

Brunswick Harbor Deepening Project

Mitigation Closeout Report



**US Army Corps
of Engineers**
Savannah District

**Planning Branch
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Background:

1. The mitigation requirements for the Brunswick Harbor Deepening Project are based on two different types of environmental impacts: Essential Fish Habitat (EFH) and wetlands. Wetland mitigation was approved in the East River Turning Basin EA and FONSI, signed on April 18, 2007, and the GRR signed on April 24, 2007. The EFH mitigation was approved by NMFS in an email dated October 26, 2010. Modifications to the approved plans became necessary primarily as a result of FAA concerns regarding the proposed construction of marsh at the Brunswick “bird island”. Modifications to the EFH and wetland mitigation plans were coordinated with the natural resource agencies by emails dated May 14, 2010 and September 13, 2010. Details concerning the mitigation plans are included in the May 11, 2011 MFR from PD-E titled “Brunswick Harbor Deepening Project Mitigation”. No objections to the proposed revisions were received from any natural resource agency, and the final EFH mitigation was approved by NMFS in an email dated October 26, 2010.
2. To determine project impacts and quantify the habitat losses caused by the mitigation efforts, the Habitat Equivalency Analysis method was used during the development of the GRR. The Habitat Equivalency Analysis was specifically designed to determine how much restoration was required to compensate for habitat injuries to the ecosystem. This method assumes that equivalent habitats will provide equivalent services, meaning that years of lost services can be compensated for by providing acres of additional habitat. Additional information on the Habitat Equivalency Analysis method can be found on the following website: <https://casedocuments.darrp.noaa.gov/northwest/cbay/pdf/cbhy-a.pdf>

Project wetland impacts from the project included wetlands excavated to expand the East River Turning Basin expansion, wetlands excavated at the mitigation sites to ensure sufficient tidal flushing of the restoration areas on Andrews Island, and future fills for ramp and weir construction. Calculations from the Habitat Equivalency Analysis method determined that wetland impacts totaled approximately 74.2 credits. The 2007 GRR stated that to mitigate for the 7.6 acres of impacts to salt marsh, the project must restore approximately 16.7 acres of salt marsh to fulfill the required 74.2 credits.

To restore wetlands at Andrews Island to fulfill the mitigation requirements, Savannah District began work in 2008 by lowering the elevation of several areas outside the Andrews Island dike to allow for tidal influence, sprigging the majority of the areas with *Spartina alterniflora*, and sprigging Area C with *Juncus roemerianus*. Construction was completed at the 12 restoration sites in 2010. In

two areas the plantings did not grow well due to frequent inundation during the first year's growing season. In response, the District replanted Area 2 with *Spartina alterniflora* between July 22 and 25, 2011 and replanted Area C with *Juncus roemerianus* between September 14 and 16, 2011. As part of adaptive management, the District also ditched several restoration sites in the fall of 2012 to reduce standing water on those planted sites. These efforts increased the total acreage to 16.82 acres restored.

Along with restoring salt marsh habitat to mitigate for expanding the East River Turning Basin, Savannah District placed dredged material within the Brunswick Sound to create a bird island. That beneficial use feature was completed in 2008 and provides additional environmental benefits. A map of the overall mitigation areas is shown in Figure 1.

3. Once the construction efforts at Andrew's Island were completed, Savannah District was required to monitor the areas for five years to ensure that the project was meeting the mitigation requirements. The following success criteria were established in the 2007 GRR:

- Year 1 (2012) – 15% coverage
- Year 2 (2013) – 30% coverage
- Year 3 (2014) – 60% coverage
- Year 4 (2015) – 90% coverage
- Year 5 (2016) – maintain 90% coverage and evaluate status of success and lessons learned

In order to track progress being made on Andrew's Island, the District monitored the wetland mitigation twice each year. As the marsh matured, the goal was to increase the amount of vegetation coverage at each of the areas on Andrew's Island. This report documents the conditions of the wetland mitigation sites in 2016 and summarizes the results from the entire post-construction monitoring period.

