JACKSONVILLE HARBOR NAVIGATION STUDY
DUVAL COUNTY, FLORIDA

FINAL INTEGRATED GENERAL REEVALUATION REPORT II AND SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

U.S. Army Corps of Engineers | Jacksonville District

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FINAL INTEGRATED GENERAL REEVALUATION REPORT II AND FINALSUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT JACKSONVILLE HARBOR, DUVAL COUNTY, FLORIDA

LEAD AGENCY: Jacksonville District, U.S. Army Corps of Engineers

Jacksonville Harbor is located in Duval County, Florida. Jacksonville Harbor consists of 20 river miles starting at the mouth of the St. Johns River where it empties into the Atlantic Ocean. The study focuses on the portion of the harbor up to River Mile 20. The harbor project provides access to deep draft vessel traffic using terminal facilities located in the City of Jacksonville, Florida. The primary concentration of port facilities along Jacksonville Harbor is between miles 8 and 20 of the Federal navigation project. The recommended plan is the locally preferred plan (LPP), which includes deepening the Federal channel to 47 feet from the entrance channel to approximately River Mile 13; two areas of widening at the Training Wall Reach and St. Johns Bluff Reach; and two new turning basins at Blount Island and Brills Cut.

The Federal objective of water resources planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements.

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EXECUTIVE SUMMARY

FINAL INTEGRATED GENERAL REEVALUATION REPORT II AND SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT JACKSONVILLE HARBOR NAVIGATION STUDY DUVAL COUNTY, FLORIDA

Description of Report: This report is an integrated Final General Reevaluation Report (GRR) and Final Supplemental Environmental Impact Statement (SEIS). This report updates the 1998 EIS prepared for the Jacksonville Harbor Navigation Study (Record of Decision signed in 2001) as well as the Jacksonville Harbor Navigation Study-General Reevaluation Report completed in 2002. The report and SEIS describe the formulation and evaluation of plans considered to address navigation needs of Jacksonville Harbor; economic and environmental conditions and potential effects of the alternative plans; environmental mitigation; and project costs and implementation information.

Purpose and Need: The purpose of this study is to evaluate Federal interest in alternative plans (including the no-action plan) for reducing transportation costs at Jacksonville Harbor and the effects of the alternatives on the natural system and human environment, including economic development effects. The study area generally encompasses the St. Johns River from its mouth at the Atlantic Ocean near Mayport, Florida to River Mile 20 in Jacksonville, Florida. The non-federal sponsor is the Jacksonville Port Authority. Port facilities and users within the study area include container and bulk shipping facilities at Blount Island, Dames Point, Talleyrand and several private terminal facilities including oil terminals and naval facilities. There is an opportunity to improve navigation at Jacksonville Harbor by reducing transportation costs for larger ships forecast to call at Jacksonville Harbor.

History, Authority, Prior Studies: The original deepening study was authorized through a resolution from the Committee on Public Works and Transportation, U.S. House of Representatives, dated February 5, 1992 resulting in a feasibility study that recommended modifications from the entrance channel to River Mile 14.7, including deepening 38 feet to 40 feet. Deepening of that segment was authorized in 1999 Water Resources Development Act, and construction was completed in 2003. A General Reevaluation Report (GRR) recommended deepening the harbor from River Mile 14.7 to River Mile 20 from 38 feet to 40 feet; deepening of that segment was authorized in the FY2006 Appropriations Act and construction was completed in 2010.

To follow through with the intent of the original 1992 study authorization, it was determined by U.S. Army Corps of Engineers (USACE) that further study was needed. The Feasibility and Cost Sharing Agreement (FCSA) for this study was signed July 1, 2005 and amended June 15, 2006.

President Barack Obama issued an Executive Order (“We Can’t Wait”) expediting completion of the Jacksonville Harbor deepening study and reducing the study schedule by 14 months.

Alternative Plans: The Jacksonville Harbor Federal navigation project encompasses approximately 20 river miles from the mouth of the St. Johns River at Mayport to the Talleyrand terminal near downtown Jacksonville (**Figure 1**). The current authorized channel depth is 40 feet for the main channel and 38 feet for the West Blount Island Channel. For planning purposes, the project was evaluated in segments (reaches). Evaluation segment 1 was originally from the entrance channel to approximately River Mile 14 (Dames Point), but was later reduced to approximately River Mile 13. Segments 2 and 3 include additional reaches between Dames Point and Talleyrand and the West Blount Island Channel (Cuts F and G).

Ship simulation modeling was conducted to determine changes in the project footprint required for the larger vessels to maneuver in the channel. The modeling was also used to identify navigation problems and measures required to improve navigation in the harbor. After initial evaluation and with concurrence of the non-federal sponsor, Segments 2 and 3 were eliminated because it was determined that the majority of benefiting vessels primarily transit Segment 1. Multiple channel deepening and widening measures and turning basins were combined into alternative plans. The following alternative plans and combinations were evaluated:

- No action.

- Deepening Alternatives: Depths between 41 and 50 feet were evaluated.

- Widening Alternatives: Widening areas at the Training Wall Reach and St. Johns Bluff Reach were evaluated. Successful meeting in these areas was shown in ship simulation, in combination with deepening alternatives. A stand-alone widening alternative was also evaluated.

- Turning Basins: Turning Basins at Blount Island and Brills Cut were evaluated in combination with deepening and widening alternatives.

- Nonstructural Alternatives: Nonstructural measures considered included additional tug assists and the use of high tide conditions to allow deeper draft vessels to transit the harbor.

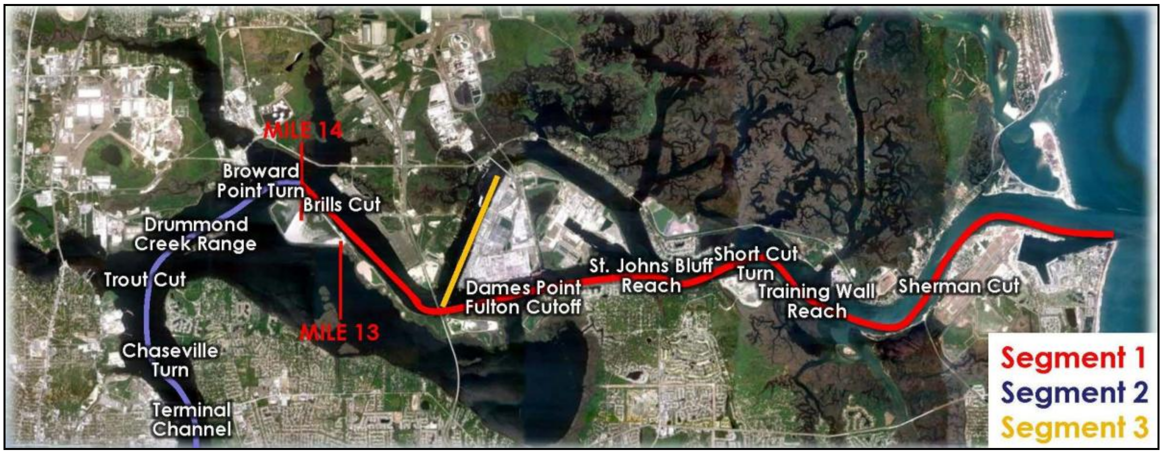

FIGURE 1: JACKSONVILLE HARBOR STUDY SEGMENTS

The National Economic Development Plan (NED) and the Recommended Plan: Based on an evaluation of alternative plan economic costs and benefits, the NED plan includes a 45-foot deep channel with associated widening and turning basins. This is the depth at which net benefits (benefits minus costs) are greatest. The benefit-to-cost ratio (BCR) for the NED plan is 3.3 (**Table 1**). The non-federal sponsor, the Jacksonville Port Authority (JAXPORT), subsequently requested a locally preferred plan (LPP) including a 47-foot depth with associated widening and turning basins. The LPP has positive net benefits and is economically justified (BCR is 2.7). The recommendations for the widening areas and the turning basins are the same for both the NED and the LPP. In accordance with USACE policy, the LPP was submitted for consideration to the Assistant Secretary of the Army for Civil Works (ASA-CW) and approved for consideration as the recommended plan on May 17, 2013.

The recommended plan (preferred alternative) is the locally preferred plan (LPP). The recommended plan includes deepening the Federal channel to 47 feet from the entrance channel to approximately River Mile 13, two areas of widening at the Training Wall Reach and St. Johns Bluff Reach, and two new Turning Basins at Blount Island and Brills Cut (**Figure 2**).

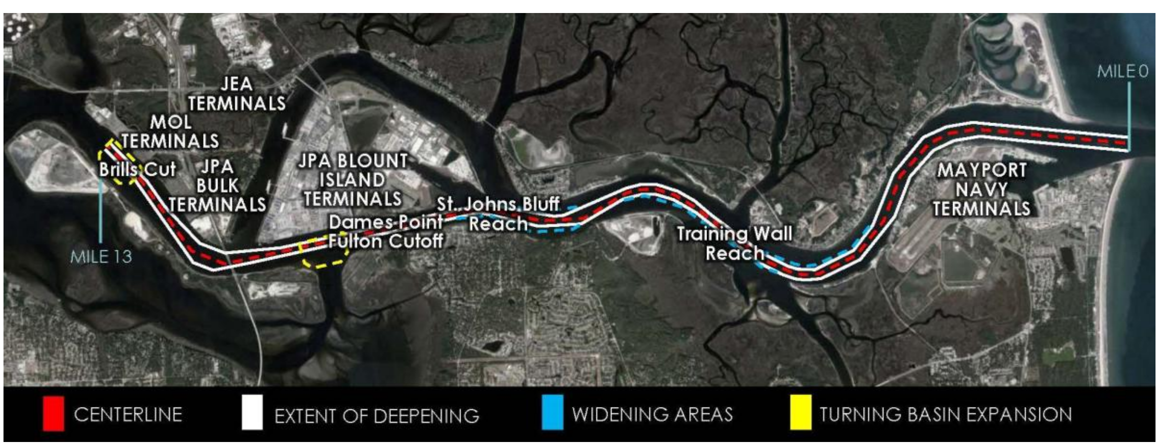

FIGURE 2: RECOMMENDED PLAN

Table 1: NED and LPP Benefits and Costs

Depth	AAEQ Costs	*AAEQ IDC*	AAEQ Benefits	AAEQ Net Benefits	BCR 3.50%	BCR 7%
45ft	**$25,500,000**	*$2,700,000*	**$ 84,200,000**	**$58,700,000**	**3.30**	**1.60**
47ft	**$33,700,000**	*$3,500,000*	**$ 89,700,000**	**$56,000,000**	**2.70**	**1.30**

**Average Annual Equivalent Costs (AAEQ) Costs include AAEQ IDC (shown above) and AAEQ O&M*

Construction of the recommended plan involves dredging of approximately 18 million cubic yards of material. Fracturing (confined blasting) of consolidated sediments and underlying rock may be required prior to dredging. Dredged material is designated for an ocean dredged material disposal site (ODMDS). As that plan is refined in PED, we have the option of further pursuing beneficial uses if cost-effective and regulatory and environmental protection requirements are met.

Based on hydrodynamic modeling performed to evaluate salinity changes associated with deepening the navigation channel, the recommended plan may cause minor changes in salinitywithin a portion of the study area. The predicted ecological effects would be a minor increase in salinity stress on some wetlands and submerged aquatic vegetation as well as a minor change in some fish and macroinvertebrate distributions. Uncertainty exists about the magnitude of both the effect of deepening on salinity and the ecological response to changes in salinity.

Recognizing this uncertainty, a conservative approach was adopted in both the evaluation of impacts and the proposed mitigation plan to offset the predicted impacts. The recommended plan includes mitigation measures including land preservation. As there were no discernible differences in the modeling results of impacts for the NED plan versus the recommended plan (LPP), there is no anticipated increase in mitigation needed for the LPP plan as compared to the NED plan. Projected environmental impacts warrant initial mitigation (i.e. conservation land purchase) and monitoring during construction plus 1 year post construction. Additionally, the non-federal sponsor has agreed to pay for additional monitoring and modeling efforts post construction. Should the results of the construction monitoring or any additional monitoring undertaken by the sponsor indicate that impacts from the project are greater than were anticipated during feasibility; a Post Authorization Change (PAC) report would be done to determine if further mitigation actions are warranted.

Benefits, Costs, and Implementation of the Recommended Plan: Project benefits are based on transportation cost savings. These benefits, or transportation cost savings, are attributable to enabling vessels to use their capacity more efficiently, and/or reduced susceptibility to tidal delays and congestion. The project first cost of the recommended plan is estimated at $600.9 million at October 1, 2013 price levels with the Federal share of the recommended plan $361.9 million, and the non-federal share $239 million. After authorization, it is estimated that the project could be constructed in approximately 6 years, assuming sufficient Federal and non-federal appropriations to support award of construction contracts.

Coordination with Agencies and the Public: To ensure that the public and Federal, tribal, state, and local agencies were kept informed about progress on technical analyses and policy issues, public meetings were held throughout the study period. In addition to a May 2009 public workshop at the initiation of the study, additional meetings were conducted to inform the public and receive initial comments on ecological modeling and proposed methods for evaluating impacts (May 2012), preliminary ecological modeling results (October 2012 and September 2013), methods for blasting if required for dredging (March 2013), ship wake and storm surge modeling results (September 2013) and to present the draft report/SEIS (June 2013 and September 2013). In addition, the public and agencies were invited to participate in bi-monthly teleconferences throughout the study beginning August 2012.

Areas of Controversy:

Bank Erosion: Residents and agencies with land holdings along the St. Johns River have commented on existing erosion problems, and how the proposed deepening may affect this issue. Vessel wakes and operating assumptions were evaluated during the study, demonstrating that changes in wave action associated with the deeper and wider channel and the design vessel ship wake will not cause increased erosion provided vessels do not exceed the design speed limit. Nonetheless, beneficial use of dredged material may be considered during PED if economically feasible to improve the stability of bank areas subject to erosion. Refer to Appendix J (Dredged Material Management Plan [DMMP]) for more information.

Environmental Impacts Analysis: Public and Agency concerns were expressed throughout the study about the effects of deepening the channel from the current 40-foot depth on salinity and associated ecological changes to wetlands, submerged aquatic vegetation, and the abundance, diversity, and distribution of economically and ecologically important fish and shrimp species. Ecological models were developed to predict effects of potential salinity changes on ecological indicators including wetlands, submerged aquatic vegetation (eelgrass) invertebrates (crabs, clams, shrimp), fish (sp), plankton, and water quality. Based on the models and evaluations, wetlands and submerged aquatic vegetation in the project area may be slightly affected by the recommended plan (i.e., changes in salinity stress frequency). Assumptions for these models and evaluations were conservative in order to illustrate a worst-case scenario; changes to other key ecological indicators were predicted to be minimal. In general, ecological resources in the project area are likely to be more affected by inter-annual variability associated with regional rainfall patterns (drought, storm events), potential sea level rise, and possible water withdrawals than induced salinity changes associated with deepening.

Mitigation: To offset predicted impacts to wetlands, submerged aquatic vegetation, and fisheries in the project area, a suite of mitigation measures were developed including land preservation and conservation. Combined, these measures will improve habitat in and around the St. Johns River in the project area. A project Corrective Action Plan is included to collect field data on key ecological indicators, assess changes, and recommend additional actions to ensure that salinity effects caused by the project are appropriately mitigated. During the study, environmental interests also expressed support for including removal of the Rodman Dam and restoration of the Ocklawaha River (a major tributary of the St. Johns River) as a mitigation option. Restoration of flow and ecological function in the Ocklawaha River may provide ecological benefits to the St. Johns River system; however, the economic and social effects of the project are complex and controversial. This option was not supported by the non-federal sponsor as a component of a navigation project and was ultimately screened from the study.

Regional and Local Economic Effects: Concerns were expressed that the report does not fully analyze local and regional economic impacts of alternative plans, especially with respect to effects on local employment. Although regional economic effects were evaluated, those effects are not included in the Federal economic analysis supporting the recommended plan. The Federal economic analysis focuses on National Economic Development (NED) benefits, which are defined as positive changes in the net value of the national output of goods and services expressed in monetary units. NED benefits were computed and compared to construction and other implementation costs in order to support a recommendation to Congress to authorize Federal participation in the project.

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ON
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**Of note: The last page of the document is a reference map that may be folded out and used throughout the reading of this report.*

1.0 STUDY INFORMATION*

1.1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Jacksonville District is investigating navigation improvements including widening and deepening of the Jacksonville Harbor. Jacksonville Harbor is in Duval County, Florida.

The harbor project provides access to deep draft vessel traffic using terminal facilities located in the City of Jacksonville, Florida as shown in **Figure 3**.

The investigations described in this report evaluate the feasibility of options to address navigation concerns and provide navigation improvements.

1.2 STUDY AUTHORITY

A resolution from the Committee on Public Works and Transportation, United States House of Representatives, dated February 5, 1992, provides the study authority as follows:

> Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Jacksonville Harbor, Florida, published as House Document 214, Eighty-ninth Congress, First Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of navigation and other purposes.

The Jacksonville District, in coordination with South Atlantic Division, determined that further study in the nature of a General Reevaluation Report (GRR) will fulfill the intent of the Congressional directive. This GRR II will assess the extent of the Federal interest in participation in a solution to identified navigation problems.

1.3 PURPOSE AND SCOPE

The purpose of this GRR is to examine whether navigation improvements to the existing Federal navigation project at Jacksonville Harbor, Jacksonville, Florida are warranted and in the Federal interest. The study includes a survey of existing and future conditions; an evaluation of related problems and opportunities; development of potential alternatives and associated evaluation and comparison of costs, benefits, and feasibility of those alternatives; an environmental impact statement and identification of a recommended plan. The results of the study are documented in this report and consist of an executive summary, main report, and supporting appendices. This report serves as both the USACE Decision Document for the navigation improvement project and as the Environmental

Impact Statement (EIS) supplement for the proposed action. This report (GRRII) updates the 1998 EIS prepared for the Jacksonville Harbor Navigation Study (Record of Decision signed in 2001) as well as the Jacksonville Harbor Navigation Study-General Reevaluation Report completed in 2002.

1.4 LOCATION OF THE STUDY AREA

Jacksonville Harbor is in Duval County, Florida and at the mouth of the St. Johns River where it empties into the Atlantic Ocean. The harbor project provides access to deep draft vessel traffic using terminal facilities located in the City of Jacksonville, Florida as shown in **Figure 3**.

FIGURE 3: LOCATION OF JACKSONVILLE HARBOR

1.5 HISTORY OF THE INVESTIGATION

The Chief of Engineers Report dated May 19, 1965 recommended modification of the existing project for Jacksonville Harbor, Florida (from the entrance channel to River Mile 20), "to provide for maintenance of the existing ocean entrance 42 and 40 feet deep, deepening of the interior channel to 38 feet to the Municipal Docks and Terminals, and widening the channel near mile 5 and mile 7 by 100 feet and 200 feet, respectively." The Water Resources Development Act of 1999 modified some of the project features. The project features authorized in WRDA

1999 (and constructed in 2003) include a 40-foot project depth from the entrance channel to river mile 14.7, and a 38-foot project depth for Cuts F and G, and channel widths that vary from approximately 400 feet to 1,200 feet. Section 129 of the Energy and Water Development Appropriations Act, 2006, Public Law 109-103, authorized deepening and widening of miles 14.7 to 20 to the new project depth of 40 feet. Funding was provided through the American Recovery and Rehabilitation Act (ARRA) of 2009 and the project was completed in 2010.

The existing federally authorized Jacksonville Harbor project provides for Federal maintenance of an existing channel depth of 40 feet with bottom widths ranging from 400 to 1,200 feet from the Atlantic Ocean to Mile 20 of the St. Johns River and 38 feet in the West Blount Island Channel (cuts F and G). As a result of a determination of Federal interest in further improvements, a cost sharing agreement for the GRR II study was entered into on July 1, 2005 and was amended on June 15, 2006. The study is cost shared at 65/35.

1.6 PRIOR REPORTS AND EXISTING PROJECTS

1.6.1 Prior Reports

Federal interest in navigation on the St. Johns River dates back to 1869. **Table 2** lists the prior studies and reports over the years on reaches of the river that are today the deep draft portion of the Jacksonville Harbor project.

Table 2: Prior Studies and Reports

		CHIEF OF ENGINEERS	PUBLISHED DOCUMENTS				
STUDY[1] TYPE	REPORT DATE	RECOMMENDATIONS	CONGRESSIONAL DOCUMENTS				
			TYPE[2]	NO.	CONGRESS	SESSION	NOTE
S	01/29/1869	---					3
S	06/30/1872	---					4
S	03/25/1879	Favorable					5
S	02/18/1895	Favorable	H.Ex	346	53	3	6
PE	4/30/1909	Favorable					
S	11/22/1909	Favorable	H	611	61	2	
PE	4/29/1922	Favorable					
S	3/4/1926	Favorable	H	483	70	2	
S	6/3/1935	---					
S	11/19/1940	Favorable	H	322	77	1	
S	5/23/1944	Favorable	S	230	78	2	
S	8/9/1945	Favorable	S	179	79	2	
PE	12/26/1950	Unfavorable					
S	5/19/1965	Favorable	H	214	89	1	
S	5/15/1981	Favorable	H	233	98	2	
R	6/29/1994	Favorable					
FR	4/21/1999	Favorable	S	507	106		7
R	11/19/2005	Favorable			109		8

1 Abbreviations are: PE = Preliminary Evaluations R = Reconnaissance Report
FR = Feasibility Report S = Surveys

2 Symbols are: H = U.S. House of Representatives Document S = U.S. Senate Document

3 Annual Report of the Chief of Engineers, 1869, page 266.

4 Annual Report of the Chief of Engineers, 1872, page 672.

5 Annual Report of the Chief of Engineers, 1879, page 767.

6 Annual Report of the Chief of Engineers, 1895, page 1586.

7 Public Law 106-53, Aug. 17, 1999, 106th Congress, “Water Resources Development Act of 1999”, Sec.101(a)(17)

8 Public Law 109-103, Nov. 19, 2005, 109th Congress, “Energy and Water Development Appropriations Act, 2006"

Two other studies, not included in **Table 2**, involved the consideration of navigation improvements in the vicinity of Blount Island. Both of those studies were under the authority of Section 107 of the 1960 Rivers and Harbors Act, as amended. The reconnaissance study and report, dated December 1985, considered the Federal interest of widening the turn at the junction of the main ship channel in Jacksonville and the Blount Island west channel. The study results showed economic justification for the widener. Just prior to the report, Section 102 of Public Law 99-141, dated November 1, 1985, provided the authorization for widening of the turn in Jacksonville with the use of available operation and maintenance funds. Based on language in the Act, no further study was needed for authorization of the work. A second reconnaissance study report, dated August 1989, considered the deepening of the channel on the west side of Blount Island. The study was favorable but the Jacksonville Port Authority deferred further study pending the availability of funds. Since that time the WRDA 1999 authorization included deepening the West Blount Island channel from 30 feet to 38 feet based on the April 21, 1999 feasibility study listed in **Table 2** above.

1.6.2 Existing Projects

1.6.2.1 Jacksonville Harbor Mile Point Area

The Chief of Engineers Report dated April 30, 2012 recommends construction of a relocated Mile Point training wall. Relocation of the Mile Point training wall involves removal of the western 3,110 feet of the existing Mile Point training wall; land removal and dredging to open the confluence of the Intracoastal Waterway (IWW) and the St. Johns River; construction of a new training wall western leg (approximately 4,250 feet) and relocated eastern leg (approximately 2,050 feet); restoration of Great Marsh Island as the least cost disposal alternative and mitigation site while providing beneficial use of dredged material; and construction of a flow improvement channel to offset project induced adverse impacts. The recommended plan reduces the ebb tide crosscurrents at the confluence of the St. Johns River with the Intracoastal Waterway (IWW). The Assistant Secretary of the Army (ASA) for Civil Works (CW) submitted the Final Integrated Feasibility Report to Congress on August 16, 2012.

1.6.2.2 Intracoastal Waterway

The Intracoastal Waterway (IWW) crosses the St. Johns River south of the Mile Point training wall at Pablo Creek and to the north at Sisters Creek. The IWW has an authorized bottom width of 125 feet at a depth of 12 feet both on the north and south side of the St. Johns River. The first Federal authorization for the IWW (at Pablo Creek) from Jacksonville to Miami was provided in the Rivers and Harbors Act of January 21, 1927. Using an existing private canal, USACE took possession of the waterway on December 11, 1929. That first project called for a canal 8 feet deep by 75 feet wide and subsequently has been deepened and widened further. Construction began when the United States snagboat D-1 moved from the St. Johns River into Pablo Creek and headed south clearing obstructions. The first Federal authorization for the IWW north of the St. Johns River (which includes Sisters Creek), known as the Atlantic Intracoastal Waterway (AIWW) occurred under the River and Harbor Act of March 4, 1913, and provided for a channel 7 feet deep by 100 feet wide (found in document H. Doc. 898/62/2). See **Figure 4**.

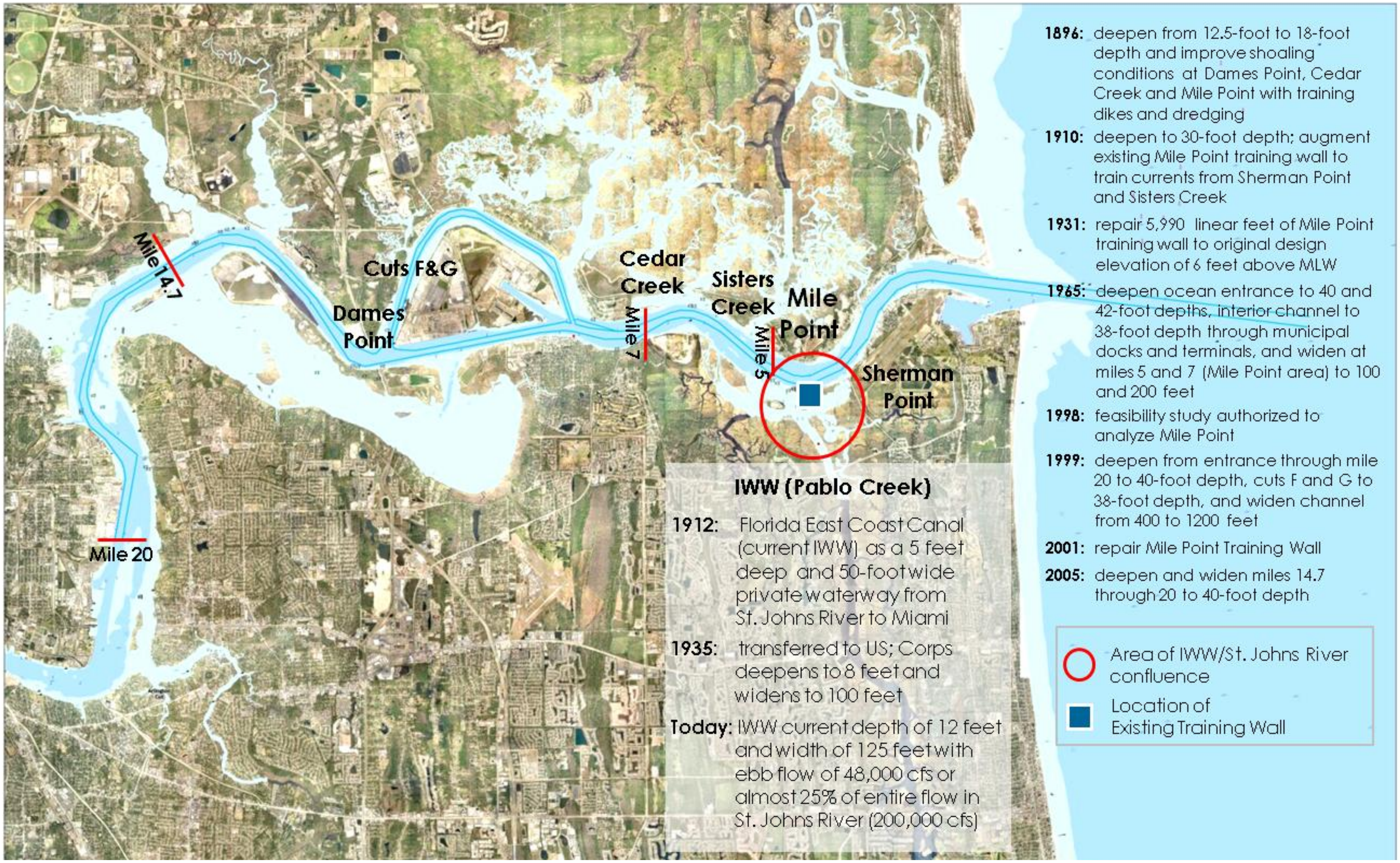


FIGURE 4: JACKSONVILLE HARBOR FEDERAL PROJECT

1.7 PLANNING PROCESS AND REPORT ORGANIZATION

The USACE planning process follows the six-step process defined in the Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. This process, used for all planning studies conducted by USACE, provides a structured approach to problem solving, and provides a rational framework for sound decision making. The six steps are:

Step 1: Identify problems and opportunities
Step 2: Inventory and forecast conditions
Step 3: Formulate alternative plans
Step 4: Evaluate alternative plans
Step 5: Compare alternative plans
Step 6: Select a plan

This study started with the issuance of Federal funds to initiate a GRR, following execution of the Feasibility and Cost Sharing Agreement (FCSA), and will terminate on the date the GRR is submitted to the Office of Management and Budget by the Assistant Secretary of the Army for Civil Works (ASA (CW)) for review of consistency with the policies and programs of the President. The products of the feasibility phase include the general reevaluation report, integrated National Environmental Policy Act (NEPA) documentation, and a Chief of Engineers Report.

The six-step planning process for the study was modified with incorporation of a 3x3x3 SMART Planning Charette (a USACE initiative to streamline the planning process) and the President’s “We Can’t Wait Initiative.” Both of these initiatives resulted in an accelerated study process as well as a detailed review of remaining study-related activities and the associated risks in reducing the level of detail evaluated during the feasibility study phase.

2.0 EXISTING CONDITIONS*

Step two of the planning process entails quantifying and qualifying the planning area resources important to clearly define and characterize the problems and opportunities identified in Section 4.0. Both existing conditions and future conditions expected to occur without a project must be characterized.

2.1 GENERAL CONDITIONS

Jacksonville Harbor is located within the St. Johns River, which spans 310 miles making it the longest river in Florida. The St. Johns River drainage basin encompasses over 8,840 square miles spread across 16 counties (Sucsy and Morris, 2002). The lower St. Johns River (LSJR) is the estuarine portion of the river, formed at the confluence of the middle St. Johns River and the Ocklawaha River upstream of Palatka, Florida (Hendrickson et al 2003). Along its path, the river's width varies dramatically. Within the project study area, the river is about 1,600 feet wide near its mouth on the Atlantic Ocean, 1,200 feet at the Main Street Bridge in downtown Jacksonville, 16,000 feet at the Buckman Bridge, 12,000 feet near the Shands Bridge, and 3,500 feet at the US-17 Bridge in Palatka **(Figure 5**). At Palatka (**Figure 6**: River Mile 81), the river width generally decreases to about 2,000 feet and to about 700 feet at River Mile 96, before expanding in width again at Lake George.

The St. Johns is a slow-moving river with a very mild slope averaging 0.1 foot drop per mile (Toth 1993). **Figure 7** provides estimates of the longitudinal river bed elevations. The mild slope of the river allows tidal effects to extend at least 106 river miles from the river mouth in Duval County to Lake George in Volusia County. Lake George, with an area of 67 square miles, is the second largest lake in Florida. The filling and draining of Lake George, due to subtidal variability of Atlantic Ocean water levels, causes intermittent periods of reverse flow extending far upstream in the Lower St. Johns River. These reverse flow periods, when the daily net discharge moves upstream, extend the upstream movement of salt as well as upstream dispersal of pollutants entering the river.

The St. Johns River Water Management District (SJRWMD) manages and divides the basin into three sub-basins — including the Upper, Middle, and Lower St. Johns River. The Upper St. Johns River sub-basin extends from the headwaters of the St. Johns River in Okeechobee and Indian River counties to the confluence of the Econlockhatchee River in Seminole County. The Middle St. Johns River sub-basin extends from Lake Harney (Seminole and Volusia counties) to the confluence of the Ocklawaha River near Welaka. The Lower St. Johns River (LSJR) sub-basin extends from the confluence of the Ocklawaha River to the river mouth at the Atlantic Ocean in Duval County (http://www.protectingourwater.org/watersheds/map). In addition to these three sub-basins, the Lake George and Ocklawaha River Basins also drain into the St. Johns River.

A map of the entire watershed is shown in **Figure 8**.

The local watersheds of the LSJR encompass about 2,755 square miles, about 32% of the total watershed area (SJRWMD 2012: Chapter 3 Watershed Hydrology). LSJR discharge at the Buffalo Bluff gauging station accounts for 73% of the total gauged sources from that point to the river mouth (Sucsy and Morris, 2002). The main tributaries of the Lower St. Johns River include Black Creek, Deep Creek, Sixmile Creek, Etoniah Creek, Julington Creek, McCullough Creek, Arlington River, Broward River, Dunns Creek, Ortega River, Trout River, and the Atlantic Intracoastal Waterway. Located in the Lower St. Johns River, the Jacksonville Harbor main shipping channel, a 20-mile stretch of the river (**Figure 6**), extends from the river mouth to the Jacksonville Port Authority (JAXPORT) Talleyrand Marine Terminal just north of downtown Jacksonville. The proposed construction area includes approximately the first thirteen river miles (See **Figure 5 and Figure 6**).

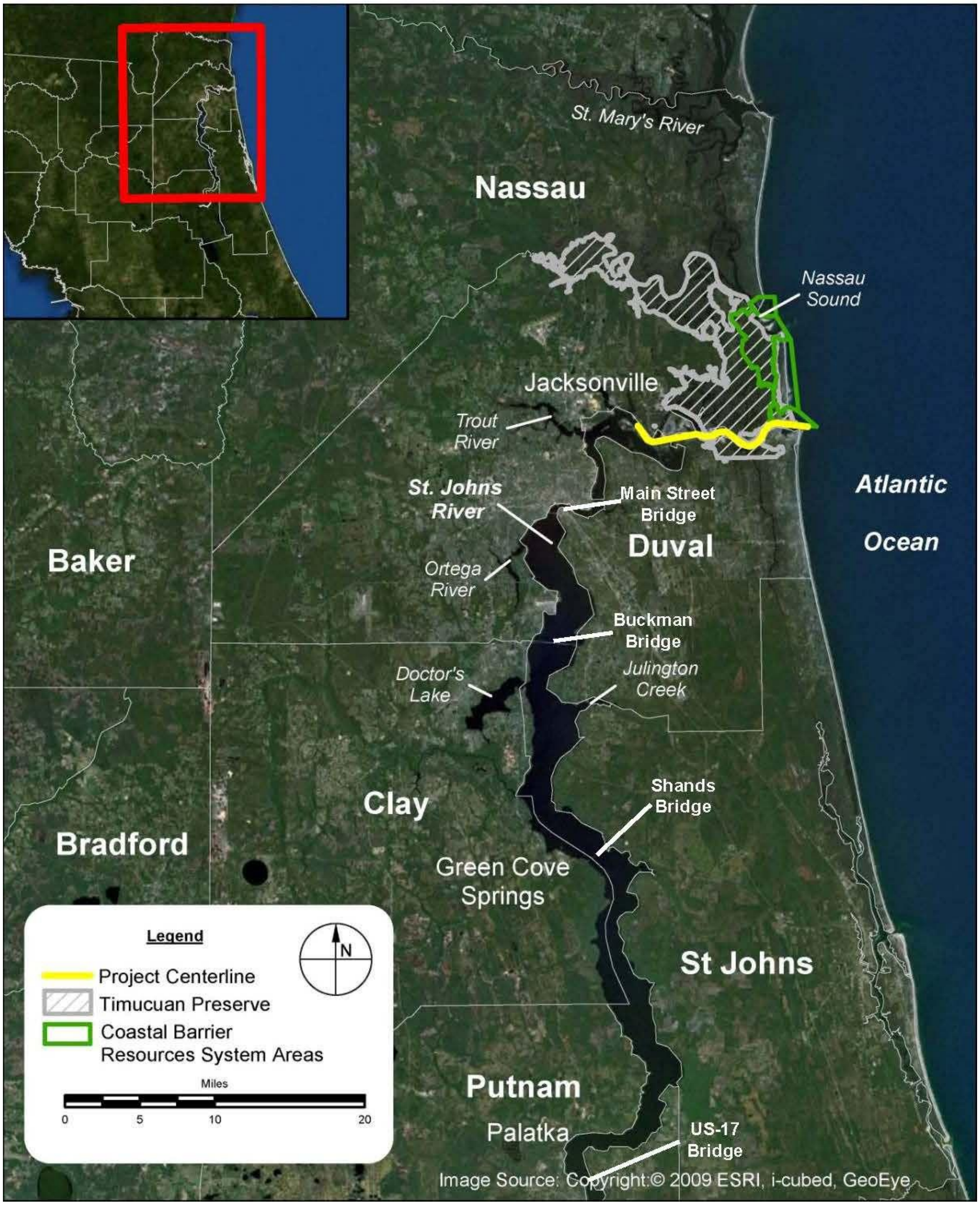


FIGURE 5: JACKSONVILLE HARBOR DEEPENING SEIS STUDY AREA

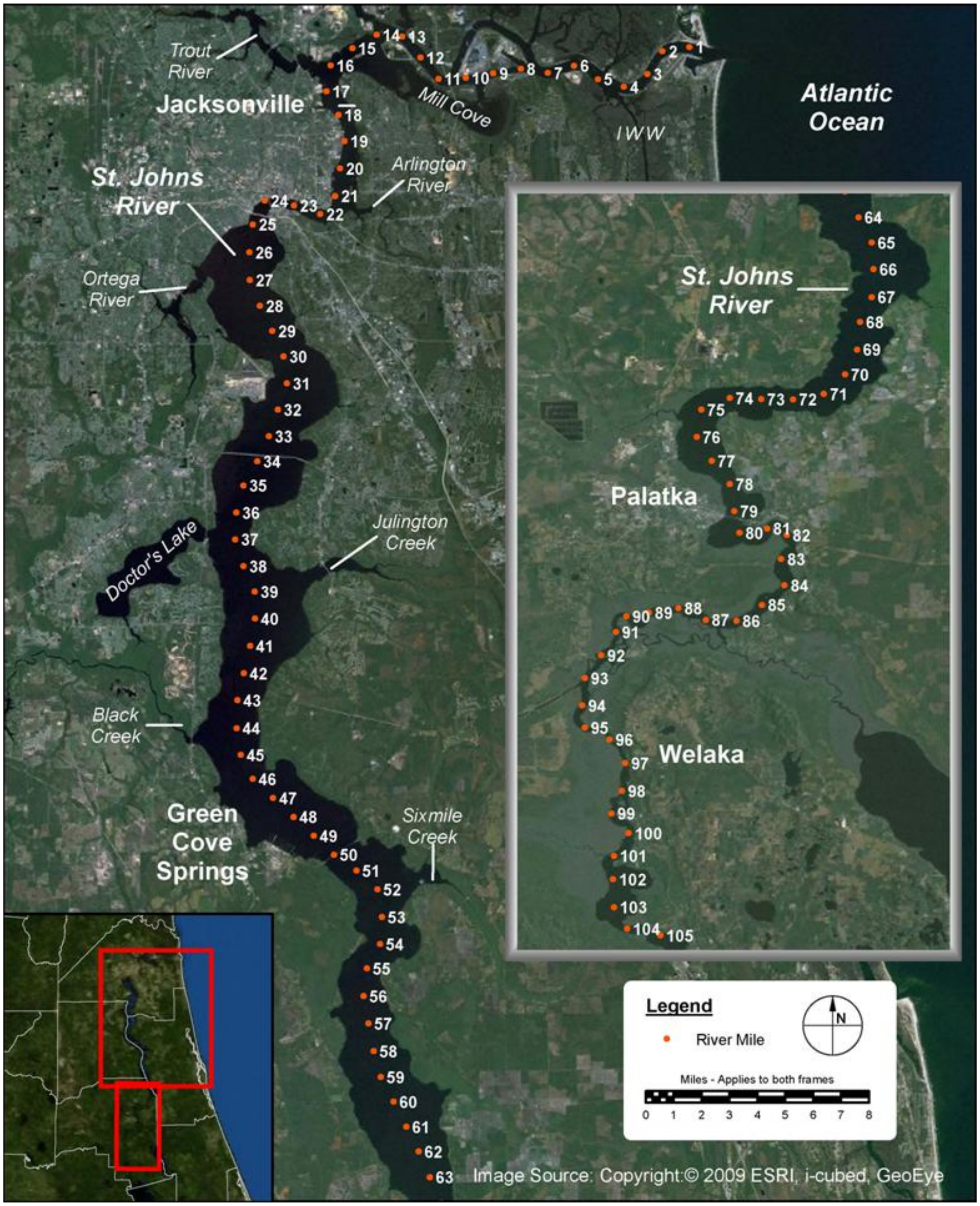


FIGURE 6: STATUTE RIVER MILES WITHIN THE PROJECT STUDY AREA

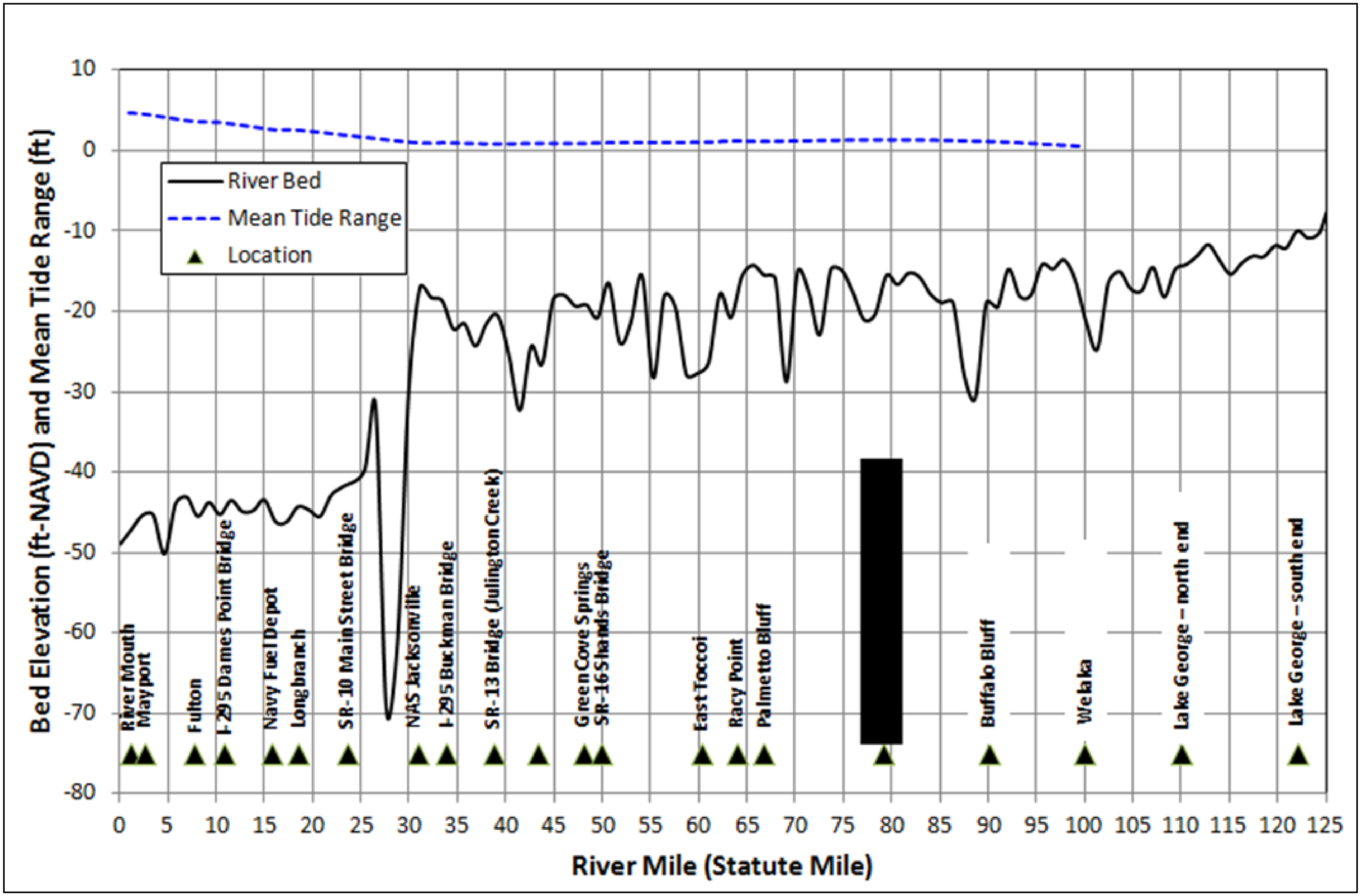


FIGURE 7: RIVER BED ELEVATIONS ALONG ST. JOHNS RIVER

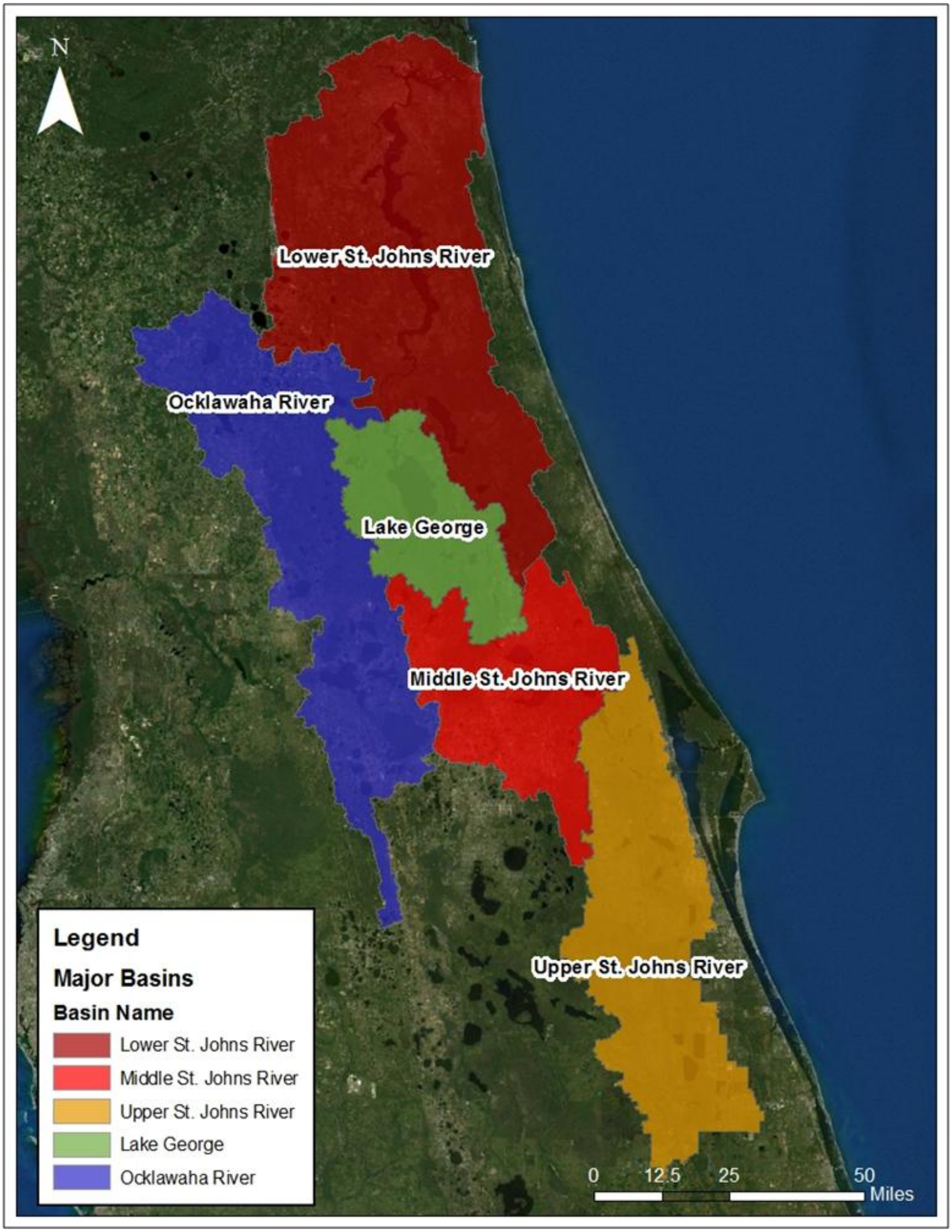


FIGURE 8: MAJOR TRIBUTARY BASINS AND SUB-BASINS OF THE ST. JOHNS RIVER

2.2 PHYSICAL CONDITIONS

2.2.1 Geology and Geomorphology

The LSJR basin is composed of three major landscape divisions: the Sea Island District located in the north and northwestern portions of the basin, the Eastern Flatwoods District which covers the eastern most part of the basin, and the Central Lake District located on the south and southwest flanks of the basin. The basin owes its origins to the emergence of the three distinct marine terraces which rose above the level of sea during the Pleistocene age. The Pensacola Terrace extends inland about 20 miles and includes the eastern part of the Eastern Flatwoods District and the northeastern portion of the Sea Island District. On the east, the Pensacola Terrace merges with shore features of recent origin. The elevation of the Pensacola Terrace rises from sea level near the coast to about 40 feet above sea level along the western margin. On the western edge of the LSJR basin, the higher Tsala Apopka (between the 40 to 70-foot contours) and Newberry Terraces (between the 70 to 100-foot contours) contain the river basin's portion of the Central Lake District and the remainder of the basin's Eastern Flatwoods and Sea Island Districts. Erosion and deposition have produced ridges and depressions on the surfaces of the emergent terraces. Various subclassification schemes have been used to describe these minor landforms. The St. Johns River valley and associated elongated lakes appear to be remnants of coastal lagoons formed before the Pleistocene sea receded (SJRWMD 1994).

2.2.2 Groundwater Hydrology

Three hydrogeologic units are present in the study area: the surficial aquifer system, the intermediate confining unit, and the Floridan aquifer system. The surficial aquifer system overlies the intermediate confining unit and consists primarily of undifferentiated deposits containing sand, clay, shell, and some limestone and dolomite. The intermediate confining unit underlies the entire area and retards the vertical movement of water between the surficial aquifer system and the Floridan aquifer.

The intermediate confining unit consists of beds of relatively low permeability sediments that vary in thickness and areal extent. The unit may be breached by sinkholes, fractures, and other openings. The Floridan aquifer system is composed primarily of limestone and dolomite. The rate of leakage through the intermediate confining unit is controlled by the leakage coefficient of the intermediate confining unit and the head difference between the Upper Floridan aquifer and the surficial aquifer system. The Cedar Keys, Oldsmar and Avon Park Formations and the Ocala Limestone are part of the Floridan aquifer system. The Upper Floridan aquifer is contained primarily in the Ocala Limestone. The Hawthorn Group is the principal confining unit that covers the Floridan aquifer in much of the basin (SJRWMD 1994).

2.2.3 Tides and Salinity

The St. Johns River is tidal up to and above Jacksonville. The incoming ocean tide acts as a nearly pure progressive shallow-water wave over the lower 31 mi, from the river mouth through Jacksonville with maximum flood occurring near the time of high tide (Sucsy and Morris, 2002). According to the National Oceanic and Atmospheric Administration (NOAA 1996), the mean range of tide decreases from 5.5 feet at the ocean to 4.5 feet at Mayport within a two mile distance. The jetties and the river topography effectively damp the tidal signal as it progresses into the entrance. **Table 3** summarizes the mean range of tide (mean high water - mean low water) at representative locations.

The LSJR exhibits typical characteristics of an estuary, where saline water from the ocean mixes freely with fresh water from inland drainage. Three major factors govern the upstream extent of salinity in the river: net freshwater discharge entering the upper river through Astor, net volume of ocean water entering the river mouth, and wind. The chemical character of the water in the river varies from seawater near the coast to freshwater farther inland (generally south/upstream of Green Cove Springs). Farther upstream from Palatka, salinity may increase due to chlorides introduced from ground water seepage of buried saltwater and related saltwater springs. Under drought conditions, sea water intrusion extends upstream as far as Palatka.

Table 3: Mean Tidal Ranges in St. Johns River, Julington Creek, and Doctors Lake

River Mile[1]	Location	Coordinates in State Plane Florida East (NAD83)		Mean Tidal Range (feet)
		Easting (feet)	Northing (feet)	
0.0	Degaussing Structure	531634.5	2204416.8	4.81
1.0	Mayport Naval Station	525869.3	2205637.6	4.67
2.5	Mayport	520599.9	2204457.0	4.52
7.6	Fulton	496407.3	2202120.3	3.62
10.7	I-295 Dames Point Bridge	480132.0	2200996.6	3.42
15.7	Navy Fuel Depot	458591.5	2205946.6	2.60
16.6	Phoenix Park	455404.7	2199890.4	2.51
18.4	Longbranch	460624.2	2191387.0	2.51
23.6	Jacksonville,SR-10 Main Street Bridge	448460.1	2176907.2	1.83
31.0	Piney Point/ NAS Jacksonville	446687.8	2143565.6	0.87
33.7	I-295 Buckman Bridge	437637.6	2130307.9	0.88
38.8	SR-13 Bridge (Julington Creek)	457017.0	2109573.8	0.73
n/a	Peoria Point (Doctors Lake)	416422.7	2104365.2	0.80
48.0	Green Cove Springs	446184.4	2056899.5	0.78
49.9	SR-16 Shands Bridge	457241.4	2052582.0	0.87
60.3	East Toccoi	480777.2	2008819.2	0.95
64.0	Racy Point	482264.2	1988228.1	1.14
66.7	Palmetto Bluff	477946.1	1974283.8	1.05
79.1	Palatka US 17 Bridge	455497.1	1930759.2	1.27
90.1	Buffalo Bluff	439510.1	1913284.5	1.04
100.0	Welaka	441389.7	1870251.8	0.42

1. Approximate distance from ocean entrance in statute miles

Note: All tide range values sourced from the 1983 – 2001 National Tidal Datum Epoch at http://tidesandcurrents.noaa.gov/gmap3/index.shtml?type=BenchMarkSheets&region

2.2.4 Currents Affecting Navigation

Strong river currents extend as far upstream as downtown Jacksonville (approximately River Mile 25, where the river width expands from less than 2,000 feet to about 16,000 feet). **Table 4** provides National Oceanic and Atmospheric Administration (NOAA) estimated average maximum currents at flood and ebb in the St. Johns River and its tributaries. An ADCIRC hydrodynamic model provided estimates of currents for the Palatka US-17 Bridge, Buffalo Bluff, and Welaka (Taylor Engineering, Inc. 2013).

The velocity of the current between the jetties at the river mouth is 1.9 knots on flood and 2.3 knots on ebb, and near Mile Point 2.7 knots on flood and 2.9 knots on ebb. At Mile Point, USACE plans to reconfigure the training walls to reduce crosscurrents resulting from the intersection of the river and the IWW/AIWW. It is expected that the training wall project will be completed before initiation of the proposed deepening project (USACE 2012).

The Dames Point Turn at River Mile 11 is a sharp turn complicated by crosscurrents coming from the old channel behind Blount Island. The turn requires that vessels navigate deep into the bend on both the flood and ebb. In addition, the channel in this area is used as a turning basin for vessels using Blount Island terminal and the waterfront facilities in the old channel to the west of Blount Island.

The Trout River Cut at about River Mile 17 extends through rock formations. Deep loaded vessels must exercise great care to avoid leaving the channel in this area and foundering on the rock at the edges of the channel. Channel pilots provide the local navigation knowledge necessary to predict currents which tend to push vessels sideways across the channel on both the flood and ebb. Vessels with poor handling characteristics require an assist tug when transiting the area of the Trout River Cut and the Chaseville Turn to avoid colliding with vessels docked at the many oil terminals on the west bank of the river.

At downtown Jacksonville (Commodore Point at about River Mile 22), the velocity of current is about 1 knot. The area consists of a nearly 90-degree turn, complicated by the Hart Bridge with its piers in the turn and the Mathews Bridge just to the north. Vessels with relatively poor handling characteristics or engines without sufficient horsepower use assist tugs to avoid hitting the support piers of either bridge (NOAA 1993).

Winds also have considerable effect on water level and current velocity. Strong northerly and northeasterly winds raise the water level about 2 feet at Jacksonville. Strong southerly and southwesterly winds lower the water level about 1 to 1.5 feet, increase ebb current velocity, and decrease or interrupt flood current velocity (NOAA 1993).

Table 4: Estimated Average Maximum Currents in St. Johns River and Tributaries

River Mile[1]	Location	Coordinates in State Plane Florida East (NAD83)		NOAA Predicted Average Maximum Currents	
		Easting (feet)	Northing (feet)	Flood (knots)	Ebb (knots)
0.0	St. Johns River Entrance (between jetties)	535327.2	2205604.3	1.9	2.3
2.5	Mayport	519554.7	2203224.4	2.2	3.1
3.7	Southeast of Mile Point	515849.3	2199019.9	2.7	2.9
n/a	Pablo Creek bascule bridge	517879.9	2177772.0	3.4	5.2
4.8	Sister Creek entrance (bridge)	510595.7	2202059.6	1.4	1.4
6.6	St. Johns Bluff	501136.8	2202099.4	1.6	2.2
14.2	Channel south of Drummond Point	466144.3	2209251.7	1.3	1.6
16.7	Phoenix Park	457924.7	2199403.5	1.1	1.0
17.3	Channel near Chaseville	459616.8	2197466.5	1.1	1.6
18.6	Quarantine Station	461348.3	2208477.4	1.1	1.2
21.4	Commodore Point terminal channel	458551.9	2175940.8	1.0	1.0
23.4	Jacksonville, off Washington St.	450041.3	2177516.4	1.8	1.9
24.1	Jacksonville, F.E.C. RR bridge	446349.7	2177537.8	1.6	1.7
25.1	Winter Point	443165.5	2172682.9	1.1	1.1
36.4	Mandarin Point	439674.2	2116947.7	0.6	0.7
49.5	Red Bay Point near SR-16 Shands Bridge	456716.5	2055021.6	0.9	0.6
79.1	Palatka US-17 Bridge[2]	455497.1	1930759.2	0.6	1.9
90.1	Buffalo Bluff[2]	439510.1	1913284.5	0.5	1.8
100.0	Welaka[2]	441389.7	1870251.8	0.3	1.3

[1]Approximate distance from ocean entrance in statute miles
[2]These currents are based on ADCIRC; all other currents in this table are based on NOAA currents.

2.2.5 Shoreline Erosion

As with any large, dynamic riverine system, areas along the St. Johns River shoreline are subject to erosion and/or accretion of material over time regardless of the level of human impact or activity. In other words, the St. Johns River is not a static entity and is very much affected by a wide variability in conditions produced by the natural environment including extreme events such as hurricanes and droughts. The major factors that contribute to shoreline erosion include underlying geologic conditions, tidal range, water current velocities, wave climate, shoreline configuration/hardening, and erosion that occurs naturally and constantly from rainfall runoff and the evolving condition of surface resistance to wear from development.

2.2.6 Sea Level Rise

Throughout geologic history global sea level variations, both rise and falls, have occurred. Two processes are predominantly responsible for relative changes in sea level: change in the absolute water level of oceans and the subsidence or uplift of land by geologic processes.

Relative sea level (RSL) refers to local elevation of the sea with respect to land, including the lowering or rising of land through geologic processes such as subsidence and glacial rebound. It is anticipated that sea level will rise within the next 100 years. To incorporate the direct and indirect physical effects of projected future sea-level change on design, construction, operation, and maintenance of coastal projects, USACE has provided guidance in the form of an Engineering Circular, EC 1165-2-212.

The EC 1165-2-212 engineering circular provides both a methodology and a procedure for determining a range of sea level change estimates based on global sea level change rates, the local historic sea level change rate, the construction (base) year of the project, and the design life of the project. Three estimates are required by the guidance, a baseline estimate representing the minimum expected sea level change, an intermediate estimate, and a high estimate representing the maximum expected sea level change (**Figure 9**).

Adjusting equation (2) to include the historic global mean sea-level change rate of +1.7 mm/year results in updated values for the variable b being equal to 2.71E-5 for modified NRC Curve I (Intermediate), 7.0E-5 for modified NRC Curve II, and 1.13E-4 for modified NRC Curve III (High).

Equation 2: $E(t) = 0.0017t + bt^2$

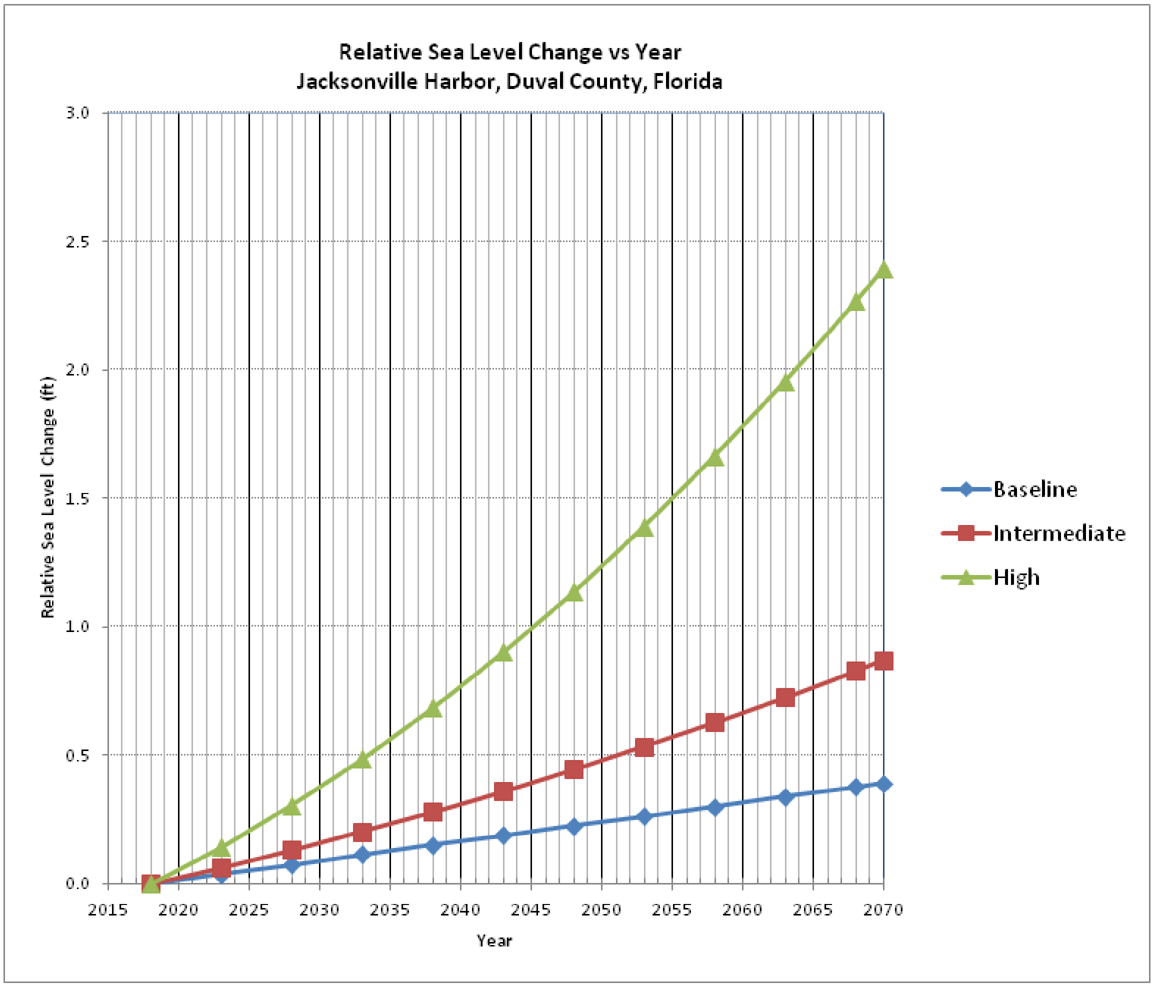


FIGURE 9: RELATIVE SEA LEVEL CHANGE VS. YEAR JACKSONVILLE HARBOR

2.2.7 Water Quality

2.2.7.1 Salinity

Within the study area, the LSJR transitions from a slow-moving river to a tidally mixed estuarine system. The SJRWMD (2012) described the river as a "low gradient, blackwater river, with abundant riverine and floodplain wetlands". The LSJR exhibits characteristics associated with riverine, lacustrine, and estuarine aquatic environments.

Upstream discharge in conjunction with ocean water levels and wind generally determines salinity distribution in the LSJR. River salinity declines from oceanic levels at the mouth to near zero generally between the Buckman and Shands Bridges (approximately River Miles 34 - 50) (Sucsy and Morris, 2002). Farther upstream, in the vicinity of Lake George, salinity may increase slightly due to inflow of saline groundwater (Sucsy et al., 2012; SJRWMD, 2008).Salinity plays a major role in determining the distribution of ecological communities in and along the river in the study area. Salinity determines the downstream extent of submerged aquatic vegetation in the littoral zone and the types of wetland vegetation that form the marsh communities along the river and tributaries. SJRWMD (2002) identified three salinity-based ecological zones for the river:

Meso-polyhaline riverine – mouth to Fuller Warren Bridge (~River Mile 25)
Oligohaline lacustrine – Fuller Warren Bridge to Orange Park (~River Mile 41)
Freshwater lacustrine – upstream of Orange Park

A more recent study, Sucsy et al. (2012) identified three slightly different salinity-based ecological zones using Practical Salinity Scale 1978 (PSS1978) units (http://bats.bios.edu/methods/chapter5.pdf):

- Polyhaline, salinity 0 to 18 PSS78 – mouth to Dames Point (~River Mile 11)
- Mesohaline, salinity 5 to 18 PSS78 – Dames Point to Buckman Bridge (~River Mile 34)
- Oligohaline, salinity 0.5 to 5 PSS78 – upstream of Buckman Bridge

Table 5 lists salinity parts per thousand (ppt) characteristics from measurements at several locations in the river from near the mouth and upstream as far as the Shands Bridge.

Table 5: Mean and One Standard Deviation of Measured Surface, Mid-Depth, and Bottom Salinity in St. Johns River

River Mile[1]	Location	Salinity[2] (ppt)		
		Surface	Mid-Depth)	Bottom
2.6	Mayport Bar Pilots Dock	24.8 ± 6.3	25.2 ± 6.3	n/a
12.0	Dames Point	21.7 ± 6.9	23.3 ± 6.5	23.7 ± 6.6
27.8	Acosta Bridge	6.9 ± 6.3	6.9 ± 6.3	7.0 ± 6.4
38.4	Buckman Bridge[3]	2.7 ± 3.4	2.8 ± 3.7	3.4 ± 4.4
57.0	Shands Bridge[3]	0.8 ± 1.1	0.8 ± 1.2	0.9 ± 1.2

[1] Approximate distance from ocean entrance in statute miles
[2] Salinity values sourced from USGS continuous measurements
[3] Minimum measured salinity at Buckman Bridge and Shands Bridge is zero.

2.2.7.2 Water Quality

The State of Florida classifies the LSJR main channel as Class III (designated uses: Fish Consumption; Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife). Class II waters (designated use: Shellfish Propagation or Harvesting) occur near the mouth of the river in Fort George Inlet. Department of Agriculture and Consumer Services

(DACS, 2012) classifies the shellfish harvesting areas in Fort George Inlet immediately north of the St. Johns River as “Prohibited” due to actual or potential pollution.

Florida’s Surface Water Improvement and Management (SWIM) Act of 1987 identified the LSJR as a priority water body for immediate restoration. In 1993, the St. Johns River Water Management District completed the required SWIM Plan (Campbell et al.,1993). The SWIM plan noted that river water quality was degraded in parts of the main stem and in many of the tributaries. Water quality degradation had occurred due to nonpoint source pollution from agricultural, urban, and industrial runoff; point source pollution from numerous permitted and unpermitted sources; leaking septic tank drain fields and other sources. Water (and sediment) quality issues included high nutrient loads, high turbidity, low dissolved oxygen, and chemical contamination.

The 2008 SWIM Plan update discussed management projects implemented under the SWIM plan through 2007 and projected activities through 2012. One of the key water quality improvement activities for the LSJR is the development of total maximum daily loads (TMDL) for substances that cause degraded water quality in the river and tributaries. For water bodies considered “impaired” (i.e., not meeting their designated use) the Florida Department of Environmental Protection (FDEP), in conjunction with the SJRWMD and U.S. Environmental Protection Agency (USEPA), develop TMDLs and, subsequently, Basin Management Action Plans (BMAP).

The TMDLs are developed for defined water body segments within a larger basin. Each segment is identified by a unique Water Body Identification number (WBID). The SJRWMD (2002) initial phase of TMDL development for the LSJRB begins with an assessment of water quality and ecological health and identification of impaired water bodies in the basin. The assessment noted that anthropogenic nutrient loads from point and nonpoint sources negatively affected the water quality of the river and tributaries and caused spring and summer algal blooms that resulted in fish kills and aquatic vegetation losses. The study identified numerous areas within the LSJRB that were potentially impaired due to nutrients, coliforms, dissolved oxygen, or metals.

The SJRWMD (2004) second phase of TMDL development resulted in the “Verified List” of impaired water bodies requiring TMDLs. This list included 39 high priority, 101 medium priority, and 21 low priority WBIDS within the LSJRB.

Several segments of the river and numerous tributaries (including Dunn Creek, Broward River, Trout River, Ortega River, Cedar River, Ribault River, Goodbys Creek, Durbin Creek, Doctors Lake and many others) are subject to TMDL development. Draft and final TMDL reports[1] for over 40 areas in the LSJRB provide details of specific impairment and the resulting TMDLs. The FDEP “Total

[1] Reports available from the FDEP at http://www.dep.state.fl.us/water/tmdl/index.htm

Maximum Daily Load for Nutrients for the Lower St. Johns River" report (LSJR TMDL, 2008) describes the calculations for the LSJR for nutrient TMDLs.

The State of Florida and a large group of public stakeholders have developed BMAPs to implement the TMDLs and improve water quality to applicable standards for the main stem and many of the tributaries. The LSJR TMDL report (2008) presents the BMAP for the LSJR. The plan included the following structural and nonstructural management strategies:

- Wastewater treatment plant upgrades
- Redirecting wastewater discharges to beneficial reuse for irrigation and other purposes
- Stormwater retrofits
- Urban structural best management practices (BMPs)
- Urban nonstructural BMPs such as cleaning and maintenance activities
- Agricultural BMPs
- Environmental education, and
- Water quality credit trading

State and local agencies are implementing the BMAP. The LSJR TMDL Annual Progress Report (2011) reported declining urban total nitrogen (TN) and total phosphorus (TP) nutrient loads resulting from improved wastewater and stormwater treatment. The TN loads from agricultural areas have declined under low flow conditions but agricultural TP loads may be increasing, particularly under high flow conditions. Point source loads are decreasing as a result of reduced effluent concentrations and discharge volumes. Riverine TN concentration declines appear related to the reduced loadings. Riverine TP concentrations appear to have declined during low flow and increased during high flow conditions.

Adopted TMDLs for the LSJR and other river and tributary segments in the LSJRB have been codified in Florida Administrative Code (Chapter 62-304.415 F.A.C.). This rule distinguishes the freshwater portion of the LSJR (from Buffalo Bluff, slightly upstream of Palatka, to Black Creek, just upstream of Doctors Lake) and the marine segment from Black Creek to the mouth. The rule also sets nutrient load limits for total phosphorus (TP) and total nitrogen (TN) for both sections of the river. Additionally, the rule requires other specific pollutant reductions for many of the tributaries of the river.

The 2012 State of the River Report (UNF/JU, 2012) provides the most recent summary of water quality conditions in the LSJR. The report examined status and trends of several water quality indicators (dissolved oxygen [DO]), nutrients, turbidity, algal blooms, fecal coliforms, and metals)) with respect to historical conditions and current water quality criteria (WQC) or, for nutrients, Florida's proposed numeric criteria. The report notes that while water quality problems remain, several measures of water quality have improved during recent years. The remainder of this section summarizes information from the 2012 State of the River Report.

On average, LSJR DO concentrations meet the WQC. However, individual measured values may fall below WQC. The DO values tend to vary seasonally, with lowest values occurring in the summer. Biological oxygen demand (BOD) has been relatively stable since 1997.

Nutrient concentrations in the LSJR main stem have remained fairly stable since 1997 but recently have shown some declining trends. Controls on phosphorus use in the 1970s led to reductions in phosphorus concentrations in the LSJR. Since 1997, annual median total phosphorus values have been below the proposed numeric WQC, but individual measurements often exceeded the WQC. Nitrogen concentrations, measured as TN, have been relatively stable and generally below the proposed numeric WQC since 1997. Total ammonia concentrations have also been relatively stable since 1997 after decreasing from 1968 through 1983. Nitrogen measured as nitrate plus nitrite decreased in 2010 and 2011 after remaining relatively unchanged from 1997 through 2009.

Monitoring data indicate that turbidity in the main stem of the LSJR is decreasing. However, episodic spikes in turbidity occur with rainfall and algal blooms.

Algal blooms affect water quality in the LSJR by reducing DO, decreasing light penetration, increasing nitrogen loading by "fixing" atmospheric nitrogen, and releasing toxins. Section 2.3.7 Phytoplankton summarizes recent information about LSJR algal blooms.

Fecal coliform are indicator bacteria that may occur in the river from human or other warm-blooded animal sources. Fecal coliform levels in the LSJR main stem are in compliance with the WQC.

Annual median concentrations of metals (arsenic, cadmium, copper, nickel, silver, zinc) in the LSJR main stem generally appear stable or on a downward trend. Nonetheless, some maximum metals concentrations still exceed the WQC. Cadmium often exceeds the WQC in the freshwater reaches of the LSJR. Copper and silver often exceed the WQC in both freshwater and saltwater reaches.

2.2.8 American Heritage River Status

The entire St. Johns River, including the LSJRB, was officially designated an American Heritage River by President Clinton on July 30, 1998, in recognition of its ecological, historic, economic, and cultural significance. This designation resulted in a formal agreement that the signatory partners (Federal agencies, state agencies, and the river community) would work together to preserve and enhance the water quality and ecological and cultural resources along the St. Johns River, to stimulate economic revitalization, and to cooperate with other state, local, and Federal agencies to serve their common interest in the St. Johns River. Federal agencies entered into this agreement for all the purposes stated above, to the extent allowed by law and agency policy, including staffing and funding.

In support of these efforts, River Summits were held to discuss economic and environmental issues that affect the entire river. As a result of the community input at the River Summits, a high level working group was formed that included local government officials, nonprofit organizations, civic leaders, and key agencies. The working group endorsed a report called the "St. Johns River Restoration Strategy" in May 2003 (St. Johns River Restoration Working Group, 2003). Among other recommendations, the report called for the creation of a river-wide nonprofit organization to support the goals of the American Heritage River Initiative and the objectives identified at the River Summits. Based on this report and recommendations, the St. Johns River Alliance was formed. The St. Johns River Alliance has an active Board of Directors and maintains a list of projects that promote river restoration, public awareness, public access, and economic links to river health (http://www.stjohnsriveralliance.com/). The St. Johns River Alliance is supported by funding from the municipalities in the St. Johns River watershed and through some private support. The Alliance has created a unique forum for key stakeholders such as citizens groups, local governments, and natural resource management agencies to share information and to promote efforts along the entire river.

2.2.9 Dredged Material Management Areas

There are several options for dredged material management. These include existing USACE facilities at Bartram and Buck Islands, placement on the beaches and nearshore immediately south of the river mouth, the existing Jacksonville Ocean Dredged Material Disposal Site (ODMDS), and a new, proposed ODMDS (**Figure 10**). Use of the rock dredged from the channel template to create artificial reefs on the continental shelf adjacent to the river mouth is a potential beneficial use option.

Conditions and rules for use of the ODMDS are defined in the Site Management and Monitoring Plan (SMMP) for the site. The plan was developed by USACE in 1997, and updated and revised between 2007 and 2010. The USEPA approved the revised plan (Meiburg 2010). Having used the ODMDS for channel maintenance dredged material disposal, the ODMDS (**Figure 9**) has available capacity of about 3 to 4 million cubic yards. Capacity is further discussed in the paragraphs below.

The Naval Station Mayport has an annual maintenance dredging volume of about 450,000 cubic yards. The effects of deepening the Naval Station Mayport harbor and channel will likely result in an increase of about 2%, 7%, and 2% in sedimentation within the Naval Station Mayport turning basin, Naval Station Mayport entrance channel, and Federal navigation entrance channel, respectively (NAVFAC 2008 in USEPA 2012). The USEPA estimated annual shoaling rates in Jacksonville Harbor channel at 1,120,000 cubic yards/year (USEPA 2012). The capacity of the existing USACE upland confined disposal facilities and ODMDS to handle the current maintenance dredging needs will reach an endpoint in the near future, see **Appendix J**.

Some beach nearshore quality material could be placed on beaches or the nearshore to the south of the river mouth (**Figure 10**). The Final EIS for the ODMDS and EPA designation of the new ODMDS site is expected to be complete in 2014.

The USACE is required by the SMMP to record a variety of details about each load disposed in the ODMDS and perform a bathymetric survey to verify disposal success within 60 days of completion of the disposal effort. The revised plan includes a Regional Biological Opinion (RBO) for swimming sea turtles, whales, and sturgeon. The RBO contains "mandatory terms and conditions to implement reasonable and prudent measures that are associated with an "Incidental Take" that is also specified in the RBO" (Meiburg 2010).

FIGURE 10: USACE PROJECT FOOTPRINT AND POTENTIAL DREDGED MATERIAL MANAGEMENT AREAS

2.2.10 Land Use

Dominant land use types include urban, upland forest, wetlands, and agriculture. Upland forest is primarily (23%) pine plantation which provides the raw material for pulp and paper mills in Palatka and Fernandina Beach (http://cpbis.gatech.edu/data/mills-online-new?state=Florida). The greatest density of urban land uses occurs in Jacksonville/Duval County and northern St. Johns and Clay counties. Development is moving toward southeast Duval, and deeper into St. Johns and Clay counties. At the upper end of the lower St. Johns River, East Palatka continues to expand. Agriculture, concentrated in the "Tri-County Agricultural Area" (TCAA) of Flagler, St. Johns, and Putnam counties, includes row crops (primary potato and cabbage) and sod farms. A large portion of the stormwater discharge from the TCAA reaches the St. Johns River. Wetland areas occur south of Palatka to Lake George, interspersed throughout the TCAA, and as part of St. Johns River tributary drainage basins including Rice, Deep, 12-Mile, Six-Mile, Black, and Julington creeks, and the Ortega River. Within the City of Jacksonville, Arlington, Trout, and Broward rivers, as well as Dunns Creek drainages include some wetlands in their upstream extents. At the St. Johns River mouth, the Timucuan Ecological and Historic Preserve includes 46,000 acres of estuarine wetlands bordering the St. Johns and Nassau Rivers (the estuarine drainage north of the St. Johns River, the Intracoastal Waterway, has extensive bordering salt marshes to the south of its confluence with the river and runs through the Timucuan Preserve north of the river (http://www.dep.state.fl.us/lands/submerged.htm).

