATIVE

Due to the poor foundation conditions at the proposed jetty construction site, consideration was given to constructing pile supported sheet pile wall jetties with the supporting piles driven through the poor foundation layers and into firm foundation material. Two alternative designs were developed as discussed below:

4.10.1 Batter Pile/Vinyl Sheet Pile Jetty

This option consists of driving 30 ft. lengths of vinyl sheet pile into the bottom along the proposed jetty alignments. The sheet pile would have a top elevation of +5.0 ft. MLLW. The elevation of the bottom of the sheet pile would be about - 25 ft. MLLW. To provide initial stabilization of the sheet pile, 50 ft. long treated timber piles would be driven at 5 ft. intervals on each side of the vinyl sheet pile and attached to the sheet pile with 8 in. x 8 in. treated timber wales. The stabilization of the sheet pile would be completed by driving a 50 ft. long by 14" in diameter at a point 3' from the end treated timber batter piles at 5 ft. intervals on each side of the vinyl sheet pile.

4.10.2 Earth Fill/Vinyl Sheet Pile Jetty

This option consists of two (2) walls of 46 ft. lengths of vinyl sheet pile separated by a distance of 8 ft. and driven into the bottom along the proposed jetty alignments. The sheet pile would have a top elevation of +5.0 ft. MLLW. The elevation of the bottom of the sheet pile would be about - 41 ft. MLLW. To provide stabilization of the sheet pile walls, structural fill (possibly dredged material) would be placed between the walls and steel tie rods would be placed at 5 ft. intervals on each side of the walls to provide tension between the walls. A concrete cap would be placed on the top of the sheet pile walls.

4.11 SELECTION OF JETTY ALTERNATIVE

Evaluation of each of these alternatives resulted in the selection of the Batter Pile/Vinyl Sheet Pile Jetty for further evaluation. This conclusion was reached due to the significantly higher construction cost of the Earth Fill/Vinyl Sheet Pile Jetty and the likelihood that the environmental permitting agencies would grant permits for construction of this alternative.

Additional design analysis was conducted for the Batter Pile/Vinyl Sheet Pile Jetty to optimize the functional performance and cost-effectiveness of the alternative. This analysis consisted of determining the design wave heights expected to impact the two (2) jetties (North Jetty and South Jetty) considering the extensive shoal system in the area. The results of this analysis indicated that the outer 400 lf of the North Jetty would be subjected to breaking wave heights of about 6.4 ft.

The remainder of the North Jetty as well as the entire length of the South Jetty would be subjected to wave heights of about 3.0 ft. Details of the design analysis are presented in Section C-4 of Appendix C. This analysis resulted in the development of the typical batter pile jetty sections shown in Figure 4-17. There are two designs for the batter pile jetty: 1) Section A with SG950 vinyl sheet pile for higher wave energy and 2) Section B with SG650 vinyl sheet pile for lower wave energy. Cross-sections of the two designs are shown in Figure 4-17 and will have 12”x12”x48” and 10”x10”x36” batter piles, respectively. A typical view of the length of the batter pile structure is also shown in Figure 4-17.

A decision was made to hold off on any additional testing or geotechnical engineering/report due to the extremely soft material encountered. The additional drilling will be done in the initial stages of PED to evaluate the foundation conditions and complete the design of the sheet pile/battered pile jetties. Depending of the findings, there may be some additional costs for the deeper piles and a different pile type.

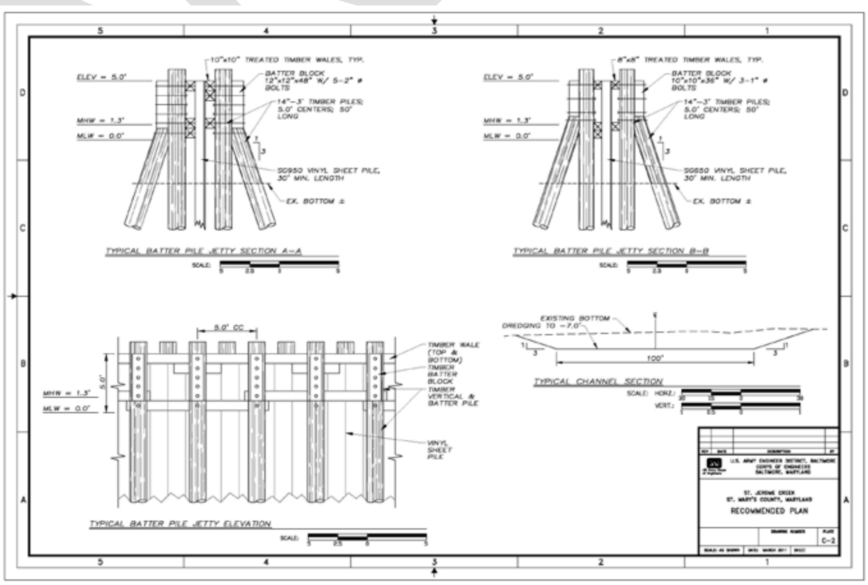


Figure 4-17 Batter Pile/Vinyl Sheet Pile Jetty

4.12 RECOMMENDED PLAN SELECTION

The selection of the best plan was based predominantly on the cost of the structure, the effectiveness of the structure, coordination with federal, state, and local agencies and the non-federal sponsor. Alternative 7 with Realigned Channel using Batter Pile Vinyl Sheet Pile Jetty was chosen because of its functional performance and cost-effectiveness.

In Section 5, Alternative 7 with Realigned Channel using Batter Pile Vinyl Sheet Pile Jetty is optimized by analyzing three different piles (treated timber, timber polymer protection and pre-cast concrete) to determine the National Economic Development (NED) plan in accordance with USACE policy. The NED plan is the plan that provides maximum net benefits. A detailed analysis of the potential with-project impacts and the NED analysis are presented in Section 5.

4.13 DREDGING METHOD

Hydraulic or mechanical dredging could be used for this project. Hydraulic dredging would involve using a pipeline to convey the dredged material from the dredging site to a placement site. Mechanical dredging by use of a clamshell or similar dredging rig, which would mechanically scoop up material and dump it into a nearby barge, would also accomplish the project purpose. This material would then be disposed of in one of two ways. By one method, the material is taken by barge to a disposal site and placed by opening the bottom of the barge. The other method is to take the material to a longshore staging area, where it is loaded into dump trucks for disposal on land. Hydraulic dredging is considered to be less detrimental to water quality and is preferred for that reason over mechanical. Mechanical dredging is also undesirable for this project since a nearby upland placement site is available. Further, mechanical dredging would require the double handling of the dredged material, which would be more expensive than hydraulic dredging. For these reasons, this alternative will not be considered further.

Approximately 50 ft. of pipeline will be placed across a small fringed wetland area to the South Prong and to the placement site in order to convey the dredged material to the placement site.

Section 5.0 PLAN DESCRIPTION AND EVALUATION

Section 4 described the plan formulation process. Planning objectives and constraints were established, viable solutions for providing protection from shoaling were identified, and design criteria and assumptions were assembled. With this information, alternative plans were formulated and a viable alternative to solve the navigation problem was identified. This section provides an integrated evaluation of the economic, social, environmental, and cultural impacts for various levels of protection and identifies the recommended (NED) plan of improvement.

5.1 PLAN DESCRIPTION

Once the determination was made that Alternative 7 with Realigned Channel using Batter Pile/ Vinyl Sheet Pile Jetties was the best solution to the navigation problems in St. Jerome Creek, a detailed evaluation of three different pile alternatives (treated timber, timber polymer protection and pre-cast concrete) was conducted to determine the recommended plan. The project benefits and costs of treated timber piles, timber polymer protection and pre-cast concrete are evaluated below and compared to the "without-project" condition. The recommended, or NED, plan would be the alternative that maximizes the net benefits derived from construction of the batter pile vinyl sheet pile jetties. If no plan realizes benefits in excess of costs, the no action plan will be recommended.

5.1.1 Without-Project

The without-project plan represents the base from which all changes are measured. The future conditions for St. Jerome Creek can be measured through economic and environmental changes.

5.1.1.1 <u>Future Without-Project Economic Conditions</u>

Without navigation improvements to St. Jerome Creek, shoaling will continue to impede navigation of larger boats within a year following maintenance dredging, and commercial watermen will continue to experience navigation problems and operating inefficiencies. Without dredging, tidal delays, grounding damages, and operating inefficiencies will increase as depths in the harbor decrease (Table 5-1). Total average annual damage to vessels and infrastructure currently equals $763,700. Based on the FY 2012 federal discount rate of 4.000% and a 50-year project life, the present value of the damage expected to be incurred is $16,405,397.

If no action is taken to reduce shoaling in the federal navigation channel, shoaling can be expected to continue at a rate of approximately 5,100 cy per year, with required maintenance dredging every five years. The total present value of the maintenance dredging operations is $702,800 and the average annual cost is $129,800. See Appendix A for a more detailed explanation of the without project conditions.

Table 5-1 - Summary of Costs Incurred by Commercial Watermen – Without Project (10 Yr Dredge Cycle)

Channel Depth	Analysis Period	Labor Lost Due to Tidal Delays	Additional Fuel Cost	Vessel Damages	Incr. Maint. Cost	Relocation Costs	Total Cost	Pres. Value Factor	PV Of Total Cost
6.0	1	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.9615	$177,684
5.0	2	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.9246	$758,025
4.0	3	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.8890	$923,305
3.0	4	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.8548	$853,542
2.0	5	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.8219	$687,188
6.0	6	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.7903	$146,043
5.0	7	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.7599	$623,041
4.0	8	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.7307	$758,889
3.0	9	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.7026	$701,549
2.0	10	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.6756	$564,818
6.0	11	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.6496	$120,037
5.0	12	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.6246	$512,094
4.0	13	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.6006	$623,752
3.0	14	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.5775	$576,622
2.0	15	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.5553	$464,239
6.0	16	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.5339	$98,662
5.0	17	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.5134	$420,904
4.0	18	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.4936	$512,678
3.0	19	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.4746	$473,941
2.0	20	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.4564	$381,571
6.0	21	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.4388	$81,093
5.0	22	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.4220	$345,953
4.0	23	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.4057	$421,384
3.0	24	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.3901	$389,545
2.0	25	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.3751	$313,624
6.0	26	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.3607	$66,652
5.0	27	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.3468	$284,348
4.0	28	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.3335	$346,347
3.0	29	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.3207	$320,178
2.0	30	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.3083	$257,776
6.0	31	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.2965	$54,783
5.0	32	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.2851	$233,713
4.0	33	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.2741	$284,672
3.0	34	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.2636	$263,163
2.0	35	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.2534	$211,873
6.0	36	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.2437	$45,028
5.0	37	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.2343	$192,095
4.0	38	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.2253	$233,980
3.0	39	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.2166	$216,301
2.0	40	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.2083	$174,144
6.0	41	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.2003	$37,010
5.0	42	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.1926	$157,888
4.0	43	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.1852	$192,314
3.0	44	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.1780	$177,783
2.0	45	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.1712	$143,134
6.0	46	$121,991	$2,800	$24,000	$36,000	$0	$184,791	0.1646	$30,419
5.0	47	$688,880	$16,000	$46,000	$69,000	$0	$819,880	0.1583	$129,773
4.0	48	$620,498	$16,000	$32,000	$48,000	$322,094	$1,038,592	0.1522	$158,068
3.0	49	$613,322	$16,000	$34,000	$51,000	$284,201	$998,523	0.1463	$146,125
2.0	50	$478,668	$13,200	$24,000	$36,000	$284,201	$836,069	0.1407	$117,645
Present Value of Costs to Watermen									$16,405,397
Capital Recovery Factor (CRF)									0.0466
Average Annual Cost = (PV of Total Costs) x (CRF)									$763,700

5.1.1.2 Future Without-Project Environmental Conditions

The no federal action "without project" condition represents the basis from which all change is measured. Under this scenario, no structure would be constructed to reduce shoaling at the channel entrance and just inside the mouth of the channel in St. Jerome Creek. The location of the federal channel would go unchanged. Shoaling would continue and as a result there would be continued impacts to fishing and boating industries. The continued siltation of the channel would maintain hazardous conditions for navigation, potentially leading to a situation where the channel is unusable by larger vessels. Turbidity produced by boat traffic would continue to impair water quality. Conversely, the dynamic shoreline and natural sand transport along the shoreline would be maintained.

