MAY 2006

# Draft Supplemental Design Documentation Report and Draft Supplemental Environmental Assessment

## L-40 Borrow Canal Modifications
## C-51 West End Flood Control Project
## Palm Beach County, Florida

U.S. Army Corps
of Engineers
JACKSONVILLE
DISTRICT

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**Design Documentation Report**
**Canal 51 and Stormwater Treatment Area 1 East**
**Central and Southern Florida Project**

## S-362 Discharges to Arthur R. Marshal Loxahatchee National Wildlife Refuge

1. Introduction. The C-51 West End Flood Control Plan was authorized in Section 315 of the Water Resources Development Act (WRDA) of 1996. Authorized components included, but were not limited to, construction of the following: Stormwater Treatment Area 1 East (STA1E) Works, pump stations 319 and 362, C-51 enlargement and gated structure 155A. The project was designed to enhance the level of flood protection that exists in the C-51 basin; provide additional clean water to Water Conservation Area 1 (WCA-1), otherwise known as the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge); and reduce harmful discharges of freshwater to Lake Worth Lagoon. The authorized plan as well as several alternatives for achieving these goals was analyzed in a Final Environmental Impact Statement (FEIS) dated February 1998. Constructed by the U.S. Army Corps of Engineers (COE), as of May 2005 the STA1E is nearly complete except repairs that occurred during the hurricanes of 2004. The scope of the supplemental study is to evaluate alternative means to diminish the potential impacts of pump station 362 (S-362) discharge to the Levee 40 borrow canal (L-40BC) on WCA-1.

Once STA1E is fully operational as authorized, S-362 will discharge treated water into the L-40BC, which bounds WCA-1 to the east. Once stages in the L-40BC exceed top of bank, S-362 discharges will split between canal flow and overland flow through the interior of the Refuge. US Fish and Wildlife Service Refuge officials have identified new concerns as to the potential impact of discharge from L-40BC entering WCA-1. USFWS concern centers on the possibility that discharges from S-362 will cause muck material to be dislodged from the bottom of the L-40BC and transport this material into the interior of the Refuge by discharges when stages exceed top of bank. This migration of muck material could potentially cause damage to indigenous plant species and create an environment favoring exotic plants.

Based on these newly identified concerns, an RMA-2 (River Management Associates) analysis was performed to test the L-40BC's capacity to prevent overflow into the Refuge.

2. Objective: Based on the identified concerns of the Refuge a finite element hydrodynamic numerical model was developed to represent WCA1. The objective of this modeling analysis is to evaluate the velocity distribution of several alternatives downstream of S-362. Velocities in the L-40BC were examined to determine a distance from S-362 where velocities exceeded 0.3 feet per second. In addition for flows that infiltrated into the interior of the Refuge an area calculation was computed to determine the area that had velocities greater than 0.075 feet per second.

3. Model: WCA-1 was modeled using RMA2, a depth-averaged hydrodynamic model of the Corps' TABS-MD modeling system. The model solves the depth-averaged (2D) nonlinear Navier-Stokes equations using an eddy viscosity turbulence closure. The Newton-Raphson iterative approach is used to solve the nonlinear equations. The model uses a fully implicit

Galerkin finite element formulation, allowing for time steps as large as the variation in boundary forcing dictates.

A. Material Specification: The RMA-2 model uses the Manning's or Chezy equation to compute friction and eddy viscosity coefficients are used to define turbulence characteristics. Two basic material types were used to represent the land type within the refuge. Manning's n-value of 0.03 was used for the L-40 and L-7 borrow canals and a variable depth value was used for the marsh. The variable depth Manning's coefficient was approximated based on a Corps report, Part VI Section 7 – Design Memorandum, Interim Report on Evaluation of Manning's n in Vegetated Areas (dated April 2, 1964). In this report several sites with varying depths were analyzed to determine n-values based on depth. The mathematical form of the dependence of the Manning's friction coefficient with depth is (see Figure 1):

$$n = \frac{n_0}{d^{\alpha}} + n_v e^{-d/d_0}$$

where $d$ = water depth

$n_0$ = scaling friction factor for depth dependence

$n_v$ = scaling factor for exponential decay dependence (vegetative effects)

$\alpha$ = exponent on depth dependence

$d_0$ = reference depth for exponential decay

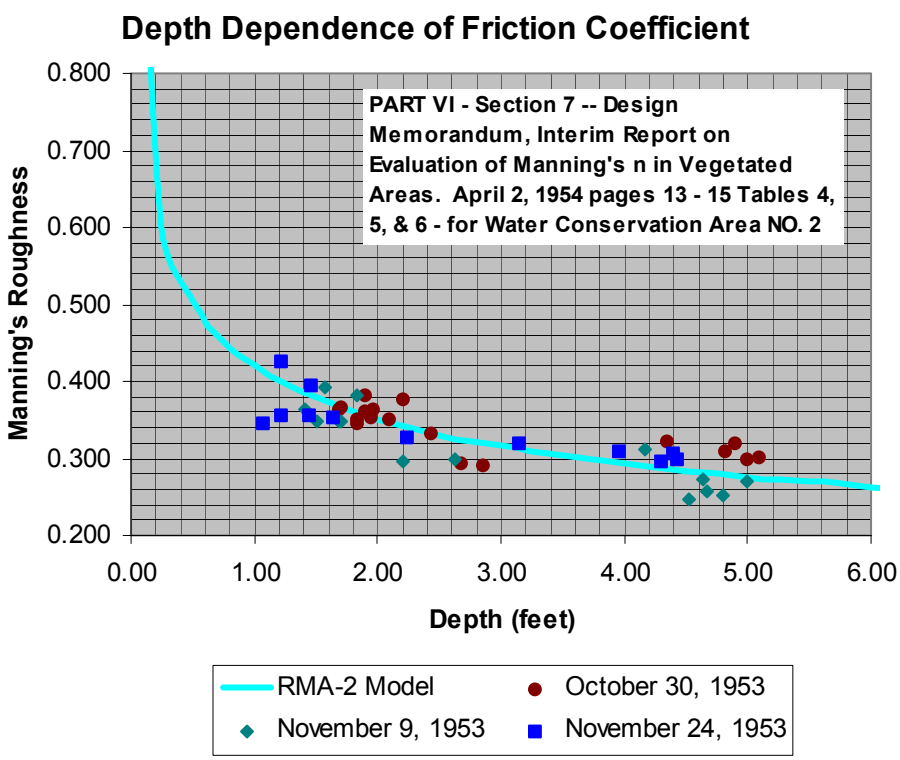


**Figure 1 Manning's n-value with depth for Marsh Flow**

B. Topography. Several data sets were used for the development of the topography for the model mesh. All data was converted using Corpscon 6.0 to North American Datum of 1927 (NAD27) and National Geodetic Vertical Datum of 1929 (NGVD29) feet. Figure 2 is a representation of the contour.