2.2.11 Public Lands Adjacent to the Proposed Project Construction Area

Florida's sovereignty submerged lands include, but are not limited to, tidal lands, islands, sandbars, shallow banks, and lands waterward of the ordinary or mean high water line, beneath navigable freshwater or beneath tidally-influenced waters. The State of Florida acquired title to sovereignty submerged lands on March 3, 1845, by virtue of statehood. The Board of Trustees (Governor and Cabinet) of the Internal Improvement Trust Fund holds title to Florida's sovereign submerged lands. Rule 18-21 F.A.C defines Sovereignty Submerged Lands Management. All the submerged lands outside the Federal channel are claimed as public lands by the state of Florida except those relatively few individual properties that have been grandfathered in or otherwise exempted from state ownership. The open waters of the main channel, the marshes and channels at the mouth of the river and elsewhere adjacent to the proposed construction site are public. In addition, at the mouth of the river, the Timucuan Ecological and Historic Preserve, administered by the National Park Service **(Figure 11**) has within its borders "one of the last great expanses of unspoiled coastal wetlands on the Atlantic coast" (http://www.nps.gov/foca/index.htm). The Preserve includes Kingsley Plantation on the Fort George River, listed on the National Register of Historic Places. It is the oldest remaining example of an antebellum Spanish Colonial Plantation and has the largest concentration of tabby slave

quarters in the United States. Also included in the Preserve is Fort Caroline National Memorial which is on the St. Johns River. Fort Caroline National Memorial was established in 1950 in commemoration of the 16th century French settlement of La Caroline, the Ribault Monument. The Theodore Roosevelt Area is also found within the Preserve. See the following website for the 2013 The Preserve's Foundation Document Overview:
http://www.nps.gov/timu/parkmgmt/upload/TIMU_Overview_1113-Final-2-2.pdf.

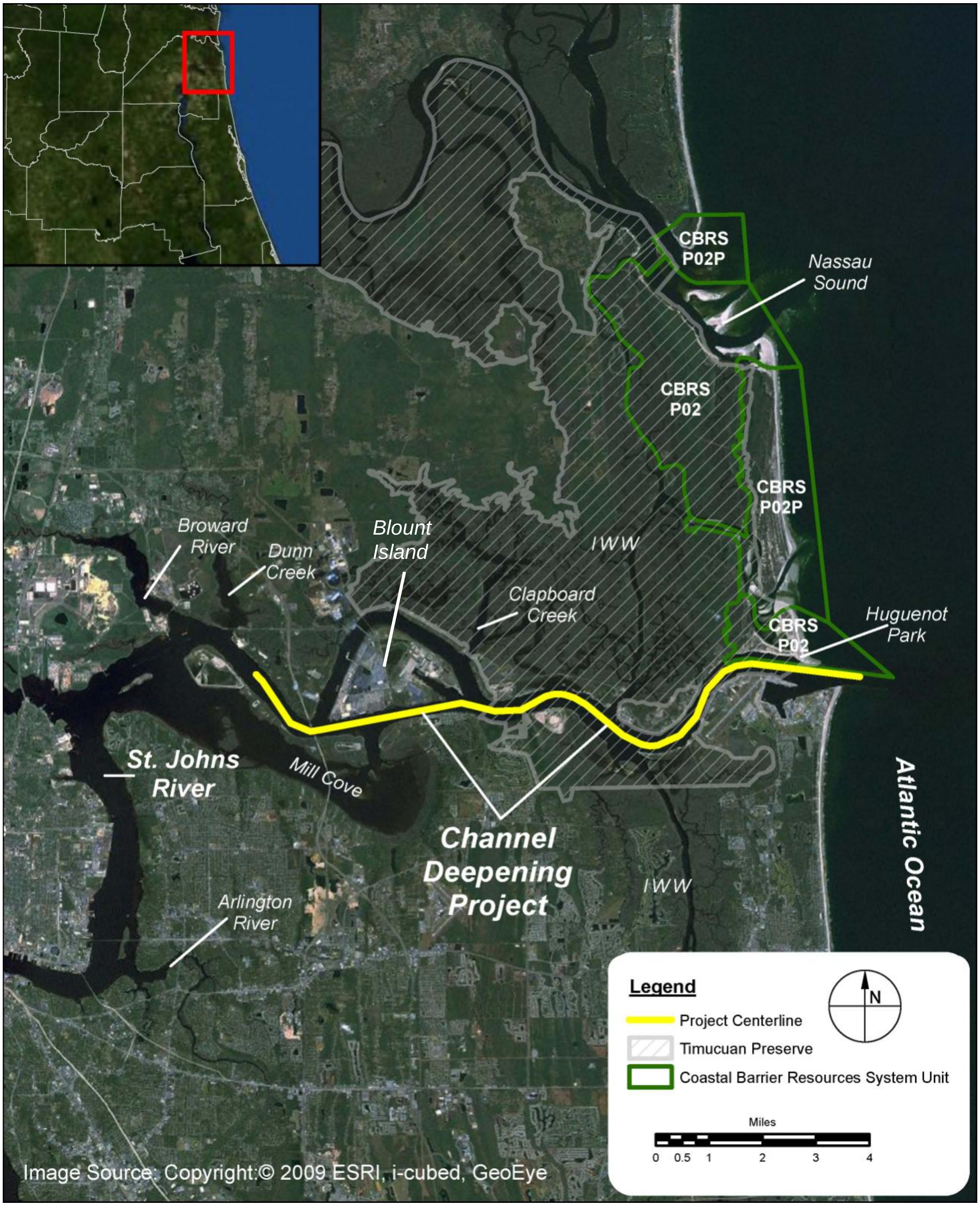


FIGURE 11: TIMUCUAN PRESERVE, HUGUENOT PARK, AND CBRS UNITS IN THE PROJECT AREA

State-protected wetlands on the south side of the river and in locations bordering the preserve and Intracoastal Waterway to the south complete the public lands at the river mouth.

Huguenot Memorial Park (**Figure 11**), Federal land leased and managed by the City of Jacksonville, is a part of the Jacksonville Harbor Deepening study (USACE 2012b). The park is managed "to protect natural resources while providing recreational benefits to the residents and tourists of Duval County, Florida". The park lands are also part of the Coastal Barrier Resources System (see Section 2.2.12 below).

<u>The Timucuan Ecological and Historic Preserve</u>

In 1988 Congress created the Timucuan Ecological and Historic Preserve as part of the National Park System. The Timucuan Preserve was created to "preserve certain wetlands and historic and prehistoric sites in the St. Johns River Valley" and to protect the many cultural resources present at the preserve. It encompasses approximately 46,000 acres that include the confluence of the Nassau and St. Johns Rivers **(Figure 11)**. The preserve is bounded by the Atlantic Ocean and Little Talbot Island to the east, the Nassau River to the north, and the St. Johns River to the south. Pearson Island, Fanning Island, and the northern portion of Black Hammock Island are three small areas in the preserve that are heavily developed. These areas within the preserve boundary are not considered part of the preserve.

Approximately three-quarters of the preserve consist of tidal creeks and marshes that form an estuarine system of salt marsh, coastal hammock, and marine and brackish waters. The estuary is the largest marsh-estuarine system on the east coast of Florida and is the only example of an Atlantic Sea Island estuarine system in Florida. The estuary is one of the most productive in Florida, based on commercial landings of fin-fish. The area provides habitat for several state- and federally-listed rare, threatened, or endangered species. Lands and waters in the preserve are owned by the Federal government, the State of Florida, the City of Jacksonville, non-profit organizations, and private individuals. Preserve lands are managed by the National Park Service (NPS).

Because the preserve is 75% wetlands and open water, water-related issues naturally predominate. For that reason, land use anywhere in the associated watersheds connected by either groundwater or surface water has the potential to affect the preserve (NPS 1996).

The NPS is a cooperative partner of the Three Rivers Conservation Coalition. Other partners include the FDEP State Parks system, FDEP Coastal and Aquatic Managed Areas (CAMA), and the Nature Conservancy. This partnership was established with the purpose of preserving water quality, and providing assistance and coordination of data collection within and adjacent to the

Timucuan Preserve. An ongoing priority of the Three Rivers Conservation Coalition is to be proactive in reviewing plans and interacting with local governments to ensure that planning efforts help protect water quality.

The NPS is also an active player in collecting water quality data with the City of Jacksonville and the Nassau-St. Johns River Aquatic Preserve. Every two months, the City of Jacksonville monitors ambient water quality at 12 stations within the preserve. The NPS provides field support as needed, as well as funding for the monitoring of chlorophyll *a*. The NPS is also proactive in reviewing zoning changes and dock permits, general development plans, and the management plans of other agencies to ensure water quality protection standards are met.

<u>Other Parks and Preserves</u>

Within and near Jacksonville at the river mouth, on the main river, and in tributaries of the main channel, a large number of parks and preserves are managed by the City of Jacksonville, the State of Florida and the Federal government (http://www.coj.net/departments/parks-and-recreation/):

City of Jacksonville

- Alimicani Park
- Betz Tiger Point Preserve
- Castaway Island Preserve
- Cedar Point Park
- Dutton Island Park and Preserve
- Huguenot Memorial Park (Federal lands managed by the City)
- Helen Cooper Floyd Park
- Julington Durbin Creeks Preserve
- Kathryn Abbey Hanna Park
- Reddie Point Preserve Sal Taylor Creek Preserve

State Park Partner Preserves

- Amelia Island State Park
- Big Talbot Island State Park
- Fort George Island State Cultural Site
- George Crady Bridge Fishing Pier
- Little Talbot Island State Park
- Pumpkin Hill Creek State Preserve
- Nassau River - St. Johns River Marshes and Fort Clinch Aquatic Preserves
- Yellow Bluff Fort Historic State Park

National Park Partner Preserves

- The Timucuan Ecological and Historic Preserve

- Fort Caroline National Memorial
- Kingsley Plantation
- Cedar Point
- Theodore Roosevelt Area

Fort Caroline National Memorial and Ribault Column in Fort Caroline National Monument are adjacent to the St. Johns River and frequently host events such as living history encampments, educational programs, weddings, naturalization ceremonies, bird watching, and nature hikes. Some members of the public may also use the Fort Caroline boat dock to access these events.

Other well-known parks and preserves along the river or on tributaries to the main stem include Bayard Point Conservation Area, Moccasin Slough, Haw Creek State Preserve, Upper Black Creek, Kingsley Lake, and the North Fork of Black Creek. These parks and preserves are all used by members of the public for passive and active recreation.

2.2.12 Coastal Barrier Resources

Recognizing the importance of barrier islands to the overall stability of the shorelines of America and the damage done to barrier islands and their functions by subsidizing their development, Congress passed the Coastal Barrier Resources Act (CBRA of 1982, amended 1990) to remove Federal incentives to develop these areas. The act made designated Coastal Barrier Resource System (CBRS) units ineligible for most new Federal expenditures and financial assistance. The mouth of the St. Johns River includes two CBRA Units: P02 and P02P (**Figure 11**). The "P" designation recognizes that parts are already protected under other laws as state or Federal reserves. Located on the north side of the confluence of the St. Johns River and the Atlantic Ocean (opposite Mayport Naval Station) P02 and P02P include Ft. George Island, Little Talbot Island, Talbot Island, Coon Key, Long Island, Bird Island, Nassau Sound, and the southern tip of Amelia Island.

2.2.13 Air Quality

Jacksonville has experienced impacts to air quality as a result of urban, suburban, and industrial growth. By 1948, air pollution in Jacksonville had reached levels high enough to damage nylon clothing. By the early 1960s air pollution was suspected of causing vegetation damage and airborne particles were damaging automobile paint (JCCI, 2007; Sheehy et al., 1963). A pilot air quality study measured Jacksonville air contaminants in 1961 (Sheehy et al., 1963), finding airborne fluoride concentrations high enough to damage vegetation, photochemical smog production, and air pollutant transport from Jacksonville across the St. Johns River.

Implementation of air emissions controls substantially reduced air pollution in the Jacksonville area. The USEPA currently defines the Jacksonville/Duval County area as an air quality attainment area meaning the area meets Federal ambient air quality standards. In accordance with Federal and state regulations, the City of Jacksonville Air Quality Branch (AQB) monitors and reports concentrations of carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead and particulate matter, and provides most state air pollution source permitting functions for Duval County. The AQB also provides support for businesses in meeting local, state, and Federal standards. Current air quality pollutant concentrations are available at http://www.coj.net/departments/neighborhoods/environmental-quality/air-quality.aspx.

The City of Jacksonville monitors ambient air quality at twelve stations "strategically located throughout Duval County" (personal communication, Steve Pace, City of Jacksonville). The data provide the information necessary to develop the air quality index the city reports on a daily basis. Based on an index combining levels of very fine particulate matter (PM2.5) and ozone, most days in most years (87% of the last six years), air quality in Jacksonville has measured "Good" (**Table 6**). During 12% of the time the air was judged "Moderate", and less than 1% of the time the air fell below Moderate (**Table 6**). **Table 7** provides the annual average concentration of six national primary air pollutants. The USEPA provides a detailed discussion of air pollution monitoring, air quality standards and criteria pollutants at http://www.epa.gov/oaqps001/montring.html#standards.

Table 6: Air Quality Index (PM2.5 and Ozone Concentration based; provided by City of Jacksonville 2013)

	Days Per Year					
Year	**Good**	**Moderate**	**Unhealthy For Sensitive Groups**	**Unhealthy**	**Very Unhealthy**	**Hazardous**
2007	309	50	3	3	0	0
2008	312	53	0	0	0	0
2009	320	44	1	0	0	0
2010	312	52	1	0	0	0
2011	305	52	5	3	0	0
2012	342	21	2	1	0	0
	87%	**12%**	**<1%**	**<1%**	**0**	**0**

Good - Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate - Air quality is acceptable; some pollutants may present a moderate health concern for very few people.
Unhealthy for Sensitive Groups - General public is not likely to be affected; people with lung disease, older adults, and children are at a greater risk from exposure to ozone, whereas persons with heart and lung disease, older adults and children are at greater risk from the presence of particles in the air.
Unhealthy - Everyone may begin to experience some adverse health effects, and members of the sensitive groups may experience more serious effects.

Table 7: City of Jacksonville Criteria Air Pollutant Average Annual Concentrations (provided by City of Jacksonville 2013)

POLLUTANT	2007	2008	2009	2010	2011	2012	AVERAGE
CO (ppm) (CP)	0.26	0.22	0.17	0.22	0.16	0.17	**0.20**
NO2 (ppb) (CPO)	9.9	9.4	8.2	9.3	8.4	8.1	**8.88**
Ozone - O3 (ppb)	29.2	27.2	24.5	27.2	27.2	24.4	**26.62**
SO2 (ppb)	1.05	0.83	0.6	0.75	0.62	0.12	**0.66**
PM2.5 -FRM* (µg/m3)	10.21	8.78	8.01	8.7	8.77	7.51	**8.66**
PM2.5 -FEM* (µg/m3)	11.39	9.42	8.11	7.17	8.11	5.83	**8.34**
PM10 -FEM* (µg/m3)	24.34	21.82	21.88	21.53	21.39	19.41	**21.73**
*FRM - Federal Reference Method							
*FEM - Federal Equivalence Method							

2.2.14 Noise

The ambient (or surrounding) noise level of the urbanized portions of the study area (including the project construction area and upstream to about River Mile 40) includes human (recreational boat traffic, ship engines, occasional military aircraft, construction activities, etc.) and natural (wind, waves, birds, etc.) sources. All of these sources are intermittent; their strength, as well as frequency, can vary considerably due to the type of activity, distance from receptor, and weather conditions. The USEPA has established that construction noise resulting in an hourly equivalent sound level of 75 dB at a sensitive receptor (e.g., hospital, residence, church) would represent a significant impact. During operation, heavy equipment and other construction activities generate noise levels ranging typically from 70 to 90 dB at a distance of 50 feet. The portion of the study area where construction would occur is within 1,000 feet of Mayport, residential housing on Batten and Fanning Islands on the north banks (approximately River Miles 2-4), and residential neighborhoods on the river banks adjacent to Blount Island. In addition to noise in the air, pile driving and other construction and/or upgrade activities can produce underwater noise. For underwater environments, ambient noise includes tides, currents, waves, as well as noise produced by marine mammals and by humans. Human-caused noise can be generated from the operation of vessels or boats, aircraft, dredging equipment, and other activities.

2.2.15 Hazardous, Toxic, and Radioactive Waste (HTRW)

Hazardous and toxic materials and waste are not anticipated to be encountered within the proposed project footprint. Hazardous materials and waste are identified and regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Occupational Safety and Health Act of 1970 (OSH Act); the Resource Conservation and Recovery Act (RCRA); the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); and the Emergency Planning and Community Right-to-Know Act (EPCRA). The Clean Water Act (CWA) also addresses hazardous materials and waste through Spill Prevention, Control, and Countermeasures (SPCC) and National Pollutant Discharge Elimination System (NPDES) requirements. Per the Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Wate Amendments of 1984 (42 USC 6903[5]), the definition of hazardous waste is as follows: The term ''hazardous waste'' means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may: (A) Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

An HTRW Assessment (Reconnaissance Phase) for River Miles 0-20 of the St. Johns River Federal channel, as well as various potential Dredged Material Management Area (DMMA) sites in the project vicinity was conducted by USACE. The scope of the proposed deepening project has been reduced to River Miles 0-13. Based upon a review of current and previous HTRW assessments, and due to the reduction of the project scope which eliminated potential areas of concern from the assessment, the project area is highly likely to be free of HTRW materials.

Within the current scope of the project, off-site concerns were only noted from the current and historic operations at the Atlantic Marine Florida LLC facility located at 8500 Heckscher Drive. These concerns referenced isolated incidents that are not likely to affect the project area due to the size of the incidents, the satisfactory remediation of the incident impacts, the approximately 1000-foot distance of the channel from the shore, and the high velocity currents (up to 5 feet/sec) in this area. Additionally, testing of channel material in this location has historically not shown evidence of HTRW materials. Construction or maintenance dredging in this area of the Federal channel is also currently authorized by the USEPA to use the Ocean Dredged Material Disposal (ODMDS) under Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

A separate HTRW Assessment was completed in December 2004 for the Jacksonville Harbor Mile Point Project, which included the Atlantic Marine Facility site within the report's assessment area. This report also concluded that "the review of available HTRW data, historical sediment and water quality data, aerial and water site visits, and the frequency of dredging activity within the project area all indicate that the site is highly likely to be free of hazardous and toxic materials and waste." The report also cited a 2004 Jacksonville District, USACE interview regarding USEPA Section 103 suitability testing of the river sediments for offshore disposal from this location. According to that interview, no contamination has been detected in that section of the river, and the sand nature of the sediment was not conducive to absorption of hazardous material into the sediment particulates.

2.2.16 Cultural Resources

The earliest widely accepted date of occupation by aboriginal inhabitants of Florida dates from around 12,000 years ago (Milanich 1994). This earliest cultural period, called the Paleo-Indian period, lasted until about 10,000 YBP (years before present). Sea level was lower and the continental shelves were exposed (an area almost twice the width of the current size of the state). The configuration of the St. Johns River was possibly different than it is presently. The river was smaller and more deeply entrenched due to lower sea level, exposing land on both sides of the river that is now submerged. Channel meanders, point bars, and bluffs that once existed have been eroded and are now submerged by sea level rise.

Few Paleo-Indian terrestrial archaeological sites are recorded in northeastern Florida; however, a fluted projectile point indicative of this time period was discovered at Jacksonville Beach in the 1950s (Milanich 1994). It is possible these types of sites are located underwater on the now submerged river banks or have been lost to erosion.

During the Archaic period (ca. 10,000 YBP - ca. 2500 YBP), a wider range of resources was exploited and may have led to a more sedentary existence. Sea level rose to its present position. Known terrestrial archaeological sites in Duval County mostly date to the Late Archaic time period and are located along existing inland waterways and marshes. Presumably, Early Archaic sites (~9,000 YBP) are located in now drowned river valleys and positive relief features offshore since sea level rose around 10,000 years ago. Two inundated, prehistoric sites are recorded in the St. Johns River, including one of the earliest recorded Archaic sites in Duval County (9DU21117) dated to around 6,000-7,000 YBP.

The Age of Exploration into northeastern Florida began in 1520 with the discovery of the St. Johns River by the Spanish. Initially the French, under Jean Ribault in 1562, and then the Spanish attempted to colonize this area of northeastern Florida. Fort Caroline was built along the banks of the St. Johns River by the French in 1564, but was captured by the Spanish in 1565. Spain maintained control of northeastern Florida until 1763 when the British took it over (Tebeau 1999).

During the American Revolution, British Loyalists from Georgia and South Carolina fled to Florida. The British sympathizers sent warships and constructed floating batteries to guard the St. Johns River (PCI 2012). Great Britain returned

Florida to the Spanish in 1784 and finally Florida became a part of the United States in 1821.

From the early Colonial period onward, numerous sailing vessels transited into the St. John's River and sailed up and down the Atlantic Coast. In 1829, the first steam boat, the *George Washington*, entered the St. Johns and ushered in the advent of steamships and expanded maritime traffic and port development (PCI 2012). Florida's ports dominated the lumber and naval stores industry at this time and Jacksonville and Fernandina grew in economic status (Tebeau 1999).

While Florida was not a major participant during the Civil War, it supplied men and goods to the Confederacy (Tebeau 1999). Many steamer captains in Jacksonville became blockade runners to supply these goods, but by 1862, the Union had blockaded the river and Confederate forces had abandoned Jacksonville (PCI 2012). Despite being impoverished after the Civil War, Jacksonville rebounded with timber, fishing, shipbuilding and steamship packet industries. By 1900, Jacksonville had become a thriving port with a large population (Tebeau 1999).

More than 50 shipwrecks have been recorded in the vicinity of Duval County, including the St. John's River and offshore in the Atlantic (Singer 1996). None are previously recorded in the project area by the Florida Master Site File (FMSF). To the north of the project area in Nassau County, there are four known 18 and 19th century shipwrecks recorded near the shore. Due to the long maritime history of the Atlantic Coast and the St. Johns River, and fact that the once exposed river valleys were available for occupation during prehistory, there is potential for submerged historic properties to be adversely impacted by the proposed project.

2.2.17 Aesthetics

The lower St. Johns River in the project construction area includes major commercial shipping activity, recreational boating, fishing, and sailing. The study area lies in the near vicinity of commercial port facilities, businesses, and residential neighborhoods. However, this portion of the St. Johns River also has many scenic qualities and perhaps the most remarkable of which are the extensive salt marshes at the river mouth.

Upstream of the river mouth and harbor for the next thirty to forty miles, the Jacksonville metropolitan area and neighborhoods are visible along the waterfront and reflect the urbanized character of this portion of the watershed. The river then becomes more rural in nature, with more widely spaced residences and undeveloped shoreline upstream to Palatka and beyond. Commercial river traffic becomes much less common upstream of approximately River Mile 25 as the river broadens and becomes much more shallow (typically ten feet or less).

2.2.18 Environmental Justice

The goal of environmental justice is to ensure that all Americans are afforded the same degree of protection from environmental and health hazards and have equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work. On February 11, 1994, President Bill Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," to focus Federal agencies' attention on the environmental and human health conditions in minority and/or low-income communities with the goal of achieving environmental justice. The Executive Order directs Federal agencies to make environmental justice part of their mission to the greatest extent practicable and permitted by law.

With respect to each Federal agency's environmental justice program, the Executive Order mandates objectives in the following areas: (1) identify disproportionately high and adverse human health or environmental effects on minority and low income populations; (2) coordinate research and data collection; (3) conduct public meetings; and (4) develop interagency model projects.

Scoping letters for the project were prepared in 2007. The first public meeting was held in 2009. Bi-monthly agency and public conference calls have been held beginning in August 2012. Minutes from these calls are available on the Jacksonville District USACE website. Several public meeting have also been held as part of the General Re-evaluation Report (GRR-11) and these minutes are also available on the District web site: www.saj.usace.army.mil.

Jacksonville Harbor is included within the U.S. Census Bureau's delineation for the Jacksonville, Florida Metropolitan Statistical Area (MSA, 27260). Jacksonville is the principal city within this MSA, which also includes Baker, Clay, Duval, Nassau, and St. Johns counties. The 2011 American Community Survey Profile (www.census.gov) for Jacksonville, Florida indicates that the MSA household population is 311,932. The median age is 35.2 years with 30.2% of adults having graduated high school, 23.9% having some college, 8.9% having achieved an Associate's degree, 16.5% a Bachelors degree, and 7.7% having a Graduate or Professional degree. The median income is $49,192. Unemployment is 8% in the state and 7.4% in Jacksonville (Bureau of Labor Statistics).

The largest industries by employment in the MSA include Education, Health, and Social Services (19.4%), Retail Trade (12.3%), and Finance, Insurance, and Real Estate (12%). The following lists employment distribution by industry category:

•Agriculture, forestry, fishing, hunting, and mining – 0.2%
•Construction – 7.6%
•Manufacturing – 6.3%
•Wholesale trade – 3.1%

•Retail trade – 12.3%
•Transportation, warehousing, and utilities – 6.9%
•Information – 2.1%
•Finance, insurance, and real estate – 12%
•Professional and business services – 11.2%
•Education, health, and social services – 19.4%
•Arts, entertainment, recreation, accommodation and food services – 8.9%
•Public administration – 5.3%
•Other services – 4.6%

According to the JAXPORT website, the port authority employs about 150 people while many others are employed in activities related to port operations. In addition to providing commodity transportation, the Port of Jacksonville is also utilized by Carnival Cruise Lines providing a large number of jobs in cruise-related operations and activities.

2.3 BIOLOGICAL CONDITIONS

2.3.1 General Environmental Setting

The lower St. Johns is a broad and meandering river, within which lies the Federal system of navigation channels for Jacksonville Harbor. The channel deepening area includes the confluence of the lower St. Johns River and the IWW/AIWW, which is located within the City of Jacksonville, Duval County, Florida. In its first 20 miles (from River Mile 0 at the river mouth), the river includes a mix of channels dredged to accommodate deep draft vessels, and an estuary with extensive salt marshes, adjacent wetlands, and hardwood hammocks that support a diverse community of plants and animals. Regular maintenance dredging of the harbor channel is performed by USACE to maintain the authorized depth of 40 feet plus two feet of allowable over-dredge depth. The first 13 river miles of the Jacksonville Harbor project comprise the proposed channel deepening section (**Figure 10**). The IWW/AIWW is also dredged by USACE to maintain the authorized depth of 12 feet, plus 2 feet of allowable over-dredge depth.

In the vicinity of Blount Island (**Figure 10**; about River Mile 9), the old St. Johns River channel goes to the north of the island and a manmade cut runs along the south of the island. Blount Island was once a series of islands in the St. Johns River. The islands were connected using training walls along the river channel to contain the main body of water flow in the navigation channel. Dredged material from maintenance work to remove shoals was placed along the back of the training walls and gradually filled the river bottom between the islands. The manmade cut along the south side of Blount Island, known as the Dames Point-Fulton Cut, removed three sharp turns in the river to enable larger vessels in the world fleet to safely navigate the river. Material from that cut went into the Blount

Island DMMAs and into the formation of Bartram Island (**Figure 10**; formally known as Quarantine Island).

Blount Island and Dames Point between approximately River Miles 8 and 13 are major port areas operated by the Jacksonville Port Authority (JAXPORT). The river has significant commercial and military vessel traffic in the Federal navigation channel associated with the terminals at Dames Point, Blount Island, and, farther upstream, Talleyrand Terminal and Commodore Point. The river beyond Commodore Point widens, becomes much more shallow, and without the depth necessary for significant commercial vessel activity.

Upstream, a highly urbanized watershed comprises most of the next 25 river miles. South of Jacksonville and its suburbs, the river edges include forested wetlands and tributaries that drain extensive wetlands.

2.3.2 Threatened and Endangered Species

Table 8 lists threatened and endangered species that may occur in the study area, and that may be affected by the proposed work.

Table 8: Status of Listed Species that May Occur Within the Study Area

Species	***State Listing****	***Federal Listing****
West Indian (Florida) Manatee	LE	LE
Piping Plover	LT	LT
Wood Stork	LE	LE
Red Knot		C
Loggerhead Sea Turtle	LT	LT
Green Sea Turtle	LE	LE
Leatherback Sea Turtle	LE	LE
Kemp’s Ridley Sea Turtle	LE	LE
Gopher Tortoise	LT	C
Short-nosed Sturgeon	LE	LE
Atlantic Sturgeon	LT	LE
Smalltooth Sawfish	LE	LE
North Atlantic Right Whale	LE	LE

* LE=Endangered, LT=Threatened, and C=Candidate

2.3.2.1 West Indian (Florida) Manatee

The West Indian manatee is one of the most endangered marine mammals in coastal waters of the U.S. In the southeastern U.S., manatees are limited primarily to Florida and Georgia. This group constitutes a separate subspecies called the Florida manatee (*Trichechus manatus latirostris*) that comprises four recognized populations or management stocks (Atlantic Coast, Southwest, Upper St. Johns River, and Northwest), based on regional manatee wintering sites (http://www.nefsc.noaa.gov/publications/tm/tm213/pdfs/F2009App6.pdf; USFWS, 2001). Adult Florida manatees average about 3.0 meters (9.8 feet) in length and 1,000 kg (2,200 pounds) in weight. Their maximum lifespan is approximately 59 years. The age of first pregnancy is 3 to 4 years, and their gestation period for a single calf is 11 to 14 months, with an average interbirth interval of 2.5 years (USFWS 2001).

Manatees are seen mostly as solitary individuals or in groups of up to six individuals. Some larger aggregations may occur, such as feeding groups that may number up to approximately 20 individuals and winter aggregations near sources of warm water (such as power plant outfalls) that may contain hundreds of individuals (Jefferson et al. 2008).

Most manatees in the southeastern U.S. migrate between a summer range and a winter range, determined by water temperature changes. During winter months, the Florida manatee population confines itself to coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeastern Georgia (USFWS 2001). As water temperatures rise in spring, individuals disperse from these winter aggregation areas, some migrating as far north as coastal Virginia (USFWS 2001). Manatees inhabit both salt and freshwater of sufficient depth (1.5 meters to usually less than 6 meters) throughout their range. They are usually found in canals, rivers, estuaries, and saltwater bays, but on occasion have swum as far as 3.7 miles off the Florida coast (USFWS 2001).

The West Indian (Florida) manatee (*Trichechus manatus latirostris*) is known to occur in the study area primarily during the spring, summer, and fall months. As water temperatures decline during the winter months, manatees generally leave the St. Johns River, as well as the IWW, and move to warm water refugia such as springs or industrial warm water discharges (O’Shea and Ludlow 1992). Since 1993, researchers at Jacksonville University have been conducting year round bi-weekly aerial and aquatic manatee surveys of the St. Johns River and other water bodies within Duval County. Surveys conducted during 2009 through 2011 recorded approximately 70 manatees within the surveyed area. These data can be viewed at http://www.ju.edu/marco/.

Demographic analysis reported by Runge et al. (2004 and 2007) indicates that manatee populations are increasing or stable over much of Florida except for the Southwest Region. The analysis suggests that the Atlantic Coast Region is experiencing a population growth rate of 3.7% per year. Other researchers have also indicated that wintering populations of manatees along the Atlantic Coast have been increasing at rates of 4-6% per year since 1994 (Craig and Reynolds 2004). The Florida Fish and Wildlife Conservation Commission (FWC) reported a total of 4,834 manatees during the annual manatee synoptic survey conducted in 2011 statewide. A total of 5,076 animals were reported in 2010 statewide. Due to warmer than average weather, the FWC did not conduct the annual manatee synoptic survey in 2012.

Manatees are herbivores and consume freshwater and marine plants of all kinds. They spend as much as eight hours per day grazing, and consume both native plants (e.g. *Vallisneria americana*, the dominant submerged aquatic plant species in the LSJR), as well as exotics such as water hyacinths and hydrilla (www.fws.gov/endangered/esa-library/pdf/manatee.pdf*).*

Critical habitat was designated for the manatee in 1976 (50 Code of Federal Regulations [CFR] § 17.95(a)) and encompasses the St. Johns River, including a portion of the proposed project construction area (i.e., the entrance channel and Federal navigation channel). Like other Atlantic coast counties where manatees occur, Duval County has an FWC approved manatee plan, regularly updated, that provides extensive detail on the manatee activities in the river and the various manatee zones in the river (http://myfwc.com/wildlifehabitats/managed/manatee/protection-plans/).

2.3.2.2 Piping Plover

The piping plover is listed as endangered in Canada and the inland United States, and as threatened along the Atlantic coast. This small shorebird can occur inland but prefers sandy beaches and tidal mudflats where it forages along the waterline or high up the beach along the wrack line. Piping plovers eat a variety of insects and aquatic invertebrates. Population declines resulting in its Federal listing resulted from direct and unintentional harassment by people, dogs, and vehicles; destruction of beach habitat for development; and changes in water level regulation (Haig 1992). Piping plover populations have been increasing since its listing in 1985. Designated critical habitat for wintering piping plovers occurs north of the St. Johns River inlet, including Huguenot Memorial Park and other areas (**Figure 12:** Unit FL-35). Duval County is one of the Florida counties in which piping plovers are “usually seen” (http://www.fws.gov/verobeach/MSRPPDFs/PipingPlover.pdf).

2.3.2.3 Wood Stork

Wood storks (*Mycteria americana*) are large, long-legged wading birds that primarily occur in the southeastern United States with nesting areas mostly restricted to Florida, Georgia, and South Carolina. A highly colonial species, wood storks generally nest in large rookeries and feed in flocks. The primary habitat for wood storks includes freshwater and estuarine wetlands. Nesting mostly occurs in cypress forests and mangrove swamps. Wood storks feed in freshwater marshes, tidal creeks and pools, and manmade aquatic habitats such as roadside ditches and retention ponds.

Presently, the wood stork breeding population is believed greater than 8,000 nesting pairs. The southeast United States breeding population of the wood stork declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960, and to a low of approximately 5,000 pairs in the late 1970s (USFWS 2005). Since 2003, the 3-year population averages have exceeded 6,000 nesting pairs. Although these averages fall below the benchmark of 10,000 nesting pairs identified in the recovery plan to delist the species, it does meet the criteria to "downlist" the species from endangered to threatened. As such, the USFWS has proposed to reclassify the continental United States breeding population of wood stork from endangered to threatened under the Endangered Species Act of 1973. The proposed rule is currently under review.

In the project vicinity, wood storks likely feed within the tidal channels and pools and other shallow water habitats associated with the St. Johns River. Portions of the project site are within the 13-mile foraging buffer of 4 nesting colonies of Wood Storks in Duval County: Jacksonville Zoo, Cedar Point Road, Dee Dot Ranch, and Pumpkin Hill (**Figure 13**).

2.3.2.4 Red Knot

The Red Knot (*Calidris canutus rufa)* is a medium-sized shorebird that undertakes an annual 30,000 kilometer hemispheric migration, one of the longest among shorebirds. This bird must rest and feed during migration and some individuals may overwinter in Florida. In Florida, the Red Knot feeds on coquina clams (*Donax* sp.), periwinkles, various other mollusks, crustaceans, and other invertebrates found along the shoreline especially in the intertidal zone. Just north of the harbor entrance is Wards Bank at the Huguenot Park which is identified as an important stopover and wintering habitat for the species. Further south, Anastasia Island (south of St. Augustine) in St. Johns County, Florida is of similar importance. North of the project along the Florida and Georgia coasts, the barrier islands (many of which are, at least partly, in state or Federal ownership) are also habitat for Red Knots (U.S. Fish and Wildlife Service 2007 and Harrington 2001).

FIGURE 12: LOCATIONS OF WINTERING PIPING PLOVER CRITICAL HABITAT UNITS IN THE PROJECT VICINITY (HTTP://WWW.FWS.GOV/PLOVER/FINALCHMAPS/PLOVER_FL_35_TO_36.JPG)

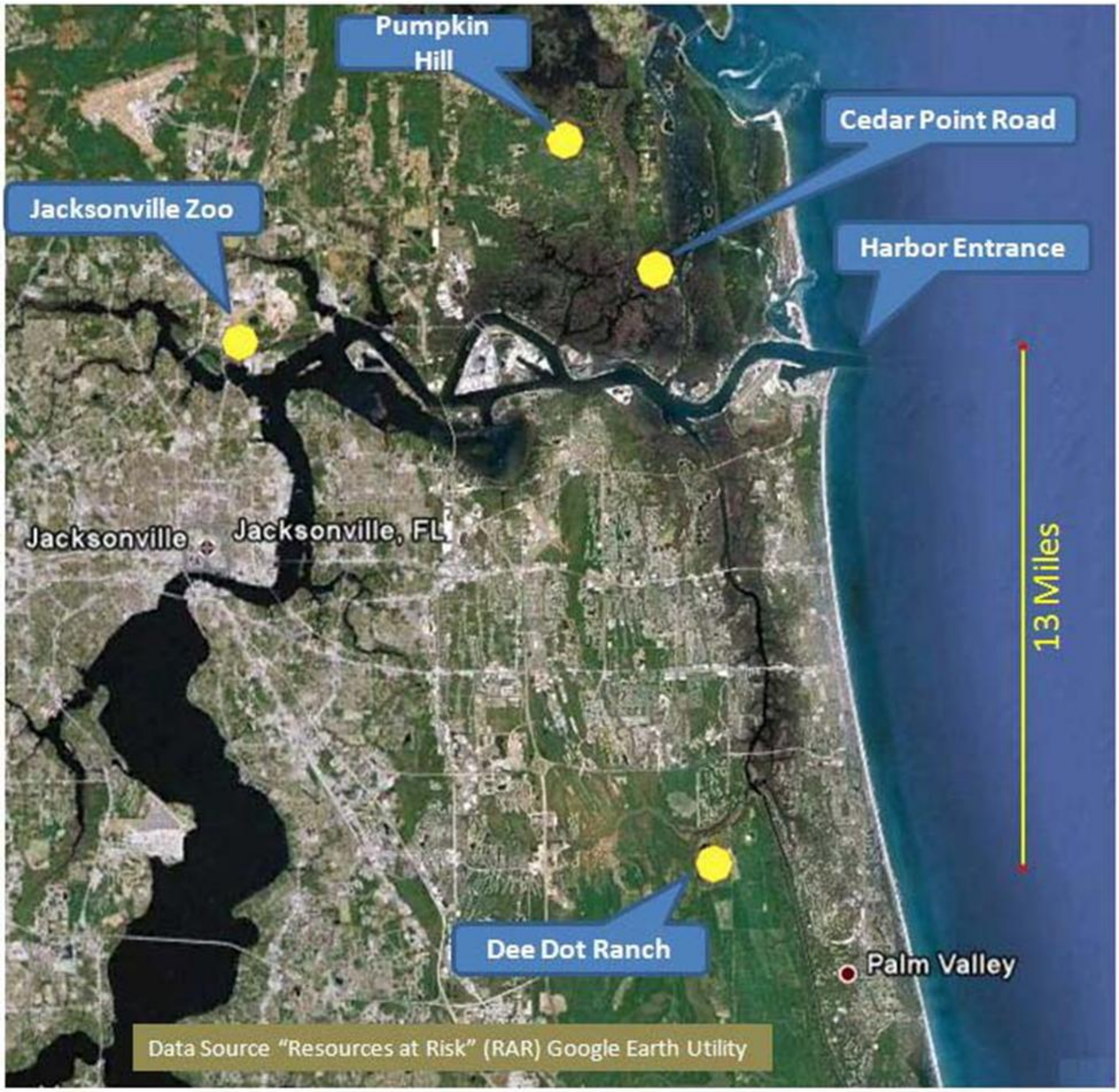


FIGURE 13: WOOD STORK NESTING COLONIES IN THE PROJECT VICINITY

2.3.2.5 Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) is the most common species of sea turtle nesting along the Florida coast. The loggerhead is distributed worldwide throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Loggerhead turtles use different habitats within the oceanic and coastal environment during different life stages. Adult loggerheads are known to make considerable migrations between foraging and nesting grounds. Post-hatchlings and young juveniles live an oceanic existence drifting with ocean currents and are commonly associated with sargassum (a type of brown algae) rafts and open ocean drift lines. At some point, oceanic juveniles migrate to neritic (shallow coastal) waters and continue maturing until adulthood. Juvenile loggerheads commonly feed within the bays, sounds, and estuaries along the Atlantic and Gulf coasts; however, adults infrequently use these inshore waters (http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm#description).

The USFWS and NOAA-NMFS listed the loggerhead sea turtle as threatened throughout its range in July 28, 1978 (43 FR 82808). On September 22, 2011 (76 FR 58868), nine population segments were listed as threatened (4) or endangered (5). The northwest Atlantic population is considered threatened. Critical habitat is proposed for Loggerhead sea turtles throughout much of the Atlantic along and off the coast of the Southeast United States and in the Gulf of Mexico (25 March 2013, 76 FR 17999). The proposed critical habitat unit closest to the project is designated as follows: LOGG-N-14—*Southern Boundary of Kathryn Abbey Hanna Park to Mantanzas Inlet, Duval and St. Johns Counties, Florida:* This unit contains nearshore reproductive habitat only. The boundaries of the unit are nearshore areas from the south boundary of Kathryn Abbey Hanna Park to Matanzas Inlet (crossing St. Augustine Inlet) from the mean high water (MHW) line seaward 1.6 kilometers.

The FWC Fish and Wildlife Research Institute database shows that from 2007 through 2011, loggerhead sea turtles deposited 522 nests on Duval County beaches. Considerably higher density of nesting is reported further south from Brevard through Broward Counties in Florida. The FWC recently performed a detailed statistical analysis of long-term loggerhead nesting data. The study revealed three distinct trends including a 23% increase in nesting between 1989 and 1998 followed by a sharp decline over the next ten years. Between 2007 and 2012, loggerhead nesting increased dramatically. From the study, the FWC concluded overall the change in nesting counts between 1989 and 2012 is positive.

During previous dredging operations, the USACE endangered species observers have occasionally seen loggerhead sea turtles within the study area. A review of the USACE Sea Turtle Database indicates that hopper dredging within Jacksonville Harbor between 1994 and 2008 resulted in the take of three loggerheads. All three takes occurred between St. Johns approximately River Mile 4 and the entrance channel.

2.3.2.6 Green Sea Turtle

The USFWS and NOAA-NMFS currently list the green sea turtle (*Chelonia mydas*) as threatened throughout its range, except for breeding populations in Florida and along the Pacific coast of Mexico where it is listed as endangered. It was listed as endangered/threatened on July 28, 1978. No critical habitat occurs in the project vicinity.

Green turtles typically occupy three habitat types: high-energy oceanic beaches, convergence zones in the pelagic (open ocean) habitat, and benthic (bottom) feeding grounds in relatively shallow, protected waters. Except when migrating Green Sea turtles are attracted to fairly shallow waters inside reefs, bays, inlets, lagoons, and shoals with an abundance of marine grass and algae. Green turtles use these shallow water areas for foraging. Hatchlings have been observed to seek refuge and food in sargassum rafts.

The turtles migrate from nesting areas to feeding grounds, which sometimes occur several thousand miles away. Most green turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting areas to their feeding grounds. The major nesting beaches always lie in places where the seawater temperature is greater than 25º C. Green turtles apparently have strong nesting site fidelity and often make long-distance migrations between feeding grounds and nesting beaches. Green turtles require open beaches with a sloping platform and minimal disturbance for nesting. Females deposit egg clutches on high energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line (NOAA-NMFS and USFWS, 1991).

The green turtle has a worldwide distribution in tropical and subtropical waters. Major Green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers and include areas of the Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina, and in larger numbers in Florida.

The Florida green turtle nesting aggregation is recognized as a regionally significant colony. Along northeast Florida beaches, the primary nesting season for green turtles is mid-May through August. Nassau and Duval County beaches together recorded 12 or fewer nests during 2007 through 2011. In the Southeast U.S., most green turtle nests occur south of Cape Canaveral; the beaches of five southeast Florida coast counties (Brevard, Indian River, St. Lucie, Martin, and Palm Beach counties) accounted for most of the nests each year.

Green turtles have been recorded by USACE endangered species observers within the study area waters. The USACE Sea Turtle Database (http://el.erdc.usace.army.mil/seaturtles/disclaimer.cfm) indicates that hopper dredging within the Jacksonville Harbor between 1994 and 2008 resulted in the take of one green turtle between St. Johns approximately River Mile 4 and the entrance channel.

2.3.2.7 Leatherback Sea Turtle

The USFWS and NOAA-NMFS currently list the leatherback sea turtle (*Dermochelys coriacea*) as endangered. It was initially listed throughout its U.S. and foreign range on June 2, 1970 (35 FR 8491-8498). Critical Habitat in the

U.S. Virgin Islands was designated on September 26, 1978 and March 23, 1979 (43 FR 43688-43689 and 44 FR 17710-17712, respectively). The leatherback is considered an endangered species worldwide and is listed in Appendix 1 of the Convention on International Trade in Endangered Species (CITES), a list of the most highly endangered animals worldwide.

The leatherback is the largest living turtle and is so distinctive that it is placed in its own unique family, *Dermochelyidae* (NOAA-NMFS and USFWS, 1992a). The adult leatherback can reach lengths up to 8 feet and weigh 2,000 pounds. Their shell comprises a mosaic of small bones covered by firm, leathery skin with seven longitudinal ridges. The skin is predominantly black and the flippers are black with white margins (http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/leatherback-sea-turtle.htm).

The leatherback is the most pelagic of the sea turtles and moves into coastal waters only during the reproductive season. These turtles seldom travel in large groups, although small groups may move into coastal waters following concentrations of jellyfish. Leatherbacks inhabit primarily the upper reaches of the open ocean, but they also frequently descend into deep waters from 650 to 1,650 feet in depth. Adult females require sandy nesting beaches backed with vegetation and sufficiently sloped so the crawl to dry sand is not too lengthy. These preferred beaches are relatively close to deep waters and generally rough seas.

In the Atlantic the leatherback turtle may be found as far north as Cape Sable off of Nova Scotia, Nova Scotia, Newfoundland, and the British Isles to as far south as the waters of Guyana, French Guiana and Columbia. Nesting occurs from February through July with sites located from Georgia to the U.S. Virgin Islands. During the summer, leatherbacks tend to be found along the eastern seaboard of the U.S., from the Gulf of Maine to the middle of Florida.

From 2007 through 2011, the FWC Fish and Wildlife Research Institute had reported thirteen leatherback turtle nests on Duval County beaches. The small nesting population within Florida is increasing. Nesting populations at all 68 beaches evaluated within the state are increasing from 3.1% to 16.3% per year, and the number of nests across the state has been increasing by 10.2% per year since 1979 (Stewart et al 2011).

The study area does not include designated critical habitat for this species.

2.3.2.8 Kemp's Ridley Sea Turtle

USACE Endangered species observers have not recorded the Kemp's ridley sea turtle (*Lepidochelys kempii*) within the project area and this species has never been taken by a USACE dredge operating in Jacksonville Harbor. Kemp's ridley sea turtles have not been recorded nesting on Florida beaches or along the eastern coast of the Unites States (http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00O). However, this sea turtle is known to occur in nearshore waters along the east coast of Florida (Schmid and Ogren, 1992). One Kemp's Ridley Sea Turtle nested at Huguenot Memorial Park in 2012 (Personal communication, Bobby Taylor, CPAC District 6 Chair, 2012).

Critical habitat has not been designated for the Kemp's ridley sea turtle.

2.3.2.9 Gopher Tortoise

The Gopher Tortoise (*Gopherus polyphemus*) typically occupies burrows that it digs in sandy soil. The embankments of upland dredged material placement sites may be inhabited by the Gopher Tortoise. This species has historically been found at or near the Buck Island DMMA. However, in accordance with a permit issued by the FWC, the animals were relocated to an approved recipient site. This species has not been confirmed at the Bartram Island DMMA.

2.3.2.10 Atlantic Sturgeon

Historically, the range of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) included major estuary and river systems from Labrador to the St. Johns River, Florida. Their populations have been decimated due to overharvesting. The Atlantic States Marine Fisheries Commission in 1998 banned harvest through 2038 along the entire Atlantic Seaboard. The remaining main threats to the recovery of this species are dams located on Atlantic Seaboard Rivers, which block sturgeon access to historical spawning areas. Additional threats to the sturgeon in the St. Johns River include poor water quality, fishery by-catch, and habitat degradation issues. Florida presently has no documented breeding population of Atlantic sturgeon in either the St. Johns or St. Marys rivers.

In recent years, only two reports of Atlantic sturgeon in the St. Johns River, Florida or the St. Marys River, Florida/Georgia have been confirmed. However, in January 2010, shrimp try-nets in 15-meter depths used for chase-trawling chilled sea turtles during Kings Bay Trident submarine channel maintenance. During this exercise, a trawler netted and released 21 subadult (approximately 1 meter) Atlantic sturgeon in the St. Marys estuary (Slay, Pers. Comm. 2010). Dr. Doug Peterson's University of Georgia sampling study also captured nine subadult (~1 meter) Atlantic sturgeon in the tidally-influenced St. Marys, ranging through summer, fall, and winter captures during 2010 (Peterson, Pers. Comm. 2010). In February of 2011, two year-one/year-two juvenile (~40 centimeter) Atlantic sturgeon were caught on hook and line, from the shore, in the St. Johns River (Snyder, Pers. Comm. 2011). This could suggest that the nearby Atlantic sturgeon populations are increasing sufficiently to reestablish resident juvenile populations in the St. Marys and St. Johns Rivers. This is the first step which necessarily precedes the St. Marys River and St. Johns River regaining their breeding populations, as the resident juveniles mature. So the status is "extirpated or nearly extirpated, but migrants are occupying northeast Florida rivers (ASSRT 2007; FWC 2011)."

No critical habitat has been designated for the Atlantic sturgeon.

2.3.2.11 Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) historically occurred in the St. Johns River (Gilbert, 1992); however, this species has experienced significant declines within its southern geographic range (Rogers and Weber, 1994; Kahnle et al., 1998; Collins et al., 2000). Beginning in the spring of 2001, the Florida Fish and Wildlife Research Institute (FFWRI) and the USFWS began research on the population status and distribution of the species in the St. Johns River. During approximately 4,500 hours of gill-net sampling in the St. Johns River from January through August of 2002 and 2003, only one shortnose sturgeon was captured in 2002
(http://myfwc.com/research/saltwater/sturgeon/research/population-evaluation/).

Designated critical habitat for this species does not occur in the project area.

2.3.2.12 Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*), currently listed as endangered by NMFS, rarely occurs within the project area. This species has become rare along the southeastern U.S. Atlantic and northern Gulf of Mexico coasts during the past 30 years, with its known primary range now reduced to the coastal waters of Everglades National Park in extreme southern Florida. Fishing and habitat degradation have extirpated the smalltooth sawfish from its historic range.

The smalltooth sawfish, distributed in tropical and subtropical waters worldwide, normally inhabits shallow waters (10 meters or less), often near river mouths or in estuarine lagoons over sandy or muddy substrates, but may also occur in deeper waters (20 meters) of the continental shelf. Shallow water less than 1 meter deep appears as an important nursery area for young smalltooth sawfish. Maintenance and protection of habitat is an important component of the smalltooth sawfish recovery plan (NMFS, 2006). Recent studies indicate that key habitat features (particularly for immature individuals) nominally consist of shallow water, proximity to mangroves, and estuarine conditions. Smalltooth sawfish grow slowly and mature at about 10 years of age. Females bear live young, and the litters reportedly range from 15 to 20 embryos requiring a year of gestation (NMFS 2006). Their diet consists of macroinvertebrates and fishes such as herrings and mullets. The smalltooth sawfish reportedly uses its saw to rake surficial sediments in search of crustaceans and benthic fishes or to slash through schools of herrings and mullets (NMFS 2006).

The smalltooth sawfish (*Pristis pectinata*) is widely distributed within the coastal waters of the eastern and western Atlantic (Last and Stevens 1994). However, according to Simpendorfer et al (2008), this species' western Atlantic population was dramatically reduced during the 20th century, from widespread and abundant, to very rare with a restricted population range. They reported that the present core range of the western Atlantic population extends along the southern coast of Florida from the Ten Thousand Islands to Florida Bay, with moderate occurrence in the Florida Keys and at the mouth of the Caloosahatchee River. They also reported that smalltooth sawfish observations have not been recorded within the St. Johns River from 1950 to 2008 (Simpfendorfer et al. 2008). The occurrence of this species within the project area is highly unlikely.

No critical habitat has been designated for the smalltooth sawfish.

2.3.2.13 North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is one of the most endangered whales in the world. The New England Aquarium's Atlantic right whale research and conservation initiative estimates a total world population of less than 500 individuals (http://www.neaq.org/animals_and_exhibits/animals/northern_right_whale/index.php). North Atlantic right whales range from Iceland to eastern Florida, primarily in coastal waters. This species uses the waters around Cape Cod and Great South Channel to feed, nurse, and mate during summer (Kraus et al. 1988, Schaeff et al. 1993). From June to September, most animals feed north of Cape Cod. Southward migration occurs offshore from mid-October to early January (Kraus et al. 1993). Coastal waters of the southeastern U.S. (off Georgia and northeastern Florida) are important wintering and calving grounds for North Atlantic right whales. Migration northward along the North Carolina coast may begin as early as January but primarily occurs during March and April (Firestone et al. 2008).

Designated critical habitat for the North Atlantic right whale includes portions of Cape Cod Bay and Stellwagen Bank and the Great South Channel (off Massachusetts) and a strip of near coastal waters extending from southern Georgia to Sebastian Inlet, Florida. The southern critical habitat area (**Figure 14**) widens near the Georgia-Florida boundary where the highest concentrations of individual whales gather during their winter calving season (typically December through March, with peak calving in December and January). During this time, the population consists primarily of mothers and newborn calves, some juveniles, and occasionally some adult males and noncalving adult females (http://www.neaq.org). Sightings of North Atlantic right whales within waters off Florida are limited to late fall to early spring months. Sightings are concentrated near northeastern Florida and southeastern Georgia **(Figure 15:** recent sightings); however, sightings of individual whales have been reported as far south as Palm Beach County, Florida. In 2011, two individuals were spotted in the St. Johns River **(Figure 15).**

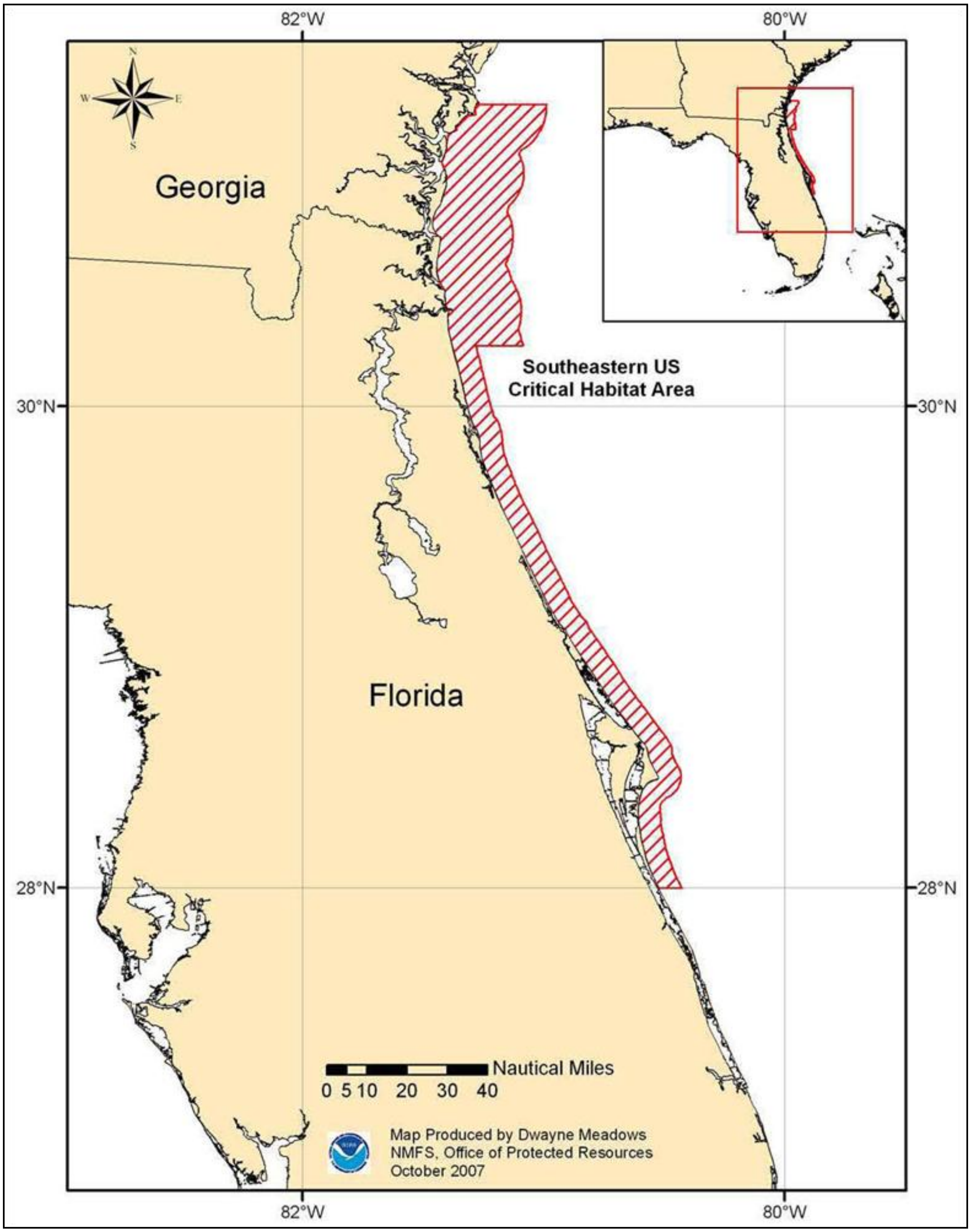


FIGURE 14: NORTH ATLANTIC RIGHT WHALE CRITICAL HABITAT, SOUTHEASTERN UNITED STATES

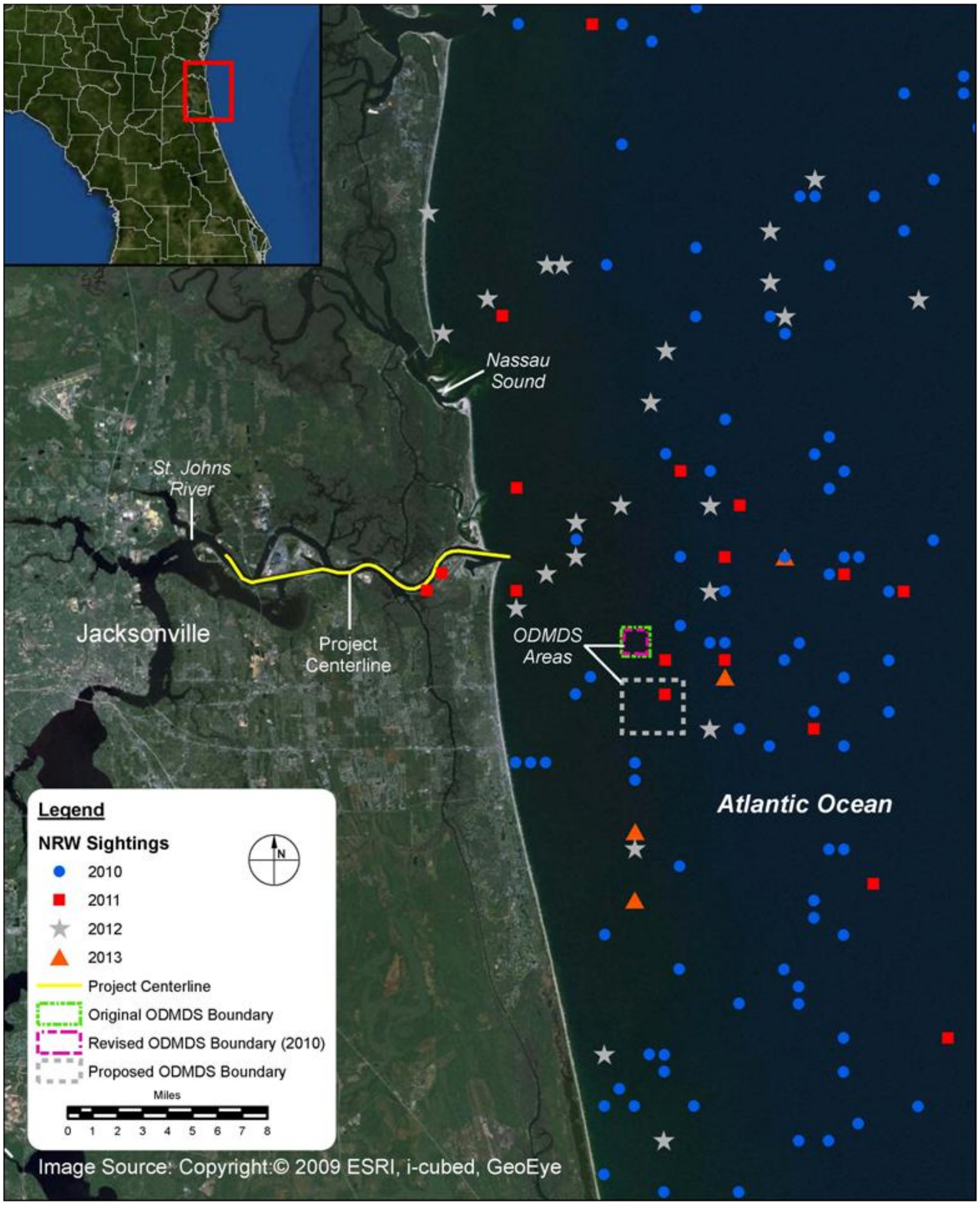


FIGURE 15: NORTH ATLANTIC RIGHT WHALE SIGHTINGS IN THE PROJECT AREA (JANUARY 2010 – JANUARY 2013)

2.3.3 Essential Fish Habitat

The project dredging area, totaling about 350 acres, consists mostly of sandy bottom habitat, with some rock and rock outcrop (Dial Cordy 2011). Adjacent to the project construction area lie extensive salt marsh and tidal channels. All these habitats are part of the essential fish habitat (EFH) of species managed by the Mid-Atlantic Fisheries Management Council (MAFMC) and the South Atlantic Fisheries Management Council (SAFMC), and the National Marine Fisheries Service (NMFS), as well as their prey species (**Table 9** and **Table 10**, **Figure 16**).

The St. Johns River and its tributaries within the proposed project dredging area have been designated "Habitat Area of Particular Concern" (HAPC) by the MAFMC and the SAFMC. Habitats of particular concern are those important to the Summer Flounder, Coastal Migratory Pelagics, Snapper-Grouper Complex, and Penaeid Shrimp (SAFMC 1998; NMFS 2010). Depending on the species, most of the project study area (the river mouth to Palatka) is identified as EFH (e.g. see habitat maps for penaeid shrimps at http://ccma.nos.noaa.gov/products/biogeography/sa-efh/). Dial Cordy (2011; EFH Assessment) and Taylor Engineering (2013a: ecological modeling of the LSJR) provide additional information on EFH and the related habitats in the LSJR.

Table 9: Managed species identified by the NMFS that are known to occur in St. Johns River vicinity, Duval County, Florida. Source: Dial Cordy 2011.

Common Name	Species	HAPC	Presence
MAFMC			
Summer Flounder	*Paralichthys denatatus*	Yes	Year Round
Bluefish	*Pomatomus saltatrix*	No	Year Round
SAFMC			
Coastal Migratory Pelagics	5 species	No	Summer
Snapper-Grouper Complex	73 species	Yes	Summer
Penaeid Shrimp	3 species	Yes	Summer/Winter
Highly Migratory Atlantic Species			
Atlantic Sharpnose Shark	*Rhizoprionodon terraenvae*	No	Year Round
Blacktip Shark	*Carcharinus limbatus*	No	Summer
Blacknose Shark	*Carcharhinus acronotus*	No	Summer
Bonnethead Shark	*Sphyrna tiburo*	No	Year Round
Bull Shark	*Carcharhinus leucas*	No	Unknown/Rare
Dusky Shark	*Carcharhinus obscures*	No	Unknown/Rare
Finetooth Shark	*Carcharhinus isodon*	No	Unknown/Rare
Lemon Shark	*Negaprion brevirostris*	No	Unknown/Rare
Nurse Shark	*Gingloymostoma cirratum*	No	Unknown/Rare
Sandbar Shark	*Carcharhinus plumbeus*	Yes	Unknown/Rare
Sand Tiger Shark	*Odontaspis taurus*	No	Unknown /Rare
Scalloped Hammerhead	*Sphyrna lewini*	No	Seasonal Migration
Spinner Shark	*Carcharhinus brevipinna*	No	Seasonal Migration
Tiger Shark	*Galeocerdo cuvieri*	No	Unknown/Rare

Table 10: Prey species that May Occur within the Study Area. Source: USACE 2009

Species	Life Stage	Substrate Preference	
		Unconsolidated Sediment	Salt Marsh & Tidal Channel
Ladyfish (*Elops saurus)*	A	A	
Striped anchovy (*Anchoa hepsetus)*	A, J, L	A, J, L	
Bay anchovy (*Anchoa mitchilli)*	A, J, L	A, J, L	
Scaled sardine (*Harengula jaguana)*	J	J	
Atlantic thread herring (*Opisthonema oglinum)*	A, J, L	A, J, L	
Sheepshead minnow (*Cyprindon variegates)*	A, J, L	A, J, L	A, J, L
Atlantic menhaden (*Brevoortia tyrannus)*	A, J, L	A	J, L
Yellowfin menhaden (*Brevoortia smithi)*	A, J, L	A	J, L
Bay scallop (*Argopecten irradians)*	A, J, L	A, J	L
Atlantic rangia (*Rangia cuneata)*	A, J, L	A, J, L	A, J, L
Quahog (*Mercenaria sp.)*	A, J	A, J	
Grass shrimp (*Palaemonetes pugio)*	A, J		A, J
Striped mullet (*Mugil cephalus)*	A, J	A, J	
Spot (*Leiostomus xanthurus)*	A, J	A	
Atlantic croaker (*Micropogonias undulates)*	A, J	A, J	
Silversides (*Menidia sp.)*	A, J, L	A, J, L	A, J, L
American eel (*Anguilla rostrata)*	A, J, L	J, L	A, J, L
Hardhead catfish (*Arius felis)*	A, J, L	A, J, L	
Gafftopsail catfish (*Bagre marinus)*	A, J, L	A, J, L	
Inshore lizardfish (*Synodus foetens)*	A, J, L		A, J, L
Oyster toadfish (*Opsanus tau)*	J	J	
Atlantic needlefish (*Strongylura marina)*	A, J, L	A, J, L	
Timucu (*Strongylura timucu)*	J	J	
Killifish (*Fundulus sp.)*	A, J, L		A, J, L
Sailfin molly (*Poecilia latipinna)*	A, J, L		A, J, L
Pipefish (*Sygnathus sp.)*	A, J, L		A, J, L
Sea robin (*Prionotus sp.)*	J	J	
Mojarra (*Eucinostomus sp.)*	A, J	A, J	
Pinfish (*Lagodon rhomboides)*	A, J, L	A, J, L	A, J, L
Silver perch (*Bairdiella chrysoura)*	A, J, L	A, J, L	
Kingfish (*Menticirrhus sp.)*	A, J	A, J	
Gobies (*Bathygobius sp., Gobionellus sp.)*	A, J, L	A, J, L	A, J, L

Source: Dennis et al 2001; SAFMC 1998; University of Florida 2008.
A=adult; J=juvenile; L=larvae

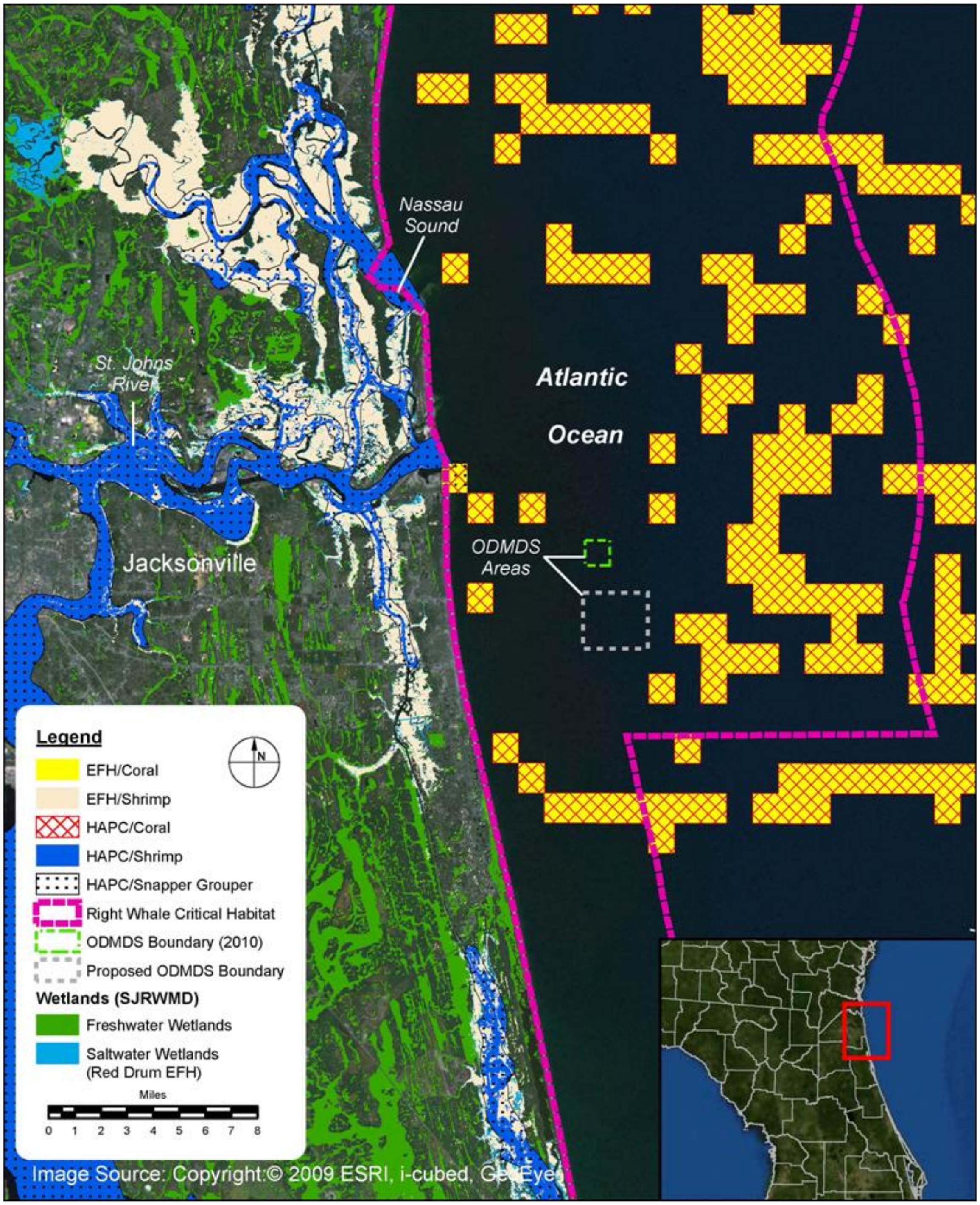


FIGURE 16: ESSENTIAL FISH HABITAT (EFH) AND HABITAT AREAS OF PARTICULAR CONCERN (HAPC) AT THE MOUTH OF THE ST. JOHNS RIVER

Dial Cordy (2011) described the estuarine community present in the project construction footprint as bottom substrates (dominated by sand with some rock) and water column. The estuary is home and/or habitat for a wide range of fish species managed by the SAFMC, as well as other very common species such as striped mullet. Both managed and unmanaged species are popular with commercial and recreational anglers.

2.3.4 Mammals

The Marine Mammal Protection Act, enacted in 1972 and substantially amended in 1996, provides Federal protection to all marine mammals. Species potentially found in marine waters off the mouth of the St. Johns River include many species rarely seen, and only a few commonly known species (**Table 11**), such as the West Indian manatee (*Trichechus manatus manatus*), and bottlenose dolphin. The marine mammal commission lists the bottlenose dolphin as a species of special concern due to the depletion of the western north Atlantic coastal migratory stock (http://mmc.gov/species/bottlenosedolphin.shtml).

Table 11: Marine Mammals associated with Florida waters

Order/Family	Common Name	*Species*	Status	Distribution	Comments
Sirenia/Trichechidae	West Indian manatee	*Trichechus manatus manatus*	rare	coastal marine areas, but not usually N of Suwannee R. in Gulf; enters rivers and connected springs	Federally Listed Species. Duval County maintains a Manatee Protection Plan
Delphinidae	Bottle-nosed dolphin	*Turciops truncatus*	common	coastal marine areas	Western north Atlantic coastal stock listed as depleted under MMPA
	Atlantic spotted dolphin	*Stenella frontalis*	rare	coastal marine area	
	Common or Saddleback dolphin	*Delphinus delphis*	rare	coastal marine areas	records from St. Johns county
	Grampus or Risso's dolphin	*Grampus griseus*	rare	coastal marine areas	recorded near St. Augustine and Tarpon Springs
	Killer whale	*Orcinus orca*	rare	coastal marine areas	records from Marineland (St. Johns county) through Keys to Collier county
	Short-finned pilot whale	*Globicephala macrorhyncha*	uncommon	coastal marine areas	numerous records along entire coast
Ziphiidae	Goose-beaked whale	*Ziphius cavirostris*	rare	coastal marine areas	recorded from St. Johns, Volusia, Brevard, and Pasco counties
	Antillean beaked whale	*Mesoplodon europaeus*	rare	coastal marine areas	
	True's beaked whale	*Mesoplodon mirus*	rare	Atlantic coastal marine areas S to Flagler Co.	
Physeteridae	Sperm whale	*Physeter catodon*	rare	coastal marine areas	also referred to as *P. macrocephalus*; records from Atlantic and Gulf coasts
	Pygmy sperm whale	*Kogia breviceps*	uncommon	coastal marine areas	numerous records along Atlantic coast, but rarely along Gulf coast
Balaenopteridae	Sei whale	*Balaenoptera borealis*	rare	coastal marine areas	recorded off Duval county
Balaenidae	Right whale	*Eubalaena glacialis*	uncommon	coastal marine areas	winter migrant off Florida; recorded off Atlantic and Gulf coasts

*****

**(adapted from American Society of Mammalogists website http://www.mammalsociety.org/mammals-florida)*

Marine mammal species known to occur in the project area include bottlenose dolphin (*Tursiops truncatus*), Atlantic spotted dolphin (*Stenella frontalis*), and North Atlantic Right Whale (discussed separately in Section 2.3.2.10). During monitoring of naval activities near Mayport and the Jacksonville Range Complex in April 2009, shipboard U.S. Navy marine mammal biologists recorded 20 dolphin sightings over the four-day exercise. The sightings included both bottlenose and spotted dolphins. Passive acoustic monitoring in the project area in July 2009 recorded the presence of the same two dolphin species. While these observations occurred at locations 20 miles or more offshore of the river mouth, the locations are within the general use area for vessels entering Jacksonville Harbor (DoN 2009).

Relatively little dolphin research has occurred within the project footprint section of the river. Between 1994 and 1997 Caldwell (2001) studied dolphins in an area from about River Mile 17 to coastal waters adjacent to the river mouth and the Atlantic Intracoastal Waterway to the north and south of the main river channel. Caldwell identified three bottlenose dolphin communities in her study area and concluded that the dolphins in the main river channel and coastal areas were seasonal residents; only the IWW to the north included dolphins with year-round fidelity. Her research suggested that bottlenose dolphins used the river to about River Mile 15 (**Figure 6:** about to Trout River).

More recent research (personal communication, Quincy Gibson, Assistant Professor, University of North Florida) appears to indicate that the river harbors a year-round population in addition to seasonal residents. She also has evidence to suggest that dolphins may have expanded upstream to about River Mile 21 (**Figure 6**; The Mathews Bridge) since Caldwell's fieldwork period. Dolphins have been observed by USACE biologists near the Fuller-Warren Bridge at approximately River Mile 25.

Other mammals that occur in the general project area and use the river extensively include the river otter (*Lutra canadensis*). **Table 12** (from England, Thims and Miller and Middlebrook Company 2008) reports other mammals that live in Huguenot Park (and likely elsewhere along the project area river bank uplands).

Table 12: Mammals inhabiting Huguenot Park (From England Tims, and Miller and Middlebrook Company 2008)

Common Name	Species
Bobcat	*Lynx rufus*
Cotton Mouse	*Peromyscus gossypinus*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Mole	*Scalopus aquaticus*
Gray Squirrel	*Sciurus carolinensis*
Hispid Cotton Rat	*Sigmodon hispidus*
Marsh Rabbit	*Sylvilagus palustris*
Nine-banded Armadillo	*Dasypus novemcinctus*
Raccoon	*Procyon lotor*
Virginia Opossum	*Didelphis virginiana*

2.3.5 Birds

The Migratory Bird Treaty Act applies to over 800 species of migratory birds and protects both live and dead birds and bird parts (including nests, feathers, and eggs). Over 200 species, including fulltime residents and seasonal migratory bird species visit the St. Johns River, as it lies along the Atlantic flyway for birds migrating to winter habitat in the Caribbean, Central and South America, and Florida (SJRWMD 2012: Chapter 13 Appendix 3).

Numerous species including both migratory and non-migratory species have been recorded as part of monitoring efforts since 2006 at dredged material management areas maintained by USACE (**Table 13**: Bartram Island, Buck Island) and the U.S. Marine Corps (Dayson Island). The list of northeast shorebird species observed by Sprandal et al (1994) is also included. England-Thims & Miller, Inc. and the Middlebrook Company (2008) included a long list (179) bird species reported from Huguenot Park.