This scenario would assume maintenance dredging at the 10-year interval as in the past due to funding limitations. Periodic dredging will produce local, short-term impacts to water quality due to turbidity. With each dredging event, there will be a minor, short-term loss of the plankton community due to entrainment and suppression of plankton communities due to turbidity. Soft-bottom habitat will be removed by dredging resulting in a loss of any benthic fauna that have colonized the area. Mobile species such as fish and crabs are expected to leave the area to avoid dredging impacts. Although no impacts to rare, threatened, and endangered species are expected, each dredging event does present the potential risk to any transient species such as sea turtles that could be in the area. Overall, the mouth of St. Jerome Creek would be a periodically disturbed ecosystem.

An upland placement site would be needed for each dredging event. Placement of dredged material would be dependent on development of additional placement sites which have been difficult to identify in the region. Placement, therefore, could become a regional problem if additional placement sites are not identified. Further, there would be a lost opportunity of using the placement site in a more productive way such as agriculture or habitat.

Alternatively, there is the potential for the beneficial use of sandy dredged material along proximal open Bay shorelines in the future, rather than upland placement, pending the appropriate coordination, planning, and approvals. Sandy material could be used for beach nourishment on any recreational beaches in the vicinity and or simply be placed to counteract effects of shoreline erosion. Counteracting the shoreline erosion could have environmental habitat benefits by replacing shoreline habitat losses caused by indirect effects of shoreline hardening, with beneficiaries ranging from horseshoe crabs to a variety of shorebirds. Also, humans in the vicinity could use nourished shoreline recreationally. There may also be the potential to incorporate a mix of dredged material from different portions of the channel to dilute the silty material to meet the required sand versus fines content. The interest may also arise to place dredged material on existing vegetated tidal wetlands in vicinity to counteract effects of sea-level rise. This could be done via pumping low density slurry into existing vegetated tidal wetlands in protected waters of the creek using straw bales to create containment cells. This could be undertaken for maintaining tidal wetlands that are eroded or drowning due to sea level rise and climate change.

5.1.2 With-Project Conditions

The with-project plans consist of variations to Alternative 7 with Realigned Channel using Batter Pile Vinyl Sheet Pile Jetties:

Alternative 7 with realigned channel, shown in Figure 5-1, includes a jetty to the south approximately 1,330 ft. in length connected to the shoreline about 200 ft. south of the northern tip of Deep Point. The north jetty would be approximately 1,770 ft. in length and connect about 250 ft. east of the tip of the sand spit of St. Jerome Point. The existing entrance channel will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. The purpose of the channel section realignment would be to make the channel more hydraulically efficient to reduce the potential for shoaling. The realigned channel will proceed straight through the inlet and intersect the channel section in St. Jerome Creek.

This batter pile vinyl sheet pile jetty structure, shown in Figure 5-2, consists of driving 30 ft. lengths of vinyl sheet pile into the bottom along the proposed jetty alignments. The sheet pile would have a top elevation of +5.0 ft. MLLW. The elevation of the bottom of the sheet pile would be about - 25 ft. MLLW. To provide initial stabilization of the sheet pile, 50 ft. long treated timber piles would be driven at 5 ft. intervals on each side of the vinyl sheet pile and attached to the sheet pile with 8 in. x 8 in. treated timber wales. The stabilization of the sheet pile would be completed by driving 50 ft. long by 14"-3' diameter treated timber batter piles at 5 ft. intervals on each side of the vinyl sheet pile.

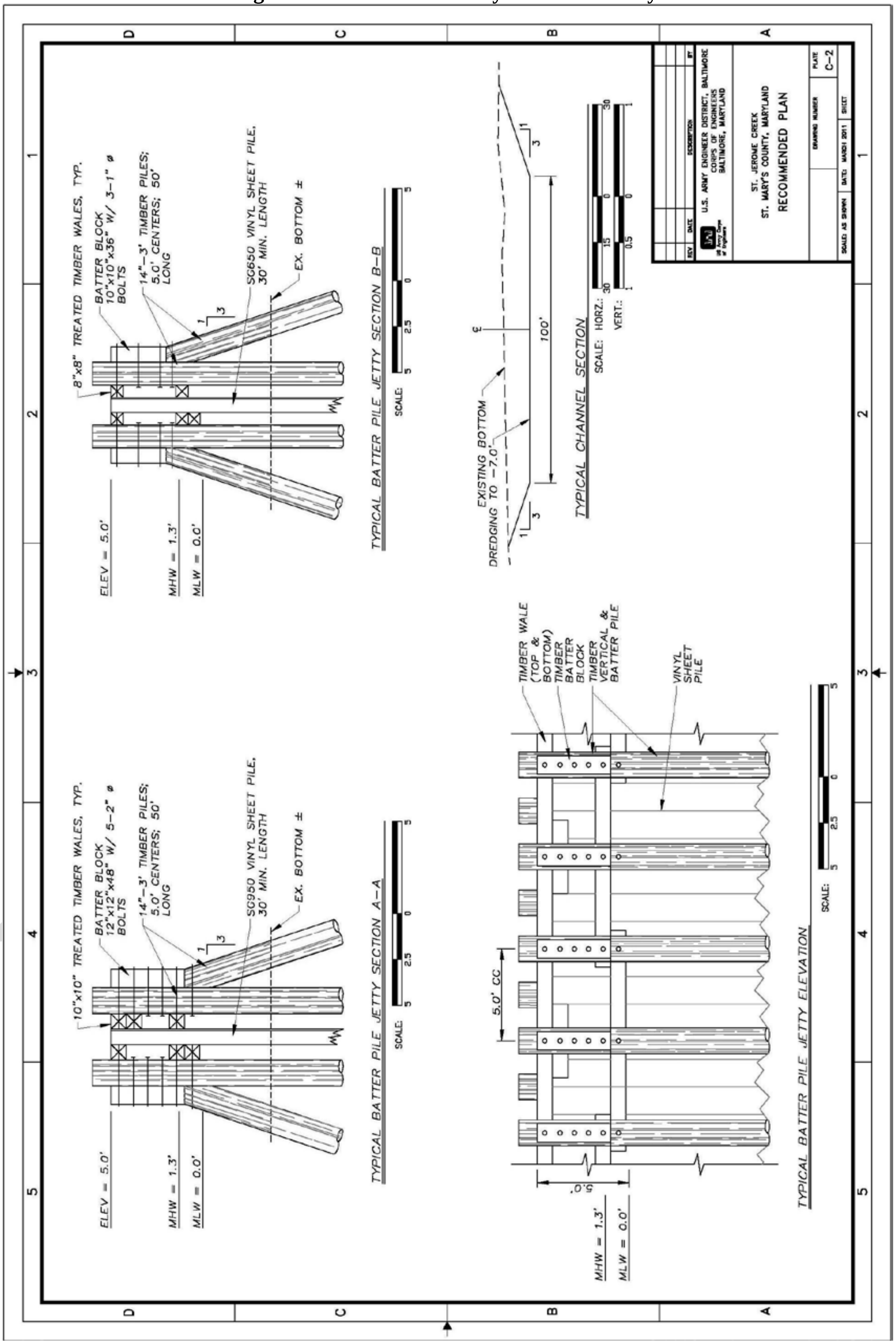
For the purpose of optimizing the batter pile vinyl sheet pile jetties, three alternative plans were evaluated using different pilings (treated timber, timber polymer protection and pre-cast concrete). These alternatives were labeled as Treated Timber Piles, Timber Polymer Protection Piles and Concrete Piles, respectively**.** Each of these pile alternatives has different initial construction and maintenance cost. A typical plan view and cross-section for Alternative 7 with Realigned Channel using Batter Pile Vinyl Sheet Pile Jetties are shown in Figure 5-1 and 5-2.

5.1.2.1 Foundation Analysis

Foundation conditions indicated that the majority of the borings had a range of weight of rod to very low blows per 0.5 ft which indicates that the soil would not support the load of the initial proposed stone jetties. It was concluded that constructing stone jetties in the proposed location would result in extreme settlement of the structure and possibly failure of the underlying foundation. Since the proposed locations of the jetties were determined to be the optimum location to reduce the shoaling in the navigation channel (based on the hydrodynamics analysis),

Figure 5-1 – Batter Pile/Vinyl Sheet Pile Jetty

Figure 5-2 – Batter Pile/Vinyl Sheet Pile Jetty



the batter pile vinyl sheet pile jetties were chosen due to the significantly higher construction cost of an Earth Fill/Vinyl Sheet Pile Jetty structure. Details of the foundation analysis are presented in Appendix C.

5.1.2.2 Excavation, Placement, and Dewatering

It is estimated that approximately 30,000 cy of material will need to be excavated from the realigned portion of the federal channel within St. Jerome Creek hydraulically. It is anticipated that the previously used St. Mary's County dredged material placement site on the Orebaugh farm, located about 550 ft. south of the Buzz's Marina Way, will be available for disposal of the excavated material.

The material placed hydraulically at the site will contain a significant volume of river water that will be returned to the Southern Prong of St. Jerome Creek. During placement, the water will be retained within the confines of the placement site until it has met predetermined water quality standards established by the criteria set forth in the anticipated Water Quality Certification (WQC) that will be requested from the Maryland Department of the Environment (MDE). The contractor for the Project will monitor the return water hourly during pumping operations to ensure that the quality of water reaching the river is satisfactory. If their readings indicate unsatisfactory conditions, raising the weir on the outfall structure, or suspending dredging will increase the retention time for the water until such time that it does meet the WQC requirements.

5.1.3 Estimate of First Costs

Quantities and cost estimates were developed for the alternative plans with suitable assumptions as necessary for cost estimating at the feasibility study level. The cost estimates are awardable contract amounts based on a March 2011 price level. The non-federal sponsor's required share could increase if the federal costs of planning, design, and implementation for the project exceed the statutory federal per project participation limit for this authority and the non-federal sponsor agrees to contribute funds for any costs that would normally be part of the federal share but are over the per project limit (see Section 1.2 Study Authority).

The construction cost estimates are based on USACE experience with similar projects and include formal estimates for construction management, preparation of plans and specifications and costs for lands, easements, rights of way, relocations, and dredged material placement sites (LERRD) which may be required for construction of the project.

Detailed construction cost estimates for three (3) options for the selected Batter Pile/Vinyl Sheet Pile Jetty are presented in Section C-5 of Appendix C. Option 1 shows costs for treated timber piles in the construction of the jetties. While Option 2 details timber polymer protection and Option 3 includes pre-cast concrete piles in the construction of the selected Batter Pile/Vinyl Sheet Pile Jetty. These three (3) options were considered to evaluate the cost differential of using treated timber piles which would be less expensive for the initial construction but would have a higher maintenance cost and replacement costs during the 50 yr. project life, timber polymer protection piles which would be more expensive for the initial construction but would have lower maintenance cost and probably no replacement cost during the 50 yr. project life and pre-cast concrete piles which would have the highest construction costs but the lowest maintenance costs and the best probability of no replacement cost during the 50 yr. project life.

Option 3 would exceed the initial construction cost of Option 1 by $1,333,346 and Option 2 by $626,390.