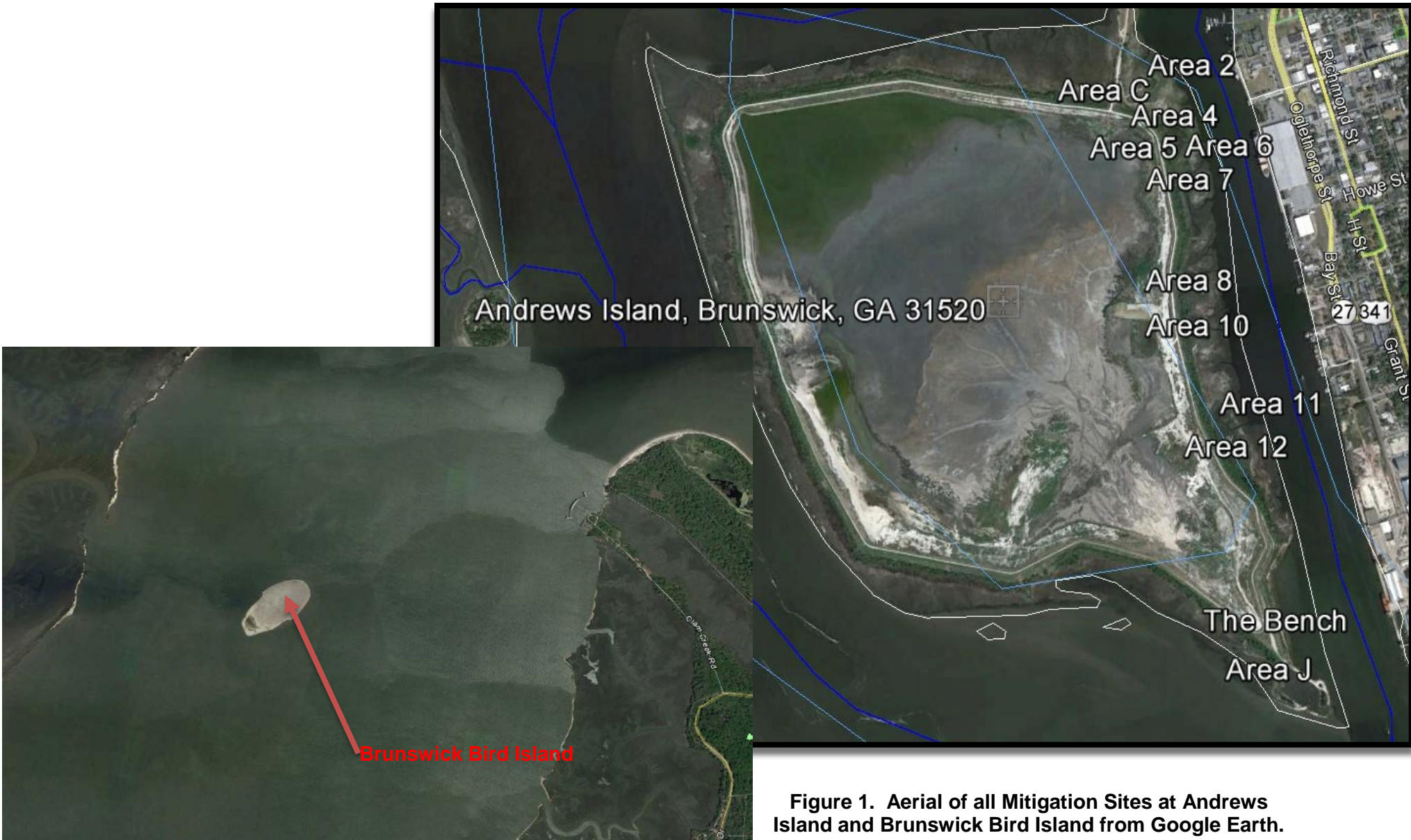


Figure 1. Aerial of all Mitigation Sites at Andrews Island and Brunswick Bird Island from Google Earth.

Summary of Previous Monitoring Results:

During the first year of monitoring the wetland vegetation in 2012, the percent of the sites that had revegetated (marsh grass coverage) was approximately 80% of the mitigation commitment (13.51 acres out of the 16.82 required). The deficit in marsh acreage was 3.31 acres. Through coordination with Georgia Department of Natural Resources (GADNR) a conservative estimate of 70% coverage was established since it was uncertain at the time of the 2012 survey how much of the areas would remain healthy due to standing water in several of the mitigation areas. USACE Savannah District Planning Division and GADNR decided to allow ditching in the fall of 2012 in areas with standing water during low tide.

During the second year of monitoring in 2013, the percent of the sites covered with vegetation was approximately 95% (16.14 acres out of the 16.82 required). It was determined that these numbers may have been slightly overstated due to the inability to access/discover every existing bare or water inundated area. With the sprigged marsh grasses becoming increasingly taller and thicker, it was more difficult to visually detect and traverse the areas. However, all significant bare or water inundated areas were accounted for and all of the areas had observable increased marsh grass coverage. As a result, a conservative estimate of 85% was determined to be a more appropriate estimate at that time.

During the third year of monitoring in 2014, the percent of vegetative coverage exceeded the mitigation commitment (17.58 acres out of the 16.82 required). It was noted that those numbers may have been overstated due to the inability to access/discover every existing bare or water inundated area. All significant bare or water inundated areas were accounted for and all of the areas (with the exception of C) had increased or maintained marsh grass percent coverage since the spring survey. As a result, a conservative estimate of 95% was determined to be a more appropriate percent coverage. GADNR provided aerial photos of the mitigation sites which were useful in detecting any missed bare areas.