Table 13: Records of Bird Species from locations in the project construction area

Common Name	Species	1994 NE FL[1]	2006-2010 Bartram Isl[2]	2006-2010 Buck Isl[3]	2009 Little Marsh Isl[4]
American Avocet	*Rccurviro Americana*	*x*			x
American Black Duck	*Anas rubripa*			x	
American Crow	*Corvus brachrhynchos*		x		
American Oystercatcher	*Haematopus palliatus*	*x*			
American Pipit	*Anthus rubescens*				x
American Redstart	*Setophaga ruticilla*			x	x
American Robin	*Turdus migratorius*		x		x
American White Pelican	*Pelecanus erythrorhynchos*			x	x
Anhinga	*Anhinga anhinga*		x	x	x
Bald Eagle	*Haliaeetus leucocephalus*			x	
Barn Swallow	*Hirundo rustica*				x
Black-bellied Plover	*Himantopus mexicanus*	*x*	x		x
Black Skimmer	*Rynchops niger*		x		x
Black Vulture	*Coragyps atratus*			x	x
Black-crowned Night Heron	Nycticorax nycticorax			x	x
Black-necked Stilt	*Himantopus mexicanus*		x	x	
Bobolink	*Dolichonyv oryzivorus*				x
Bridled Tern	*Sterna anaethetus*			x	
Brown Pelican	*Pelecanus occidentalis*				x
Buteo spp	*Buteo spp*				x
Canada Goose	*Branta canadensis*			x	x
Cattle Egret	*Bubulcus ibis*			x	x
Common Gackle	*Quiscalus quiscula*		x		x
Common Ground-Dove	*Columbina passerine*		x		x
Common Snipe	*Gallinago gallinago*	*x*			
Common Tern	*Sterna hirundo*		x		x
Common Yellow Throat	*Geothylypis trichas*		x	x	x
Cooper's Hawk	*Accipiter cooperii*		x		x
Cormorant	*Phalacrocorax carbo*				
Dowitcher spp.	*Limnodromus spp*	*x*	x	x	x
Dunlin, Calidris alpina	*Calidris alpina*	*x*	x	x	x
Eurasian Collared Dove	*Streptopelia decaocto*			x	x
Fish Crow	*Corvus ossifragus*			x	x
Gadwall	*Anas strepera*		x	x	x

Common Name	Species	1994 NE FL[1]	2006-2010 Bartram Isl[2]	2006-2010 Buck Isl[3]	2009 Little Marsh Isl[4]
Great Black Backed Gull	*Larus marinus*		x	x	x
Great Blue Heron	*Ardea beroaies*		x	x	x
Great Egret	*Ardea alba*		x		
Greater Shearwater	*Puffinus gravis*		x	x	
Greater Yellowlegs	*Tringa melanoleuca*	*x*	x	x	
Gull-billed Tern	*Gelochelidon nilotica*			x	x
Killdeer	*Charadrius vociferus*	*x*	x	x	
Laughing Gull	*Larus atricilla*		x	x	
Least Sandpiper	*Calidris minutilla*		x	x	x
Least Tern	*Stema albifron*		x	x	x
Lesser Yellowlegs	*Tringa flavipes*	*x*		x	x
Long-billed Kerlew	*Numenius americanus*	*x*			
Little Blue Heron	*Egretta caerulea*		x	x	x
Mallard Duck	*Anas platyrhynchos*				x
Mottled Duck	*Anas fulvigula*		x	x	
Mourning Dove	*Zenaida macroura*		x	x	
Northern Harrier	*Circus cyaneus)*		x	x	x
Northern Mockingbird	*Mimus polyglottos*			x	x
Northern Shoveler	*Anas clypeata*		x		
Osprey	*Pandion haliaetus*			x	
Peep sp	*Calidris sp*	*x*	x		x
Piping Plover	*Charadrius melodus*		x		x
Purple Sandpiper	*Erolia maritima*		x		
Red Knot	*Calidris canutus*	*x*			
Red Winged Blackbird	*Agelaius phoeniceus*		*x*	x	
Red Shouldered blackbird	*Agelaius assimilis*				x
Red-tailed Hawk	*Buteo jamaicensis*			x	x
Red Winged Blackbird	*Agelaius phoeniceus*		x	x	x
Roseatte Spoonbill	*Ajaia ajaja*		*x*	x	
Royal Tern	*Thalasseus maximus*			x	x
Ruddy Turnstone,	*Arenaria interpres*		x	x	
Sanderling	*Calidris alba*	*x*	x	x	x
Sandwich Tern	*Thalasseus sandvicensis*			x	
Semipalmated Plover	*Charadrius semipalmatus*	*x*	x	x	x
Smooth Billed Ant	*Crotophaga ani*			x	
Snail Kite	*Rostrhamus sociabilis*			x	
Snowy Egret	*Earetta thula*		x	x	

Common Name	Species	1994 NE FL[1]	2006-2010 Bartram Isl[2]	2006-2010 Buck Isl[3]	2009 Little Marsh Isl[4]
Sooty Tern	*Onychoprion fuscatus*			x	
Spotted Sandpiper	*Actitis macularius*		x		x
Stilt Sandpiper	*Calidris himantopus*		x	x	
Swallow Tail Kite	*Elanoides forficatus*		x	x	x
Tree Swallow	*Tachycineta bicolor*			x	
Turkey Vulture	*Cathartes aura*			x	x
Western Sandpiper	*Calidris mauri*	*x*		x	x
White Ibis	*Eudocimus albus*			x	
White Pelican	*Pelecanus evthrorhvnchos*		x		
White Tipped Dove	*Leptotila verreauxi*				
Willet	*Tringa semipalmata*	*s*		x	x
Wilson's Plover	*Charadrius wilsonia*		x	x	x
Wood Stork	*Mvcteria americana*		x	x	

1. Sprandel et al 1997
2. Bartram Island Bird Monitoring reports, various dates 2006-2010. Provided by Paul Stodola, USACE Jacksonville District
3. Buck Island Bird Monitoring reports, various dates 2006-2010. Provided by Paul Stodola, USACE Jacksonville District
4. Daily Bird Monitoring Reports Marine Corps Terminal Maintenance Dredging, Blount Island, Duval County, Florida Contract Number: W912EP-09-C-0009. Provided by Paul Stodola, USACE Jacksonville District

The Timucuan Ecological and Historic Preserve, through the NPS Inventory and Monitoring Program, collects bird monitoring data. Landbird monitoring data have been collected at 26 spatially-balanced random locations within the Preserve using an adaptation of the variable-circular plot (VCP) technique with distance estimation. Sampling activities occurred in April and in May 2010. There were 653 birds representing 50 species detected and the house finch was the only non-native species detected. An evaluation of sampling effort relative to the number of species detected indicated that the sample adequately characterized the bird diversity, and analyses suggest bird diversity is medium at the Preserve. The Preserve's bird species list containing over 300 species (National Park Service, personal communication, 2013).

2.3.6 Amphibians and Reptiles

A large number of amphibians and reptiles live in the freshwater portions of the study area and in freshwaters within the coastal zone in natural areas such as Huguenot Park (**Table 14**). Some of the reptiles, such as the diamond back terrapin and American alligator, can tolerate the estuarine waters when mature.

Table 14: Amphibians and Reptiles reported resident in Huguenot Park, Jacksonville FL (England, Tims, and Miller and Middlebrook Company, Inc. 2008).

Amphibians and Reptiles	Species
Eastern Narrowmouth Toad	*Gastrophryne carolinensis*
Eastern Spadefoot Toad	*Scaphiopus holbrookii*
Green Treefrog	*Hyla cinerea*
Southern Chorus Frog	*Pseudacris nigrita*
Southern Cricket Frog	*Acris gryllus*
Southern Leopard Frog	*Rana sphenocephala*
Southern Spring Peeper	*Hyla crucifer bartramiana*
Southern Toad	*Bufo terrestris*
Squirrel Treefrog	*Hyla Squirella*
Atlantic Loggerhead Turtle	*Caretta caretta caretta*
American Alligator	*Alligator mississippiensis*
Broad-headed Skink	*Eumeces laticeps*
Corn Snake	*Elaphe quttata quttata*
Cuban Brown Anole	*Anolis sagrei sagrei*
Diamondback Terrapin	*Malaclemys terrapin tequesta*
Dusky Pigmy Rattlesnake	*Sistrurus miliarius barbouri*
Eastern Diamondback Rattlesnake	*Crotalus adamanteus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Slender Glass Lizard	*Ophisaurus attenuatus longicaudus*
Florida Box Turtle	*Terrapene carolina bauri*
Florida Snapping Turtle	*Chelydra serpentina osceola*
Garter Snake	*Thamnophis sirtalis*
Gopher Tortoise	*Gopherus polyphemus*
Green Anole	*Anolis carolinensis*
Green Turtle	*Chelonia mydas*
Ground Skink	*Scincella lateralis*
Leatherback Turtle	*Dermochelys coriacea*
Peninsula Ribbon Snake	*Thamnophis sauritus sackeni*
Rough Green Snake	*Opheochrys aestivus*
Six-lined Racerunner	*Cnemidophorus sexlineatus*
Southeastern Five-lined Skink	*Eumeces inexpectatus*
Southern Black Racer	*Coluber constrictor priapus*
Striped Mud Turtle	*Kinosternon baurii*
Yellow Rat Snake	*Elaphe obsoleta quadrivittata*

The Timucuan Ecological and Historic Preserve has certified the occurrence of 21 species of amphibians and 43 species of reptiles within the Preserve (Byrne

2010, Tuberville 2004, Tuberville 2005). Additional information on the results of amphibian monitoring within the Preserve can be found at the following:

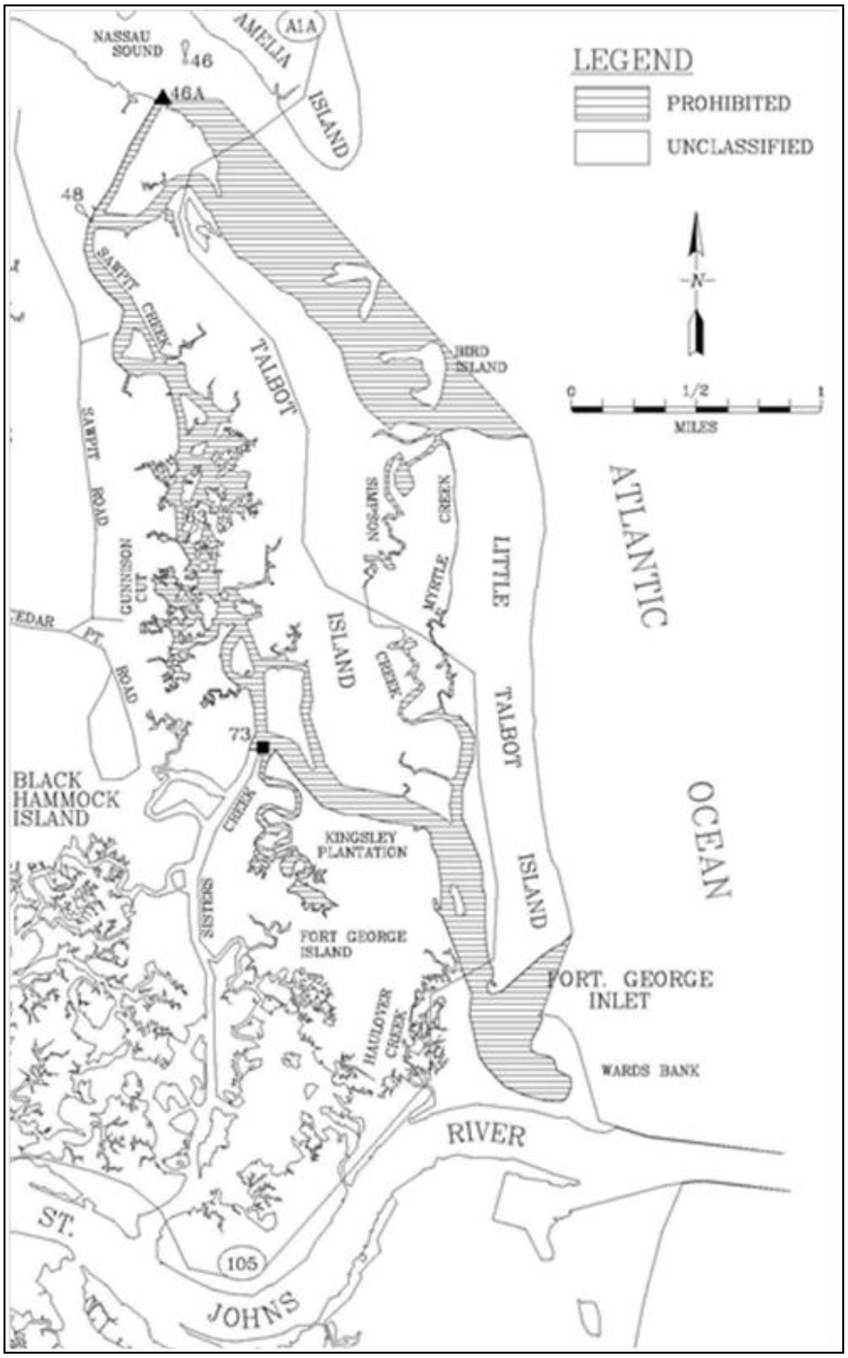
https://irma.nps.gov/gueststs/users/issue.aspx?wa=wsignin1.0&wtrealm=https%3a%2f%2firma.nps.gov%2fApp%2f&wctx=rm%3d0%26id%3dpassive%26ru%3d%252fApp%252freference%252fdownloaddigitalfile%253fcode%253d419372%2526file%253dByrne_2010_TIMU_Amphibian_Monitoring_Summary_2009.pdf&wct=2013-11-04T19%3a10%3a01Z.

2.3.7 Macroinvertebrates Including Shellfish

In addition to the protected species and EFH resources described above, the study area supports marine, estuarine, and freshwater communities. Oysters can be found on the mud flats at the river's edge and within the nearby salt marsh and tidal channels. Due to likely pollution of the estuary, the shellfish harvesting areas are identified as "Prohibited" (**Figure 17**). Other macroinvertebrates commonly found in soft-bottom estuarine habitat in northeast Florida include annelids, a variety of mollusks other than oysters, arthropods, sponges, and polyps (Hoffman and Olsen 1982).

The commercial shrimp fishery in the LSJR basin is based upon three penaeid shrimp species: northern white shrimp, northern brown shrimp, and northern pink shrimp which are trawled in coastal waters with depths between 20 feet and 80 feet (USDOI MMS 1984). Year-to-year variations in rainfall control the extent of upstream migration of these species. The shrimping year can be divided into three seasons: (1) the offseason (January through May); (2) brown shrimp season (June through August); (3) white shrimp season (late August to January). Large white shrimp migrate to commercial fishing areas from August through December, while brown and pink shrimp remain in estuaries during winter (SAFMC 1998). The bulk of the shrimp harvest takes place in the Atlantic Ocean during the 9-month period from June through February. Bait shrimp used as live bait are caught along the river (DoN 1997). Rock shrimp are harvested offshore in deep water. Spawning and migrating adult shrimp may be present in the vicinity in and around the ODMDS alternative sites. Nearshore shrimp trawling grounds are located between the alternative sites and the coastline in the first few miles off the beach.

A number of authors have made investigations of the number and kinds of invertebrates in the LSJR. Most recently, Hymel (2009) produced a literature based inventory of benthic macroinvertebrates in the Timucuan Ecological and Historic Preserve (TIMU), reporting that in TIMU, six stations from the Environmental Monitoring and Assessment Program (EMAP), 27 from the LSJR studies, and four from a 2003 commissioned study, documented more than 350 benthic macroinvertebrates (BMI) taxa. Dominant BMI taxa included polychaetes (Sabellaria vulgaris, Tharyx spp., Aphelochaeta marioni, Paraonis fulgens, Caullerilla spp., Streblospio benedicti, Mediomastus spp., Marenzellaria viridis, Podarke spp., Paraprionospio pinnata), gastropods (Boonea impressa, Nassarius obsoletus), bivalves (Pleuromeris tridentata, Tellina versicolor, Gemma gemma, Abra aequalis), amphipods (Rhepoxynius hudsoni, Protohaustorius deichmannae, Apocorophium lacustre), and phoronid worms (Phoronis spp.)." Long (2004) identified BMI taxa in Sisters Creek and the Ft. George River; there are other literature examples as well, that point to a well developed, diverse macroinvertebrate fauna in the LSJR.



(FDACS 2012)

FIGURE 17: SHELLFISH HARVESTING AREA CLASSIFICATION MAP #96 DUVAL COUNTY

2.3.8 Other Wildlife Resources

Freshwater commercial fishing in the St. Johns River from Duval County south includes the estuarine and freshwater harvest of freshwater species such as American eel, American shad, blue crab, mullet, and all species of catfish (Brody 1994). Recreational anglers also fish for these taxa and other species such as penaeid shrimp (where almost all the commercial catch comes from the nearshore Atlantic). The shrimp spend a significant portion of their lifetime, however, in the lower St. Johns River (WSIS 2012; MacDonald et al 2009).

A wide variety of fish species that dwell in softbottom, hardbottom, and coastal pelagic (i.e., at or near the sea surface in the water column) habitats are caught and landed off the coast of northeast Florida. Important commercial fin fisheries species from these groups include northern brown shrimp, northern white shrimp (softbottom), snappers, and king mackerel (coastal pelagic).

Upstream of the channel deepening area, the salinity gradient has a profound effect on the species composition and the aquatic ecosystem shifts from estuarine to freshwater. Water column community changes include the growing presence of less salt tolerant species such as largemouth bass (*Micropterus salmoides*), a centrarchid species popular with recreational anglers. Going farther upstream towards Palatka, a wide range of less salt tolerant centrarchids enter the freshwater community. MacDonald et al (2009), working with eight years of fish community samples from the entire length of the LSJR, demonstrated changing community structure based on the variability of freshwater inflows to the LSJR, which creates the salinity gradient seen in the river (see also SJRWMD 2012: Chapter 12).

2.3.9 Wetlands

Within the mouth of the river and several miles upstream, extensive estuarine wetlands dominated by smooth cordgrass (*Spartina alternifora*) and Black needlerush (*Juncus romerianus*) border the open water habitats (**Figure 18**). These areas support a wide variety of invertebrates and vertebrates, including a wide variety of fishes at different life cycle stages, resident fishes whose life cycle remains within the marsh, shorebirds, migratory birds, and some more surprising species, particularly at the marsh borders, such as adult American alligators, raccoons, and a variety of rodents. Shifts from predominately estuarine marsh to freshwater wetland communities are relatively complete by about River Mile 25, though salt tolerant vegetation may be observed upstream to at least Black Creek (about River Mile 45). **Figure 18** illustrates wetland distribution in the LSJR SEIS study area using 2009 SJRWMD Florida land use and cover classification system (FLUCCS) map data. All freshwater wetlands are shown as one color; all estuarine marshes are shown as a different color.

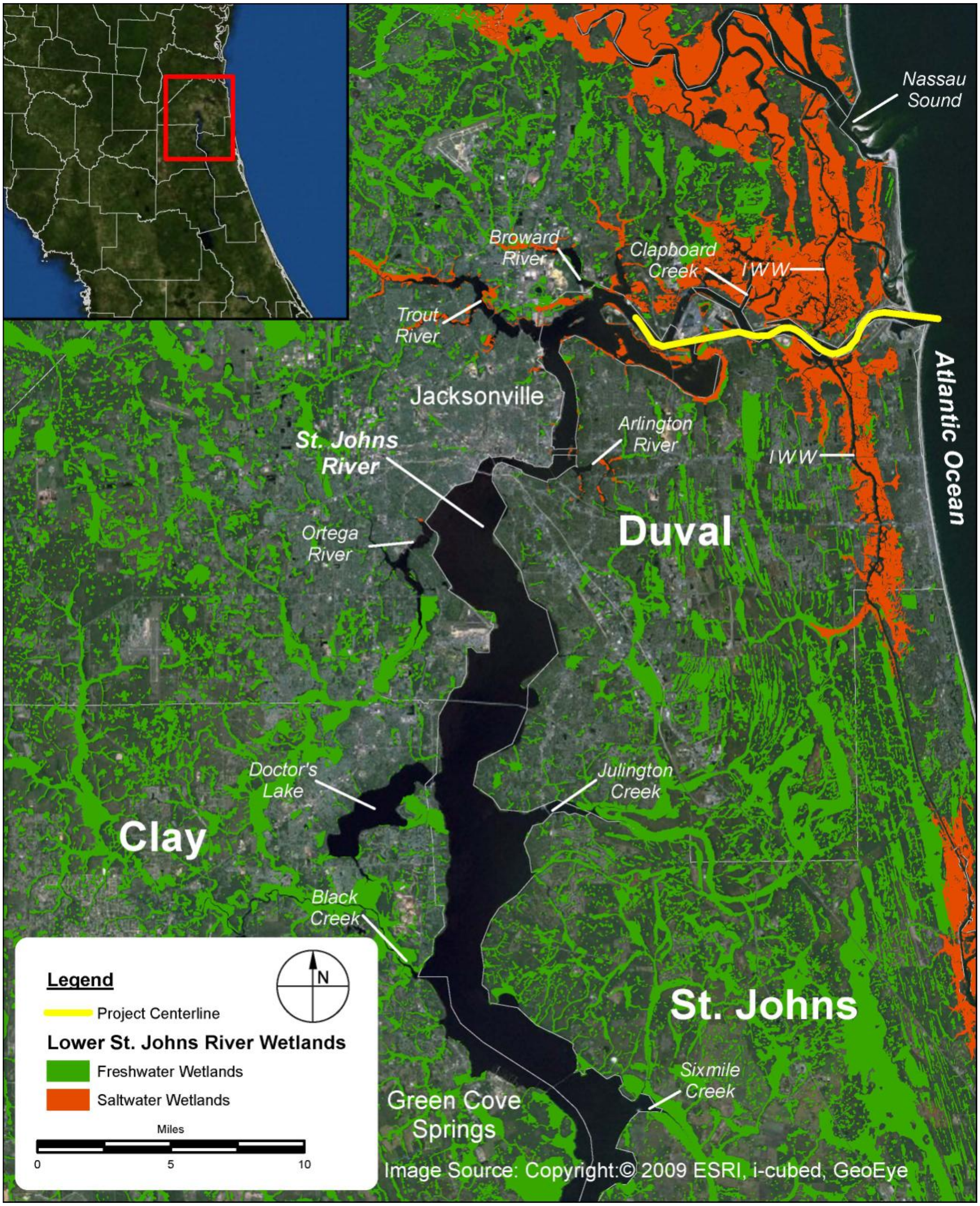


FIGURE 18: WETLANDS OF THE LOWER ST. JOHNS RIVER STUDY AREA

2.3.10 Submerged Aquatic Vegetation (SAV)

The submerged aquatic vegetation (SAV) community in the LSJR includes 12 species dominated by *Vallisneria americana* (WSIS 2012 Chapter 9 SAV: 61% of total abundance). The downstream extent of the LSJR SAV community occurs in the vicinity of River Mile 25 near the Fuller Warren Bridge. The sparse distribution of *V. americana* in this location varies from year to year, consistent with the salinity model for this species developed by SJRWMD (WSIS 2012), which indicates that salinities of above 5 parts per thousand (ppt) for more than a week or exposure to 10 ppt for more than a day will likely stress the plant. These conditions are the norm near River Mile 25. Along the river's edge, salt tolerant vegetation becomes less abundant upstream of the Fuller Warren Bridge and disappears by Green Cove Springs (about River Miles 25-50).

SAV becomes more abundant and dense upstream, with persistent beds occurring at a SJRWMD monitoring station near the Bolles School at about River Mile 31. The Bolles School monitoring station likely represents the most downstream extent of persistent SAV beds in the LSJR. Monitoring by SJRWMD (WSIS 2012) shows that SAV from the Bolles School site upstream to a monitoring station at Moccasin Slough near River Mile 37 is subject to periodic salinity stress which affects both distribution and abundance. SAV in this area is also subject to low-light stress during high runoff conditions.

The SAV provides an important food source for manatees and habitat for macroinvertebrates and fishes. The SAV in the LSJR does not cover a large portion of the riverbed, typically extending out from the shoreline about 50 meters (WSIS 2012: Chapter 9 p.9-19), but represents the highest quality habitat in otherwise open-water areas of the aquatic ecosystem.

2.3.11 Other Vegetation Communities

Natural habitats lining the river and marshes nearest the mouth of the river may include sabal palm, grasses, shrubs, and cacti, as well as other salt tolerant species. At the edges of the marshes distant from the main channel (e.g. in the Timucuan Ecological and Historic Preserve [TIMU]) bordering communities also include live oaks, some pines, and other relatively salt tolerant tree and shrub species.

In 2005, a comprehensive floristic survey was conducted for TIMU. Nine community types were identified, seven of which occur within the project area, which includes Fort Caroline National Memorial and the Theodore Roosevelt Area. These include: open beach along the shoreline of the Fort Caroline exhibit; extensive expanses of salt marsh in the northern portion of the Theodore Roosevelt Area and the western side of Fort Caroline; shell middens in the salt marshes of the Theodore Roosevelt Area and integrating with the maritime hammock, which also borders the salt marsh of Fort Caroline; sandhill community in the Theodore Roosevelt Area; freshwater ponds and mixed swamp; maritime hammock at Fort Caroline National Memorial and the Theodore Roosevelt Area; and disturbed habitats which occur around development for facilities and public access (Zomelefer 2007).

2.3.12 Phytoplankton

University of North Florida/Jacksonville University (2012) summarizes phytoplankton characteristics in the LSJR. Phytoplankton abundance in blackwater rivers such as the LSJR is usually limited by nutrient availability and light levels. However, when nutrient levels increase due to natural or anthropogenic causes, rapid increases in phytoplankton abundance (i.e., algal blooms) may occur. Natural algal blooms likely occurred in the river prior to the increases in nutrient loading from human activities. However, high nutrient concentrations in the river that occurred with development increased the frequency and severity of blooms.

In the LSJR, cyanobacteria (blue-green algae) are the dominant phytoplankton in blooms due at least in part to their ability to grow under lower light levels. Some of the cyanobacteria occurring in blooms may release toxins that can affect aquatic organisms and human health. An algal bloom in which toxins are produced is known as a “harmful algal bloom” (HAB). *Anabaena circinalis* and *Microcystis aeruginosa* are the two most widely distributed toxin producing cyanobacteria in the LSJR, but other toxin producing cyanobacteria also occur in Florida.

Cyanobacteria accounted for more than 50% of the total phytoplankton chlorophyll-a at concentrations lower than considered a bloom (40 µg $L^{-1)}$ and more than 80% during bloom conditions. Most algal blooms in the LSJR occur in the freshwater portions of the estuary. Dinoflagellates, considered marine algae, can also produce toxins, and dinoflagellate blooms tend to occur to the greatest extent in the oligohaline section of the river between about river miles 40 and 60 (WSIS 2012: Chapter 8).

Chlorophyll-a is commonly used as a measure of phytoplankton abundance. Median annual chlorophyll-a levels in the LSJR are usually below the freshwater standard. Individual summer measurements of chlorophyll-a, however, frequently exceed the standard and, in 2010 annual median chlorophyll-a notably exceeded the standard.

2.3.13 Invasive and Exotic Species

For this invasive species discussion, the project area includes the St. Johns River from the ocean inlet, upstream to River Mile 14 or just west of Bartram Island, the ODMDS, and the upland DMMAs, as well as a one mile zone around the DMMAs. The DMMAs included in this investigation are Reed Island, Bartram Island, Little Marsh Island, and Buck Island.

Terrestrial Invasive Species

Within Duval County, Florida there have been 2881 reported sightings of terrestrial invasive species recorded by the Early Detection and Distribution Mapping System (EDDMapS). **Figure 19** displays the 663 sightings which occurred within a one mile boundary of the project area (EDDMapS, 2012). Analysis results of the terrestrial invasive data within one mile of the project area boundary are presented in **Table 15** and indicate that 47 different invasive species have been observed. Care must be taken when reviewing the data in **Table 15** as a sighting record does not necessarily equate to a single member of the species being discovered. For example, there is a single sighting record for salt cedar on Reed Island. However, Reed Island represents a seed source for the *Tamarix spp*. (salt cedar) and the single entry represents approximately 30 acres of *Tamarix spp*. monoculture (pers. Obs)(**Figure 20**).

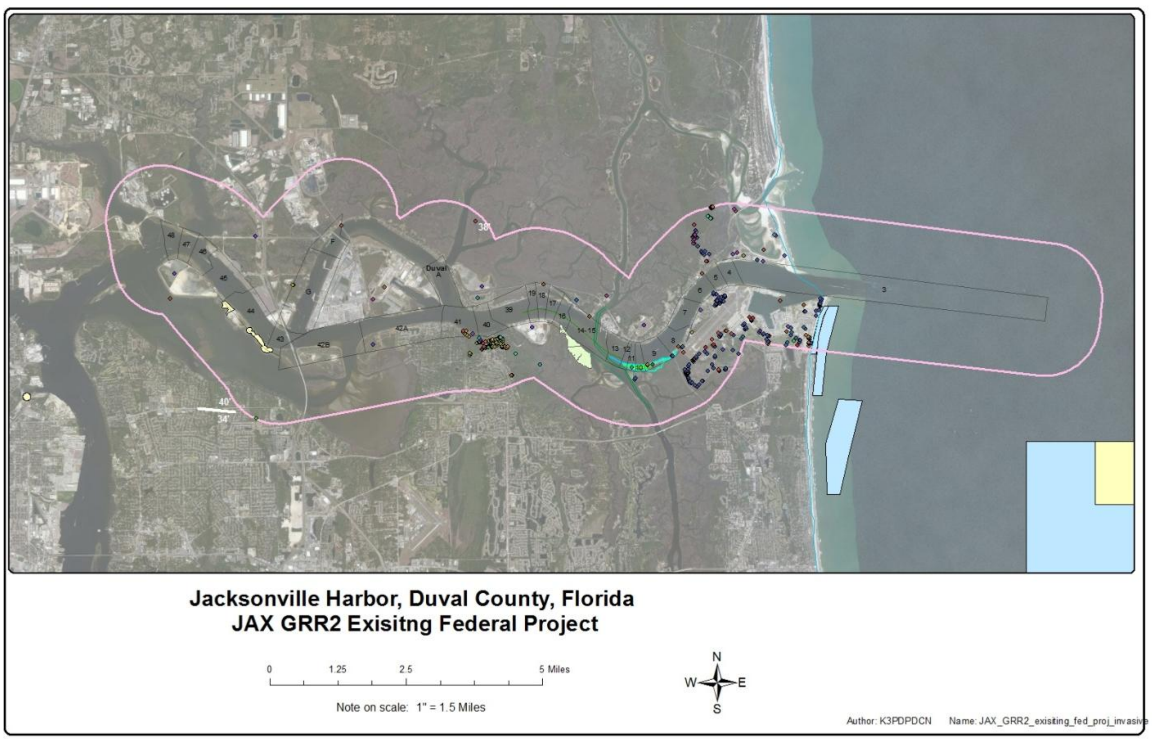


FIGURE 19: PROJECT AREA WITH 1 MILE BUFFER ZONE AROUND PROJECT AND SIGHTED INVASIVE SPECIES

Table 15: Listing of the Terrestrial Invasive Species sightings within 1 mile of project area

COMMON NAME	SCIENTIFIC NAME	NUMBER OF EDDMAPS SIGHTINGS	CLASS
Greylag Goose	Anser anser	2	Aves
Muscovy duck	Cairina moschata	11	Aves
Eurasian collared-dove	Streptopelia decaocto	31	Aves
rock dove	Columba livia	47	Aves
white-winged dove	Zenaida asiatica	4	Aves
house finch	Carpodacus mexicanus	46	Aves
house sparrow	Passer domesticus	73	Aves
common pheasant	Phasianus colchicus	1	Aves
budgerigar	Melopsittacus undulatus	1	Aves
Monk Parakeet	Myiopsitta monachus	9	Aves
Red-crowned parrot	Amazona viridigenalis	1	Aves
european starling	Sturnus vulgaris	86	Aves
common boa	Boa constrictor	1	Reptilia
Cuban Rock Iguana	Cyclura nubila	1	Reptilia
Texas horned lizard	Phrynosoma cornutum	7	Reptilia
American evergreen	Syngonium podophyllum	1	Liliopsida
arrowleaf elephant's ear	Xanthosoma sagittifolium	1	Liliopsida
boatlily	Tradescantia spathacea	1	Liliopsida
white-flowered spiderwort	Tradescantia fluminensis	1	Liliopsida
umbrella plant	Cyperus involucratus	1	Liliopsida
air-potato	Dioscorea bulbifera	16	Liliopsida
winged yam	Dioscorea alata	2	Liliopsida
Sprenger's asparagus fern	Asparagus aethiopicus	13	Liliopsida
crowfootgrass	Dactyloctenium aegyptium	1	Liliopsida
torpedograss	Panicum repens	17	Liliopsida
alligatorweed	Alternanthera philoxeroides	13	Magnoliopsida
Asiatic hawksbeard	Youngia japonica	1	Magnoliopsida
Bay Biscayne creeping-oxeye	Sphagneticola trilobata	1	Magnoliopsida
sacred bamboo	Nandina domestica	2	Magnoliopsida

COMMON NAME	SCIENTIFIC NAME	NUMBER OF EDDMAPS SIGHTINGS	CLASS
catclaw-vine	Macfadyena unguis-cati	7	Magnoliopsida
Japanese honeysuckle	Lonicera japonica	3	Magnoliopsida
mexicantea	Dysphania ambrosioides	1	Magnoliopsida
thorny olive	Elaeagnus pungens	1	Magnoliopsida
Chinese tallowtree	Triadica sebifera	46	Magnoliopsida
Chinese wisteria	Wisteria sinensis	2	Magnoliopsida
kudzu	Pueraria montana	10	Magnoliopsida
mimosa	Albizia julibrissin	2	Magnoliopsida
red sesbania	Sesbania punicea	9	Magnoliopsida
camphortree	Cinnamomum camphora	7	Magnoliopsida
chinaberry	Melia azedarach	13	Magnoliopsida
paper-mulberry	Broussonetia papyrifera	1	Magnoliopsida
strawberry guava	Psidium cattleianum	1	Magnoliopsida
pink woodsorrel	Oxalis debilis	1	Magnoliopsida
Tamarisk	Tamarix spp.	7	Magnoliopsida
largeleaf lantana	Lantana camara	155	Magnoliopsida
narrow swordfern	Nephrolepis cordifolia	4	Filicopsida
ladder brake	Pteris vittata	1	Filicopsida
	TOTAL SIGHTINGS	**663**	

FIGURE 20: REED ISLAND AND AREAS OF SALT CEDAR

Despite the number of terrestrial invasive species reported within the project area, this analysis will only discuss the more relevant taxa. Some species, such as invasive exotic birds are mentioned here to acknowledge that they do occur within the project boundaries, but they are not discussed in detail due to the unlikelihood of them being directly impacted by the proposed deepening.

Currently there are 47 (12 bird, 3 reptile, and 32 plant species) different invasive terrestrial species sightings within the project area. Any statement of current terrestrial invasive species conditions in this area must also include the efforts that are currently underway to control and/or eradicate invasive species. The Operations Division, Invasive Species Management Group in USACE Jacksonville District has organized multiple field days for mapping the location of terrestrial invasive plant species, and organized volunteer group work days for the removal of these invasive plants. Specifically, there has been a significant effort on Reed Island to eliminate the *Tamarix spp*. seed source. Field days dedicated to the removal of *Tamarix spp*. were held on February 29, 2012 and August 22 through 23, 2012, as well as various other days when invasive species managers are in the field monitoring and treating any small colonies of invasive plants. There have been 32 sightings of invasive plant species (**Table 15**), and of these sightings there are 14 taxa which have had multiple sightings suggesting that there may be a growing/established population of these species.

For plant species, the Florida Exotic Pest Plant Council (FLEPPC) further defines invasive plant species into one of two categories. A Category I invasive plant is an invasive plant that has documented ecological damage from altering native plant communities by displacing the native species, changing the community structure, changing the community ecological functions, or hybridizing with native species. A Category II invasive plant species is an invasive plant that has increased in abundance or frequency but has not yet altered Florida plant communities to the extent shown by Category I species, however if ecological damage from these species is demonstrated then these species may be altered to become Category I type invasive species (FLEPPC, 2012).

The upland DMMAs, which are utilized for dredged material placement, provide an environment that is well suited for the introduction and establishment of invasive plant species. As mentioned earlier, Reed Island is a seed source for the *Tamarix spp*., and is located next to Bartram Island, a disposal area that will be used for the Jacksonville Harbor Deepening Project, and which has already had *Tamarix spp*. sightings recorded. Currently *Tamarix spp.* are not listed as a Category I or II plant by FLEPPC, but are considered by United States Department of Agriculture to be an invasive species (United States Department of Agriculture, 2012), and if listed in the FLEPPC the *Tamarix spp*. would be expected to be listed as a Category I. There are currently efforts in place to help reduce the spread of the *Tamarix ramisissima* species, including coordination between USACE, the City of Jacksonville, JAXPORT, the Florida/Carribean Exotic Pest Management Team, and other volunteers to eliminate the *Tamarix ramisissima* seed source on Reed, Buck and Bartram Islands.

The air potato (*Dioscorea bulbifera*) is another invasive terrestrial plant that occurs within the project area, and is listed by the FLEPPC as a Category I invasive plant. The annual volunteer effort to remove air potatoes is coordinated by the First Coast Invasive Working Group and includes Duval, Clay, St. Johns, Baker and Nassau counties (Florida Department of Environmental Protection, 2012).

The other invasive plant species that were sighted more than once or twice within the project area, suggesting an established population, and classified as a Category I invasive plant species are:

- *Asparagus aethiopicus*, or Sprenger's asparagus fern

- *Panicum repens*, or torpedograss
- *Macfadyena unguis-cati*, or catclaw-vine
- *Pueraria montana*, or kudzu
- *Cinnamomum camphora*, or camphortree
- *Lantana camara*, or largeleaf lantana

In addition to the Category I invasive plants there are also several invasive Category II invasive plants:

- *Alternanthera philoxeroides*, or alligatorweed
- *Sesbania punicea*, or red sesbania
- *Melia azedarach*, or chinaberry

Chinese tallowtree (*Triadica sebifera*) is also not listed as either Category I or Category II on the FLEPPC website, but is considered an invasive plant by the National Invasive Species Council, 2012, and if listed on the FLEPPC would be expected to be listed as a Category I type of invasive plant.

Aquatic Invasive Species

In addition to the terrestrial invasive species listed above, the 2012 State of the River Report (2012 SOTR) for the LSJR Basin lists the aquatic invasive species (**Table 16**) found within the St. Johns River. This includes a total of 24 invasive marine and/or brackish species, and 2 new invasive species for 2012. These marine species are of particular concern, as it has been documented that many of these invasive species were introduced through shipping activities. It is known that invasive species are being introduced through ballast water from ships. While the U.S. Coast Guard has issued regulations for the exchange of ballast waters 200 miles offshore, or the installation of a Ballast Water Management System (BWMS), this regulation doesn't address all of the issues related to shipping industry transport of invasive species. This regulation (Federal Register, 2012) requires vessels without a BWMS installed, and if it is safe to exchange their ballast water 200 miles off-shore. This regulation doesn't address the invasive species transport issues because it leaves four possible avenues for invasive species introduction. The four possibilities are:

1) Exchanging ballast water may leave residual water in the ballast where an invasive species may survive until new water is pumped in, or invasive species which attach to the inside of the ballast may not release their attachment during the exchange and become possible ballast fouling. (Duggan, et al., 2005, Drake, et al. 2007).
2) Attachment of larval invasive species to the hull of the vessel (Edyvean, R. 2010).
3) Attachment of larval invasive species to the "cool" side of open water engine heat exchange systems (Edyvean, R. 2010).

4) Transport of invasive species in the bilge of a vessel.

The current ballast water exchange regulation does address the ballast water introduction pathway, although introduction via ballast water is still possible, but the risk of introduction is reduced.

Dredged material resulting from the deepening would be placed primarily within an approved offshore area. Offshore placement of rocky material may be utilized by invasive Lionfish (*Pterois volitans*, and *Pterois miles*). There are several organizations in the Western Atlantic, Gulf of Mexico, and the Caribbean who regularly schedule efforts to eradicate/control the Lionfish populations through different programs, including Lionfish fishing tournaments, culling expeditions, and efforts to condition or teach native fishes, particularly members of the Serranidae (Grouper) family, to prey on this species. Green and Côte (2009) suggest that if Lionfish populations are not being actively managed the populations have the ability to far exceed sustainable levels of predation of native species, leading to the eventual decline of native species.

Another invasive species is the Giant Asian Tiger Prawns (*Penaeus monodon*), which is likely to have had an impact on the native recreational/commercial penaeid shrimp populations of white shrimp (*Litopenaeus setiferus*), pink shrimp (Farfantepenaeus duorarum) and brown shrimp (Farfantepenaeus aztecus). Although many species of penaeid shrimp, including Penaeus monodo*n,* have being cultured in shrimp farms for an extended period of time, there is little peer reviewed information on the escape of these species and the effects these introductions have had on the natural ecosystems (Rodríguez, and Suárez. 2001).

Table 16: Non-native aquatic species recorded in the Lower St. Johns River Basin (Environmental Protection Board. 2012)

COMMON NAME	SCIENTIFIC NAME	HABITAT REALM	DATE	ORIGIN	PROBABLE VECTORS	PROHIBITED STATUS?	REFERENCE
Pleated (or rough) sea squirt	*Styela plicata*	Marine	Unknown; Documented on ships in NY and Philadelphia in the 1800s; Reported offshore Jacksonville as early as 1940.	Indo-Pacific? This species is now found in tropical and warm temperate oceans around the world.	Ship/boat hull fouling; Ship ballast water/sediment; Importation of mollusk cultures	No	**De Barros, et al. 2009; GBIF 2012d**
Brown bryozoan **NEW FOR 2012**	*Bugula neritina*	Marine, Brackish	Beaufort, NC (1878 record); Dry Tortugas (1900 record); widespread in SE Atlantic by mid-1900's.	Native range is unknown – probably Mediterranean Sea (1758 record).	Ship/boat hull fouling	No	**Eldredge and Smith 2001; GBIF 2012c; NEMESIS 2012**
Bocourt swimming crab	*Callinectes bocourti*	Marine, Brackish	First US report was Biscayne Bay, FL, 1950.	Caribbean and South America	From the Caribbean via major eddies in Gulf Stream or southern storm events	Federal Injurious Wildlife List "No such live fish, mollusks, crustacean, or any progeny or eggs thereof may be released into the wild" (without a permit from FWC) (U.S. Lacey Act; 50 CFR Ch. I Sec. 16.13)	**USGS 2012b**
Indo-Pacific swimming crab	*Charybdis hellerii*	Marine	First US report was South Carolina (1986), Indian River Lagoon, FL (1995)	Indo-Pacific	Ship ballast water/sediment, or drift of juveniles from Cuba	Federal Injurious Wildlife List (U.S. Lacey Act)	**USGS 2012b**
Green porcelain crab	*Petrolisthes armatus*	Marine, Brackish	Indian River Lagoon, FL (1977), Georgia (1994), and SC (1995)	Caribbean and South America	Natural range expansion, Ship ballast water/sediment, importation of mollusk cultures	Federal Injurious Wildlife List (U.S. Lacey Act)	**Power, et al. 2006**
Slender mud tube-builder amphipod	*Corophium lacustre*	Freshwater, Brackish	First record in the St. Johns River in 1998.	Europe and Africa	Ship ballast water/sediment from Europe	Federal Injurious Wildlife List (U.S. Lacey Act)	**GBIF 2012b; Power, et al. 2006**
Skeleton shrimp	*Caprella scaura*	Marine	Caribbean Sea (1968), St. Johns River (2001)	Indian Ocean	Ship/boat hull fouling; Ship ballast water/sediment	Federal Injurious Wildlife List (U.S. Lacey Act)	**Foster, et al. 2004; GBIF 2012a**
Wharf roach	*Ligia exotica*	Marine	Unknown	Northeast Atlantic and Mediterranean Basin	Bulk freight/cargo, Ship ballast water/sediment, Shipping material from Europe	Federal Injurious Wildlife List (U.S. Lacey Act)	**Power, et al. 2006**
Striped barnacle	*Balanus amphitrite*	Marine	Unknown	Indo-Pacific	Ship/boat hull fouling	Federal Injurious Wildlife List (U.S. Lacey Act)	**Power, et al. 2006**
Triangular barnacle	*Balanus trigonus*	Marine	Unknown	Indo-Pacific	Ship/boat hull fouling	Federal Injurious Wildlife List (U.S. Lacey Act)	**GSMFC 2010**
Barnacle	*Balanus reticulatus*	Marine	Unknown	Indo-Pacific	Ship/boat hull fouling	Federal Injurious Wildlife List (U.S. Lacey Act)	**GSMFC 2010**
Titan acorn barnacle	*Megabalanus coccopoma*	Marine	First recorded in Duval Co, FL - 2004; Common by 2006.	Pacific Ocean	Ship/boat hull fouling	Federal Injurious Wildlife List (U.S. Lacey Act)	**Frank 2008a**
Mediterranean acorn barnacle	*Megabalanus antillensis (*also known as *M. tintinnabulum)*	Marine	Unknown	Europe (Mediterranean Sea)	Ship/boat hull fouling	Federal Injurious Wildlife List (U.S. Lacey Act)	**Masterson 2007; McCarthy 2011**
Asian tiger shrimp	*Penaeus monodon*	Marine, Brackish	First recorded in Duval Co, FL – 2008.	Australasia	Aquaculture stock	Federal Injurious Wildlife List (U.S. Lacey Act)	**USGS 2012b**
Lionfish	*Primarily Pterois volitans (red lionfish) with a small number of Pterois miles (devil firefish)*	Marine	First U.S. reports were Dania, FL (1985) and Biscayne Bay (1992). Offshore Jacksonville (2001).	Indo-Pacific	Humans: aquarium releases or escapes	Federal Injurious Wildlife List (U.S. Lacey Act)	**USGS 2012b**
Mozambique tilapia	*Oreochromis mossambicus*	Freshwater, Brackish	1960's - Introduced/established in Dade Co, FL. Recorded in LSJRB between 2001 and 2006.	Africa	Humans: Stocked, intentionally released, escapes from fish farms, aquarium releases	Federal Injurious Wildlife List (U.S. Lacey Act)	**Brodie 2008; GSMFC 2010; USGS 2012b**
Wiper (Hybrid Striped Bass) (Whiterock = *female striped bass x male white bass,* Sunshine Bass = *male striped*	*Morone chrysops x saxatilis (Artificial hybrid between the white bass and the striped bass)*	Freshwater, Brackish, Marine	Intentionally stocked in the 1970's. Identified in 1992.	Artificial Hybrid	Humans: Intentional fish stocking	Federal Injurious Wildlife List (U.S. Lacey Act)	**USGS 2012b**

COMMON NAME	SCIENTIFIC NAME	HABITAT REALM	DATE	ORIGIN	PROBABLE VECTORS	PROHIBITED STATUS?	REFERENCE
bass x female white bass)							
Charrua mussel	*Mytella charruana*	Marine	1986- Jacksonville; 2004- Mosquito Lagoon; 2006- Mayport (Duval Co), 2006- Marineland (Flagler Co)	South America	Ship ballast water/sediment	Federal Injurious Wildlife List (U.S. Lacey Act)	**Lee 2008a**
Green mussel	*Perna viridis*	Marine, Brackish	1999- Tampa Bay; 2003- St. Augustine and Jacksonville	Indo-Pacific	Ship ballast water/sediment, Ship/boat hull fouling, Humans	Federal Injurious Wildlife List (U.S. Lacey Act)	**Frank 2008a**
Mouse-ear marshsnail	*Myosotella myosotis*	Marine	Unknown	Europe	Bulk freight/cargo, Ship ballast water/sediment,	Federal Injurious Wildlife List (U.S. Lacey Act)	**Lee 2008a**
Striped falselimpet	*Siphonaria pectinata*	Marine	Unknown	Europe and Africa (Mediterranean Sea)	Bulk freight/cargo, Ship ballast water/sediment, Ship/boat hull fouling, Humans	Federal Injurious Wildlife List (U.S. Lacey Act)	**Lee 2008a; McCarthy 2008**
Fimbriate shipworm	*Bankia fimbriatula*	Marine	Unknown	Pacific?	Ship/boat hull fouling, Humans	Federal Injurious Wildlife List (U.S. Lacey Act)	**Lee 2008a**
Striate Piddock shipworm	*Martesia striata*	Marine	Unknown	Indo-Pacific?	Ship/boat hull fouling, Humans	Federal Injurious Wildlife List (U.S. Lacey Act)	**Lee 2008a**
Gulf Wedge Clam **NEW FOR 2012**	*Rangia cuneata*	Brackish	Present in Atlantic east coast Pleistocene deposits; First live Atlantic record in 1946.	Prior to 1946, native range was considered Gulf Coast of northern FL to TX.	Possible vectors: transplanted seed oysters, oyster shipments, ballast water	Federal Injurious Wildlife List (U.S. Lacey Act)	**Carlton 1992; Carlton 2012; Foltz, et al. 1995; GBIF 2012c; Lee 2012b; NEMESIS 2012; Verween, et al. 2006**

2.3.14 Recreation

Recreational boat traffic regularly transits through the study area via the St. Johns River and the IWW. Fishing is a very popular recreational activity, and many fishermen can typically be observed using nearby parks or boating on the LSJR or its tributaries. Upstream of the proposed construction area, fishing is equally popular. Access to the river is available at a number of locations in Clay, St. Johns, and Putnam counties. Fishing for estuarine and freshwater finfish, shrimp, and crabs are all common activities along the river banks and from boats in the river.

In addition to the numerous parks available for public use (see Section 2.2.10), FWC (https://public.myfwc.com/LE/boatramp/public/CountyMap.aspx) lists 29 boat ramps in Duval County which provide access to the St. Johns River and associated natural areas. Clay and St. Johns counties contribute another ten ramps, and Putnam County provides river access at nine public boat ramps on the river including six near the upstream end of the project study area and a total of twenty public landings on tributary waterways in the county (http://www.putnam-fl.com/bocc/index.php?option=comcontent&view=article&id=493&Itemid=155). St. Johns County maintains six parks on the river, some with boat ramps. In addition, numerous private access points are available at fish camps and marinas.

Recreational fishing for both fin and shellfish with FWC recreational fishing licenses are popular activities most of the year. Passive recreation includes such activities as sailing, boating, and paddling the Putnam County Blueway, which stretches for over 60 river miles along the shallow edges of the St. Johns River in Putnam County.

2.4 ECONOMIC CONDITIONS

The goal of the economic analysis is to determine whether reducing the cost of cargo movement at Jacksonville Harbor by deepening the navigation channel is economically justified. This requires identifying the factors that have the greatest bearing on the cost of freight movement and determining how those factors are likely to change in response to the alternatives. Therefore the purpose of this section of the report is to describe the process used to identify these factors, and explain their significance to the analysis. As a result, this section provides characterizations of the following topics:

a) economic study area
b) commodity types, volumes, sources and destinations
c) trade regions, lanes and routes
d) fleet composition
e) freight movements by trade route and
f) a concluding inventory of what matters and why

It is important to note that this is not intended to provide an exhaustive inventory of Jacksonville Harbor. It is intended to develop an informed answer to the question, “Is deepening of the first 13 river miles economically justified, and if yes, to what depth?”

2.4.1 Economic Study Area

The purpose of defining and describing an economic study area is to identify the relevant population centers, their economic activities, and the physical linkages to the Federal navigation project. The description of the economic study area concludes with a description of the relevant local service facilities and general navigation features.

2.4.1.1 Trade Hinterland: Boundaries, Population, and Economic Activity

Essential components of trade are economic activity, people, and infrastructure connectivity. Without these, there can be no trade and as a result, no need for freight transport. The intent of the hinterland analysis is to identify the basic components of trade in the area (economic activity and population) anticipated to be served by Jacksonville Harbor. Hinterland spatial boundaries were determined qualitatively based on the relative distance of population centers from surrounding seaports while considering each seaport’s cargo volume. The core hinterland for Jacksonville Harbor is based on the metropolitan statistical areas located in Northeast Florida, and Southeast Georgia.[2] The domestic hinterland population is anticipated to grow from 4.7 million in 2012, to over 7 million by 2040.

As of 2011, the hinterland had a combined GDP (gross domestic product) of $169 billion in chained 2005 dollars, and an average unemployment rate of 8.3%. The primary economic sectors include financial services, tourism, professional services, and trade (retail and wholesale).

2.4.1.2 Major Infrastructure Linking the Population Centers

Hinterland population centers are connected and in a sense, bounded by I-10, I-95, I-4, and I-75. Both I-10 and I-95 are within minutes of the major JAXPORT marine terminals at Jacksonville Harbor.

Florida East Coast Railway (FEC) and CSX provide railway connections that link the Jacksonville Harbor hinterland to not only the hinterlands of other seaports, but to inland intermodal facilities within the interior of the country. Blount Island

[2] MSAs consist of Deltona-Daytona-Ormond, Gainesville, Jacksonville, Ocala, Palm Coast, Valdosta, and Orlando

and Talleyrand have on-dock rail, and an intermodal container transfer facility is being developed at Dames Point.

Table 17: Port Facilities

	General Navigation Feature (GNF)	Local Service Facility	GNF Width (feet)	GNF Length (nm)	GNF Depth (feet)
Channel Sections within Project footprint	St John's Bar Cut Range - East Section		800	2.10	42
	St John's Bar Cut Range - West Section		800	1.50	40
	Pilot Town Cut Range		950	1.00	40
	Mayport Cut Range		1050	0.50	40
	Sherman Cut Range		950-650	0.70	40
	Mile Point Lower Range and Turn		650	0.50	40
	Training Wall Reach		650-500	1.10	40
	Short Cut Turn		600	0.40	40
	White Shells Cut Range		580-1280	0.70	40
	St John's Bluff Reach		1200-1100	0.60	40
	Dames Point - Fulton Cutoff Range	JEA Coal Dock, BIMT-35-34-33-32-31-30	1580-500	2.70	40
	Blount Island Channel	BIMT-22-20/ JEA Fuel Dock	300-800	1.70	38
	Dames Point Turn		900-1200	0.40	40
	Quarantine / Upper Range	DPMT-18-17-16-10	1000-550	0.70	40
Channel sections out of project	Brills Cut Range	Dames Point (Cruise)	550-450	0.80	40
	Broward Point Turn	BP Amoco – Amerada Hess	625-850	1.00	40
	Drummond Creek Range	Navy Fuel Depot	650-400	1.50	40
	Trout River Cut Range		400-500	1.00	40
	Chaseville Turn	US Gypsum, NuStar	500-700	0.60	40
	Long Branch Range	TransMonaigne, Chevron	650-2000	0.70	40
	Terminal Channel	Talleyrand Marine Terminal	575-1025	3.00	40

Table 17 provides detail on the channel sections and facilities relevant to the analysis.

Table 18: Historical Cargo Volume

Calendar Year	1,000 Metric Tonnes
2000	17,872
2001	16,156
2002	16,244
2003	20,280
2004	19,926
2005	20,991
2006	21,196
2007	19,594
2008	19,350
2009	16,258
2010	17,551

Table 19: Average Annual Growth Rate

Calendar Year	Growth Rate
2000-2005	3.66%
2005-2010	-3.52%
2000-2010	-0.18%

2.4.2 Cargo

Jacksonville Harbor is the primary deep draft port for waterborne commerce in northeast Florida. The closest major ports to Jacksonville Harbor are Savannah Harbor, which is located about 150 statute miles to the north in Georgia, and Canaveral Harbor, about 170 miles to the south in Florida. Jacksonville Harbor allows for transportation of international and domestic cargo to and from the terminals located along the Federal channel. The existing harbor project provides access to deep draft vessel traffic using terminal locations located in the City of Jacksonville.

Total tonnage handled in the port is approximately 17.5 million tons according to the Waterborne Commerce of the U.S. – 2010. Historical tonnage for Jacksonville Harbor and average annual growth rates for Calendar Years 2000-2010 are shown in **Table 18 and Table 19.** This tonnage is sufficient to place the port among the top three cargo ports in the State of Florida and 38th in the country.

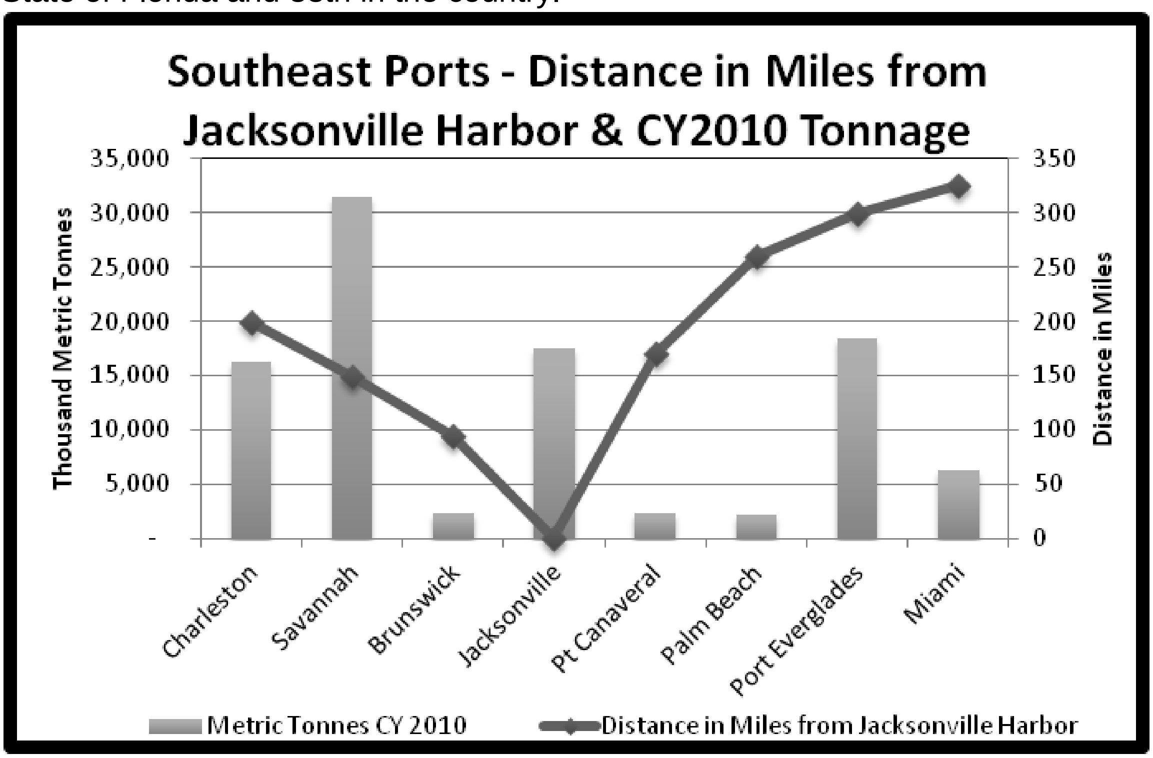


FIGURE 21: TONNAGE COMPARISON OF SOUTHEAST PORTS EAST COAST FL, GA, SC

Coal, petroleum products, food and farm products, vehicles and parts, and construction materials made up over 75% of the cargo composition between 2006 and 2010. These commodities transit primarily on container, liquid bulk and dry bulk vessels.

Using PIERS data, the commodities were organized into container, dry bulk, liquid bulk, and break-bulk and neo-bulk trade concepts. As **Figure 22** illustrates, there is substantial liquid and dry bulk volume moving through the harbor. However, those cargoes are a declining share of the total port volume. However, while all other cargoes are either flat or declining, container throughput shows a steady increase, even during the recessionary period of 2008-2009.

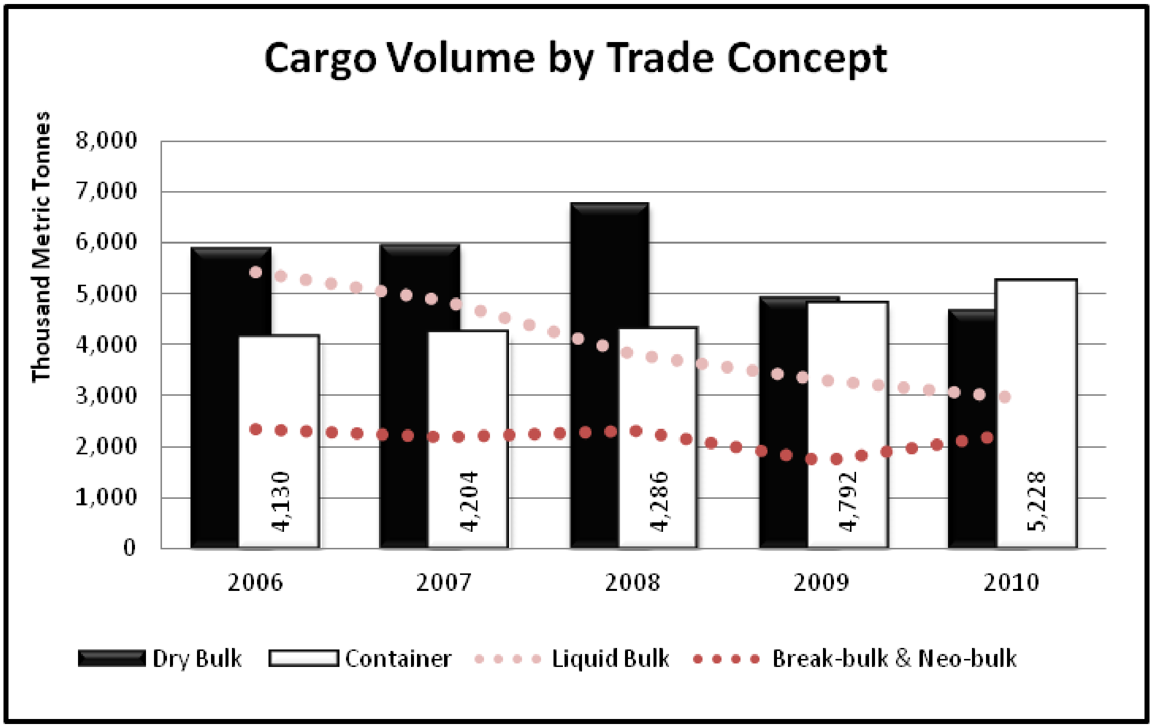


FIGURE 22: CARGO VOLUME BY TRADE CONCEPT

Table 20 provides detail on the major container cargoes moving through the harbor. The substantial increase in cargo throughput on the major East-West trades is the main reason for the increase in total container volume at Jacksonville Harbor.

Table 20: Containers moving on major trades

VOLUME IN TEUS					
Commodity Name	**2006**	**2007**	**2008**	**2009**	**2010**
FE-ECUS-PAN	-	-	9,474	49,359	54,412
FE-ECUS-SUEZ	-	-	4,304	11,132	33,257
FE-EU-ECUS-GMEX	48,555	57,342	53,648	53,271	48,813
ECSA-ECUS	59,429	60,703	55,864	52,883	62,163
	VOLUME IN METRIC TONNES				
Commodity Name	**2006**	**2007**	**2008**	**2009**	**2010**
FE-ECUS-PAN	-	-	50,427	334,432	416,206
FE-ECUS-SUEZ	-	-	32,705	96,595	273,826
FE-EU-ECUS-GMEX	440,206	494,355	482,640	529,011	433,523
ECSA-ECUS	459,117	447,715	386,300	410,232	504,966

The Jacksonville Port Authority (JAXPORT) has been moving to aggressively exploit its undeveloped terminal sites for both bulk and containerized cargo. Two major lines that represent global container alliances have made commitments to secure private terminals in Jacksonville Harbor that would bring major global services to the port. Prior to the development of the Mitsui terminal, Jacksonville was primarily a regional container port for Puerto Rico and the Caribbean, with some limited service to South America. The development of the Mitsui Terminal has brought major east-west global services to Jacksonville Harbor.

The new TraPac Container Terminal (built in 2009), has two 1,200-foot berths that line a 158-acre facility used by Mitsui O.S.K. Lines (MOL) and its terminal operating partner, TraPac, to load and unload container ships sailing to and from ports in Asia. Jaxport (Jacksonville Port Authority) is leasing this space to Tokyo-based MOL. The TraPac Container Terminal is located between two existing Jaxport facilities: the Jaxport cruise terminal just off of Heckscher Drive and Jaxport's existing bulk cargo terminals at the southern end of the Dames Point peninsula. Jaxport and the Florida Department of Transportation (FDOT) have completed road improvements at State Road 9-A/Heckscher Drive and Heckscher Drive/New Berlin Road to better accommodate vehicular and truck movement through the area.

MOL's liner route network coverage is global, and there are plans for future global expansion. In 1995, MOL's leadership helped create a world strategic alliance with other carriers. To better serve trans-Pacific, trans-Atlantic, and Asia-Europe routes, MOL, APL of Singapore, and Hyundai Merchant Marine of South Korea formed the New World Alliance (NWA), which plays a key role in cargo trade on these international routes. The NWA growth is particularly strong in Asia, which has seen tremendous economic expansion in recent years, and in South America and Africa, markets where MOL traditionally has held an advantage. The Alliance also serves the Middle East, Russia, and Australia. MOL operates liner routes with a fleet of over 100 containerships. These vessels range in size of up to 8,000 TEUs. MOL continues to launch new vessels to boost efficiency and competitiveness. MOL has expanded its container inventory in step with the growth of its containership fleet to include maintenance of reefer containers to meet growth.

MOL has 8 owned-and-operated container terminals worldwide (Tokyo, Yokohama, Osaka, Kobe [Japan], Laem Chabang [Thailand], Los Angeles, Oakland, Jacksonville [USA]). To meet expanding needs, new terminals are being built at Cai Mep Port in Vietnam, and in Maasvlakte 2 Zone in the Port of Rotterdam, the Netherlands. MOL terminals have state-of-the-art systems and equipment.

MOL also serves the global auto industry with a large, flexible fleet. MOL launched Japan's first ship designed to transport cars. Since then, MOL service has expanded from handling Japanese exports to serving global auto production centers including Japan/South Korea, North America, Europe, and Southeast Asia. Today's car carriers are designed to ship all types of motor vehicles, from automobiles to construction machinery. Since the cargo can move under its own power, these roll on/roll off carriers need no specialized loading equipment other than rampways used to drive the vehicles on and off the ships. The largest car carrier in service today can accommodate 5,300 vehicles on 13 cargo decks. The Blount Island terminal at Jaxport is 754 acres, Jaxport's largest marine facility terminal, and is one of the largest vehicle import/export centers in the U.S. The terminal also handles Ro/Ro, heavy lift, breakbulk and liquid bulk cargoes.

As of the first quarter of 2011, MOL featured a total of 88 service lanes, 7 lanes for Asia to Africa and the Middle East, 6 lanes for Asia to Europe, 2 lanes for Asia to the Mediterranean, 16 lanes for Asia to North America, 5 lanes for Asia to Oceania, 10 lanes for Asia to South America and Latin America, 4 lanes for Europe to Africa, 1 lane for Europe to North America, 23 lanes for Intra-Asia services, 5 lanes for Latin America services, 7 lanes for North America to Latin/South America, 1 lane for North America to South Africa, and 1 lane for South America to Africa service.

Out of the 16 Asia to North America lanes, 5 service lanes call the east coast of the U.S. (routes CNY, NYX, SVE, NUE and SZX, of which the first three call Jacksonville). The CNY port rotation has a Panama Canal transit and calls the following U.S. ports: Miami, Jacksonville, Savannah, Charleston, Norfolk, and New York (different calls under eastbound and westbound rotations). The NYX rotation calls New York, Norfolk, Savannah, Jacksonville, and Miami. The SVE rotation is a Suez transit westbound calling New York (after Halifax), Norfolk, Jacksonville, followed by Savannah (and returns westbound around the cape of Africa to Singapore). The NUE rotation is a Panama transit calling New York, Norfolk, and Charleston. The SZX rotation is a Suez Canal transit calling New York, Charleston, Savannah, and Norfolk. The other 11 service lanes are from Asia to the west coast of the U.S. (i.e., Los Angeles/Oakland, Pacific Southwest, Pacific Northwest, and west coast Canada).

The Europe to North America trade route (APX) has the following U.S. port calls, eastbound: New York, Norfolk, Charleston, Savannah, Jacksonville, Miami, followed by a Panama Canal transit to Los Angeles and Oakland. The North America to South Africa trade route (via APX) has New York, Charleston, Savannah, Jacksonville, and Miami as port of loadings with intermediate ports in rotation to Europe. For the North America Latin/South America trade route, Jacksonville is a port of call to MOL for 4 out of the 7 trade routes (ACW, CNY, ECX, and NYX).

2.4.2.1 Container

Container cargo trade concepts were aggregated into trade route groupings based on an assessment of cargo origin/destination, vessel type and class, and carrier. A trade route was deemed significant if a channel deepening could conceivably influence vessel size deployment and/or channel utilization behavior. This implies the fleet moving the cargo will have its range of operational drafts constrained due to insufficient channel depth in the future without project condition. Furthermore, the fleet servicing these routes is likely to transition to larger vessels over the period of analysis.

- FE-ECUS-PAN: This trade represents the Far East to U.S. East Coast end to end trade that transits the Panama Canal. Currently, the vessels using this route tend to call the MOL TraPac terminal at Dames Point, and tend to be Panamax size vessels. This traffic is anticipated to shift to Post-Panamax Generation 1 to Post-Panamax Generation 2 size vessels in the future. Services include the NYX rotation which calls New York, Norfolk, Savannah, Jacksonville, and Miami.

- FE-ECUS-SUEZ: Far-East/Southern Asia/Indian Sub-Continent to U.S. East Coast end to end trade that transits the Suez Canal. Currently, the vessels using this route call the MOL TraPac terminal at Dames Point, and tend to be Panamax and Post-Panamax Generation 1 size vessels. This traffic is anticipated to shift to Post-Panamax Generation 2 size vessels in the future. The SVE rotation is a Suez transit westbound calling New York (after Halifax), Norfolk, Jacksonville, followed by Savannah (and returns westbound around the cape of Africa to Singapore). The SZX rotation is a Suez Canal transit calling New York, Charleston, Savannah, and Norfolk.

- FE-EU-ECUS-GMEX: This route represents a composite of services calling Jacksonville in vessel sizes ranging from Sub-Panamax to Panamax. Regions served include Europe, U.S. East Coast, U.S. West Coast, and U.S. Gulf Coast. The Europe to North America trade route (APX) has the following U.S. port calls, eastbound: New York, Norfolk, Charleston, Savannah, Jacksonville, Miami, followed by a Panama Canal transit to Los Angeles and Oakland. The North America to South Africa trade route (via APX) has New York, Charleston, Savannah, Jacksonville, and Miami as port of loadings with intermediate ports in rotation to Europe.

- ECSA-ECUS: This trade route services the North and South American Eastern seaboards. Vessels servicing this trade are in the Panamax class. It is anticipated that in the future, this trade will transition to Post-Panamax Generation 1 with or without a project.

ROUTE GROUP	**FE-ECUS-PAN**	**FE-ECUS-SUEZ**	**FE-EU-ECUS-GMEX**	**ECSA-ECUS**
Carrier	HMM	K-Line/MOL	MOL	Hamburg Sud
	APL	MOL/Evergreen	APL	Alianca
		CMA-CGM		CSAV
Services	NYX	PEX3	APX	Libra Tango-New Tango
	CNY	SVE	Liberty Bridge	
		SVS		
VOYAGE DETAILS				
Frequency	Weekly	Weekly	Weekly	Weekly
RT Voyage (# days)	63-77	63-70	70-91	49
# Vessels	9-11	9-10	13	7
Avg TEU Capacity	4632-4861	5900-6000	4,800	4400
Circuitry Distance (nm)	~ 24,000	~26,000	~20,000	~13,600

2.4.2.2 Dry Bulk

Dry bulk cargo moving through Jacksonville consists of the coal, limestone, and dry bulk construction materials. Coal sourced from foreign deepwater ports increased steadily between 2006 and 2008 but fell rather sharply between 2008 and 2009. Coal is received either from domestic sources by rail, or foreign sources by ocean going vessels. Coal is primarily sourced from Puerto Bolivar in Columbia. Depending on price fluctuations, the plant maintains the capability to alter fuel sources as necessary to meet electricity demand. Coal is used to generate electricity at the St Johns River Power Park.

Dry-bulk construction materials (limestone, granite, and gypsum) are sourced primarily from Central America, Canada, and the Caribbean. Most of these materials are delivered to the Bulk facility located at Dames Point. There are limestone cargoes delivered to the JEA Northside facility from time to time.

- Coal: Coal and Coke
- Dry Bulk: Granite, limestone, limestone chips, gypsum

Commodity	2006-2010 Average	2006-2010 Total	%
COAL & COKE	3,394,641	16,973,207	61.1%
LIMESTONE CHIPS	515,826	2,579,132	9.3%
STONES & PEBBLES	138,341	691,707	2.5%
LIMESTONE	648,145	3,240,727	11.7%
GRANITE	490,543	2,452,715	8.8%
GYPSUM	368,413	1,842,063	6.6%
BULK POTASSIC FERT, PEAT MOSS	5,259	21,037	0.1%
Total Tonnes	**5,561,170**	**27,800,589**	**100%**

2.4.2.3 Other

Remaining cargo categories that are of less importance to the analysis consist of liquid bulk, break-bulk, and vehicular cargoes. The containerized trade moving on domestic flag ships between Jacksonville and Puerto Rico makes up approximately 60% of the total container throughput. However, while these trade concepts move through the port in significant quantities, their only relevance to the economic analysis is that they represent a source of harbor congestion. These cargoes were grouped into the following types:

- CAR-PR-JAX: Puerto Rican Trade
- GENERAL-CARGO: Break-bulk, multi-project cargo, RoRo
- LIQUID BULK: Petroleum products, chemicals
- AUTOS: Motor Vehicles

Table 21 provides detail on the number of vessel calls by class in the existing condition. With respect to the containerships and bulkers, there is a preference for ships with higher capacity over time.

Table 21: Vessel Calls in Existing Condition[3]

Vessel Class Name	2006	2007	2008	2009	2010
Sub-Panamax1	157	166	151	114	80
Sub-Panamax2	228	197	158	159	150
PX1	51	55	58	91	94
Panamax		1	24	123	168
Post-Panamax Generation 1					29
REEFER	27	22	17	14	16
RORO	197	221	200	196	198
VEHICLES CARRIER	475	521	581	429	493
GC	251	231	225	212	240
BARGE-GC-BULK	521	552	532	471	504
BARGE-TANK	177	341	375	319	319
10-20k DWT Bulker	8	7		4	
20-30k DWT Bulker	21	10	2	5	12
30-40k DWT Bulker	41	33	16	5	10
40-50k DWT Bulker	50	37	47	20	15
50-60k DWT Bulker	28	33	29	8	5
60-70k DWT Bulker	26	13	19	34	39
70-80k DWT Bulker	11	32	35	40	30
10-20k DWT Tanker	9	10	12	13	10
20-30k DWT Tanker	5	3	2	1	3
30-40k DWT Tanker	21	17	15	18	12
40-50k DWT Tanker	154	143	124	93	75
50-60k DWT Tanker	9	9	18	20	28
60-70k DWT Tanker	8	22	21	23	13
70-80k DWT Tanker	9	5	20	18	10
Total # Calls	**2484**	**2681**	**2681**	**2430**	**2553**

2.4.3 Underkeel Clearance

ER 1105-2-100 defines underkeel clearance as the "minimum amount of clearance to assure safety." Underkeel clearance is the difference between the bottom of the channel and the lowest protrusion of the vessel. Pilots' data, which includes the actual sailing draft, date, and time of a vessel call, is evaluated, as well as tide charts to verify this amount. Due to changes in tide throughout the channel and course of a trip through Jacksonville Harbor, the actual under-keel clearance is changing throughout the trip.

2.4.4 Turning Basins

Ships currently turn off of the existing terminal docks in Jacksonville Harbor in areas where channel widths and berthing areas provide sufficient turning diameters. The introduction of larger ships may require reevaluation of existing turning locations.

[3] The number of cruise vessel calls are not shown here.

2.5 POPULATION DYNAMICS

The City of Jacksonville is the largest community within Duval County and the only city to lie along the project area. The total county population, according to the 2011 census data (www.census.gov), is estimated to be 860,479. Jacksonville has a total population of 817,602. The 2011 total population of Florida is estimated to be 19,057,542. Minorities comprise approximately 42.9% of the county's population, most of whom are African Americans (28.9%). The median household income was approximately $49,192 and the mean family income was approximately $76,027 for Duval County (American Community Survey (ACS) 2010 Census).

Any individual with total income less than an amount deemed to be sufficient to purchase basic needs of food, shelter, clothing, and other essential goods and services is classified as poor. The amount of income necessary to purchase these basic needs is the poverty line or threshold and is set by the Office of Management and Budget (U.S. Census 2010). The 2011 poverty line for an individual under 65 years of age is $11,702 and for over 65 years of age is $10,788. The poverty line for a three-person family with one child and two adults is $18,106. For a family with two adults and two children the poverty line is $22,811 (U.S. Census 2011). Within the 13 census tracts surrounding the study area, 11.65% of families (two adults and two children) are below the poverty threshold. The percentage of individuals below the poverty level in Jacksonville between 2007 and 2011 was 15.2%. Families with only a female present had the highest poverty rates at 40% for females having children less than 5 years (US Census Bureau State and County QuickFacts). According to the 2011 American Community Survey (ACS) 15.9% of the US population had income below their respective poverty level.

A population density map for Duval County is shown in **Figure 23** below.

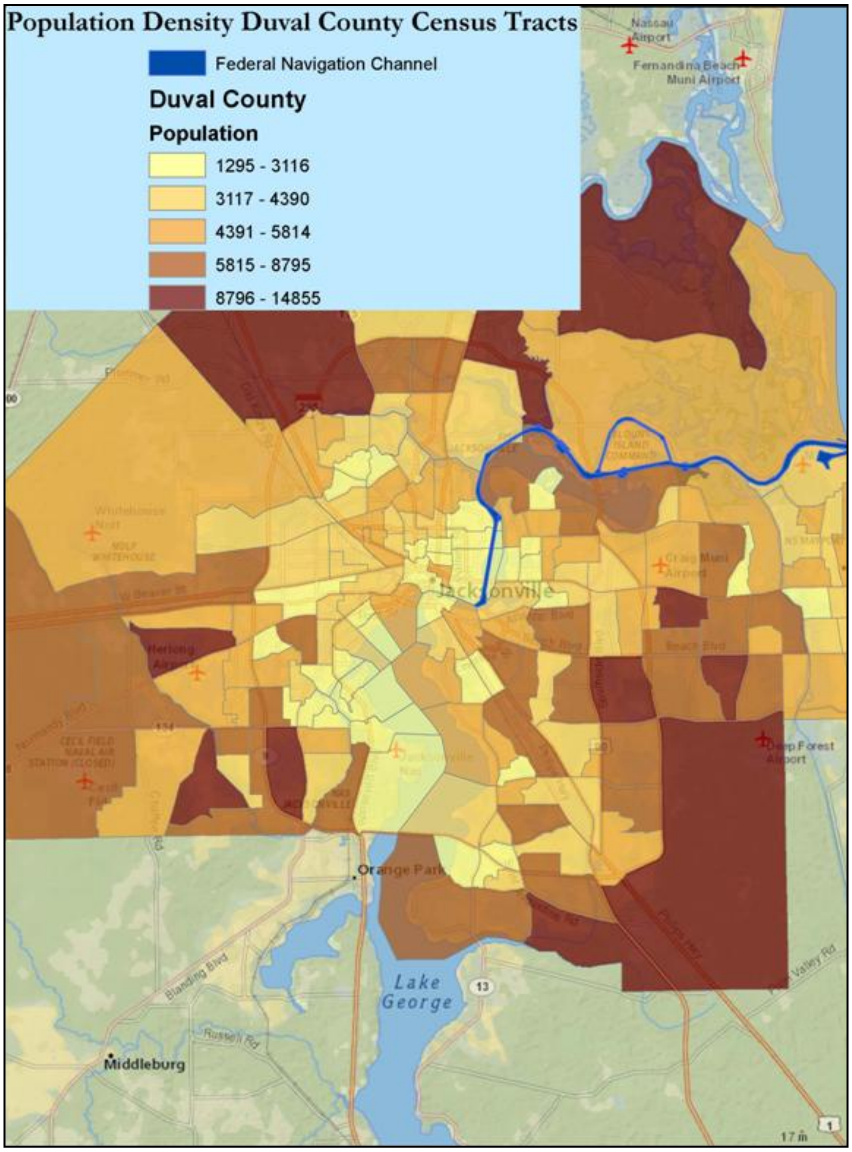


FIGURE 23: POPULATION DENSITY MAP FOR DUVAL COUNTY, FLORIDA

The 2010 U.S. Census tracts shown below comprise the Jacksonville Harbor area of interest (**Figure 24)**. The Duval County Census Tracts used in this analysis are 101.03, 101.02, 102.01, 102.02, 147.01, 147.02, 146.01, 143.33, 143.34, 143.30, 139.01, 139.04, and 138. The data taken from these tracts was then combined into the area of interest. The tracts neighboring the port were then compared to those of the City of Jacksonville and Duval County to create comparison areas and are presented in **Table 22** below.