Table 5-2 - Project Costs For Construction (FY 2012)

Recommended Plan	*Treated Timber Piles*	*Timber Polymer Protection Piles*	*Concrete Piles*
North Jetty			
Outer 400 LF. (High Wave Energy)	$1,057,601	$1,148,240	$1,228,549
Remaining 1,370 LF. (Low Wave Energy)	$2,699,652	$3,010,093	$3,285,149
South Jetty			
Entire 1,330 LF. (Low Wave Energy)	$2,620,812	$2,922,188	$3,189,213
Jetty Mobilization / Demobilization	$41,500	$46,000	$50,000
Hydraulic Dredging Activities			
Existing DMP Retrofit	$898,070	$898,070	$898,070
Dredging 30,000 CY.	$300,105	$300,105	$300,105
Dredging Mobilization / Demobilization	$300,000	$300,000	$300,000
Contract Administration	$304,000	$304,000	$304,000
CONSTRUCTION COSTS:	**$8,221,740**	**$8,928,696**	**$9,555,086**

5.2 ECONOMIC ASSESSMENT

5.2.1 Future With Project Economic Evaluation

This section evaluates the cost annualization and benefit-cost analysis results for the proposed realignment of the federal channel and construction of sheet pile jetties to stabilize the mouth of St. Jerome Creek. A summary of principle costs currently incurred by commercial watermen is presented below in Table 5-3. The with-project costs include dredging calculated every 10.5 years. Average annualized costs associated with the existing condition amount to $763,700.

5.2.2 Total Annual Costs

Cost estimates in Tables below are rounded to the nearest $100. Interest During Construction (IDC) is calculated at the FY 2012 federal interest rate of 4.000 percent and based on a construction period of 7 months as shown below in Table 5-5, the Summary of Costs for Project Alternatives. Costs are converted to present value equivalents based on a 50 year project life and then compared to estimated annual project benefits to determine the NED plan.

Additional costs will be incurred for replacing timber piles used to support the vinyl sheet piles. Timber batter-piles will require replacements approximately 30 years after initial construction at an estimated cost of $4.1M. This expense annualized over the 50-year project life yields additional annual cost of $58,800. Timber polymer protection piles or concrete piles would not require replacement during the 50-year project life and are not annualized for this analysis. For comparison, Table 5-4 presents the pile replacement costs for each alternative.

Table 5-3 - Summary of Costs Incurred by Commercial Watermen – With Project (10.5 Yr Dredge Cycle)

Channel Depth	Analysis Period	Labor Lost Due to Tidal Delays	Additional Fuel Cost	Vessel Damages	Incr. Maint. Cost	Relocation Costs	Total Cost	Pres. Value Factor	PV Of Total Cost
6.7	1	$0	$0	$0	$0	$0	$0	0.9615	$0
6.4	2	$0	$0	$0	$0	$0	$0	0.9246	$0
6.1	3	$59,592	$1,350	$24,000	$36,000	$0	$120,942	0.8890	$107,517
5.9	4	$151,580	$3,400	$24,000	$36,000	$0	$214,980	0.8548	$183,766
5.6	5	$259,603	$5,900	$24,000	$36,000	$0	$325,503	0.8219	$267,540
5.3	6	$433,520	$9,900	$46,000	$69,000	$0	$558,420	0.7903	$441,328
5.0	7	$661,555	$15,300	$46,000	$69,000	$0	$791,855	0.7599	$601,745
4.7	8	$162,687	$4,200	$22,000	$33,000	$322,100	$543,987	0.7307	$397,486
4.4	9	$266,497	$6,900	$22,000	$33,000	$0	$328,397	0.7026	$230,727
4.1	10	$506,256	$13,000	$32,000	$48,000	$0	$599,256	0.6756	$404,836
6.7	11	$0	$0	$0	$0	$0	$0	0.6496	$0
6.4	12	$0	$0	$0	$0	$0	$0	0.6246	$0
6.1	13	$59,592	$1,350	$24,000	$36,000	$0	$120,942	0.6006	$72,635
5.9	14	$151,580	$3,400	$24,000	$36,000	$0	$214,980	0.5775	$124,146
5.6	15	$259,603	$5,900	$24,000	$36,000	$0	$325,503	0.5553	$180,740
5.3	16	$433,520	$9,900	$46,000	$69,000	$0	$558,420	0.5339	$298,145
5.0	17	$661,555	$15,300	$46,000	$69,000	$0	$791,855	0.5134	$406,517
4.7	18	$162,687	$4,200	$22,000	$33,000	$322,100	$543,987	0.4936	$268,527
4.4	19	$266,497	$6,900	$22,000	$33,000	$0	$328,397	0.4746	$155,871
4.1	20	$506,256	$13,000	$32,000	$48,000	$0	$599,256	0.4564	$273,493
6.7	21	$0	$0	$0	$0	$0	$0	0.4388	$0
6.4	22	$0	$0	$0	$0	$0	$0	0.4220	$0
6.1	23	$59,592	$1,350	$24,000	$36,000	$0	$120,942	0.4057	$49,069
5.9	24	$151,580	$3,400	$24,000	$36,000	$0	$214,980	0.3901	$83,868
5.6	25	$259,603	$5,900	$24,000	$36,000	$0	$325,503	0.3751	$122,102
5.3	26	$433,520	$9,900	$46,000	$69,000	$0	$558,420	0.3607	$201,416
5.0	27	$661,555	$15,300	$46,000	$69,000	$0	$791,855	0.3468	$274,629
4.7	28	$162,687	$4,200	$22,000	$33,000	$322,100	$543,987	0.3335	$181,407
4.4	29	$266,497	$6,900	$22,000	$33,000	$0	$328,397	0.3207	$105,301
4.1	30	$506,256	$13,000	$32,000	$48,000	$0	$599,256	0.3083	$184,762
6.7	31	$0	$0	$0	$0	$0	$0	0.2965	$0
6.4	32	$0	$0	$0	$0	$0	$0	0.2851	$0
6.1	33	$59,592	$1,350	$24,000	$36,000	$0	$120,942	0.2741	$33,150
5.9	34	$151,580	$3,400	$24,000	$36,000	$0	$214,980	0.2636	$56,658
5.6	35	$259,603	$5,900	$24,000	$36,000	$0	$325,503	0.2534	$82,488
5.3	36	$433,520	$9,900	$46,000	$69,000	$0	$558,420	0.2437	$136,070
5.0	37	$661,555	$15,300	$46,000	$69,000	$0	$791,855	0.2343	$185,529
4.7	38	$162,687	$4,200	$22,000	$33,000	$322,100	$543,987	0.2253	$122,552
4.4	39	$266,497	$6,900	$22,000	$33,000	$0	$328,397	0.2166	$71,138
4.1	40	$506,256	$13,000	$32,000	$48,000	$0	$599,256	0.2083	$124,818
6.7	41	$0	$0	$0	$0	$0	$0	0.2003	$0
6.4	42	$0	$0	$0	$0	$0	$0	0.1926	$0
6.1	43	$59,592	$1,350	$24,000	$36,000	$0	$120,942	0.1852	$22,395
5.9	44	$151,580	$3,400	$24,000	$36,000	$0	$214,980	0.1780	$38,276
5.6	45	$259,603	$5,900	$24,000	$36,000	$0	$325,503	0.1712	$55,726
5.3	46	$433,520	$9,900	$46,000	$69,000	$0	$558,420	0.1646	$91,924
5.0	47	$661,555	$15,300	$46,000	$69,000	$0	$791,855	0.1583	$125,337
4.7	48	$162,687	$4,200	$22,000	$33,000	$322,100	$543,987	0.1522	$82,792
4.4	49	$266,497	$6,900	$22,000	$33,000	$0	$328,397	0.1463	$48,058
4.1	50	$506,256	$13,000	$32,000	$48,000	$0	$599,256	0.1407	$84,323
√									
Present Value of Costs to Watermen									$6,978,804
Capital Recovery Factor (CRF)									0.0466
Average Annual Cost = (PV of Total Costs) x (CRF)									$324,900

Table 5-4 - Pile Replacement Cost

	TIMBER PILES	TIMBER POLYMER PROTECTION PILES	CONCRETE PILES
CONSTRUCTION COST	$8,221,740	$8,928,696	$9,555,086
REPLACEMENT COST	$4,099,400	$4,801,800	$5,424,200
	REPLACEMENT IN YR 30	NO REPLACEMENT IN 50 YRS	NO REPLACEMENT IN 50 YRS

5.2.3 Benefit Analysis

Economic benefits are a measurement of the difference between the continuation of the without-project conditions and the future with-project alternatives. Benefits for St. Jerome Creek accrue in three areas: reduced inefficiencies due to tidal delays, reduced maintenance dredging costs, and increased recreational quality. Under the with-project conditions, average annualized costs of inefficiencies due to tidal delays amount to $324,900. This amount is subtracted from costs of $763,700 in the without-project condition (Table 5-1) yielding a net annual benefit in reduced delay costs in the amount of $438,800.

Benefits gained from enhanced recreational quality ($174,300) are then added to the benefits gained by watermen. Under current USACE policy, recreation must be incidental in the formulation process and may not be more than 50 percent of the total benefits required for justification of a project. BCRs based on commercial benefits alone as well as combined commercial and recreational benefits are presented in Table 5-6. No alternatives require more than 50 percent recreational benefits for project justification, therefore all recreation benefits are included in the final benefit to cost analysis. The Total Annual Benefits in the amount of $613,100 are weighed against the costs of each project alternative to determine the Benefit-Cost Ratio (BCR). Annualized costs of each alternative are also provided in Table 5-6.

A project is considered economically justified if it has a BCR of 1.0 or greater. The BCR of each alternative is determined by dividing its total annual benefits by its total annual costs. The alternative having the greatest BCR which maximizes net annual benefits would be the NED plan. Over a 50-year analysis period, batter pile jetties using timber polymer protection piles would be the NED plan based on the highest net annual benefits of $94,400 and a BCR of 1.18.

Project costs and benefits were updated to the December 2014 price level using the FY15 Federal interest rate of 3.375% and the Civil Works Construction Cost Index for Breakwaters and Seawalls (EGM 1110-2-1304, 30 September 2014). The cost of the project in FY15 dollars is $10,291,077, which including interest during 7 months of construction, amounts to $10,378,316. The annual cost of the project over the 50-year project life is $470,900 with annualized benefits of $613,100. The resulting BCR of 1.30 supports the recommended project.

Table 5-5 - Summary of Costs for Project Alternatives (FY 2012)

Annualized Cost Calculation	WOP 5-Yr. Dredge Cycle	Alt 7 Batter Pile Timber Jetty - w/ realignment	Alt 7 Batter Pile Timber Polymer Protection Jetty - w/ realignment	Alt 7 Batter Pile Concrete Jetty - w/ realignment
Total Project Implementation Cost	$0	$8,949,370*	$9,657,647*	$10,282,716*
Interest During Construction	$0	$90,000	$97,100	$103,400
Total Investment Cost	$0	$9,039,370	$9,754,747	$10,386,116
Capital Recovery Factor (CRF) =	0.04655	0.04655	0.04655	0.04655
Average Annual Cost	$0	$420,800	$454,100	$483,500
Operation & Maintenance Cost				
Maintenance Dredging	$129,800	$64,700	$64,700	$64,700
Timber Pile Replacement	$0	$58,800	$0	$0
Total Annual Cost of Alternatives	$129,800	$544,300	$518,800	$548,200

* The cost of Plans and Specifications ($581,550), which consists of a Phase I Submerged Archaeological Investigations ($50,000), a Value Engineering study ($90,000), Geotechnical Drilling and Testing ($125,000) and Plans & Specs labor costs ($316,550), and Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas (LERRD) ($146,080) are included in each Total Project Implementation Costs.

Table 5-6 - Cost Benefit Analysis and BCR (FY 2012)

Calculation of NED Annual Benefits	WOP 5-Yr. Dredge Cycle	Alt 7 Batter Pile Timber Jetty - w/ realignment	Alt 7 Batter Pile Timber Polymer Protection Jetty - w/ realignment	Alt 7 Batter Pile Concrete Jetty - w/ realignment
Annual Costs of Without-Project Condition	$763,700	$763,700	$763,700	$763,700
Less: Annual Costs to watermen with Project	($763,700)	($324,900)	($324,900)	($324,900)
Net Annual Benefits for With-Project Alternatives	$0	$438,800	$438,800	$438,800
Plus: Benefits for Recreational Quality Enhancement		$174,300	$174,300	$174,300
Total Annual Benefits of Alternatives	$0	$613,100	$613,100	$613,100
Total Annual Net Benefits (Benefits minus Costs)	$0	$68,800	$94,400	$64,900
Benefit to Cost Ratio				
Annual Benefits of Alternatives	$0	$613,100	$613,100	$613,100
Annual Costs	$129,800	$544,300	$518,800	$548,200
Benefit to Cost Ratio	**0.00**	**1.13**	**1.18**	**1.12**

5.3 REAL ESTATE REQUIRMENTS

Construction of the recommended plan will require a permanent channel improvement easement for the St Jerome Point and Deep Point jetties tie-ins above the MHWL. Any required staging of materials on fast land will be done within this perpetual channel improvement easement area. Operation and maintenance requirements are expected to be minimal, and will be done from the water. The real estate plan, map of the required lands and a cost estimate are provided in Appendix B.