1) The United States Geological Survey (USGS) High Accuracy Elevation Data (HAED) was used to represent the interior of area of WCA-1. The HAED data was collected horizontally in North American Datum of 1983 (NAD83) and vertically in North American Vertical Datum of 1988 (NAVD88) meters. Additional information about the HAED can be found at http://sflwww.er.usgs.gov/projects/elev_data/.
2) A COE contractor surveyed L-40BC channel in November and December of 2004 (Survey Number 04-113). The survey was performed using differential GPS positioning with (TRIMBLE 4000 SSE Receivers) and ODOM MODEL depth recorder using a high-frequency (200 KHZ) transducer. Muck probes were performed at all cross sections with a __?__.
3) The L-7BC and portions of the L-40BC used as-built information to approximate the bottom depth of the borrow canals.

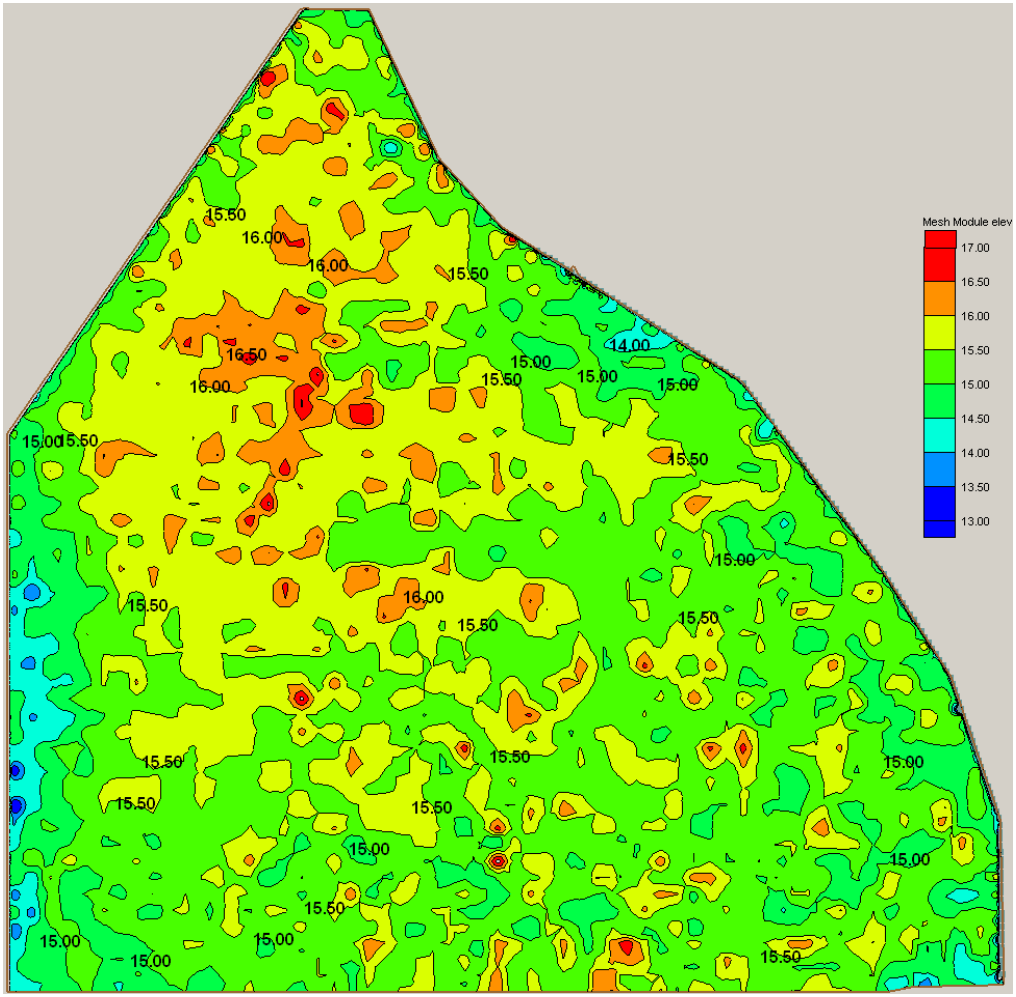


**Figure 2 Overall Contour Map of Model Mesh**

C. Boundary Conditions. Two types of boundary conditions were used for the model. Boundary Discharge Lines (BQL) for the pump station (S-362) and a Boundary Head Line across the southern boundary of the model. Each pump was represented by its on individual discharge. Due to model instabilities a minimum of 5 cfs was used for any pump that was not running. Table 1 depicts the discharges and corresponding stages for each model run. Figure 3 shows where these pump discharges correspond with the regulation schedule for WCA-1.

**Table 1**
**Boundary Conditions**

| Time Step (hrs) | Pump 1 (cfs) | Pump 2 (cfs) | Pump 3 (cfs) | Pump 4 (cfs) | Pump 5 (cfs) | Total Pump Station (cfs) | BHL Stage (ft) |
|---|---|---|---|---|---|---|---|
| 288 | 960 | 960 | 960 | 550 | 550 | 3980 | 18.00 |
| 576 | 960 | 960 | 960 | 5 | 550 | 3435 | 17.75 |
| 864 | 960 | 960 | 5 | 550 | 550 | 3025 | 17.50 |
| 1152 | 960 | 960 | 960 | 5 | 5 | 2890 | 17.25 |
| 1440 | 960 | 960 | 5 | 5 | 550 | 2480 | 17.00 |
| 1728 | 960 | 5 | 5 | 550 | 550 | 2070 | 16.75 |
| 2016 | 960 | 960 | 5 | 5 | 5 | 1935 | 16.50 |
| 2304 | 960 | 5 | 5 | 5 | 550 | 1525 | 16.25 |
| 2592 | 5 | 5 | 5 | 550 | 550 | 1115 | 16.00 |
| 2880 | 960 | 5 | 5 | 5 | 5 | 980 | 15.75 |
| 3168 | 5 | 5 | 5 | 5 | 550 | 570 | 15.50 |