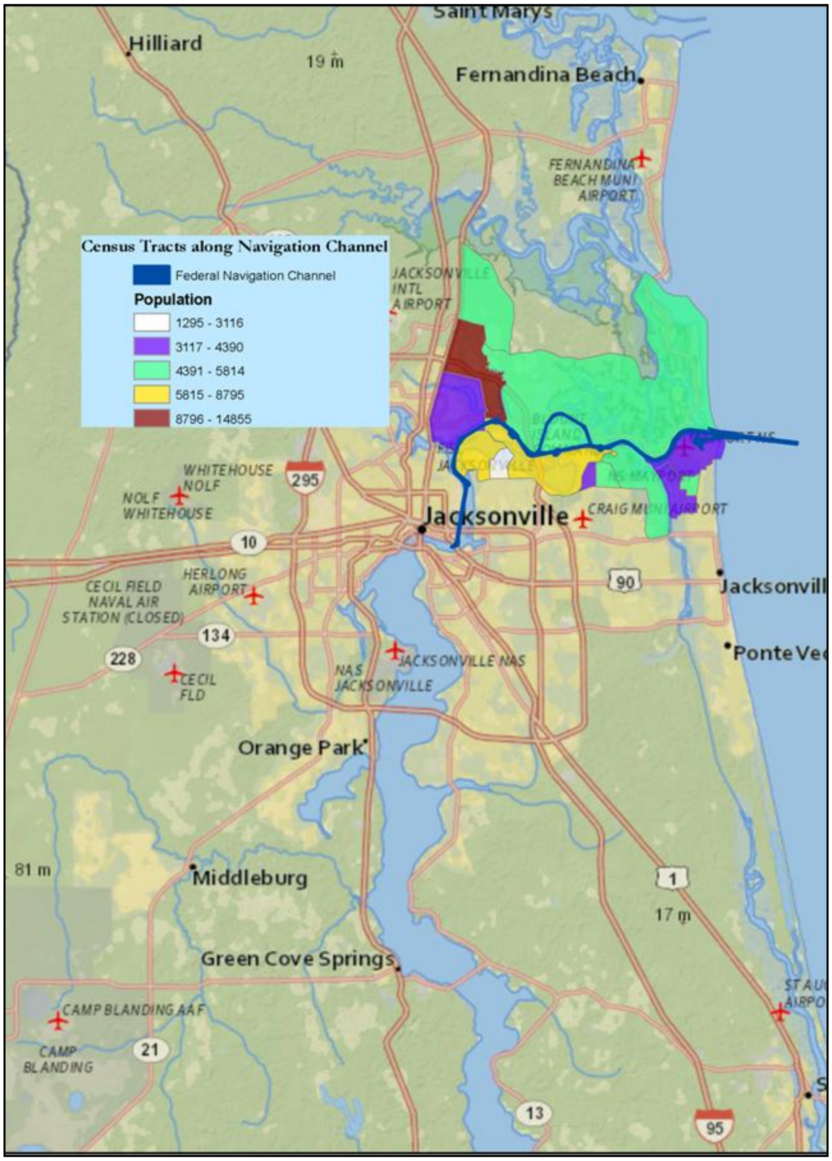


FIGURE 24: CENSUS TRACTS ALONG NAVIGATION CHANNEL

Table 22: Demographic Summary

Census Tracts Neighboring Port and Entrance Channel Combined			City of Jacksonville			Duval County		
*Based on 2010 US Census Data	Total Pop.	Percent of Pop.	Total Pop.	Percent of Pop.	Disparity	Total Pop.	Percent of Pop.	Disparity
Total	69,346	100.00%	817,602	100.00%	0.00%	860,479	100.00%	0.00%
Ethnicity								
White	46,851	67.56%	455,226	55.70%	11.86%	491,013	57.10%	10.46%
African American	13,859	19.99%	245,329	30.00%	-10.10%	248,679	28.90%	-8.91%
Native American	137	0.19%	2083	0.30%	-0.11%	2,272	0.30%	-0.11%
Asian	1,848	2.66%	33,933	4.20%	-1.54%	34,976	4.10%	-1.44%
Hispanic or Latino	4,556	6.57%	61,558	7.50%	-0.93	63,213	7.30%	-0.73
Pacific Islander	6	0.01%	575	0.07%	-0.06%	575	0.10%	-0.09%
Other	69	0.10%	1,674	0.20%	-0.10%	1,773	0.20%	-0.10%
2+ Ethnicities	1,807	2.61%	17,224	2.10%	0.51%	17,978	2.10%	0.51%
Minority	22,495	32.44%	362,376	44.33%	-11.89%	369,466	42.90%	-10.46%
Age								
Under 18	17,487	25.20%	196,942	24.10%	1.10%	204,833	23.80%	1.40%
Over 18	21,105	74.80%	620,660	75.90%	-1.10%	655,646	76.20%	-1.40%
65 and over	7,082	10.21%	88,105	10.80%	-0.60%	94,353	10.97%	-0.76%
Income (Families)								
Total:	16,093	100.00%	164,033	100.00%	0.00%	209,148	100.00%	0.00%
Less than $10,000	514	3.19%	14,787	9.01%	-4.41%	11,149	5.30%	-2.10%
$10,000 to $14,999	367	2.28%	8,057	4.91%	-1.83%	6,677	3.20%	-0.92%
$15,000 to $24,999	995	6.18%	16,454	10.03%	-2.22%	16,749	8.00%	-1.82%
$25,000 to $34,999	1368	8.50%	20,669	12.60%	-2.10%	20,226	9.70%	-1.20%
$35,000 to $49,999	2737	17.01%	27,725	16.90%	2.81%	29,304	14.00%	3.01%
$50,000 to $74,999	3151	19.58%	6,349	3.87%	16.34%	44,328	21.20%	-1.62%
$75,000 to $99,999	2422	15.05%	27,856	16.98%	0.82%	31,518	15.10%	-0.05%
$100,000 to $149,999	2743	17.04%	27,428	16.72%	3.03%	30,992	14.80%	2.24%
$150,000 to $199,999	908	5.64%	6,349	3.87%	2.40%	9,957	4.80%	0.84%
$200,000 or more	888	5.52%	8,359	5.10%	1.25%	8,248	3.90%	1.62%
Family of 4 Poverty Level<$25K								

2.6 AIR DRAFT

According to the St. Johns Bar Pilots Navigation Guidelines for the St. Johns River 2013, page 17, the N.B. Broward (Dames Point) Bridge has a vertical clearance of 174 feet over the center 400 feet. The Blount Island overhead power cables have an authorized vertical clearance of 175 feet. Vessels transiting Jacksonville Harbor are subject to these vertical restrictions.

3.0 FUTURE WITHOUT-PROJECT CONDITIONS

The future without project condition forms the basis from which alternative plans are formulated and impacts are assessed. Under the future without-project conditions there would be no Federal action to address the navigation concerns.

Within the study area there are economic, environmental, and technical changes underway that will likely impact future conditions.

3.1 FUTURE WITHOUT-PROJECT COMMODITY PROJECTIONS

Global economic growth is anticipated to slow over the next several years due to the sovereign debt crisis occurring in the Eurozone. Total U.S. exports and imports are anticipated to expand at an average annual rate of 1.46% and 2.25% respectively through 2060. Import and export tonnages at the Port of Jacksonville are recovering after the Great Recession of 2008-2009, which saw a drop of around 30% for imports and 8% for exports. Imports are projected to increase from 10.0 million tons in 2010 to 22.0 million tons by 2060. Exports are projected to grow from 4.9 million tons in 2010 to 14.6 million tons by 2060. Dry bulk and containerized cargo have the highest share and are expected to grow faster over time relative to liquid bulk and general cargo. Coal from Colombia is projected to remain at around 4 million metric tonnes for the entire forecast period commensurate with electricity generation needs. Containerized cargo is anticipated to be the most prominent import for the Port of Jacksonville over the period of analysis. **Table 23** provides detail on the commodity growth rates while **Table 24** provides the forecasted commodity TEUS and tonnages. The forecasted tonnages are based on a commodity forecast completed by Global Insight.

Table 23: Future Without-Project Commodity Growth Rates

Commodity	2010 -2020	2020-2060
FE-ECUS-PAN	10.27%	3.67%
FE-ECUS-SUEZ	7.69%	3.78%
FE-EU-ECUS-GMEX	3.76%	2.64%
ECSA-ECUS	5.17%	3.80%
CAR-PR-JAX	0.00%	0.04%
GENERAL-CARGO	5.92%	1.14%
COAL	5.06%	0.63%
DRY-BULK	3.08%	0.67%
LIQUID-BULK	1.65%	0.44%
AUTOS	5.67%	1.46%

Table 24: Future Without-Project Forecasted TEUs and Tonnages

UNITS	Commodity Name	2020	2030	2040	2050
TEUS	FE-ECUS-PAN	155,031	277,703	362,482	475,925
	FE-ECUS-SUEZ	56,483	95,934	128,908	175,157
	FE-EU-ECUS-GMEX	107,922	143,351	183,954	239,964
	ECSA-ECUS	108,947	168,913	237,435	338,440
	CAR-PR-JAX	445,978	447,636	449,295	450,961
Tonnes	GENERAL-CARGO	1,405,995	1,788,623	2,209,429	2,209,429
	COAL[4]	4,000,000	4,000,000	4,000,000	4,000,000
	DRY-BULK	2,359,793	2,695,416	3,084,247	3,084,247
	LIQUID-BULK	4,522,288	4,937,923	5,385,516	5,385,516
	AUTOS	1,513,216	2,036,165	2,700,377	2,700,377

Jacksonville Port Authority (JAXPORT) has attracted new bulk commodity shippers such as CEMEX/Rinker that will bring upwards of 2.0 million tons of aggregate into the port at a site nearing completion adjacent to the Martin Marietta site. Also, Vulcan Materials will likely secure a similar site in proximity to the existing berth that will serve Martin Marietta and CEMEX/Rinker. Interviews with these aggregate firms suggest that the local market is limited to within about 100 miles of the port and will experience modest growth reflecting changes in population.

In addition, the Panama Canal expansion, facilitating the use of larger vessels, is expected to be operational in 2015. The existing Panama Canal dimensions can accommodate a maximum vessel draft of 39.5 feet (tropical freshwater), maximum vessel beam of 106 feet, and maximum vessel length of 965 feet. The expanded canal is designed to accommodate a maximum vessel draft of 50 feet (tropical freshwater), a maximum vessel beam of 160 feet, and a maximum vessel length of 1,200 feet. Vessels that may be affected by the Panama Canal expansion that could transit Jacksonville Harbor with additional deepening include Post-Panamax containerships. Post-Panamax container vessels that transit on Asia trade routes currently call on the west coast of the United States with land bridge service (rail and truck) to the rest of the United States. With the Panama Canal expansion, these vessels will be able to transit to the east coast United States ports. Affected vessels include the Post-Panamax Generation II (Post-Panamax Generation 2) which has vessel dimensions of a maximum draft of 48 feet, beam of 141 feet, and length of 1,139 feet. This class of vessel is more than three times the length of an American football field.

3.2 FUTURE WITHOUT-PROJECT FLEET PROJECTIONS

The future without-project condition fleet is characterized by the same sizes present in the existing condition fleet. However, there is anticipated to be some fleet transition in the future without-project condition. **Table 25** provides greater

[4] Coal was kept constant at 4,000,000 metric tonnes per year based on interviews with the terminal operator.

detail on the number of vessel calls anticipated to move through the Harbor in the future without-project condition.

Table 25: Future Without-Project Vessel Calls

Class	2020	2030	2040	2050
Sub-Panamax1	116	152	197	260
Sub-Panamax2	172	212	263	334
PX1	88	131	152	202
Panamax	210	329	397	531
Post-Panamax Generation 1	287	511	707	939
Post-Panamax Generation 2	0	0	0	0
REEFER	15	19	23	23
RORO	254	306	367	372
VEHICLES CARRIER	609	803	1042	1042
GC	120	168	220	263
BARGE-GC-BULK	475	521	576	577
BARGE-TANK	32	35	38	38
10-20k DWT Bulker	1	1	1	1
20-30k DWT Bulker	3	3	4	4
30-40k DWT Bulker	8	9	10	10
40-50k DWT Bulker	22	24	27	27
50-60k DWT Bulker	15	15	16	16
60-70k DWT Bulker	42	43	45	45
70-80k DWT Bulker	35	36	37	37
80-90k DWT Bulker	0	0	0	0
90-100k DWT Bulker	0	0	0	0
10-20k DWT Tanker	2	3	3	3
20-30k DWT Tanker	1	1	1	1
30-40k DWT Tanker	8	9	10	10
40-50k DWT Tanker	34	38	41	41
50-60k DWT Tanker	14	15	16	16
60-70k DWT Tanker	6	7	7	7
70-80k DWT Tanker	4	4	4	4
6-12k DWT Cruise	75	75	75	75
Total # Calls	**2648**	**3470**	**4279**	**4878**

3.3 POPULATION PROJECTIONS

The areas that constitute the economic hinterland population include metropolitan and micropolitan statistical areas of Deltona-Daytona Beach-Ormond Beach, Gainesville, Jacksonville, Ocala, Orlando, Palm Coast, Lake City, and Palatka. The population figures for 2012 are based on U.S. Census Bureau estimates. Global Insight projected a population growth rate for the Alabama-Florida-Georgia region of around 1.39%. This growth rate was applied to the 2012 Census figures to estimate the population growth between 2012 and 2040. See **Table 26** for greater detail.

Table 26: Population Projections

Year	Jacksonville Hinterland Population Growth	Source
2012	4,807,764	U.S. Census Estimate
2020	5,369,133	Global Insight Population Growth Rate
2030	6,163,897	Global Insight Population Growth Rate
2040	7,076,306	Global Insight Population Growth Rate

With an increasing population, area demands tend to grow as the population seeks to sustain or better its current standard of living. As the demand for products expands, the supply will likely grow to satisfy that demand. To support that demand, the port imports will likely be a part of that growth to serve the needs of the area. Whether a deeper depth on Jacksonville Harbor occurs is not likely to have significant impact one way or the other on the area population growth or demand.

3.4 PANAMA CANAL EXPANSION

The existing Panama Canal dimensions can accommodate a maximum vessel draft of 39.5 feet (tropical freshwater), maximum vessel beam of 106 feet, and maximum vessel length of 965 feet. The expanded canal, which is currently scheduled for completion in 2015, is designed to accommodate a maximum vessel draft of 50 feet (tropical freshwater), maximum vessel beam of 160 feet, and maximum vessel length of 1,200 feet. Vessels that may be affected by the expansion that could transit Jacksonville Harbor, with additional deepening, include Post-Panamax containerships. Post-Panamax container vessels that transit on Asia trade routes currently call on the west cost of the United States with land bridge service (rail and truck) to the rest of the United States will be able to transit to the east coast United States ports with the canal expansion. Affected vessels include the Maersk S-Class which has vessel dimensions of maximum draft of 48 feet, beam of 141 feet, and length of 1,139 feet. This class of vessel is more than three times the length of an American football field.

3.5 ENVIRONMENTAL RESOURCES

Selection of the no-action alternative will result in no change of the authorized Federal channel design. The physical, chemical, and biological components of the LSJR ecosystem will change in response to potentially controllable (primarily man-induced) and generally uncontrollable (natural) processes.

If the Jacksonville Harbor Federal channel maintains its currently authorized template (the no-action alternative), the following will occur:

- Harbor channel maintenance will continue. This ongoing process is required to maintain the channel at its design depth and allow continued use of the harbor by ships currently calling on Jacksonville.

- Maintenance of shoaling areas, turning basins, and other necessary activities associated with the harbor channel will continue, generating sediments requiring disposal. Harbor maintenance dredging and maintenance dredging associated with the Mayport Naval Station harbor and channel will continue to be disposed at the existing Jacksonville Dredge Material Management Area (DMMA) at a rate of about 1.2 million cubic yards/year of dredged material. Ultimately USACE will have to identify and permit additional dredged material disposal options or renovate existing facilities.
- Harbor calls (incoming shipping traffic) to the public and private terminals likely will increase to some extent simply based on future economic growth. Increases in traffic will at some point result in added congestion.
- Increased harbor calls will increase the cargo handling and land shipping activity, all of which will increase the air pollutant emissions from the harbor industry in Jacksonville.
- Increased harbor industry will increase pressure on city and regional infrastructure, which may require increased maintenance and potentially expanded transportation facilities.
- Sea level rise will continue, at least at the present rate, with the consequence of increasing salinities within the LSJR.
- Population growth and related growth in uses of the river (both as a source of commerce and recreation) will increase pressure on the natural system and populations.
- Development in the greater Jacksonville area (Nassau, Duval, St. Johns, Clay, and Putnam counties) will continue, further increasing stormwater runoff and impacts to wetlands because of direct and indirect impacts of development (e.g. filling of wetlands and uplands as a direct impact, and habitat fragmentation as an indirect impact).

3.6 OPERATIONS AND MAINTENANCE

Under the future without-project condition, the harbor would continue to be maintained in accordance with the approved existing 2013 Dredged Material Management Plan (DMMP). Under the future without-project condition **Table 27** shows areas of approximately 2 feet advanced maintenance required. The base condition for the future operations and maintenance (O&M) if no deepening were to occur is as follows;

- Channel Section 1 (Cuts 3 to 13, ~River Miles 0 to 5), 555,000 cubic yards will be placed in the nearshore every 3 years.
- Channel Section 2A (Cuts 14 to 42, ~River Miles 5 to 11)
    - 870,000 cubic yards will be placed in Buck Island Cell A every 2 years
    - 435,000 cubic yards/year will be offloaded from Buck Island Cell A at no cost for construction purposes.

- o 124,800 cubic yards will be placed in Buck Island Cell B every 2 years.
- For dredging that takes place in Sections 2B/3 (~River Miles 11 to 20/Cuts F and G)
  - o A FY 12/13 contract to raise dikes at Bartram Island Cells A and B-2 to 55 feet will provide enough Federal capacity for the next 20 years. The only Federal action required for Sections 2B/3 is dredging approximately 450,000 cubic yards every 3 years. This is covered by O&M funding.
  - o Approximately 457,600 cubic yards/year need to be dredged from non-federal areas, and USACE recommends the non-federal sponsor purchase 167 acres of upland to construct a new DMMA. This would be paid for with 100% non-federal funds since this area will solely be used for dredged material to maintain non-federal berths and confined disposal facilities.

Table 27: Future Without-Project Advanced Maintenance

DEPTH SEGMENT NO.	DREDGE SEGMENT LIMITS CUT	STATION	AUTHORIZED PROJECT DEPTH	ADVANCE MAINT. DEPTH	ALLOWABLE OVERDEPTH	DREDGING DEPTH	DREDGING DEPTH TOLERANCE	MAXIMUM EXPECTED DISTURBANCE DEPTH	BEACH-QUALITY MAT'L
1	BAR 3 BAR 3	0+00 210+00	42	2	2	46	5	51	NO
2	BAR 3 BAR 3	210+00 217+54	40	0	2	42	4	46	YES
3	BAR 3 7	217+54 28+21.83	40	2	2	44	4	48	YES
4	8 13	0+00 18+14.83	40	0	2	42	4	46	YES
5	13 42	18+14.83 17+00	40	0	2	42	4	46	NO
6	42 42	17+00 45+00	40	2	2	44	4	48	NO
7	42 42	45+00 107+00	40	0	2	42	4	46	NO
8	42 42	107+00 135+00	40	2	2	44	4	48	NO
9	42 45	135+00 40+00	40	0	2	42	4	46	NO
10	45 48	40+00 13+45.42	40	2	2	44	4	48	NO
11	49 50	0+00 6+53.19	40	0	2	42	4	46	NO
12	50 TC	6+53.19 65+00	40	2	2	44	4	48	NO
13	TC TC	65+00 177+23.86	34	0	2	36	4	40	NO
14	TC TC	0+00 14+32.53	30	2	2	34	4	38	NO
15	F G	5+00 91+21.49	38	1	1	40	6	46	NO

NOTES
1. THE TERM "DEPTH SEGMENT" IS NOT STANDARD PROJECT NOMENCLATURE. IT IS USED HERE TO FACILITATE COMPARING THE INFORMATION IN THIS TABLE TO THE PERMIT PLATES.
2. ALL DEPTHS ARE IN FEET.
3. "TC" = TERMINAL CHANNEL
4. CUTS "F" AND "G" LIE IN THE OLD RIVER CHANNEL.

US Army Corps of Engineers Jacksonville District

PERMIT DRAWING NOT FOR CONSTRUCTION

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

JACKSONVILLE HARBOR, FLORIDA MAINTENANCE DREDGING
WATER QUALITY CERTIFICATE APPLICATION
AUTHORIZED PROJECT DEPTHS & BASIS FOR DREDGING DEPTHS
APRIL 2012

PLATE 04 OF 26

3.7 FUTURE WITHOUT-PROJECT SEA LEVEL RISE

Equation (3) of EC 1165-2-212 Appendix B calculates eustatic sea level change over the life of the project. E(t) is eustatic sea level change and b is a constant provided in EC 1165-2-212; t1 is the time between the project's construction date and 1992 and t2 is the time between a future date at which one wants an estimate for sea-level change and 1992 (or t2 = t1 + number of years after construction [Knuuti, 2002]). For example, if a designer wants to know the projected eustatic sea-level change at the end of a project's period of analysis, and the project is to have a fifty year life and is to be constructed in 2009, t1 = 2009 – 1992 = 17 and t2 = 2059 – 1992 = 67.

$$\textit{Equation 3: } E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)$$

Modifying equation (3) to include site-specific sea level change data, results in an equation for Relative Sea Level (RSL). This equation is used to estimate baseline, intermediate and high sea level change values over the life of the project.

$$RSL(t_2) - RSL(t_1) = (e+M)\,(t_2 - t_1) + b(t_2^2 - t_1^2)$$

RSL(t1) and RSL(t2) are the total RSL at times t1 and t2, and the quantity (e + M) is the local change in sea level in meters/year that accounts for the eustatic change as well as uplift or subsidence. The quantity (e+M) is found from the nearest tide gage with a tidal record of at least 40 years.

Based on historical sea level measurements taken from NOS gage 8720218 at Mayport, Florida, the historic sea level rise rate (e+M) was determined to be 2.29 +/- .31 mm/year (0.0075 feet/year) (http://tidesandcurrents.noaa.gov/sltrends/index.shtml). The project base year was specified as 2018, and the project life was projected to be 50 years. Table 2, of the Engineering Appendix A, shows the results of equation (3) every five years, starting from the base year of 2018. From this table, the average baseline, intermediate, and high sea level change rates were found to be +2.29 mm/year (0.0075 feet/year), +5.05 mm/year (0.0166 feet/year), and +13.82 mm/year (0.0453 feet/year), respectively. **Figure 9** shows the three levels of projected future sea level change for the life of the project.

The local rate of vertical land movement is found by subtracting the regional MSL trend from local MSL trend. The regional MSL trend is assumed equal to the eustatic mean sea level trend of 1.7 mm/year. Therefore at Jacksonville Harbor, there is 0.59 mm/year of subsidence.

4.0 PROBLEMS AND OPPORTUNITIES

Transportation delays and inefficiencies occur due to the existing conditions at Jacksonville Harbor. Vessels are restricted to the maximum depth of 40 feet, the authorized project depth. Larger vessels must light-load, wait for tidal advantage, or use smaller vessels in lieu of larger vessels to transit Jacksonville Harbor. This causes increased transportation costs. The 40-foot project depth impacts the introduction of larger vessels into the fleet and efficient use of larger vessels already using the harbor. These impacts also create transportation inefficiencies. In addition, the larger vessels are constrained by limited turning areas. See also the “Need or Opportunity” section on page iii. Specific problems include:

1. Deep draft navigation problems and opportunities primarily involve either the problem of transportation cost inefficiencies or the opportunity to reduce transportation costs.
2. Navigation concerns include two main problems: insufficient Federal channel depths and restrictive channel widths and turning basins.
3. Larger ships currently experience transportation delays due to insufficient Federal channel depths. To reach port terminals larger ships must light-load or cargo must be shipped using smaller vessels.
4. Light-loading and use of smaller vessels require the vessel operator to forego potential transportation cost savings available from the economies of scale associated with larger ships.
5. Restrictive channel widths limit ship passage to one-way traffic in many reaches and larger container ships require expanded turning basins.

4.1 PUBLIC AND AGENCY CONCERNS

The following issues have generated comments and concerns from stakeholders, and are discussed in this report:

1. Salinity Impacts: How the proposed deepening may affect salinity levels within the St. Johns River has generated more concern and comment than perhaps any other issue. The models that USACE utilized to evaluate this effect have also been questioned, including their reliability. Since the models are predictive tools, stakeholders have suggested that long-term monitoring of salinity be conducted if the Federal channel is deepened. A long-term Corrective Action Plan, which includes field data collection, has been prepared by USACE to provide assurances that actual effects will be assessed and corrective actions coordinated (see Appendix E).

2. Mitigation: Regulatory agencies indicated a concern with calculating potential salinity impacts and mitigation based on the delta between the future with-project and future without-project condition, both of which use the historical rate of sea level rise. It was requested that the predicted salinity effect of the proposed deepening at time of construction be used instead. As a result, the USACE

analysis incorporated a similar approach that separated the effects of potential salinity increases from those of sea level rise, and also meeting current USACE Planning Guidance.

3. Shoreline Erosion: Residents and agencies with land holdings along the St. Johns River commented on existing erosion problems, and how the proposed deepening may affect this issue. Some of these stakeholders have also requested that USACE place dredged material along their shorelines to reduce erosion. The following policies relate to this issue: 1) "It is the Corps' policy to regulate the discharge of dredged material from its projects to assure that dredged material disposal occurs in the least costly, environmentally acceptable manner, consistent with engineering requirements established for the project" (per 33 CFR § 336.1(c)(1); 2) "It is the policy of the Corps that all dredged material management studies include an assessment of potential beneficial uses for environmental purposes including fish and wildlife habitat creation, ecosystem restoration and enhancement and/or hurricane and storm damage reduction." ER 1105-2-100 at E-69. In accordance with ER 1105-2-100, USACE is considering beneficial use of dredged material as a part of the Jacksonville Harbor Dredged Material Management Plan (DMMP). The current plan is to use the ODMDS but as that plan is refined in PED there may be an option to further pursue beneficial uses. Beneficial use alternatives under consideration include placement of material that may have the effect of shoreline stabilization. Development of these DMMP alternatives is discussed in **Appendix J**. Discussion of shoreline erosion (including ship wake analysis) can be found in **Appendix K and Section 7.2.5**.

4. Accelerated Study Schedule: Stakeholders expressed concern on whether the accelerated study schedule would adversely affect the assessment of environmental impacts. All analyses have been completed that were planned under the old schedule. Concurrent reviews will occur in order to meet the accelerated schedule.

5. Confined Blasting: USACE proposes to use confined underwater blasting as a rock pretreatment technique. This method has been previously utilized by the Jacksonville District in San Juan Harbor, Puerto Rico (2000) and Miami Harbor, Florida (2005) to significantly reduce the potential impacts on protected marine species (by reducing potential impacts associated with pressure from a blast detonation). In addition, USACE commits to implementing the same protective measures that were employed at Miami for the Jacksonville Harbor Deepening Project. The U.S. Fish and Wildlife Service (USFWS) recently stated that the potential use of confined blasting techniques to deepen the Federal channel is a concern. Also, in early scoping, the Florida Fish and Wildlife Conservation Commission (FFWCC) stated that the no-action alternative should be selected because they felt that threatened and endangered species could not be adequately protected during blasting operations. Refer to **Appendix A**, **Attachment D (Pretreatment [Blasting] Plan)** for more information on blasting.

6. North Atlantic Right Whale: During the Mile Point Study, the National Marine Fisheries Service (NMFS) stated they are concerned as to how the proposed deepening of the Federal channel, and potentially greater ship transits, may affect the whale. In accordance with Section 7 of the Endangered Species Act, coordination with NMFS on the whale and other species under their purview has been completed. It is assumed that under the future with-project condition as compared to the future without-project condition overall vessel calls will be lower under the with-project condition (see **Appendix B [Economic])**.

7. Sea Level Rise: Stakeholders have expressed concern regarding the rates of sea level rise that are being used in the modeling, as they would prefer a greater rate of increase. Engineering Circular, EC 1165-2-212 provides for the analysis of three scenarios, as is detailed in Section 2.2.6 (existing conditions sea level rise), **Section 3.7** (future without-project sea level rise), **Section 6.3.2** (with-project sea level rise), and Engineering **Appendix A**.

Additional discussion of public and agency comments can be found in **Section 7** and **Appendix K**.

4.1.1 Homeowner Concerns

Meetings and coordination with homeowners that live adjacent to the St. Johns River have identified concerns related to potential impacts of channel deepening, effects of using blasting techniques, potential impacts to homeowners' views of the river, increased truck traffic and noise from use of the Buck Island confined disposal facility beneficial use site, and shoreline erosion concerns.

a. Shoreline Erosion. Several areas along the Jacksonville Harbor channel show erosion. Since identification of those shoreline erosion problems, several shoreline and training wall improvements have resolved some of the problems, and in only some of the areas. Jacksonville Port Authority (JAXPORT) stabilized the north shoreline along river miles 12 through 13. In addition, USACE helped prevent a potential breakthrough of the St. Johns River at Bartram Island (about River Mile 11.3) by repairing approximately 1000 feet of training wall along the north shoreline of Bartram Island between river miles 11 and 12. Another USACE effort involved rehabilitation of a portion of the St. Johns Bluff Training Wall along the south shoreline of the Federal channel between river miles 7 and 7.5, effectively resolving the erosion problem in that area. Shoreline erosion areas between River Miles 4 and 5 in the Mile Point area have been evaluated and the relocation of the Mile Point Training Wall is pending authorization. River miles 1 through 2, the Huguenot Park area, just west of the north jetty may require further evaluation. During the March 12, 2013 public meeting, homeowners living along the north side of the channel between miles 7 and 8 expressed concerns related to ongoing erosion.

b. St. Johns Bluff View and Buck Island Impacts. Through meetings and correspondence the homeowners that live on St. Johns Bluff (adjacent to the Timucuan Ecological and Historic Preserve and Ft. Caroline National Monument [National Park Service] overlooking St. Johns Creek) have concerns about future expansion of the existing Buck Island Confined Disposal Facility (CDF) and their viewshed. Those homeowners, as well as National Park Service representatives, do not want their view of the St. Johns River impaired by raising the height of the dikes to expand the capacity of the Buck Island CDF.

   The current Interim Dredged Material Management Plan (DMMP) for Jacksonville Harbor does not recommend expansion of the Buck Island CDF since the JAXPORT continues to use that area as a beneficial use site to recycle dredge material from past new work and maintenance dredging of Jacksonville Harbor, and plans to continue to mine material from the Buck Island CDF (for construction fill as maintenance dredging operations place material there). The continuing removal of material from the site prevents the need to raise the dikes.

c. Blasting of Dense Rock Layers. Homeowners along the St. Johns River have expressed concerns about potential impacts of rock blasting on their homes, bulkheads, and shorelines. A public meeting took place on this topic March 12, 2013. Homeowners expressed concerns at this meeting related to the impacts of blasting to their shoreline, as they have existing erosion and failure of their shorelines. They stated concerns that blasting with dredging could make this issue worse.

4.2 COAST GUARD DATA

The United States Coast Guard (USCG) provides the data for any aids to navigation costs, such as costs to relocate range markers due to a change in the centerline of the channel with widening. They have not expressed any concerns with the study at this time and have provided their input on the potential effects that widening and deepening would have on the USCG.

4.3 PLANNING OBJECTIVES

4.3.1 Federal objectives

The Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation’s environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements.

1) The objective of this study is to provide solutions to the previously defined problems in accordance with the Federal objective, objectives of the non-federal sponsor, and those of other interested parties. Planning objectives are statements that describe the desired results of the planning process. Their goal is to solve the problems and take advantage of the opportunities that are identified for the study. Study planning objectives must:

- Be clearly defined
- Provide information on the effect desired
- State what will be accomplished
- State the location of where the action will take place
- State when the action would take place

2) Four accounts are established in the Principles and Guidelines (P&G) to facilitate the evaluation and display of the effects of the plans. The accounts are:

- National economic development account: changes in the economic value of the national output of goods and services
- Environmental quality (EQ) account: non-monetary effects on ecological, cultural, and aesthetic resources including positive and adverse effects of ecosystem restoration plans
- Regional economic development (RED) account: changes in the distribution of regional economic activity (e.g. income and employment)
- Other social effects (OSE) account: plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation, and others

The EQ, RED, and OSE accounts are displayed in qualitative discussions versus quantitative analysis for the NED account.

4.3.1.1 Study Objectives

The objective of the Jacksonville Harbor Study is to evaluate improvements for Jacksonville Harbor to efficiently and safely accommodate larger vessels while preserving natural and recreational resources impacted by navigation improvements. Discussions with JAXPORT representatives and terminal operators indicate that many of the vessels that currently use Jacksonville Harbor must light-load or wait on tidal advantage (at certain times of the day tidal advantage may be up to approximately 2 additional feet) in order to enter or leave the harbor causing increased transportation costs as a result of insufficient channel depth. The current 40-foot channel depth at Jacksonville Harbor impacts the introduction of larger vessels into the fleet utilizing the existing terminals. The container terminal at Dames Point has capacity for additional larger vessels that will be affected by these draft restrictions. The loss of those larger vessels results in a loss of transportation efficiencies. Specific objectives include:

1. Reduce navigation transportation costs to and from Jacksonville Harbor to the extent possible over the period of analysis (starting in the base year for 50 years).
2. Develop an alternative that is environmentally sustainable for the period of analysis (starting in the base year for 50 years).
3. Reduce navigation constraints facing harbor pilots and their operating practices including the one-way transit restriction in certain reaches (starting in the base year for 50 years).

4.3.1.2 Opportunities

a) Bring the forecast volume of goods into the harbor on fewer larger ships providing transportation cost savings.
b) Eliminate or reduce navigation restrictions and inefficiencies (i.e., channel depth limitations and one-way transit restrictions) to enable maritime carriers to realize transportation economies of scale without adversely impacting their shipping operations.
c) Reduce the risk of adverse environmental impacts from a new project, or protect or improve environmentally sensitive areas in the vicinity of the Federal project through potential beneficial uses of dredged material.
d) Determine if beneficial uses of dredged material such as manufactured soils, recycling of dredge material for construction fill, development of artificial reefs, use of dredged material for environmental restoration, use of beach quality material for placement along adjacent beaches, or use of material for shoreline stabilization would provide appropriate alternatives for disposal of dredged material.

4.4 PLANNING CONSTRAINTS

Constraints are restrictions that limit the planning process. Plan formulation involves meeting the study objectives while not violating constraints. Specific study constraints include:

1. Height restrictions of the Dames Point Bridge and Jacksonville Electric Authority power lines limit the air draft of vessels to 175 feet.
2. Strong massive rock exists in the project area that would ordinarily need to be blasted for economical excavation. Homeowners along the St. Johns River and environmental resource agencies have expressed concerns about blasting. The homeowners' concerns are about impacts to their

property and the agencies have expressed concerns about water clarity. The project would seek to minimize impacts by placing limitations on times blasting can occur.

3. There is limited capacity at the existing upland disposal facilities. The project would need to examine other means of disposal of dredged material including beneficial uses.
4. Jacksonville Harbor is bordered by several Federal lands such as Fort Caroline National Memorial and Timucuan Ecological and Historical Preserve, and state lands including a portion of Huguenot Memorial Park, and Nassau-St Johns River Marshes State Aquatic Preserve. The project will seek to minimize impacts wherever practicable.
5. There are endangered and threatened species that exist within the project footprint. Endangered species impacts will be consistent with applicable laws and consultation under the Endangered Species Act.
6. Adverse effects on environmental resources including essential fish habitat, salt marsh, and bird sanctuaries that exist near current upland confined disposal sites and other general navigation features such as training walls will be avoided, minimized, or mitigated for.
7. Placement of material on the beaches during the sea turtle nesting season will be avoided to the maximum extent practicable.
8. Development of available lands adjacent to the harbor limits the selection of potential future areas for use as upland confined disposal sites.

4.5 RELATED ENVIRONMENTAL DOCUMENTS

The proposed action is included in sections of this Integrated General Reevaluation Report II (GRRII) and Supplemental Environmental Impact Statement (SEIS) in order to satisfy the requirements of the National Environmental Policy Act (NEPA). Other NEPA documents prepared by USACE related to the planned action include the EIS on the Jacksonville Harbor Navigation Channel Deepening (1998); a Jacksonville Harbor Navigation Study, General Re-Evaluation Report and Environmental Assessment (2002); the Environmental Assessment (2003) entitled Shore Protection Structure and Alternative Placement Site Construction, Mile Point, Jacksonville Harbor, Duval County, Florida; and the Environmental Assessment (2012) for the Jacksonville Harbor Mile Point Feasibility Study. This Supplemental Environmental Impact Statement (SEIS) updates the EIS prepared for the Jacksonville Harbor Navigation Study in 1998 (Record of Decision signed in 2001), as well as the Jacksonville Harbor Navigation Study-General Reevaluation Report completed in 2002.

4.6 DECISIONS TO BE MADE

This Integrated GRR II and SEIS will provide recommendations for changes to the Jacksonville Harbor project. Various alternatives were evaluated and specific protective measures are suggested to minimize, avoid, or mitigate for adverse effects to local resources.

4.7 AGENCY GOAL OR OBJECTIVE

Planning objectives of the study involve the use of available information and modeling to evaluate navigation improvements. The planning objective for the feasibility phase of the Jacksonville Harbor navigation study is to:

- Identify the plan that most efficiently and safely maximizes net benefits for Jacksonville Harbor existing and future ship traffic while protecting, conserving and/or restoring natural and recreational resources.

4.8 SCOPING AND ISSUES

4.8.1 Relevant Issues

The following issues were identified as relevant to the current investigations and appropriate for further evaluation: the consideration of threatened and endangered species including the Florida manatee, piping plover, wood stork, sea turtles, shortnose sturgeon, and smalltooth sawfish; Essential Fish Habitat (EFH), including salt marsh; other fish and wildlife resources; cultural resources; water quality; air quality; hazardous, toxic, and radioactive waste; aesthetics; recreation; noise; and socio-economics (including navigation).

4.8.2 Impact Measurement

See the detailed impact assessments in the integrated supplemental environmental impact statement **Section 7.0** regarding specific alternatives section.

4.8.3 Issues Eliminated from Further Analysis

Impacts to housing and population dynamics were eliminated from further analysis. The proposed action of this project is expected to have little or no impact on these issues.

4.9 PERMITS, LICENSES, AND ENTITLEMENTS

4.9.1 Water Quality Certification

This project would be performed in compliance with State of Florida water quality standards and the Coastal Zone Management Act (see **Appendix G**). The Florida State Clearinghouse stated by letter dated June 25, 2007 that “based on the information contained in the scoping notice and the enclosed state agency comments, the state has determined that, at this stage, the proposed Federal action is consistent with the Florida Coastal Management Program.” The state’s final consistency determination would be issued concurrently with water quality certification (state permit).

4.9.2 Endangered Species Act- Section 7 Coordination

In accordance with Section 7 of the Endangered Species Act, USACE has completed formal consultation with the USFWS and the NMFS (refer to **Section 7.2** for additional information on effects determinations). The USFWS provided a consultation letter dated November 15, 2013, and the NMFS provided a Biological Opinion on February 6, 2014 on the proposed deepening (see Appendix F).

5.0 FORMULATION AND EVALUATION OF ALTERNATIVE PLANS*

Preliminary plans were formulated by combining management measures. Each plan was formulated in consideration of the following 4 criteria described in the Principles and Guidelines (P&G):

- Completeness: Extent to which the plan provides and accounts for all necessary investments or actions to ensure realization of the planning objectives
- Effectiveness: Extent to which the plan contributes to achieving the planning objectives
- Efficiency: Extent to which the plan is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment
- Acceptability: Workability and viability of the alternative plan with respect to acceptance by Federal and non-federal entities and the public, and compatibility with existing laws, regulations, and public policies

5.1 PLAN FORMULATION RATIONALE

Step 3 of the Planning Process as described in ER 1105-2-100 is "Formulation of Alternative Plans."

1. Alternative plans are formulated to identify ways of achieving planning objectives within the project constraints, in order to solve the problems and realize the opportunities listed in Step 1 of the Planning Process which is to "Specify Problems and Opportunities."
2. Structural and nonstructural management measures are identified and combined management measures to form alternative plans.
3. Planners will keep focus on complete plan(s) while doing individual tasks, to ensure their plans address the problems of the planning area.
4. Section 904 of the WRDA (Water Resources Development Act) of 1986 requires USACE to address the following during the formulation and evaluation of alternative plans:
    a. Enhancing national economic development (NED) - including benefits to particular regions that are not transfers from other regions
    b. Protecting and restoring the quality of the total environment
    c. The well-being of the people of the United States
    d. Preservation of cultural as well as historical values
5. Nonstructural measures must be considered in the plan formulation process as means to address problems and opportunities.
6. Revised costs of mitigation will be included in the final cost/benefit analysis.

In accordance with this policy, alternative plans were formulated for the Jacksonville Harbor study and evaluated on the basis of transportation cost savings.

5.2 MANAGEMENT MEASURES

A management measure is a feature or activity that can be implemented at a specific geographic site (**Figure 25**) to address one or more planning objectives. Management measures are used to create plans and can be categorized as nonstructural or structural.

1) The following nonstructural management measures were identified to improve navigation in Jacksonville Harbor:

   a) Designate existing deep water areas for turning of future larger ships in place of turning basin construction.
   b) Examine realignment of segments of the Federal channel to areas of existing deep water by relocation of U.S. Coast Guard (USCG) aids to navigation (buoys) to avoid or minimize construction quantities.
   c) Light-load vessels to accommodate larger vessels under the existing depths.
   d) Use of tide to transit larger vessels under existing conditions.

3) The following structural management measures were identified to meet the objectives (as defined in Section 4.3) of providing transportation cost savings. As is stated in Section 5.4, deepening benefits were computed from 41 to 50 feet in one-foot increments.

Table 28: Structural Measures

Channel Segment	Cut Number	Estimated River Mile	Type	Measure	Opportunities
Sherman Cut Range	8	3-4	Widening	200' on Red Side	Transportation cost savings and two-way vessel traffic
	9	3-4	Widening	200' on Red Side	
	10	4-5	Widening	200' on Red Side	
	11	4-5	Widening	200' on Red Side	
	12	4-5	Widening	200' on Red Side	
	13	4-5	Widening	200' on Red Side tapering into Cut-14 at Atlantic Drydock tapering out to 100' on Green Side at Cut-14	
Training Wall Reach	14/15	4-5	Widening	100' on Green Side	
	16	5-6	Widening	100' on Green Side expanding to 250' in Cut-17	
Short Cut Turn	17	6-7	Widening	250' on Green Side	
	18	6-7	Widening	100' on Green Side	
	19	6-7	Widening	100' on Green Side	
St. Johns Bluff Reach/White Shells Cut	40	7-8	Widening	300' on Green Side	
	40	7-8	Widening	400' on Red Side tapering to 200' at Cut-41	
	41	7-8	Widening	200' on Red Side Varies on Green Side to match old 38' project limits	
Dames Point Fulton Cutoff Range	42	8-11	Widening	Varies on Green Side to match old 38' project limits	
Brills Cut	45	12-13	Widening	100' on Green Side	
Broward Point Turn	49	14-15	Widening	200' on Green Side	
Drummond Creek Range	50	14-16	Widening	200' on Green Side	
Trout River Cut	51	16-17	Widening	100' on Red Side tapers into Cut-52 at NuStar	
Chaseville Turn	54	18	Widening	200' expansion of Chaseville Widener at apex	
Terminal Channel	Terminal Channel	19-20	Widening	100' on Green Side	
Segment 1	Entrance to 46	Entrance Channel to River Mile 13	Deepening	Deepen from 41 feet up to 50 feet, in one foot increments	Transportation cost savings
Segment 2	46-Terminal Channel	River Mile 13 to 20	Deepening	Deepen from 41 feet up to 50 feet, in one foot increments	
Segment 3	F and G	West Blount Island Channel	Deepening	Deepen from 38 feet up to 40 feet, in one foot increments	
Blount Island Turning Basin (T.B.)	42	8-11	T.B.	Approx 2672 ft long by 1500 ft wide	Transportation Cost Savings and vessel maneuverability
Brills Cut Turning Basin (T.B.)	45	12-13	T.B.	Approx 2500 ft long by 1500 ft wide	
Talleyrand Turning Basin (T.B.)	Terminal Channel	19-20	T.B.	Approx 3025 ft long by 1500 ft wide	

The Red Side is the north side of the channel and the Green Side is the south side of the channel.

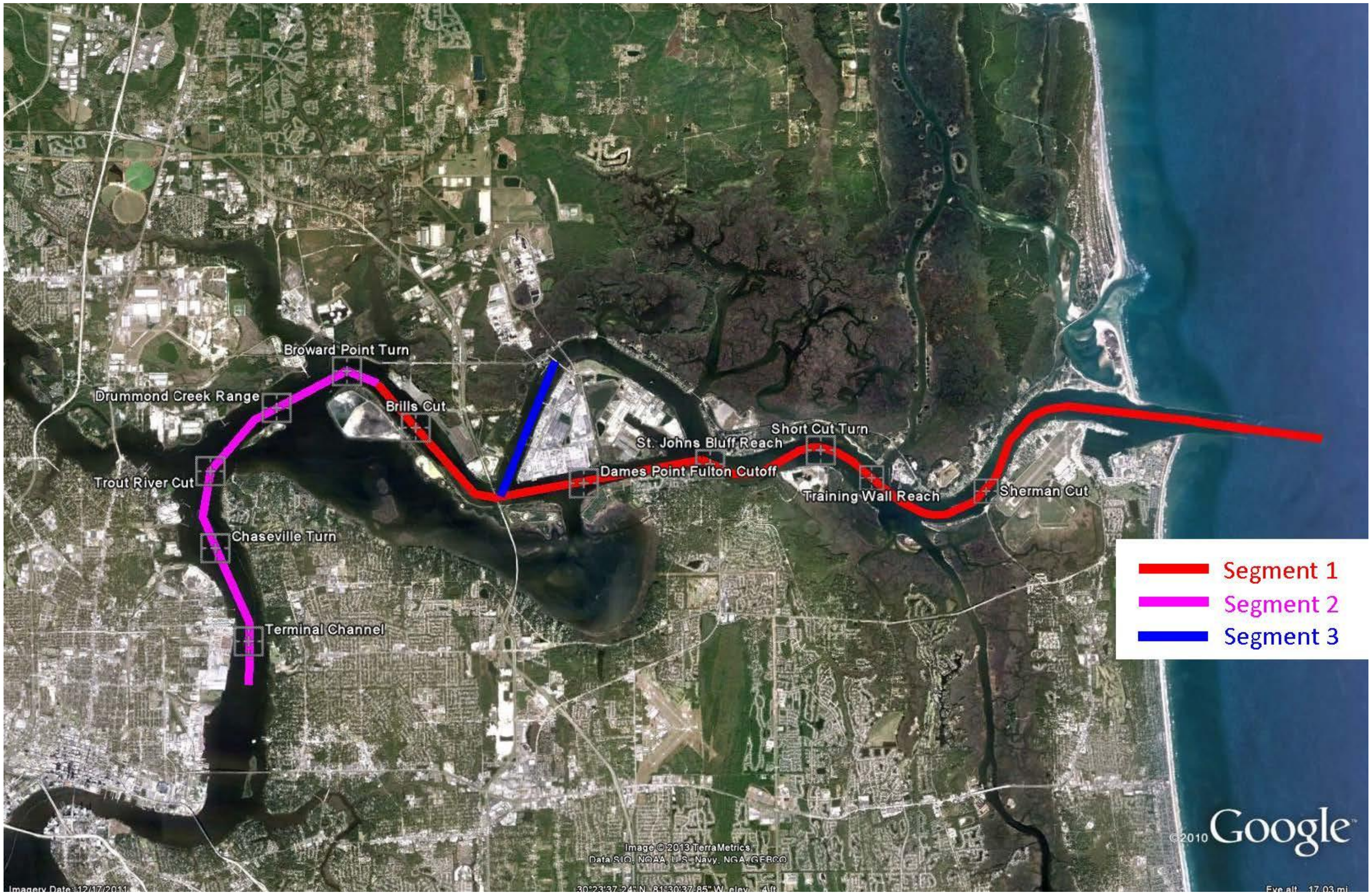


FIGURE 25: STRUCTURAL MEASURES CUTS AND SEGMENTS

5.3 ISSUES AND BASIS FOR CHOICE

Nonstructural measures were eliminated from the study due to their inability to provide transportation cost savings. Existing deep water areas for turning of future larger ships are not available in place of turning basin construction. Examination did not identify areas to realign the channel to avoid or minimize construction quantities for widening. Light-loading or use of tides does not provide transportation cost savings. **Table 29** summarizes the reason for the elimination of certain structural measures.

As is identified in the Dredged Material Management Plan (DMMP) **Appendix J**, the least cost disposal alternative for construction is to use the Ocean Dredged Material Disposal Site (ODMDS). Other alternatives under consideration include nearshore placement, use of upland sites, and beneficial use alternatives. Disposal of all dredged material for construction was assumed to be taken to the ODMDS.

MPRSA Section 103 testing and evaluation of the potential dredged material will be required prior to disposal in the new Jacksonville ODMDS. The testing and evaluation for the determination of suitability for ocean disposal will be conducted during PED. The USACE 2010 geotechnical data indicates that the new construction material for the Jacksonville Harbor Deepening project is primarily new work material consisting of sand/silt with some rock. Based on existing physical data, Tier I testing may potentially be sufficient according to 40 CFR § 227.13(b) but further analysis will be performed. The ODMDS is scheduled to be completed in 2014 and there are no current issues pending that would delay the 2014 anticipated designation.

As is discussed in the table below the reasons for elimination of alternatives is as follows:

1. Ship Simulation: Ship simulation was used to determine areas necessary for widening using the design vessel, the Maersk S-Class, which has vessel dimensions of maximum draft of 48 feet, beam of 141 feet, and length of 1,139 feet.
2. Lack of deepening benefits: After initial evaluation using a preliminary cost/benefit analysis and with concurrence of the non-federal sponsor, Segments 2 and 3 were eliminated. It was determined that the majority of benefiting vessels primarily transit Segment 1; therefore there were not significant deepening benefits beyond Segment 1.

Table 29: Structural Measures eliminated from the study

Channel Segment	Cut Number	River Mile	Type	Widening Measure	Reason for Elimination
Sherman Cut Range	8	3-4	Widening	200' on Red Side	Ship simulation showed no additional benefits of two-way traffic. Widening in these areas would be for channel reconfiguration needed for the deepening alternatives only.
	9	3-4	Widening	200' on Red Side	
	10	4-5	Widening	200' on Red Side	
	11	4-5	Widening	200' on Red Side	
	12	4-5	Widening	200' on Red Side	
	13	4-5	Widening	200' on Red Side tapering into Cut-14 at Atlantic Drydock tapering out to 100' on Green Side at Cut-14	
	16	5-6	Widening	100' on Green Side expanding to 250' in Cut-17	
Short Cut Turn	17	6-7	Widening	250' on Green Side	
	18	6-7	Widening	100' on Green Side	
	19	6-7	Widening	100' on Green Side	
St. Johns Bluff Reach/White Shells Cut	41	7-8	Widening	200' on Red Side Varies on Green Side to match old 38' project limits	
Dames Point Fulton Cutoff Range	42	8-11	Widening	Varies on Green Side to match old 38' project limits	
Brills Cut	45	12-13	Widening	100' on Green Side	
Broward Point Turn	49	14-15	Widening	200' on Green Side	Area eliminated from consideration due to lack of deepening preliminary benefits and at the request of the non-federal sponsor.
Drummond Creek Range	50	14-16	Widening	200' on Green Side	
Trout River Cut	51	16-17	Widening	100' on Red Side tapers into Cut-52 at NuStar	
Caseville Turn	54	18	Widening	200' expansion of Caseville Widener at apex	
Terminal Channel	Terminal Channel	19-20	Widening	100' on Green Side	
Talleyrand Turning Basin			T.B.	~3025' long by ~1500' wide	
Segment 2	46-Terminal Channel	River Mile 13 to 20	Deepening	Deepen from 41 feet up to 50 feet, in one foot increments	The analysis showed that the majority of benefiting vessels transit Segment 1, this enabled Segments 2 and 3 to be eliminated from further study. Additionally the non-federal sponsor requested Segments 2 and 3 be dropped from further evaluation.
Segment 3	F and G	West Blount Island Channel	Deepening	Deepen from 38 feet up to 40 feet, in one foot increments	

Red on Right when Returning from Sea – Red Right Returning. For Jacksonville Harbor the Red Side is the north side of the channel and the Green Side is the south side of the channel.

5.4 PRELIMINARY ARRAY OF ALTERNATIVES

Alternative plans are made up of structural and/or nonstructural measures that function together to address one or more of the study objectives. Alternative plans were formed to improve navigation in the harbor. The revised study area is shown in **Figure 26**.

(1) No-action (required by NEPA).

(2) Deepening Alternatives: Current ship movements on Jacksonville Harbor appear to have an acceptable width. Future vessels are expected to be larger under the with-project condition than those in the existing fleet. In deciding what alternatives to consider for deepening, the identification of the various terminals and their locations along the river was necessary. The alternatives were formed by combining and expanding on the management measures.

a. In addition to reducing the study area approximately 6 miles (Segment 2) as is discussed in Section 5.3; Segment 1 was reduced from River Mile 14 (Cut 47) to approximately River Mile 13 (Cut 45) because there are no NED benefits from approximately River Mile 13 to 14.
b. Deepening benefits were computed from 41 to 50 feet in one-foot increments.

(3) Widening Only Alternatives: Ship simulation analysis is used to determine the adequacy of a proposed project improvement plan (i.e. deepening) and to develop possible design modifications to ensure project safety and efficiency, and minimum adverse impacts to the environment. Per the results of the ship simulation analysis (See **Appendix A**); the widening measures were determined to be required for deepening thus the benefits when combined with deepening are incidental. A stand alone widening alternative was carried forward along with the combined deepening alternatives. The two widening areas in Segment 1 are at the Turning Wall Reach and the St. Johns Bluff Reach. Successful meeting in these areas was shown in ship simulation.

(4) Turning Basins: Ship simulation identified two turning basins that are carried forward for investigation.

a. Blount Island Turning Basin: Located between River Mile 10 and 11 (Cut 42B)
b. Brills Cut Turning Basin: Located just past the TRAPAC MOL Container Terminal at River Mile 13 (Cut 45)

(5) As stated in Section 5.3, nonstructural alternatives were eliminated due to their inability to create transportation cost savings. The nonstructural alternatives include use of additional tug assists and using the tide to transit the harbor for deeper draft vessels.

5.5 EVALUATION ARRAY OF ALTERNATIVE PLANS

Deepening benefits were computed from 41 to 50 feet in one foot increments. The widening alternative was run independently as well as with the deepening increments. Costs and benefits were run to determine the plan that maximizes net benefits (NED plan).

Engineer Research and Development Center (ERDC) ship simulation (2010) and the final ERDC report (complete March 2012) helped to refine the widening measures. Ship simulation was used to identify the project footprint if deepening would occur and larger vessels would transit; ship simulation was used to identify what areas would need widening and to eliminate those that would not. A preliminary cost/benefit analysis greatly helped to refine the deepening measures. The analysis showed that the vast majority of benefiting vessels would call in Segment 1, this enabled Segments 2 and 3 to be eliminated from further study. The widening measures that remained after ship simulation are necessary for deepening; however two of them do offer additional benefits of two-way traffic (**Table 30**). Those measures were evaluated separately for added benefits. The following is a list of alternative plans that were evaluated for NED benefits to determine the NED plan.

Deepening and Widening Alternatives Segment 1 (Entrance Channel to approximately River Mile 13): Incidental widening benefits were realized from two-way traffic areas at the Training Wall Reach and St. Johns Bluff Reach. Widening in these areas was identified through ship simulation as necessary for deepening; however additional benefits were derived from allowing two-way traffic. Deepening up to 50 feet from the existing 40-foot project depth was determined by HarborSym. Two Turning Basins were identified through the ship simulation. HarborSym was used to determine which will be carried forward for recommendation.

No-action alternative

Final Array of Alternatives (**Table 30**): The final widening areas considered for benefits are the Training Wall Reach and St. Johns Bluff Reach areas. These areas are necessary when deepening for larger vessels to transit; they do however offer benefits under the existing channel depth as well. Widening in these areas provides two-way traffic for the existing fleet. Segment 1 was carried forward to the final array of alternatives to be studied for deepening benefits; the majority of benefiting vessels transit this area. Two turning basins were carried forward for evaluation based on the ship simulation results.

Table 30: Final Array of Alternatives

Alternative	Channel Segment	River Mile	Measure	Reason Carried Forward
Widening Only Alterantive	Training Wall Reach	4-5	Widen 100' on Green Side	Ship simulation showed successful two-way meeting
	St. Johns Bluff Reach/White Shells Cut	7-8	Widen300' on Green Side	
Deepening Alternative (Includes Widening and Turning Basins)	Segment 1	Entrance Channel to ~13	Deepen up to 50 feet	The majority of benefiting vessels transit this segment, the non-federal sponsor supports this segment
	Blount Island Turning Basin	8-11	Approx. 2672' long by 1500' wide	Ship Simulation showed successful turning
	Brills Cut (Cut-45) Turning Basin	12-13	Approx. 2500' long by 1500' wide	
	Training Wall Reach	4-5	Widen 100' on Green Side	Ship simulation showed successful two-way meeting
	St. Johns Bluff Reach/White Shells Cut	7-8	Widen300' on Green Side	
The Red Side is the north side of the channel and the Green Side is the south side of the channel.				

The Brills Cut Turning Basin is a new turning basin; there is a local turning basin off of the existing container terminal. This is a separate proposed turning basin and is not an extension of the existing local turning basin.

5.5.1 Final Comparison of Alternative Plans/Decision Criteria

The final array of alternatives was derived using a cost/benefit analysis for the deepening alternatives and ship simulation for the widening and turning basin alternatives.

Widening Only Alternative: The cost/benefit analysis showed greater costs than benefits for this alternative; incidental widening benefits are still realized as widening is necessary for deepening. Incidental widening benefits are provided by the addition of two-way traffic in these areas. They are incidental because the widening must be done to support the new channel footprint under the with-project condition.

Deepening Alternatives: The vessel fleet transitions to Post-Panamax generation II vessels, which account for a significant portion of the benefits realized at a 44-foot depth. Therefore, the preliminary cost/benefit analysis was not favorable (significantly lower net benefits than 44-foot depths and deeper) for 41 to 43-foot depths. Net benefits are the greatest at a 45-foot depth and the non-federal sponsor requested a locally preferred plan (LPP) at a 47-foot depth; therefore, 48 to 50-foot depths were eliminated from further study. **Table 31** shows the average annual equivalent (AAEQ) costs and benefits of the final array of alternative plans (44 to 47-foot depths). The two turning basins (Blount Island

and Brills Cut) are recommended per the results of ship simulation. The turning basins are needed to allow for the larger vessels to maneuver under the with-project condition.

Table 31: Comparison of Final Array of Alternative Plans/Decision Criteria[5]

Depth	AAEQ Costs*	AAEQ Benefits	AAEQ Net Benefits	BCR
44ft	$23,340,000	$66,730,000	$43,390,000	2.90
45ft	$25,480,000	$84,220,000	$58,740,000	3.30
46ft	$31,780,000	$88,030,000	$56,250,000	2.80
47ft	$33,720,000	$89,690,000	$55,970,000	2.70
*Costs include IDC and O&M.				

*Note: FY14 Price Levels at 3.50%

5.6 PLAN SELECTION

The NED plan has been identified to be 45 feet. This is the depth where the net benefits are the highest. The non-federal sponsor has requested a locally preferred plan (LPP) of 47 feet[6]. There are positive net benefits at this depth. The recommended plan is the LPP of 47 feet. In addition to deepening, the two areas of widening at the Training Wall Reach and the St. Johns Bluff Reach are recommended. Two turning basins located at Blount Island and Brills Cut were recommended under the final 2012 ship simulation report. **Figure 26** outlines the recommended plan area.

Table 32 shows the total average annual equivalent (AAEQ) benefits for a 45-foot and 47-foot channel to be estimated at $84 million and $90 million, respectively. The NED and LPP are shown below at the existing FY14 interest rate of 3.50% and the 7% interest rate.

Table 32: Total AAEQ Costs and Benefits of the NED and LPP

Depth	**AAEQ Costs**	*AAEQ IDC*	**AAEQ Benefits**	**AAEQ Net Benefits**	**BCR 3.50%**	**BCR 7%**
45ft	**$25,500,000**	*$2,700,000*	**$ 84,200,000**	**$58,700,000**	**3.30**	**1.60**
47ft	**$33,700,000**	*$3,500,000*	**$ 89,700,000**	**$56,000,000**	**2.70**	**1.30**

* AAEQ Costs include AAEQ IDC (shown above) and AAEQ O&M), costs at FY14 price levels

[5] Section 6.2.1 Project Schedule and Interest During PED/Construction.
[6] JAXPORT Letter dated February 25, 2013

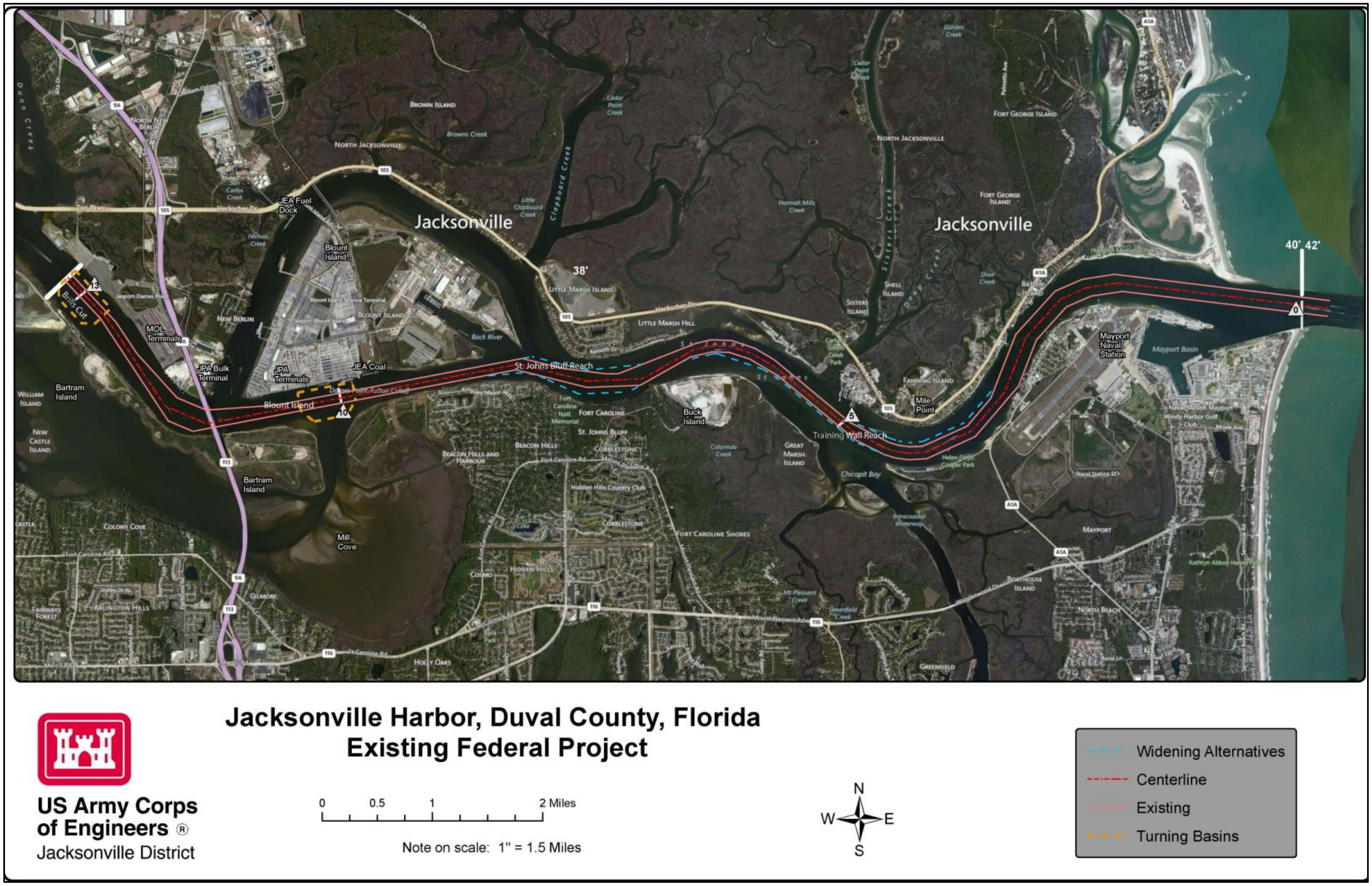


FIGURE 26: JACKSONVILLE HARBOR RECOMMENDED PLAN

5.6.1 Deviation from the NED Plan: Reasons for the LPP

The economic analysis measures the change in the cost of cargo movement for channel depth alternatives ranging from 41 to 50 feet. The analysis accounts for the fact that larger vessels sail at a range of operational drafts. Past a certain point, each deeper operational draft is associated with a diminishing probability of occurrence. Channel depth alternatives necessary to accommodate deeper vessel sailing drafts come at an increasing cost. The NED Plan is that alternative that maximizes transportation cost savings (benefits) for the lowest cost. From the national perspective, the 45-foot alternative provides the greatest net benefit; it can accommodate the full transition of the East-West trade to Post-Panamax generation 2 vessels for the lowest investment cost. Channel depths greater than 45 feet show that benefits continue to increase, but at a slower rate than the alternative costs.

The NED benefits are defined as net positive changes in the national output of goods and services. As a result, NED benefits tend to be more diffuse in nature. Currently other major container ports in the South Atlantic region are either deepening, or studying the feasibility of doing so to be ready for the completion of the Panama Canal improvements. Miami and Savannah are both anticipated to have project depths of 47 feet or greater and share many of the same services as Jacksonville. This has led JAXPORT to select 47 feet as a LPP.

5.6.1.1 LPP Environmental

Environmental impacts caused by the implementation of the NED plan (45 feet) or the LPP (47 feet) are expected to be similar in some respects. Main stem hydrodynamic and ecological modeling indicates negligible differences between the two plans. However, the LPP may require more blasting. The construction duration of the NED plan and the LPP is estimated to be 5 to 6 years, and the exact duration for either plan would be dependent on the number of dredging contractors employed. In addition to potentially more blasting, the LPP would either take longer to build or it would utilize more dredging contractors to finish construction in the same amount of time as the NED plan. Therefore, the LPP does pose a greater risk to resources such as threatened and endangered species. The USACE is prepared to address this additional risk through consultation procedures outlined in the Endangered Species Act and the Marine Mammal Protection Act. The longer construction duration, or greater number of dredges, associated with the LPP may also affect air emissions; however, the study area is still expected to remain in attainment of air quality criteria regardless of what plan, NED or LPP, is constructed. Finally, the LPP would potentially disrupt recreational and commercial river traffic to a greater extent than the NED plan.

5.6.1.2 LPP Engineering

The proposed channel widening measures and 2 new turning basins were developed through extensive ship simulation modeling conducted at ERDC. The widening measures are necessary to accommodate the design vessel and provide safe navigation and economic benefits for the future project. The areal dimensions of these proposed improvements are irrespective of the depth chosen for the project; therefore, there is no difference in this regard between the two plans. Since it is anticipated that the majority of the increase in future O&M dredging will result from the increase to the project dimensions, it is expected that there will be a negligible difference between the LPP and NED plans regarding impacts to the shoaling rate (additional sediment transport modeling is underway to confirm). Advance maintenance areas are being strategically located within the project to prevent an increase in maintenance dredging frequency requirements and these areas would be identical for either project depth (Section 6.5 details the locations of these). **Appendix J** details changes in O&M quantities for the with-project condition.

The biggest difference between the LPP and NED plans includes the estimated initial construction dredging quantities of approximately 18 million cubic yards and 13.5 million cubic yards, respectively. In addition, the 2-foot difference translates to roughly a doubling of the anticipated quantity of rock to be dredged within the total volume above. The disposal plan calls for all dredged material from the project to be placed in the ODMDS. The increase in the construction dredging quantity of approximately 4.5 million cubic yards will have an impact on the long-term ODMDS capacity. A new ODMDS is currently being evaluated and will have a total capacity of at least 65-million cubic yards depending upon its final configuration and this is considered to be a without-project condition for purposes of the GRR II study. Currently, it is estimated that between approximately 245,000 and 1.12 million cubic yards will be placed in the ODMDS on an average annual basis from the maintenance of the Jacksonville Harbor and Mayport Naval Station navigation projects; therefore, over a 50-year project life a total of up to 56 million cubic yards could be placed there. The actual amount needed for the ODMDS will depend upon completion of permitting for near-shore disposal and planned improvements made to upland disposal areas that would keep the quantity towards the lower end. The placement of the additional 4.5 million cubic yards from the LPP would reduce the service life of the ODMDS by approximately 4 years if the maximum possible O&M placement rate is needed. The final EIS for the USEPA designation of the new ODMDS is expected to be approved in 2014.

In addition to the above impacts to the Federal project, the increases in project depth from 45 feet mean low water to 47 feet mean low water will require JAXPORT to make significant improvements to the berthing area bulkheads and other infrastructure that are triggered by deepening below 45 feet. These costs and other total project cost differences between the LPP and NED Plans are provided in **Tables 37 and 38**.

5.6.1.3 Incremental Costs and Benefits

The incremental average annual equivalent (AAEQ) benefits and costs are displayed in **Table 33**, incremental costs and benefits of the Locally Preferred Plan. As shown in this table, the incremental AAEQ benefits for the 47-foot channel are estimated at $5.5 million, all of which are transportation savings benefits. Total AAEQ benefits for the 45-foot and 47-foot channel depths result in approximately $84 million and $90 million, respectively.

The incremental benefits for the LPP (47-foot project depth) plan increase but are insufficient to offset the incremental cost. The non-federal sponsor would be responsible for 100% of the incremental costs, in accordance with WRDA 1986, in addition to their cost-shared portion of the 45-foot plan as is shown in **Tables 37 and 38.**

Table 33: Incremental Costs and Benefits of the Locally Preferred Plan

Incremental AAEQ Cost	Incremental AAEQ Benefits	Net Incremental AAEQ Benefits	Incremental BCR
$ 8,240,000	$ 5,470,000	$ (2,770,000)	0.66

*Note: FY14 Price Levels at 3.50%

Table 34: Summary of Direct and Indirect Impacts

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
GENERAL CONSEQUENCES (refer to Section 7.1.1)	Larger ships and increased ship transits are predicted. Deepening would result in predicted or anticipated increases in salinity, tidal amplitude, stress levels on aquatic plants, risk to threatened and endangered species, and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.	Larger ships and increased ship transits are predicted. Deepening would result in predicted or anticipated increases in salinity, tidal amplitude, stress levels on aquatic plants, risk to threatened and endangered species, and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.	Larger ships and increased ship transits are predicted. Deepening would result in predicted or anticipated increases in salinity, tidal amplitude, stress levels on aquatic plants, risk to threatened and endangered species, and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.	Larger ships and increased ship transits are predicted. Deepening would result in predicted or anticipated increases in salinity, tidal amplitude, stress levels on aquatic plants, risk to threatened and endangered species, and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.	Larger ships and increased ship transits are predicted. Deepening would result in predicted or anticipated increases in salinity, tidal amplitude, stress levels on aquatic plants, risk to threatened and endangered species, and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.	An even greater increase in ship transits is predicted. This may result in increased risk to threatened and endangered species and air pollution. Other factors (i.e. sea level rise, variable rainfall levels) would affect salinity, tidal amplitude and stress levels on aquatic plants.
GEOLOGY AND GEOMORPHOLOGY (refer to Section 7.2.1)	Increased channel depth.	Increased channel depth.	Increased channel depth.	Increased channel depth.	Increased channel depth.	No effect.
GROUND WATER HYDROLOGY (refer to Section 7.2.2)	No significant salinity increase is anticipated within surficial aquifer. No effect to Floridan Aquifer.	No significant salinity increase is anticipated within surficial aquifer. No effect to Floridan Aquifer.	No significant salinity increase is anticipated within surficial aquifer. No effect to Floridan Aquifer.	No significant salinity increase is anticipated within surficial aquifer. No effect to Floridan Aquifer.	No significant salinity increase is anticipated within surficial aquifer. No effect to Floridan Aquifer.	No effect. (However, other factors such as sea level rise may cause a slight salinity increase within surficial aquifer)
TIDES (refer to Section 7.2.3)	Minor increases (0.1 feet) in tidal range are predicted in certain areas (refer to Table 41).	No data available.	Minor increases (0.2 feet) in tidal range are predicted in certain areas (refer to Table 41).	Minor increases (0.2 feet) in tidal range are predicted in certain areas (refer to Table 41).	Minor increases (0.2 to 0.3 feet) in tidal range are predicted in certain areas (refer to Table 41).	No effect. (However, other factors such as sea level rise may slightly affect future tides)
CURRENTS AFFECTING NAVIGATION (refer to Section 7.2.4)	Minor decreases (-0.1 to -0.2 feet/s) and increases (0.1 feet/s) in velocity are predicted within certain areas (refer to Table 42).	No data available.	Minor decreases (-0.1 to -0.2 feet/s) and increases (0.1 feet/s) in velocity are predicted within certain areas (refer to Table 42).	No data available.	Minor decreases (-0.2 to -0.3 feet/s) and increases (0.1 to 0.2 feet/s) in velocity are predicted within certain areas (refer to Table 42).	No effect. (However, other factors such as sea level rise may slightly affect future currents)
SEA LEVEL RISE (SLR) (refer to Section 7.2.5 and Appendix A)	Deepening would have no effect on SLR.	Deepening would have no effect on SLR.	Deepening would have no effect on SLR.	Deepening would have no effect on SLR.	Deepening would have no effect on SLR.	No effect
WATER QUALITY-SALINITY (refer to Section 7.2.6.1 and Appendices A and D)	Minor decreases (-0.2 ppt) and increases (0.2 ppt) in depth averaged salinity are predicted in certain areas of the main stem (refer to Table 48).	No data available.	Minor decreases (-0.2 ppt) and increases (0.2 ppt) in depth averaged salinity are predicted in certain areas of the main stem (refer to Table 48).	Minor decreases (-0.1 ppt) and increases (0.2 ppt) in depth averaged salinity (≤ 0.2 ppt) are predicted in certain areas of the main stem (refer to Table 48). Minor decreases and increases in depth averaged salinity in modeled tributaries and marsh.	Minor decreases (-0.2 ppt) and increases (0.5 ppt) in depth averaged salinity are predicted in certain areas (refer to Table 48).	No effect. (However, other factors such as sea level rise and rainfall variability would affect salinity)

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
WATER QUALITY-WATER AGE (RESIDENCE TIME), DISSOLVED OXYGEN AND CHLOROPHYLL A (refer to Section 7.2.7.3)	Minor changes are predicted in water age (refer to Table 52).	No data available.	Minor changes are predicted in water age (refer to Table 53).	Minor changes are predicted in water age (refer to Table 53). No discernible effect on dissolved oxygen or chlorophyll a.	Minor changes are predicted in water age (refer to Table 54).	No effect. (However, other factors such as sea level rise and rainfall variability may affect water age)
AMERICAN HERITAGE RIVER STATUS (refer to Section 7.2.7)	No effect to status.	No effect to status.	No effect to status.	No effect to status.	No effect to status.	No effect to status.
DREDGED MATERIAL MANAGEMENT AREAS (refer to Section 7.2.8)	New and maintenance dredging material placement would occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.	New and maintenance dredging material placement would occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.	New and maintenance dredging material placement would occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.	New and maintenance dredging material placement would occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.	New and maintenance dredging material placement would occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.	Maintenance dredged material placement would continue to occur at Ocean Dredged Material Disposal Site, and possibly beach, nearshore, and upland areas.
LAND USE (refer to Section 7.2.9)	Temporary affect in construction areas, otherwise no effect.	Temporary affect in construction areas, otherwise no effect.	Temporary affect in construction areas, otherwise no effect.	Temporary affect in construction areas, otherwise no effect.	Temporary affect in construction areas, otherwise no effect.	No effect. (However, other factors such as sea level rise may affect land use).
PUBLIC LANDS ADJACENT TO PROJECT AREA (refer to Section 7.2.10)	No direct affects. Indirect effects would include predicted changes in salinity and tides for some areas.	No direct affects. Indirect effects would include predicted changes in salinity and tides for some areas.	No direct affects. Indirect effects would include predicted changes in salinity and tides for some areas.	No direct affects. Indirect effects would include predicted changes in salinity and tides for some areas.	No direct affects. Indirect effects would include predicted changes in salinity and tides for some areas.	No effect. (However, other factors such as sea level rise may affect public lands)
COASTAL BARRIER RESOURCES ACT (CBRA) UNITS (refer to Section 7.2.11)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect. (However, other factors such as sea level rise may affect CBRA units)
AIR QUALITY (refer to Section 7.2.12 and Appendix I)	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.	Slight increase in air pollution is predicted. Port associated activities would be compliant with air quality regulations.
NOISE (refer to Section 7.2.13)	Construction noise levels would comply with local regulations. Construction noise not anticipated to exceed 55 dBA at noise sensitive areas.	Construction noise levels would comply with local regulations. Construction noise not anticipated to exceed 55 dBA at noise sensitive areas.	Construction noise levels would comply with local regulations. Construction noise not anticipated to exceed 55 dBA at noise sensitive areas.	Construction noise levels would comply with local regulations. Construction noise not anticipated to exceed 55 dBA at noise sensitive areas.	Construction noise levels would comply with local regulations. Construction noise not anticipated to exceed 55 dBA at noise sensitive areas.	No effect to existing levels of noise.
HAZARDOUS, TOXIC, RADIOACTIVE WASTE (HTRW) (refer to Section 7.2.14)	Encountering HTRW is not anticipated.	Encountering HTRW is not anticipated.	Encountering HTRW is not anticipated.	Encountering HTRW is not anticipated.	Encountering HTRW is not anticipated.	No effect.
CULTURAL RESOUCES (refer to Section 7.2.15)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect
AESTHETICS (refer to Section 7.2.16)	No effect to major aesthetic characteristics. Larger and more numerous ships transiting through the port.	No effect to major aesthetic characteristics. Larger and more numerous ships transiting through the port.	No effect to major aesthetic characteristics. Larger and more numerous ships transiting through the port.	No effect to major aesthetic characteristics. Larger and more numerous ships transiting through the port.	No effect to major aesthetic characteristics. Larger and more numerous ships transiting through the port.	No effect to major aesthetic characteristics. An even higher number of ships are predicted to transit through the port.