Section 6.0 **AFFECTED ENVIRONMENT**

This section documents both the direct and indirect impacts of the project to the affected environment.

6.1 LAND USE

The project will not have direct adverse impacts on the current land use or current zoning for St. Jerome Point, Deep Point and the adjacent areas. It is planned that the jetties would be constructed by water and that a staging area for daily access of the project site by workers would be negotiated and established at a local marina. Upon completion of the construction activities, all facilities associated with the administrative/staging area will be removed, with the site returned to pre-construction conditions. The tip of the northern shoreline, approximately 300 ft, would be removed and converted to open water, as it would be included in the realigned federal channel. Approximately 7,000 cy of material, equating to 0.5 ac of the sand spit (above MLW), would be removed to accomplish this.

As of the fall of 2009, the proposed dredged material placement site is holding material from the last dredge cycle (39,675 cy), which took place in 2006. Upon commencement of the proposed jetty construction, an indirect impact would be that the material currently held at the placement site would be removed to provide space for the newly dredged material. It is anticipated that the placement area would be in use for approximately one to two years for the dewatering of the dredged material. Upon the completion of this activity, the material would be hauled off-site and the placement area would be re-graded. It is expected that this area would be returned to agricultural use.

6.2 PHYSICAL SETTING AND PROPERTIES

Table 6-1 provides a summary of the impacts determination for the proposed project.

6.2.1 Location

The project will not impact the location of St. Jerome Creek, either directly or indirectly. A permanent, direct impact would be the change in location of the federal navigation channel.

Placement of the dredged material at the upland site would not impact the location of St. Jerome Creek.

6.2.2 Landscape and Aesthetics

The project would have direct and permanent impacts on the landscape and aesthetics of St. Jerome Creek. The landscape would permanently change to include the jetties. Each jetty would extend approximately 40 ft. inland from MHW. The proposed jetties would be constructed to a height of +5 ft MLLW. The south jetty would connect to the shoreline about 100 ft. south of the northern tip of Deep Point and would be 1,330 ft. in length. The north jetty would connect at the tip of St. Jerome Point and would be 1,770 ft. in length. This is expected to be a minor impact to the Chesapeake Bay viewshed. The proposed project would impact landowners and users adjacent to the project, but is not anticipated to block any of the viewshed. Additionally, roughly 0.5 acre, impacting 300 ft. of sandy shoreline, at the tip of St. Jerome Point would be

Table 6-1 - Summary of Impacts from the Proposed Action

Resource	Proposed Action	No Action
Land Use	Conversion of 0.5 acre of sandy shoreline habitat to federal channel (open water). Upland placement site would continue its current use. Conversion of 0.46 acre of open water to jetty.	No Impact
Physical Setting	Permanent change to location of federal channel and spur. Federal channel depth dredged to seven ft. (authorized depth) and width to 100 ft. over length of 1,600 ft. A 400 foot spur would be maintained to connect federal and county channels. 3.72 acres would be dredged. Jetties permanently added to viewshed- potential negative impact to local residents. Potential, minor changes to waves and currents near jetties. Jetties extend 40 ft. in land from MHW.	Location of federal channel would be unchanged.
Sediment	Approximately 30,000 cy removed from channel. Potential change of substrate from sand to clay, silt, or silty sand in some areas. Loss of benthic habitat and current substrate within 0.46 acre jetty footprint. At greatest depth, jetty boundaries would extend to 2.13 acres. Potential accretion of sand deposits behind jetties where they anchor to shore.	No impact. Shoaling would continue.
Social and Economic Setting	Short-term negative impacts likely to oyster aquaculture operation, and potentially to other local fishing efforts. Long-term positive benefits expected to fishing and boating industries due to reduction in shoaling of channel. Potential disruptions to local aquaculture operations.	Continued impacts to fishing and boating industries due to shoaling of channel.
Infrastructure	No negative impacts expected to boat traffic. Possible temporary disruptions to boat traffic during construction.	Continued siltation of the channel would maintain hazardous conditions for navigation; potentially unusable by larger vessels.
Environmental Conditions		
Air Quality	No Impact	No Impact
Water Quality	Minor, short term, localized turbidity, increased nutrients, and decreased dissolved oxygen at dredging site.	Increased turbidity due to boat traffic would continue.
Biological Resources		

Resource	Proposed Action	No Action
Plankton	Minor, short-term loss of plankton community due to entrainment and suppression of communities due to increased turbidity.	No Impact
Vegetation	No impact.	No Impact
Rare, Threatened, and Endangered Species	No impacts expected, but Atlantic sturgeon (*Acipenser oxyrinchus*) and sea turtles potentially transient in area.	No Impact
Wildlife	Minor loss or short-term displacement of terrestrial wildlife at upland placement site.	No Impact
Wetlands	No impact to vegetated wetlands. 0.5 ac of sand beach shoreline would be lost. Dynamic shorelines would be stabilized. Temporary, minor impact to fringe wetland where 50 ft of pipeline crosses.	No Impact
Essential Fish Habitat	No impact	No Impact
Cultural	Potential impact. A Phase I submerged archaeological investigation will be performed immediately upon start of the Design and Implementation phase. A survey of the locations of the new and spur channels plus both jetties to include magnetometer, side-scan sonar, and sub-bottom profile.	No Impact
Hazardous, Toxic, and Radioactive Waste	No Impact	No Impact
Noise	Minor, temporary increase due to construction.	No Impact
Environmental Justice	No Impact	No Impact

permanently removed to provide for the new alignment of the federal channel and the north jetty.

There would be a temporary construction area on land during jetty construction that would impact approximately 2,000 square foot for each jetty.

Deposition in the areas behind the jetties would alter the current habitat permanently and could potentially lead to a loss of shallow water habitat. It is likely that the current sand beaches would be enlarged where deposition is enhanced by the jetties. These habitat changes would be indirect effects.

Construction of the project would alter the natural aesthetics at the mouth of St. Jerome Creek. The project would cause the loss of one of the few remaining natural inlets with dynamic shoals along the Chesapeake's Western Shore. Beaches, shoals, and the channel will no longer be naturally dynamic. These impacts would be permanent. The proposed jetties would be constructed to a height of +5 ft MLLW. The south jetty would be approximately 1,330 ft. in length and connect to the shoreline about 200 ft. south of the northern tip of Deep Point. The north jetty would be approximately 1,770 ft. in length and connect about 250 ft. east of the tip of the sand spit of St. Jerome Point. The existing entrance channel will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. This is expected to be a minor impact to the Chesapeake Bay viewshed. The proposed project would impact landowners and users adjacent to the project, but is not anticipated to block any of the viewshed.

No additional impacts, either direct or indirect, to aesthetics are expected at the dredged material placement site since the current use of the site is being continued.

6.2.3 Physiography, Geology and Topography

Neither dredging, construction, nor placement would have a direct or indirect impact on upland physiography, geology, or topography. The federal channel would be dredged to a depth of seven ft. It is currently as shallow as two ft. in some areas.

6.2.4 Climate

No direct or indirect impacts to climate are anticipated.

6.2.5 Tidal Data, Currents, Wave Action, Salinity and Water Temperature

The proposed action would directly impact currents in the Chesapeake Bay mainstem adjacent to the mouth as the jetty structures would alter northerly and southerly flow. However, the proposed action is not anticipated to adversely impact the tidal currents, salinity or water temperature in St. Jerome Creek or the Chesapeake Bay. Some minor adjustments in the currents would occur around the jetties including the reduction of currents along the Chesapeake Bay in the areas behind the jetties. There may also be minor, direct changes to waves in the local project area as a result of jetty construction. No indirect effects are anticipated.

Based on discussions held with MDE (6 February 2014, Appendix E), it is not expected that the jetties would impede tidal flushing. By maintaining the desired depth in the navigational channel, tidal exchange is anticipated to increase. The jetties are not expected to inhibit wind-driven circulation. Initial numerical modeling (Appendix C) identified the potential for a slight reduction in the total flow during the ebb and flood tide phases of a typical tidal cycle. However, this modeling was completed using original bathymetry and not that under conditions of the proposed project. The cross-section for flow through the creek mouth would be larger with the proposed project compared to the original bathymetry, suggesting that flow would increase rather than decrease. Additional modeling completed to investigate the effect of the jetties on circulation in St. Jerome Creek is discussed in Appendix C.

6.2.6 Sediments

Approximately 30,000 cy of material would be removed to dredge the federal channel to a depth of seven ft. and a width of 100 ft. to provide a 1,600 foot channel. This would be a direct effect. A spur will remain off the federal channel to the left after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available into this county channel. In most places, the bottom substrate would not be changed, and would remain sand. In other locations, an indirect effect would be a change in the bottom substrate to clay or a silt/sand mix. Further, the sediment substrate across the mouth of St. Jerome Creek would be permanently converted to a jetty within the jetty footprint. This long-term, direct effect would impact 1,330 ft. for the south jetty and 1,770 ft. for the north jetty. A footprint was calculated by measuring horizontally from the outside of one batter block to the next at the top of the jetty. The footprint of the south jetty would be 8,313 square ft. (6.25 ft. in width), and that of the north jetty would be 11,563 square ft. (7 ft. in width). However, depending upon the water depth, the above grade structure could be as wide as 30 ft. due to the sloping piles, resulting in a much larger footprint in certain locations. At its deepest, the jetty boundaries would extend over 2.13 acres.

The proposed dredging activity is similar to the dredging already occurring in the channel. Indirect effects of this project would be to decrease the dredging frequency and diminish the ongoing and long-term disruption by fine sands, which have historically shoaled in the St. Jerome Creek channel.

Based on pre-project analyses, the net transport of sand along the shoreline north of the channel entrance is approximately 4,200 cy/yr from the north to the south towards the channel entrance. The net transport of sand along the shoreline south of the channel entrance is approximately 13,300 cy/yr from south to north towards the channel entrance. Based upon modeling, it is anticipated that a direct effect of the proposed action is the interception of some of the sand that is currently transported along the Chesapeake Bay shoreline. Tidal and wave modeling provides an estimate of erosion and deposition that would result from implementation of the proposed action. This modeling suggests that for waves from the northeast, an indirect effect is the development of a sediment deposition area to the north of the north jetty as sediment is moved along the shoreline and out into the mouth of St. Jerome Creek. The channel appears to show improved self-scouring along its entire length except for a localized area where the new channel makes its entrance into St. Jerome Creek. That short length of new channel may need some short-term maintenance before it reaches equilibrium and becomes self-scouring. For waves from the southeast, some deposition occurs along the outer parts of the navigation channel but within the jetties. The results are similar to waves from the northeast. For both northeast waves and southeast waves, there is a small area of deposition in St. Jerome Creek near the existing turning basin. Until this area achieves equilibrium, an indirect effect would be the potential need for maintenance dredging to avoid incursion into the county channel.

The dredged material placed at the proposed upland site would continue the current use of that upland area as a disposal site and is not expected to negatively impact the site.

6.2.7 Soils

Minimal excavation may be required at the jetties' interface with the uplands in order to construct the lower wale support system. This would be a direct effect. It is expected that any disturbed soils would be reworked and re-graded on-site.

The dredged material placement site for the proposed action requires the same 11 acres of agricultural lands that was used previously. The dredged material placed at the proposed upland site would continue the current use of that upland area as a disposal site and is not expected to introduce any additional negative impacts to the site. Temporary, indirect and negative impacts would be expected to the soils in the general area as the soils would remain buried from continued use as a disposal site.