During the fourth year of monitoring in 2015, the percent of vegetative coverage again exceeded the mitigation requirement (18.22 acres out of the 16.82 required). The numbers were again thought to possibly be slightly overstated due to the inability to access/discover every existing bare or water inundated area. As a result, a conservative estimate of 95% was determined to be a more appropriate percent coverage. After completing the 2015 surveys, the smaller pools onsite were observed supporting a variety of marsh/wetland fauna and algae and were a good food source for wading birds, fish, and invertebrates.

Final Year's Monitoring Results:

On March 8, 2016, GADNR provided USACE Savannah District Planning Division with areal images taken of the mitigation areas by an Unmanned Aerial Vehicle (UAV). The images were taken on February 5, 2016 from approximately 200 feet above the ground. This test of GADNR's new UAVs was discussed at an earlier meeting to assess the quality and usefulness of such technology in future GADNR or USACE projects.

In lieu of a 2016 spring survey of the mitigation areas, Savannah District Planning Division environmental staff met on site with GADNR staff on April 19 to discuss the images and ground-truth the images with observations of one the larger areas which the photos showed had the most unvegetated acreage.

The group walked Area C and agreed that there was more vegetation present than depicted in the aerial image. They agreed that images may better represent the vegetative percent coverage if taken during or immediately after the growing season (sometime in August), rather than in February while most vegetation may still be dormant. GADNR volunteered to retake the images later in the year around August.

A comprehensive topographic and vegetative survey was conducted on September 12 and 13, 2016. A Savannah District survey crew using Ashtech ProFlex 500 land surveying equipment measured the bare, open water areas to develop a detailed analysis of vegetative coverage at each of the restoration sites. Savannah District environmental staff were also on site to assist with the comprehensive survey. During the final year of monitoring in 2016, the percent of vegetative coverage was over 100% of the mitigation requirement (17.79 acres out of the 16.82 required). Table 1 summarizes the mitigation commitments and the extent of the revegetation from the September 2016 comprehensive survey. Table 2 summarizes the mitigation commitments and extent of attainment from the aerial imagery taken in 2016 by GADNR.



Figure 2. Survey Efforts in Area 10.



Figure 3 (above). Survey Efforts in Area 12.



Figure 4 (Left) Area J.



**Figures 5 and 6.
Area C
Vegetation
Coverage.**

Table 1. Mitigation Commitments and Attainment Status from September 2016 Survey

Area	Design Size (Acres)	Perimeter (estimated limits of growing area) (Acres)	Wetland Mitigation Required (Acres)	2016 Wetland Condition (Acres)	Wetland Deficit/Excess (Acres)
Area C (<i>J. roemerianus</i>)	2.54	2.24	1.14	2.08	+0.94
Area J total	5.91	5.11	4.59	4.51	-0.08
Area 2 (<i>S. alterniflora</i>)	0.60	0.60	0.62	0.55	-0.07
Area 4 (<i>S. alterniflora</i>)	1.10	1.07	0	0.69	+0.69
Area 5 (<i>S. alterniflora</i>)	0.30	0.36	1.36	0.29	-1.07
Area 6 (<i>S. alterniflora</i>)	0.10	0.15	0	0.09	+0.09
Area 7 (<i>S. alterniflora</i>)	0.72	1.44	0.60	1.39	+0.79
Area 8 (<i>S. alterniflora</i>)	1.07	0.87	0.76	0.86	+0.10
Area 10 (<i>S. alterniflora</i>)	1.41	1.36	1.23	1.33	+0.10
Area 11 (<i>S. alterniflora</i>)	2.08	2.03	1.98	2.0	+0.02
Area 12 (<i>S. alterniflora</i>)	1.12	1.06	0.76	0.97	+0.21
Shelf (<i>S. alterniflora</i>)	2.30	3.50	3.53	2.78	-0.75
Fix inundated areas (ditching)			0.25	0.25	0
Totals	19.25	19.79	16.82	17.79	+0.97

Table 2 summarizes the mitigation commitments and extent of attainment from the aerial imagery taken in July 2016 by GADNR compared with the results of the USACE survey. The data gathered from the USACE 2016 comprehensive survey indicate that the project has exceeded the mitigation requirements by almost an acre, while data from the GADNR aerial photography show that the project exceeded its requirements by almost 1.5 acres. The two different methods used to determine project success had for the most part very similar results. There were a few additional areas that the aerial photography was able to identify compared to the on-the-ground comprehensive survey. Those additional areas explain why the acreage calculated from the aerial photography is slightly greater than that obtained from the comprehensive survey.