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
GENERAL ENVIRONMENTAL CONSEQUENCES (refer to Section 7.3.1)	Generally slight changes in physical and water quality conditions. However, changes may be greater in specific areas. Salinity change may modify biological communities (i.e. wetlands, submerged aquatic vegetation, and fauna). Phytoplankton dynamics may slightly change.	Generally slight changes in physical and water quality conditions. However, changes may be greater in specific areas. Salinity change may modify biological communities (i.e. wetlands, submerged aquatic vegetation, and fauna). Phytoplankton dynamics may slightly change.	Generally slight changes in physical and water quality conditions. However, changes may be greater in specific areas. Salinity change may modify biological communities (i.e. wetlands, submerged aquatic vegetation, and fauna). Phytoplankton dynamics may slightly change.	Generally slight changes in physical and water quality conditions. However, changes may be greater in specific areas. Salinity change may modify biological communities (i.e. wetlands, submerged aquatic vegetation, and fauna). Phytoplankton dynamics may slightly change.	Generally slight changes in physical and water quality conditions. However, changes may be greater in specific areas. Salinity change may modify biological communities (i.e. wetlands, submerged aquatic vegetation, and fauna). Phytoplankton dynamics may slightly change.	No effect. (Other factors such as sea level rise and variable rainfall would affect salinity levels and may also modify biological communities)
WEST INDIAN MANATEE (refer to Sections 7.3.2, 7.3.2.1)	Dredging and blasting operations may affect, but are not likely to adversely affect the manatee. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Indirect impacts due to salinity change would also affect foraging areas (wetlands and submerged aquatic vegetation). Mitigation would be performed. Increased ship traffic may create greater risk to manatee.	Dredging and blasting operations may affect, but are not likely to adversely affect the manatee. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Indirect impacts due to salinity change would also affect foraging areas (wetlands and submerged aquatic vegetation). Mitigation would be performed. Increased ship traffic may create greater risk to manatee.	Dredging and blasting operations may affect, but are not likely to adversely affect the manatee. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Indirect impacts due to salinity change would also affect foraging areas (wetlands and submerged aquatic vegetation). Mitigation would be performed. Increased ship traffic may create greater risk to manatee.	Dredging and blasting operations may affect, but are not likely to adversely affect the manatee. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Indirect impacts due to salinity change would also affect foraging areas (wetlands and submerged aquatic vegetation). Mitigation would be performed. Increased ship traffic may create greater risk to manatee.	Dredging and blasting operations may affect, but are not likely to adversely affect the manatee. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Indirect impacts due to salinity change would also affect foraging areas (wetlands and submerged aquatic vegetation). Mitigation would be performed. Increased ship traffic may create greater risk to manatee.	Number of ships transiting through the port is expected to be even higher resulting in a greater risk to manatees. Future maintenance dredging may affect, but is not likely to adversely affect the manatee. Protective measures would be implemented. (Other factors such as sea level rise and variable rainfall may affect foraging areas)
PIPING PLOVER (refer to Sections 7.3.2, 7.3.2.2)	Possible placement of dredged material on beach and nearshore areas may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.	Possible placement of dredged material on beach and nearshore areas may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.	Possible placement of dredged material on beach and nearshore areas may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.	Possible placement of dredged material on beach and nearshore areas may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.	Possible placement of dredged material on beach and nearshore areas may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.	Future placement of maintenance dredged material on area beaches and nearshore may affect, but is not likely to adversely affect the plover. Protective measures would be implemented.
WOOD STORK (refer to Sections 7.3.2, 7.3.2.3)	Possible placement of dredged material in upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.	Possible placement of dredged material in upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.	Possible placement of dredged material in upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.	Possible placement of dredged material in upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.	Possible placement of dredged material in upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.	Future placement of maintenance dredged material at upland locations may affect, but is not likely to adversely affect the stork. Protective measures would be implemented.

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
SEA TURTLES (refer to Sections 7.3.2, 7.3.2.4)	Hopper dredging and blasting operations as well as possible placement of dredged material on area beaches may affect sea turtles. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Hopper dredging and blasting operations as well as possible placement of dredged material on area beaches may affect sea turtles. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Hopper dredging and blasting operations as well as possible placement of dredged material on area beaches may affect sea turtles. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Hopper dredging and blasting operations as well as possible placement of dredged material on area beaches may affect sea turtles. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Hopper dredging and blasting operations as well as possible placement of dredged material on area beaches may affect sea turtles. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Future maintenance dredging with possible use of hopper dredge and possible placement of dredged material on area beaches may affect sea turtles. Protective measures would be implemented.
SHORT-NOSED STURGEON (refer to Sections 7.3.2, 7.3.2.6)	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Future maintenance dredging may affect, but is not likely to adversely affect the sturgeon. Protective measures would be implemented.
ATLANTIC STURGEON (refer to Sections 7.3.2, 7.3.2.7)	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sturgeon. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Future maintenance dredging may affect, but is not likely to adversely affect the sturgeon. Protective measures would be implemented.
SMALLTOOTH SAWFISH (refer to Sections 7.3.2, 7.3.2.8)	Dredging and blasting operations may affect, but not likely to adversely affect the sawfish. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sawfish. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sawfish. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sawfish. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may affect, but not likely to adversely affect the sawfish. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Future maintenance dredging may affect, but is not likely to adversely affect the sawfish. Protective measures would be implemented.
NORTH ATLANTIC RIGHT WHALE (refer to Sections 7.3.2, 7.3.2.9)	Dredging and to a lesser extent blasting operations may affect the whale. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Increased ship traffic may create greater risk to the whale.	Dredging and to a lesser extent blasting operations may affect the whale. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Increased ship traffic may create greater risk to the whale.	Dredging and to a lesser extent blasting operations may affect the whale. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Increased ship traffic may create greater risk to the whale.	Dredging and to a lesser extent blasting operations may affect the whale. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Increased ship traffic may create greater risk to the whale.	Dredging and to a lesser extent blasting operations may affect the whale. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented. Increased ship traffic may create greater risk to the whale.	Number of ships transiting through the port is expected to be even higher resulting in a greater risk to the whale. Future maintenance dredging may affect the whale. Protective measures would be implemented.

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
ESSENTIAL FISH HABITAT (refer to Section 7.3.3.1 and Appendices D, E, and L)	Dredging and blasting operations would directly affect EFH. Magnitude and duration would change with each deepening alternative. Indirect impacts due to salinity change would also affect EFH. Mitigation would be performed.	Dredging and blasting operations would directly affect EFH. Magnitude and duration would change with each deepening alternative. Indirect impacts due to salinity change would also affect EFH. Mitigation would be performed.	Dredging and blasting operations would directly affect EFH. Magnitude and duration would change with each deepening alternative. Indirect impacts due to salinity change would also affect EFH. Mitigation would be performed.	Dredging and blasting operations would directly affect EFH. Magnitude and duration would change with each deepening alternative. Indirect impacts due to salinity change would also affect EFH. Mitigation would be performed.	Dredging and blasting operations would directly affect EFH. Magnitude and duration would change with each deepening alternative. Indirect impacts due to salinity change would also affect EFH. Mitigation would be performed.	Maintenance dredging operations would continue to affect EFH. (Other factors such as sea level rise and variable rainfall would affect salinity levels and may also modify EFH)
MARINE MAMMALS (refer to Section 7.3.4)	Dredging and blasting operations may impact marine mammals. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may impact marine mammals. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may impact marine mammals. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may impact marine mammals. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Dredging and blasting operations may impact marine mammals. Magnitude and duration would change with each deepening alternative. Protective measures would be implemented.	Future maintenance dredging may impact marine mammals. Protective measures would be implemented.
BIRDS (refer to Section 7.3.5)	Dredged material placement in upland locations may impact nesting birds. Protective measures would be implemented.	Dredged material placement in upland locations may impact nesting birds. Protective measures would be implemented.	Dredged material placement in upland locations may impact nesting birds. Protective measures would be implemented.	Dredged material placement in upland locations may impact nesting birds. Protective measures would be implemented.	Dredged material placement in upland locations may impact nesting birds. Protective measures would be implemented.	Future placement of dredged material in upland locations may impact nesting birds. Protective measures would be implemented.
REPTILES AND AMPHIBIANS (refer to Section 7.3.6)	Significant impacts are not anticipated.	Significant impacts are not anticipated.	Significant impacts are not anticipated.	Significant impacts are not anticipated.	Significant impacts are not anticipated.	Significant impacts are not anticipated from future maintenance operations.
MACROINVERTEBRATES INCLUDING SHELLFISH (BMI) (refer to Section 7.3.7 and Appendix D)	Dredging and blasting operations would temporarily impact BMI. Indirect impacts due to salinity change would also affect BMI habitat (wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact BMI. Indirect impacts due to salinity change would also affect BMI habitat (wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact BMI. Indirect impacts due to salinity change would also affect BMI habitat (wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact BMI. Indirect impacts due to salinity change would also affect BMI habitat (wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact BMI. Indirect impacts due to salinity change would also affect BMI habitat (wetlands and submerged aquatic vegetation).	Future maintenance dredging would temporarily impact BMI. (Other factors such as sea level rise and variable rainfall would affect salinity levels and may also affect BMI)
OTHER WILDLIFE RESOURCES (FISH) (refer to Section 7.3.8 and Appendix D)	Dredging and blasting operations would temporarily impact fish. Indirect impacts due to salinity change would also affect fish habitat (water column, wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact fish. Indirect impacts due to salinity change would also affect fish habitat (water column, wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact fish. Indirect impacts due to salinity change would also affect fish habitat (water column, wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact fish. Indirect impacts due to salinity change would also affect fish habitat (water column, wetlands and submerged aquatic vegetation).	Dredging and blasting operations would temporarily impact fish. Indirect impacts due to salinity change would also affect fish habitat (water column, wetlands and submerged aquatic vegetation).	Future maintenance dredging would temporarily impact fish. (Other factors such as sea level rise and variable rainfall would affect salinity levels and may also affect fish)

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
WETLANDS (refer to Section 7.3.9 and Appendices D and E)	Dredging operations would not directly affect wetlands. Predicted indirect effects due to salinity change would have a minor impact on wetlands. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect wetlands. Predicted indirect effects due to salinity change would have a minor impact on wetlands. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect wetlands. Predicted indirect effects due to salinity change would have a minor impact on wetlands. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect wetlands. Predicted indirect effects due to salinity change would have a minor impact on an estimated 394.57 acres of wetlands. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect wetlands. Predicted indirect effects due to salinity change would have a minor impact on wetlands. Mitigation and, if necessary, corrective action would be performed.	No effect. (However, other factors such as sea level rise and variable rainfall would affect salinity levels and may also modify wetland communities)
SUBMERGED AQUATIC VEGETATION (SAV) (refer to Section 7.3.10 and Appendices D and E)	Dredging operations would not directly affect SAV. Predicted indirect effects due to salinity change would have a minor impact on SAV. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect SAV. Predicted indirect effects due to salinity change would have a minor impact on SAV. Mitigation and, if necessary,corrective actionwould be performed.	Dredging operations would not directly affect SAV. Predicted indirect effects due to salinity change would have a minor on SAV. Mitigation and, if nessary, corrective action would be performed.	Dredging operations would not directly affect SAV. Predicted indirect effects due to salinity change would have a minor impact an estimated 180.5 acres of SAV. Mitigation and, if necessary, corrective action would be performed.	Dredging operations would not directly affect SAV. Predicted indirect effects due to salinity change would have a minor impact on SAV. Mitigation and, if necessary, corrective action would be performed.	No effect. (However, other factors such as sea level rise and variable rainfall would affect salinity levels and may also modify SAV communities)
PHYTOPLANKTON (refer to Section 7.3.11 and Appendix D)	Little or no effect on water age and this would not encourage algal bloom development.	Little or no effect on water age and this would not encourage algal bloom development.	Little or no effect on water age and this would not encourage algal bloom development.	Little or no effect on water age and this would not encourage algal bloom development.	Little or no effect on water age and this would not encourage algal bloom development.	No effect. (However, other factors such as sea level rise and variable rainfall may affect water age)
INVASIVE AND EXOTIC SPECIES (refer to Section 7.3.12)	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.	Regulations will help control aquatic invasive species. USACE will continue to remove or control invasive plants at upland dredged material management areas.
ENVIRONMENTAL JUSTICE (refer to Section 7.4)	Deepening would not have a disproportionate impact on low-income and minority populations.	Deepening would not have a disproportionate impact on low-income and minority populations.	Deepening would not have a disproportionate impact on low-income and minority populations.	Deepening would not have a disproportionate impact on low-income and minority populations.	Deepening would not have a disproportionate impact on low-income and minority populations.	No effect.
ENERGY REQUIREMENTS AND CONSERVATION (refer to Section 7.5)	Energy requirements for deepening would increase in proportion to construction time. Larger but fewer ships are predicted to call then the no action alternative. Newer, larger ships will have more efficient engines.	Energy requirements for deepening would increase in proportion to construction time. Larger but fewer ships are predicted to call then the no action alternative. Newer, larger ships will have more efficient engines.	Energy requirements for deepening would increase in proportion to construction time. Larger but fewer ships are predicted to call then the no action alternative. Newer, larger ships will have more efficient engines.	Energy requirements for deepening would increase in proportion to construction time. Fewer but larger ships are predicted to call then the no action alternative. Newer, larger ships will have more efficient engines.	Energy requirements for deepening would increase in proportion to construction time. Fewer but larger ships are predicted to call then the no action alternative. Newer, larger ships will have more efficient engines.	Number of ships transiting through the port is expected to be even higher which may result in greater energy requirements.
NATURAL OR DEPLETABLE RESOURCES (refer to Section 7.6)	Unacceptable adverse impacts would not occur to natural or depletable resources.	Unacceptable adverse impacts would not occur to natural or depletable resources.	Unacceptable adverse impacts would not occur to natural or depletable resources.	Unacceptable adverse impacts would not occur to natural or depletable resources.	Unacceptable adverse impacts would not occur to natural or depletable resources.	No effect.

ALTERNATIVE ENVIRONMENTAL FACTOR	44-foot Deep Channel	45-foot Deep Channel	46-foot Deep Channel	47-foot Deep Channel	50-foot Deep Channel	No-action Status Quo
REUSE AND CONSERVATION POTENTIAL (refer to Section 7.7)	Dredged rock and sediment may be used for beneficial uses. Energy will be conserved as much as practical.	Dredged rock and sediment may be used for beneficial uses. Energy will be conserved as much as practical.	Dredged rock and sediment may be used for beneficial uses. Energy will be conserved as much as practical.	Dredged rock and sediment may be used for beneficial uses. Energy will be conserved as much as practical.	Dredged rock and sediment may be used for beneficial uses. Energy will be conserved as much as practical.	Dredged material from maintenance operations may be used for beneficial uses.
URBAN QUALITY (refer to Section 7.8)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
SOLID WASTE (refer to Section 7.9)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
SCIENTIFIC RESOURCES (refer to Section 7.10)	Deepening may result in short term disruption of research.	Deepening may result in short term disruption of research.	Deepening may result in short term disruption of research.	Deepening may result in short term disruption of research.	Deepening may result in short term disruption of research.	Future maintenance operations may result in short term disruption of research.
NATIVE AMERICANS (refer to Section 7.11)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
DRINKING WATER (refer to Section 7.12)	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.

6.0 THE RECOMMENDED PLAN

The recommended plan for navigation improvements at Jacksonville Harbor has to be responsive to local needs and desires as well as the economic and environmental criteria established by Federal and state law. To do this the plan must be able to handle current and forecasted vessel traffic and avoid or minimize the impact to the environment and without excessive delays and damage. The subsequent paragraphs outline the plan design, construction, and operation and maintenance procedures.

The U.S. Army Corps of Engineers (USACE) decision making for the selection of a recommended plan begins at the district level and continues at the division and headquarters levels through subsequent reviews and approvals. For congressionally authorized projects, such as this, the final agency decision maker is the Secretary of the Army through the Assistant Secretary of the Army for Civil Works (ASA [CW]).

The Locally Preferred Plan (LPP), the plan that the non-federal sponsor has requested is the Recommended Plan. The LPP is economically justified and environmentally acceptable.

6.1 DESCRIPTION OF THE RECOMMENDED PLAN

The Recommended Plan is the LPP of 47-feet MLLW. This plan includes deepening from the existing 40-foot channel to 47 feet from the entrance channel to approximately River Mile 13. The following areas of widening are included as part of the new channel footprint for the LPP:

- Mile Point: Widen to the north by 200 feet from Cuts 8 to 13 (~River Miles 3 to 5)
- Training Wall Reach: Widen to the south 100 feet from Cuts 14 to 16 (~River Miles 5 to 6) transitioning to 250 feet for Cut 17 (~River Mile 6) and back to 100 feet from Cuts 18 to 19 (~River Mile 6)
- St. Johns Bluff Reach: Widen both sides of the channel varying amounts up to 300 feet from Cuts 40 to 41 (~River Miles 7 to 8)

The following turning basin areas are recommended based on the ship simulation results to be included in the Recommended Plan.

- Blount Island: ~2,700 feet long by 1,500 feet wide located in Cut 42 (~River Mile 10)
- Brills Cut: ~2,500 feet long by 1,500 feet wide located in Cut 45 (~River Mile 13)

All material dredged for construction is assumed to go to the Ocean Dredged Material Disposal Site (ODMDS). This was assumed in the project cost estimates. Details of the site are discussed in **Section 7.2.9**.

6.1.1 Environmental Mitigation

An interagency assessment team was assembled to assist in conducting a Uniform Mitigation Assessment Method (UMAM) assessment for potential impacts and associated mitigation for the proposed deepening of Jacksonville Harbor. The team was composed of representatives from the following agencies: U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), Florida Department of Environmental Protection (FDEP), Florida Fish and Wildlife Conservation Commission (FFWCC), National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS). Numerous meetings and site visits were conducted to observe and discuss the characterization of the wetland areas/submerged aquatic vegetation (SAV), potential effects related to the proposed project and proposed compensatory mitigation. The mitigation plan consists of conservation land purchase of approximately 638 acres of freshwater wetlands, uplands, river shoreline, and salt marsh wetlands. It has been determined by USACE that this plan would be sufficient to offset any minor effects that may occur as a result of the proposed project. A long-term Corrective Action Plan, which includes field data collection, has been prepared by USACE to provide assurances that actual effects will be assessed and corrective actions coordinated. See **Appendix E** for details of the mitigation considerations and the Corrective Action Plan.

6.2 DETAILED COST ESTIMATES (MCACES)

Based on planning level benefits and costs as shown in **Table 35**, the 45-foot deepening alternative is the National Economic Development (NED) plan; however, the 47-foot deepening alternative is the locally preferred plan (LPP) and the recommended plan.

Once the NED plan and later the LPP were determined, a detailed cost estimate was developed using the Micro Computer Aided Cost Estimating System (MCACES). As outlined in **Appendix N** (Cost), the 45-foot NED plan construction cost, (including Preconstruction Engineering and Design (PED) and aids to navigation) is approximately $508,500,000; the 47-foot LPP is $684,200,000. The average annual costs were determined to be approximately $25 million for the NED plan and approximately $34 million for the LPP. The average annual benefit for the NED plan is approximately $84 million and $90 million for the LPP. Therefore, the benefit-to-cost ratio is estimated at 3.3 for the NED plan and 2.7 for the LPP.

As a result of the cost risk analysis, the contingency for the NED and LPP were determined to be 27% and 26.3% respectively. It was determined that the potential impact of certain risks to the 45-foot project is actually greater than the 47-foot project. An example is the impact of higher fuel prices. The combined CDEP/MII study showed that a 25% increase in fuel cost resulted in the cost of dredging for the 47-foot project to increase by about 6%. The same 25% increase in fuel cost increased the cost of dredging for the 45-foot project by about 8.5%. Certain risks have a relatively fixed cost regardless of the dredging depth. The fixed cost represents a higher percentage of total cost for the 45' project as compared to the 47-foot project. The nature of Monte Carlo simulation is that different modeling runs result in slightly different contingency values. This is commonly +/- 0.1 for a contingency percentage value. As a result, a portion of the 0.9% difference in contingency percentage values between 45 feet and 47 feet is not likely to be statistically significant.

6.2.1 Project Schedule and Interest during PED/Construction

Interest during Construction (IDC) accounts for the opportunity cost of expended funds before the benefits of the project are available and is included among the economic costs that comprise the NED project costs. The amount of the pre-base year cost equivalent adjustments depends on the interest rate; the construction schedule, which determines the point in time at which costs occur; and the magnitude of the costs to be adjusted. The PED durations are included in the IDC, as well as the construction durations. The current construction schedule assumes authorization of the project in a future Water Resources Development Act (WRDA). Assuming Congress provides funding subsequently to authorization of the project, the proposed schedule of activities would follow resulting in benefits starting in the base year of the proposed project. The IDC was computed with the 2014 fiscal year interest rate of 3.50%. Total construction duration is assumed to be 6 years for the LPP and 5 years for the NED. The following is the schedule for construction that was used in computing the IDC for the LPP.

Table 35: Schedule for Construction Used for Computation of IDC

Description	Duration in Months	Cumulative Months
Division Engineer's Transmittal	0	S
Design Agreement	3	S+3
Plans and Specification	10	S+13
Project Partnership Agreement (PPA) Initiated	4	S+17
Advertise (Contingent upon funding) Contract	2	S+19
Award Contract	3	S+22
Construction Start	1	S+23
Construction Complete	72	S+95

6.3 DESIGN AND CONSTRUCTION CONSIDERATIONS

Due to more pronounced environmental conditions such as wind, waves, and tides, an additional 2 feet is included for the outer portion of the project between Entrance Channel Bar Cut-3 Station 0+00 and Bar Cut-3 Station 210+00 (River Mile 1). This additional 2 feet for this reach is already incorporated into the existing 40-foot project (42-foot depth) and will simply be carried forward into the recommended plan to provide an additional 2 feet for vessel underkeel clearance in this reach. In addition to depth there are improvements to the Federal channel that are necessary to facilitate the navigation of the design vessel (as tested through ship simulation) and a summary of these measures is provided in **Appendix A**.

6.3.1 Value Engineering

Value Engineering (VE) is a process used to study the functions a project is to accomplish. As a result, the VE team takes a critical look at how these functions are met, and it identifies alternative ways to achieve the equivalent function while increasing the value, and the benefit to cost ratio of the project. The project was studied using the USACE standard value engineering (VE) methodology. The initial VE analysis determined that there may be added value to developing further options for O&M dredging, timing of dredging and disposal, use of adaptive management, and continuing to develop dredged material disposal alternatives. The VE process is iterative and will continue throughout the PED phase. The VE analysis is located in **Appendix A**.

6.3.2 With-Project Sea Level Rise

The average baseline, intermediate, and high sea level change rates were found to be +2.29 mm/year (0.0078 feet/year), +5.05 mm/year (0.0166 feet/year), and +13.82 mm/year (0.0453 feet/year), respectively. The total regional sea level rise predicted by the three scenarios (baseline, intermediate, and high) will not have a significant impact on the performance of the Jacksonville Harbor navigation project. Potential impacts of rising sea level include overtopping of waterside structures, increased shoreline erosion, and flooding of low lying areas. A positive potential impact of sea level rise on the project is a reduction in required maintenance due to increased depth in the channel. In general, regional sea level rise (baseline, intermediate, and high) will not affect the function of the project alternatives or the overall safety of the design vessel. While there is expected to be a small increase in tidal surge and penetration for all three scenarios, the structural aspects of the project will be either unaffected or can be easily adapted to accommodate the change.

6.3.3 Storm Surge

In order to evaluate the potential impacts of the deepening project on storm surge a coupled hydrodynamic and wave modeling system, ADCIRC (hydrodynamic) plus SWAN (wave) has been setup and calibrated for two historic storm events. A description of the setup, calibration and results is located in **Attachment J**, Hydrodynamic Modeling for Storm Surge and Sea Level Change. Preliminary results indicate that the 47-foot project alternative has a minimal affect on the mean low water and mean high water tidal datums and causes no significant increase in peak storm surge elevations. This modeling effort provides a storm event surge assessment including USACE sea level rise rates (EC 1165-

2-212 – Sea Level Change Considerations for Civil Works Programs) for the proposed project alternative channel deepening.

The ADCIRC+SWAN Storm Event Modeling for the Jacksonville Harbor Navigation Channel Design study requires application of water level data from two different storms to calibrate and verify the ADCIRC + SWAN model. Because the study examines water levels during extreme events, ideal storms to calibrate and verify the model are those that caused the highest observed storm surges in the project area and had accurate measured data at multiple locations along the river. To select the appropriate storms, this study relied on an ongoing Taylor Engineering / Baker AECOM Georgia and Northeast Florida storm surge study (GANEFLSSS) for the Federal Emergency Management Agency (FEMA).

Calibration and validation of the coupled ADCIRC+SWAN hydrodynamic and wind-wave numerical model for simulation of currents and water levels in Jacksonville Harbor was conducted. Two storm events were used to validate the ADCIRC+SWAN numerical model, Hurricane Dora (1964) and Hurricane Frances by comparing observed time-series water levels at three gages during Dora and fourteen during Frances.

To evaluate the 47-foot project depth effects on tide and storm surge levels in combination with sea level change (SLC) scenarios, the ADCIRC+SWAN hydrodynamic model applied different Jacksonville Harbor channel depth configurations (existing and 47-foot depth), SLC scenarios (0.4, 1, 2, and 6 feet), and synthetic storm forcing (50- and 100-year storms). The model results indicate that the 47-foot channel configuration scenario produces only slightly elevated peak water levels as compared to the baseline channel configuration and negligible changes in pre-storm tides. The largest difference in maximum water surface elevation of 0.3 feet, between the without project depths and the 47-foot project depths, occurs for the 0.4 foot sea level rise and 50-year storm event.

6.3.4 Tides

The effect of tides on the river is significant. Tidal influences are prevalent from the mouth of the river to slightly more than 100 statute miles upriver, near Georgetown, where the tide becomes negligible. The exact point where the river becomes non-tidal will constantly change, depending on the strength of the tide signal (e.g., spring or neap tides), and the interaction of the tide with the variable river flow. Tidal effects have been reported as far south as Lake Harney, upstream of DeLand.

According to the National Oceanic and Atmospheric Administration[7], the mean range of tide decreases from 5.5 feet at the ocean to 4.5 feet at Mayport within a

7 *Tide Tables 1997 High and Low Water Predictions, East Coast of North South America Including Greenland*, Issued 1996, National Oceanic and Atmospheric Administration, National Ocean Service, 241.

2-mile distance. The jetties and the river topography effectively dampen the signal as it progresses into the entrance**.** The total flow in the lower reaches of the river is comprised of about 80%-90% tide-induced flow, with the remaining flow caused by wind, freshwater inflow (from tributaries and rain), and industrial and treatment plant discharges. The river flow generally increases downstream, with the highest flows occurring at the mouth of the river. The total discharge of the river is normally greater than 50,000 cubic feet per second (cfs) and will often exceed 200,000 cfs. River flow is seasonal, generally following the seasonal rain patterns with higher flows occurring in the late summer to early fall, and lower flows occurring in the winter months. The average annual non-tidal discharge at the river mouth is approximately 15,000 cfs.

In the St. Johns River, the tidal current consists of saltwater flow interacting with freshwater discharge. According to the U.S. Geological Survey (USGS) seawater moving upstream from the mouth of the St. Johns River mixes with the river water to form a zone of transition. The chemical character of the water in this zone varies from seawater near the coast to freshwater farther inland. Between the City of Jacksonville and the ocean, the river shows some vertical stratification between seawater and overlying river water. Daily maximum chloride concentrations in the river range from 2,000 mg/L at the Main Street Bridge to 19,000 mg/L at Mayport 50 percent of the days. At Drummond Point, about halfway between these two sites, daily maximum chloride concentrations exceeded 10,000 mg/L about 50 percent of the days, and exceeded 15,000 mg/L less than 7 percent of the days.[8]

6.3.5 Geotechnical Considerations

Based on EFDC model results (Appendix A, Attachment K) the 47-foot plan increases tide range compared to the without-project condition, at the Bar Pilot Dock by 0.1 feet (0.03 meters), at Long Branch by 0.2 feet, at the Main Street Bridge by 0.2 feet (0.06 meters). Model results do not show appreciable differences in water level duration curves at the Buckman Bridge and Shands Bridge and therefore no increases in water level upstream of the Buckman Bridge are expected. Based on these tide range increases the estimated tidal prism increase is 7 percent of the 85 x 106 m3 Lower St. Johns River (LSJR) estimate given by Sucsy and Morris (2002).

Maximum flood and ebb currents lead the high and low tide by 15 minutes to 1 hour on average. Based on measurements (NOAA, 1999) spanning previous Jacksonville Harbor construction dredging, the modification of tide phase due to the 47-foot plan is expected to cause the maximum flood and ebb currents to occur 20 minutes to 1 hour earlier than the without-project condition.[9]

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8 *Appraisal of the Interconnection Between the St. Johns River and the Surficial Aquifer, East-Central Duval County, Florida*, U.S. Geological Survey, Water Resources Investigations Report 82-4109, Tallahassee, Florida, 1983, 5.

9 Sucsy, P. and Morris, F. . “Calibration of a Three-Dimensional Circulation and Mixing Model of Lower St. Johns River.” (Memorandum draft). St. Johns River Water Management District,

While use of a cutterhead hydraulic dredge, such as the TEXAS, allows for dredging of rock with an unconfined compressive strength of less than 5000 PSI, pretreatment of massive dense rock layers with an unconfined compressive strength greater than 5,000 PSI will require blasting according to USACE geotechnical analysis. One alternative to complete pretreatment over the entire 13-mile project area of the river involves a combination of cutterhead suction dredging and blasting.

Past dredging experience indicates that some contractors recommend dredging the entire project area first with a well designed, pinned tooth cutterhead dredge, with a cutting force of 1500 to 2500 pounds per linear inch. During that first pass through the project dredging area the contractor maps any areas the cutterhead dredge cannot excavate. Those mapped areas result in a reduced area for blasting and confine the blasting to only those areas that the cutterhead dredge could not excavate.

Rock pretreatment methods will be entertained from contractors as alternatives to blasting. These methods might include the use of punch barge or pneumatic hammers to break the rock into smaller pieces for removal. These methods involve repeated striking of rock to break it.

6.3.5.1 Spudding/ Hydrohammer/ Use of Punch Barge

Pretreatment techniques are used to break-up consolidated, massive materials, like rock, prior to removal of this material by a dredge. Such factors as location, rock hardness, cost, and amount of surface requiring treatment are among factors to be taken into account when determining which method is most suitable and practicable for a given project.

Methods to pre-treat the rock within the harbor without confined underwater blasting using a punch barge/hydrohammer (also called spudding) will be investigated by USACE. Spudding is the process of fracturing the rock by dropping an array of chisels or spuds onto the rock, causing a fracture. A hydrohammer is a jackhammer mounted on a backhoe. A dredge (hydraulic or mechanical) then follows this process and excavates the rock. This is a slow process and can be relatively expensive. The punch barge would work for 12-hour periods, striking the rock below approximately once every 30 to 60 seconds. The primary environmental impact of spudding or hydrohammer is noise and vibration. This constant pounding would disrupt marine mammal behavior in the area, as well as impact other marine species that may be in the area. The impulse spectrum is broadband and can have components well into the kHz range (Laughlin, 2005 and Laughlin 2007 in Spence *et al*. 2007). Low frequencies (<200 Hz) typically dominate the overall levels for impact pile driving

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Palatka, FL., NOAA Technical Report NOS CO-OPS 025. CURRENTS IN THE ST. JOHNS RIVER, FLORIDA. SPRING AND SUMMER OF 1998. Silver Spring, Maryland.

as seen with hydrohammer or punch-barging (Spence *et al.* 2007). The effects of related sound waves are very similar to the effects of underwater blasting and may result in injuries similar in nature to those of unconfined underwater blasting. Spence *et al.* also noted that underwater sound data published in the literature typically shows a fairly wide variation in the levels generated by pile driving type activities (similar to use of a punch barge or hydrohammer). They found variations on the order of 5-10dB from one hit to another. Using the punch barge will also extend the length of the project temporally due to the slower production with the harder materials, thus temporally increasing any potential impacts to all fish and wildlife resources in the area.

6.3.5.2 Confined Underwater Blasting

To achieve the deepening of Jacksonville Harbor from the existing depth of 40-foot project depth to 47-foot project depth LPP, pretreatment of some of the rock areas may be required. The use of confined underwater blasting as a pretreatment technique is anticipated to be required for some of the deepening and widening of the authorized Federal project, where standard construction methods are unsuccessful due to the hardness of the rock. Three criteria will be used by USACE to determine which areas are most likely to need blasting (those areas documented by core borings to contain hard and/or massive rock). The analysis of potential blasting will be based on evaluations of core boring logs, punch barge usage, and production rates of previous deepening projects at Jacksonville Harbor.

<u>Methods</u>

The focus of the proposed blasting work at Jacksonville Harbor is to pretreat bedrock prior to removal by a dredge, utilizing confined blasting, meaning the shots would be “confined” in the rock. In confined blasting, each charge is placed in a hole drilled in the rock approximately 5 to 10 feet deep below the desired depth (see **Figure 27**) depending on how much rock needs to be broken and the intended project depth. The hole is then capped with an inert material, such as crushed rock (**Figure 28**). This process is referred to as “stemming the hole.” The blasting charge is set and then the chain of explosives within the rock is detonated.

For the Port of Miami Phase II expansion in 2005, blasting was successfully used as a pretreatment technique, and the stemming material was angular crushed rock. It is expected that the specifications for any construction utilizing blasting at Jacksonville Harbor would have similar stemming requirements as those that were used for the Miami Harbor Phase II project. The optimum size of stemming material is material that has an average diameter of approximately 0.05 times the diameter of the blast hole. Material must be angular to perform properly (Konya 2003). For this project, project-specific specifications will be prepared. In the

Miami Harbor Phase II project, the following requirements were in the specifications regarding stemming material:

> "*1.22.9.20 Stemming.* All blast holes shall be stemmed. The Blaster or Blasting Specialist shall determine the thickness of stemming using the blasting industry conventional stemming calculation. The minimum stemming shall be 2 feet thick. Stemming shall be placed in the blast hole in a zone encompassed by competent rock. Measures shall be taken to prevent bridging of explosive materials and stemming within the hole. Stemming shall be clean, angular to subangular, hard stone chips without fines having an approximate diameter of 1/2-inch to 3/8-inch. A barrier shall be placed between the stemming and explosive product, if necessary, to prevent the stemming from settling into the explosive product. Anything contradicting the effectiveness of stemming shall not extend through the stemming."

It is expected that the specifications for any construction utilizing blasting at Jacksonville Harbor would have similar stemming requirements as those that were used for the Miami Harbor Phase II project. The length of stemming material will vary based on the length of the hole drilled; however, minimum lengths will be included in the project specific specifications. Studies have shown that stemmed blasts have up to a 60-90% decrease in the strength of the pressure wave released, compared to open water blasts of the same charge weight (Nedwell and Thandavamoorthy, 1992; Hempen *et al*. 2005; Hempen *et al*. 2007). However, unlike open-water, i.e., unconfined blasts (**Figure 29**), very little peer-reviewed research exists on the effects that confined blasting can have on marine animals near the blast (Keevin *et al*. 1999). The visual evidence from a typical confined blast is shown in **Figure 30**.

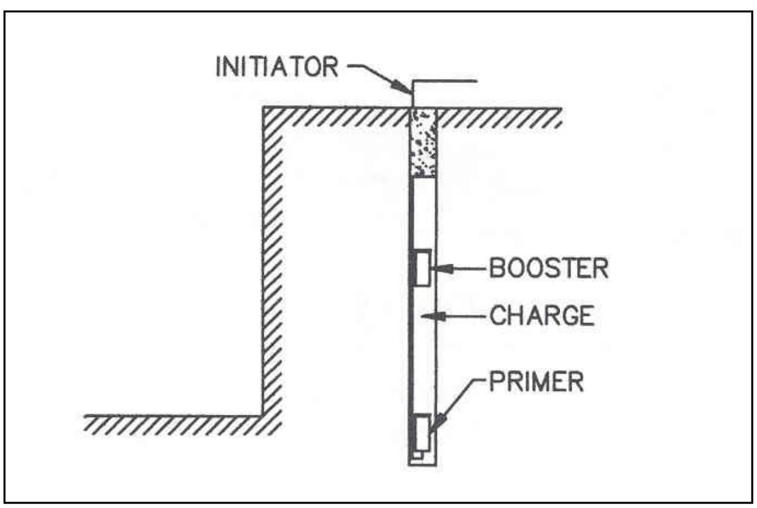


FIGURE 27: TYPICAL STEMMED HOLE FOR LOADING CHARGES

FIGURE 28: STEMMING MATERIAL

FIGURE 29: UNCONFINED BLAST OF SEVEN POUNDS OF EXPLOSIVES

FIGURE 30: CONFINED BLAST OF 3,000 POUNDS OF EXPLOSIVES

To estimate the maximum poundage of explosives that may be utilized for this project, USACE has reviewed two previous blasting projects, one at San Juan Harbor, Puerto Rico in 1994 and one at Miami Harbor in 2005. The San Juan Harbor project's heaviest delay was 375 lbs per delay and in Miami it was 376 lbs per delay. It is unknown at this time what the maximum delay weight will be for Jacksonville Harbor. This will be determined during the test blast program.

Blast Specifications.

The USACE biologists, working with senior geologists, concluded that the assumptions made during the Miami project concerning minimization of the effects of blasting are applicable and accurate for the Jacksonville Harbor project. To that effect, based upon industry standards and USACE safety & health regulations, the blasting program may consist of the following:

1) The weight of explosives to be used in each blast will be limited to the lowest poundage of explosives that can adequately break the rock.
2) Drill patterns are restricted to a minimum of an 8-foot separation from a loaded hole.
3) Hours of blasting are restricted from two hours after sunrise to one hour before sunset to allow for adequate observation of the project area for protected species.

4) Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
5) Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.
6) The blast design will consider matching the energy in the "work effort" of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.
7) Delay timing adjustments will be a minimum of 8-milliseconds between delay detonations to stagger the blast pressures and prevent cumulative addition of pressures in the water.

<u>Safety Radii</u>

The confined underwater blasting program will incorporate the use of three safety radii (**Figure 31**) typically utilized for projects involving unconfined blasts. This conservative use of an *unconfined* blast in development of the safety radii for a *confined* blast will increase the protections afforded marine species in the area. These three zones are referred to as the "danger zone," which is the inner most zone, located closest to the blast; the "safety zone," which is the middle zone and the "watch zone," which is the outer most zone.

The danger zone radius will be calculated to determine the maximum distance from the blast at which mortality to protected marine species is likely to occur. The danger zone is determined by the amount of explosives used within each delay (which can contain multiple boreholes). These calculations are based on impacts to terrestrial animals in water when exposed to a detonation suspended in the water column (unconfined blast) as researched by the U.S. Navy in the 1970s (Yelverton *et al*. 1973; Richmond *et al.* 1973), as well as observations of sea turtle injury and mortality associated with unconfined blasts for the cutting of oil rig structures in the Gulf of Mexico (Young 1991). The reduction of impact by confining the shots would more than compensate for the presumed higher sensitivity of marine species. It is the belief of USACE that the danger zone radius, coupled with a strong protected species observation and protection plan is a conservative and prudent approach to the protection of marine wildlife species. Based on a review by NMFS-OPR for the Miami Harbor phase II project, NMFS and USFWS found these protective measures sufficient to protect marine mammals under their respective jurisdictions (NMFS 2005; USFWS 2002; NMFS 2011).

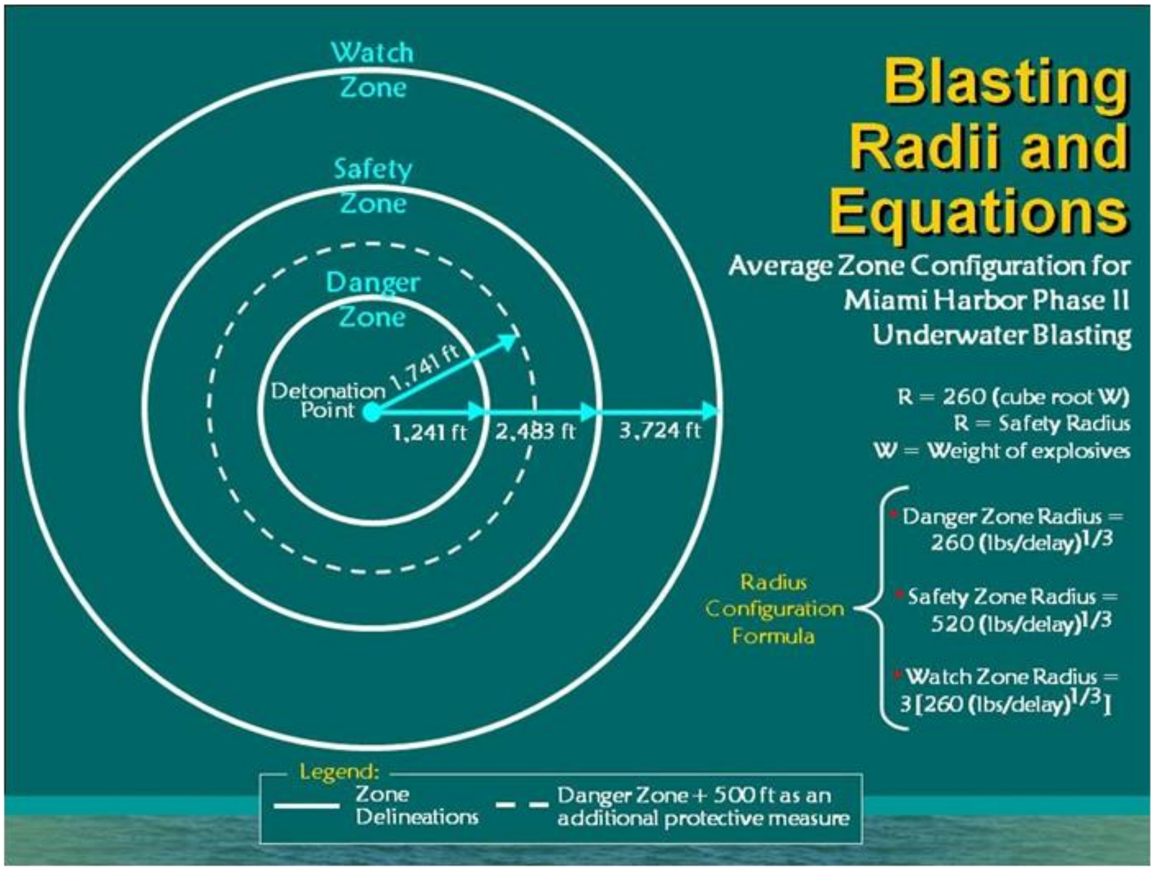


FIGURE 31: BLAST ZONE RADII AND EQUATIONS

These zone calculations will be included as part of the specifications package that the contractors will bid on before the project is awarded. Ideally, the safety radius (all three zones) should be large enough to offer a wide buffer of protection for marine animals while still remaining small enough that the area can be intensely surveyed.

Radii specifications are as follows:

1) Danger Zone (NMFS refers to this as the Caution Zone): The radius in feet from the detonation beyond which no expected mortality or injury from an open water explosion is likely to occur (NMFS 2005). The danger zone (feet) = 260 [79.25 meters] X the cube root of weight of explosives in pounds per delay (equivalent weight of TNT).

2) The Safety Zone is the approximate distance in feet beyond which injury (Level A harassment as defined in the Marine Mammal Protection Act [MMPA]) is unlikely to occur from an open water explosion (NMFS 2005). The safety zone (feet) = 520 [158.50 meters] X cube root of weight of explosives in lbs per delay (equivalent weight of TNT).

3) The Watch Zone is three times the radius of the Danger Zone to ensure that animals entering or near the Exclusion Zone (see below) are spotted and appropriate actions can be implemented before or as they enter any impact areas (i.e., a delay in blasting activities).

4) Exclusion Zone extends to 500 feet outside the Danger Zone radius. Detonation will not occur if a marine mammal or reptile may be within that zone (based on observational data).

Because of the potential duration of the blasting and the proximity of the inshore blasting to a manatee use area, a number of issues will need to be addressed. As such, USACE is considering a blasting window when manatees are less likely to be present. Other dredging and construction activities may take place inside the port during this period of time, but confined underwater blasting would not be utilized during this period.

It is crucial to balance the demands of the blasting operations with the overall safety of protected species in the project area. A radius that is excessively large will result in significant delays that prolong the blasting, construction, traffic, and overall disturbance to the area. A radius that is too small puts the animals at too great a risk should one go undetected by the observers and move into the blast area. Because of these factors, the goal is to establish the smallest radius possible without compromising animal safety and provide adequate observer coverage for whatever radius is agreed upon.

<u>Monitoring/Watch Plan</u>

A watch plan will be formulated based on the required monitoring radii and optimal observation locations. The watch plan will be consistent with the program that was utilized successfully at Miami Harbor in 2005 and will consist of at least five observers for each drill barge (if multiple drill barges are used) including at least one (1) aerial observer, two (2) boat-based observers, and two (2) observers stationed on the drill barge (**Figures 30-34**). Another observer will be placed in the most optimal observation location (boat, barge, fixed structure, shore, or aircraft) on a day-by-day basis depending on the location of the blast and the placement of dredging equipment, as determined by the blaster in charge and the chief protected species observer. This process will ensure complete coverage of the three zones as well as any critical areas. The watch will begin at least one hour prior to each blast and continue for one-half hour after each blast (Jordan *et al*. 2007).

FIGURE 32: TYPICAL OBSERVER HELICOPTER

FIGURE 33: VIEW OF TYPICAL ALTITUDE OF AERIAL OBSERVER OPERATIONS

FIGURE 34: TYPICAL VESSEL FOR BOAT-BASED OBSERVER

FIGURE 35: OBSERVER ON DRILL BARGE

Fish Repulsion

In the past, to reduce the potential for fish to be injured or killed by the blasting, USACE has allowed, and the resource agencies have requested, that blasting contractors utilize a small, unconfined explosive charge, usually a 1 pound booster, detonated about 30-seconds before the main blast to drive fish away from a blasting zone. It is assumed that noise or pressure generated by the small charge will drive fish from the immediate area, thereby reducing impacts from the larger and potentially more-damaging blast. Blasting companies use this method as a “good faith effort” to reduce potential impacts to aquatic resources. The explosives industry recommends firing a “warning shot” to frighten fish out of the area before seismic exploration work is begun (Anonymous 1978 in Keevin *et al*. 1997).

There is limited data available on the effectiveness of fish scare charges at actually reducing the magnitude of fish kills and the effectiveness may be based on the fish’s life history. Some states require the use of fish scares (Illinois, New Jersey and Washington) while others (Alaska and Texas) have determined that they are ineffective and “potentially harmful to piscivorous fishes, marine mammals and birds which are attracted to feed on fish that are stunned or wounded by the repelling charge.” Florida does not have a regulation specific to the use of scare charges associated with blasting (Lisa Gregg, pers. Comm., August 5, 2011), but FWC has requested the use of scare charges associated with previous projects that utilized blasting like the 2005 blasting at Miami Harbor. Numerous incidental observations (cited in Keevin *et al.* 1997) during blasting operations suggest that these charges are not effective in scaring fish from the blasting zone.

Keevin *et al.* (1997) conducted a study to test if fish scare charges are effective in moving fishes away from blast zones. They used three freshwater species, largemouth bass; channel catfish and flathead catfish, equipping each fish with an internal radio tag to allow the fishes movements before and after the scare charge to be tracked. Fish movement was compared with a predicted LD 0% mortality distance for an open water shot (no confinement) for a variety of charge weights. Largemouth bass showed little response to repelling charges and none would have moved from the kill zone calculated for any explosive size. Only one of the flathead catfish and two of the channel catfish moved to a safe distance for any blast. This means that only 11% of the fish used in the study would have survived the blasts.

These results call into question the true effectiveness of this minimization methodology. However, some argue that based on the monetary value of fish (American Fishery Society 1992 in Keevin *et al.* 1997) including high value commercial or recreational species like snook and tarpon found in southeast Florida inlets like Port Everglades, the low cost associated with repelling charge use would be offset if only a few fish were moved from the kill zone (Keevin *et al*. 1997).

Protocol

A blast-day (or blast-event) is made up of all the actions during a blast from the Notice to Project Team and Local Authorities two hours before the blast is detonated through the end of the protected species watch 30 minutes after the blast detonation. The typical events in a blast-event are:

Typical Blast Timeline:

- Time of Event (T) minus 2 HOURS: Notice to Project Team and Local Authorities
- T minus 1 HOUR: Protected Species Watch Begins
- T minus 15 MINUTES: Notice to Mariners (channel closes)
- T minus 1 MINUTE: Fish Scare
- Blast detonation
- T plus 5 MINUTES: All Clear Signal
- T plus 30 MINUTES: Protected Species Watch Ends
- DELAY CAPSULE (can occur between T - 1 hour and detonation): If an animal is observed in either the danger or safety zones, the blast is delayed to monitor the animal until it leaves, on its own, from both the danger and safety zones.

This timeframe lasts a minimum of 2 hours and 35 minutes, although it can be extended if a protected species (like a dolphin, manatee or turtle) enters the exclusion zone. The animal is monitored until it leaves, on its own, from both the danger and exclusion zones. There can be more than one blast-day (blast-event) in a calendar day, although two is typically the maximum for each drill barge used during construction.

Vibration

In an urban environment such as the port, which is surrounded by commercial properties, utilities, and residential communities, protection of structures must be considered. Once the areas of the project requiring blasting are identified, critical structures within the blast zones would be determined. Where vibration damage may occur, energy ratios and peak particle velocities shall be limited in accordance with state or county requirements, whichever is more stringent. Furthermore, vibration-monitoring devices will be installed to ensure that established vibration limits are not exceeded. If the energy ratio or peak particle velocity limits are exceeded, blasting will be stopped until the probable cause has been determined and corrective measures taken. Critical monitoring locations may include structures such as bulkheads, hazardous materials storage areas, and buried utilities.

Ground-borne vibration can be generated by a number of sources, including road and railways, and construction activities such as piling, blasting, and tunneling. Vibration can be defined as regularly repeated movement of a physical object about a fixed point. The parameter normally used to assess the ground vibration is the peak particle velocity (PPV) expressed in millimeters per second (mm/s).

In order to completely define ground vibration, the amplitude and frequency of the motion are measured in the three orthogonal directions generally in terms of velocity which is considered to be the best descriptor for assessing human comfort and the potential damage response of structures. The vibration velocity signals are summed (in real time) and the maximum amplitude of this vector sum is defined as the Peak Vector Sum (PVS). Vibration can cause varying degrees of damage in buildings and affect vibration-sensitive machinery or equipment. Its effect on people may be to cause disturbance or annoyance or, at higher levels, to affect a person's ability to work.

Vibration data reviewed by USACE included the two most recent blasting projects completed by the district: the deepening of San Juan Harbor in 2000 and of Miami Harbor in 2005. Both used confined underwater blasting. Both projects had significant structural resources located near the blast that were of concern (the San Juan site included the National Park Service's Castillo San Felipe del Morro, a 400 plus year old fortress overlooking the harbor and 30 additional historic sites within boundaries of the National Monument). In Miami, the harbor is bounded on the north by the port facilities and on the south by Fisher Island, a residential island. In both cases, a network of monitoring locations was established by the blasting contractor to capture vibration associated with the detonation of each blast. Additionally, at El Morro, the contractor installed monitoring devices on each crack in the stucco that covers the structure's interior walls, and a photo was taken after installation to serve as a preconstruction baseline. During construction, the crack was monitored throughout the blasting project to ensure that crack's width or length had not increased (**Figure 36**).

At Miami the maximum PVS allowed for the project was 1.0 mm/second. The average maximum PVS for the Miami Harbor deepening in 2005 was 0.3828mm/second with a range of 0.0819mm/second - 1.08mm/second during the 40 blast detonations. During both projects, no adverse impacts were reported to any of the surrounding structures by either the vibration monitoring contractor, or the building's owners/trustees.

<u>Air Pressure</u>

The USACE Safety and Health Requirements Manual (EM 385-1-1, 3 November 2003) states, "Air blast pressure exerted on structures resulting from blasting shall not exceed 133 dB (0.013 psi)." Industry standard vibration limitations would be incorporated into the design process. A conservative regression analysis of similar projects may be used to develop the design and then continually updated with calibration of the environment. The contractor will also be required to abide by state and local blasting requirements in addition to the USACE Safety Manual previously referenced in this paragraph.

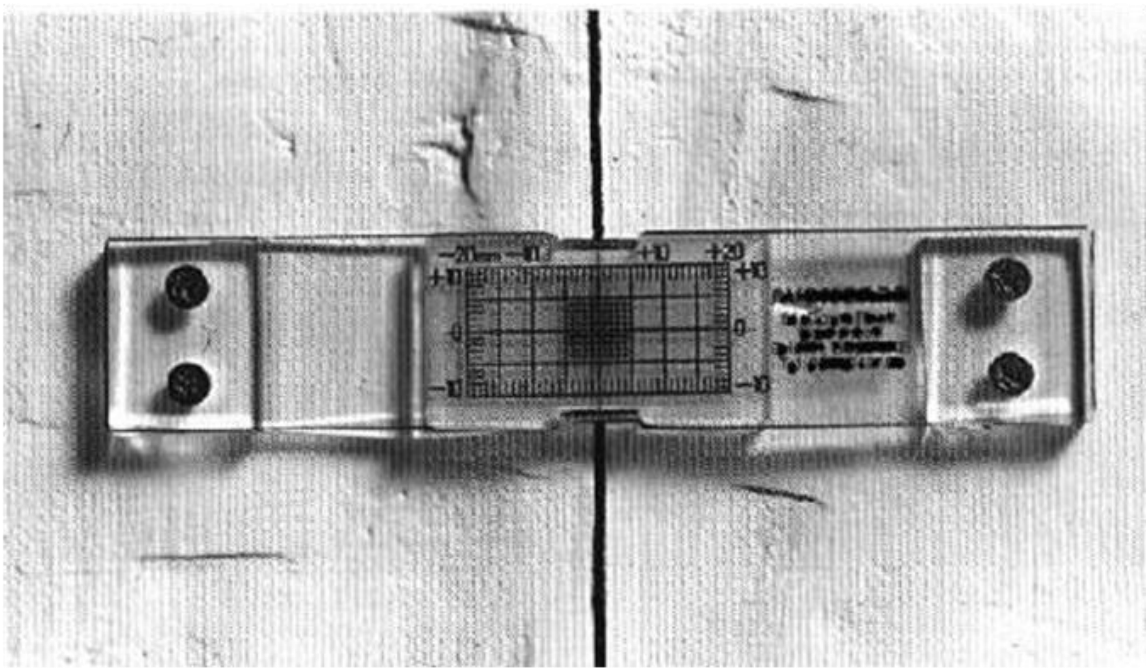


FIGURE 36: TYPICAL CRACK MONITOR DEVICE

Duration of Confined Blasting During Construction

The duration of the blasting (pretreatment) is dependent upon a number of factors including hardness of rock, how close the drill holes are placed, and the type of equipment that will be used to remove the pretreated rock. For comparison, the harbor deepening project at Miami Harbor in 2005 to 2006 estimated between 200 to 250 days of blasting with one-shot per day per drill barge (a blast-day) to pretreat the rock associated with that project. However, the contractor completed the project in 38 days with 40 blasts. The expansion at Miami Harbor currently estimates 600 blast-days for the entire project footprint. However, the actual number of blast days may be reduced by the selected contractor, based on the previously mentioned factors. The number of days needed to complete blasting operations at Jacksonville Harbor is unknown at this time.

Adaptive Improvement of Blasting Specifications and Methods

Test Blast Program

Prior to implementing a construction blasting program, a test blast program will be completed. The test blast program will have all the same protection measures in place for protected species monitoring as if blasting for construction purposes. The purpose of the test blast program is to demonstrate and/or confirm the following:

- drill boat capabilities and production rates

- ideal drill pattern for typical boreholes
- acceptable rock breakage for excavation
- tolerable vibration level emitted
- directional vibration
- calibration of the environment

The test blast program begins with a single range of individually delayed holes and progresses up to the maximum production blast intended for use. The test blast program will take place in the project area and will count toward the pretreatment of material, since the blasts of the test blast program will be cracking rock. Each test blast is designed to establish limits of vibration and air blast overpressure, with acceptable rock breakage for excavation. The final test event simulates the maximum explosive detonation as to size, overlying water depth, charge configuration, charge separation, initiation methods, and loading conditions anticipated for the typical production blast.

The results of the test blast program will be formatted in a regression analysis with other pertinent information and conclusions reached. This will be the basis for developing a completely engineered procedure for a construction blasting plan. During the testing the following data will be used to develop the regression analysis:

- distance
- pounds per delay
- peak particle velocities (TVL)
- frequencies (TVL)
- peak vector sum
- air blast, overpressure

<u>Fish Kill Monitoring</u>

In addition to monitoring for protected marine mammals, sawfish, and reptiles in the area during blasting operations, USACE will work with the resource agencies to develop a monitoring plan for fish kills associated with each blasting event. This effort may be similar to the effort that was developed by FWC in association with the Port of Miami Phase II project, and is currently a requirement of the Miami Deepening project. This plan will be developed in detail during the PE&D portion of the project, but may include collection, enumeration and identification of dead and injured fish floating on the surface after each blast. In addition, blast data will be collected from the daily blasting reports provided after each shot by the blasting contractor, as well as environmental data such as tidal currents (in-coming or outgoing). Due to health and safety restrictions, all collections will be made from the surface only. No diving to recover fish carcasses is authorized.

Coordination

As part of the development of the protected species observation protocols, which will be incorporated into the plans and specifications for the project, USACE will continue to coordinate with the resource agencies (specifically NMFS, FWC, USFWS, NPS and USEPA) and non-governmental organizations (NGO) to address concerns and potential impacts associated with the use of blasting as a construction technique.

Study Data

In addition to coordination with the agencies and NGOs, findings from any new scientific studies regarding the effects of blasting (confined or unconfined) on species that may be in the area (marine mammals, sea turtles, fishes [both with a swim bladder and without]) and reptiles will be incorporated into the design of the protection measures that will be employed in association with confined blasting activities in the port. Examples of these studies may include:

- "Caged Fish Study". As part of the August 1 and 2, 2006 After Action Review conducted for the Miami Harbor Phase II dredging project, which included blasting as a construction technique, USACE, in partnership with FWC, committed to conduct a study on the effects of blast pressures on finfishes with air bladders in close proximity to the blast. This study would attempt to answer the questions regarding proximity to the blast array, injury and death associated with confined blasting not resolved with research conducted with the Wilmington Harbor blasting conducted in 1999 (Moser 1999a and Moser 1999b). This study is expected to be completed as part of the Miami Harbor 2013-2015 dredging project.
- Other blasting project monitoring reports for projects, both from inside and outside of Florida, using confined underwater blasting as a construction technique completed prior to development of plans and specifications.

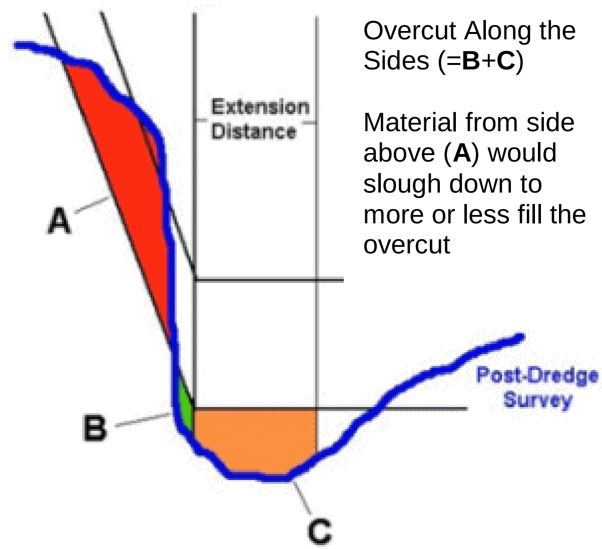
To summarize this pretreatment section USACE has concluded that confined blasting is the *least* environmentally impactful method for pretreatment of hard, consolidated rock in the port. Each blast will last no longer than 15 seconds in duration, and may even be as short as two seconds. Additionally, the blasts would be confined in the rock substrate with stemming. Because the blasts are confined within the rock structure, the distance of the blast effects are reduced significantly as compared to an unconfined blast (Nedwell and Thandavamoorthy 1992; Hempen *et al*. 2005; Hempen *et al*. 2007).

While the contractor selected by USACE determines the construction methodology, USACE through a Request for Proposal (RFP) process could rate the technical portion of a contactor's proposal to ensure evaluation of quality standards for excavation equipment. Using a Request for Proposal (RFP) contracting approach helps establish technical standards for rock excavation equipment. Additional information on blasting can be found in Appendix A, Attachment D, Pretreatment (Blasting) Plan.

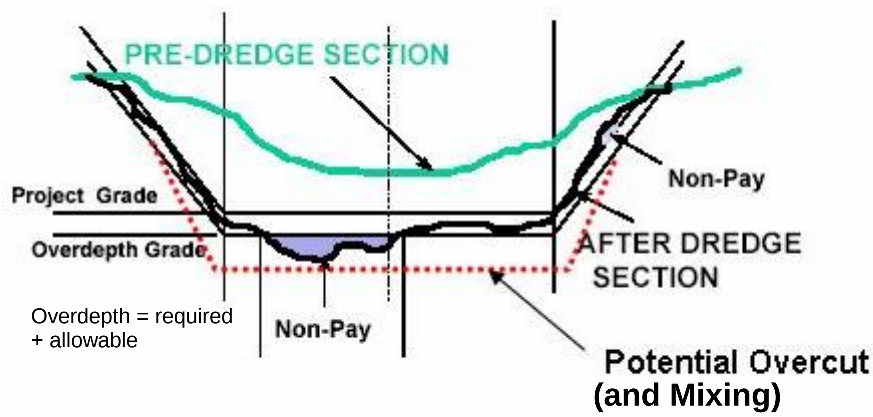
6.3.6 Type of Dredging Equipment.

The type of dredging equipment considered depends on the type of material, the depth of the channel, the depth of access to the disposal or placement site, the amount of material, the distance to the disposal or placement site, the wave-energy environment, etc. A description of types of dredging equipment can be found in Engineer Manual, EM 1110-2-5025, *Engineering and Design - Dredging and Dredged Material Disposal.*[10]

Required, Allowable, and Over-cut Beyond the Project Depth or Width



The Plans and Specifications for new work, or construction dredging, normally require dredging beyond the project depth and/or width. For this project, the two purposes of the "required" additional dredging are to remove rock/consolidated material at the bottom of the channel in order to provide an area below the project depth such that maintenance dredging equipment will be capable of removing shoal material down to the project depth in the future and to account for rapid shoaling between dredging cycles (reduce the frequency of dredging required to maintain the project depth for navigation in high shoaling areas which is referred to as advanced maintenance). An additional 1 foot of required overdepth for consolidated materials is applied throughout the entire project footprint and an additional 2 feet of required overdepth for advance maintenance is applied to those areas shown on Figure 37. In addition, the dredging contractor is allowed to go beyond the required depth. The "allowable" accounts for the inherent variability and



[10] http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-5025.pdf

inaccuracy of the dredging equipment. In addition, the dredge operator may practice over-cutting. An “over-cut” along the sides of the channel may be employed in anticipation of movement of material down the sides of the channel. Over-cut throughout the channel bottom may be the result of furrowing or pitting by the dredging equipment (the suction dredge’s cutterhead, the hopper dredge’s drag arms, or the clam-shell dredge’s bucket). Mixing and churning of material below the channel bottom may occur; the larger the equipment, the greater the potential for over-cut and mixing of material below the “allowable” channel bottom. Some of this material may become mixed-in with the dredged material. If the characteristics of the material in the overcut and mixing profile differ from that above it, the character of the dredged material may be altered. The quantity and/or quality of material for disposal or placement may be substantially changed depending on the extent of over-depth and over-cut.

Use of a Drag Bar

Since dredging equipment does not typically result in a perfectly smooth and even channel bottom; a drag bar, chain, or other item may be drug along the channel bottom to smooth down high spots and fill in low spots. This finishing technique also reduces the need for additional dredging to remove any high spots that may have been missed by the dredging equipment. It may be more cost effective to use a drag bar or other leveling device (and possibly less hazardous to sea turtles than additional hopper dredging).

6.3.7 With-Project Air Draft Restrictions

As is discussed in Section 2 (existing conditions), there are air draft clearances at Jacksonville Harbor due to the Dames Point Bridge and Jacksonville Electric Authority (JEA) power lines. The design vessel used for ship simulation (see **Appendix A**) is an S-class vessel. The S-class vessel has a dimension of approximately 199 feet from the baseline or keel of the ship to the top of the mast. Assuming a 48 foot draft, the actual air draft or distance from the waterline to the top of the mast is approximately 151 feet. The normal operating draft for the S-class vessel used in the ship simulation could vary from 31.2 to 39.4 feet. With a draft of 32 to 40 feet the actual air draft or distance from the waterline to the top of the mast is between 159 to 167 feet. The largest vessels the future fleet is anticipated to transition to with a project are Super Post Panamax vessels in the 8,000 – 9,000 TEU range and have air drafts ranging from 139 to 156 feet. As the Dames Point Bridge and JEA power lines at Blount Island have a vertical clearance of 174 feet and 175 feet, there is not an anticipated air draft concern under the with-project condition.

6.4 LERRS CONSIDERATIONS

The deepening, widening, and expansion of the turning basins are within the navigable waters of the United States and are available to the Federal government by navigation servitude. The disposal area identified for the project is a new ODMDS. The Ocean Dredged Material Disposal Site (ODMDS) is also within the navigable waters of the United States. A new site is in the process of being designated by the USEPA and should be available prior to project construction, if necessary.

Further opportunities for additional beneficial use of dredged material exist in the project vicinity. The placement options include, if found compatible, placement in the nearshore and/or erosion areas along the riverbank. Any rock excavation for the project may be placed in areas to create artificial reefs. These alternatives are not currently considered to be the least cost alternatives, and would require further development and permitting. It is assumed that these opportunities would be explored during a subsequent Value Engineering workshop during the PED Phase. It may also be possible for the local sponsor or other non-federal partner to pay any additional cost associated with material placement in a location other than the ODMDS. The current plan is to use the ODMDS but as that plan is refined in PED there may be an option to further pursue beneficial uses.

The current proposed mitigation plan involves acquisition of conservation lands in fee simple. Approximately 638 acres have been identified for mitigation. Mitigation is primarily because of potential changes to salinity from the project widening, deepening, and turning basin expansions. (See the Mitigation Plan, **Appendix E**).

All Lands, Easements, Rights-of-way, and Relocations (LERR) costs associated with mitigation features are included within the construction costs and not found within real estate (except for project planning), however a cost breakdown is included in Appendix C (Real Estate). The potential acreage and areas used for the estimate are based on current land use and location in proximity to the Timucuan Ecological and Historic Preserve and Fort Caroline National Memorial, and the St. Johns River Blueway Project.

6.5 OPERATIONS AND MAINTENANCE CONSIDERATIONS

Based on a desktop analysis of the existing O&M requirements and the proposed project expansion features, it is estimated that there will be an average annual increase of 137,000 cubic yards (cy) of shoal material to be dredged each year from the new project. Details regarding future O&M dredging and disposal requirements can be found in Appendix J (Dredged Material Management Plan). Much of the increase is due to the construction of two new turning basins that will be needed to accommodate the Post-Panamax container ships. With the incorporation of advance maintenance zones into these turning basins, it may be possible to reduce the frequency of dredging required and thus reduce contract costs and equipment mobilization costs. The average annual additional cost of

O&M due to the increases to the project footprint (widening) for the recommended plan is approximately $1.1 million.

Advance maintenance is dredging to a specified depth and/or width beyond the authorized channel dimensions in critical and fast-shoaling areas to avoid frequent redredging and ensure the reliability and least overall cost of operating and maintaining the project authorized dimensions. The following areas of advanced maintenance were identified.

Advanced Maintenance Areas:

<u>Area 1 (Entrance Channel to ~ River Mile 2)</u> = Bar Cut-3 from Station 217+00 to Station 270+00 (Full Channel) plus Bar Cut-3 Station 270+00 to end/Station 300+00 (South side of channel or Range 0 to Range 380) plus Cut-4 entire length (South side of channel or Range 0 to Range 430) plus Cut-5 entire length (South side of channel or Range 0 to Range 455) plus Cut-6 entire length (South side of channel or Range 0 to Range 455).

<u>Area 2 (~River Mile 8)</u> = Cut-41 Station 12+30 to Station 28+10 (North side of channel to include proposed widening or Range 0 to Range -500)

<u>Area 3 (~River Mile 9 to 11)</u> = Cut-42 Station 19+79.05 to Station 135+00 (Full Channel).

<u>Area 4 (Adjacent to Cut-42) (~River Mile 10)</u> = Entire Southern portion of Blount Island Turning Basin (Range -237.50 to Range -862.50)

<u>Area 5 (~River Mile 13)</u> = Entire Brills Cut Turning Basin (this covers the project channel by default from Cut-45 Station 3+18.43 to Station 28+18.43).

Area 5 is the breakpoint where the project is going from the shallower and narrower 40-foot project depth to the new project depth of 47 feet which is deeper and will be wider with the incorporation of the Brill's Cut Turning Basin. We would expect to see more shoaling in this area as we have experienced in the Talleyrand area of the Terminal Channel where the depth goes from 34 feet to 40 feet.

These areas represent similar surface areas to the previous advanced maintenance areas presented in the 2002 General Reevaluation Report (GRR) and also represent similar quantities of dredging. The areas have been strategically located based on the following five items: 1) Analysis of dredging projects over the last ten years, 2) Feedback from the St. Johns Bar Pilots regarding reoccurring hot spots, 3) Past shoaling studies, 4) Historic surveys, and 5) Currently authorized advanced maintenance areas. These items have been considered to maintain the lessened frequency of dredging in these areas. The bar pilots have been directly involved in emphasizing the need for dredging to prevent draft restrictions in the channel. We have therefore designed these areas to equal the areas of advanced maintenance which have been previously authorized. The following areas highlighted in blue are designated as advanced maintenance areas, **Figure 37**.

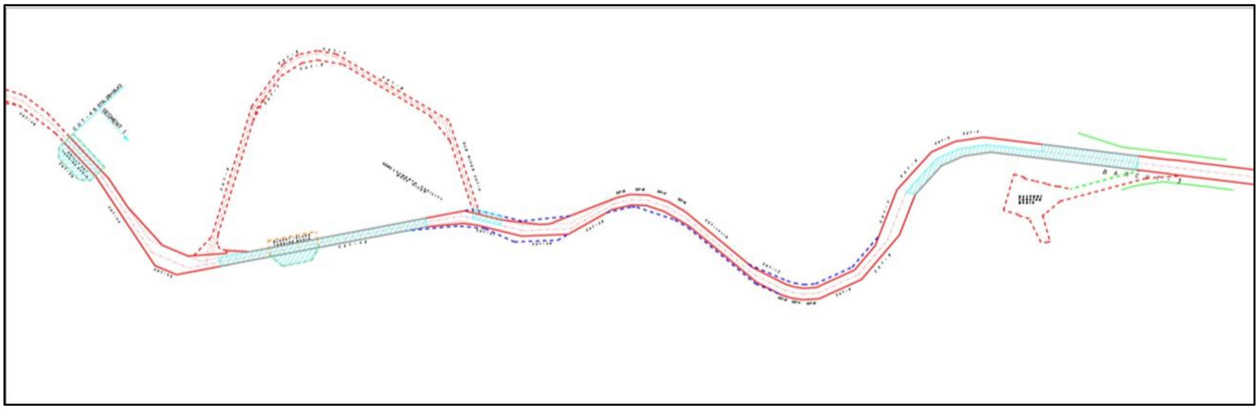


FIGURE 37: WITH-PROJECT ADVANCED MAINTENANCE AREAS

6.6 SUMMARY OF ACCOUNTS

As stated in Section 5, the Federal process incorporates four accounts to facilitate evaluation and display of effects of alternative plans. The four accounts are national economic development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE). They are established to facilitate evaluation and display of effects of alternative plans.

The NED account is required. Other information that is required by law or that will have a material bearing on the decision-making process should be included in the other accounts, or in some other appropriate format used to organize information on effects. The Federal objective is to determine the project alternative with maximum net benefits while protecting or minimizing impacts to the environment. The environmental effects of the Recommended Plan were evaluated under the environmental quality account and are detailed in section 7. The economic analysis used NED to measure the benefits of the Recommended Plan; regional shifts in economics are not expected as a part of the Recommended Plan. In regard to the Recommended Plan, the OSE account includes the effects of the project on the homeowners in the region. The opinions of these homeowners have been noted in the report and are documented in **Section 7**.

The NED account displays changes in the economic value of the national output of goods and services. Under this account, the 45-foot plan demonstrates the highest average annual equivalent (AAEQ) net benefits of approximately $59 million with a benefit-cost ratio (BCR) of 3.3 and the 47-foot locally preferred plan (LPP) plan has net benefits of approximately $56 million with a BCR of 2.7.

6.6.1 Regional Economic Development (RED) Benefits

The increased traffic with deepening at the Jacksonville Port Authority (JAXPORT) is expected to provide RED benefits as follows:

- Create new private sector port jobs in Jacksonville, while supporting operations in trucking, distribution and related services could generate direct and indirect local jobs throughout the region.
- Create new economic benefits annually for the Jacksonville area, including wages paid to private sector port workers; local and state taxes paid by area companies engaged in the service; revenue earned by businesses involved in the operations; and local services and supplies purchased by maritime-related companies.
- Create opportunities for importing directly through Jacksonville's port; regional companies may save transportation costs and may not have to pass those expenses on to Jacksonville residents.
- Enables Jacksonville businesses to export directly.
- Creates new opportunities in manufacturing, distribution and warehousing.

6.7 RISK AND UNCERTAINTY

Risk and uncertainty exists in the possibility of the fluctuation of the Federal interest rate, changes in vessel operating costs, or potential mitigation costs. Interest rates and vessel operating costs are discussed further in the Appendix B (Economics). Cost contingencies, incremental costs, and estimates for the mitigation plan are discussed in **Appendices E and N**. There are also study risks which were addressed using a Risk Register. The purpose of the register is to practice risk-based decision making throughout the study. The register was used to highlight areas of study risks and identify ways to address those risks, such as reducing the schedule, optimizing the study area, and identifying the optimum amount of modeling to make a risk-based decision.

The President of the United States issued a “We Can’t Wait Initiative” on July 19, 2012. This initiative included expediting the study for Jacksonville Harbor. The result was a reduction in the study schedule by 14 months.

6.8 IMPLEMENTATION REQUIREMENTS

To implement a plan at Jacksonville Harbor, certain conditions and requirements are necessary to meet state, local, and Federal standards set by law. A discussion of those responsibilities is in the subsequent paragraphs.

6.8.1 Division of Responsibilities

Under the Water Resources Development Act (WRDA) 1986, as amended by Section 201 of WRDA 1996, Federal participation in navigation projects is limited to sharing costs for design and construction of the general navigation features (GNF) consisting of breakwaters and jetties, entrance and primary access channels, widened channels, turning basins, anchorage areas, locks, and dredged material disposal areas with retaining dikes.

Non-federal interests are responsible for and bear all costs for acquisition of necessary lands, easements, rights-of-way and relocations; terminal facilities; as well as dredging berthing areas and interior access channels to those berthing areas.

6.8.2 Cost Sharing

1. For a commercial navigation project, with-project depths greater than 20 feet but not in excess of 45 feet, the non-federal share for the construction is 25 percent. Lands, easements, rights-of-way, and relocations (LERRs) are 100 percent non-federal costs. Operation and maintenance of the general navigation features with a 100 percent commercial vessel navigation project are a 100 percent Federal responsibility. **Table 36** summarizes the cost sharing percentages. **Tables 37 and 38** show the total cost sharing summary of the NED plan and the LPP.

2. As is shown in **Tables 37 and 38;** ER-1105-2-100 on Page E-62 states under 2(a) Harbors, General Navigation Features. (See Table E-12) Section 101 specifies cost shares for general navigation features that vary according to the channel depth: (20 feet or less, greater than 20 feet but not more than 45 feet, and greater than 45 feet). The percentage also applies to mitigation and other work cost shared the same as general navigation features. The cost share is paid during construction. Section 101 also requires the project sponsor to pay an additional amount equal to 10 percent of the total construction cost for general navigation features. This may be paid over a period not to exceed thirty years, and LERRs may be credited against it.

3. As is stated in ER-1105-2-100, projects may deviate from the NED plan if requested by the non-federal sponsor and approved by the ASA (CW). If the sponsor prefers a plan more costly than the NED plan and the increased scope of the plan is not sufficient to warrant full Federal participation, the ASA (CW) may grant an exception as long as the sponsor pays the difference in cost between those plans and the LPP. The LPP, in this case, must have outputs similar in-kind, and equal to or greater than the outputs of the Federal plan. It may also have other outputs. The incremental benefits and costs of the locally preferred plan, beyond the Federal plan, must be analyzed and documented in feasibility reports.

Table 36: General Cost Allocation

Feature	Federal Cost % [1]	Non-Federal Cost % [1]
General Nav. Features (GNF)	• 90% from 0' to 20' • 75% from 20' to 45' • 50% 46'and deeper	• 10% from 0' to 20' • 25% from 20' to 45' • 50% 46' and deeper
Mitigation	• 75%	• 25%
GNF's costs for this project include: mobilization, all dredging costs, and all disposal area construciton costs.		
Navigation Aids	• 100%	• 0%
Operation and Maintenance		
GNF	• 100% except cost share 50% costs for maint. > 45 feet	• 0% except cost share 50% for maint. > 45 feet
(1) The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF over a period of 30 years, at an interest rate determined pursuant to Section 106 of WRDA 86. The value of LERR shall be credited toward the additional 10% payment.		

Table 37: Cost Sharing Table NED Plan Summary (October 1, 2013 price levels and FY2014 discount rate)

(October 1, 2013 Price Levels and FY14 discount rate) Cost Summary NED Plan (Deepen to 45 feet)			
	Total Cost	**Federal Share**	**Non-federal Share**
General Navigation Features	**20-45 ft.**	**75%**	**25%**
Mobilization	**$6,800,000**	**$5,100,000**	**$1,700,000**
Dredging and Disposal	**$436,400,000**	**$327,300,000**	**$109,100,000**
Associated General Items[1]	**$3,900,000**	**$2,900,000**	**$1,000,000**
Environmental Mitigation	**$33,700,000**	**$7,800,000**	**$25,900,000**
Mitigation (Conservation Land Purchase)	*$2,900,000*	*$2,200,000*	*$700,000*
Monitoring (During Construction + 1 yr Post Construction)	*$7,500,000*	*$5,600,000*	*$1,900,000*
Monitoring (Year 2-10 Post Construction)	*$23,300,000*	*$0*	*$23,300,000*
Planning, Engineering, and Design	**$12,300,000**	**$9,200,000**	**$3,100,000**
Construction Management (S&I)	**$12,300,000**	**$9,200,000**	**$3,100,000**
NED Subtotal Construction of GNF	**$505,400,000**	**$361,500,000**	**$143,900,000**
Lands and Damages	**$700,000**	**$500,000**	**$200,000**
NED Total Project First Costs	**$506,100,000**	**$362,000,000**	**$144,100,000**
Non-federal Construction Costs (Local Service Facilities)	**$1,100,000**	**$0**	**$1,100,000**
Aids to Navigation[2]	**$1,300,000**	**$1,300,000**	**$0**
Credit for non-Federal LERR[3]	**$0**	**$0**	**($200,000)**
10% GNF Non-Federal[4]	**$0**	**($50,500,000)**	**$50,500,000**
Total NED Cost Allocation[5]	**$508,500,000**	**$312,800,000**	**$195,700,000**
1. Includes Turbidity and Endangered Species Monitoring.			
2. Navigation Aids - 100% Federal			
3. Real Estate Costs: These RE Costs are for incidental costs (administrative costs only). Credit is given for the incidental costs borne by the non-Federal sponsor for lands, easements, rights of w ay and relocations per Section 101 of WRDA 86.			
4. The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF, pursuant to Section 101 of WRDA 86. The value of LERR shall be credited tow ard the additional 10% payment. The value of lands provided for mitigation including the sponsor's incidental cost of acquisition are not creditable against this 10% since that value is cost shared as a GNF.			
5. In addition to these costs the AAEQ increases in O&M costs are approximately $1.1 million. Currently no additional O&M is identified for the LPP, any O&M above the NED w ill be the responsibility of the non-Federal Sponsor.			