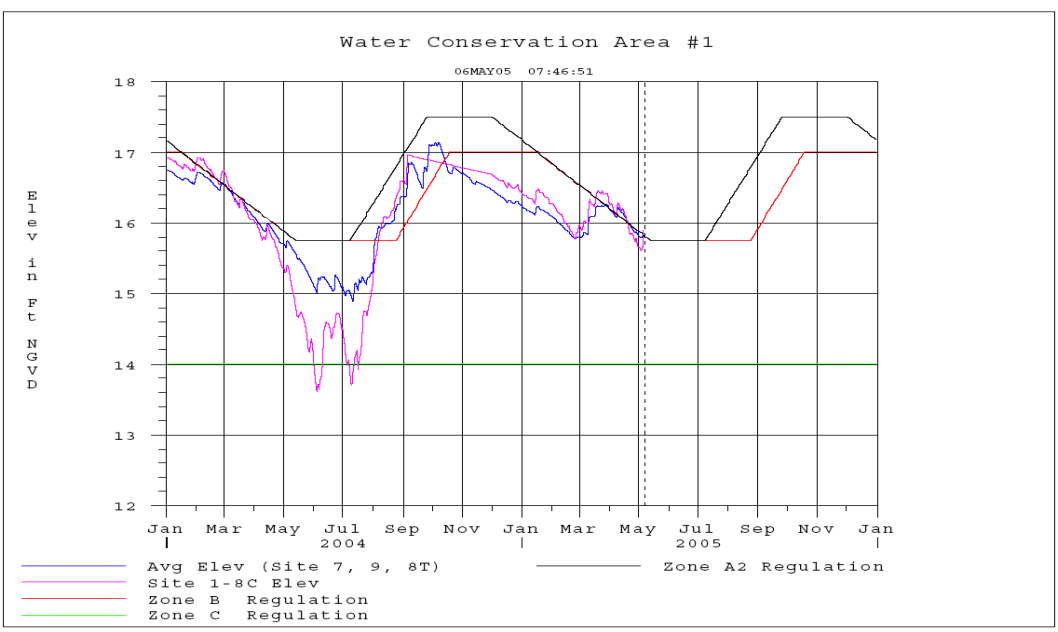


**Figure 3 Water Canservation Area 1 Regulation Schedule**

4. Alternatives. Several alternatives were modeled for comparison purposes.

A. Alternative 1 - Existing Condition. The current configuration of the pump station with the removal of the plug that was left in during the pump test for S-362. Plots were not generated for this plan due to minor differences with Alternative 2.

B. Alternative 2 - Dredge Muck Only. Changes were made to the channel geometry from Alternative 1 based on the depth of muck based on the COE survey performed November and December 2004. Figure 4 shows the geometry near the pump station for this alternative.

C. Alternative 3 – 200 foot Canal with Berm and Muck Removal. Widens the canal bottom width from 40 to 200 feet and constructs a berm along the western side (850 feet) of the borrow canal. The canal is dredged from 3,500 feet upstream to 10,000 feet downstream of the S-319 Pump Station. The purpose of the berm is to turn the flow of water to the south and prevent the infiltration of flows directly downstream of the pump station. Figure 5 shows the geometry near the pump station for this alternative.

D. Alternative 4 – 200 foot Canal No Berm and Muck Removal. Widens the canal bottom width from 40 to 200 feet. The canal is dredged from 3,500 feet upstream to 10,000 feet downstream of the S-319 Pump Station. The berm was not added to see how much water would infiltrate directly into the Refuge.

E. Alternative 5 – 150 foot Canal with Berm and Muck Removal. Widens the canal bottom width from 40 to 150 feet and constructs a berm along the western side (850 feet) of the borrow canal. The canal is dredged from 3,500 feet upstream to 10,000 feet downstream of the S-319 Pump Station. The purpose of the berm is to turn the flow of water to the south and prevent the infiltration of flows directly downstream of the pump station.

F. Alternative 6 – 100 foot Canal with Berm and Muck Removal. Widens the canal bottom width from 40 to 100 feet and constructs a berm along the western side (850 feet) of the borrow canal. The canal is dredged from 3,500 feet upstream to 10,000 feet downstream of the S-319 Pump Station. The purpose of the berm is to turn the flow of water to the south and prevent the infiltration of flows directly downstream of the pump station.

G. Alternative 7 – 100 foot Canal with Berm and Muck Removal. Similar to Alternative 6 except the berm is 1500 feet long (650 feet longer than other alternatives).

H. Alternative 8 – 75 foot Canal with Berm and Muck Removal. Widens the canal bottom width from 40 to 75 feet and constructs a berm along the western side (850 feet) of the borrow canal. The canal is dredged from 3,500 feet upstream to 10,000 feet downstream of the S-319 Pump Station. The purpose of the berm is to turn the flow of water to the south and prevent the infiltration of flows directly downstream of the pump station.

5. Results. Comparison plots of velocity contours and vectors for Alternatives 2 and 3 can be found on Figures 6 through 27. In addition flow distributions were calculated for all alternatives at approximately the same transect locations for all alternatives (Table 2 tabulates the data and Figure 28 gives the approximate location of the transects). For impacts into the interior of the Refuge an area calculation was computed for the area that had velocities above 0.075 feet per

second (Table 3). Figures 29 to _ depict the areas impacted with velocities above 0.075 feete per second.

6. Conclusions. Based on the minimum area impacted within the Refuge and the ability to turn more water to the south it is recommended that the canal be widened to 200 feet with a berm constructed on the Refuge side of the L-40BC. It is also recommend that the canal be dredged 3500 feet upstream and 10,000 feet downstream of the confluence of the S-362 discharge canal with the L-40BC based on model velocities in the canal.