The placement area would be in use for approximately one to two years for the dewatering of the dredged material. It is anticipated that this area would be returned to agricultural use. Although not expected, a potential indirect effect would be the reduction in productivity of this agricultural field area. Productivity could be restored with application of lime and fertilizer to reach the proper soil chemistry for productive farmland. The St. Mary's County Soil Conservation District provided concurrence (via email on April 4, 2011) with USACE's determination that no additional impacts will occur to the prime and unique soils impacted by the proposed dredge spoils disposal activity.

6.2.8 Prime and Other Important Farmlands

Soils classified as prime farmland and farmland of statewide importance would be temporarily impacted, indirectly, due to the construction of the project. The proposed upland dredged material placement site is located in an area with these types of soils. As of the fall of 2009, this area still contained material from the last dredge cycle, which took place in 2006. Prior to this, the area was farmed for soybeans.

6.2.9 Wild and Scenic Rivers

Since St. Jerome Creek is not listed as a Wild and Scenic or American Heritage River, no impacts would occur.

6.2.10 Air Quality

Short-term, localized, direct impacts may occur as a result of the dredging and placement operations in the form of exhaust emissions from dredging and construction equipment. USACE would take precautions to minimize visible emissions and fugitive dust emissions, with best management practices (dust suppression) implemented during project construction. These short-term impacts are not expected to contribute emissions that would adversely affect the regional air quality. No indirect effects are anticipated.

6.2.11 Water Quality

The proposed action is anticipated to have a direct impact on water quality. The proposed action may cause short-term, minor, and temporary turbidity in the immediate vicinity of the dredging areas due to the physical removal of the fine-grained sediments. Site conditions are expected to limit the use of turbidity curtains as channel velocities and offshore fetches are too extreme for their use. Turbidity curtains could potentially be used at the interface of the northerly jetty into the sand peninsula to minimize the resuspension of sediment into the water column during dredging and placement activities.

Hydraulic dredging is proposed for dredging the channel and transporting material to the upland placement site. The use of hydraulic dredging is expected to minimize the resuspension of dredged material into the water column. The dredging of the realigned channel and construction of the jetties would diminish the turbidity levels over the long term by decreasing shoaling rates and reducing/eliminating boat propeller scouring of the bottom. Regardless, short-term localized elevations in turbidity will likely be associated with construction of the jetties due to the operation of tug and barge traffic in the relatively shallow waters surrounding the proposed project.

The hydraulically dredged material is expected to be approximately 70 percent water and 30 percent sediment. Dredged material is expected to be mostly sand. Dewatering of the dredged material would take place in the upland placement site. The return water from this facility would outfall to Maryland waters and would meet State water quality standards in accordance with water quality certification conditions. If the effluent contains suspended solids in excess of the water quality certificate, measures will be taken to retain the slurry longer to increase settling. Proper handling of dewatering the sediment would prevent indirect impacts to water quality when this water is released back to the Bay.

Since the material is mostly sand, little turbidity is expected and the material is expected to settle very quickly. Negative impacts to water quality from the proposed project are expected to be minor and temporary in nature. It is expected that the proposed project will positively impact water quality in and adjacent to the channel once dredging and construction is complete.

Completed modeling focused on evaluating shoaling rates within the federal and county channel and suggest little to no change in tidal circulation within the creek. Although these models were not designed to specifically look at circulation within the creek, because tidal circulation would likely be maintained at present levels, no long-term impact to water quality via reduced flushing or impaired circulation would be expected. Detailed project design efforts in the next planning stage will further evaluate the impacts on circulation and flushing within St. Jerome Creek. USACE would utilize this information in its application to MDE for Water Quality Certification. In the event that potential detrimental impacts to water quality were identified, USACE would likely be required to modify project design to reduce these effects.

6.3 SOCIAL AND ECONOMIC SETTING

6.3.1 Population

There are no anticipated impacts to the population.

6.3.2 Education

There are no known impacts to education as a result of the proposed action.

6.3.3 Employment and Income

The economic benefits of an improved navigation channel in the St. Jerome Creek are defined by prevention of the increased operating costs and damages that would be experienced in the future without a project. These would be indirect effects from the project. It is assumed that with a project, all boats currently using the channel will be able to pass through for a longer period of time. Therefore, it is anticipated that there will be a beneficial, indirect impact to economics and employment in the area.

An indirect effect of the project would be support to the local area's economy. The dredging of the federal navigation channel would support the area's economy by allowing a full range of commercial and recreational watercraft to enter the Chesapeake Bay. Since many residents of the area are dependent on the federal navigation channel for commercial fishing, the proposed action is expected to have a net positive effect on the local economy and help support the economic prosperity of its citizens over the short and long-term.

It is expected that there could be short-term negative and direct impacts to the oyster aquaculture facilities close to the mouth following dredging (refer to Section 6.3.4.1). These impacts would be expected to be minimal.

6.3.4 Fleet and Boating Infrastructure and Commercial Activity

With an improved federal channel in the St. Jerome Creek, the commercial, charter, and recreational watermen can safely navigate their vessels in St. Jerome Creek. In the long term, crabs, oysters and finfish will continue to be harvested from St. Jerome Creek, the Chesapeake Bay, and the surrounding area. However, there may be short-term, indirect effects to local fishing and aquaculture operations if water quality is degraded during construction. Therefore, it is anticipated that over the long-term, the project would have a beneficial impact to the commercial activity in and around the St. Jerome Creek.

Implementation of the Proposed Action will result in safer navigation for boaters. This would be an indirect effect. Therefore, the role of St. Jerome Creek as a safe harbor for vessels caught in dangerous sea and wind conditions would improve.

6.3.4.1 Economic Setting

Although no longer a permitted aquaculture facility, the Circle C Oyster Farm previously operated in St. Jerome Creek. During an earlier stage of the project, Circle C was in operation and indicated strong opposition to the proposed jetties and breakwaters. Based on a previous county dredging project, Circle C was concerned that the proposed project would impact the shoreline behind the jetties at the mouth of the channel and the oyster bars within St. Jerome Creek. An indirect effect of the project would have been a decrease in Circle C revenues gained from resale of oysters if disturbed sediment degraded water quality. Additionally, increased turbidity in St. Jerome Creek during the period of construction and subsequent maintenance dredging could have affected the flavor and growth rates of oysters being cultivated. Similar impacts could be associated with current aquaculture facilities in St. Jerome Creek. Lost revenue to oyster aquaculture facilities is considered a Regional Economic Development impact and is not considered in this analysis. However, during the seven month construction period, the additional labor costs incurred to clean oysters before they are sold to area markets and restaurants is considered an economic cost when discerning the NED plan. During normal conditions, oysters are flushed every other day compared to 3 times per day during periods of increased turbidity. The annualized cost of this additional labor, over the 50 year life of the project, is approximately $2,000.

6.3.5 Vessel Delays

It is anticipated that with an improved navigation channel, there would be much greater periods without delays for vessels that use the St. Jerome Creek. This would be an indirect effect of the project.

6.3.6 Recreation

A minor, temporary and direct impact to boat traffic may occur as a result of dredging, as commercial and recreational boaters may be inconvenienced by the dredge working in the channel. The dredging and construction operations may temporarily require the redirection of any boat traffic around the area. It is anticipated that a beneficial, indirect effect of the project would occur once the construction is completed and reliable navigation to the St. Jerome Creek is restored. The removal of the 0.5 ac sand spit will not impact recreation. This area is not used recreationally as it is a constantly changing environment and is often submerged at high tide (St. Mary's County, pers. Comm. 2012).

6.4 INFRASTRUCTURE

6.4.1 Traffic and Transportation

The existing entrance channel of the federal channel would be realigned to eliminate the turn in the channel to the left after it passes Deep Point and continues into the existing turning basin. A spur will remain off the federal channel to the left after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available into this county channel. The realignment of the federal channel would be a permanent and direct, but a minor long-term impact. Proper communication of the realignment would prevent this change from causing more significant impacts.

The capacity of the existing road systems in St. Mary's County would not be directly impacted by the proposed project. Dredging activities will be restricted to the channel and will require the use of a hydraulic dredge coupled with a pipeline to convey the dredged material to the placement site. The entire portion of the pipeline in the channel will be marked and lighted in accordance with U.S. Coast Guard regulations. The presence of the pipeline in the water would be a direct effect. The project activities would be short-term, and the temporary presence of dredging equipment is not expected to significantly impact existing transportation routes.

Notice to mariners of the time of the dredging, construction, and placement of the material would be coordinated through the U.S. Coast Guard.

6.4.2 Utilities

As there are no utilities located in the project area, no impacts are anticipated.

6.5 BIOLOGICAL RESOURCES

6.5.1 Plankton

Temporary reductions in plankton within a limited area could occur from dredging, but would occur more frequently if the project were not constructed due to the need for increased dredging frequency to maintain the channel.

Due to entrainment, it is anticipated that there will be temporary, direct, and negative impacts to the phytoplankton and zooplankton during the dredging operations. In the short term, the turbidity associated with dredging and construction is likely to cause and indirect effect by suppressing light penetration into the water column and could locally depress the phytoplankton community. However, the area currently is very turbid so this may limit the negative impacts on plankton resources. Significant increases in nutrient concentrations, such as ammonia, due to dredging activities are not expected, but would be an indirect effect. If they were to occur, these localized increases could tend to elevate phytoplankton concentrations, but this is not expected to be significant because of the small amounts of nutrients expected to be released. Tidal currents and wave action are also expected to help lessen localized effects on the phytoplankton through exchange with nearby waters. Any phytoplankton and zooplankton entrained in the sediment slurry that is removed by dredging would be lost to the Chesapeake Bay system and removed from the food web. However, the majority of the plankton occurring at the site will be comparable to plankton that is widely dispersed and abundant over a broad region of the Chesapeake Bay. The impacts would be localized and not significant in the long-term. As a result, zooplankton communities that are dependent on phytoplankton densities are not expected to be limited by food availability. Effects on photosensitive zooplankton species due to localized light penetration are expected to be short lived due to current exchanges and rapid settling of most of the materials.

There are members of the macrozooplankton community, such as copepods and some amphipods that have entirely planktonic lifecycles. These organisms are important food sources for higher trophic level species. Project construction impacts, such as increased turbidity, may produce localized depressions in the populations of these macrozooplankton as an indirect effectf. Impacts are expected to be temporary and are not expected to have a Chesapeake Bay-wide effect on the populations of these organisms.

While there would be a short-term impact to the biota where the jetty would be constructed, there should be little to no long-term adverse effects. The jetty would impact a small portion of the water column. A permanent effect on the plankton is not expected. It is anticipated that the phytoplankton and zooplankton would reestablish and would not exhibit long-term or adverse impacts.

6.5.2 Benthic Community

Temporary reductions in benthic community within a limited area could occur from dredging, but would occur more frequently if the project were not constructed if frequent dredging was needed. This would be a direct effect of the project. Jetty construction operations would result in a permanent loss of benthic habitat of at least 0.46 acre in the jetty footprint and the destruction of any benthic organisms (including clams) that were entrained with the dredged sediment. The area could be slightly larger depending on water depth. Dredging would immediately impact and deepen to 7 ft. MLLW 3.72 acre (3.67 acre in federal channel and 0.05 acre in spur). In areas where the substrate is changed from sand to clay or a silt/sand mix, there could be a shift in organisms that recolonize the benthos. Losses or changes in the benthic community could indirectly affect high trophic organisms that feed on benthic organisms.

An indirect effect of the project would be the attraction of benthic organisms and fish that require or prefer hard substrate to the jetties. This would enhance a different group of organisms than what had been present in the channel area, but would provide some compensation for the lost benthic habitat.