The NED plan is cost shared 75/25 as is shown in **Table 37 and** the LPP has an estimated additional cost of $176 million. The additional cost would be a 100% non-federal cost as is outlined in **Table 38**.

Table 38: Cost Sharing Table Recommended Plan/LPP Summary (October 1, 2013 price levels and FY2014 discount rate)

(October 1, 2013 Price Levels and FY14 discount rate) Cost Summary LPP Plan (Deepen to 47 feet)			
	Total Cost	Federal Share	Non-federal Share
General Navigation Features	20-47 ft.	75% of NED[5]	25% of NED + Addtl
Mobilization	$9,700,000	$5,100,000	$4,500,000
Dredging and Disposal	$520,500,000	$327,300,000	$193,100,000
Associated General Items[1]	$3,700,000	$2,900,000	$800,000
Subtotal Environmental Mitigation	$33,400,000	$7,700,000	$25,700,000
Mitigation (Conservation Land Purchase)	*$2,900,000*	*$2,140,000*	*$720,000*
Monitoring (During Construction + 1 yr Post Construction)	*$7,400,000*	*$5,600,000*	*$1,900,000*
Monitoring (Year 2-10 Post Construction)	*$23,100,000*	*$0*	*$23,100,000*
Planning, Engineering, and Design	$16,500,000	$9,200,000	$7,300,000
Construction Management (S&I)	$16,500,000	$9,200,000	$7,300,000
Subtotal Construction of GNF	$600,200,000	$361,400,000	$238,800,000
Lands and Damages	$700,000	$500,000	$200,000
Total Project First Costs	$600,900,000	$361,900,000	$239,000,000
Non-federal Construction Costs (Local Service Facilities)	$82,000,000	$0	$82,000,000
Aids to Navigation[2]	$1,300,000	$1,300,000	$0
Credit for non-Federal LERR[3]	$0	$0	($200,000)
10% GNF Non-Federal[4]	$0	($50,500,000)	$50,500,000
Total Cost Allocation[6]	$684,200,000	$312,700,000	$371,500,000
1. Includes Turbidity and Endangered Species Monitoring.			
2. Navigation Aids - 100% Federal			
3. Real Estate Costs: These RE Costs are for incidental costs (administrative costs only). Credit is given for the incidental costs borne by the non-Federal sponsor for lands, easements, rights of w ay and relocations per Section 101 of WRDA 86.			
4. The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF, pursuant to Section 101 of WRDA 86. The value of LERR shall be credited tow ard the additional 10% payment. The value of lands provided for mitigation including the sponsor's incidental cost of acquisition are not creditable against this 10% since that value is cost shared as a GNF.			
5. The Federal share is the same that of the NED plan, w hich at 45 feet is 75%.			
6. In addition to these costs the AAEQ increases in O&M costs are approximately $1.1 million. Currently no additional O&M is identified for the LPP, any O&M above the NED w ill be the responsibility of the non-Federal Sponsor.			

6.8.2.1 Fully Funded Total Costs

The total project costs (constant dollar fully funded costs) are used to determine the total costs escalated to the estimated midpoint date of construction. The total project cost is $676 million, including GNF and LERR. When other associated costs are included (e.g. local service facilities and aids to navigation are included) the total project cost is $766 million.

6.8.3 Financial Analysis of Non-federal Sponsor's Capabilities

The non-federal sponsor, Jacksonville Port Authority, concurs with the financial responsibility as it pertains to the rules as stated above.

6.8.4 View of the Non-federal Sponsor

The Jacksonville Port Authority fully supports this project both financially through cost sharing and legislatively through the project authorization. The letter of support is included in **Appendix F**.

6.9 ENVIRONMENTAL OPERATING PRINCIPLES

The USACE Environmental Operating Principles (EOPs; see below) have been taken into consideration throughout the study process, and will continue to be part of construction and operation of the proposed Jacksonville Harbor deepening.

Environmental Operating Principles (EOPs)

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

In coordination with the agencies and other stakeholders, USACE proactively considered the environmental consequences of the proposed deepening project. Avoidance and minimization measures were evaluated, and mitigation will be provided to offset unavoidable adverse impacts to natural resources (i.e., wetlands and submerged aquatic vegetation). The project is located within the St. Johns River, which has been designated an American Heritage River. In accordance with the mandate of this designation and the EOPs, USACE will propose a project that supports economic and environmentally sustainable solutions. The project would be constructed in compliance with all applicable laws. A risk management assessment has been performed, which included environmental concerns. In addition, USACE coordinated with all stakeholders to gather scientific, economic, and social information. This coordination was conducted in a manner that encouraged all groups to express their views.

6.10 USACE CAMPAIGN PLAN

USACE Vision: A great engineering force of highly disciplined people working with our partners through disciplined thought and action to deliver innovative and sustainable solutions to the Nation's engineering challenges.

USACE Mission: Provide public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters.

Commander's Intent: The USACE will be one disciplined team, in thought, word, and action. We will meet our commitments, with and through our partners, by saying what we will do and doing what we will say. Through executive of the Campaign Plan, USACE will become a GREAT organization as evidenced by the following in all mission areas: delivering superior performance; setting the standard for the profession; making a positive impact on the Nation and other nations; and being built to last by having a strong "bench" of educated, trained, competent, experienced, and certified professionals.

The recommended plan for this project is consistent with these themes. The project team took the latest policy and planning guidance and worked with professionals familiar with the local system to design a project that will work in tandem with adjacent projects to help provide safe, effective, and efficient navigation. Extensive reviews were performed to ensure quality and consistency. The team worked with stakeholders on the state and Federal level as well as local stakeholders.

7.0 ENVIRONMENTAL CONSEQUENCES*

This Supplemental Environmental Impact Statement (SEIS) considers the possibility of deepening (and as a consequence necessary widening) the currently authorized Federal channel from the entrance channel at the mouth of the river, to approximately River Mile 13 (**Figure 26**). This chapter considers the potential environmental consequences of six alternatives:

- The no-action alternative: maintaining the existing channel template
- A 44-foot deep channel template (44 feet)
- The 45-foot deep U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Plan
- A 46-foot deep channel template (46 feet)
- The 47-foot deep JAXPORT Locally Preferred Plan (LPP)
- A 50-foot deep channel template (50 feet)

This chapter discusses the environmental consequences of the alternatives using the same main subject areas addressed in **Chapter 2** (**Existing Conditions**). Within the subject headings, environmental consequences common to a set of alternatives are discussed together. When appropriate, the discussion includes environmental consequences specific to an individual alternative or a specific subject area topic.

Several parts of this chapter discuss environmental consequences based upon hydrodynamic modeling of the Lower St. Johns River (LSJR) and ecological and water quality models driven by hydrodynamic model results. The hydrodynamic and ecological models are described in a series of separate reports (Taylor 2011, 2013a, 2013b, 2013c, 2013d), **Appendix A Attachments E, F, J, K, L, M**.

The hydrodynamic and ecological modeling (begun before USACE and JAXPORT had identified the NED Plan and LPP) simulated a 40-foot deep “baseline” or existing condition channel configuration and, 44, 46, and 50-foot project depths. The bathymetry modeled for the baseline condition included the recently completed Mayport Naval Station dredging and the proposed Mile Point project channel modifications, as well as the overdredge and advance maintenance associated with those projects. Each of the modeled project depths modified the baseline condition to include the proposed channel depth plus a 3-foot overdredge allowance and, in some locations, 2-feet for advance maintenance. Appendix A describes these conditions.

The hydrodynamic and ecological modeling also included simulations of 50-year post construction conditions. The 50-year simulations used the same baseline and project depths and other model input data as the 2018 conditions, with the exception of a 0.39-foot sea level rise and 155 million gallons per day (MGD) water withdrawal from the middle St. Johns River.

Because the first batch of model simulations were completed before the NED Plan and LPP were identified by USACE and the local sponsor, these simulations did not include the selected NED Plan and LPP depths. Therefore, this chapter considers the 46-foot model simulation as representing the 45-foot NED Plan channel. The impact assessment for the NED may then overestimate potential project effects but nonetheless provides a reasonable and conservative assessment using the available information. After the local sponsor identified the 47-foot project depth as its LPP and USACE chose the LPP as the Recommended Plan, a second batch of simulations modeled the 47-foot LPP channel. Notably, the locally preferred 47-foot project includes an additional 2-foot overdredge and, in some places, 2 feet of advance maintenance.

Except for the LPP, all of the proposed project alternatives involve the similar action, to dredge the Jacksonville Harbor navigation channel from the Atlantic Ocean upstream to approximately River Mile 14. The LPP involves dredging the Jacksonville Harbor navigation channel from the Atlantic Ocean upstream to approximately River Mile 13. The primary difference among the proposed alternatives is the channel depth. Unless otherwise noted in the following discussions, similar consequences arise from each alternative. However, the magnitude of the consequences may vary, usually increasing in magnitude with increasing project depth and length. Where appropriate, discussions will identify the magnitude of change associated with the various alternatives.

7.1 General Description of Potential Consequences

The proposed project, which deepens the channel of the St. Johns River between River Mile 0 and River Mile 13, will result in two general categories of consequences. Those consequences may result in environmental impacts.

- The project will allow harbor access to larger ships. Those ships are expected to come from the renovated and widened Panama Canal expansion project, which is constructing an additional, larger and deeper set of locks. Those locks will allow passage of larger ships into the Atlantic Ocean and consequently to American ports that have sufficiently large channels. The expected completion date for the Panama Canal project is now June 2015. An increased number of larger ships could result in:
    - Reduced number of commercial ships calling on the port
    - Change in risk of ships in the Federal channel colliding with whales, manatees and other marine mammals
    - Change in levels of air pollutant emissions and water quality discharges from changes in vessel traffic, port activity, and fuel consumption

- The deepened channel will allow a greater volume of seawater to penetrate up the St. Johns River. This could result in:
    - Increased tidal amplitude within the river and adjacent marshes
    - Increases in salinity within the estuary which could:
        - Impact freshwater wetlands and submerged aquatic vegetation (SAV) in areas of increased salinity
        - Change community composition and diversity of plant and animal communities in areas of increased salinities
        - Shift the location of optimal salinities for those species with salinity preferences
    - Change in water residence times, which in conjunction with salinity changes could:
        - Alter plankton species composition and growth patterns
        - Alter dissolved oxygen dynamics in the river main channel

See **Table 39** for an overview of physical and environmental factors, models used to predict effects, predicted effects, and the location of more detailed information. A summary of Direct and Indirect Effects for all alternatives can be found in **Table 34**.

Table 39: Overview of Effects, Models, and Results

Factor	Model	Results (compared to without deepening/widening)	More Detailed Description
Ground Water	USGS SEAWAT	Small increase in salinity, surficial aquifer at river channel boundary. No impact on Floridan aquifer.	Appendix A, Attachment A
Tides	EFDC	Up to 0.3 feet in some areas downstream of Buckman Bridge.	Appendix A, Attachment K
Currents (mid-width, main stem of river)	AdH	Small decrease at Bar Pilots. 0 to 0.7 feet/second increase in some areas and upstream.	Appendix A, Attachment G
Sea Level Rise	Historic, Moderate, and High	No affect on 0.39, 1.0, or 2.0 feet rise by 2068 (0.39' assumed in most calculations/models here).	Occurs with or without deepening and widening, Appendix A, Attachments K, J
Storm Surge	ADCIRC+SWAN hydrodynamic	47' project, 100-year event, increase 0.25 to 0.5 ft, several small isolated areas approaching 0.7 ft.	Appendix A, Attachment J
Salinity (main channel)	EFDC	-0.4 to +0.5 ppt change Dames Point to Buckman Bridge.	Appendix D; Appendix A, Attachment K
Water Age	EFDC	-1.6% to +1.3% change in water age.	Appendix D; Appendix A, Attachment K
Salinity (tributaries and salt marsh)	MIKE 21 and ADCIRC	-0.4 to +0.1 ppt change in Timucuan marsh. 0 to +0.5 ppt change in Cedar/Ortega rivers.	Appendix A, Attachment M
Dissolved Oxygen	CE-QUAL-ICM	-0.3% to +0.1% change in bottom layer dissolved oxygen.	Appendix D, Sub-appendix H
Ship wake and Bank Erosion	AdH	20% increase in shoaling. 1-foot increase in ship wake along the southern bank Cut-41 reach.	Appendix A, Attachment G
Submerged Aquatic Vegetation (SAV)	SJRWMD ecological model	Minor salinity stress increase (181 acres).	Appendix E; Appendix D; Appendix A, Attachment K
Fish	SJRWMD ecological model	Minor shifts in salinity and fish distribution (e.g., Bay Anchovy would shift slightly upstream).	Appendix D

Factor	Model	Results (compared to without deepening/widening)	More Detailed Description
Benthic Macro-Invertebrate Model	SJRWMD ecological model	Minor shift in salinity. Distribution of many species tied to SAV.	Appendix D
Wetland Model	USACE wetland model	Minor salinity stress increase.	Appendix E; Appendix D; Appendix A, Attachment K
Phytoplankton Model	EFDC and CE-QUAL-ICM	Minor shifts flushing and chlorophyll a. Little change phytoplankton blooms.	Appendix D; Appendix A, Attachment K
Water Quality	EFDC and CE-QUAL-ICM	Minor shift in salinity, dissolved oxygen, tidal flushing.	Appendix D; Appendix A, Attachment L
Air Emissions	Mid-Tier Emission Inventory (EPA, '09)	5% to 10% reduction in emissions by year 2040 compared to without deepening/widening.	Appendix I

SEAWAT: Simulation of Three-Dimensional Variable-Density Ground-Water Flow and Transport (USGS).

EFDC: Environmental Fluid Dynamics Code. Widely used for determining Total Mean Daily Load (TMDL) by EPA.

MIKE FM 21: 2D modeling of coast and sea (commercial software from DHI).

Integrated Compartment Model (CE-QUAL-ICM): three-dimensional eutrophication model (US Army Corps of Engineers) with hydraulics input supplied by the Environmental Fluid Dynamics Code (EFDC)

ADCIRC+SWAN: coupling the depth-integrated ADCIRC hydrodynamic model to the 2D phase-averaged spectral wave model SWAN

Adaptive Hydraulics (AdH) software, a high-resolution finite element model developed to primarily simulate the pre-and post-dredging hydrodynamics for input to ship simulation

Coastal Modeling System (CMS) is an integrated two-dimensional (2-D) numerical modeling package for simulating waves, current, water level, sediment transport, and morphology change at coastal inlets and entrances.

7.2 Physical Consequences

7.2.1 Geology and Geomorphology (Bathymetry)

The proposed project would deepen the currently authorized Federal channel from its current 40-foot mean lower low water (MLLW) bottom depth between River Mile 0 and approximately River Mile 13. **Table 40** provides USACE channel depth alternatives considered in this SEIS.

Table 40: Change in Federal Channel Bathymetry (Mile 0 to Mile 13)

Alternative	Change in Bathymetry (below MLLW)
no-action	0 feet
44-foot deep channel template	-4 feet
45-foot deep USACE NED Plan	-5 feet
46 foot deep channel template	-6 feet
47-foot deep JAXPORT Locally Preferred Plan	-7 feet
50 foot deep channel template	-10 feet

Notably, the 44-foot, 46-foot, and 50-foot project alternatives include an additional 3-foot overdredge and 2 feet of advance maintenance. The locally preferred 47-foot project includes an additional 2-foot over-dredge and, in some places, 2 feet of advance maintenance.

7.2.2 Ground Water Hydrology

The U.S. Geological Survey has studied how the proposed deepening may impact groundwater in the surficial aquifer, and their report dated 2013 is provided in the Engineering Appendix and referenced in the SEIS. The groundwater model, SEAWAT, used by the U.S. Geological Survey (USGS) is on the USACE list of software allowed for use. The USGS study does not necessarily simulate actual conditions, but employs a range of plausible hypothetical conditions to determine the risk to the surficial aquifer from saline water intrusion caused by deepening the channel. Simulations have determined that the minimal increase in river salinity resulting from any of the proposed deepening alternatives, and no increase in hydrostatic head, will not significantly increase the surficial aquifer salinity except at the boundary of the river channel where the surficial aquifer is likely already impacted from exposure to the high river salinity.

The Floridan Aquifer is the primary drinking water supply in Duval County and was determined to be safe from salinity influence from the deepening. There is sufficient low permeability sediment separating the channel from the Floridan Aquifer to avoid salinity impact from the channel deepening. There are water-bearing zones within the upper Hawthorn Group above the Floridan Aquifer that have not been fully defined laterally, but they are protected by low permeability material overlying these water-bearing zones, separating them from the channel.

7.2.3 Tides

Taylor (2013c) describes the application of the Environmental Fluid Dynamics Code (EFDC) hydrodynamic modeling for the Jacksonville Harbor Deepening Project General Reevaluation Report II (GRRII). Among the alternatives listed, the EFDC modeling evaluated the tide levels for the 2018 no-action (baseline), 44-foot, 46-foot, 47-foot and 50-foot project channel templates at five water level stations along the main stem of the St. Johns River (Bar Pilot, Long Branch, Main Street Bridge, Buckman Bridge, and Shands Bridge [See **Appendix A Attachment K**]).

Comparisons of water level duration curves provide summaries of the simulated changes in the water level regime (tidal range) resulting from project construction (**Table 41**). Comparing the no-action to other channel deepening alternatives, tidal range increased not more than 0.3 feet regardless of the deepening alternative. Model results do not show appreciable differences in water level duration curves at Buckman Bridge and the Shands Bridge. Based on these comparisons, 44-foot, 46-foot, 47-foot, and 50-foot project depths would not likely affect water levels upstream of the Buckman Bridge for the 2018 scenarios.

Table 41: Change in Tide Range (feet) from 2018 no-action (Baseline) Conditions Calculated as differences in average high-low tide elevation

Station	**Channel Deepening Alternative**			
	44 feet	**46 feet**	**47 feet**	**50 feet**
Bar Pilot	0.0	+0.1	+0.1	+0.2
Long Branch	+0.1	+0.2	+0.2	+0.3
Main Street Bridge	+0.1	+0.1	+0.2	+0.2
Buckman Bridge	0.0	0.0	0.0	0.0
Shands Bridge	0.0	0.0	0.0	0.0

7.2.4 Currents Affecting Navigation

As the EFDC model cell sizes measure several hundred feet in length and width, the EFDC model does not provide suitable resolution to evaluate the changes in currents at specific point locations. However, comparison of pre- and post-project modeled flow velocity at mid-width of the main stem of the river (**Tables 42 and 43**) can provide some insights into the magnitude of change in navigation currents:

- Current velocity decreases slightly in mean flood and mean ebb currents mid-width near Bar Pilot as the project alternatives result in a deeper navigation channel and increased channel conveyance capacity.
- The other four locations in **Table 42** are upstream of Mile 13 and beyond the project dredging template. Because of the improved flow conveyance in the project area, the model simulations of channel deepening alternatives show small increases in mean currents at Long Branch, the Main Street Bridge, and at the Buckman Bridge. The model results show very small change in mean currents at the Shands Bridge.

Table 42: Change in Modeled Water Surface Mean Currents from 2018 no-action (Baseline) Conditions

Mid-Width of River Near	Average Flood Currents Change (feet/sec)			Average Ebb Currents Change (feet/sec)		
	44 feet	46 feet	50 feet	44 feet	46 feet	50 feet
Bar Pilot	-0.2	-0.2	-0.3	-0.1	-0.1	-0.2
Long Branch	0.0	0.0	0.1	0.0	0.1	0.1
Main Street	0.1	0.1	0.2	0.1	0.1	0.2
Buckman	0.0	0.0	0.1	0.0	0.0	0.1
Shands	0.0	0.0	0.0	0.0	0.0	0.0

Table 43: Change in Modeled Water Surface Mean Currents from 2068 no-action (Baseline) Conditions

Mid-Width of River Near	Average Flood Currents Change (feet/sec)			Average Ebb Currents Change (feet/sec)		
	44 feet	46 feet	50 feet	44 feet	46 feet	50 feet
Bar Pilot	-0.1	-0.2	-0.2	-0.1	-0.1	-0.2
Long Branch	0.0	0.0	0.1	0.0	0.1	0.1
Main Street	0.1	0.1	0.2	0.1	0.1	0.2
Buckman	0.0	0.0	0.1	0.0	0.0	0.1
Shands	0.0	0.0	0.0	0.0	0.0	0.0

7.2.5 Shoreline Erosion

Shoreline erosion is not anticipated by USACE to increase as a direct result of the construction of the project. This position is based on analyses of the predicted changes in current velocities along the project (determined to be negligible), changes to the tide range (average of 2 inches or less), a side slope analysis of the predicted channel slopes relative to the existing shoreline (no direct impact), and an analysis of ship wake height generated by the design vessel transiting the new channel (generally shows that the ship wake and effect on water stages at the river banks tend to diminish under the with-project condition). A more detailed discussion of these analyses can be found in **Appendix A, Engineering** in this GRRII. Furthermore, ship traffic operations and usage of vessels on the St. Johns River and the Federal navigation project by the general public and shippers is not regulated by the USACE, but rather by the U.S. Coast Guard (USCG) and various state and local agencies. Changes in types of vessels, frequency of transit, vessel speed, proximity to shoreline and other operational parameters may occur with or without the implementation of the new project. Therefore, any increased erosion due to maritime activities or any changes in such activities over time would be extremely difficult to assess as being attributable solely or in part to the proposed channel improvements. Any incident of observed erosion would have to be specifically investigated in order to attempt to determine its cause as every location along the St. Johns River has site specific conditions unique to that exact location.

7.2.6 Sea Level Rise

Sea level rise will affect the LSJR regardless of channel deepening. The EFDC model simulation of 2068 conditions (i.e., 50 years after project construction) included a projected 0.39-foot sea level increase (applied at the model's ocean boundary). This value represents the 50-year increase in sea level determined from the USACE baseline sea level rise rate described in **Section 2.2.6**. The 2068 simulations also included 155 MGD water withdrawal (applied at the upstream boundary of the model) to account for projected public water supply consumption.

Table 44 lists the predicted change in tide range for the 2068 project alternative simulations relative to the 2068 no-action alternative. The modeled project alternatives increase tidal range by 0.3 feet or less at Bar Pilot, Long Branch, and theMain Street Bridge (Taylor 2013c). Model results do not predict appreciable differences in tide range at the Buckman Bridge and the Shands Bridge. Based on these comparisons, at the 2068 project horizon, channel deepening up to the 50-foot project depth will not likely affect water levels upstream of Buckman Bridge. These changes are similar in magnitude to those predicted for the 2018 simulations. Though sea level rise will cause an overall increase in water levels in the LSJR, the modeled sea level rise will not alter the magnitude of project-induced tidal range changes.

Table 44: Change in Tide Range (feet) from 2068 no-action (Baseline) Conditions

Station	2068 Channel Deepening Alternatives			
	44 feet	**46 feet**	**47 feet**	**50 feet**
Bar Pilot	0.0	0.0	+0.1	+0.2
Long Branch	+0.1	+0.2	+0.2	+0.3
Main Street	+0.1	+0.2	+0.2	+0.2
Buckman Bridge	0.0	0.0	0.0	0.0
Shands Bridge	0.0	0.0	0.0	0.0

7.2.7 Water Quality

7.2.7.1 Main Channel Salinity changes

<u>2018 Scenarios</u>

The EFDC model provided estimates of the salinity at select stations in the river. Median salinity is defined as the salinity concentration which salinities stayed below 50% of the time, or conversely stayed above 50% of the time (measured in parts per thousand). **Table 45** provides the median salinity at the top and bottom layer and depth-averaged salinity for the 2018 no-action (baseline), 44-foot, 46-foot, 47-foot, and 50-foot project alternatives.

Table 46 shows salinity generally increasing with deeper and longer dredged channels. The salinity increase fades upstream of the Buckman Bridge. Model results indicate very small changes in median salinity at the Shands Bridge and upstream.

<u>2068 Scenarios</u>

The following tables provide the median salinity at the top and bottom layer and depth-averaged salinity for the 2068 no-action (baseline), 44-foot, 46-foot, 47-foot, and 50-foot project alternatives. **Table 47** shows salinity generally follows the increase with deeper and longer channels exhibited for the 2018 alternatives. Salinity increase fades upstream of the Buckman Bridge. Model results indicate very small changes in median salinity at the Shands Bridge and upstream. See **Table 48** below.

Table 45: Top, Bottom, and Depth-Averaged Median Salinity for Various 2018 Alternatives

Alternative	Layer	Station			
		Dames Point (ppt)	Acosta Bridge (ppt)	Buckman Bridge (ppt)	Shands Bridge* (ppt)
No-action	Top	19.9	9.4	1.6	
	Bottom	29.0	13.0	2.2	
	Depth-Averaged	25.3	11.8	2.0	0.4
44-foot	Top	20.0	9.5	1.6	
	Bottom	28.8	13.1	2.2	
	Depth-Averaged	25.1	12.0	2.1	0.4
46-foot	Top	20.2	9.7	1.7	
	Bottom	28.8	13.2	2.3	
	Depth-Averaged	25.1	12.0	2.1	0.4
47-foot	Top	20.2	9.6	1.6	
	Bottom	28.7	13.1	2.2	
	Depth-Averaged	25.2	12.0	2.0	0.4
50-foot	Top	20.4	9.9	1.8	
	Bottom	28.6	13.5	2.4	
	Depth Averaged	25.1	12.3	2.2	0.4

*Note: No appreciable difference between top and bottom salinities at the Shands Bridge.

Table 46: Differences Between the No-action Top, Bottom, and Depth-Averaged Median Salinities and Various 2018 Alternatives

Alternative	Layer	Station			
		Dames Point (ppt)	Acosta Bridge (ppt)	Buckman Bridge (ppt)	Shands Bridge* (ppt)
44-feet	Top	0.1	0.1	0.0	
	Bottom	-0.2	0.1	0.0	
	Depth-Averaged	-0.2	0.2	0.1	0.0
46-feet	Top	0.3	0.3	0.1	
	Bottom	-0.2	0.2	0.1	
	Depth-Averaged	-0.2	0.2	0.1	0.0
47-feet	Top	0.3	0.2	0.0	
	Bottom	-0.3	0.1	0.0	
	Depth-Averaged	-0.1	0.2	0.0	0.0
50-feet	Top	0.5	0.5	0.2	
	Bottom	-0.4	0.5	0.2	
	Depth-Averaged	-0.2	0.5	0.2	0.0

Table 47: Top, Bottom, and Depth-Averaged Median Salinities for Various 2068 Alternatives

Alternative	Layer	Station			
		Dames Point (ppt)	Acosta Bridge (ppt)	Buckman Bridge (ppt)	Shands Bridge* (ppt)
No-action	Top	20.4	10.1	2.1	
	Bottom	29.4	13.7	3.4	
	Depth-Averaged	25.7	12.5	2.9	0.5
44-feet	Top	20.6	10.3	2.2	
	Bottom	29.2	13.9	3.3	
	Depth-Averaged	25.6	12.7	2.9	0.5
46-feet	Top	20.8	10.4	2.2	
	Bottom	29.2	14.0	3.5	
	Depth-Averaged	25.6	12.8	3.0	0.5
47-feet	Top	20.7	10.4	2.2	
	Bottom	29.1	13.8	3.4	
	Depth-Averaged	25.6	12.7	2.9	0.5
50-feet	Top	21.0	10.7	2.3	
	Bottom	29.0	14.2	3.6	
	Depth-Averaged	25.6	13.0	3.1	0.5

*Note: No appreciable difference between top and bottom salinities at the Shands Bridge.

Table 48: Differences Between the No-action Top, Bottom, and Depth-Averaged Median Salinities and Various 2068 Alternatives

Alternative	Layer	Station			
		Dames Point (ppt)	Acosta Bridge (ppt)	Buckman Bridge (ppt)	Shands Bridge* (ppt)
44-feet	Top	0.2	0.2	0.1	
	Bottom	-0.2	0.2	-0.1	
	Depth-Averaged	-0.1	0.2	0.0	0.0
46-feet	Top	0.4	0.3	0.1	
	Bottom	-0.2	0.3	0.1	
	Depth-Averaged	-0.1	0.3	0.1	0.0
47-feet	Top	0.3	0.3	0.1	
	Bottom	-0.3	0.1	0.0	
	Depth-Averaged	-0.1	0.2	0.0	0.0
50-feet	Top	0.6	0.6	0.2	
	Bottom	-0.4	0.5	0.2	
	Depth-Averaged	-0.1	0.5	0.2	0.0

7.2.7.2 Salinity Changes in Marshes and Tributaries

Taylor (2013d) describes the results of salinity modeling in three LSJR marsh and tributary systems – including the Timucuan marsh, Cedar/Ortega rivers, and Julington/Durbin creeks, conducted with the MIKE21 hydrodynamic model. The tributary models simulated two conditions, the 2018 no-action (i.e., baseline) and 2018 LPP (47-foot depth). Both conditions were simulated for a two-year period with input data representing 2000 and 2001 hydrologic conditions. Simulation year 2000 served as a ramp-up period and 2001 served as the evaluation period. This time period was selected because it included two consecutive dry years and thus would provide an estimate of the maximum salinity changes in the marshes and tributaries.

Comparison of the 2018 no-action and 2018 LPP simulation results showed that the project would have very little effect on marsh and tributary salinity. The 50th percentile salinity value for the one-year evaluation period would change by -0.4 to 0.1 ppt in the Timucuan marsh and by 0.0 to 0.5 ppt in the Cedar/Ortega rivers. The larger of these values occurred near the mouths of the system; salinity differences diminished quickly with distance upstream. Negligible changes in salinity occurred in Julington/Durbin creeks. **Appendix A, Attachment K and Appendix D** provide more information about these simulations and results.

7.2.7.3 Other Water Quality Effects

Water Age

Water age characterizes water circulation and indicates the period a water particle has resided within any particular location (model cell) in the main stem of the river. Low water age is associated with high water circulation or water that has newly entered the river through the river's lateral inflows. High water age is associated with low water circulation or with water that has resided in the river (travelling upstream and downstream with tidal influence) for a relatively long time. Thus, fast moving water will have low water age and stagnant water will have high water age. Water age influences phytoplankton growth, with higher water age favoring development of phytoplankton blooms. Comparisons of the EFDC modeled water age for the no-action (baseline) and project alternatives provide the means to evaluate the impact of the project on water circulation.

2018 Water Age Results

EFDC model results show that the water age in the main channel mostly varies between 30 and 210 days. Modeled water age generally increased downstream as the major water inflow was located upstream at Astor and net river flow was downstream. The top layer of the water column had lower water age than the bottom layer because upper layers flow faster than lower layers.

The 47-foot alternative results in less than ±1.9 percentage point changes in probability (equivalent to less than 7 days per year) that the modeled water age is older than 30 to 210 days.

Dissolved Oxygen

Water circulation and phytoplankton growth also affect dissolved oxygen concentrations. Taylor (2013a) describes the results of CE-QUAL-ICM model simulations of dissolved oxygen. These simulations examined dissolved oxygen for the 2018 no-action and 2018 LPP (47-foot depth) scenarios for 1997 and 1998 hydrologic conditions. The model predicted very little change (-0.3 to 0.1%) in bottom layer dissolved oxygen at stations from Palatka to Fulton Point. **Appendix D** and **Appendix D, Sub-appendix H** describe the dissolved oxygen modeling and results.

Summary

The EFDC hydrodynamic and salinity model, validated for the Jacksonville Harbor Deepening project area, provided the means to assess the direct impacts of channel modifications to tides, salinity, and water circulation in the main stem of the LSJR for the 2018 (immediately after construction of the Jacksonville Harbor Deepening Project) and 2068 (project horizon) conditions. Model results show the tide range increases as much as 0.3 feet (2018 scenarios) and 0.3 feet (2068 scenarios) and flow velocity changes as much as ±0.3 feet/sec for both scenarios. Results also show median salinity increases as much as 0.5 ppt (2018 scenarios) and 0.6 ppt (2068 scenarios). Therefore, the project at 44 feet, 46 feet, 47, and 50 feet will likely not substantialy affect water circulation in the study area.

7.2.8 American Heritage River Status

The first paragraph of the U.S. Environmental Protection Agency (USEPA) American Heritage Rivers webpage states, “The heart of the American Heritage Rivers initiative is locally driven and designed solutions. The Federal role is confined to fostering community empowerment, while providing focused attention and resources to help river communities restore their environment, revitalize their economy, renew their culture and preserve their history” (http://water.epa.gov/type/watersheds/named/heritage/). None of the project alternatives would alter the river’s status as an American Heritage River. The various commitments listed above may appear contradictory to some (e.g., preserve ecological resources and stimulate economic revitalization), but the emphasis of the American Heritage River program is on maintaining a diversity of viable uses of the river. The recommended project would stimulate economic revitalization by allowing larger ships using the newly renovated Panama Canal to use JAXPORT, bringing in additional business to JAXPORT and the region. As discussed in this chapter, the proposed project alternatives do not eliminate any current functions or uses of the river but may alter some of those functions and uses. The selected alternative may alter nothing (no-action) or incrementally change river salinity dynamics in the main channel, tributaries, or marshes.

As discussed below, none of the project alternatives will result in negative impacts to historic or cultural resources. Whether or not the channel is deepened, JAXPORT has growth potential. This growth will increase, incrementally, stormwater-related discharges and emissions, and discharges from ships calling on the port. Changes to air and water quality may result from 1) increased runoff from additional impervious surfaces created with additional port infrastructure, 2) additional landside equipment use (port vehicles and vehicles used to transport materials in and out of port) and 3) increased air emissions from additional ship calls to JAXPORT (note, however, that the LPP will have fewer deep vessel transits than the no-action plan).

The LSJR Total Maximum Daily Load (TMDL) program and Basin Management Action Plan (BMAP) describe the required stormwater runoff quality necessary to improve water quality in the river. New JAXPORT development is required to adhere to these new conditions; increased stormwater runoff will require treatment to levels that will improve LSJR water quality. Ships are already restricted in their water-based discharges to the river and these restrictions will not change.

7.2.9 Dredged Material Management Areas

Alternatives that deepen the channel generate significant amounts of material that require disposal. Disposal alternatives include the use of existing upland disposal areas on Bartram Island and Buck Island, disposal on Duval County beaches (of beach quality material), and disposal at one or more Ocean Dredge Material Disposal Sites (ODMDS).

USEPA (2012a) provides a concise and detailed description of current and future sediment storage conditions and issues. The information in this section is drawn primarily from that source.

The currently available Dredged Material Management Areas (DMMAs) and the ODMDS have insufficient capacity to store material dredged during channel deepening, as well as subsequent advance maintenance and regular maintenance activities.

The annual maintenance dredging requirement for the harbor channel, turning basins and Mayport Naval Station harbor is estimated by USACE to be about 1,200,000 cubic yards. Channel deepening is expected to generate between 7.6 million cubic yards (for deepening to a 41-foot depth) to 31.5 million cubic yards (for a 50-foot deep channel). Limestone is expected to be between 0.6 million and 2.9 million cubic yards of the total dredged material volume. Depending on the alternative selected for the channel deepening project, dredged material storage needs could total 60 million cubic yards over the next 50 years.

Potential material management locations identified by USACE include:

- Most of the Bartram Island cells are full; offloading of one cell is expected to result in about 1 million cubic yards capacity for that cell.
- The Buck Island cells have variable capacity depending on offloading activity.
- The existing Jacksonville Harbor ODMDS material has a potential remaining capacity of 3 million cubic yards to 4.0 million cubic yards and would reach capacity in 3 to 13 years.
- The Fernandina Beach ODMDS had in 2008 an estimated capacity of 65 million cubic yards (NAVFAC 2008) and a current annual disposal use for maintenance of Kings Bay Entrance Channel and harbor facilities of about 1,600,000 cubic yards.

The USEPA (2012a) also concluded that while a fraction of the maintenance material dredged from the channel met state sand standards for beach placement, use of that disposal method would require separation of the dredged sand into acceptable and non-acceptable fractions, which rendered this disposal method infeasible.

The recommended alternative for management of dredged materials disposal for the range of possible deepening alternatives associated with the Federal channel, Jacksonville Harbor, and Mayport Naval Station dredging activities over the next 50 years was a new ODMDS south and a little east of the existing Jacksonville Harbor ODMDS. The EIS is still in draft state for this new ODMDS. The final EIS and completion of the USEPA site designation process is anticipated for 2014.

7.2.10 Land Use

Neither the no-action alternative nor any of the project alternatives would directly affect land use. The dredging templates lie entirely within the main stem of the LSJR; they do not include dredging of any upland or wetland areas. Maintenance dredging under the no-action alternative, as well as project dredging, would place dredged material in existing dredged material management facilities or in a Jacksonville ODMDS, actions which would not affect land use.

Project construction will require upland staging areas for equipment and crew transfer to the dredge and support vessels. Staging will likely occur on land already designated for industrial or commercial land use. Regardless, any effect on upland use from staging activities would occur temporarily for the duration of construction.

7.2.11 Public Lands Adjacent to the Proposed Project Construction Area

Neither the no-action alternative nor any of the project alternatives would directly affect public lands adjacent to the proposed project construction area.

The Timucuan Ecological and Historic Preserve and Huguenot Memorial Park are immediately adjacent to the project area near the river mouth. During project construction, preserve and park visitors may see and hear construction equipment. Turbidity may enter preserve waters if not effectively controlled

7.2.12 Coastal Barrier Resources Act (CBRA) Units

Neither the no-action alternative nor any of the project alternatives would affect the two CBRA Units located on the north side of the confluence of the St. Johns River and the Atlantic Ocean (opposite Mayport Naval Station).

7.2.13 Air Quality

Appendix I describes the air quality analyses performed for the proposed Jacksonville Harbor Deepening project. Potential changes in air pollutant emission levels due to the action alternatives were calculated as part of the air quality analysis in accordance with 40 CFR § 1508.8, which requires analysis of direct and indirect impacts on the environment that are associated with the proposed action. The proposed action alternatives involve major construction in the St. Johns River main channel and long-term changes in the type and frequency of ship calls to JAXPORT and other terminals in the project area, and possible placement of dredged material at an offshore location (a Jacksonville ODMDS), beach, nearshore, and upland locations. The air emissions associated with the proposed project may result in direct and/or indirect air quality impacts, depending on the location of the activity. In particular, based on the distance of the ODMDS from the location of the action (St. Johns River), the offshore activities to place dredged material at the proposed ODMDS or the current ODMDS would constitute indirect effects.

Air emissions resulting from the no-action alternative and project alternatives are evaluated in accordance with Federal, state, and local air pollution standards and regulations. Temporary increases in air pollution concentrations associated with the construction phases of the alternatives are compared to the most recent available emission inventory for Duval County in order to assess significance.

The USEPA identifies the Jacksonville air quality region as an *attainment area,* meaning an area that meets or exceeds USEPA air quality standards. Duval County is designated by USEPA as being in attainment for all current criteria pollutant standards (USEPA 2012b).

An air quality conformity analysis is not required if the proposed action occurs within an attainment area. Per 40 CFR Part 93, Subpart B, compliance with the General Conformity Rule is presumed if the emissions associated with a Federal action are below the relevant *de minimis* thresholds during a given year.

Jacksonville District, USACE with the cooperation and support of JAXPORT, developed an estimated inventory of air quality emissions from Jacksonville Harbor, using available data and estimating those components of the inventory not available at this time. Ship emissions were based on shipping calling records and estimates of operating times entering the port, maneuvering and moving within the port. The USEPA air emissions calculations models MOVES and NONROAD provided estimates for mobile vehicle emissions associated with port activity and port cargo handling equipment and train emissions.

Appendix I provides an air quality emissions inventory comparing current and expected emissions levels in 2018 and at 10-year intervals to 2068. With larger, newer, and more efficient vessels, there would be an overall reduction of emissions with the project deepening and widening compared to the no-action alternative.

7.2.14 Noise

Generally, noise impacts are considered adverse if they expose sensitive noise receptors to noise levels in excess of applicable standards. Duval County Code

Chapter 368 and Jacksonville Environmental Protection Board Rule No. 4 establish noise standards for the project vicinity. For the most noise-sensitive land use categories (which the county defines as including retirement housing; medical, education, and religious facilities; and undeveloped land and forests), noise levels may not exceed 55 dBA unless the noise generator is granted a variance from the noise standard.

The no-action alternative would not impact or change the existing noise environment. Noise from human (e.g., recreational boat traffic, ships, military aircraft, maintenance dredging) and natural (e.g., wind, waves, birds) sources would continue at their present levels.

Construction of each of the proposed project alternatives would generate noise from dredges and dredging equipment, watercraft (e.g., work boats, tugs, barges), and heavy equipment. Dredging operations and associated noise would occur 24 hours per day at levels similar to past maintenance dredging operations. The duration of construction noise would increase incrementally with project depth as deeper projects would likely require longer dredging durations. Subsequent to initial construction, the noise environment would resemble the current condition with periodic maintenance dredging. Noise levels generated by the construction are expected not to exceed 55 dBA at the noise-sensitive land use locations described above. After implementation of all appropriate noise control measures, if construction noise at a sensitive receiver still exceeds 55 dBA, a variance to the standard will be sought.

Some noise from construction may be heard by individuals using the public facilities at the adjacent Timucuan National Ecological and Historic Preserve and Fort Caroline National Memorial, but it is not expected to be sufficiently loud to disrupt activities at the Ft. Caroline National Monument, which lies closest to the channel construction area.

In addition to noise in the air discussed above, underwater noise can be produced by dredging, vessel operations, and blasting. For underwater environments, ambient noise includes tides, currents, waves, as well as noise produced by marine mammals and by humans. Underwater noise as it relates to marine mammals or other natural resources is discussed elsewhere in this SEIS (**Appendix A, Attachment D**).

7.2.15 Hazardous Toxic Radioactive Waste

Based upon the previous dredging history of the channel in the project area, neither the no-action alternative nor the study alternatives are expected to encounter Hazardous Toxic Radioactive Waste (HTRW). Niether the potential areas of concern described in the USACE December 9, 2009 HTRW Assessment of the Federal Channel, nor potential DMMA site locations in the project vicinity, will be affected by dredging/disposal operations or no action alternatives.

7.2.16 Cultural Resources

There are no adverse effects on submerged historic properties under the no-action alternative. There is the potential for submerged historic properties to be adversely affected by the proposed Jacksonville Harbor deepening and widening.

A submerged cultural resources survey, incorporating the use of a magnetometer, sidescan sonar and subbottom profiler, conducted in August, 2009, resulted in the report "*Cultural Remote Sensing Survey of the Jacksonville Harbor Project GRRII Duval County, Florida*." A total of 122 magnetic anomalies, 304 sidescan anomalies and 327 sub-bottom features were identified within the proposed project area. Fifty-one anomalies (20 sidescan, 21 magnetic and 10 subbottom) were recommended for avoidance or further investigation.

In 2010, USACE conducted an archaeological diver investigation of the 51 potentially significant magnetic, sidescan sonar and subbottom anomalies recommended for further investigation, resulting in the report *"Diver Identification and Archaeological Testing: Addendum to Cultural Resources Remote Sensing Survey of Jacksonville Harbor Project GRRII, Duval County, Florida"* (PCI, 2011). Two, submerged prehistoric archaeological sites (8DU21117 and 8DU21118) were identified within the proposed project area from the subbottom anomalies and are potentially eligible for the National Register of Historic Places (NRHP). Site 8DU21117, located near Drummond Creek at River Mile 14 is outside the current Federal project footprint and will not be adversely affected by this project. Site 8DU21118, located off of Great Marsh Island at Mile Point, will be buffered as a part of the Mile Point project, by the placement of dredged material to restore Great Marsh Island, to prevent adverse project impacts.

Consultation with the Florida State Historic Preservation Office (SHPO) was initiated in 2009, and is ongoing in accordance with the National Historic Preservation Act (NHPA) of 1966, as amended. In addition as part of the requirements and consultation processes contained within the NHPA implementing regulations of 36 CFR Part 800, this project is also in compliance, through ongoing consultation, with the Archaeological Resources Protection Act (96-95), the Abandoned Shipwreck Act of 1987 (PL 100-298; 43 U.S.C. 2101-2106); American Indian Religious Freedom Act (PL 95-341), Executive Orders (E.O.) 11593, 13007, and 13175, and the Presidential Memo of 1994 on Government to Government Relations. On January 10, 2011, USACE determined that the deepening and widening of Jacksonville Harbor from Mile 0 to Mile 13 will have no effects on historic properties. In a February 8, 2011 response, the SHPO concurred with the USACE no adverse effect determination (DHR Project File No. 2011-00074). The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project is in compliance with each of these Federal laws.

7.2.17 Aesthetics

The no-action alternative would not change the aesthetic resources of the LSJR or along the river shoreline. Commercial and recreational vessel traffic patterns, shoreline land uses, and natural resources that define the aesthetic characteristics of the river would remain in their current condition.

None of the proposed project alternatives would alter the major aesthetic characteristics of the river. The most obvious visible aesthetic change, common to all alternatives, would be an increase in the size of the commercial vessels transiting the river.

The NED analysis performed for the GRR II indicates that fewer ships (albeit larger ships) will use the channel after deepening. This would tend to improve aesthetic conditions for those with residences on the river in the area of the deepened channel and in the parks and preserves that border the deepened channel.

7.3 Biological Consequences

7.3.1 General Environmental Consequences

The physical and water quality changes in the LSJR resulting from channel deepening alternatives are in general small. Existing modeling and related analyses indicate that spatial variability in salinity changes will occur; however, no large-magnitude changes have been identified

Salinity changes may modify the biological community, altering or eliminating vegetative communities (i.e., SAV or wetlands), and thus altering or eliminating habitat for species using those communities. If salinity increases, community composition may in general shift to more salinity tolerant species. Species that depend on specific salinities in specific habitats may encounter inappropriate salinities in otherwise acceptable habitat. If using salinity as a cue to seek specific habitats, motile individuals may move away from optimal habitat if salinity optimum for the species under consideration occurs in otherwise less desirable habitat. Changes in the length of time water remains in the river system may change phytoplankton dynamics and may slightly increase the potential for algal bloom development.

7.3.2 Threatened and Endangered Species

A Biological Assessment (BA) was prepared by USACE to evaluate the potential effects of the proposed action on federally-listed threatened and endangered species. Additional information was also supplied to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) (**Appendix F Pertinent Correspondence and Appendix K** on comments and response). The BA details the USACE effect determinations for the West Indian manatee, piping plover, wood stork, sea turtles, shortnose sturgeon, Atlantic sturgeon, smalltooth sawfish, and North Atlantic Right Whale (**Table 49**). In accordance with Section 7 of the Endangered Species Act (ESA), the USFWS provided a consultation letter dated November 15, 2013, and the NMFS provided a Biological Opinion on February 6, 2014 on the proposed deepening (see Appendix F). This section of the SEIS summarizes the anticipated effects on threatened and endangered species resulting from the channel deepening alternatives.

Table 49: Listed Species Effect Determinations

Species	Federal Status	Effect Determination
West Indian manatee	endangered	May affect, not likely to adversely affect
Piping plover	threatened	May affect, not likely to adversely affect
Wood stork	endangered	May affect, not likely to adversely affect
Red knot	candidate	May affect, not likely to adversely affect
Sea turtles	endangered, loggerhead threatened	May affect
Gopher tortoise	candidate	May affect, not likely to adversely affect
Short-nosed sturgeon	endangered	May affect, not likely to adversely affect
Atlantic sturgeon	threatened	May affect, not likely to adversely affect
Smalltooth sawfish	endangered	May affect, not likely to adversely affect
North Atlantic Right Whale	endangered	May affect (possibly not likely to adversely affect with conditions)

7.3.2.1 West Indian (Florida) Manatee

The proposed action may affect, but is not likely to adversely affect the manatee. The contractor would adhere to the following standard manatee protection measures during construction:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with an injury to manatees. The permittee [contractor] shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the ESA, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must cease if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida, and to FWC at ImperiledSpecies@myFWC.com.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee [contractor] upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8 ½” by 11" explaining the requirements for “Idle Speed/No Wake” and the cessation of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at MyFWC.com/manatee. Questions concerning these signs can be sent to the email address listed above.

Per the USFWS letter dated November 15, 2013, the following additional measures shall be implemented to further protect manatees:

a. At least one person shall be designated as a manatee observer when in-water work is being performed. That person shall have experience in manatee observation during dredging activities, and be equipped with polarized sunglasses to aid in observation. The manatee observer shall be on site during all in-water construction activities and advise personnel to cease operation upon sighting a manatee within 50 feet of any in-water construction activity. Two observers who have experience in manatee observation during nighttime dredging activity shall be used when nighttime clamshell dredging is conducted during the months of April through November. The distance at which the nighttime clamshell operation shall cease when a manatee is present shall be expanded to 75 feet of any in-water construction activity. Lighting the expanded area shall be comparable to that used at nighttime to observe the clamshell bucket and dragline during bucket entry and exit from the water.

b. During clamshell dredging, the dredge operation shall gravity-release the clamshell bucket only at the water's surface, and only after confirmation that there are no manatees within the safety distance identified in the standard construction conditions, and expanded to 75 feet during the nighttime clamshell operations.

c. Due to the USACE identifying rock pretreatment other than blasting, such as punch barge/hydro-hammer, or pneumatic hammers, as having effects similar to those of underwater confined blasting, the measures used to protect wildlife during confined blasting shall be used for any rock pretreatment other than blasting, and incorporated into the project plans and specifications.

d. In order to offset risk of adverse effects resulting from the potential duration of blasting and impact hammering throughout the area of effect, and manatee abundance and distribution within this area during the spring, summer, and fall, the USACE shall include in its project plans and specifications a requirement to confine blasting and impact hammering to the months of December through February, when manatee presence and distribution within the area of effect is expected to be minimal.

e. In order to maximize observer visibility during blasting, the timing of the blasting shall be limited to slack tide to the maximum possible extent.

Effects of Blasting

Utilization of blasting as a technique to remove the rock from Jacksonville Harbor may have an effect on manatees in the area of any blasts fired. The project area lies within designated critical habitat for manatees, and they are commonly seen transiting through this portion of the St. Johns River. It is likely that any effect on manatees outside of the proposed safety radius will be in the form of an auditory Temporary Threshold Shift (TTS). Both the pressure and noise associated with blasting can injure marine mammals.

Direct impacts on marine mammals due to blasting activities in the project area include alteration of behavior and autecology. For example, daily movements and/or seasonal migrations of manatees may be impeded or altered. In addition, manatees may alter their behavior or sustain minor physical injury from detonation of blasts outside the danger zone. Although an incidental take would not result from sound/noise at this distance, disturbances of this nature (alteration of behavior/movements) may be considered harassment under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA).

Utilizing data from rock-contained blasts such as those at Miami Harbor in 2005, USACE has been able to estimate potential effects on protected species. These data can be correlated to the data from work completed for the Navy by the Woods Hole Oceanographic Institute (WHOI) (Ketten 2004), and USACE during the construction at Miami Harbor in 2005 (Hempen *et al*. 2007; and Jordan *et al*. 2007) concerning blasting impacts to marine mammals such as manatees. These data indicate that impacts from explosives can produce lethal and non-lethal injury as well as incidental harassment. The pressure wave from the blast is the most causative factor in injuries because it affects the air cavities in the lungs and intestines. The extent of lethal effects are proportional to the animal's mass, this is the smaller the animal, the more lethal the effects (Ketten 2004); therefore all data are based on the lowest possible affected mammal weight (infant dolphin). Non-lethal injuries include tympanic membrane rupture; however, given that manatee's behavior relies heavily on sound, the non-lethal nature of such an injury is questionable in the long-term. For that reason, it is important to use a limit where no non-lethal tympanic membrane damage occurs. Based on the WHOI and USACE Miami Harbor test data, the level of pressure impulse where no lethal and no non-lethal injuries occur is reported to be 10 to 12 pounds per square inch of pressure in the smallest species and 20 to 25 psi for larger species.

Studies by Finneran *et al*. (2000) demonstrated that temporary and permanent auditory threshold shifts (TTS and PTS, respectively) in marine mammals were used to evaluate explosion impacts. Due to the fact that marine mammals, particularly dolphins and manatees (Dr. John Reynolds, pers com., 2008; Reynolds 2003a), are highly acoustic, such impacts on behavior should be taken into account when assessing harmful impacts. While many of these impacts are not lethal and this study has shown that the impacts tend not to be cumulative, significant changes in behavior could constitute a "take" under the MMPA and the ESA.

By utilizing the confined blasting technique that was used and studied at Miami Harbor in 2005, the blasting will result in the maximum pressures from the confined shot being significantly lower than open-water shot pressures at the same charge weight. Radiation of the wave energy into rock reduces the available energy to reach the water column (Hempen *et al*. 2007). The pressures entering the water column are well below those pressures that typically propagate away from open-water (unconfined by solid media that may radiate the energy away with less harm) charges relative to charge weight per delay.

In addition to reducing the pressure wave by confining the blasts in rock, by putting in place a series of protective zones around the blast array and monitoring the area for the presence of protected species, including the manatee, USACE does not believe that any manatee will be injured or killed by the blasting activities. Hempen *et al*. (2007) also demonstrated that the pressure data collected at Miami Harbor showed that using the four zones previously described, the pressures associated with the blasts return to background levels (1 to 2 psi) at the margin of the danger zone. This means that any animal located inside the safety zone, but outside the danger zone would not be exposed to any additional pressure effects from a confined blast (Hempen *et al*. 2007, Jordan *et al* 2007). However, to ensure that the project was being very conservative in the estimation of effects on listed species, USACE assumes that the proposed action may harass manatees by causing a TTS. As a result of this assumption, USACE is consulting with USFWS under the ESA and MMPA for the potential effects on the species. It is the USACE determination, that while the project may affect manatees under the USFWS jurisdiction, the project is not likely to adversely affect them, and the USFWS concurred with that determination. Additional information on blasting, including marine animal protection measures, can be found in **Appendix A, Attachment D, Pre-treatment (Blasting) Plan**. Additional information on general blasting effects can be found in **Section 6.3.5.2**.

Channel deepening construction would likely result in elevated underwater noise levels above background levels during dredging operations. Manatees in close proximity to dredging equipment may experience a temporary reduction in their ability to hear or avoid vessels. However, these impacts should be brief and transitory in nature.

As detailed in **Section 7.3.10** and Taylor (2013a), analysis of LSJR salinities simulated for the period 1996 – 2001 indicated that changes in salinity would impact distribution of SAV in the LSJR upstream of the project area and increase salinity stress to SAV in the northern part of its range. The anticipated SAV impact areas include Important Manatee Areas as well as designated critical habitat for the manatee. In comparison to the no-action alternative, the 46-foot and 50-foot alternatives would increase the total moderate/extreme stress categories by 32 and 43 acres of potential SAV habitat per day, respectively. The ecological model developed by the SJRWMD (Dobberfuhl et al. 2012) and applied by Taylor Engineering (2013a) define moderate to extreme stress categories as those that result in obvious decline in SAV bed coverage (moderate) to loss of most or all of above-ground SAV biomass (extreme). The proposed deepening would decrease the amount of potential SAV habitat available to manatees for foraging; however, the conservative estimates of impact acreage represent a very small fraction of the total available SAV habitat in the LSJR.

It should also be noted that the reach of salinity influence is expected to increase as a result of sea level rise and possible water withdrawal or diversion from the river, neither of which is the direct result of the proposed action.

7.3.2.2 Piping Plover

The proposed action may affect, but is not likely to adversely affect wintering piping plovers. Piping plovers generally prefer sparsely vegetated to unvegetated intertidal shoreline and mudflats for foraging. Shoreline wrack along the upper beach also provides desirable foraging opportunities. Designated critical habitat (Unit FL-35) for wintering piping plovers occurs north of the St. Johns River inlet and includes Huguenot Memorial Park. Beach placement of dredged material will not occur north of the inlet and, therefore, will not affect designated critical habitat. However, the beach south of the inlet is under consideration as a disposal option. Outside of the temporary, relatively brief disposal operation, sand placement would not significantly alter shoreline conditions with respect to piping plover habitat. During the beach placement operations, some short-term displacement of foraging and resting birds, including piping plovers, could occur. Dredges, pipelines, and other equipment along the beach could displace piping plovers, or could cause them to avoid foraging along the shore if they are aurally affected (Peterson et al. 2000). Temporarily displaced birds may use habitats with similar characteristics north and south of the project area.

Minimal impacts to piping plovers should occur from project construction because motile birds can avoid construction activities. Disposal of dredged sand on the beach south of the river mouth may temporarily interrupt foraging and resting activities of shorebirds that use the project beach area. This limited interruption would occur on the immediate area of disposal and last for the duration of construction. A temporary reduction to the prey base for many shorebirds, which includes the benthic organisms, would also occur in the beach placement area. Recovery from this short-term reduction should occur within about one year after sand placement.

7.3.2.3 Wood Stork

The proposed action may affect but, is not likely to adversely affect the wood stork. Portions of the project site occur within the 13-mile foraging buffer of 4 wood stork nesting colonies in Duval County: Jacksonville Zoo, Cedar Point Road, Dee Dot Ranch, and Pumpkin Hill. The proposed action would deepen and widen the existing navigation channel and would not impact any habitat critical to the wood stork. The placement of material into upland disposal sites could temporarily provide or preclude feeding opportunity for wood storks.

7.3.2.4 Red Knot

The proposed action may affect but is not likely to adversely affect this "candidate" species which is under review by the USFWS. The coastal area south of the harbor entrance is a disposal option that, while not specifically identified as being especially important to Red Knots, is an area that may be visited by the species. Outside of the relatively brief disposal operation, the sand placement would not alter the ongoing management of the shoreline nor significantly alter the character of this shoreline with respect to Red Knott habitat.

7.3.2.5 Sea Turtles

<u>Nesting Sea Turtles</u>

The proposed action may affect sea turtles on the beach. The placement of sand on or near the shoreline during the sea turtle nesting season could impact nesting and hatching sea turtles. The proposed action would follow the terms and conditions of the Statewide Programmatic Biological Opinion of 22 August 2011 from the USFWS on beach placement and shore protection in Florida.
(http://www.fws.gov/northflorida/BOs/20110822_bo_USFWS_Statewide_Programmatic_BO_Beach_Nourish_signed.pdf.)

Escarpments obstructing beach accessibility, altered beach profiles, different sand color characteristics, and increased sand compaction often hinder nesting success the first year after beach nourishment (USFWS, 2005, 2007). Impacts of a nourishment project on sea turtle nesting habitat are typically short-term because natural processes rework a nourished beach in subsequent years. Constant wave and current action reworks the beach, and reduces sand compaction and the frequency of escarpment formation while the sun bleaches darker sand (USFWS 2005).

In summary, within a year following beach placement (construction year up to a year post construction), impacts to sea turtles associated with the project may include:

- Disturbance of nesting female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities
- Behavior modification of nesting females from beach escarpment formation during a nesting season (e.g.; behavioral changes could result in false crawls or selection of marginal or unsuitable nesting areas to deposit eggs)

- Destruction, damage, or burial of existing nests during nourishment activities
- Effects to eggs and hatchlings from changes in the physical and chemical characteristics of the nourished beach (e.g.; the quality of the placed sand could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest)
- Lighting-induced disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water

As is detailed in the DMMP **Appendix J**, beach placement is an alternative under consideration. The material proposed for placement comprises beach-quality sand of similar grain size and color to the native beach sand. Therefore, sand quality would not likely have negative effects on sea turtle nesting or hatchling emergence success. However, the proposed action could incur short-term negative effects on sea turtle nesting from nesting disturbance, sand compaction, and potential for scarp formation during construction and the first year post-construction.

Per the USFWS letter dated November 15, 2013, the following additional measures shall be implemented to further protect nesting and hatchling sea turtles on the beach:

a. All lighting used to illuminate the immediate dredge area shall be shielded and/or positioned, and/or the dredge oriented, such that the lighting is not directly visible from the beaches immediately north and south of the dredging location.

b. Lighting needed for safety and security shall, to the maximum extent consistent with applicable laws and regulations, be shielded and/or positioned to illuminate only the area of concern and not directly visible from the above beaches.

<u>Sea Turtles in the Water</u>

The proposed action may affect sea turtles in the water. The use of a Hopper Dredge, in particular, could entrain sea turtles resting on the bottom of the channel. The proposed action would follow the terms and conditions of the South Atlantic Regional Biological Opinion from the NMFS (even though navigation channel deepening and widening may be outside the scope of this opinion) http://el.erdc.usace.army.mil/seaturtles/refs-bo.cfm. With respect to blasting, (1) measures would be taken to minimize the impact of blasting on the environment and (2) monitoring would be used to minimize blasting in proximity of a sea turtle (see right whales discussion below concerning blasting).

Entrainment within hopper dredge drag heads could injure or kill sea turtles, particularly within areas of soft sediment in ship channels where turtles are known to bury themselves partially when resting (National Research Council Committee on Sea Turtle Conservation 1990). Sea turtles have also been observed partially burying themselves in soft sediments that have settled into previously dredged borrow pits (Michals 1997). Numerous methods have been implemented to reduce the number of turtle takes during hopper dredge operations, including special turtle deflecting hopper dredge drag heads, relocation trawling, dredging windows, and the implementation of trained protected species observers during dredging operations.

There would be NMFS-approved protected species observers stationed on the hopper dredge (http://el.erdc.usace.army.mil/seaturtles/docs/observercriteria.pdf). The hopper dredge would come equipped with a sea turtle drag head deflector during all dredging operations. Even with these measures in place, incidental take(s) of sea turtles during dredging remains a possibility.

To protect swimming sea turtles and smalltooth sawfish, the contractor would implement to the following standard protection measures during construction:

a. The permittee [contractor] shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee [contractor] shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of the project, outside these general conditions, if applicable, will be addressed in the primary consultation.
Per the NMFS Biological Opinion dated February 6, 2014, the following reasonable and prudent measures shall be implemented to further protect sea turtles in the water:

1. The USACE shall implement best management measures, including use of sea turtle deflector dragheads, intake and overflow screening, and relocation trawling to reduce the risk of injury or mortality of listed species and lessen the number of sea turtles killed by the proposed action.

2. The USACE shall have measures in place (NMFS-approved protected species observers, and reporting requirements, to detect and report all interactions with any protected species (ESA or Marine Mammal Protection Act) resulting from the proposed action.

Per the NMFS Biological Opinion, Incidental Take Statement, the following terms and conditions shall also be implemented to protect sea turtles in the water:

1) Hopper Dredging Window
Hopper dredging is allowed at anytime, anywhere; however, NMFS prefers that hopper dredging be conducted in winter months, in keeping with the 1997 South Atlantic Regional Biological Opinion dredging window. Also, the USACE should consider using alternative dredge types (e.g. cutterhead or clamshell type dredges) from River Mile 0-3 during the height of the summer, when sea turtle abundance in this area would be expected to be highest.

2) Sea Turtle Deflecting Draghead
In order to minimize the incidental takes of sea turtles, NMFS and the USACE typically require the use of sea turtle deflecting dragheads on all hopper-dredging projects where the potential for sea turtle interactions exists. Sea turtle deflecting dragheads are required for this project whenever they can be *effectively* used to reduce sea turtle mortalities by hopper dredges. NMFS expects that the deflectors will be effective in many areas. In certain circumstances—notably, parts of Bar Cut 3 of the proposed action area where the irregular, stiff, dense

clay bottom substrates do not let the deflectors ride smoothly or plow effectively into the bottom substrates—they are difficult to use, ineffective at their intended role, and their use could be counterproductive (i.e., deflector use could result in more rather than less turtle entrainments). Consequently, NMFS has occasionally temporarily waived their use, and specifically in Bar Cut 3 as recently as December 2011-January 2012 during Jacksonville/Mayport entrance channel dredging.

Deflector draghead removal may be necessary and/or prudent for certain portions of the proposed dredging areas where the substrate renders deflector use ineffective, or damages the dragheads (e.g., when stiff, dense clay or rock is encountered). The USACE shall consult with NMFS and receive NMFS's approval prior to removing sea turtle deflector dragheads, except within Bar Cut 3, where the deflectors are not required at any time nor is pre-approval by NMFS (to not use them) required.

Where sea turtle deflector dragheads are removed, NMFS requires 100% observer coverage.

3) Relocation Trawling

Unless specified, relocation trawling refers to capture and non-capture type trawling. NMFS authorizes capture or non-capture relocation trawling for the duration of the proposed action. Trawler crew safety shall be of paramount concern.

a) From the jetties seaward: The USACE must conduct *capture* trawling (year-round, subject to the requirements (i)-(vi) detailed further below) in areas from the seaward end of the Mayport jetties to the seaward-most portion of the ship channel being dredged/widened to reduce the number of sea turtle/hopper dredge interactions. Even though trawling over irregular bottoms is not as effective as over smooth bottoms, the number of sea turtle captures (if any) per trawling effort may give NMFS/USACE information on sea turtle abundance and potential need to modify the existing protective measures.

b) Between the Mayport jetties: Relocation trawling (capture or non-capture) is not required, but is recommended, due to high juvenile green sea turtle density. However, it is only recommended when it can be done safely, to be determined by relocation trawler Master.

c) From River Mile 3-0: Relocation trawling (capture or non-capture) is not required between River Mile 3 and River Mile 0. The St. Johns is the 3rd busiest port in the southeastern United States, with huge car carriers and container ships making up the bulk of its traffic and the channel is quite narrow from River Miles 0-3. This combined with the power of the currents and the possibility of snagging nets on the bottom, which can limit maneuverability suddenly and without warning, can create dangerous situations for relocation trawling vessels and crews.

d) Above River Mile 3 to end of project area (approximately River Mile 13): Relocation trawling (capture or non-capture) is not required, but may be carried out by the USACE as a preventive measure if it can be done safely (the decision whether to trawl or not to be determined solely by the trawling Master). Although live, healthy, sea turtles have been documented as far upriver as mile 13 (Allen Foley, FWRI, personal communication to E. Hawk, NMFS, December 19, 2013), no turtles have been reported taken by hopper dredging above Mile 3. Sea turtle presence above Mile 3 is expected to be low and seasonal, based on past experience, observer reports, and high freshwater flow.

e) Additional capture-trawling requirements:

i) These measures apply only to the particular area where a hopper dredge is working and only apply to dredges that incur takes. For example, if two hopper dredges are working independently in two different areas and one of them incurs takes that meet the following take rate criteria, only that dredge shall be subject to the following requirements. If the other dredge subsequently incurs takes that meet the following take rate criteria, then the below measures shall apply to it as well.

ii) The USACE shall require a capture-type relocation trawler to start relocating as soon as possible (within 72 hours, to the maximum extent possible) in front of the hopper dredge if turtle takes by that hopper dredge reach or exceed two turtles in any consecutive 7-day period. Trawling may be suspended after 14 days pass with no turtle takes by the dredge. This relocation trawling requirement does not supersede the safety requirements previously listed.

iii) The USACE shall require capture trawling to start as soon as possible (within 72 hours to the maximum extent possible) after 50% of any observed species take limit is reached. Trawling may be suspended if no additional capture of that species occurs within 14 days. This relocation trawling requirement does not supersede the safety requirements previously listed.

iv) The USACE shall require capture trawling to be conducted full time in Bar Cut 3, to the extent safely possible as determined by the Master of the relocation trawling vessel, after 75% of any relocation trawling species take limit is reached. This relocation trawling requirement does not supersede the safety requirements previously listed.

v) Exemptions from the trawling requirement: The USACE may request a waiver of relocation trawling requirements on a case by case basis from NMFS, which shall consider the circumstances of the request and make a determination.

vi) Non-capture trawling: When capture trawling is not required by any of the preceding terms and conditions, the USACE may initiate non-capture relocation trawling anywhere and anytime at its own discretion, wherever it can be done safely (the decision to trawl or not to be determined solely by the trawler Master) without prior consultation with NMFS. The trawling contractor shall only use non-capture trawl nets of mesh size and characteristics that are specifically designed to quickly exclude sea turtles that may pass through them, while minimizing entanglement risk. Based on its previous experience with 2011 Mayport dredging and non-capture trawling, the USACE has determined that a traditional shrimp trawling net between 30-50 feet in length with mesh size of approximately 2 inches is the best fit for non-capture trawling. Standard shrimp trawl nets of the type normally used for capture-type relocation trawling and from which the cod ends have simply been removed to allow sea turtles to escape are not authorized for use for noncapture trawling because of their demonstrated capacity to entangle and drown smaller turtles in their large meshes near the mouth of the net.

4) Protected Species Observer Coverage Aboard Hopper Dredges

The USACE has proposed 100% observer coverage aboard hopper dredges used for the proposed action.

a) NMFS requires 100% observer coverage in any portions of the river or ocean where sea turtle deflector dragheads are not used.

b) From River Mile 6 downstream as far as the seaward-most extent of dredging, NMFS requires 100% observer coverage for hopper dredging.

c) From River Mile 6 to the upstream end of the project area (approximately, River Mile 13), NMFS requires 50% observer coverage if deflectors are in place, per (a) above, 100% coverage if deflectors have been removed.

5) Silent Inspector

The USACE shall require the use of a Silent Inspector on all dredge vessels to ensure compliance with the 10-knot speed limit during the right whale calving season (November 15 through April 15 of each year). Silent Inspector reports will be provided to NMFS within 90 days following the close of right whale calving season, to: NMFS Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701- 5505.

6) Bed-Leveling Takes

If compelling observer reports and evidence indicate that a turtle was killed by a bed-leveler associated with the proposed action covered by this opinion, the USACE shall reinitiate the consultation; however, these takes shall not be counted against the Incidental Take Statement.

7) Take Reporting

If any listed species are injured or killed during the proposed project, the USACE shall provide a report summarizing the incident, within 90 days of project completion, to: NMFS Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505. Notification of take shall be provided to NMFS at the following e-mail address within 24 hours of each take: takereport.nmfsser@noaa.gov.

8) Tissue Sampling Requirements and Authority to Conduct Tissue Sampling for Genetic and Contaminants Analyses by NMFS and the USACE:

a) Every live or dead sea turtle captured by hopper dredging or relocation trawling during or associated with the proposed dredging action shall be tissue-sampled prior to release (if alive) or prior to disposal (if dead), for future genetic analysis by NMFS. Ultimately, tissue samples gathered during sampling will be used to obtain reliable genetic data on the nesting or sub-population identity of sea turtles being captured or lethally taken. This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a hopper dredge to handle and tissue-sample live- or dead-captured sea turtles without the need for an ESA Section 10 permit.

b) Sea turtle tissue samples shall be taken in accordance with NMFS's SEFSC procedures for sea turtle genetic analyses and may also be taken for contaminants (e.g., heavy metals) analysis by NMFS. Sampling shall continue uninterrupted until such time as the project ends.

c) The USACE shall ensure that tissue samples taken during the dredging project are collected and stored properly and mailed every three months until completion of the dredging project to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149.

d) The USACE shall notify NMFS when 75% of any species take limit is reached to discuss whether reinitiation might be necessary.

Effects of Blasting

It has been documented that the pressure and noise associated with unconfined blasting can physically damage sensory mechanisms and other physiological functions of individual sea turtles (Keevin and Hempen 1997). Impacts associated with blasting can be broken into two categories: direct impacts and indirect impacts.

Direct Impacts. To date, there has not been a single comprehensive study to determine the effects of underwater explosions on reptiles that defines the relationship between distance/pressure and mortality or damage (Keevin and

Hempen 1997). However, there have been studies, which demonstrate that sea turtles are killed and injured by underwater explosions (Keevin and Hempen 1997). Sea turtles with untreated internal injuries would have increased vulnerability to predators and disease. Nervous system damage was cited as a possible impact to sea turtles caused by blasting (U.S. Department of Navy 1998 as cited in USACE 2000b). Damage of the nervous system could kill sea turtles through disorientation and subsequent drowning. The Navy's review of previous studies suggested that rigid masses such as bone (or carapace and plastron) could protect tissues beneath them; however, there are no observations available to determine whether the turtle shells would indeed afford such protection. Studies conducted by Klima *et al.* (1988) evaluated unconfined blasts of only approximately 42 pounds on sea turtles (four ridleys and four loggerheads) placed in surface cages at varying distances from the explosion. Christian and Gaspin's (1974) estimates of safety zones for swimmers found that, beyond a cavitation area, waves reflected off a surface have reduced pressure pulses; therefore, an animal at shallow depths would be exposed to a reduced impulse. This finding, which considered only very small-unconfined explosive weights, implies that the turtles in the Klima *et al.* (1988) study would be under reduced effects of the shock wave. Despite this possible lowered level of impact, five of eight turtles were rendered unconscious at distances of 229 to 915 meters from the detonation site. Unconscious sea turtles that are not detected, removed and rehabilitated likely have low survival rates. For confined underwater (CU) blasting, these types of effects would not have occurred, due to the significantly reduced pressures associated with CU blasting. The proposed action will use CU blasts, which will significantly reduce the pressure wave strength and thus area around the discharge where injury or death may occur (Hempen *et al*. 2007). The USACE assumes that tolerance of turtles to blast overpressures is approximately equal to that of marine mammals (Department of the Navy 1998 in USACE 2000b), *i.e.*, death would not occur to individuals farther than 400 feet from a confined blast (Konya 2001).

For assessing impacts of blasting operations on sea turtles, USACE relied on the previous analysis conducted by NMFS as part of their ESA consultations on the Miami Harbor GRR [NMFS Consult # F/SER/2002/01094] (NMFS 2003); the Miami Harbor Phase II project [NMFS Consult #I/SER/2002/00178] (NMFS 2002a); as well as the results from the blasting conducted at Miami, where 16 sea turtles were recorded being in the action area during the 38 days when blasting occurred, without a single stranding of an injured or dead turtle being reported (Trish Adams, USFWS pers.com, 2005; Wendy Teas, NMFS, pers.com 2005; Jordan *et al*. 2007). In both of the ESA consultations for the two projects in Miami, with regard to impacts to sea turtles, NMFS found that "NOAA Fisheries believes that the use of the mitigative measures above in addition to capping the hole the explosives are placed in (which will greatly reduce the explosive energy released into the water column) will reduce the chances of a sea turtle being adversely affected by explosives to discountable levels." (NMFS 2003 and 2002).

Pressure data collected during the Miami Harbor project by USACE geophysicists and biologists showed that using the four zones previously described, the pressures associated with the blasts return to background levels (1to 2 psi) at the margin of the danger zone. This means that any animal located inside the exclusion zone, but outside the danger zone would not be exposed to any additional pressure effects from a confined blast (Hempen *et al*. 2007). Additional information on blasting, including marine animal protection measures, can be found in **Appendix A, Attachment D, Pre-treatment (Blasting) Plan**. Additional information on general blasting effects can be found in **Section 6.3.5.2**.

7.3.2.6 Gopher Tortoise

The proposed action may affect but is not likely to adversely affect this "candidate" species which is under review by the USFWS. The Gopher Tortoise may be affected by the maintenance or expansion of existing upland placement sites, such as Buck Island, and by the construction and maintenance of any new upland placement sites. The burrows could pose a threat to the integrity of the containment system and would be impacted by the maintenance or expansion of the dikes. Uplands sites for new or expanded dredged material placement may also contain Gopher Tortoise burrows. A survey for Gopher Tortoise burrows would be conducted prior to the maintenance or expansion of an existing upland placement site and prior to the construction or maintenance of any new upland disposal site. Relocation of individual gopher tortoises or some other mitigative measure would be taken to minimize or compensate for the loss.

7.3.2.7 Short-nosed Sturgeon

The proposed action may affect but is not likely to adversely affect the shortnose sturgeon. The shortnose sturgeon historically occurred in the St. Johns River (Gilbert 1992); however, this species has experienced significant declines within its southern geographic range (Rogers and Weber 1994, Kahnle et al. 1998, and Collins et al. 2000). Beginning in the spring of 2001, the Florida Fish and Wildlife Research Institute (FFWRI) and USFWS began research on the population status and distribution of the species in the St. Johns River. After approximately 4,500 hours of gill-net sampling from January through August of 2002 and 2003, only one shortnose sturgeon was captured in 2002. There is little evidence of a spawning population in the St. Johns River. The few individuals captured, mostly up river in fresh water, were not of reproductive size and probably from other river systems to the north. There is little evidence for the species presence in the Jacksonville Harbor portion of the St. Johns River. If the species were present, it is likely transient and would not be expected to linger on the bottom of the navigation channel which does not provide suitable spawning habitat or ideal feeding habitat. Effects of blasting on fish species with swimbladders, including shortnose sturgeon is discussed in **Appendix A, Attachment D**.

7.3.2.8 Atlantic Sturgeon

The proposed action may affect but is not likely to adversely affect the Atlantic sturgeon. Atlantic sturgeon is anadromous; adults spawn in freshwater in the spring and early summer and migrate into estuarine and marine waters where they spend most of their lives. In some southern rivers a fall spawning migration may also occur. They spawn in moderately flowing water in deep parts of large rivers. Sturgeon eggs are highly adhesive and usually are deposited on hard surfaces (e.g., cobble).

Historically, Atlantic sturgeon sightings have been reported from Hamilton Inlet, Labrador, south to the St. Johns River, Florida. Overharvest led to wide spread declines in abundance. The origin of the fishery dates back to colonial times. Since a 1998 harvest moratorium there have been few surveys to assess status and abundance. "Bycatch" of sturgeon in fisheries targeting other species is a current threat in the ocean environment. In their estuarine and freshwater habitats, Atlantic sturgeon face additional threats, including habitat degradation and loss from various human activities such as dredging, dams, water withdrawals, and other development.

There appears no longer to be a spawning population of the species in the St. Johns River since the impoundment of a major tributary, the Oklawaha River, at River Mile 95. There is evidence that the river serves as a nursery ground for a few young originating from other river systems to the north. The species is sensitive to low dissolved oxygen and high water temperatures both of which could be exacerbated by climate change and water withdrawal or diversion. Dredging poses a threat to habitat by disturbing benthic fauna, elimination of deep holes, alteration of rock substrate, increased turbidity and sedimentation, noise/disturbance, and hydrodynamic alteration (National Marine Fisheries Service 2012).

With impoundment of the Ocklawaha and climate change, it is unlikely that the St. Johns River will become an important habitat for the species. However, young from spawning rivers to the north may continue to use the St. Johns River and provide a possible source for recovery should conditions in the river somehow become more favorable for the species. Effects of blasting on fish species with swimbladders, including Atlantic sturgeon is discussed in **Appendix A, Attachment D**.

7.3.2.9 Smalltooth Sawfish

The proposed action may affect but is not likely to adversely affect the smalltooth sawfish. The smalltooth sawfish (*Pristis pectinata*) is widely distributed within the coastal waters of the eastern and western Atlantic (Last and Stevens 1994). However, according to C.A. Simpendorfer et al (2008), this species' eastern Atlantic population was dramatically reduced during the 20th century, from widespread and abundant, to very rare with a restricted population range. They reported that the present core range of the eastern Atlantic population extends along the southern coast of Florida from the Ten Thousand Islands to Florida Bay, with moderate occurrence in the Florida Keys and at the mouth of the Caloosahatchee River. They also reported that smalltooth sawfish observations were not been recorded within the St. Johns River from 1950 to 2008. The occurrence of this species within the project area is highly unlikely and, therefore, a very low potential for adverse impact exists with regard to the proposed channel deepening.

Effects of Blasting: Review of ichthyological information and test blast data indicates that fishes with swim bladders are more susceptible to damage from blasts, and some less-tolerant individuals may be killed within 140 feet of a confined blast (USACE 2000b). Sawfishes, as chondrichthyans, do not have air bladders, and, therefore, they would be more tolerant of blast overpressures closer to the discharge, possibly even within 70 feet of a blast (Keevin and Hempen 1997). See also **Appendix A, Attachment D**.