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# Contour Map

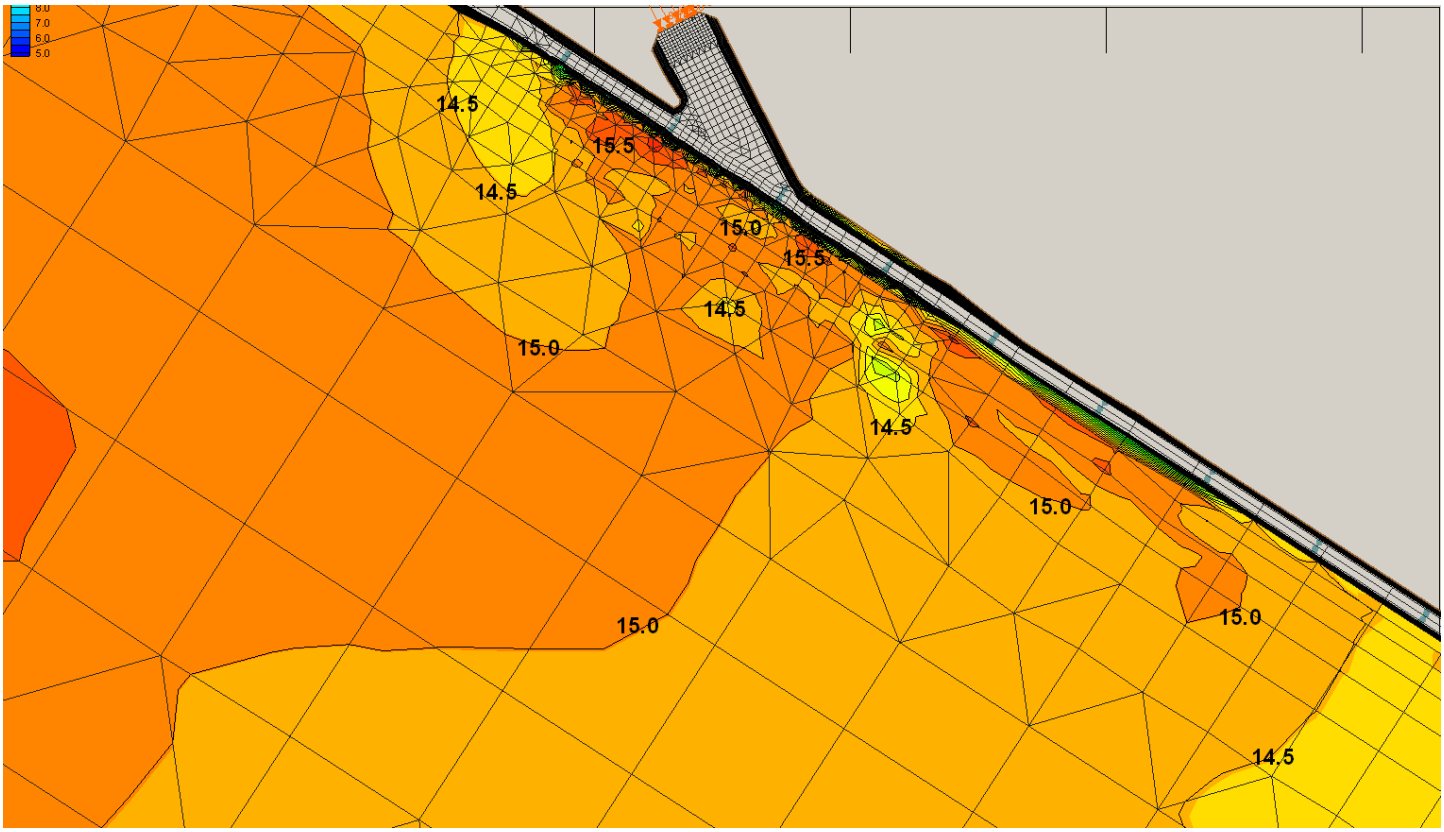



**Figure 4Mesh Contour with Muck Removed**