6.5.3 Oyster Bars and Shellfish

No direct impacts are anticipated. The project could indirectly affect oyster bars and shellfish by disturbing sediments that become deposited on these sessile organisms. In order to protect this resource, the MDNR has requested a time-of-year restriction on dredging for the period of June 1 through September 30 of any given year. Any deposition that does reach oyster bars in the vicinity could lead to a loss in production from that bar. This time-of-year restriction was coordinated with resource agencies responsible for the protection of aquatic resources. As the dredging would be conducted hydraulically, the resource agencies recommended this work restriction to protect the existing oyster resource in and adjacent to the work area. The use of hydraulic dredging is expected to minimize the resuspension of dredged material into the water column. A turbidity curtain could be used at the interface of the northerly jetty into the sand peninsula during construction to minimize impacts to the water column due to turbidity. Turbidity curtains could also be placed around areas at the Circle C Oyster Ranch to minimize potential impacts to the oyster operations. Winter time-of-year restrictions (November 15 through March 1) for the protection of waterfowl would also benefit oyster resources.

Sediment transport modeling identified the potential for minor erosion (< 0.25 m) and deposition (<0.5 m) on small portions of the NOB's. This information was produced by the numerical modeling of the jetty alignment modeling. The full discussion of the modeling effort is available in Appendix C. Figure 6.1 depicts the erosion and deposition projected from northeast waves. Projected erosion and deposition ranges from -0.75 m to 0.75 m, respectively. Figure 6.2 depicts the erosion and deposition projected from southeast waves. Throughout the study area, projected erosion and deposition ranges from -0.75 m to 1.0 m, respectively. The NE waves cause more extreme erosion, whereas SE waves lead to more extreme deposition. Within the NOB's, there are a few small areas of slight deposition (less than 0.5 m) from NE waves, but these appear to be largely offset by erosional forces (0 to -0.5 m) from SE waves. Erosion is not expected to be a negative impact on the oyster bars and would likely help maintain a sediment free surface on the NOBs.

Figure 6-1- Morphology change for Alternative 7 with straight channel with NE waves after 7.5 months

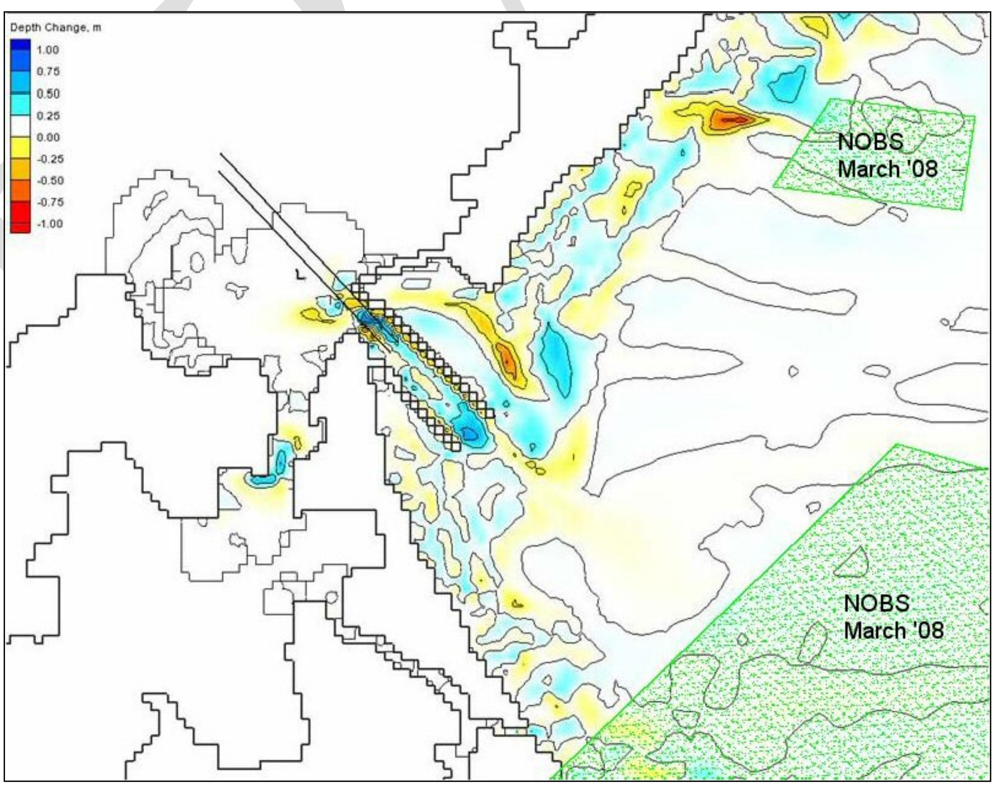
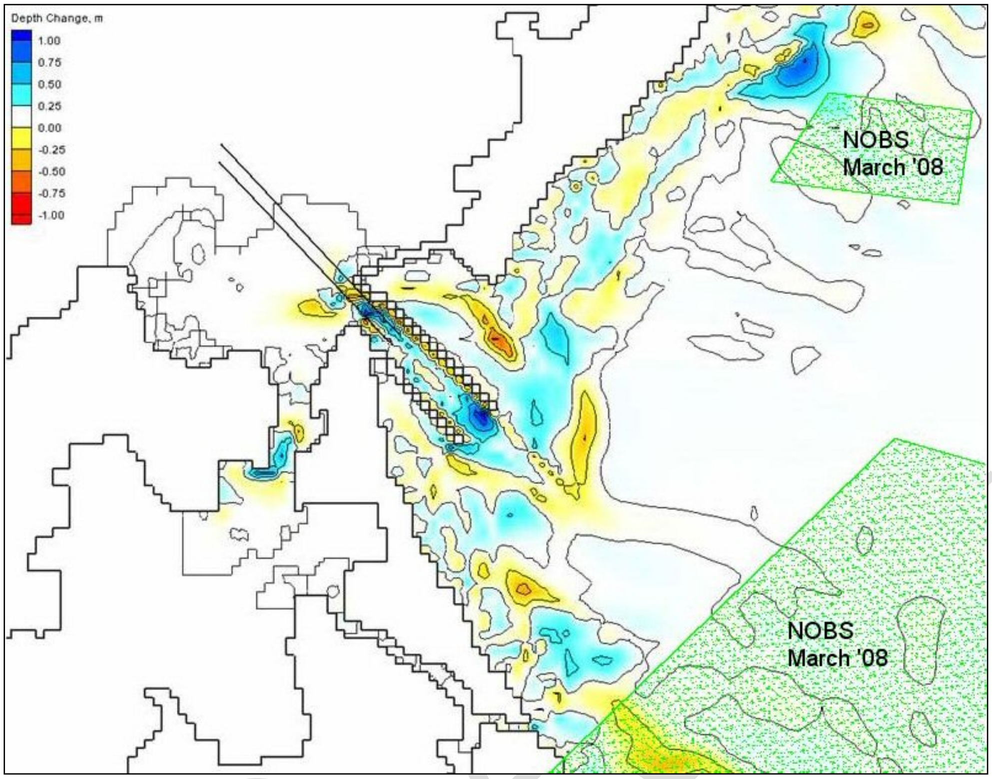


Figure 6-2 - Morphology change for Alternative 7 with straight channel with SE waves after 7.5 months



Potential impacts to blue crabs would be short term, during the dredging and jetty construction activities. Any entrainment of blue crabs by dredging equipment would be a direct effect. Negative impacts to prey sources of blue crabs would be an indirect effect. It is anticipated that the mobile species would be able to exit the project area during construction to avoid impacts and then would reestablish in the area upon completion of the project. Non-mobile shellfish species within the footprint of the jetties or dredged area would be directly impacted and lost. No data is available to judge impacts to clam resources in the vicinity.

6.5.4 Fish and Wildlife

No direct effects are anticipated to nekton and wildlife. Nekton would be able to exit the project area during construction to avoid impact and then return to the area upon completion of the project. To protect wintering and migrating waterfowl, MDNR has requested a time-of-year restriction for jetty construction from November 15 through March 1. No adverse impacts to fishery resources are expected. Implementation of the time-of-year restriction and other best management practices would reduce any impacts. Indirect effects to nekton and wildlife would occur if prey sources are impacted by dredging events and construction.

USACE is preparing the EFH assessment for review by NMFS requesting their concurrence with the findings that the activities will be minimal in their effects on EFH and associated species.

6.5.5 Commercial and Recreational Fishery

Minor temporary and direct impacts are expected to occur to commercial and recreational fishery during the dredging and construction of St. Jerome Creek as there would be some disruption to navigation. Additionally, an indirect effect would be the potential avoidance of the area by targeted fish species during construction activities. The construction of the jetties is not expected to impact pound netting activities outside the mouth of St. Jerome Creek as these are further offshore than the jetties would extend. No information is available to evaluate potential impacts to gillnetting use in the vicinity.

6.5.6 Wetlands

The USFWS NWI mapping shows the presence of estuarine and marine wetlands within St. Jerome Creek and on St. Jerome Point and Deep Point. The wetlands identified by NWI within the immediate project area on St. Jerome Point and Deep Point are unconsolidated sand beaches. Minimal to no impacts are expected to existing vegetated wetlands, except for a small fringe wetland where the pipeline will cross. However, 0.5 ac of unconsolidated sand beach would be removed to provide for the new alignment of the federal channel. Modeling of St. Jerome Creek indicates that the project area is receiving sediment from both the north and south. Additional wetland creation may occur over time if substrates accumulate in areas newly protected by the jetties.

Placement of the pipeline during hydraulic pumping is likely to result in minor local, direct, short-term impacts on existing wetland vegetation. This impact, the result of the placement of the pipeline crossing the small wetland area in order to transfer dredged material from the dredge rig to the placement site, is unavoidable. It is anticipated that no permanent harm to wetland areas will result from the Proposed Action, and that vegetation temporarily covered or impacted by the pipe will regrow to current densities over the next one or two growing seasons.

No long-term or significant impacts on wetlands are anticipated as a result of the Proposed Action. Placement of the pipeline during hydraulic pumping is likely to result in minor local, direct, short-term impacts on existing wetland vegetation. This impact, the result of the placement of the pipeline crossing the small wetland area in order to transfer dredged material from the dredge rig to the placement site, is unavoidable. It is anticipated that no permanent harm to wetland areas will result from the Proposed Action, and that vegetation temporarily covered or impacted by the pipe will regrow to current densities over the next one or two growing seasons.

6.5.7 Submerged Aquatic Vegetation

No SAV is documented in St. Jerome Creek and the surrounding area around the proposed project area. Therefore, no impacts to this resource are expected.

6.5.8 Upland Vegetation

No significant impacts to upland vegetation are expected. Minimal excavation may be required at the jetties' interface with the uplands in order to construct the lower wale support system, but no loss of vegetation is anticipated.

There would not be a need to construct a staging area. Over 0.5 acre of sandy shoreline would be removed at the tip of St. Jerome Point to create the new alignment for the federal channel and the anchor of the north jetty. The removal of any vegetation for the realignment would be a direct effect. Dredged material is to be placed on an agricultural site that is currently in use as a placement site for dredged material. No further impacts to upland vegetation are expected at the placement site.

6.5.9 Threatened or Endangered Species

Based on correspondence from both the USFWS and MD DNR, no impacts to federal or state listed rare, threatened or endangered species are expected (Appendix E). NMFS has indicated that endangered species they manage, the shortnose sturgeon and various species of endangered sea turtles may be present in the project area. In a letter dated October 6, 2011, NMFS stated that "Sea turtles are expected to be in the Chesapeake Bay in the warmer months when water temperatures are greater than 11°C (51.8°F) typically from mid-April through late November." Any summer construction would coincide with time when sea turtles would be most likely to be using the study area. Ongoing monitoring efforts have identified that it is unlikely that shortnose sturgeon would be in the project area. No direct or indirect impacts are anticipated to shortnose sturgeon.

Following coordination with NMFS, the Chesapeake Bay distinct population segment of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was listed as endangered. NMFS recognized this possibility in their October 6, 2011 letter, and identified that the project is unikely to result in impacts to Atlantic sturgeon.

In order to protect oyster resources, the MDNR has requested a time-of-year restriction on dredging for the period of June 1 through September 30 of any given year. This prevents dredging, but not other construction activities, during a good portion of the time when sea turtles could be in the project area. All construction activities would have time of year restriction where no construction activity should be performed during the period November 15 through March 1.