7.3.2.10 North Atlantic Right Whale

The proposed action may affect North Atlantic Right Whales. The transit of dredged material to the ODMDS would pass through designated critical habitat for wintering and calving right whales. Also, while the economic analysis for justification of the project does not necessarily rely on forecasts of additional port facilities or an additional number of vessel calls, it is possible that additional port facilities and additional vessel calls could result from deepening and widening of the harbor. Additional port facilities would likely require a Department of the Army permit from USACE that would include consultation with NMFS and USFWS.

Per the NMFS Biological Opinion dated February 6, 2014, the following conditions shall also be implemented to protect the right whale:

1. Dredge contractors will be required to participate, and respond asdescribed below, in the North Atlantic right whale (NARW) Early Warning System (EWS), where ships are alerted to the presence of NARWs in the project area during the calving season with the aid of aerial surveys. To the extent practicable, dredge vessel operations in the NARW calving area during the calving season will be minimized, and transit courses altered immediately if necessary, upon notification of a NARW sighting through the EWS or other observers.

2. The USACE will, during the period November 15 through April 15, require all dredge-related vessels (e.g., hopper dredges, cutterhead dredges, barges, tugboats pulling or pushing barges or scows, relocation trawlers) moving through the NARW calving area to take the following precautions: (1) vessels shall not travel at speeds in excess of 10 knots; (2) if whales have been spotted via EWS

or other observers within 15 nautical miles (nm) of the vessel's path within the previous 24 hours, the tug/barge or dredge operator shall slow down to 5 knots or less during evening hours, or when there is limited visibility due to fog, or sea states greater than sea state Beaufort 3 (NMFS further defines limited visibility, for purposes of this conservation measure, as any condition including fog, rain, smoke, sea spray, waves, inclement weather, etc. that reduce visibility to ½ nm (1000 yards) or less). A vessel traveling at 10 knots will cover a distance of 1 nm in 6 minutes; thus, this conservation measure will allow at least a 3-minute reaction/detection window during periods of reduced visibility, as defined above; (3) as noted in the Consultation History section of this opinion, as per an agreement reached between NMFS and the USACE, the speed limits for hopper dredges and dredgerelated vessels as set forth in this proposed action shall only apply until a new Regional Biological Opinion for South Atlantic hopper dredging (SARBO) is signed, at which time the project would abide by the conditions set forth in the new SARBO.

3. The USACE shall require the use of a Silent Inspector (Dredge Quality Management) on all dredge vessels to ensure compliance with the 10-knot speed limit during the right whale calving season (November 15 through April 15 of each year). Silent Inspector (Dredge Quality Management) reports will be provided to NMFS within 90 days following the close of right whale calving season, to: NMFS Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505.

4. A dredge shall not get closer than 750 yards to a right whale.

Effects of Blasting

Since blasting will not occur offshore of the jetties, and right whales are not commonly found in the river proper, the proposed use of blasting as a pre-treatment method should have no effect on the North Atlantic right whales. However, in the unlikely event that a right whale enters the jetties and swims toward the project area during construction, USACE will consult with NMFS and other wildlife agency staff to determine where the whale is in relation to the construction activities, and if there is a potential for the whale to be within the aerial monitoring zone discussed in **Section 6.3.5**, the blasting will be delayed until the whale leaves that monitoring area.

7.3.3 Essential Fish Habitat and Federally Managed Fish Species

Essential Fish Habitat (EFH) is defined by NOAA Fisheries Services as "*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.*" Habitat Areas of Particular Concern (HAPC), a component of EFH, includes those waters and substrates "which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area" (http://sero.nmfs.noaa.gov/hcd/efh_faq.htm). This section considers potential impacts to EFH and HAPC as well as non-listed and federally-managed fish species. In this context, the term "fish" includes both finfish and shellfish managed by the South Atlantic Fisheries Management Council (SAFMC) and other Federal agencies.

7.3.3.1 Essential Fish Habitat

An Essential Fish Habitat Assessment of the proposed project area is provided in **Appendix L** (Dial Cordy 2011). In summary, deepening and widening the channel would have both direct and indirect impacts on managed species as stated in the general conclusion paragraph below:

> The proposed improvements to the Jacksonville Harbor navigation channel in the St. Johns River will impact EFH. These include impacts to HAPC, especially within the inlet, which may alter important migratory routes in and out of the river system. These impacts, however, will be limited to areas of dredging and occur over a limited area within the entire river system. The use of best management practices should limit the extent and duration of turbidity impacts, which will temporarily alter fish dynamics in the vicinity of the construction activities. Permanent losses of habitat will occur, but those species inhabiting these areas are expected to recover quickly. Fishes in the St. Johns River near the construction activities should have adjacent similar habitats to utilize during times of construction. Timing of construction activities around times of high migration (e.g., penaeid shrimp) for some species will further reduce these impacts; however, some impact to juveniles in the system will be expected. Overall, the impacts to EFH and HAPC related to the navigational improvements at Jacksonville Harbor will be temporary and will not result in significant effects on managed species.

Channel deepening may have two types of impacts on EFH including direct impacts due to construction and indirect impacts due to changes in salinity regimes within and outside of the project construction area. The project area bottom consists primarily of sand, with some rock outcrop within sandy substrate and some rock substrate. Considering the alternatives in order of least to greatest depth increase, channel dredging will increase the overall depth and size of the channel, as increasing the depth and maintaining the channel bottom width leads to an unavoidable increase in the extent of channel side slopes. This will expose a small additional area of rock substrate and consequently reduce the total area of sandy substrate. This effect is not likely to greatly affect any of the species using the sand and or rock habitat, except during construction. Increases in turbidity and disturbance of sediments from dredging would result in a temporary reduction in habitat quality for the benthic and water column habitats. Individuals would be impacted if they did not or could not move sufficiently rapidly to avoid these effects.

Section 7.2.7 describes general increases in salinity within the project study area due to channel deepening. Most of the salinity changes would occur between the mouth of the river and Buckman Bridge. Salinity increases would result in minor effects on eelgrass beds; wetlands and salinity-based fish habitat (see **Appendix D**). A mitigation plan has been prepared by USACE to offset these losses including a long-term model verification and corrective action plan to evaluate potential salinity changes and impacts caused by the deepening has also been prepared (see **Appendix E**). As stated in the corrective action plan, USACE shall recoordinate with the agencies in the event that monitoring detects deepening induced impacts that exceed the predicted impacts. The no-action alternative would not impact EFH in any way not already occurring as a result of existing channel activities (e.g. stormwater receiving and other passive uses, commercial, and recreational activities).

Within the project construction area, impacts to EFH may occur due to dredging and associated activities (e.g., confined blasting, increased boat traffic), creating noise, turbidity, and currents that may entrain organisms that come near hydraulic dredging operations and to some lesser extent, mechanical dredging activity. Hydraulic dredging will result in the greatest amount of entrainment of organisms, and will most affect sessile and planktonic individuals. Motile organisms will become entrained if they have insufficient strength or speed to avoid the dredge head. Turbidity and noise from the dredging may result in some avoidance behavior by many motile organisms. Fish may be attracted to areas where sediment is disturbed due to the potential for the co-occurrence of prey species in the turbid water column, but fish and mammals may generally exhibit avoidance behavior.

Confined blasting, if used for removing rock to achieve a proposed template, would result in temporarily reducing EFH quality by disturbance of the sediment, creation of turbidity similar to other methods of dredging and generation of pressure waves, the greatest of the temporary direct impacts associated with dredging. Keevin and Hempen (1997) reviewed available literature dating as far back as 1907 concerning potential blasting effects on plants and animals. The research they summarized covered a wide range of organisms (plants, sessile and motile invertebrates, reptiles, amphibians, fish, and mammals). Other sections in this chapter will specify blasting impacts to those groups. Regarding EFH, the effects are temporary, and depend entirely on the taxon considered and distance of individuals from the confined blasting site. Additional information on blasting, including marine animal protection measures, can be found in **Appendix A, Attachment D, Pre-treatment (Blasting) Plan**.

7.3.3.2 Potential Effects on Managed Fisheries

Penaeid Shrimp EFH and EFH HAPCs include the river mouth marshes and the main river channel at least as far upstream as Palatka. The project will impact a relatively small area of sand and rock bottom and water column compared to the available EFH for LSJR-managed shrimp species (white, brown, and pink shrimp). Direct impacts to shrimp may occur as a result of entrainment during hydraulic dredging, or capture during mechanical dredging. Impacts from confined blasting may occur only immediately around the blast point, as species such as crabs and shrimp without gaseous organs are less sensitive to shock waves than fish, amphibians, reptiles, and mammals. Localized turbidity could clog gill structures in those shrimp unable to avoid the plume. If turbidity plumes are localized and minimized, turbidity impacts would likely be minor and temporary to these species. **Appendix D** includes details of penaeid shrimp salinity habitat area changes due to channel deepening alternatives.

Bluefish is a coastal pelagic species found along the east coast of the United States, managed by the Mid-Atlantic Fishery Management Council. The St. Johns River estuary provides water column EFH for juveniles and adult bluefish, but they are relatively rare (MacDonald et al 2009). Bluefish may be impacted by entrainment in dredging equipment, and by pressure waves from confined blasting, and by turbidity. Adults and juveniles may avoid construction noise and hence active dredging areas. Pressure waves from confined blasting will affect fishes within the general area of the blast. Turbidity could temporarily impact the fishes by clogging gills. With best management practices and large amounts of undisturbed adjacent estuarine habitat available to the species, impacts of dredging should be minor.

Summer flounder have EFH in the LSJR. Juveniles and adults occur there, albeit in low numbers (MacDonald et al 2009). The proposed project represents about the same potential impacts to summer flounder as bluefish. The HAPCs are designated within juvenile and adult EFH and include all species of macroalgae, seagrass, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations (NMFS 2010b). No seagrass and little cover of macroalgae occur in the project construction area. Freshwater and tidal macrophytes will not incur direct impacts from the construction, and indirect impacts (e.g., impacts to wetlands due to increased salinity) represent a minor impact compared to the scale of available habitat in the LSJR.

Impacts to the Snapper-Grouper complex of fishes may result from impacts to sand bottom, hardbottom, salt marsh, and water column EFH that this set of species may use. Dredging and confined blasting may directly and indirectly impact these EFH types, but only in local areas and temporarily. The USACE assumes that long-term or permanent impacts to salt marsh appear unlikely as the extensive river mouth marshes are already exposed to high salinity conditions and dredging will likely not dramatically increase salinity levels in those marshes.

The coastal migratory pelagics complex, managed by SAFMC includes king mackerel, cero mackerel, Spanish mackerel, little tunny, and cobia. The EFH for these species includes clear waters around coral reefs, and inshore and continental waters. Direct and indirect impacts to species of the coastal migratory pelagics complex should be short term and minimal, as these species use primarily offshore habitats. Use of beach, nearshore areas, or an ODMDS for sediment disposal may result in localized turbidity. With best management practices, impacts would include temporary displacement, and interference with gill functions if fishes enter a turbidity plume, however, fishes may avoid such plumes and the project area should quickly return to expected ambient conditions with cessation of the activity.

The EFH within the general project area for highly migratory Atlantic species include that in marine areas and the estuarine water column. The thirteen species of sharks represented in this group are relatively uncommon in the river construction area (Dennis et al 2001, MacDonald et al 2009). Only the Atlantic sharpnose and bonnethead sharks are considered to be year-round residents of the area surrounding the St. Johns River, while the blacknose and blacktip sharks may occur as seasonally abundant. The other species listed are either rare within the area or occur in seasonal migrations up and down the coast (NMFS 2006).

These species are very mobile and avoidance of areas where construction occurs is likely. Indirect impacts from placement of dredged material on beaches, in the nearshore, or in an ODMDS may occur due to turbidity. With the use of best management practices, water clarity in areas where sediment has been placed is expected to return to normal ambient conditions. Therefore, impacts to this managed species group should be temporary and minimal.

Species associated with the managed species and species groups are those that occur in the same habitats as prey species and other species that occupy similar habitats. Invertebrates that have limited movement capabilities (e.g., some crustaceans, echinoderms, mollusks, polychaetes, and annelids) may incur direct impacts from dredging, which will result in a significant localized reduction in abundance, diversity, and biomass of the affected fauna. However, dredging will impact a relatively small fraction of the total similar benthic habitat in the larger project area. Emigration from adjacent, unaffected habitat and rapid reproduction typical of these species will result in relatively minor impacts to associated benthic infaunal species. Recovery of the dredged site with respect to these invertebrates is expected within about two years. However, subsequent maintenance dredging may suppress benthic recovery within those parts of the channel that are subject to more frequent shoaling.

Zooplankton are primarily filter feeders and suspended inorganic particles can foul the fine structures associated with feeding appendages. Zooplankton that feed by ciliary action (e.g., echinoderm larvae) would also be susceptible to mechanical effects of suspended particles (Sullivan and Hancock 1977). Zooplankton mortality is assumed from the physical trauma associated with dredging activities (Reine and Clark 1998). The overall impact on the zooplankton community should be minimal due to the limited extent and transient nature of the sediment plume.

Over 170 species of coastal and estuarine fish have been identified for the lower St. Johns River (Dennis et al. 2001; McDonald et al. 2009). These fishes may play important roles in the various life stages of managed species, especially as prey species. Displacement of individuals through avoidance behavior and entrainment in dredging equipment during construction are the primary impacts to these species. Mortality of demersal eggs and larvae would in particular occur in localized dredging areas. Suspended sediments may affect feeding and oxygen exchange of pelagic individuals, but these impacts should be minimal due to the limited extent and transient nature of the sediment plume.

7.3.4 Marine Mammals

The Federal government prohibits any unauthorized activity that has the potential to disturb or harass a marine mammal or marine mammal stock in the wild. The Federal government has broadly defined “harassment” as “any act of pursuit, torment or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering” (16 U.S.C. 1362, Sec.3(18)(A)). Harassment under part (i) is termed Level A Harassment and under part (ii) is called Level B Harassment.

While dolphins and manatees that frequent the LSJR must have a certain amount of tolerance to human activities (Dr. Quincy Gibson, personal communication 2012) and related noises, cetaceans and manatees are relatively difficult to observe. Detecting impacts to marine mammals may be difficult. This fact should be considered in assessing channel construction impacts on these taxa. Reviewing articles on known effects of noise on marine mammals, Weilgar (2007) concluded that short-term studies may be inconclusive due to the difficulty of interpreting findings of such studies and that long-term population studies may be the most useful tool in “relating disturbance reactions to population impacts.” In response to noise disturbance, marine mammals may alter their surface behavior (swim speed, respiration rate), reduce their foraging behavior in the presence of seismic survey activities, and other behavior variant from the observed norms, but the consequences of those behavioral changes is not understood. Weilgar (2007) also summarized literature reporting displacement of marine mammals from critical feeding and breeding grounds when exposed to industrial noise, dredging, and shipping.

Marine mammals may avoid ships if possible. Injury to acoustic organs and associated stranding represents the most extreme noise impact to marine mammals and is associated with the use of sonars operating within their range of detection. CEDA (2011) stated that construction and dredging noise occurred in a bandwith of <1 kHz and that a mid-frequency sonar bandwith is 2.8 – 8.2 kHz.

The use of blasting to deepen the port may have an effect on dolphins that are in close proximity to any blasts fired to crack rock. It is likely that any effect on dolphins outside of the proposed safety radius will be in the form of a TTS. Both the pressure and noise associated with blasting can injure marine mammals.

As with manatees, direct impacts on dolphins due to blasting activities in the project area include alteration of behavior. For example, daily movements and/or seasonal migrations of dolphins may be impeded or altered. Although an incidental take would not result from sound/noise outside of the confined underwater blast danger zone, disturbances of this nature (alteration of behavior/movements) are considered harassment under the Marine Mammal Protection Act (MMPA). It is anticipated that effects to dolphins will not differ based on which dredge depth is selected.

Utilizing data from rock-contained blasts such as those at Miami Harbor in 2005, USACE has been able to estimate potential effects on protected species. These data can be correlated to the data from work completed for the Navy by the Woods Hole Oceanographic Institute (WHOI) (Ketten 2004), and from USACE during the construction at Miami Harbor in 2005 (Hempen *et al*, 2007; Jordan *et al.* 2007) concerning blasting impacts to marine mammals. These data indicate that impacts from explosives can produce lethal and non-lethal injury as well as incidental harassment. The pressure wave from the blast is the most causative factor in injuries because it affects the air cavities in the lungs and intestines. The extent of lethal effects are proportional to the animal's mass, i.e., the smaller the animal, the more lethal the effects (Ketten 2004); therefore all data are based on the lowest possible affected mammal weight (infant dolphin). Non-lethal injuries include tympanic membrane rupture; however, given that dolphin's behavior relies heavily on sound, the non-lethal nature of such an injury is questionable in the long-term. For that reason, it is important to use a limit where no non-lethal tympanic membrane damage occurs. Based on the WHOI and the USACE Miami Harbor test data, the level of pressure impulse where no lethal and no non-lethal injuries occur is reported to be 10-12 pounds per square inch of pressure in the smallest species and 20-25 psi for larger species.

Studies by Finneran *et al.* (2000) showed that TTS and PTS in marine mammals were used to evaluate explosion impacts. Due to the fact that marine mammals are highly acoustic, such physiological impacts should be taken into account when assessing harmful impacts. While many of these impacts are not lethal and this study has shown that the impacts tend not to be cumulative, significant changes in behavior could constitute a "take" under the MMPA.

By utilizing the confined blasting technique that was used and studied at Miami Harbor in 2005, the blasting will result in the maximum pressures from the confined shooting being significantly lower than open-water shot pressures at the same charge weight. Radiation of the wave energy into rock reduces the available energy to reach the water column (Hempen *et al*. 2007). The pressures entering the water column are well below those pressures that typically propagate away from open-water (unconfined by solid media that may radiate the energy away with less harm) charges relative to charge weight per delay.

In addition to reducing the pressure wave by confining the blasts in rock, by putting in place a series of protective zones around the blast array, and monitoring the area for the presence of protected species, including bottlenose dolphins, USACE does not believe that any dolphin will be killed or injured. Hempen *et al*. (2007) also demonstrate that the pressure data collected at Miami Harbor showed that using the three zones previously described, the pressures associated with the blasts return to background levels (1 to 2 psi) at the margin of the danger zone. This means that any animal located inside the safety zone, but outside the danger zone would not be exposed to any additional pressure effects from a confined blast (Hempen *et al*. 2007, Jordan *et al.* 2007). However, to ensure that the project was being very conservative in estimation of effects to listed species, USACE assumed that the proposed action may harass dolphins by causing a TTS. As a result of this assumption, USACE will submit a request for an Incidental Harassment Authorization from the NMFS during the Preconstruction Engineering and Design portion of the project. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses. The USACE concludes that causing a TTS in an individual dolphin near a confined blast meets these criteria.

Project dredging will likely require some confined blasting to loosen rock that proves too hard for removal by cutterhead dredge. The USACE has determined the likely distribution and relative amount of rock in the various reaches of the 13 mile project area (**Figure 38**). While not all the rock in all the areas will require confined blasting, some of the material will likely require blasting to aid removal. The primary means of avoiding and minimizing impacts of explosives use is to limit the use of explosives to those locations that will not yield to any other method of material removal, and to use confined, as opposed to unconfined blasting techniques. Additional information on blasting, including marine animal protection measures, can be found in **Appendix A, Attachment D, Pre-treatment (Blasting) Plan**.

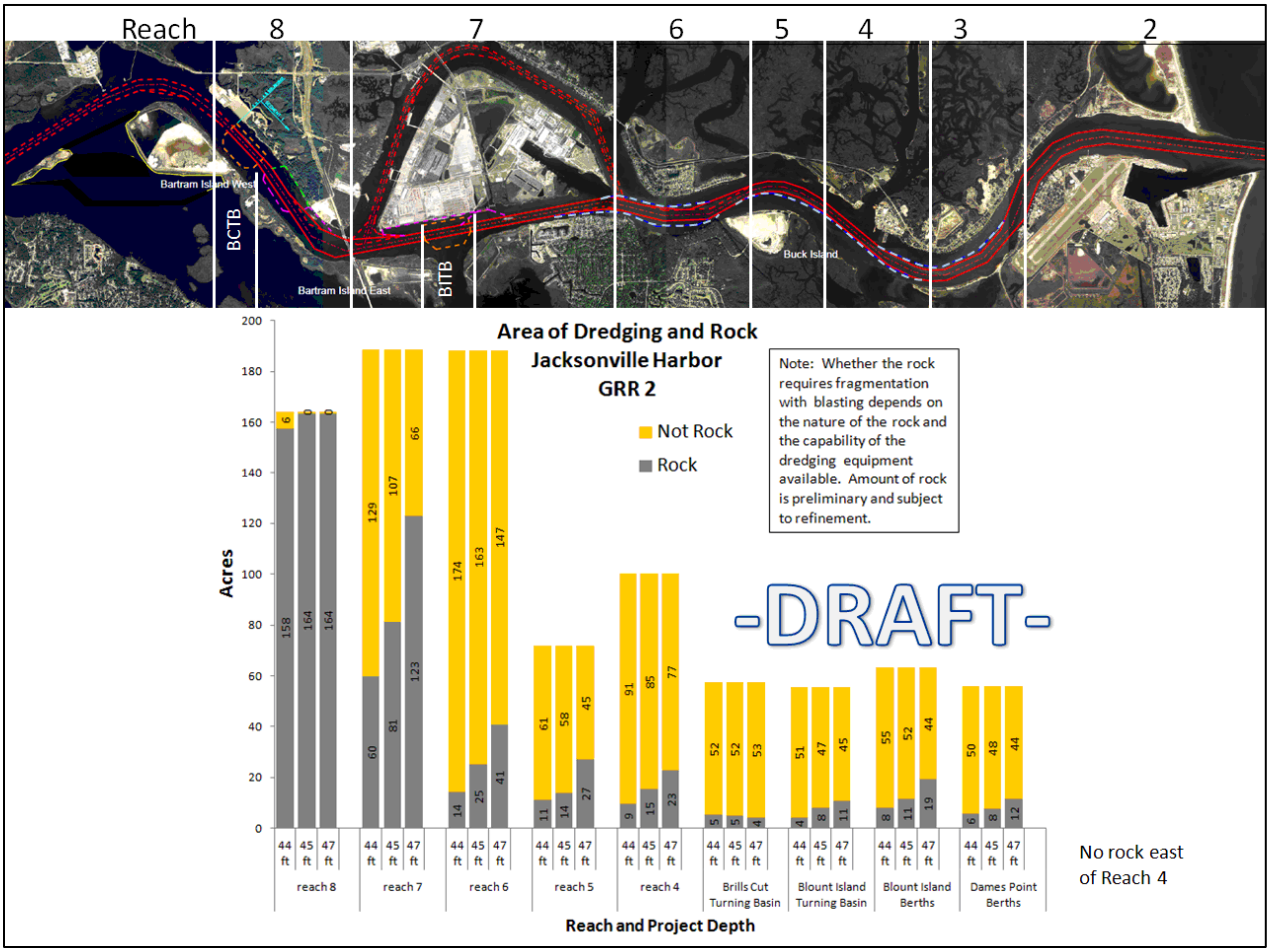


FIGURE 38: ESTIMATED DISTRIBUTION OF ROCK SUBSTRATES IN THE JACKSONVILLE HARBOR CHANNEL DEEPENING FOOTPRINT

7.3.5 Birds

A very large and diverse bird community resides in the LSJR (SJRWMD 2012). The project alternatives will cause only temporary impacts to the bird community as individuals avoid active construction areas due to noise and general activity. Since the dredging will occur in deep water (and not in wading depth) and with the very large amount of habitat available in the general project area for the full variety of bird behaviors, impacts to the bird community are expected to be temporary and minimal.

Placement of dredged material within the upland disposal areas may displace individuals using the site for foraging and resting. The large area of general habitat will allow the individuals using these sites now to change the location for these activities with minimal temporary impact. Measures would be implemented to protect nesting bird species, which include monitoring nesting habitat and buffer/exclusion zones around active nests.

7.3.6 Reptiles and Amphibians

Amphibians and reptiles present in the general project area include a range of freshwater and marine species. Within the project construction area, individuals may incur impacts from construction activity including hydraulic and mechanical dredging, blasting, and sediment placement on beaches, nearshore areas, and ODMDS. Aside from considerations regarding marine turtles (see above), the reptiles and amphibians present in the general project area will probably not incur significant impacts. Based on hydrodynamic and water quality modeling, USACE has determined that the proposed deepening would cause minor environmental changes within the preserve, and these are likely to result in insignificant impacts to reptiles and amphibians (other than considerations for sea turtles). Impacts to these categories of species from the proposed project are likely insignificant.

7.3.7 Macroinvertebrates including Shellfishes

Macroinvertebrates and shellfish occur over the entire project area. The majority of the benthic habitat is unvegetated and the species present are largely sessile or weakly motile. Changes to salinity, if sufficiently large, can incur impacts in a very short period. However, the high fecundity of most of these species will likely result in a standing stock to be replaced in a relatively short timeframe. Salinity increases occurring over longer timeframes will probably result in the replacement of salinity intolerant species with more salinity tolerant species in the same general taxonomic categories. Shifts from freshwater to more saline conditions will most likely reduce the number of insects, freshwater mussels and mollusks, and result in an overall decline in the number of taxa (Montagna et al 2011). Analysis of maximum bottom salinities simulated for a six year period (see **Appendix D:** Ecological Modeling) showed relatively small upstream advances of maximum salinities. Increasing channel depth alternatives resulted in incremental, small upstream advances in salinities. Inter-annual differences in salinity zone sizes were in general much greater than differences between project alternatives. The baseline and 50-year horizon without-project conditions provided the greatest fraction of the total differences in maximum bottom salinity zone comparisons of current and 50-year horizon conditions (Taylor 2013a)

If changes are considered in terms of percentage area lost or gained, comparisons of baseline conditions compared to 50-year horizon alternatives show that the greatest change occurs in the <5 ppt zone, followed by the 24 ppt to 30 ppt (**Figure 39**). The negative change in the 24 ppt to 30 ppt range most likely show the effect of the physical characteristics of that portion of the river (between about River Mile 17 and River Mile 24) including a large sill where the river bed changes elevations from 40 feet to 50 feet (NAVD) to 20 feet to 15 feet (NAVD). The narrowness of the river and the abrupt change in elevation probably result in less circulation and mixing in that portion of the river. The loss of area occurs as salinity increases at the downstream end of the 24 ppt to 30 ppt zone without expanding significantly at the upstream end of the zone.

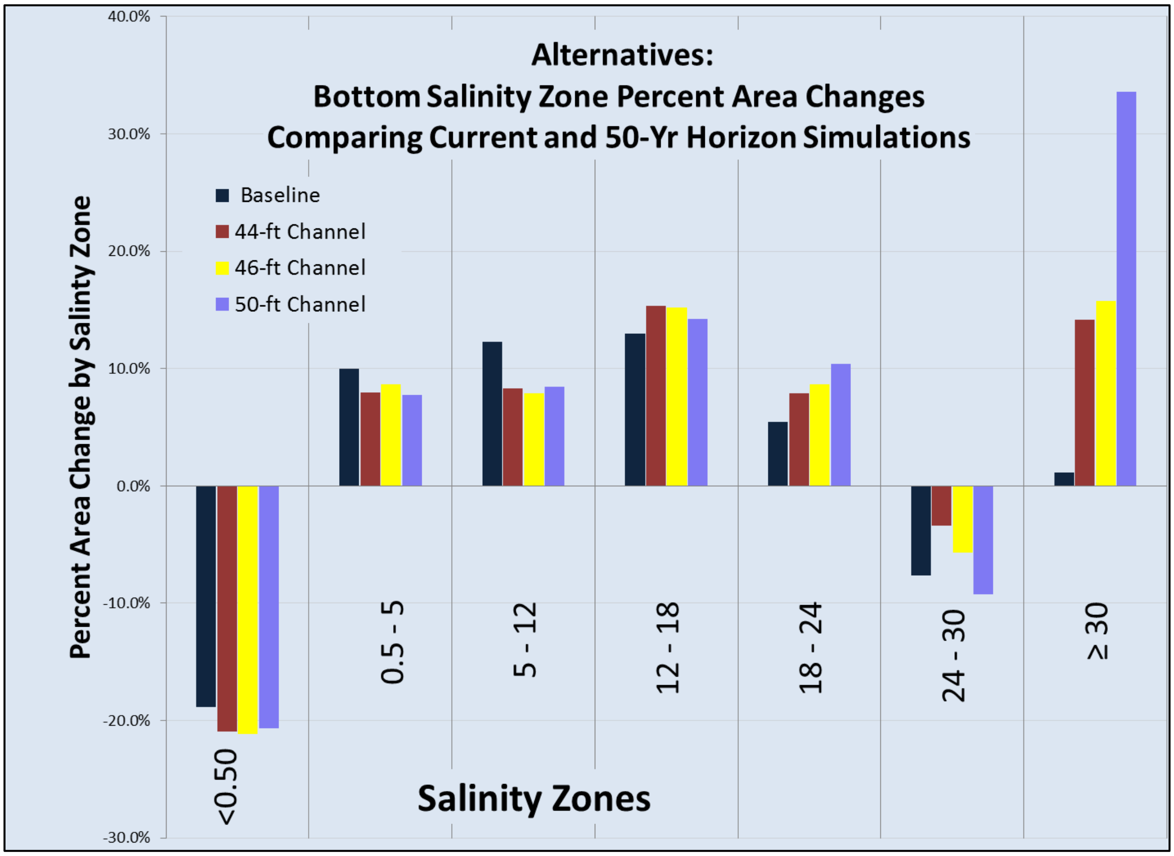


FIGURE 39: PERCENT CHANGE IN BOTTOM SALINITY ZONE AREAS: COMPARISON OF CURRENT AND 50-YR HORIZON SALINITY SIMULATION RESULTS

Benthic macroinvertebrates (BMI) densities show relatively little change with the various alternatives, as discussed in **Appendix D**. The greatest densities occur in salinities <0.5 ppt. The greatest diversity and density of BMI occurs in SAV. Therefore, impacts to SAV will have a larger per unit area impact on macroinvertebrates than salinity changes in other habitats (e.g., unvegetated bottom, water column, emergent wetlands). However, SAV represents a small fraction of the total BMI habitat area and impacts to SAV appear minor (see **Section 7.3.10** and **Appendix D**).

Shrimp and blue crab are commercially and recreationally desirable macroinvertebrates whose habitat may expand as a result of increased salinities. MacDonald et al (2009) found that blue crabs were not concentrated in the river by season or size, suggesting that increases in salinity would not result in significant impacts to that species. "Shrimp" represents three species including white, brown, and pink shrimp that use unvegetated and vegetated estuarine wetlands, open, unvegetated benthic sediments, and the water column. Assuming that increases in salinity will increase areas of estuarine marsh, and will not impact the existing estuarine marshes at the river mouth, these species should not be impacted by deepening. Considering effects of upstream water withdrawal on blue crab abundance, the SJRWMD (2012) concluded that salinity increases in the LSJR could result in increases in the blue crab population.

The three commercially harvested shrimp species found in the LSJR are more seasonally variable than blue crab, but are similarly tolerant of a wide range of salinities; nauplii through post-larval stages are tolerant of a wide range of salinities and salinity with optima near marine conditions. Shrimp are harvested almost solely in the nearshore waters of the Atlantic near the river mouth, but the populations are assumed supported by the St. Johns River estuary. Sampling conducted by the USFWC (MacDonald et al. 2009, Brodie et al. 2013) verified the presence of significant populations of all three commercial shrimp species in the LSJR. Analysis of salinity simulation results suggested that the dredging alternatives will not change salinity regimes sufficiently in the LSJR mainstem to significantly impact the shrimp populations (**Appendix D**).

The salinity changes brought about by the project are estimated to be minor, particularly in the first 13 miles of the river closest to the ocean. Salinity modeling of the river and tributaries in the Timucuan Ecological and Historic Preserve (TIMU) indicated little change in water elevations or salinities. Note that TIMU houses the largest oyster reef community in the Jacksonville area (Anderson et al 2005). Other potential stresses include eutrophication, toxicants, and overharvesting. The project construction will not produce significant amounts of pollutants and increased management of pollutants from ships (e.g. bilgewater pumping) is now, or will in the future reduce pollutants from these sources. See **Appendix D and Appendix A**, **Attachment M Marsh Modeling** for an analysis of potential salinity changes in the marshes adjacent to the river. Changes to the sediment load should be similarly minor, and should not result in negative impacts to species that are strongly influenced by those factors, such as oysters and other shellfish that live in the shallow channels and vegetation of the marshes bordering the river.

After reviewing the available literature on the subject of blasting effects on invertebrates, Keevin and Hempen (1997) concluded that “invertebrates are insensitive to pressure related damage from underwater explosions.” They concluded that gas-containing organs are a primary source of internal damage to aquatic and marine organisms found in the vicinity of blasts. Since invertebrates have no gas organ they should incur much less impact except when extremely close to a blast location.

7.3.8 Other Wildlife Resources (Fish)

Potential fisheries impacts to freshwater species may occur due to salinity changes that reduce freshwater and low salinity zones and increase higher salinity zones. Losses of SAV from increased salinity would result in lower quality habitat for a wide variety of fish species. Changes in circulation patterns may result in potential for phytoplankton blooms and resultant declines in dissolved oxygen (SJRWMD Chapter 12).

Salinity simulations provided a basis to assess potential changes in riverine salinity within the SEIS study area. **Appendix D** (Ecological Modeling Report) provides a detailed analysis of changes in riverine salinity simulations for the years 1996 through 2001. Six salinity zones (<0.5 ppt, 0.5 to 12 ppt, 12 to 18 ppt, 18 to 24 ppt, 24 to 30 ppt, ≥ 30 ppt) were used to assess salinity changes. Similar to the maximum bottom salinities, maximum water column salinity zones varied greatly to year (**Figure 40**). This variability was greater than changes in area resulting from the different alternatives (**Figure 30**). **Appendix D** also provides a plan view of the salinity zones in the river. Upstream salinity movements of salinity zones for the various years could be relatively dramatic, with a loss of the <0.5 ppt zone in dry years. Salinity zone location shifts due to project alternatives were relatively small by comparison.

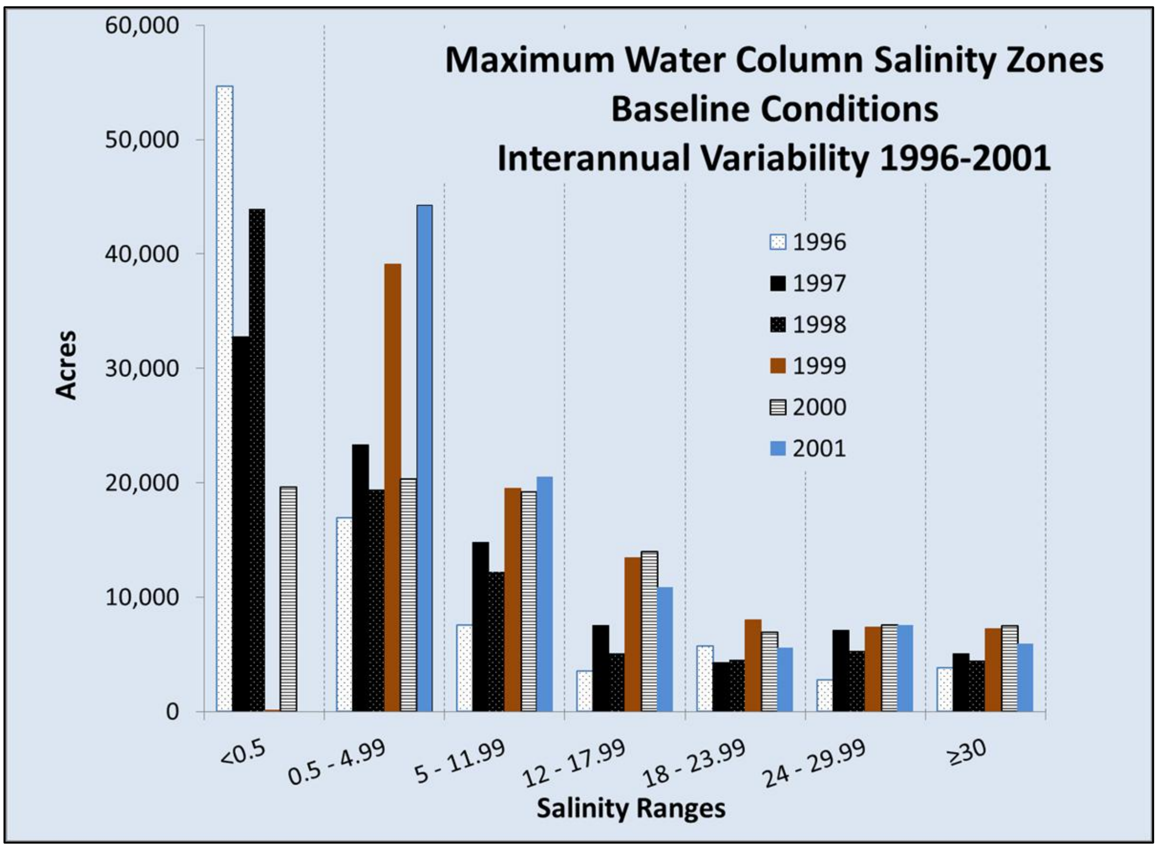


Figure 40: Inter-annual Variability of Salinity Zone Areas for Baseline Conditions

Assuming that the analyses provided in **Appendix D** and briefly summarized here represent the likely general effects of the project alternatives, impacts to fish populations will be minor, with changes most likely represented by small losses of freshwater habitat area and parallel gains in estuarine habitat.

Brodie et al. (2013) provide additional analyses of salinity population center relationships between species or “pseudospecies” (combinations of a fish species and month of collection, size class, and collection gear). Analysis of 38 pseudospecies’ results (**Appendix D: Ecological Modeling for Jacksonville Harbor Deepening GRRII: Table 5.2**) identified the pseudospecies central tendency of salinity habitat range (25% to 75% of full salinity range). The river area examined included 32,580 acres of mainstem channel defined in the salinity modeling mesh between Julington Creek and the river mouth at the Atlantic Ocean. The boundaries were defined by the USFWC pseudospecies data used for the analyses (Brodie et al 2013).

In general, the project alternative salinity simulations produced small shifts in the size and locations of pseduospecies salinity zones in the river. These shifts occurred as loss of some downstream habitat and expansion of the upstream habitat space. Percent of habitat area (acres) lost typically ranged in the 3% or less range, with occasional net expansions in habitat space and occasional losses and gains larger than 3% (e.g. **Figure 42**). The 2018 and 2068 salinity habitat changes showed similar patterns (e.g. **Figure 42**). These changes were smaller than the year-to-year variation in salinity zones, driven by variations in upstream inflows. Most often, large habitat area gains or losses were associated with relatively small 2018 Baseline or 2068 future without-project (FWOP) habitat space (**Figure 42**).

Habitat space losses in Mill Cove (e.g., for a bay anchovy pseudospecies) represented the loss in shallow water habitat that could occur in the most downstream portion of the LSJR, where mainstem shallow water habitat is less common than deep water open channel habitat. This particular habitat loss did not occur as a common or dominant pattern in salinity habitat shifts. Mill Cove was the most apparent area of change, where LPP salinity simulations resulted in the shift of ten fish pseudospecies salinity habitats partially or totally out of Mill Cove (see **Appendix D**). However, an additional five pseudospecies with 2018 baseline habitat partially or totally covering Mill Cove were not affected. It is likely that if shifts in portions of a fish species’ life stages shift out of Mill Cove (or any other particular area) another species will partially or completely replace the standing stocks found in the without-project condition. In addition, habitat loss from Mill Cove muddy bottom shallow water habitat was made up, at least in part, with shallow muddy bottom habitat gains at the upstream end of pseudospecies habitats. In, the bay anchovy pseudospecies experienced a net loss of habitat, as upstream expansion did not offset downstream losses. Many additional pseudospecies salinity habitat findings are detailed in **Appendix D**. Commercial and recreationally important species followed the same patterns described above (**Appendix D**). The data analyses suggested at most, minor impacts to pseudospecies tested.

The salinity habitat analyses identified small salinity habitat shifts, primarily negative (by loss of downstream habitat without equal upstream expansion) for pseudospecies representing fishes performing important ecological, commercial, and recreational functions. In some cases the analysis also identified small gains in habitat space. The results did not suggest a major loss in important habitat space, but where that did occur, such as loss of habitat in Mill Cove, upstream habitat expansion at least partially offset that loss. Finally, it is important to remember that each pseudospecies represented a collection of a particular species size class during one calendar month with one type of gear. Comparisons of sets of all pseudospecies for each species collected did not reveal patterns of major salinity habitat spaces losses or gains. In fact, most of the pseudospecies sets revealed small gains and losses, depending on the pseudospecies.

Salinity simulations for the Timucuan marsh, Cedar/Ortega rivers, and Julington/Durbin creeks indicated the Recommended Plan (47-foot) would cause small to negligible changes in salinity in these areas. The predicted salinity changes are unlikely to affect fish populations in these marsh and tributary systems.

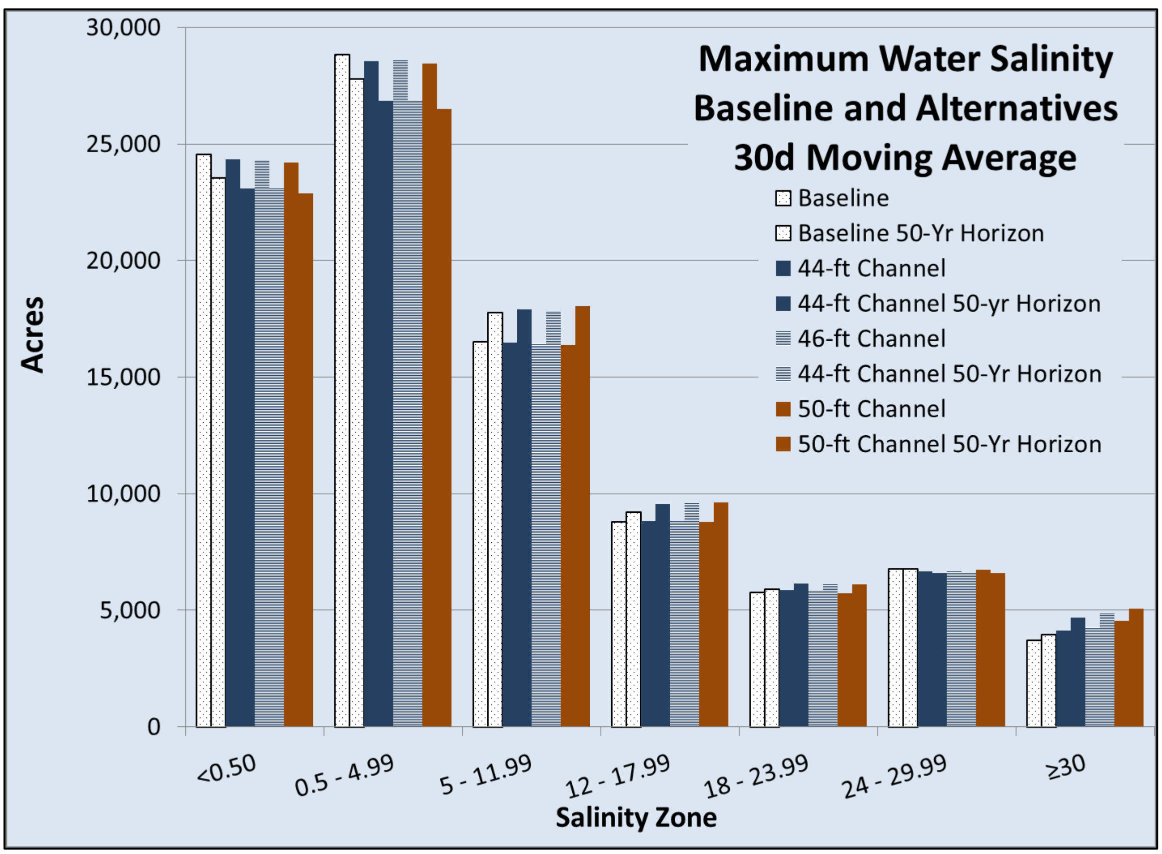


FIGURE 41: SALINITY ZONE AREA CHANGES, ALL ALTERNATIVES

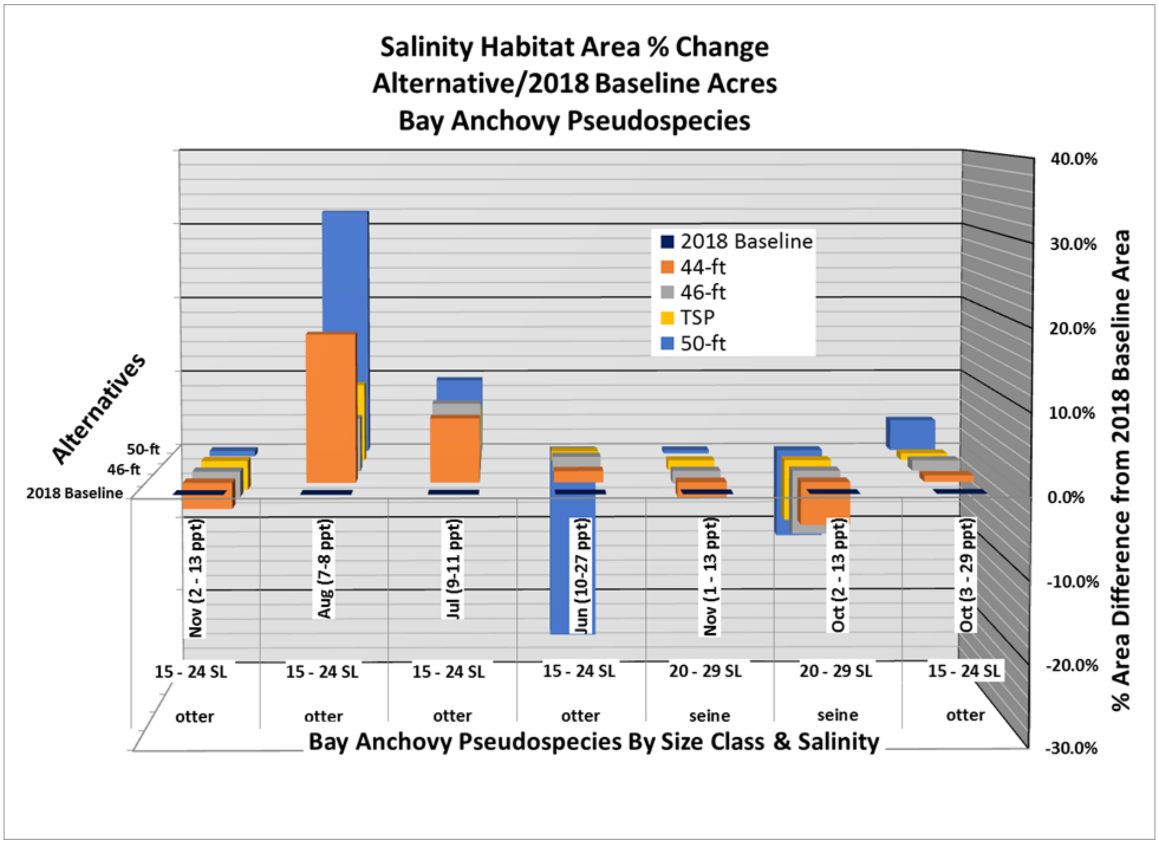


FIGURE 42: BAY ANCHOVY PSEUDOSPECIES PERCENT AREA CHANGES – 2018 BASELINE AND OTHER ALTERNATIVES. SL – STANDARD LENGTH

For additional information on salinity changes and impacts see **Appendix D**.

7.3.9 Wetlands

<u>Wetlands Modeling</u>

Neither the no-action alternative nor the project alternatives will directly affect wetlands in the LSJR. Wetlands do not occur within the project dredging templates.

By altering salinity distribution in the LSJR, however, the project alternatives will indirectly affect wetland communities. Taylor (2013a) describes the potential effects of project-induced salinity changes on wetland communities. Hydrodynamic modeling was used to estimate potential salinity changes along the river's edge. Salinity changes were then evaluated based on recently analyzed results of a decade-long wetland monitoring study from the lower Cape Fear River in North Carolina (Hackney 2013), together with field observations of wetland vegetation distribution and salinity stress indicators in tidal wetlands of the LSJR.

Hackney's (2013) monitoring data followed deepening of the Cape Fear River navigation channel and indicated that increased salinity associated with increased tidal flux from a long history of channel modifications and rising sea level resulted in a transition of wetland communities from temperate tidal swamp to tidal marsh. Hackney described a transition zone from tidal swamp to tidal marsh defined by the frequency of occurrence of high tide salinity exceeding 1.0 ppt. Cape Fear tidal swamps occurred where less than 12% of high tides resulted in >1 ppt salinity. Tidal marsh "dominated by species of herbaceous vascular plants with varying tolerance to saline water" occurred where more than 25% of high tides exceeded 1 ppt salinity. The zone between 12% and 25% frequency of 1 ppt high tide salinity defined a transition area in which freshwater vegetation exhibited salt-stress and salt intolerant vegetation disappeared from the wetlands. Based on the results of the LSJR salinity models and field observations of tidal wetland vegetation in the LSJR, the tidal swamp to tidal marsh transition in the LSJR appears to follow a pattern similar to that documented in the Cape Fear River (Hackney, C.T., 2013, personal communication). This pattern provides the basis for assessment of salinity-induced effects on wetlands in the LSJR. The reader should refer to Taylor (2013a), for an in-depth discussion of the LSJR wetlands assessment based on the above salinity frequency.

Hydrodynamic model simulation of the no-action alternative indicated that salinity greater than 1 ppt occurs at 12% or less frequency south of the Shands Bridge (River Mile 50). High tide salinity >1 ppt occurs at 25% or greater frequency north of Black Creek (River Mile 44.5). Thus, the transition zone from tidal swamp to tidal marsh with the no-action alternative spans approximately 5.5 river miles from the Shands Bridge to Black Creek

For all of the project alternatives, the location of the >25% frequency of 1 ppt high tide salinity does not differ from the no-action alternative. The location of the <12% frequency of 1 ppt high tide salinity moves about 0.5 mile downstream on the east side of the river relative its location for the no-action alternative. The overall effect of the project alternatives may shorten the tidal swamp to tidal marsh transition area by about 0.5 miles on the east side of the river. Freshwater inflow from Black Creek may prevent higher salinity water from moving farther upstream on the west side of the river.

Moving downstream from the swamp to marsh transition area, tidal marshes along the LSJR main stem contain increasing abundance of salt tolerant vegetation. Based on the Florida Land Use, Cover, and Forms Classification System (FLUCCS) codes in the SJRWMD 2009 land use GIS data set, tidal marshes downstream (north) of the Fuller Warren Bridge are nearly all salt marsh. Increases in salinity are unlikely to affect these salt marsh wetlands. However, the vegetative composition of tidal marshes between the Fuller Warren Bridge and Black Creek may shift to include greater abundance of salt tolerant vegetation. The most highly salt-sensitive vegetation could disappear as salinity increases in these wetlands. Wetland soils could be affected by increased sulfate content of saline water, resulting in decomposition of soil organic matter and subsidence of the soil surface (Hackney, C.T., personal communication, March 2013). The combination of vegetation and soil changes may result in altered wetland appearance and function.

With any of the project alternatives, the southern boundary of wetlands with FLUCCS classification "saltwater marshes" may shift upstream, but the magnitude of change cannot be reliably predicted. Wetland field data collection would be required to identify these changes.

Salinity changes in the LSJR main stem could potentially affect tributary wetland communities. Tributary salinity models of the Timucuan marsh, Cedar/Ortega rivers and Julington/Durbin creeks showed that the Recommended Plan would cause only very small changes in salinity relative to the 2018 Baseline (Taylor 2013d). The proposed project would likely have negligible effect on wetlands in these tributary systems. Salinity distribution in tributaries is also affected by upstream freshwater runoff, groundwater seepage, soil surface elevations, and other factors.

For additional details concerning salinity changes see **Appendix D** on ecological models.

<u>Wetlands Effects Assessment</u>

As previously stated, none of the project alternatives will directly affect wetlands in the LSJR as they do not occur within the project dredging templates. The model results indicate that the proposed project would have minor effects on the wetlands within the LSJR. Slight increases in average salinity within mesohaline and/or polyhaline salt marsh areas would have a negligible effect on these wetlands. These areas already experience wide swings in salinity, with values that approach marine salinities during dry periods, and minor salinity increases (i.e., 0.2 ppt) are not likely to cause changes to existing wetlands. There could be minor effect on aquatic species distribution for those that utilize these areas. Within the oligohaline zone, average salinity levels were predicted to rise from 0 to 0.1 ppt. Changes of this magnitude should cause extremely minor changes in vegetation composition or structure, including tree stress or senescence, and should not lead to any quantifiable increase in sulfur reduction, soil mineralization or other soil effects that would alter the ecology of the area. No changes in average salinity concentrations have been predicted within the tidal freshwater zone.

The interagency Uniform Mitigation Assessment Method (UMAM) functional analysis did not identify any functional units of compensation that would be required to replace or substitute for unavoidable losses of wetlands as the effects would be less than the quantifiable threshold. In order to cause a functional loss in one of the three effect categories in UMAM, the effect must be on a 10% order of magnitude, or at least a 1 on a scale of 0 to 10. The effects on wetlands would not be of this magnitude. In order to establish a target or measure to ensure compensatory mitigation is sufficient to offset any loss of functional value that may occur, an elevated delta of 0.1 was established for each of the three UMAM categories, representing the most minimal effect that could be quantified. The delta was applied to the acreage for each area of potential effect, with those scores then being summed to provide a total number of functional units to offset any project effects. The results indicate that 39.46 units of compensatory mitigation would be the target to ensure the base mitigation plan is sufficient to offset any loss of wetland functional value (see Table 50).

Table 50: Elevated delta of 0.1 and wetland acreage for each area of potential effect to calculate a representative number of functional units to offset any project effects

Wetland Area	Delta	Affected Acreage	Impact (Units)
Mainstem	0.1	96.07	9.61
Ortega River	0.1	73.74	7.37
Trout River	0.1	21.90	2.19
Pottsburg Creek	0.1	11.27	1.13
Cedar Creek	0.1	16.77	1.68
Dunn Creek	0.1	4.07	0.41
Julington Creek	0.1	108.48	10.85
Durbin Creek	0.1	62.27	6.23
Total		394.57	39.46

Mitigation is being proposed to offset minor wetland effects that may occur as a result of the proposed project (see Appendix E). The plan consists of purchasing conservation lands. The USACE will continue to coordinate with regulatory agencies on other mitigation options including wetlands restoration opportunities. Also, a Corrective Action Plan (CAP) has been developed. The CAP provides a methodology to evaluate whether project effects are exceeding those that were predicted by the models. If it is determined that additional effects are indeed occurring, then the CAP specifies additional compensatory mitigation may be implemented. A more thorough description of the project effects, assessment methodology, and mitigation proposed are included in Appendix E of this report.

7.3.10 Submerged Aquatic Vegetation (SAV)

Neither the no-action alternative nor the project alternatives will directly affect SAV communities in the LSJR. SAV does not occur in the deep, highly saline waters of the project channel.

However, the downstream extent of LSJR SAV beds occurs in the vicinity of River Mile 25, south of the Fuller Warren Bridge (SJRWMD 2012). *Vallisneria americana* dominates the sparsely distributed SAV beds. Upstream of this area, SAV beds gradually become more abundant with *V. americana* continuing as the dominant species. The distribution of SAV in the LSJR from the River Mile 25 up to River Mile 37 is strongly influenced by fluctuating salinity and light (i.e., low light during highly turbid periods) stresses. The no-action alternative would not affect salinity and light stress to SAV.

<u>SAV Modeling</u>

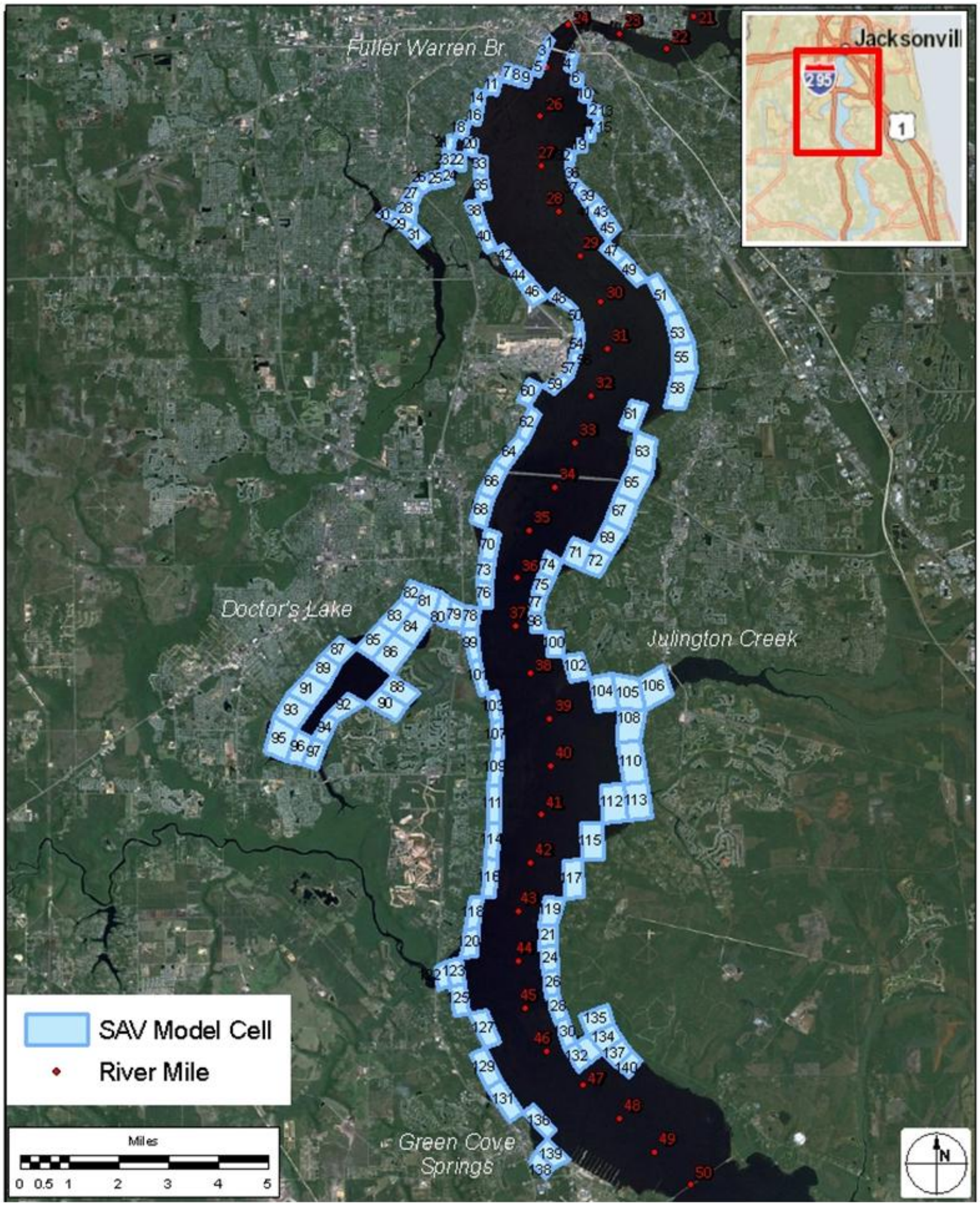
The project alternatives will cause increased salinity in the LSJR upstream of the project area and increase salinity stress to SAV in the northern part of its range. Using the results of hydrodynamic models of the project alternatives, an ecological model developed by the SJRWMD was applied to evaluate salinity stress on SAV resulting from the project alternatives and to compare stress levels to baseline (i.e., no-action alternative) stress levels (Taylor 2013a). The remainder of this section discusses impacts of the project alternatives based on the results of the ecological model. The reader should refer to Taylor (2013a), included as **Appendix D**, for an in-depth discussion of the SAV ecological model.

The ecological model estimated SAV salinity stress in 140 littoral zone model grid cells from about River Mile 24.5 (Fuller Warren Bridge) to River Mile 48 (Green Cove Springs). **Figure 43** shows the model grid cells. The model simulated conditions for a six-year period (1996 – 2001) based on recorded rainfall, runoff, and other data. The EFDC hydrodynamic models of the no-action and project alternatives provided 90-day average salinity values for each grid cell which were used to assign a daily salinity stress category — no effect and low, moderate, or extreme stress — to each cell. Dobberfuhl et al. (2012) reported the visible effects of these stress categories as:

- No effect: no adverse effect from salinity stress
- Low stress: minor decline in SAV bed spatial coverage
- Moderate stress: obvious decline in SAV bed coverage
- Extreme stress: loss of most or all above-ground SAV biomass

Notably, the model predicts salinity stress in cells which represent potential SAV habitat. SAV do not occur uniformly in the cells and, when present, usually occur within 50 meters of shore. The model cell widths are 4 to 6 times wider than the typical SAV bed width and therefore overestimate the acreage of potential SAV habitat. Dobberfuhl (2012) adjusted model-predicted stress acreages by a factor of 0.25 to account for the overestimate.

FIGURE 43: SAV EVALUATION CELLS



Generally, the models showed that increasing project depths result in increased SAV salinity stress upstream to River Mile 35 (about 2.5 miles south of the Buckman Bridge).

SAV exposed to moderate or extreme stress is most likely to experience adverse effects which “significantly reduce” its ecological function (Dobberfuhl et al., 2012). The model predicts little change in the area of the LSJR subject to no salinity stress for any of the simulated project conditions. The only change in the no stress area occurs, with all project alternatives, on the west side of the river immediately south of the Buckman Bridge (River Mile 34 to 35) where one model cell changes from no stress to >0 to 5% stress frequency. Downstream of the Buckman Bridge, stress frequencies progressively increase with increased simulated channel depths.

Table 51 lists the average area of potential SAV habitat affected by each of the four salinity stress conditions for the no-action and project alternatives (from Taylor 2013a). The average acreages (i.e., the sum, for the six-year simulation period, of the daily total acres under a stress condition divided by the total number of simulation days) are adjusted from the model-predicted acreages by a factor of 0.25 to account for the model’s overestimate of potential SAV habitat acreage. Though the averages do not consider the influence of frequency or duration of the salinity stress conditions on the SAV community, they provide a simple method of comparing overall effects of the project alternatives relative to the no-action alternative. For example, under the no-action alternative, the model predicts that an average of 16 acres of SAV habitat would be subjected to “extreme” salinity stress. The 47-foot project would result in 20 acres of SAV habitat subjected to “extreme” salinity stress, which is an increase of four acres.

The model-predicted SAV stress conditions allow comparison of the magnitude of effect of the project alternatives. They do not provide a means of addressing the effects of temporal distribution of the stress condition on SAV. Nonetheless, as the duration or frequency of salinity stress increases, the ability of SAV to recover from the stress diminishes.

Table 51: Potential SAV Habitat Area Subject to Salinity Stress

	Potential SAV Habitat Area (acres/day)				
Stress Condition	no-action	44 ft Project	46 ft Project	47 ft* Project	50 ft Project
No Effect	2,720	2711	2,706	2,709	2,691
Low	592	593	595	593	601
Moderate	158	163	165	164	170
Extreme	16	19	21	20	24

*Note that the 47-foot project simulation assumed that the proposed deepening would occur from River Mile 0 to River Mile 13. The other three alternatives (44 feet, 46 feet, 50 feet) assumed that the proposed deepening would occur from River Mile 0 to River Mile 14, which would result in slightly greater increases in salinity and a slightly greater SAV acreage subjected to salinity stress.

SAV Effects Assessment

The model results indicate that the proposed project would have minor effects on SAV within the LSJR. These minor effects were determined to be too small to quantify using the Uniform Mitigation Assessment Methodology (UMAM) tool. However, increases in moderate to extreme stress frequency to SAV would range from 0% to 3% within the project effects area. Changes of the predicted stress frequencies could cause minor changes in SAV bed abundance and composition. The SAV beds in this area already experience multiple stressors such as salinity and turbidity variability that affect distribution and abundance .

Based on the SAV model results and on recent SJRWMD SAV mapping, USACE conducted a UMAM evaluation of the proposed project effects on SAV (See **Appendix E, Mitigation Plan**. The UMAM functional analysis did not identify any functional units of compensation that would be required to replace or substitute for unavoidable losses of SAV as the effects would be less than the quantifiable threshold. In order to cause a functional loss in one of the three effect categories in a UMAM analysis, the effect must be on a 10% order of magnitude, or at least a 1 on a scale of 0 to 10. The effects on SAV would not be of this magnitude. In order to establish a target or measure to ensure compensatory mitigation is sufficient to offset any loss of functional value that may occur, an elevated delta of 0.1 was established for each of the three UMAM categories, representing the most minimal effect that could be quantified. The delta was applied to the acreage for each area of potential effect, with those scores then being summed to provide a total number of functional units to offset any project effects. This was performed for SAV effects predicted by the model. The results indicate that 18.05 units of compensatory mitigation would be the target (see Table 52).

Table 52: Elevated delta of 0.1 and SAV acreage for each area of potential effect to calculate a representative number of functional units to offset any project effects

SAV Zone	Delta	Affected Acreage	Impact (Units)
1	0.1	2.9	0.29
2	0.1	100.1	10.01
3	0.1	67.3	6.73
4	0.1	10.2	1.02
Total		180.5	18.05

Mitigation is being proposed to offset minor SAV effects that may occur as a result of the proposed project (see Appendix E). The plan consists of purchasing conservation lands. The USACE will continue to coordinate with regulatory agencies on other mitigation options including SAV restoration opportunities. Also, aCorrective Action Plan (CAP) has been developed. The CAP provides a methodology to evaluate whether project effects are exceeding those that were predicted by the models. If it is determined that additional are indeed occurring, then the CAP specifies additional compensatory mitigation that may be implemented. A more thorough description of the project effects, assessment methodology, and mitigation proposed are included in Appendix E of this report.

7.3.11 Phytoplankton

Phytoplankton communities in the LSJR could experience short-term reduction in productivity due to turbidity generated by dredging. Turbidity could also have a short-term impact on phytoplankton at the ODMDS. Such effects, occurring with the no-action alternative and the project alternatives, would not be significant.

The no-action alternative would not cause indirect effects to phytoplankton communities. The project alternatives could indirectly affect phytoplankton by altering salinity and water residence time in the LSJR. The upstream shift of salinity gradients predicted by the hydrodynamic models (Taylor 2013c) indicates that marine phytoplankton species could be distributed slightly farther upstream. The downstream limit of occurrence of freshwater phytoplankton species would shift slightly upstream.

In addition to shifts in phytoplankton community composition, phytoplankton abundance could be affected by changes in water residence time. The LSJR is subject to phytoplankton "blooms" in which phytoplankton abundance increases to levels that adversely affect water quality. Phytoplankton blooms may cause dissolved oxygen depletion, shade SAV beds, and, depending on the species composition of the bloom, release toxins that can affect fish, wildlife, and humans. Provided phytoplankton are not nutrient or light limited, increased water residence time, or "water age", may encourage algal bloom development by minimizing plankton cell dispersal and allowing accumulation of algal biomass.

Section 7.2.7.3 discusses water age results at four locations, including Dames Point, Acosta Bridge, Buckman Bridge, and Shands Bridge, from the EFDC simulations of the harbor deepening alternatives. Relative to the no-action alternative, the project alternatives could cause slight increases or decreases in the likelihood of exceeding a given water age. Generally, the alternatives change the likelihood of exceeding a given water age value by less than 0.5 percentage points.

Figures 44 and **45** show time series plots of simulated water age at stations near Mandarin Point and Racy Point. The tightly overlapping plots of the 2018 Baseline and project alternatives illustrate the very minor influence of the projects on water age.

Potential project effects on algal bloom metrics – chlorophyll-a and dissolved oxygen were evaluated with the CE-QUAL-ICM water quality model (Taylor 2013a). The results of the water quality model simulations indicate that the proposed project will cause little or no adverse impact on chlorophyll a or dissolved oxygen.

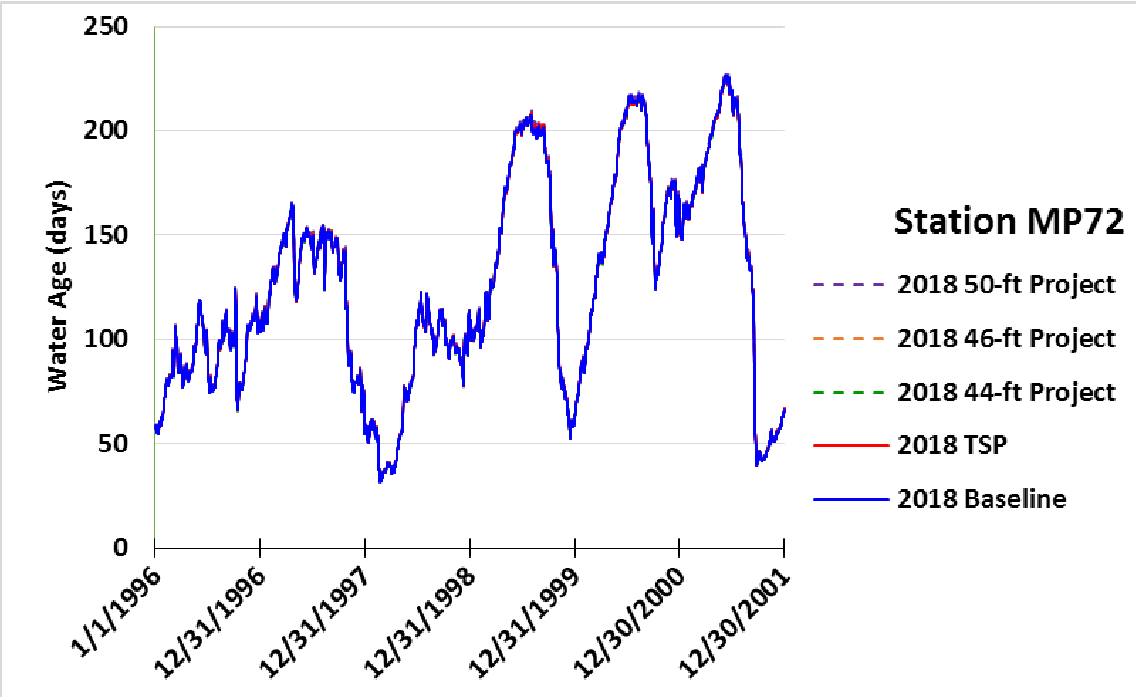


FIGURE 44: WATER NEAR MANDARIN POINT FOR 2018 BASELINE AND PROJECT ALTERNATIVES

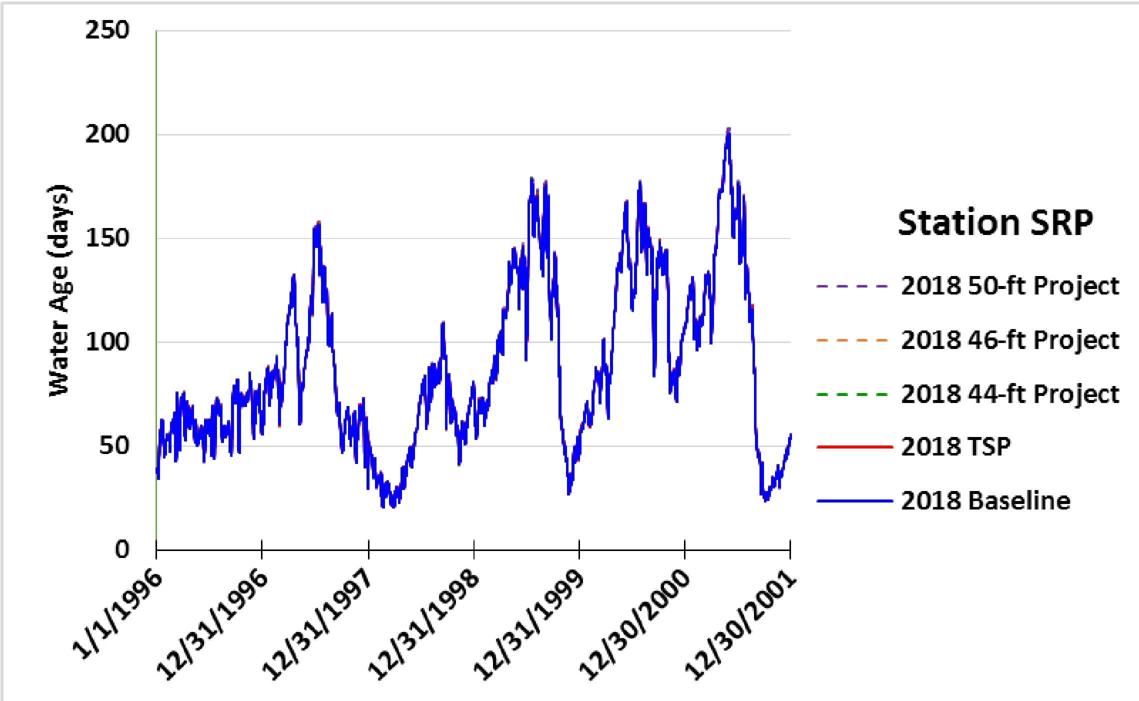


FIGURE 45: WATER AGE AT RACY POINT FOR 2018 BASELINE AND PROJECT ALTERNATIVES

7.3.12 Invasive and Exotic Species

Recent Federal regulations require the shipping industry to implement better control of the invasive species introduction pathway through the ballasts of ships (U.S. Coast Guard, 2012). These new regulations should decrease the rate of which invasive species are introduced to the study area, as well as other US port areas.

If the deepening project is not completed, then existing aquatic and terrestrial invasive species may expand in distribution and new invasive species may be introduced into the area. The USACE has determined that the no-action plan would result in a greater increase in deep draft vessel transits through Jacksonville Harbor as compared to the Recommended Plan (47-foot LPP). The Recommended Plan should result in larger, but fewer, deep draft vessels transiting through the harbor. Evidence for the continued increase in the number of different aquatic invasive species can be found by comparing historic and more recent numbers in the state of the Lower St. Johns River State of the River Reports. **Figure 46** indicates that over time there has been a trend of increasing numbers of invasive aquatic species, and if this project does not occur (the status quo is maintained) then it would be expected that current increasing trends in aquatic invasion numbers would continue, although the rate of introduction may decrease with the new ballast water regulations in place.

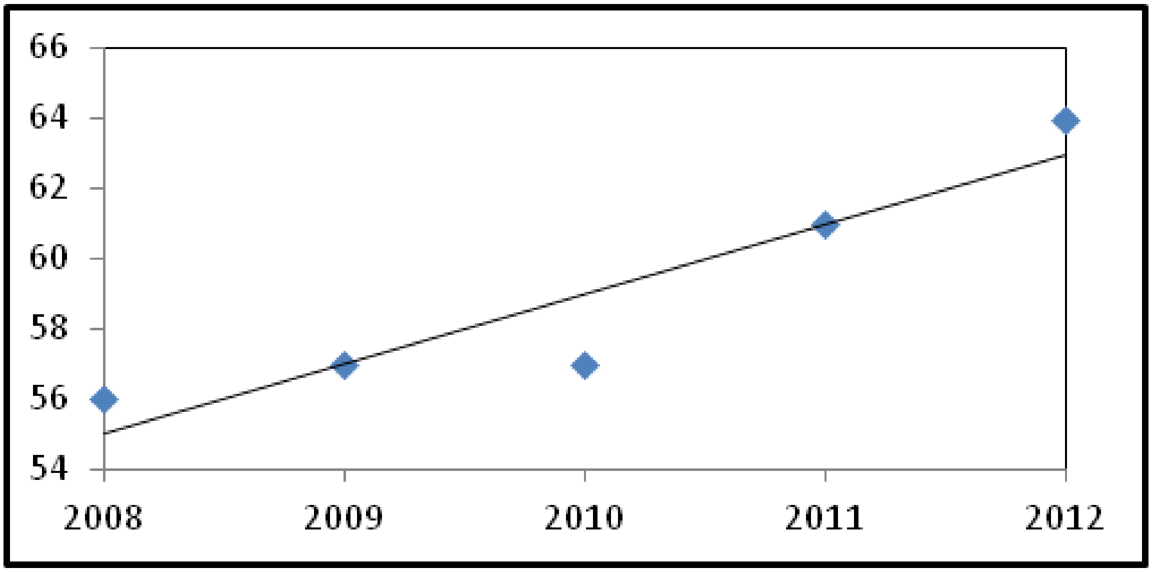


FIGURE 46: NUMBER OF AQUATIC INVASIVE SPECIES IN THE LOWER ST. JOHNS RIVER

Completing the Jacksonville Harbor Deepening project may cause a shift in the upstream salinity values and may cause a minor shift in the location of various salinity levels, which could affect the environmental boundaries for different species, including Invasive species. A change in the salinity gradient may cause a shift in habitat types. This environmental shift may present an opportunity for an invasive species to take advantage of the environmental disturbance. As previously stated, hydrodynamic modeling predicts that the proposed deepening would cause minor changes in salinity to increase in a portion of the study area. The potential shift in salinity boundaries is discussed in detail in **Section 7.2.6** and **Appendix A** of this document.

If an offshore placement area is selected and the material to be placed within the area contains material that is unconsolidated, then there should be no effect on the aquatic invasive species in the area. However, if rocky material is placed offshore, then Lionfish (*Pterois volitans*, and *Pterois miles*) may utilize this area.

For upland placement sites it is expected that there would be no effect on aquatic invasive species. Terrestrial invasive species will take advantage of the habitat disturbance caused by the placement of material in upland sites. As discussed in **Section 2.3.13**, there are 32 invasive plant species that have been recorded within one mile of the project area, and multiple sightings for individual species indicating established populations. It is expected that some of these invasive plant species will take advantage of the habitat disturbance caused by placement of dredged material and expand their current habitat. The USACE will continue to coordinate with the agencies, and expand on the current monitoring efforts in the area to eliminate and/or control invasive plants. **Section 2.3.13** refers to different efforts to identify areas of invasion and remove or control invasive plants, specifically it mentions current efforts to eradicate or control the salt cedar

(*Tamarix ramisissima)* species, and the air potato (*Dioscorea bulbifera*) species. To ensure the maximum benefit from this project any upland placement area should be monitored after completion of dredging to ensure native flora populates disturbed habitats, and any invasive flora found in placement areas should be documented and eradicated.

7.4 Environmental Justice

Demographics Analysis in the Project Area

The section below provides a discussion of the demographics of the project area and potential impacts to environmental justice communities. Using U.S. Census data a demographic analysis was conducted to determine if there were disproportionate populations of minority, juvenile, elderly or low-income communities along the length of the navigation channel when compared to Duval County and the City of Jacksonville as a whole. For the minority, elderly, and juvenile populations, the Area of Interest used for comparison was comprised of the thirteen 2010 census tracts that were adjacent to the Jacksonville Harbor listed in the data collection section above (refer to Section 2.2.17). Similar methodology used to develop the comparison areas for the low-income analyses using year 2010 census data as 2011 data was insufficient. As defined by OMB for the year 2011, the poverty level for a family of 4 was determined to be $22,811.

The Area of Interest (combined census tracts) was compared to two Base Areas: the populations of the City of Jacksonville and Duval County.