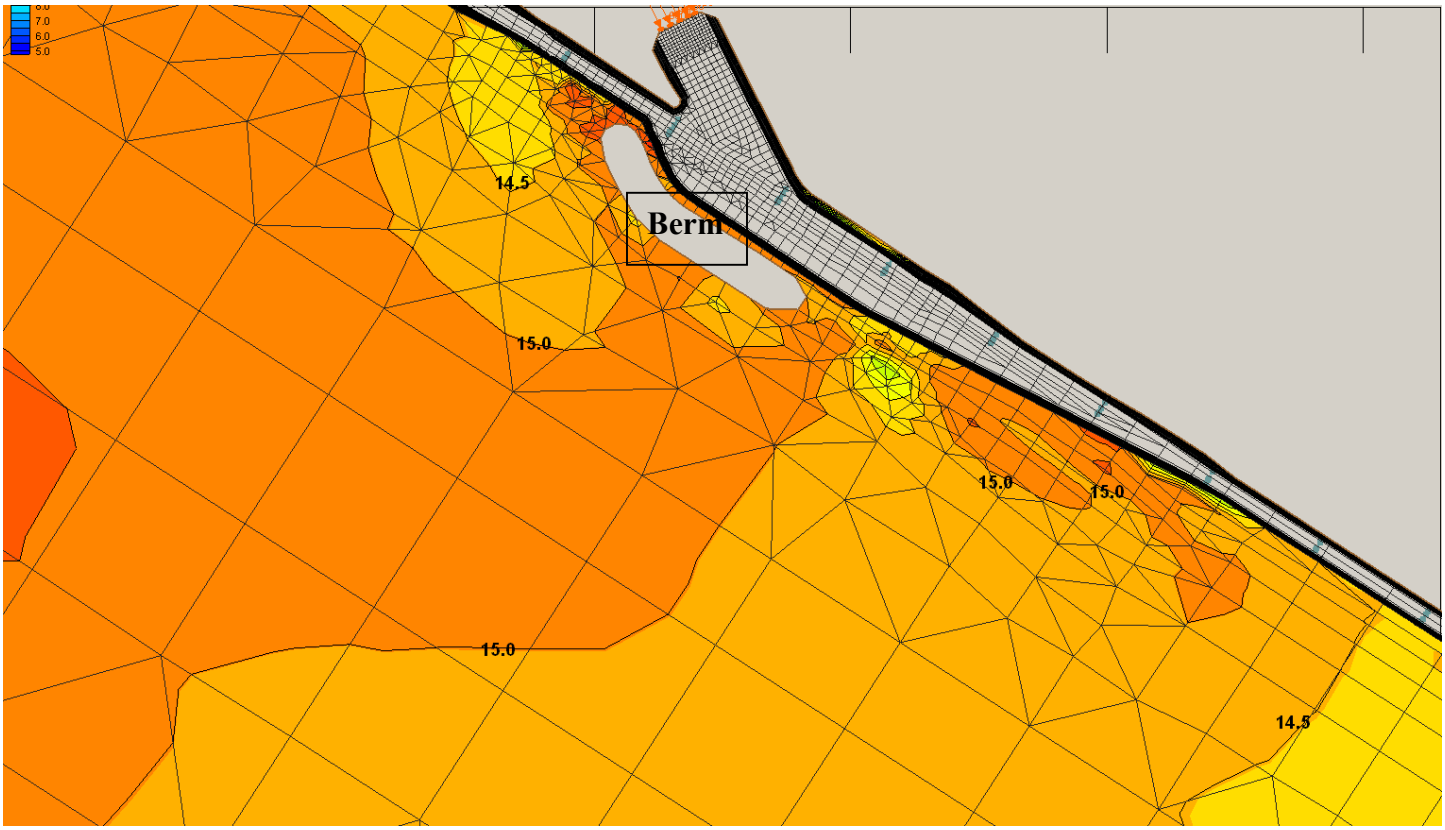



**Figure 5 Mesh Contour with 200 foot Canal Widening and Berm**

# 550 cfs Discharge