Table 2. Comparison of GADNR UAV 2016 Survey vs USACE September 2016 Survey Results

Area	Wetland Mitigation Required (Acres)	DNR UAV 2016 Wetland Condition (Acres)	DNR UAV Wetland Deficit/Excess (Acres)	USACE Wetland Deficit/Excess (Acres)	Difference between USACE DNR Deficit/Excess (USACE-DNR numbers) (Acres)
Area C (<i>J. roemerianus</i>)	1.14	2.08	+0.94	+0.94	0
Area J total	4.59	4.49	-0.10	-0.08	0.02
Area 2 (<i>S. alterniflora</i>)	0.62	0.55	-0.07	-0.07	0
Area 4 (<i>S. alterniflora</i>)	0	0.54	+0.54	+0.69	0.15
Area 5 (<i>S. alterniflora</i>)	1.36	0.27	-1.09	-1.07	0.02
Area 6 (<i>S. alterniflora</i>)	0	0.13	+0.13	+0.09	-0.04
Area 7 (<i>S. alterniflora</i>)	0.60	1.38	+0.78	+0.79	0.01
Area 8 (<i>S. alterniflora</i>)	0.76	0.85	+0.09	+0.10	0.01
Area 10 (<i>S. alterniflora</i>)	1.23	1.33	+0.10	+0.10	0
Area 11 (<i>S. alterniflora</i>)	1.98	2.0	+0.02	+0.02	0
Area 12 (<i>S. alterniflora</i>)	0.76	0.96	+0.20	+0.21	0.01
Shelf (<i>S. alterniflora</i>)	3.53	3.37	-0.16	-0.75	-0.59
Fix inundated areas (ditching)	0.25	0.25	0	0	0
Totals	16.82	18.19	+1.37	+0.97	-0.4

Conclusions:

The Brunswick Harbor Deepening Project committed to restore approximately 16.7 acres of salt marsh habitat, and approximately 18.1¹ acres for additional environmental benefits by creating a bird island with dredged material. Savannah District finished constructing the bird island in 2008, and completed lowering the marsh elevations and planting the mitigation sites on Andrew's Island in September 2011. Savannah District monitored the wetland restoration sites for 5 years, as specified in the 2007 GRR. The final survey results in 2016 demonstrate that the project not only met the success criteria established in the 2007 GRR, but also exceeded those mitigation requirements.

¹ 2001. Limited Re-evaluation Report, Finding of No Significant Impact and Final Environmental Assessment: Brunswick Harbor Deepening Project, Construction of Bird Nesting Island

The project exceeded the required vegetation coverage requirement throughout the duration of the 5-year monitoring program. In year one (2012), the project was to maintain 15% vegetative coverage but survey results showed about 70% coverage. In year two (2013), the project was to maintain 30% coverage but survey results showed about 85% coverage. In year three (2014), the project was to maintain 60% coverage while survey results showed about 95% coverage. In year four (2015) and five (2016), the sites were to maintain 90% vegetative coverage, and survey results showed 95% coverage and over 100% respectively.

USACE will apply the excess 0.97 acres of wetlands created over the required amount as compensation for marsh that was disturbed at the end of the Andrews Island DMCA outflow pipes at Weir #1 and Weir #3, and a ditched area through the marsh where a dredge pipe was brought to the DMCA from the river. This compensation addresses Project impacts from use of the DMCA that occurred up to the USACE comprehensive survey in September 2016.

While oyster habitat was not part of the original Brunswick Harbor Deepening Project wetland mitigation plan, during the first few years of the project, Savannah District counted some oyster beds that developed within the restoration sites toward the project's EFH habitat commitment. Over time, those areas silted in and are slowly being replaced with *Spartina*, which also fulfill the project's EFH commitment. As seen in Figure 3, oyster habitat still exists in several planting stakes in the area.

The following observations may be applicable for monitoring other wetland restoration sites:

- Savannah District environmental staff monitored the sites at least twice a year via site visits to track the status of the revegetation. That frequency appeared to be just right.
- When standing water was spotted, ditching was performed to drain the water to allow proper flushing and prevent standing water that would kill the marsh plants. The minor adjustments to the sites proved to be very effective in increasing the growth of *Spartina*.
- The project was planted in excess of the required acreage to ensure that it would meet the required 90% vegetation coverage. That proved to be a wise decision, as it allowed for some sites to perform less well than others.
- Careful observation of the elevations of adjacent marshes to determine the target elevation of marsh restoration sites proved quite important. A desktop analysis based on existing information and professional judgement was initially used for the mitigation design. After the initial construction and a few years of monitoring, it was observed that some restoration sites had lower elevations than the surrounding natural marsh, and were having issues with flooding. Additional work was performed in Area C so that it would match the elevation of adjacent natural marsh. As a result, Area C revegetated much better, confirming that using the proper marsh elevation is very important to successful saltmarsh mitigation efforts.