The population distributions for a given tract were added, and each demographic of interest was converted to a percentage of the total population for a given area. The percentages were then used to calculate ratios to compare the differences between the Area of Interest and the Base Areas. These results are displayed in **Table 53**. A ratio of 1.0 indicates that the population distributions are equal for each given area. If the resulting ratios for the Area of Interest to a given Base Area is less than 1.0, then the populations within the Area of Interest contains LESS of a percentage of a given disadvantaged population when compared with the surrounding cities and/or counties. If the ratio is much greater than 1.0, then the populations within the Area of Interest contain MORE of a percentage of a given environmental justice community than the surrounding cities and/or counties. For all the comparisons completed, the ratios ranged from 0.2 to 1.06. (see **Figures 47-50** below). Out of the seven comparisons, only one of the computed ratios was greater than 1.0 (juvenile populations when compared to the City of Jacksonville and Duval County), and the ratio was still close to unity (1.05 vs. 1.06), therefore the potential impacts are not disproportionate to children living around the port area when compared to Duval County.

Table 53: Census Data used for Ratio Calculations

	All Tracts Neighboring Port			Jacksonville			Duval County		
*Based on 2010 US Census Data	Total Pop.	Ratio	Percent of Pop.	Total Pop.	Ratio	Percent of Pop.	Total Pop.	Ratio	Percent of Pop.
Total	69,346		100.0%	817,602		100.0%	860,479		100.0%
Ethnicity									
White	46,851	1.00	67.6%	455,226	1.21	55.7%	491,013	1.18	57.1%
African American	13,859	0.30	20.0%	245,329	0.67	30.0%	248,679	0.69	28.9%
Native American	137	0.00	0.2%	2,083	0.78	0.3%	2,272	0.75	0.3%
Asian	1,848	0.04	2.7%	33,933	0.64	4.2%	34,976	0.66	4.1%
Hispanic or Latino	4,556	0.10	6.6%	61,558	0.88	7.5%	63,213	0.89	7.3%
Pacific Islander	6	0.00	0.0%	575	0.12	0.1%	575	0.13	0.1%
Other	69	0.00	0.1%	1,674	0.49	0.2%	1,773	0.48	0.2%
2+ Ethnicities	1,807	0.04	2.6%	17,224	1.24	2.1%	17,978	1.25	2.1%
Minority	22,495	0.48	32.4%	362,376	0.73	44.3%	369,466	0.76	42.9%
Age									
Under 18	17,487	0.83	25.2%	196,942	1.05	24.1%	204,833	1.06	23.8%
Over 18	21,105	1.00	30.4%	620,660	0.40	75.9%	655,646	0.40	76.2%
65 and over	7,082	1.00	10.2%	88,105	0.95	10.8%	94,353	0.93	11.0%
Families below Poverty Threshold	1,220	0.08	11.65%	39,298	0.32	24.0%	34,575	0.20	16.5%
Familes above Poverty Threshold	14,873	1.00	92.42%	124,735	1.22	76.0%	174,573	0.91	83.5%

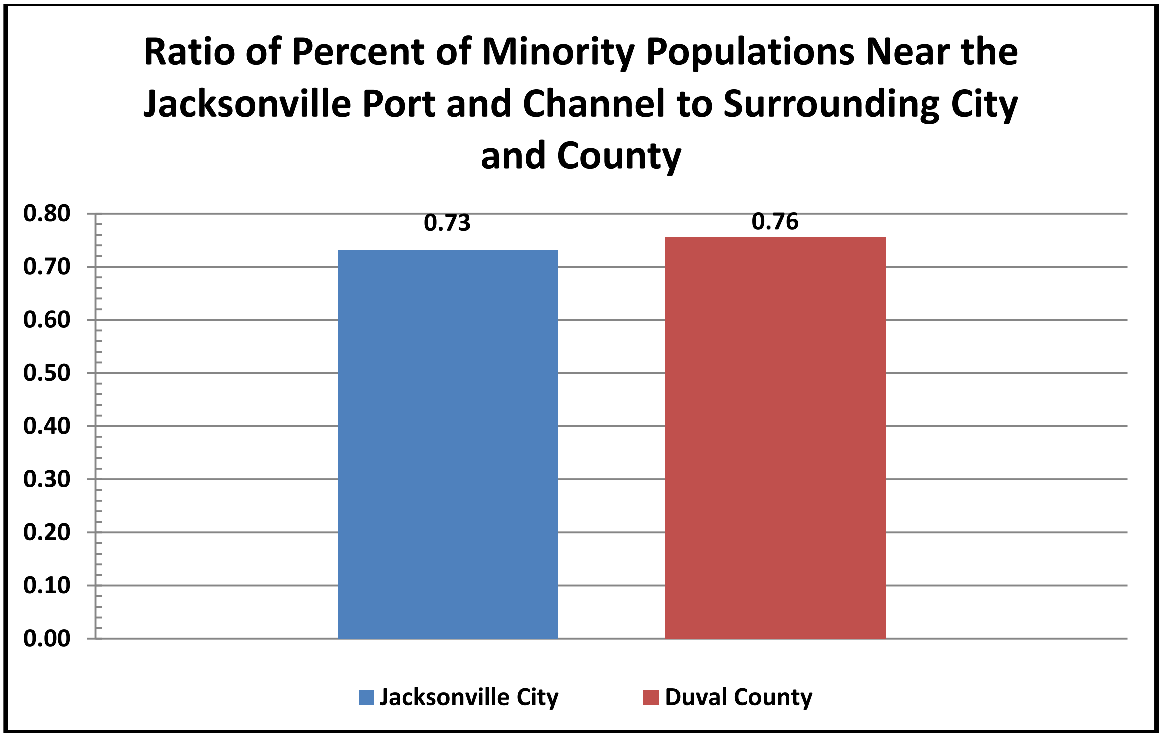


FIGURE 47: RATIO OF PERCENT OF MINORITY POPULATIONS NEAR THE PORT TO SURROUNDING AREAS

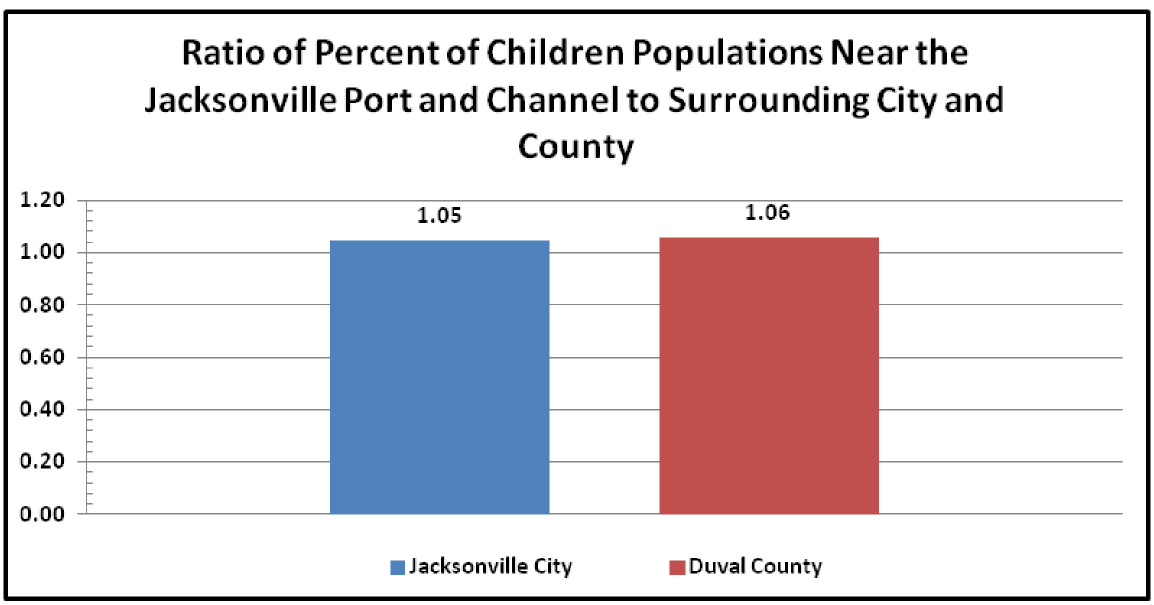


FIGURE 48: RATIO OF PERCENT OF JUVENILE POPULATIONS NEAR THE PORT TO SURROUNDING AREAS

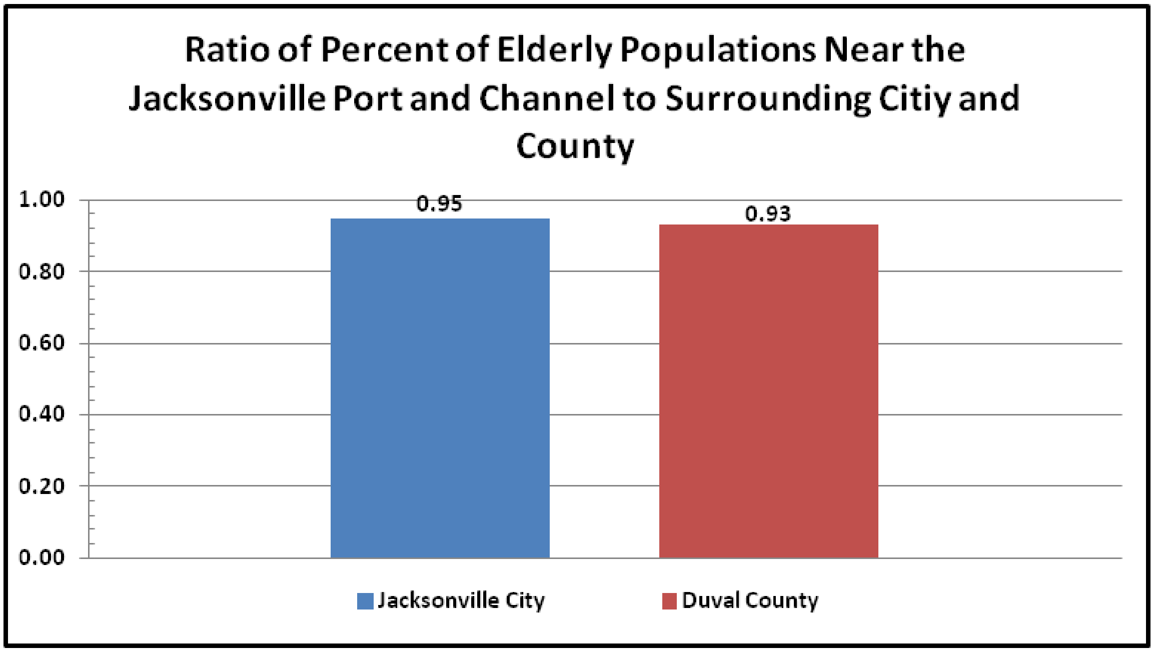


FIGURE 49: RATIO OF PERCENT OF ELDERLY POPULATIONS NEAR THE PORT TO SURROUNDING AREAS

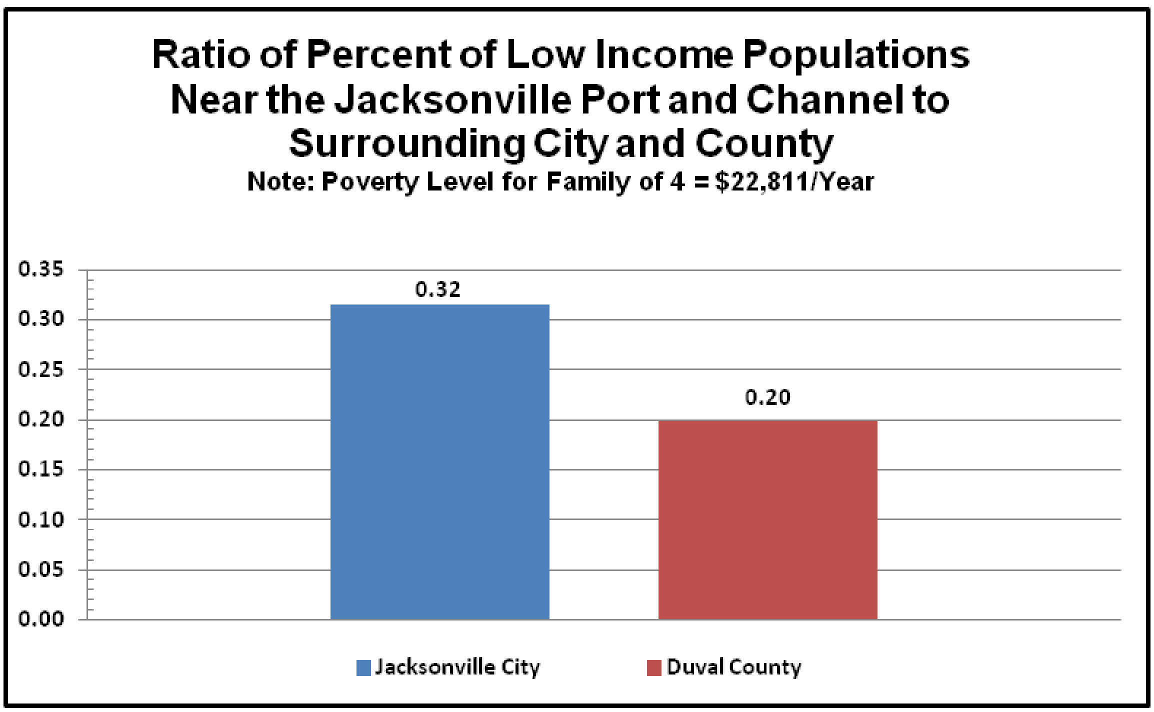
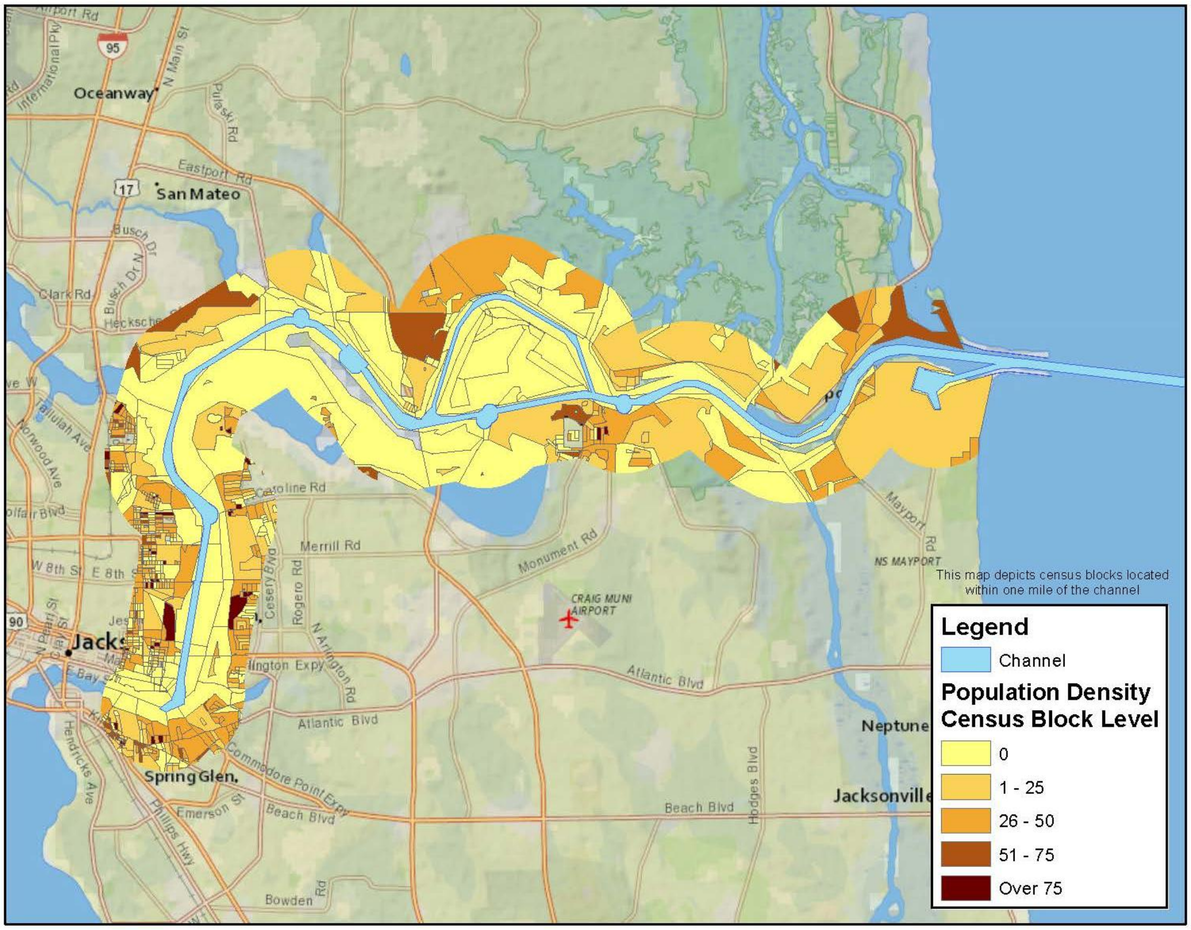


FIGURE 50: RATIO OF PERCENT OF LOW INCOME FAMILIES NEAR THE PORT TO SURROUNDING AREAS

To analyze potential disproportionate effects on environmental justice communities surrounding the navigation channel, census block data within one mile of the navigation channel was collected and is displayed in **Figure 51**.

FIGURE 51: POPULATION DENSITY CENSUS BLOCK LEVELS WITHIN ONE MILE OF THE NAVIGATION CHANNEL (ST. JOHNS RIVER)



The data show that very few people are residing within the one mile buffer, with most of the construction area around Blount Island having a population of 0. The lightest orange blocks are the second greatest occurrence and have populations of 25 persons or less.

The same census blocks were analyzed for populations living below the poverty limits and for social institutions (**Figures 52 and 53**).

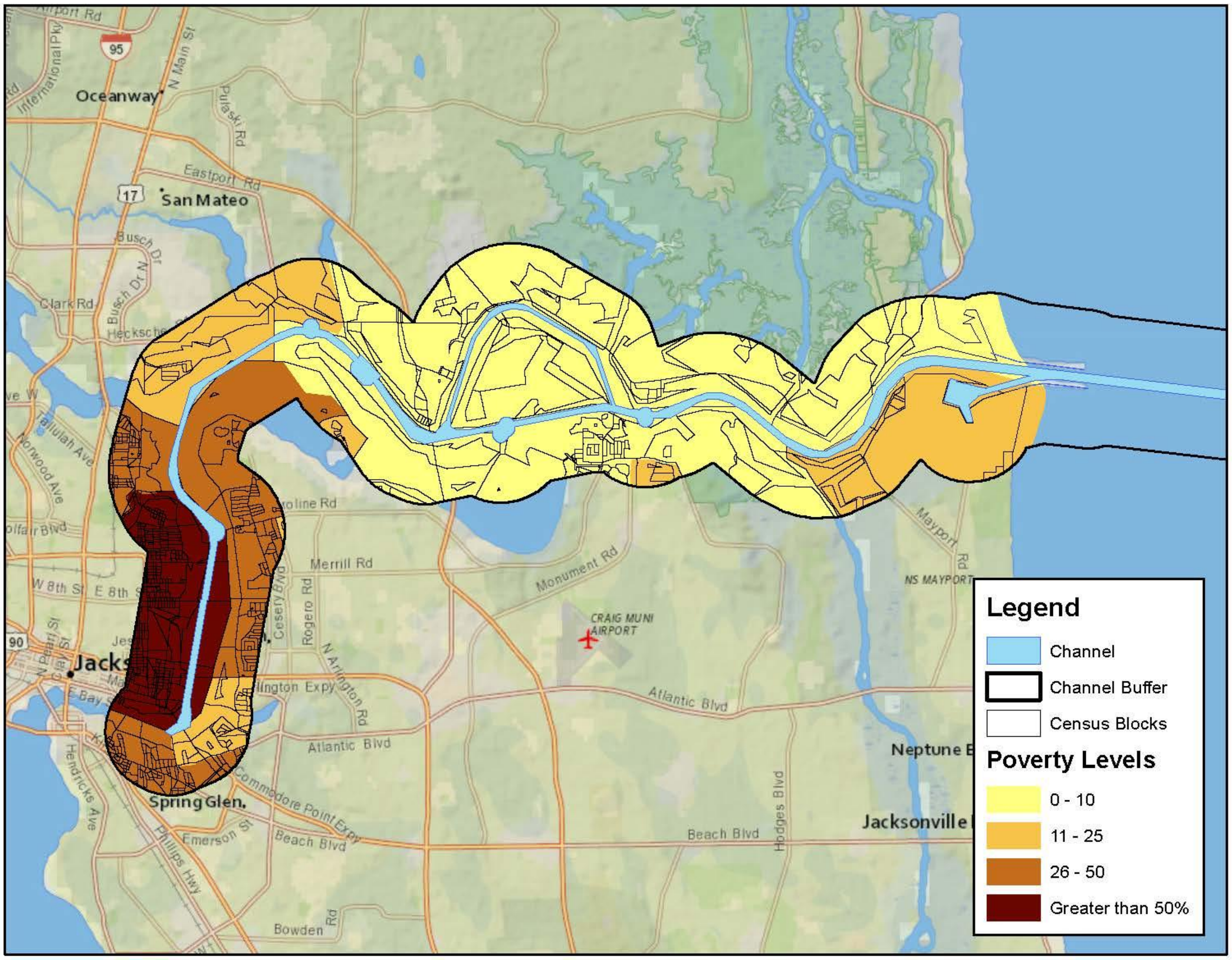


FIGURE 52: VARIOUS POVERTY LEVELS WITHIN ONE MILE OF THE NAVIGATION CHANNEL (ST. JOHNS RIVER)

Less than 10% of the populations surrounding the main area of construction are living below the poverty level (below $23K for a family of 4).

Social Institutions

Figure 53 below shows the locations of naval bases, hospitals, and schools/child care facilities within one mile of the navigation channel and the area where the proposed deepening would occur. With the exception of Mayport Naval Station, these facilities are dispersed throughout the area and are not located disproportionately near the navigation channel. The deepening activities, including disposal of dredged material, will not have significant impacts on any populations, including minority and low-income populations. Sediment deposition will be in an approved ocean dredged material disposal site (ODMDS). Construction is proposed to begin in 2015 and last approximately five years.

The proposed project contains the following terminals beginning from the entrance channel upstream to River Mile 13: Mayport Naval, Jacksonville Ports Authority (JPA) Blount Island, JPA Bulk, Jacksonville Electric Authority (JEA), and MOL/TraPac terminals.

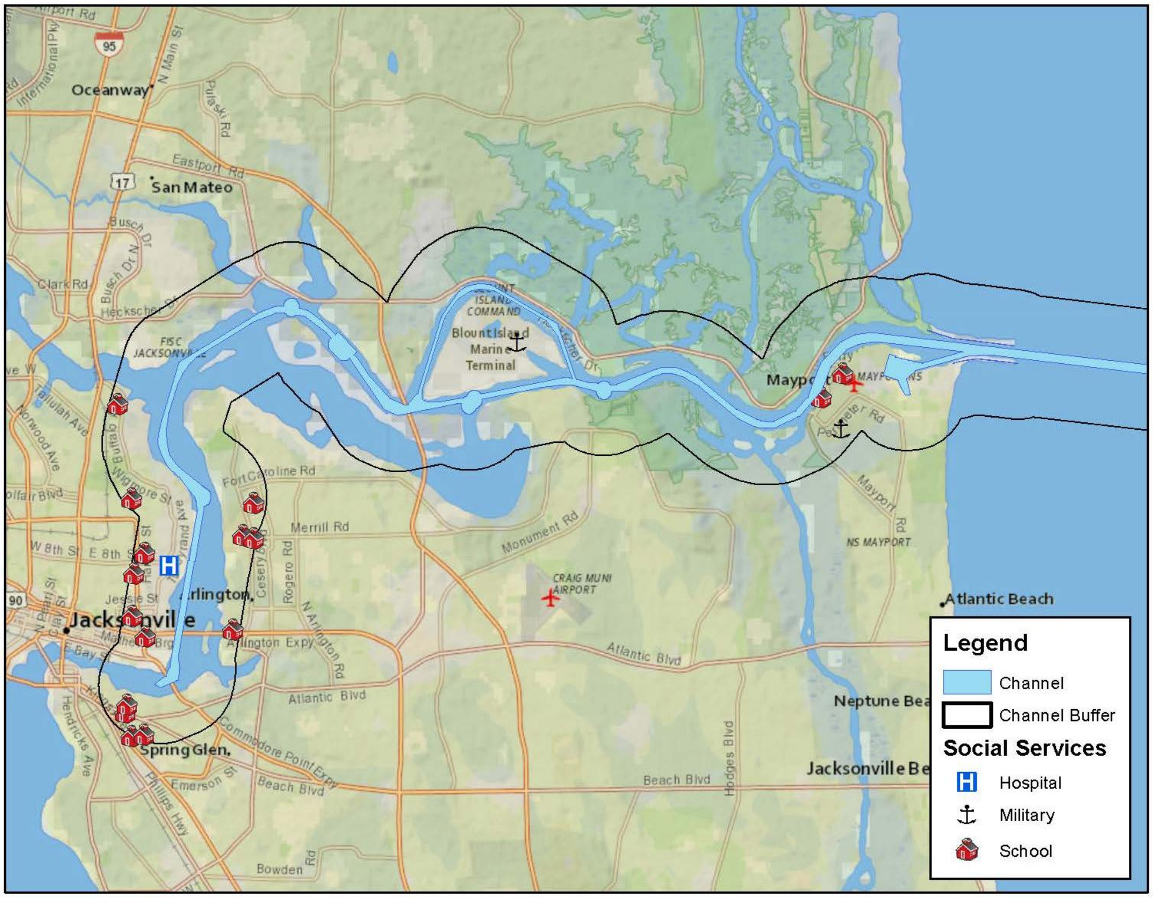


FIGURE 53: LOCATIONS OF NAVAL BASES, SCHOOLS/CHILDCARE FACILITIES, AND HOSPITALS ALONG THE NAVIGATION CHANNEL

Public Safety

As a public safety measure, boating would be prohibited near the operating construction equipment (and sediment placement location). Recreational access to these areas would return to pre-construction conditions following completion of the project. Although short-term impacts could occur, no long-term adverse effects are anticipated. Commercial shipping would continue in the Federal navigation channel. The USACE would provide information to the USCG so they could issue a “Notice to Mariners” prior to initiation of construction and for each major change in the construction activities. This would alert public boaters of areas to avoid and the possibility of limited and restricted access. The public would be excluded from landside construction areas. No significant adverse impacts to public safety are expected from the proposed project.

Conclusions

The results of the data indicate that the Area of Interest, i.e., the area potentially impacted by the project, does not contain disproportionate populations of minority, juvenile, elderly, or low-income communities when compared to the surrounding city or county. On the basis of the analysis described above, construction of the proposed project and port operations would not have a disproportionally adverse impact on areas with a high concentration of low-income and minority populations. The areas expected to receive most of the construction impacts are very sparsely populated and therefore are not disproportionately affected by the proposed deepening.

The USACE evaluated potential project impacts of the proposed harbor deepening and found that the information shows that the proposed action would not cause disproportionately high and adverse impacts on minority, elderly, low-income populations, or children. Schools/childcare facilities and hospitals are dispersed throughout the community and are not disproportionately located near the navigation channel or the terminals, so disproportionate impacts to children are not expected.

7.5 Energy Requirements and Conservation

Energy requirements for the proposed project would include fuel for the dredges, equipment and labor transportation, and other construction operations. The no-action alternative incurs these energy requirements for every maintenance dredging operation. The proposed project alternatives would have initial energy requirements for the dredging to deepen the channel. Energy requirements would increase in rough proportion to the increase in construction time associated with the deeper project alternatives. After deepening, any of the proposed alternatives would incur maintenance dredging energy consumption similar to that of the no-action alternative.

Channel deepening will allow the larger Post-Panamax vessels to use the port of Jacksonville in the future. These larger ships carry more cargo than the older, smaller vessels that they will eventually replace. Consequently, USACE predicts that the deeper channel from any of the project alternatives will result in fewer ship calls at JAXPORT than would occur with the no-action alternative. The newer, larger vessels are mandated to have more efficient engines. Fewer, more efficient ships using the port with the deeper project alternatives could reduce energy requirements associated with vessel operations.

7.6 Natural or Depletable Resources

No natural energy resources occur within the proposed project area. The sediments excavated to deepen the Jacksonville Harbor channel are a depletable resource that will be permanently disposed of the Jacksonville

ODMDS. Fuel is a depletable resource that would be consumed by construction equipment during initial construction and subsequent maintenance dredging. Impacts to wetlands, fish, and water quality are discussed elsewhere in this SEIS. The use of these natural or depletable resources is not considered an unacceptable adverse impact of the proposed project alternatives.

7.7 Reuse and Conservation Potential

The USACE may evaluate the option of recovering rock removed from the channel for construction of shoreline protection structures along the river shoreline. Energy resources will be conserved to the extent required by applicable Federal requirements for energy efficiency.

7.8 Urban Quality

Urban areas abutting the Jacksonville Harbor project include Mayport Village on the south side of the river and residential areas along Heckscher Drive which runs along the north side of the river in the project area. No direct, permanent impacts related to urban quality are expected with the no-action alternative or the project alternatives.

7.9 Solid Waste

No impacts related to solid waste are expected due to this project. Precautionary measures anticipated in the contract specifications would identify and require proper disposal of solid wastes during project construction and maintenance. Disposal of any solid waste material into the river or Atlantic Ocean waters would not be permitted.

7.10 Scientific Resources

The LSJR provides opportunities for scientific study of estuarine and riverine environments. Various academic and governmental entities perform research and monitoring in the project area. Project construction may have result in short-term disruption of scientific research in active construction areas. This effect will be temporary and may be mitigated by working with the USACE construction management team to identify times to access sites generally closed to the public if those sites are part of a research program.

Neither the no-action alternative nor the project alternatives would adversely affect scientific resources in the LSJR.

7.11 Native Americans

None of the project activities occur on land belonging to Native Americans.

The Timucua are the best known of the Native Americans that occupied the LSJR area before European settlement. Historically significant Native American sites along the LSJR are protected in areas such as the Timucuan Ecological and Historic Preserve. Project activities would not affect known significant Timucua or other Native American sites.

Neither the no-action alternative nor the project alternatives should adversely affect Native Americans.

7.12 Drinking Water

Though surface water withdrawal for public water supply has been proposed and evaluated for the middle St. Johns River and Ocklawaha River (a tributary to the LSJR) (SJRWMD, 2012), the LSJR contains salt concentrations that render it unsuitable for use as a potable water supply without desalination. Neither the no-action alternative nor the project alternatives would affect drinking water supply.

7.13 Cumulative Impacts

A cumulative impact is the additive or interactive effect on the environment that could result from the incremental impact of the alternatives when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Interactive effects may be either countervailing (where the net adverse cumulative effect is less than the sum of individual effects) or synergistic (where the net adverse cumulative effect is greater than the sum of the individual effects). Cumulative impacts can result from individually minor but collectively significant actions that take place over time. Accordingly, a cumulative impact analysis identifies and defines the scope of other actions and their interrelationship with the alternatives (or grouping of alternatives) if there is an overlap in space and time. Cumulative impacts are most likely to occur when there is an overlapping geographic location and a coincident or sequential timing of events. Because the environmental analysis required under NEPA is forward-looking, the aggregate effect of past actions is analyzed to the extent relevant and useful in analyzing whether the reasonably foreseeable effects of the alternatives (or grouping of alternatives) may have a continuing, additive, and significant relationship to those effects.

Past, present, and future changes in the St. Johns River can be largely attributed to the following factors:

- Hydrologic alteration and manipulation of the river and its tributaries (such as dredging, filling, impoundment, shoreline hardening/stabilization, and construction of levees and artificial waterways)
- Changes in land use within the river's watershed (such as commercial/residential development, agriculture/forestry, surface and

ground water withdrawal, runoff, and generation of domestic and industrial/commercial waste)

- Commercial and recreational activities on the water along with the construction and operation of docks, marinas, berths, and other support facilities
- Measures taken to ameliorate the impacts of activities within the watershed (such as stormwater management, treatment of domestic and industrial/commercial waste, regulation of water use/withdrawal and regulation of boating, shipping, and construction on the water)
- Sea level rise

The cumulative impact analysis presented in this SEIS is consistent with guidance documents issued by CEQ, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997), and USEPA, *Consideration Of Cumulative Impacts In USEPA Review of NEPA Documents*, (USEPA 1999c) as well as CEQ's additional *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005). The analysis used the following approach:

- For each resource area addressed in Chapter 2, the potential for cumulative effects on these resources from the action alternatives in combination with other past, present, or reasonably foreseeable future actions was considered.
- For those resource areas that were determined to have potential for cumulative effects, an appropriate geographic scope (or geographic study area) for the cumulative impacts analysis for those resources was identified.
- Within the geographic study area for each resource, past, present, or future actions having the potential for additive and/or interactive effects were identified.
- The cumulative impacts of the past, present, and future actions in combination with the impacts assessed for the alternative sets (Chapter 7) was then assessed. This assessment considered synergistic and countervailing impacts and identified whether the cumulative impacts on resources was adverse or beneficial and minor, moderate, or significant.

7.13.1 General Project Area

The general project study area considered in this SEIS extends from a point in the river main channel slightly downstream of Lake George (river mile 105) to the river mouth, and beyond into the Atlantic Ocean to the channel entrance buoy to the east and the proposed ODMDS site to the southeast of the river mouth. The river mouth marshes in the first several river miles to the north and south, Mill Cove, and the mouths and lower portions of the tributaries are also in the general project area. The project construction site extends from the river mouth to River Mile 13.

Salinity modeling suggested that channel construction for design depths of 44 feet to 50 feet (NAVD) will alter salinities to one extent or another as far upstream or slightly farther than the Shands Bridge near Green Cove Springs (river mile 50). The upstream extent of salinity changes provides an approximate boundary for consideration of effects of salinity changes due to deepening. Simulations and related analyses reported in SJRWMD (2012) considering effects of upstream water withdrawals located a similar zone of possible salinity changes, including consideration of cumulative impacts.

7.13.2 Relevant Past and Present Actions

The river channel has also seen a number of water projects to improve the channel, beginning in 1899 with authorization of a channel 200 feet wide and 13 feet deep from Jacksonville to Palatka. Subsequent authorizations included navigation projects to Sanford, Lake Harney, and Lake Monroe. The first 20 miles of the Federal channel was deepened in 1965 to a depth of 38 feet with widths varying from 400 to 1,200 feet. By 1998, the Mayport Naval Station had a basin and channel depth of 42 feet. The Water Resources Development Act of 1999 authorized deepening the main channel from 38 to 40 ft from the entrance channel to about river mil 14.7. The 2002 General Reevaluation Report authorized the 40-foot project depth from river mile 14.7 to river mile 20. Since completion of that construction, the channel authorized depth has remained at 40 ft for the channel from the river mouth to river mile 20 (USACE 2002). Mayport Naval Station obtained authorization and deepened their harbor and channel, including the entrance channel in the Atlantic Ocean to 50 feet deep in the past few years.

These past deepening events may have already resulted in some upstream movement of salinity. An assessment of river shoreline wetlands within the project area indicate that salinity stress occurs upstream to approximately Black Creek, just upstream of Doctors Lake. The condition of the wetlands suggests that the stresses have occurred relatively recently (Courtney Hackney, Ph.D., personal communication, December 2012).

The most recent action, now ongoing, is the redesign and reconstruction of the Mile Point area shorelines to improve navigation characteristics at the intersection of the Florida Atlantic Intracoastal Waterway and the main stem of the St. Johns River. The Mile Point construction is expected to be complete prior to the beginning of any channel deepening associated with this SEIS.

The Ocklawaha River (the largest tributary to the St. Johns River) was initially authorized as a Federal project in 1890. With subsequent authorizations the project includes a channel 6 feet deep from the mouth of the river to the head of

Silver Springs Run (deauthorized before completed), about 57.7 miles; clearing the channel of obstructions from Silver Springs Run to Lake Griffin, including certain artificial waterways and extensions thereof, and maintaining dikes to obtain a navigable depth of about 4 feet to Leesburg, about 33.4 miles; and construction of a lock and dam at Moss Bluff to maintain the water level in Lake Griffin. The length of the project is about 85.7 miles in the river and 5.4 miles in Silver Springs Run. As part of the Cross Florida Barge Canal Project (now deauthorized) the Buckman Lock/Canal and Rodman Dam (forming Lake Ocklawaha) were constructed in the Ocklawaha basin between 1964 and 1969.The Ocklawaha watershed includes a number of lakes along the center interior of the state from Gainesville to the north and near Orlando to the south. Many of these lakes are connected by a number of natural and artificial waterways (in addition to the federally-authorized projects mentioned above). Lake Apopka located in the southern portion of the watershed was once badly polluted with nutrients and pesticides. While problems remain, considerable efforts have resulted in water quality improvements for Lake Apopka. Though a number of strategies will continue to be developed and implemented to combat the mobilization of nutrients and contaminants from other portions of the watershed, it remains a concern.

For a more comprehensive description of past, present, and future plans within the St. Johns River watershed (including those under the Florida Surface Water Improvement and Management Program [SWIM]), refer to the publications and websites of the SJRWMD and the Florida Department of Environmental Protection (FDEP).
http://www.dep.state.fl.us/water/watersheds/swim.htm
http://www.protectingourwater.org/watersheds/map/ocklawaha/
http://www.sjrwmd.com/waterbodies/

Since the initial studies and surveys of the St. Johns River in the late 1800's, the City of Jacksonville/Duval County has grown up around much of the first river miles. From Mayport Naval Station on the south shore of the river mouth, development covers most of the south shore of the river for many miles. On the north river bank, residential development along the river levee extends almost to the river mouth, and merges with industrial developments on Blount Island and beyond. Urban development then dominates both sides of the river until about river mile 40. Intermittent development and smaller towns beyond this point mix with natural forested wetlands and (further inland) pine flatwoods, and row crop farming. Discharges associated with residential, commercial, and agricultural development have all influenced water quality in the river and river tributaries of the LSJR.

The LSJR, particularly in Jacksonville, has intermittently developed algal blooms indicative of excess nutrients in the water column. These nutrients come mainly from stormwater runoff, which carries the products and byproducts of human activity (e.g., over-fertilization and watering of lawns, failing septic tanks, and the wastes products of dense pet populations) in densely populated areas.

7.13.3 Relevant Future Actions

The USACE will continue to dredge the channel, whether or not channel deepening occurs. The upland disposal facilities are approaching capacity. If USACE desires upland disposal of the dredged material, the existing upland facilities for disposal will require renovation and disposal of dewatered material in the facilities and/or construction of new upland dredge material management areas. There are two existing ODMDS (Fernandina ODMDS and Jacksonville ODMDS). The USACE has proposed a new ODMDS facility to be located southeast of the existing Jacksonville ODMDS. The USEPA has the lead role in development of the draft EIS for the ODMDS (USEPA 2012a).

Further upland development may occur at the Mayport Naval Station as a result of "other ongoing development and/or recapitalization efforts" associated with a variety of planned or proposed actions that will involve the station in additional waterside activity (NAVFAC 2008). The EIS for deepening of the naval station and harbor (NAVFAC 2008) also indicates that future actions by the port may include an offshore undersea warfare training range starting about 50 nm offshore, and sonar training based at Mayport Naval Station.

Deepening the Federal channel from river mile 0 to river mile 13 would allow larger (broader beam, longer, deeper draft) ships access to many of the Dames Point and Blount Island terminals, and the cruise ship terminal. USACE National Economic Development (NED) Analysis for this study has indicated that the USACE expects fewer total annual ship calls to the terminals of the port of Jacksonville when compared to the future-without project condition, but expects that the ships calling would have greater draft and length, and carry more cargo.

Renovation of existing port (public and private) terminals and construction of new terminals are likely consequences of larger ships calling at the ports. Along with the growth in port activity, the population growth of Jacksonville will at least in part occur due to the increase in port activity and related private enterprise.

Regardless of the shipping and related commercial industrial development in the Jacksonville Harbor, the regional population will continue to grow. Additional development will include more wastewater treatment plants, stormwater runoff structures and discharges, residential and commercial wells, and residential and commercial septic systems for locations distant from a wastewater treatment system.

As the population increases, so will the number of people consuming harvestable species that grow and live in the river. As the value of commercially harvested species increase in value, due to a growing population and a limited stock of individuals, fishing pressure is likely to increase.

Upstream of the project area, in the central and upper basins of the St. Johns River, the SJRWMD is assessing surface water withdrawals from the river as a potable water source. The assessment report (SJRWMD 2012) considers (depending on the particular resource being considered) withdrawals of up to 262 MGD, including diversions from the St. Johns River (up to 155 MGD) and the Ocklawaha River (up to 107 MGD). The USACE evaluated salinity dynamics with channel deepening and withdrawals of 155 MGD.

In addition to potential changes from human activity, changing climactic and oceanic conditions may also alter the LSJR ecosystem in ways less predictable or foreseeable than man-made changes. Seasonal rainfall patterns exert significant influence over seasonal water quality conditions in the LSJR, and longer periods of extended low or high rainfall patterns cause greater long-term salinity ranges in the river. If climactic conditions undergo a permanent change, the LSJR could have a much different flora and fauna simply due to long-term increases or decrease in annual rainfall or altered seasonal pattern of rainfall. Sea level rise is very likely to continue at its current rate, or that rate may increase. Sea level rise may have significant effects on the St. Johns River if for no other reason than the river basin is relatively flat and the river has a very low slope (less than an inch per mile along the main channel axis). A small increase in sea level has the potential to affect hydrology and hydrodynamics in a relatively large are area of the LSJR.

7.13.4 Cumulative Impact Analysis

The potential cumulative impacts resulting from the combination of past, present and future actions within the river and the watershed include those on the following resources: water (quality, both salinity and nutrient concentrations); marine mammal, fish, and invertebrate communities; wetlands; and SAV.

The Jacksonville/Duval County region likely will continue to grow in population and level of commerce, regardless of whether channel deepening occurs. Increases in population and all attendant activities will result in greater potential for water pollution, and more air pollutant emissions. Natural habitat will continue to shrink as increasing human populations converts wild space to human residential and commercial purposes. Whether or not the water quality degrades is an unknown. Based on current discussions of water quality management at the state and Federal (EPA) numeric nutrient concentrations, if applied appropriately, and over time, should improve water quality in the LSJR. Potential water quality improvement associated with full implementation of FDEP-mandated Basin Management Action Plans (BMAP) to improve water quality in the LSJR may further benefit the system.

Upstream water withdrawals are a very likely future occurrence, as the SJRWMD has already approved a permit for one main channel surface water withdrawal (*www.sjrwmd.com/facts/SeminoleCountypermit.html).* The SJRWMD is now establishing limits for that withdrawal in the main channel of the river, which may reach 155 mgd. However, withdrawals from the Ocklawaha River, the largest tributary to the St. Johns River, could also occur, further decreasing the amount of fresh water flow reaching the LSJR. Salinity increases will likely continue to occur in the LSJR as additional water withdrawals are permitted and occur. The degree of salinity increase was estimated by SJRWMD to be minor for most of the ecosystem components they considered (SJRWMD 2012). Using a slightly different model with a more detailed and current representation of LSJR main channel bathymetry, Taylor (2011, 2013c) also identified only relatively small shifts in salinity regimes within the study area. However, such changes in salinity will result in the development of a greater area of estuarine marsh primarily at the expense of freshwater forested wetlands.

Within the LSJR watershed, improved stormwater management to meet current and projected stormwater management standards is an indirect means of improving water quality that will benefit the river water quality. As part of mitigation-based stormwater management improvements, better monitoring of stormwater discharges to accurately characterize water quality and water quality improvements will support the most cost-effective improvements to the system. Assuming that watershed best management practices for stormwater management are fully developed, LSJR water quality should improve. Support of current and future actions by local and regional governments to meet TMDL and newly adopted numeric nutrient criteria for river and tributary waters may also help reduce the potential for long-term degradation of LSJR water quality.

Endangered species will likely incur no greater cumulative impacts with the project than without it. The most important drivers of such change may be the expected expansion in human population and natural habitat changes and losses associated with human activities. The same holds true for both managed and unmanaged species and the riverine and nearshore Atlantic Ocean habitats they use.

The use of another, new ODMDS in the Atlantic Ocean off the Jacksonville coast will also result in potential impacts as the site is used repeatedly to dispose of dredged material from maintenance operations. These impacts can be avoided and minimized by using best management practices defined by the Federal agencies responsible for these resources, including seasonal avoidance of site use and ship operation to avoid impacts with threatened and endangered species.

For marine mammals, the changes in salinity would not likely cause any significant issues. Bottlenose dolphins may take advantage of a slightly extended salinity range to extend their movements upstream. The salinity changes are unlikely to affect right whales, which rarely use any part of the river. Increase in salinity would slightly reduce the quality of the most downstream areas of SAV, possibly requiring manatees to move a short distance farther upstream for optimal food sources.

Marine mammals may incur impacts over a long period due to long-term exposure to the larger ships that will use a deeper harbor channel. In addition, the ship operators may have a more difficult time seeing the individuals at risk. Resident bottlenose dolphin populations have apparently adjusted to the current conditions in the first 20 miles of the LSJR (Quincy Gibson, Assistant Professor UNF personal communication December 2012). However, how this species, which uses sound as a primary tool to interact with its environment, functions in this crowded, noisy environment is not understood. Therefore, assessment of potential long-term impacts of larger, potentially louder ships is not feasible. In addition, the river will undergo a variety of other changes over the next 50 years, which may also impact this species (and others) in unknown ways. Under the future with-project condition as compared to the future without-project condition the USACE National Economic Development (NED) analysis for this project predicts a slight decrease in the number of ships calling JAXPORT, see **Appendix B**. Thus, at least with respect to large ship traffic, bottlenose dolphins and manatees may incur relatively less impact than some other resources However, the species will still contend with greater overall boat traffic due to likely increases in recreational boating not related to the harbor improvements studied in this report. Better enforcement of existing marine speed limits and consideration of additional speed zones within the river may better protect bottlenose dolphins and manatees. Manatees move much more slowly and are at greater collision risk from recreational vehicles than the dolphins.

Fishes and macroinvertebrates, likewise will see an upstream shift towards higher salinity levels in the area of effect. It is conceivable that there would be a reduction in habitat utilization for freshwater fish and macroinvertebrates in the future with a near equal increase in habitat utilization for those that are adapted to estuarine conditions. This change would likely occur regardless of the proposed project, with sea level rise likely being the major contributor towards the upstream shift to higher salinity levels. Cumulatively, however, there could be some intensification caused as a result of the project. Assessment of potential salinity and fish population relationships provides a more detailed evaluation of potential long-term effects.

A large portion of the macroinvertebrate community species have short lifespans and reproduce prolifically as a strategy to deal with widely fluctuating and relatively unstable habitats such as riverine surface sediments. The BMI communities will fairly rapidly reflect shifts in salinities. What may be more important to the long-term dynamics of those populations and the species in them are changes in water quality and human predation of those species pursued for commercial and recreational fishing. Urbanization and increased population and population density will likely lead to additional public and private uses of the LSJR main channel and tributaries, in particular putting increased pressure on wildlife, particularly fish and invertebrates that are harvested commercially and recreationally.

Exposure to increased salinity could further impact freshwater wetlands already responding to past channel deepening activities, changes in stormwater runoff patterns, and sea level rise. Ecological modeling efforts described in Taylor (2013a) describe potential effects on wetlands due to salinity changes from combinations of channel deepening, sea level rise, and water withdrawals. The future condition simulations were set up to evaluate conditions in 2068, 50 years after the proposed harbor deepening construction. Using the methods discussed in **Section 7.3.9**, the 2068 hydrodynamic model results were used to determine the frequency of occurrence of >1 ppt salinity at high tide. The location of 12% and 25% frequencies indicate the likely transition zone from tidal swamp to tidal marsh. The upstream movement of this transition zone represents the upstream extent of impact to tidal wetlands.

Under the 2068 future without-project conditions, the tidal marsh to tidal swamp transition shifts about 2 miles upstream relative to the 2018 baseline. Over the 50-year time frame, the potential impact on the location of tidal swamp to tidal marsh transition due to sea level rise and water withdrawal is much greater than the initial effect of channel deepening.

None of the 2068 post-project alternative simulations indicated any shift in location of the 25% frequency >1 ppt high tide salinity locations relative to the 2068 future without-project condition. On the east side of the river, two model cells at the mouth of Six-Mile Creek (river mile 52) become slightly more fresh with all of the project alternatives, causing a one-mile downstream shift in the location of the 12% frequency >1 ppt tidal swamp indicator.

SAV also occurs in that section of the river where ongoing, long-term salinity changes are occurring and will occur in the future. A cumulative increase in salinity due to sea level rise, water withdrawal or other factors could further impact potential SAV habitat in addition to any impact due to channel deepening. Ecological modeling efforts described in Taylor (2013a) describe potential effects on SAV habitat due to salinity changes from combinations of channel deepening, sea level rise and water withdrawals. The future condition simulations were set up to evaluate conditions in 2068, 50 years after the proposed harbor deepening is complete. Using the methods discussed in **Section 7.3.10**, the 2068 hydrodynamic model results were used to determine the frequency of salinity stress on SAV and the spatial extent and acreage of potential habitat exposed to salinity stress.

With the 2068 no-action alternative, the no or low stress zone moves about one mile upriver relative to the 2018 no-action alternative. The most apparent increase in salinity stress frequency (up to 7 percentage points) occurs near the Fuller Warren Bridge (River Mile 25). Littoral cells from River Mile 27 to river mile 37 (south of the Ortega River to Doctors Lake) experience a 1 to 5 percentage point increase in the frequency of moderate or extreme SAV salinity stress in 2068 due to factors other than channel deepening.

With each of the 2068 project alternatives, the northern extent of the no stress zone occurs near the mouth of Doctors Lake (near river mile 37), unchanged from its location with the 2068 future without-project simulation. With all four project alternatives, all cells downstream of River Mile 29 experience salinity stress frequencies greater than 20%. With the Recommended Plan, stress frequency increases 1 to 2 percentage points between Mandarin Point and the Fuller Warren Bridge.

Stress defined as the sum of the total number of acres under each stress condition and divided by the total number of simulation days provides another way to consider potential channel deepening effects on SAV (**Table 54**). Note that stress acres are adjusted from the model-predicted acreage by a factor of 0.25 to account for the model's overestimate of potential SAV habitat acreage. Relative to the 2018 no-action alternative, the 2068 future without-project condition lost 134 acres/day of no stress habitat (a 5% loss). The increase in stress acres/day (as the sum of the three stress categories) for the 2068 Recommended Plan amounted to less than 0.5% of the 2068 future without-project no stress acres/day value.

Table 54: Potential SAV Habitat Area Subject to Salinity Stress in 2068

	Potential SAV Habitat Area (acres/day)				
Stress Condition	2068 FWOP	2068 44 ft Project	2068 46 ft Project	2068 47 ft Project	2068 50 ft Project
No Effect	2,586	2,576	2,571	2,574	2,553
Low	675	676	677	675	683
Moderate	196	201	203	202	209
Extreme	30	34	36	36	42

Expansion of habitats for estuarine and marine plant and animal species will occur at the expense of salinity intolerant species. However, the main stem LSJR includes the lesser portion of the total freshwater wetland area in the entire St. Johns River watershed. Salinity impacts to freshwater species will likely comprise a small portion of the total SJR habitat area.

The use of another, new ODMDS in the Atlantic Ocean off the Jacksonville coast will also result in potential impacts as the site is used to dispose of dredged material. These impacts can be avoided and minimized using best management practices (BMP) defined by the Federal agencies responsible for these resources. The BMPs may include seasonal avoidance of site use and ship operation to avoid impacts with threatened and endangered species. By the time the new ODMDS has reached its capacity, invertebrates will have colonized most of the surface and surface sediments. A new marine invertebrate and vertebrate community will have developed over most of the new habitat.

7.14 Irreversible and Irretrievable Commitment of Resources

7.14.1 Irreversible

An irreversible commitment of resources is one in which the ability to use a resource is lost forever. The removal of sediment from the channel and placement in the ODMDS would irreversibly commit those sediment resources. Consumption of fossil fuels by project construction equipment would be an irreversible commitment of energy resources.

7.14.2 Irretrievable

An irretrievable commitment of resources means that opportunities for other uses are foregone for the period of the proposed action. Typically, it refers to the use of renewable resources, including human effort, and to other utilization opportunities foregone in favor of the proposed action.

The project alternatives would result in the temporary loss of benthic habitat and associated fauna within the dredging template and at the ODMDS. This is an irretrievable loss because benthic habitat will redevelop and fauna will reoccupy the affected areas following construction.

7.15 Unavoidable Adverse Environmental Effects

The primary unavoidable adverse impact of the project alternatives is alteration of the salinity regime in the LSJR. The deepened channel will result in the movement of higher saline water farther upstream. The magnitude of upstream movement increases with increase in project depth. The change in salinity will shift the northern boundary of SAV upstream, and allow salt tolerant marsh vegetation and estuarine flora and fauna to move farther upstream. **Sections 7.3.7 - 7.3.12** discuss the magnitude of these effects for different project alternatives.

To identify and offset these unavoidable effects on riverine ecological communities, USACE will provide mitigation. See the Mitigation Plan **Appendix E** for more information.

Other unavoidable adverse impacts of the proposed deepening include:

- Burial of infauna and non-motile epifauna in the ODMDS due to placement of dredged material. Recovery would depend on the ability of buried organisms to burrow through the sediment layer and the ability of adjacent populations to recolonize the area. However, the affected area is a small percentage of the total offshore bottom habitat in the region.
- Impacts to infaunal communities within the dredged area due to sand removal and habitat alteration. These impacts are reversible, as the affected areas would gradually fill with sand from adjacent areas and be recolonized by infauna.
- Temporary, localized water column turbidity at the dredge and ODMDS during construction. Turbidity would be monitored during construction to ensure that turbidity from construction activities conforms to state water quality standards.
- Temporary, localized air quality and noise impacts due to emissions from offshore and onshore construction equipment.
- Temporary aesthetic/visual impacts due to the presence of construction equipment in the channel and along the project shoreline.
- Temporary interruption of commercial and recreational vessel traffic during construction.

7.16 Local Short-Term Uses and Maintenance/Enhancement of Long-Term Productivity

All of the project alternatives are expected to produce localized, short-term impacts on riverine and offshore benthic communities and water quality, but are not expected to cause significant adverse impacts on long-term biological productivity. Channel dredging projects have a temporary and short-term impact on benthic biological resources in the dredged area and in the offshore disposal area. In an evaluation of recolonization studies conducted in the eastern United States, the marine benthos was observed to experience a decrease in the number of species, densities, and biomass with a subsequent rapid recovery (Bolam and Rees, 2003). Although a change in the health of populations, community structure and composition, trophic structure, or system function could occur, these impacts would be temporary and typically the recovery time would range from a few months to slightly more than 1 year (Rakocinski et al., 1996). The USACE placement sites in the northeastern United States have been monitored since 1977 as part of the DAMOS program (Disposal Area Monitoring System). Disposal mounds analyzed in the DAMOS program showed rapid recovery of species diversity and density within 3 to 6 months following placement of material (USACE, 1978; USACE, 1983; USACE, 1993). However, the composition of the benthic community shifted initially to more opportunistic species. Within 2 to 5 years, the benthic communities at disposal mounds were typically similar to those in undisturbed areas (USACE, 1993).

Most motile organisms (fishes, crabs, and some sand dwelling organisms) within the dredging and offshore disposal areas should be able to escape these areas during construction. Less-motile individuals that are unable to escape from construction would be lost, but lost populations of those individuals will likely recolonize rapidly after project completion. Any project alternative would produce temporary increases in turbidity but would not result in significant long-term water quality degradation. Short-term reductions in primary productivity and reproductive and feeding success of invertebrate species and fish are expected. These impacts should not negatively affect the sustainability of these populations given the localized scale of impacts.

Construction of the project alternatives will involve a short-term increase in consumption of energy resources. The larger, more fuel-efficient ships that will use the deeper channel should result in more efficient long-term energy consumption and increased productivity.

7.17 Indirect Effects

An indirect impact of a project can be defined as an effect on the environment in the project area that is not immediately attributable to the project but is caused indirectly by the project. The project alternatives would allow deeper draft vessels to access JAXPORT facilities and allow the port to handle greater volumes of cargo. An increase in goods moving through the port could trigger a need for more and larger facilities to handle the increased cargo. Construction of the proposed project alternatives will benefit JAXPORT, Jacksonville, the shipping industry, and local and state economies.

7.18 Compatibility with Federal, State, and Local Objectives

Construction of the project alternatives would be compatible with Federal, state, and local objectives to ensure the economic viability of JAXPORT and support economic activity in the region.

With the appropriate environmental impact avoidance, minimization, and mitigation and monitoring, the project alternatives would be compatible with the Federal, state, and local objectives for environmental protection.

7.19 Conflicts and Controversy

A number of issues continue to be discussed with agencies and other stakeholders, including salinity impacts and mitigation, shoreline erosion, and potential impacts to threatened and endangered species.

7.20 Uncertain, Unique, or Unknown Risks

The project alternatives involve dredging the Jacksonville Harbor channel with conventional dredging methodologies. These methods do not involve uncertain, unique, or unknown risks.

The evaluation of the project alternatives' effects on natural communities as a result of the movement of higher salinity water upstream in the LSJR and tributaries relies on the use of hydrodynamic and ecological models. The hydrodynamic model reports (Taylor 2011, 2013b, 2013c) present error statistics for the EFDC and CE-QUAL-ICM models. Similar error statistics cannot, however, be calculated for the ecological models. This represents an uncertain risk associated with evaluation of the ecological model results.

Recorded conditions for streamflow, rainfall, land use, and other factors during a six-year period (1996 – 2001) provide input data for the hydrodynamic models. Future condition hydrodynamic model simulations further rely on assumptions about the rate of sea level rise, quantity of water withdrawal from the middle St. Johns River, patterns of land use, and other factors. Actual conditions will deviate from those used to drive the models. These deviations introduce additional uncertainty in the models' ability to predict future conditions and impacts. These uncertainties are, however, inherent in the use of numerical models and do not represent an unknown risk.

7.21 Precedent and Principle for Future Actions

The project alternatives involve increasing the depth of the Jacksonville Harbor navigation channel with conventional dredging and dredged material management methodologies. The USACE and others have performed dredging for over one hundred years. The project would not set precedent of principle for future actions.

7.22 Environmental Commitments

The USACE commits to completing or implementing the following analyses and measures:

1. Salinity impacts to wetlands and submerged aquatic vegetation induced by the proposed deepening will be mitigated. Mitigation planning will continue to be coordinated with regulatory agencies (see **Appendix E**).

2. As part of the Corrective Action Plan, results of data collection will be coordinated with the regulatory agencies and other stakeholders and modification to the mitigation plan, if necessary, will be implemented (see **Appendix E**).

3. Protective measures for threatened and endangered species will be implemented pursuant to Endangered Species Act-Section 7 consultation (see Section 7.3.2 and Appendix F).

4. A Pre-treatment (Blasting) Plan, which includes protection measures for marine animals, has been prepared and has been coordinated with regulatory agencies (see **Appendix A, Attachment D [Pre-treatment Plan]**).

5. The proposed deepening will be performed in compliance with state water quality statutes.

6. Migratory birds will be protected in accordance with the Migratory Bird Treaty Act.

7. During the construction phase, equipment emissions and noise will be controlled in compliance with applicable laws.

8. During the construction phase, the USACE contracting officer will notify the contractor in writing of any observed noncompliance with Federal, state, or local laws or regulations, permits and the contractor's Environmental Protection Plan.

7.23 Compliance with Environmental Requirements

7.23.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and a SEIS has been prepared and was made available to stakeholders for review and comment. The project will be in full compliance with the National Environmental Policy Act.

7.23.2 Endangered Species Act of 1973

In accordance with Section 7 of the Endangered Species Act, USACE initiated formal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) on February 15, 2013. The USFWS provided a consultation letter dated November 15, 2013, and the NMFS provided a Biological Opinion on February 6, 2014, on the proposed deepening (see Appendix F). This project will be in full compliance with the act.

7.23.3 Fish and Wildlife Coordination Act (FWCA) of 1958

This project has been coordinated with the USFWS. A Fish and Wildlife Coordination Act Report has been prepared. This project will be in full compliance with the act.

7.23.4 National Historic Preservation Act of 1966 (INTER ALIA)

In 2010, USACE conducted an archaeological diver investigation of the 51 potentially significant magnetic, sidescan sonar and subbottom anomalies recommended for further investigation (PCI, 2011). Two, submerged prehistoric archaeological sites (8DU21117 and 8DU21118) were identified within the proposed project area from the subbottom anomalies and are potentially eligible for the National Register of Historic Places (NRHP). Site 8DU21117, located near Drummond Creek at River Mile 14 is outside the current Federal project footprint and will not be adversely affected by this project. Site 8DU21118, located off Great Marsh Island at Mile Point, will be buffered as a part of the Mile Point project, by the placement of dredged material to restore Great Marsh Island, to prevent adverse project impacts. The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project will be in compliance with applicable requirements.

7.23.5 Clean Water Act of 1972

The project will be in compliance with this act. A Section 401 water quality certification will be obtained from the Florida Department of Environmental Protection. All state water quality standards will be met. A Section 404(b) (1) evaluation is included in this report as **Appendix H**. Public notification has been issued in a manner which satisfies the requirements of Section 404 of the Clean Water Act.

7.23.6 Clean Air Act of 1972

An air quality emission analysis for the Port of Jacksonville has been prepared, and has been coordinated with the USEPA and FDEP (see **Appendix I**). The study area is in attainment with all air quality criteria and the proposed project will not cause the study area to go out of attainment. During construction, vehicular emission and airborne dust particulates resulting from construction activities will be controlled. This project will be in compliance with the act.

7.23.7 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR Part 930 Subpart C is included in this report as **Appendix G**. The Florida State Clearinghouse stated by letter dated August 13, 2013 that the proposed deepening is provisionally consistent with the Florida Coastal Management Program (see **Appendix K**). A final consistency determination will be provided concurrently with the issuance of the state water quality certification (permit).

7.23.8 Farmland Protection Policy Act of 1981

If pursued as part of project mitigation, conservation lands to be purchased would be examined for agricultural use and coordinated with the Natural Resource Conservation Service as required by the act.

7.23.9 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project-related activities. This act is not applicable.

7.23.10 Marine Mammal Protection Act of 1972

Protective measures for marine mammals such as whales and manatees will be implemented. This project is being coordinated with the USFWS and NMFS. An Incidental Harassment Authorization will be requested for the proposed use of confined blasting techniques. The project will be in compliance with the act.

7.23.11 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

7.23.12 Federal Water Project Recreation Act

The principles of the Federal Water Project Recreation Act, (Public Law 89-72) as amended, have been fully considered.

7.23.13 Fishery Conservation and Management Act of 1976

The project has been coordinated with the National Marine Fisheries Service and will be in compliance with the act.

7.23.14 Submerged Lands Act of 1953

The project would occur on submerged lands of the State of Florida. The navigation project will be in compliance with the act.

7.23.15 Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act of 1990

Neither the no-action alternative nor any of the project alternatives would affect the two CBRA units located on the north side of the confluence of the St. Johns River and the Atlantic Ocean (opposite Mayport Naval Station). The project will be in compliance with the act.

7.23.16 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action will be subject to the public notice, possible public hearing, and other evaluations normally conducted for activities subject to the act. The project will be in full compliance.

7.23.17 Anadromous Fish Conservation Act

The project has been coordinated with NMFS and will be in compliance with the act.

7.23.18 Migratory Bird Treaty Act and Migratory Bird Conservation Act

Measures will be taken to protect migratory birds, i.e. avoiding nesting sites. The project will be in compliance with these acts.

7.23.19 Marine Protection, Research and Sanctuaries Act

The term "dumping" as defined in the Act, 33 U.S.C. 1402(f), does apply to the disposal of material within a designated ODMDS. Concurrence from USEPA under Section 103 of the act would be required along with any required testing of the material for suitability for ocean dumping. The project will be in compliance with the act.

7.23. 20 Magnuson-Stevens Fishery Conservation and Management Act

The proposed work has been coordinated with the NMFS. The NMFS provided a letter dated December 20, 2013, which contained EFH Conservation Recommendations (see Appendix F). The project will be in full compliance with the act.

7.23.21 E.O. 11990, Protection of Wetlands

Salinity impacts to wetlands induced by the proposed deepening have been evaluated, and will be mitigated.

7.23.22 E.O. 11988, Flood Plain Management

This project would have no adverse impacts to flood plain management.

7.23.23 E.O. 12898, Environmental Justice

In accordance with this E.O., USACE has determined that no group of people would bear a disproportionate share of the environmental consequences resulting from the proposed work.

7.23.24 E.O. 13089, Coral Reef Protection

This project would not impact those species, habitats, and other natural resources associated with coral reefs.

7.23.25 E.O. 13112, Invasive Species

Under this EO, the introduction of invasive species has been evaluated (see **Section 7.3.12**).

7.24 Public Involvement*

7.24.1 Authority

Public involvement during this study is being conducting in compliance with the following Federal laws and regulations:

- National Environmental Policy Act (NEPA) of 1969**,** as amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), Sept. 13, 1982);
- U.S. Clean Water Act, Section 404(a);
- Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA, Sec. 1501.7 Scoping and Sec. 1506.6 Public Involvement;
- Engineering Regulation (ER) 200-2-2;
- ER 1105-2-100.

Federal agencies are required under NEPA to undertake an assessment of the environmental effects of their proposed actions prior to making decisions. Two major purposes of the environmental review process are better informed decisions and citizen involvement, both of which should lead to implementation of NEPA policies. There are three Federal agencies that have particular responsibilities for NEPA. Primary responsibility is vested in the Council on Environmental Quality (CEQ), established by Congress as outlined in NEPA. Congress placed CEQ in the Executive Office of the President and gave it many responsibilities, including the responsibility to ensure that Federal agencies meet their obligations under the Act. The CEQ oversees implementation of NEPA, principally through issuance and interpretation of NEPA regulations that implement the procedural requirements of NEPA. CEQ also reviews and approves Federal agency NEPA procedures, approves of alternative arrangements for compliance with NEPA in the case of emergencies, and helps to resolve disputes between Federal agencies and with other governmental entities and members of the public (CEQ 2007).

The U.S. Environmental Protection Agency (USEPA) Office of Federal Activities reviews environmental impact statements (EIS) and some environmental assessments (EA) issued by Federal agencies. It provides its comments to the public by publishing summaries of them in the Federal Register, a daily publication that provides notice of Federal agency actions. The USEPA reviews are intended to assist Federal agencies in improving their NEPA analyses and decisions (CEQ 2007).

Another government entity involved in NEPA is the U.S. Institute for Environmental Conflict Resolution, which was established by the Environmental Policy and Conflict Resolution Act of 1998 to assist in resolving conflict over environmental issues that involve Federal agencies. While part of the Federal Government (it is located within the Morris K. Udall Foundation, a Federal agency located in Tucson, Arizona), it provides an independent, neutral, place for Federal agencies to work with citizens as well as State, local, and Tribal governments, private organizations, and businesses to reach common ground. The Institute provides dispute resolution alternatives to litigation and other adversarial approaches. The Institute is also charged with assisting the Federal Government in the implementation of the substantive policies set forth in Section 101 of NEPA (CEQ 2007).

In 1978, CEQ issued binding regulations directing agencies on the fundamental requirements necessary to fulfill their NEPA obligations. The CEQ regulations set forth minimum requirements for agencies. The CEQ regulations also called for agencies to create their own implementing procedures that supplement the minimum requirements based on each agency's specific mandates, obligations, and missions. In accordance with these regulations, the USACE created ER 200-2-2 and ER 1105-2-100 to provide specific internal guidance on a number of issues including NEPA.

7.24.2 Scoping

As stated by the CEQ, there shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process is called scoping. The CEQ identifies the public that should be involved in the scoping process as affected Federal, state, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental grounds).

Public involvement continues to be a critical component of the Jacksonville Harbor Navigation (Deepening) Study. Scoping efforts began early in order to identify issues that could be taken into consideration during the study's plan formulation process. These efforts have included Federal Register notification, a scoping letter, a public workshop, public meetings, monthly and bi-monthly teleconferences, as well as more informal communications.

7.24.2.1 Notice of Intent and Scoping Letter

In compliance with ER-200-2-2 (repeated in CEQ Regulation 1501.7), a Notice of Intent to prepare a Supplemental Environmental Impact Statement (SEIS) was published in the Federal Register on April 13, 2007. A scoping letter dated May 4, 2007 was sent to stakeholders soliciting views and comments regarding environmental and cultural resources, study objectives, and important features within the study area.

7.24.2.2 Public Workshop and Public Meetings

A public workshop and public meetings were held in order to provide the public with opportunities to discuss the study, and were scheduled as follows:

- Public Workshop - May 5, 2009
- Public Meeting on Hydrodynamic, Ecological, and Water Quality Modeling (1) - May 22, 2012
- Public Meeting on Hydrodynamic, Ecological, and Water Quality Modeling (2) - October 25, 2012
- Public Meeting on the Potential Use of Confined Blasting Techniques - March 12, 2013
- Public Meeting on the Draft Integrated General Re-evaluation Report II and DSEIS - June 27, 2013
- Public Meeting on the Revised Draft Integrated General Re-evaluation Report II and DSEIS - September 24, 2013

All of the meetings followed a similar format consisting of a brief presentation, formal comment period, and were concluded with an informal poster session which provided stakeholders with additional opportunity to further discuss the study. The meetings were advertized through the local media (newspaper and in some cases television), mailings, e-mailing, and on the study website.

7.24.2.3 Bi-Monthly Teleconferences

Beginning in August of 2012, USACE held bi-monthly teleconferences to provide project updates to stakeholders and to take comment. These teleconferences are expected to continue through 2013.

7.24.2.4 Study Website

Study presentations, reports, minutes to meetings, and other documents can be found at the following study website:

http://www.saj.usace.army.mil/Missions/CivilWorks/Navigation/NavigationProjects/JacksonvilleHarborChannelDeepeningStudy.aspx

7.24.2.5 Comment Period on Draft Integrated General Re-evaluation Report II and DSEIS

The Draft Integrated General Re-evaluation Report II and DSEIS were provided to the public for review and comment on May 31, 2013. A revised Draft Integrated General Re-evaluation Report and DSEIS were provided to the public in the same manner as the initial Draft Integrated General Re-evaluation Report and DSEIS on September 3, 2013. All analyses, including modeling, were completed and made available to the public on the study website by September 30, 2013. The comment period, which began on May 31, 2013, was extended to October 24, 2013 in order to provide stakeholders an opportunity to review and comment on all completed analyses and modeling. All comments received on the draft report, as well as responses can be found in **Appendix K**. Correspondence received during preparation and revision of the draft report is in **Appendix F**.

7.24.3 Agency Coordination

Coordination on this study with Federal, state, or local agencies are summarized as follows:

- Scoping Letter - May 4, 2007
- Feasibility Scoping Meeting - February 7, 2008
- Public Workshop - May 5, 2009
- Hydrodynamic, Ecological, and Water Quality Modeling Meetings with Individual Agencies - April and May, 2011
- Hydrodynamic, Ecological, and Water Quality Modeling Interagency Meetings - March 12 and October 22, 2012
- Hydrodynamic, Ecological, and Water Quality Modeling Public Meetings - May 22 and October 25, 2012
- Monthly Interagency Teleconferences-starting in June 2012 through 2013
- Bi-monthly Public Teleconferences-starting in August 2012 through 2013
- USACE and Florida Fish and Wildlife Conservation Commission Cooperative Agreement on Fisheries Impact Assessment -Signed January 25, 2013
- Endangered Species Act, Section 7 Consultation-Initiated February 15, 2013
- Fish and Wildlife Coordination Act, Information Submittal to U.S. Fish and Wildlife Service - transmitted February 19, 2013
- Impact and Mitigation Regulatory Agency Meetings - February and March, 2013, and continued through coordination of Draft Integrated General Re-evaluation Report II and DSEIS

- Long-term Monitoring Interagency Meetings - January and February, 2013, and additional interagency meetings as needed
- Comment Period on Draft Integrated General Re-evaluation Report II and DSEIS-Scheduled to begin May 31 and extended to October 24, 2013
- Essential Fish Habitat Coordination with National Marine Fisheries Service - scheduled initiated in May, 2013
- Public Meeting on the Draft Integrated General Re-evaluation Report II and DSEIS - June 27, 2013
- Public Meeting on the Final Integrated General Re-evaluation Report II and DSEIS - September 24, 2013
- Final State and Agency Review - Scheduled for 2014
- Initiate Water Quality Certification (WQC aka state permit) - Scheduled for Spring 2014
- Receive Water Quality Certification - Scheduled for Spring 2015

In addition to the above items, extensive informal coordination with the agencies has also been conducted.

Finally, in accordance with ER 1105-2-100 and 40 CFR § 1501.6, USACE invited the USEPA, NMFS, and USFWS to be cooperating agencies on this study. These agencies were specifically requested to provide technical input on modeling and mitigation. The USEPA accepted this offer and provided comments on modeling, mitigation, and monitoring as well as other study concerns and issues. Pursuant to the Interagency Cooperation Agreement between the FDEP and USACE, FDEP has appointed a team member to the proposed deepening of Jacksonville Harbor.

7.24.3.1 List of Recipients

A mailing list of recipients can be found in **Appendix F**.

7.24.4 Comments Received and Responses

Public and agency comments were compiled throughout the study, and USACE has prepared a response to each comment. The comments and responses of the DRAFT GRR II and SEIS are presented in **Appendix F** and summarized below. Additional comments and responses are in **Appendix K**. Where responses indicated a change or addition to the report, they have been included in the final report.

7.24.4.1 Public Comment

Common areas of public interest or concern are presented below.

- Dredged material placement on beaches

- Effects on regional economics
- Water quality (including salinity) of the river
- Sedimentation or siltation along the river and tributaries
- Shoreline erosion (including from ship wakes)
- Determination of existing environmental resources
- Concern on amount of environmental impact
- Quality and quantity of mitigation
- Insufficient data or length of data record to perform modeling
- Model inadequacy
- Effect of water withdrawals on the river
- Concerns related to fishing resources
- Sea level rise
- Groundwater/aquifer effects and saltwater intrusion
- Disposal of dredged material
- Concerns over compressed schedule
- Human health effects from creosote in dredged material

7.24.4.2 Agency Comment

Common areas of agency interest or concern are presented below.

- Dredged material placement (including beneficial use)
- Effects of blasting
- Environmental impacts
- Salinity and effects on submerged aquatic vegetation and other resources
- Upstream surface water use, water withdrawals
- Storm surge
- Sea level rise
- Flushing, circulation and sedimentation of adjacent areas to the channel (including tributaries)
- Impact to historic properties in the study area
- Relocate Talleyrand facilities to Blount Island
- Impact to threatened and endangered species
- Grounding of vessels in the channel due to insufficient depth
- Eradication of exotic-invasive plants on upland placement areas
- Quality of dredged materials (including contamination)
- Shoreline erosion
- Impact to aquifers and groundwater
- Impacts to the viewshed of Ribault Monument

- Mitigation costs
- Increasing size of vessels
- Invasive species introduction by vessels
- Concern about using qualitative analyses versus quantitative
- Concerns over compressed schedule
- Impacts to fisheries resources
- Future monitoring

8.0 RECOMMENDATIONS

I concur with the findings presented in this report. The recommended plan developed is technically sound, economically justified, and socially and environmentally acceptable.

The work proposed is not within existing authority. I recommend that the plan selected herein for the 47 foot locally preferred deepening alternative be authorized by Congress for implementation. Mitigation is required for wetlands and submerged aquatic vegetation affected by the deepening. A mitigation plan, consisting of conservation land purchase of 638 acres of freshwater wetlands, uplands, river shoreline, and salt marsh wetlands has been proposed. Aids to navigation will be provided at 100% Federal cost. For the purpose of calculating the Section 902 limit, the total estimated project first cost of the project is $600,900,000, October 1, 2013 price level, including an estimated Federal share of $361,900,000 and an estimated non-federal share of $239,000,000. The total estimated project cost includes only GNF costs plus LERR value. The Federal share includes only the Government's percentage share of GNF costs. The estimated non-federal share includes only the non-federal initial percentage share of GNF costs (i.e. not the extra 10% payment amount) plus LERR value. The cost for local service facilities is approximately $82 million dollars and is primarily for upgrading the bulkheads for the deeper channel. These costs are 100% non-federal and are not included in the first total cost of the recommended plan.

The recommended plan conforms to the essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines on project development. If the project were to receive funds for Federal implementation, it would be implemented subject to the cost sharing, financing, and other applicable requirements of Federal law and policy for navigation projects including WRDA 1986, as amended; and would be implemented with such modifications, as the Chief of Engineers deems advisable within his discretionary authority. Aids to navigation are to be funded by the U.S. Coast Guard. Federal implementation is contingent upon the non-federal sponsor agreeing to comply with applicable Federal laws and policies. Prior to implementation, the non-federal sponsor shall agree to:

a. Provide, during the periods of design and construction, funds necessary to make its total contribution for commercial navigation equal to:

(1) 25 percent of the cost of design and construction of the GNFs attributable to dredging to a depth in excess of -20 feet MLLW but not in excess of -45 feet MLLW, plus

(2) 100 percent of the costs attributable to dredging to a depth over -45 feet MLLW;

b. Provide all lands, easement, and rights-of-way (LER), including those necessary for the borrowing of material and placement of dredged or excavated material, and perform or assure performance of all relocations, including utility relocations, all as determined by the Government to be necessary for the construction or operation and maintenance of the GNFs. Provide and maintain during the authorized life of the project the mitigation lands (approximately 638 acres) determined required for mitigation for impacts for the project.

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the GNFs, an additional amount equal to 10 percent of the total cost of construction of the NED GNFs less the amount of credit afforded by the Government for the value of the LER and relocations, including utility relocations, provided by the non-federal sponsor for the GNFs. If the amount of credit afforded by the Government for the value of LER, and relocations, including utility relocations, provided by the non-federal sponsor equals or exceeds 10 percent of the total cost of construction of the GNFs, the non-federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LER and relocations, including utility relocations, in excess of 10 percent of the total costs of construction of the GNFs;

d. Provide, operate, and maintain, at no cost to the Government, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Government.

e. In the case of project features greater than -45 feet MLLW in depth, provide 100 percent of the excess cost of operation and maintenance of the project over that cost which the Government determines would be incurred for operation and maintenance if the project had a depth of 45 feet;

f. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

g. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating and maintaining the GNFs.

h. Hold and save the United States free from all damages arising from the construction or operation and maintenance of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.

i. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR § 33.20;

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601–9675, that may exist in, on, or under LER that the Government determines to be necessary for the construction or operation and maintenance of the GNFs. However, for lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Government provides the non-federal sponsor with prior specific written direction, in which case the non-federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume complete financial responsibility, as between the Government and the non-federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under LER that the Government determines to be necessary for the construction or operation and maintenance of the project;

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

m. Comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, PL 99-662, as amended, (33 U.S.C. 2211(e)) which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended, (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the placement of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, PL 88-352 (42 USC 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army”; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive changes the provision of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c));

p. Provide the non-federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project; and

q. Not use funds from other Federal programs, including any non-federal contribution required as a matching share therefore, to meet any of the non Federal sponsor’s obligations for the project costs unless the Federal agency providing the Federal portion of such funds verifies in writing that such funds are authorized to be used to carry out the project.

The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the State of Florida, the Jacksonville Port Authority (the non-federal sponsor), interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

Alan M. Dodd
Colonel, U. S. Army
District Commander

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