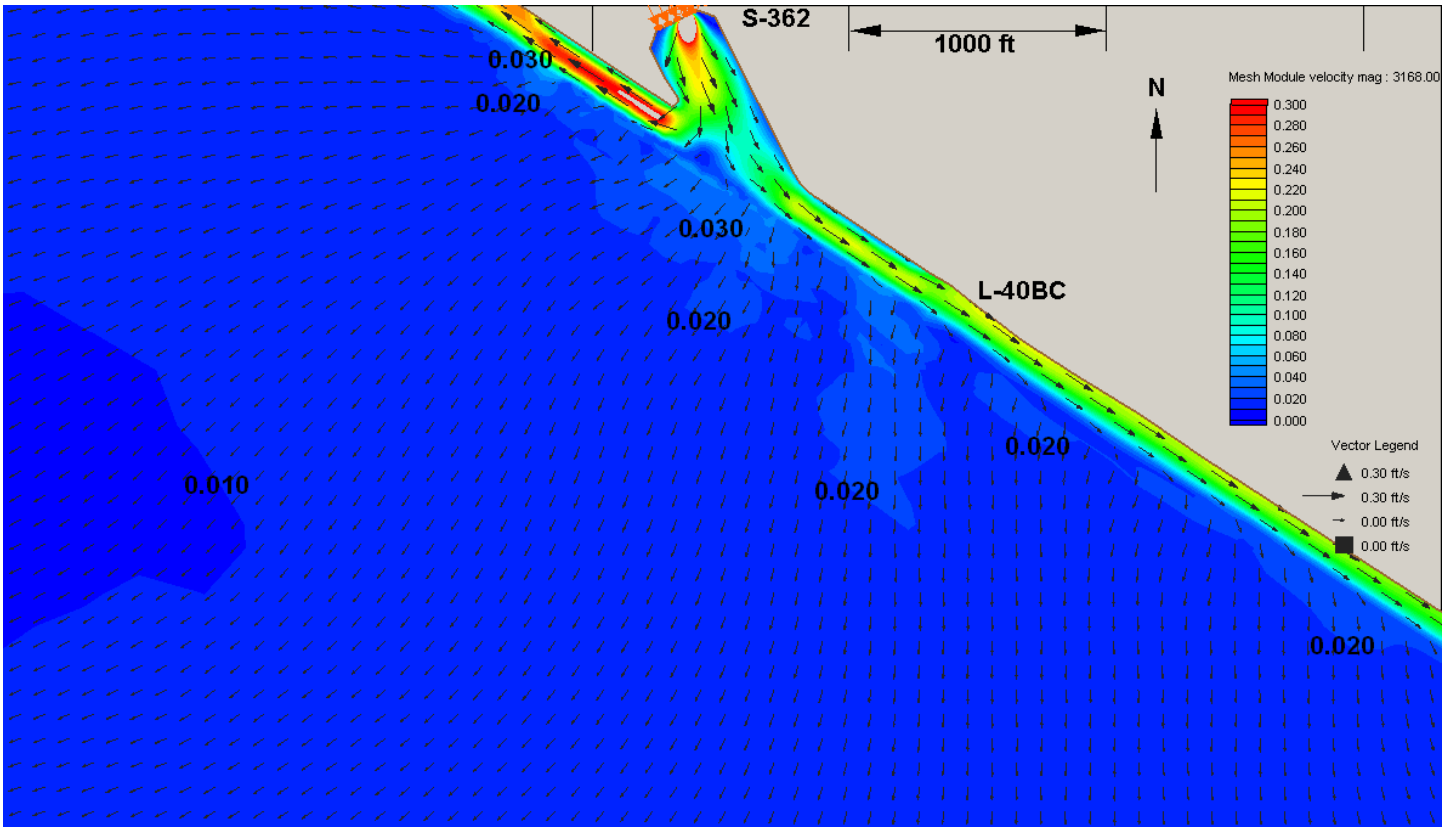



**Figure 6**

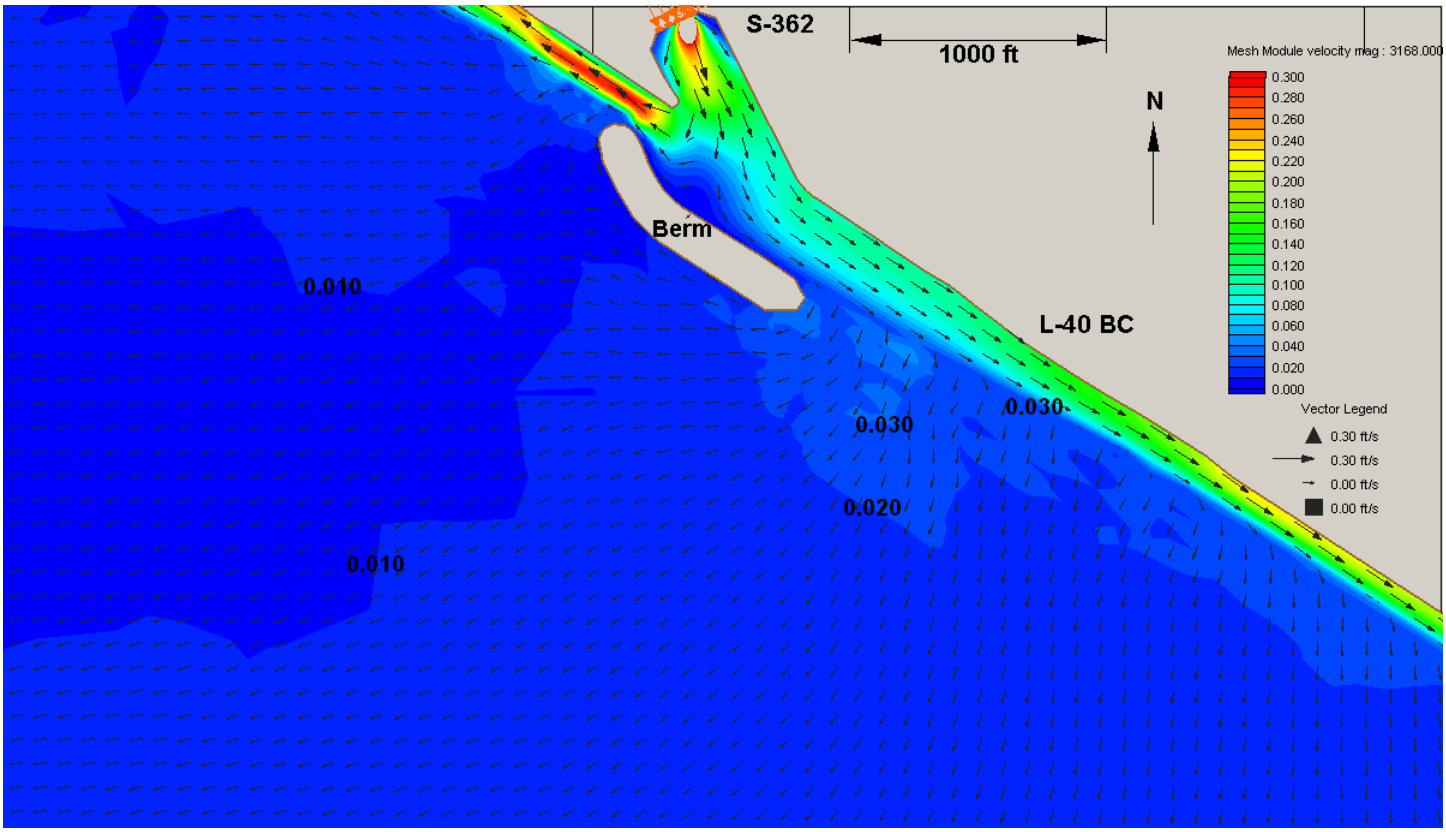



**Figure 7**

# 960 cfs Discharge

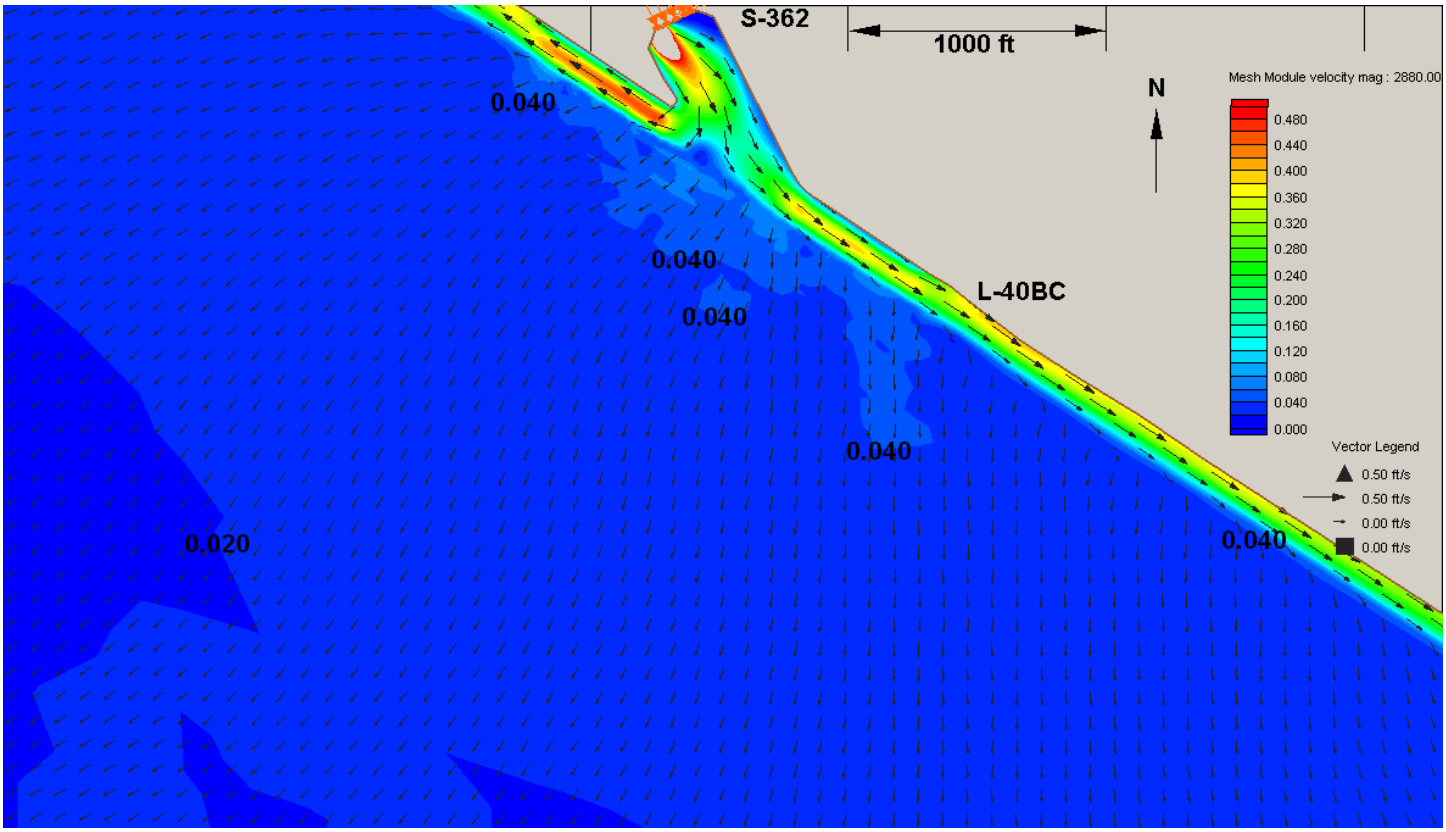