Although direct monitoring was not performed as part of the feasibility study, a small number of dead sea turtle strandings have been reported in the vicinity in the past five years with one being in the direct project area. No data on live strandings is available. Sea turtles are migratory individuals that are seasonal transients to the project area. During cooler weather months when construction would occur, sea turtles are unlikely to be present. No direct or indirect negative impacts are expected to sea turtles.

Atlantic sturgeon could be present in the project area, but monitoring suggests that they are not common. Due to the unlikelihood of their presence, no direct or indirect negative impacts are expected to Atlantic sturgeon.

6.6 ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

6.6.1 Coastal Barriers

Since a portion of the proposed project is located within the CBRA, further consultation with the USFWS was required to determine if the action was exempt from federal spending prohibitions. Per correspondence from the USFWS on December 16, 2009 (Appendix E), the proposed project qualifies for exemption since the purpose of the action is to maintain an existing federal navigation channel.

6.6.2 Critical Areas

The upland dredged material placement site as well as the federal channel and the areas where the jetties would be constructed are all within the 'Critical Area'. The areas where the jetties connect to the shoreline are additionally within the Critical Area Buffer. It is expected that this project will be determined to be a water-dependent activity that would be allowed to occur in the Buffer given specified regulatory requirements and permits.

Further use of the upland dredged material placement site would not introduce any new impacts to the critical area. No significant impacts are anticipated to the critical area from the dredging given that this type of activity has occurred repeatedly to the federal channel in St. Jerome Creek. The establishment of jetties in St. Jerome Creek would be a long-term alteration to the critical area. Connecting the jetties to the shoreline would be a permanent alteration to the Critical Area and the Buffer. Review by Critical Area Commission determined that the proposed project is consistent with the Critical Area law and Criteria (letter dated 27 September 2013, Appendix E).

6.6.3 Coastal Zone Management

Although construction of the recommended project will stabilize a dynamic inlet, which is protected under the Coastal Zone program, beneficial impacts from the proposed action are consistent with other goals of the Coastal Zone Management Program. The Coastal Zone Management Program includes goals to sustain coastal communities; sustain, develop, and revitalize marinas; and provide public access to coastal areas. Review by Critical Area Commission determined that the proposed project is consistent with the Maryland Coastal Zone Management Program (letter dated 27 September 2013, Appendix E).

6.6.4 Hazardous, Toxic, and Radioactive Waste

There is no evidence that hazardous or toxic contaminants exist in the vicinity of the project area. Therefore, no impacts are anticipated. If contamination is discovered, work at the site of the contamination would cease until coordination between MDE and USACE could occur. Appropriate remediation and worker safety measures would be implemented.

6.6.5 Noise

Increased noise levels during construction would be a direct effect of the project. With the exception of noise generated during construction, there would be no permanent changes to the noise levels in the project areas. The rise in noise level would be minor and temporary, and primarily during the daylight hours of construction. Protective equipment would be recommended to protect workers from excessive noise levels during construction.

6.6.6 Environmental Justice

Environmental Justice requires federal agencies to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The proposed action is not expected to result in disproportionately high and adverse human health or environmental effects on minority or low-income populations and will benefit all populations in the area.

6.6.7 Children's Safety

No direct or indirect effects on children are anticipated. Precautions would be taken to secure the construction site at all times to provide for the safety of children. These precautions include controlled access to the construction site during the day, temporary fencing around open trenches, equipment, and stored material (excluding stock piles of native and imported fill material), and all mobile equipment and storage trailers would be locked and secure.

6.7 CULTURAL RESOURCES

Coordination between USACE and the underwater archeologists of the MHT in August 2011 revealed that the St. Jerome Creek area in question has a high potential for containing National Register eligible historic shipwrecks and prehistoric archaeological sites.

As part of the Section 106 review of the project, the MHT (acting as the MD SHPO) recommended that USACE complete a Phase I submerged archaeological investigation of the project's area for potential affects. The survey should be performed by a qualified archeologist and conducted in accordance with the MHT's "Standards and Guidelines." The level of effort should include electronic remote sensing survey employing magnetometer, high resolution side scan sonar and sub-bottom profiling systems in all areas of expected bottom disturbance. Survey transects should be spaced at intervals not to exceed 15 m (50 ft) and magnetometer sensor height should not exceed 6 m (20 ft).

The cultural investigations above were not completed during the feasibility phase, due to the following reasons:

- Coordination was completed late in the feasibility phase and additional funding was not available to complete the work at that time (August 2011).
- At the end of FY 2011, NAB was informed that the Section 107 authority would no longer be funded. Therefore, NAB determined that the potential for federal design and implementation funding was low and the risk of requesting and expending further non-federal funding on a project with little chance of implementation was high.
- NAB's rationale was to finish the feasibility study and receive approval with funds on hand. If the financial climate of Section 107 improved and a project partnership agreement (PPA) was signed, then the cultural investigations would be the first thing completed during design and implementation phase.
- NAD recommended a Programmatic Agreement to comply with Section 106 of the NHPA in order for a FONSI to be signed and the ability of the feasibility study to be approved.

USACE and MD SHPO have executed a Programmatic Agreement (PA) available in Appendix E, dated January 17, 2014, that stipulates USACE conduct this Phase I submerged archaeological investigation prior to implementation of the project's proposed actions. USACE will conduct these investigations immediately at the beginning of the Design and Implementation (D&I) phase. If cultural and archeological resources are located in the project area, they could be avoided. If avoidance is not feasible, mitigation measures could range from doing nothing (not likely, but possible), to recordation, research, excavation, or some combination thereof. The execution and implementation of this PA completes NAB's compliance with Section 106 of the NHPA. The PA takes the place of the Section 106 review process, and outlines the measures to be taken to identify historic properties in the project area, assess the effects of the project on those properties should they exist, and provides a plan to develop measures to mitigate any adverse effects, if necessary.

6.8 SEA LEVEL RISE ASSUMPTIONS

Analysis and rates (see Appendix I) are based on EC 1165-2-212; *Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs* dated October 1, 2011. Three alternative rates of sea level rise were computed and considered as a possible future condition to predict how this would affect project performance. For mitigation features, the base year sea level rise, at the completion of construction, was used. This ensures that the project fully mitigates for impacts produced over the entire period of analysis.

Areas considered where uncertainty of sea level rise estimates may have impacts are: dredging and structural features.

The dredging scenarios include new work (realignment of channel) dredging and maintenance dredging of the existing navigation channel. No impact from sea level rise uncertainty is anticipated because the authorized dredging depths are relative to the MLLW datum. As sea level changes, the MLLW datum will be adjusted periodically, thus additional depth from sea level rise will fill in with sediment. Therefore, there is very low risk associated with sea level rise and dredging - whether new work or maintenance.

Changes in sea level will alter the functioning of coastal inlet navigation structures such as jetties designed to stabilize the channel and improve navigability. Structural features such as batter pile/vinyl sheet pile jetties carry concerns that include jetty flanking (overwash on the shoreward terminus of the jetty); increased wave forces on the batter pile and vinyl sheets; decrease in natural sand bypassing because of an effective increase in jetty length; and changes in patterns of channel shoaling.

Jetty elevation, condition of the adjacent beaches (considering flanking and water- and wind-borne sand transport), channel depth required for navigation and dredged-material placement sites should be evaluated further from the perspective of functioning with a rise in sea level during the Design phase.

6.9 CUMULATIVE IMPACTS

The impacts of the proposed action must be weighed to determine whether the additive effects of these actions will result in a significant cumulative impact on the natural and human environment of the area.

The only other activity that needs to be considered in the project area is dredging of the Southern Prong county channel. St. Mary's County dredges this channel to maintain passage as needed and as funding is available. This channel shoals approximately 0.5 ft per year. In recent years, dredging has been performed in 1982, 1991, 2006, and 2010. Dredging in 2010 was done in spots and removed 950 to 975 cy. If the federal and county channels were dredged in the same year, the impacts discussed previously to water quality, the benthos, and aquatic habitats of St. Jerome Creek could be slightly increased.

Further, this project would stabilize a dynamic shoreline and inlet. Shoreline stabilization occurs throughout the Bay and cumulatively results in a hardened shoreline that provides reduced habitat and has a reduced ability to enable the Chesapeake Bay to adapt to sea-level rise and climate change. This project would contribute to the greater than 1,000 miles of bay shoreline that is already hardened in Maryland. In some places, a stable inlet has led to increased development of the area. There is no way to forecast whether this would occur in St. Jerome Creek, but the potential for increased development should be recognized.

Section 7.0 **PLAN IMPLEMENTATION**

7.1 COST ALLOCATION AND APPORTIONMENT

Cost allocation refers to the assignment of costs among various project purposes whereas cost apportionment refers to the division of these costs among project sponsors. The planned improvements described in Section 5 will serve the needs of navigation users under the authority of CAP Section 107. This section outlines the cost allocation and the division of the total project costs among the project participants.

Federal participation in the cost of navigation projects is limited to sharing costs for general navigation features, such as navigation channels, anchorage areas, and turning basins. Cost for general navigation features that do not modify depths, such as breakwaters and jetties, are shared based on the existing or authorized water depth, whichever is greater. Non-federal participation includes sharing the costs of planning, design, and construction. In addition, the non-federal sponsor is responsible for 100-percent of the costs for any LERRDs that may be necessary for construction of the project.

Public Law 99-662 (Water Resources Development Act of 1986) has established the basis for federal and non-federal sharing of responsibility in the construction, operation, and maintenance of federal water resources projects. For the construction of general navigation features where the water depths are 6.1 m (20 ft) or less, the non-federal sponsor is required to pay 10-percent of the initial costs for project D&I at the initiation of construction. The non-federal sponsor is also required to pay an additional 10-percent of the costs following project implementation or with interest over a period not to exceed 30 years. The non-federal sponsor is allowed credit for the value of LERRD, which may be used to offset the additional 10-percent contribution. The non-federal sponsor's required share could increase if the federal costs of planning, design, and implementation for the project exceed the statutory federal per project participation limit for this authority ($10,000,000) and the non-federal sponsor agrees to contribute funds for any costs that would normally be part of the federal share but are over the per project limit. Costs associated with maintenance dredging of the navigational channel and the maintenance of the batter pile/vinyl sheet jetty is funded 100-percent by the federal government. The non-federal sponsor will be responsible for the construction and operation and maintenance of any local service facilities required for the project.

The current federal project at St. Jerome Creek consists of a channel 7 ft. in depth. Operation and maintenance of this project is a federal responsibility. The cost sharing responsibilities for the navigation improvement recommended by this report is based on the 7 ft. depth of the federal channel and is shown in Table 7-1.

7-1 – Cost Apportionment (2014)

Phase	Total Cost	Federal Share	Non-Federal Share	
Feasibility*		**100%**		
Federally Funded Study Cost	$100,000	$100,000		
		50%	**50%**	
Cost Shared Study Cost	$685,500	$342,750	$342,750	
Total Feasibility Costs	***$785,500***	***$442,750***	***$342,750***	
Design and Implementation		**90%**	**10%**	**10% Payback*** **
Plans and Specifications**	$762,825	$686,543	$76,283	$76,283
Construction	$9,380,852	$8,442,767	$938,085	$938,085
LERRD	$147,400	$0	$147,400	$0
Total Design & Implementation Cost	***$10,291,077***	***$9,129,310***	***$1,161,768***	***$1,014,368***
Credit for LERRD****				-$147,400
TOTAL PROJECT COST & CASH CONTRIBUTION	***$11,076,577***	***$9,572,060***	***$1,504,518***	***$866,968***

* The cost of the Feasibility Study is initially federally-funded for the first $100,000. Any feasibility phase costs in excess of $100,000 are cost shared 50/50 with the non-federal sponsor.

** The cost of Plans and Specifications consists of Phase I Submerged Archaeological Investigations ($60,000), a Value Engineering study ($100,000), Geotechnical Drilling and Testing ($125,000), and Plans & Specs labor costs ($441,500), plus 5% contingency.