**Figure 8**

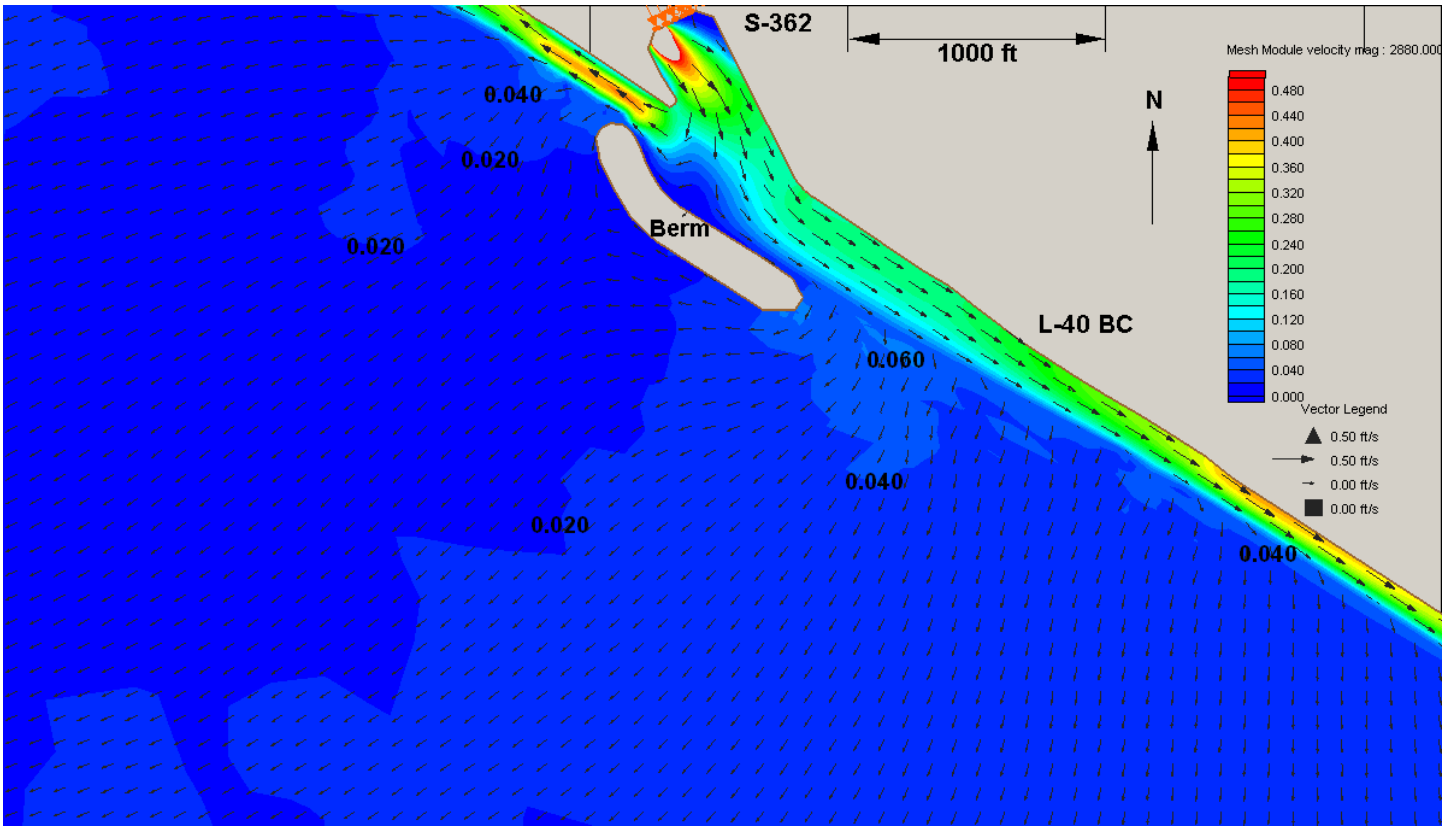



**Figure 9**

# 1100 cfs Discharge

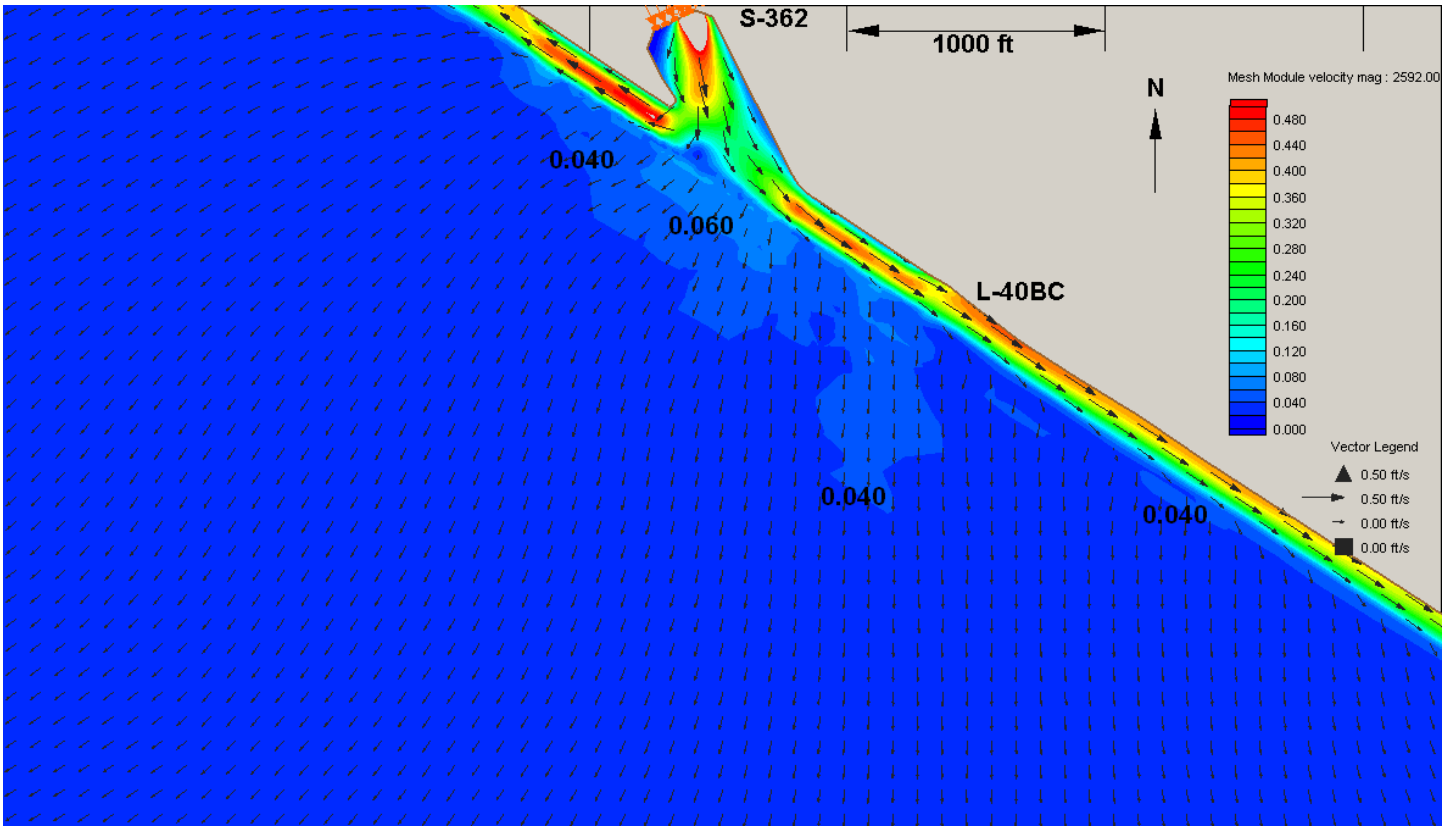