*** Ten percent of the implementation cost is required during construction of the project. An additional ten percent less the cost of LERRD is required at the end of construction, or this amount may be paid over time with interest, not to exceed 30 years. This additional ten percent will be paid to the U.S. Department of the Treasury.

****Credit against the post-construction contribution is allowed for the value of lands, easements, rights-of-way, relocation, and dredged material placement areas provided by the sponsor as LERRD.

7.2 FINANCIAL ANALYSIS

St. Mary's County Government, Maryland, the non-federal sponsor, is willing to share the costs of project implementation. For the St. Jerome Creek Shallow Draft Navigation project, the non-federal share of the construction costs is currently estimated to be $1,161,768 including the cost of LERRDs. The non-federal sponsor will be required to pay back an additional 10 percent of the total costs of construction of the General Navigation Feature (GNF) ($1,014,368), which will be offset by the value of LERRDs ($147,400), for a total of $866,968 after project implementation. Therefore, the total non-federal requirement for implementation is $2,028,736.

St. Mary's County Government, Maryland is willing and able to share the costs of project implementation and has budgeted to fund the non-federal share of the project costs. A letter of intent from the local sponsor to sign the PPA is provided in Appendix D of this report.

7.3 IMPLEMENTATION SCHEDULE

The draft feasibility report and integrated EA were sent to NAD for policy review in February 2015. The comments and recommendations from NAD will be incorporated into the report, and the report will be distributed for a 30-day public review process in March 2015. The report/EA will be revised and submitted for final review and approval in May 2015. The cost of plans and specifications is initially federally funded and the cost is shared with the sponsor during construction. Pending available funds, it is anticipated that plans and specifications would be initiated in October 2015 and would be completed in approximately five (5) months excluding the time required to obtain permits and to comply with the Phase I archaeological investigation findings.

Following completion of plans and specifications, and after all necessary LERRDs have been obtained by the local sponsor and approved by the federal government; solicitation of the construction contract may be initiated. St. Mary's County is aware of the LERRD requirements and is currently beginning their process, which will lead to acquisition of lands after the PPA is executed. Initiation of contract advertisement is currently scheduled for January 2016. Construction is anticipated to be completed in a period of seven (7) months. The batter pile/vinyl sheet pile jetty structure will be built first followed by the dredging of the channel thru the spit and into St. Jerome Creek. These dates are approximate estimations based on previous experience and on the current schedule for the review process. The dates will also be affected by the construction windows that have been proposed due to environmental time-of-year restrictions on construction activities. No dredging is permitted between June 1 and September 30. No construction of any nature is permitted between November 15 and March 1.

INITIAL D&I ACTIONS:

- USACE will conduct a Phase I submerged archaeological investigation immediately beginning the D&I phase to comply with the MHT's request. The Phase I survey would require funding and time. If historic properties are located in the project area, they could be avoided. If avoidance is not feasible, mitigation measures could range from doing nothing (not likely, but possible), to recordation, research, excavation, or some combination thereof.

- A Value Engineering (VE) (see Appendix K) study will be initiated at the beginning of the D&I phase to comply with ER 11-1-321. The Value Engineering study would require additional funding that was not accounted for in the Feasibility Cost Sharing Agreement signed on September 8, 2008. With the uncertainty of receiving future CAP Section 107 funds, USACE believes our best step is to complete the Feasibility phase with the funding on hand and perform the VE study when new funds are received after signing a Project Partnership Agreement.

- A final geotechnical engineering analysis and design of the sheet pile/battered pile jetties will be completed after the additional drilling and laboratory testing are finalized. A full geotechnical engineering report will be completed detailing the design of the structures and will include further evaluations on what influence relative sea level rise will have on the engineered design and adapt the design to account for future sea level changes. Depending of the findings, there may be some additional costs for the deeper piles and a different pile type.

Section 8.0 COORDINATION, PUBLIC REVIEWS AND COMMENTS

8.1 PUBLIC AND AGENCY COORDINATION

The purpose of public participation and agency coordination in the NEPA process is to ensure the productive use of inputs from private citizens, public interest groups, and government agencies to improve the quality of environmental decision-making as part of the project (Canter, 1996). The "public" may include any individuals, organizations, or units of government that might be affected by or interested in the results of a planning process. Consideration of the views and information of all interested persons promotes open communication and enables better decision-making. The major source of agency coordination and public involvement is through the St. Mary's County Government. At the federal level, the USFWS manages inland and terrestrial species and their associated habitat while NOAA NMFS manages marine species and their associated habitats, including oyster and SAV habitat.

Agency involvement included formal and informal coordination correspondence, review and comment activities. A chronology of the coordination as well as copies of the coordination letters is included in Appendix E. Following is a summary of key agency and official correspondence and the response or resolution of any issues.

Coordination began with a Study Initiation letter that was distributed to Maryland Department of Planning State Clearinghouse, Chesapeake Bay Program, Maryland Dept. of Housing and Community Development, MDNR, Chesapeake Bay Critical Area Commission, MDE, NOAA, USEPA, NMFS, MWA, NRCS-USDA, USFWS, CBF, Senator Mikulski, Senator Cardin, Representative Hoyer and various St. Mary's County agencies on June 3, 2009. Subsequent communications focused on Fish and Wildlife Act Coordination and CBRA with the USFWS; EFH coordination with NMFS; and coordination of concerns for rare, threatened, and endangered species with Maryland DNR as well as USFWS and NMFS per Section 7 of the Endangered Species Act.

8.2 ADDITIONAL REQUIRED COORDINATION

Additional coordination is required by the Maryland Historical Trust. It is recommended by the MHT that USACE complete a Phase I submerged archaeological investigation of the project's area for potential affects. The survey should be performed by a qualified archeologist and conducted in accordance with the MHT's "Standards and Guidelines." The level of effort should include electronic remote sensing survey employing magnetometer, high resolution side scan sonar and sub-bottom profiling systems in all areas of expected bottom disturbance. Survey transects should be spaced at intervals not to exceed 15 m (50 ft) and magnetometer sensor height should not exceed 6 m (20 ft).

It is requested that USACE consult with the Trust prior to implementing the survey work, to ensure an appropriate level of work is completed to fulfill your project requirements.

USACE will conduct this Phase I submerged archaeological investigation immediately beginning the PED phase to comply with the MHT's request. The Phase I survey would require funding and time. If historic properties are located in the project area, they could be avoided. If avoidance is not feasible, mitigation measures could range from no action, to recordation, research, excavation, or some combination thereof.

8.3 PUBLIC VIEWS AND RESPONSES

This EA will be released for public review prior to construction. A complete list of public comments and responses will be contained in Appendix E.

Section 9.0 **RECOMMENDATIONS**

I have carefully reviewed the navigation problems in the existing federal navigation channel at St. Jerome Creek near the Towns of Ridge and Airedele, Maryland, and the proposed solution outlined this report. The existing federal channel is subject to rapid shoal formation shortly after maintenance dredging. As a result, commercial waterman incur significant operating costs because of delays as they attempt to maneuver around shoals in St. Jerome Creek or wait for adequate tidal range to disembark or return to the harbor. Various alternatives have been investigated to address the shoaling problem. The alternatives have been evaluated for environmental, social, cultural, and economic impacts as well as technical feasibility. I find that the adverse effects caused by rapid shoal formation in the channel can best be reduced with the implementation of batter pile/vinyl sheet pile jetties at the entrance to St. Jerome Creek with a realigned navigation channel within the inlet and a maintained spur will remain to the left after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available.

The improved navigation system at St. Jerome Creek described in this report will provide the commercial watermen and recreational users of St. Jerome Creek, the Northern, and Southern Prong with increased accessibility and improved safety to fishing waters through the federal channel. St. Jerome Creek would also be able to be counted on once again as a safe harbor for vessels seeking shelter from dangerous sea and wind conditions in the Chesapeake Bay.

On the basis of the findings and conclusions presented, I recommend that the improved navigation system for St. Jerome Creek be authorized for implementation and consist of the following project components: construction of two batter pile/vinyl sheet pile jetties held in place by vinyl covered piles at the entrance to St. Jerome Creek. The south jetty would be approximately 1,330 ft. in length and connect to the shoreline about 200 ft. south of the northern tip of Deep Point. The north jetty would be approximately 1,770 ft. in length and connect about 250 ft. east of the tip of the sand spit of St. Jerome Point. The existing entrance channel will be realigned; however, a federally maintained spur will remain to the west after it passes Deep Point and continue to the existing Southern Prong channel so that passage is still available. The purpose of the channel section realignment would be to make the channel more hydraulically efficient to reduce the potential for shoaling. The realigned channel will proceed straight through the inlet and intersect the channel section in St. Jerome Creek.

The recommended project is a modification to the existing federal navigation project at St. Jerome Creek and will be subject to cost sharing, financing and other requirements of the Water Resources Development Act of 1986 (Public Law 99-662). The estimated total project implementation cost (design and construction) of the recommended project (full funding) is $10,291,077. Applying cost sharing policies outlined in Public Law 99-662, the estimated initial federal funding outlay is $9,129,310 and the initial estimated non-federal funding outlay is $1,161,768 (10 percent of total costs plus LERRDs). The non-federal sponsor will be required to pay back an additional 10 percent of the total costs of construction of the General Navigation Feature (GNF) ($1,014,368), which will be offset by the value of LERRDs ($147,400), for a total of $866,968 after project implementation. Therefore, the total non-federal requirement for implementation is $2,028,736. The estimated annual operation and maintenance costs of $65,700 are a federal responsibility.

Construction is anticipated to be completed in a period of seven (7) months. The batter pile/vinyl sheet pile jetty structure will be built first followed by the dredging of the channel thru the spit and into St. Jerome Creek. These dates are approximate estimations based on previous experience and on the current schedule for the review process. The dates will also be affected by the construction windows that have been proposed due to environmental time-of-year restrictions on construction activities. No dredging is permitted between June 1 and September 30. No construction of any nature is permitted between November 15 and March 1.

Section 10.0 ENVIRONMENTAL COMPLIANCE OF THE PROPOSED ACTION

	Level of Compliance[1]
Federal Statutes	
Archeological and Historic Preservation Act	Full
Clean Air Act	Full
Clean Water Act	Full
Coastal Barrier Resources Act	Full
Coastal Zone Management Act	Full
Comprehensive Environmental Response, Compensation and Liability Act	N/A
Endangered Species Act	Full
Estuary Protection Act	Full
Farmland Protection Policy Act	Full
Federal Water Project Recreation Act	Full
Fish and Wildlife Coordination Act	Full
Land and Water Conservation Fund Act	Full
Magnuson-Stevens Act	Full
Marine Mammal Protection Act	Full
National Historic Preservation Act	Full
National Environmental Policy Act	Full
Resource Conservation and Recovery Act	N/A
Rivers and Harbors Act	Full
Water Resources Planning Act	Full
Watershed Protection and Flood Prevention Act	Full
Wild and Scenic Rivers Act	N/A
Executive Orders, Memoranda, etc.	
Migratory Bird (E.O. 13186)	Full
Protection and Enhancement of Environmental Quality (E.O. 11514)	Full
Protection and Enhancement of Cultural Environment (E.O. 11593)	Full
Floodplain Management (E.O. 11988)	Full
Protection of Wetlands (E.O. 11990)	Full
Prime and Unique Farmlands (CEQ Memorandum, 11 Aug 80)	Full
Environmental Justice in Minority and Low-Income Populations (E.O. 12898)	Full
Protection of Children from Health Risks & Safety Risks (E. O. 13045)	Full
Invasive Species (E.O. 13112)	Full
Recreational Fisheries (E.O. 12962)	Full
Chesapeake Bay Restoration and Protection (E.O. 13508)	Full

[1] Level of Compliance:
Full Compliance (Full): Having met all requirements of the statute, E.O., or other environmental requirements for the current stage of planning.
Non-Compliance (NC): Violation of a requirement of the statute, E.O., or other environmental requirement.
Pending: Coordination is on-going. In most cases, full compliance involves review of draft document.
Not Applicable (N/A): No requirements for the statute, E.O., or other environmental requirement for the current stage of planning.

Section 11.0 REFERENCES

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