**Figure 10**

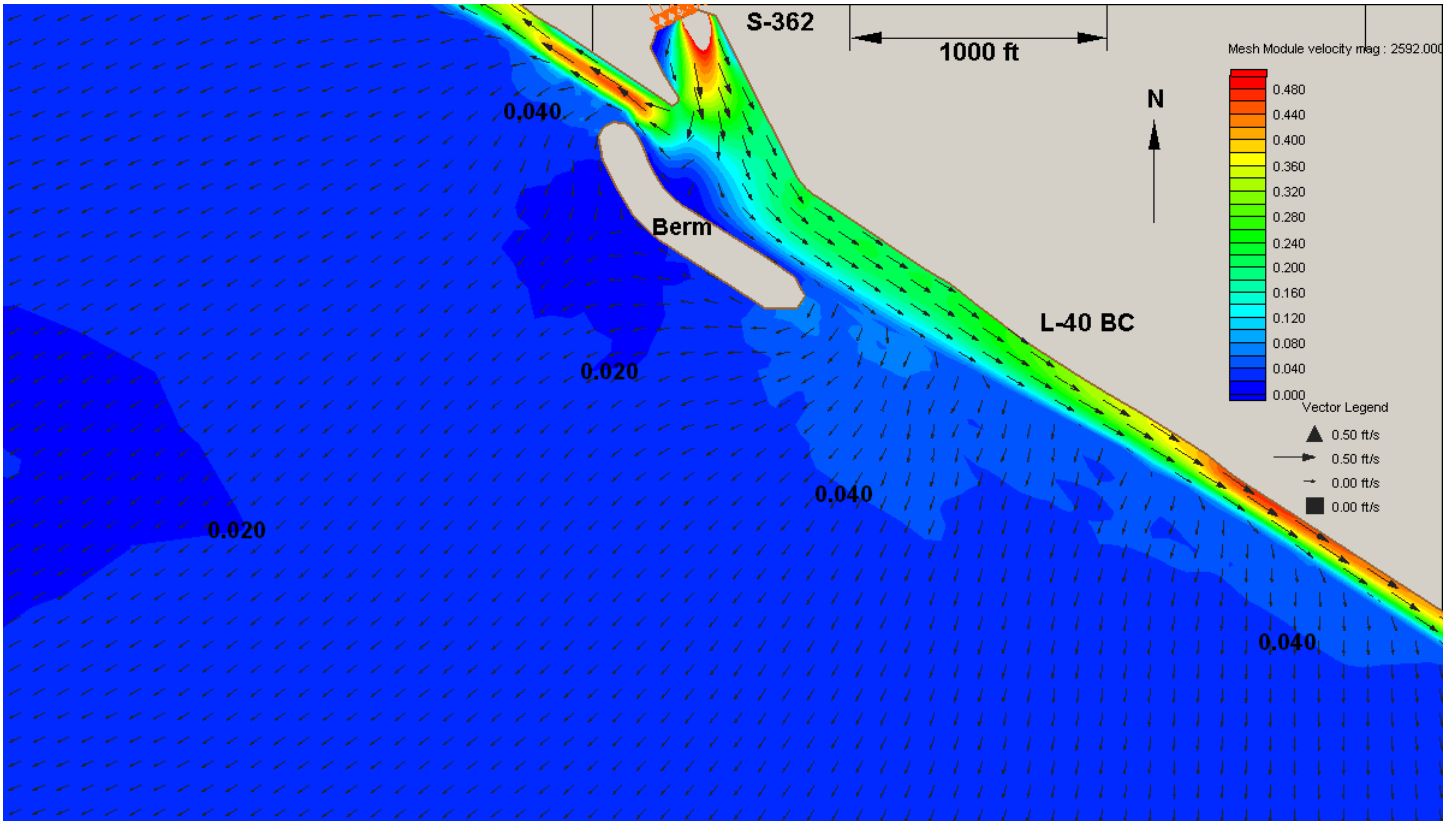



**Figure 11**

# 1510 cfs Discharge

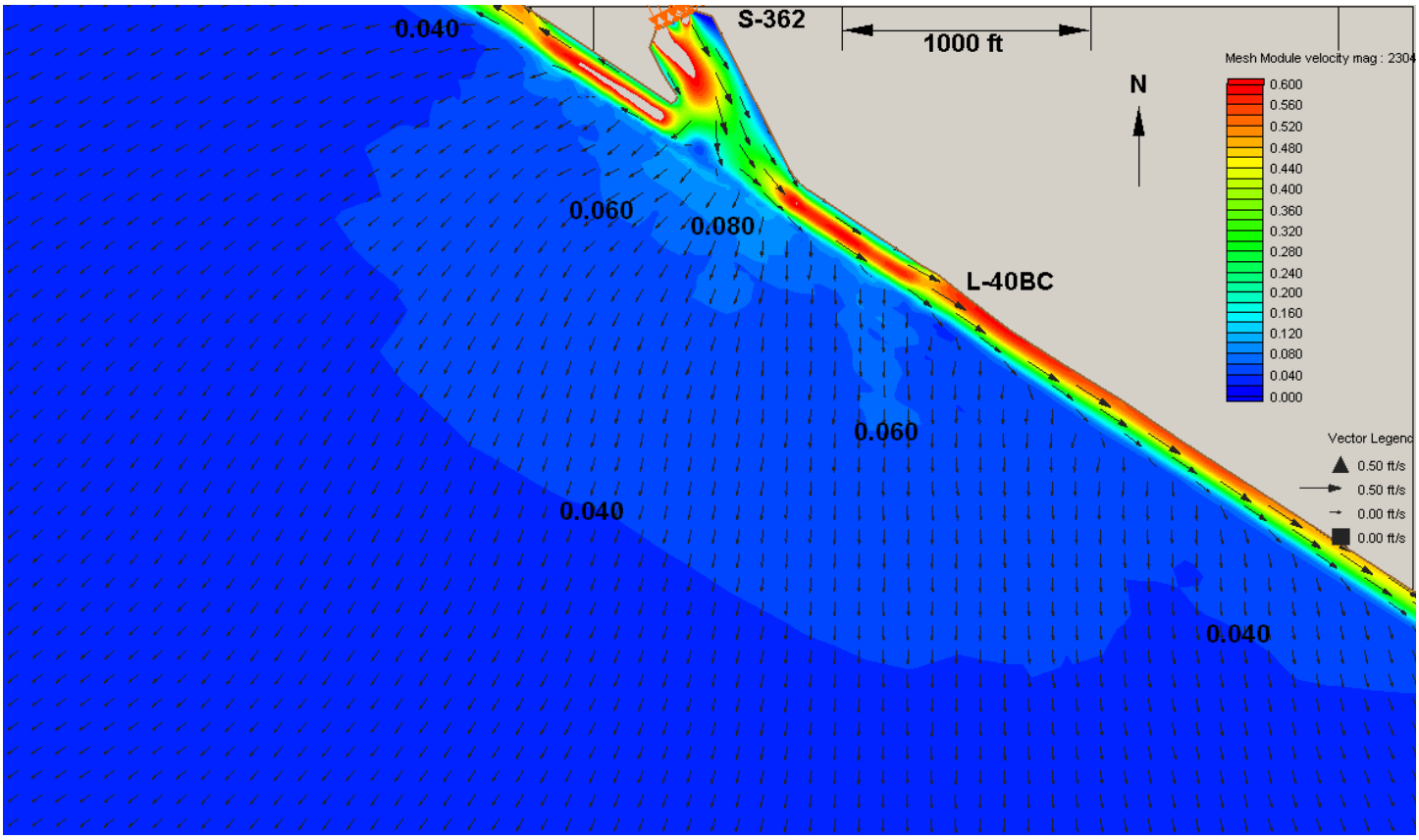



**Figure 12**

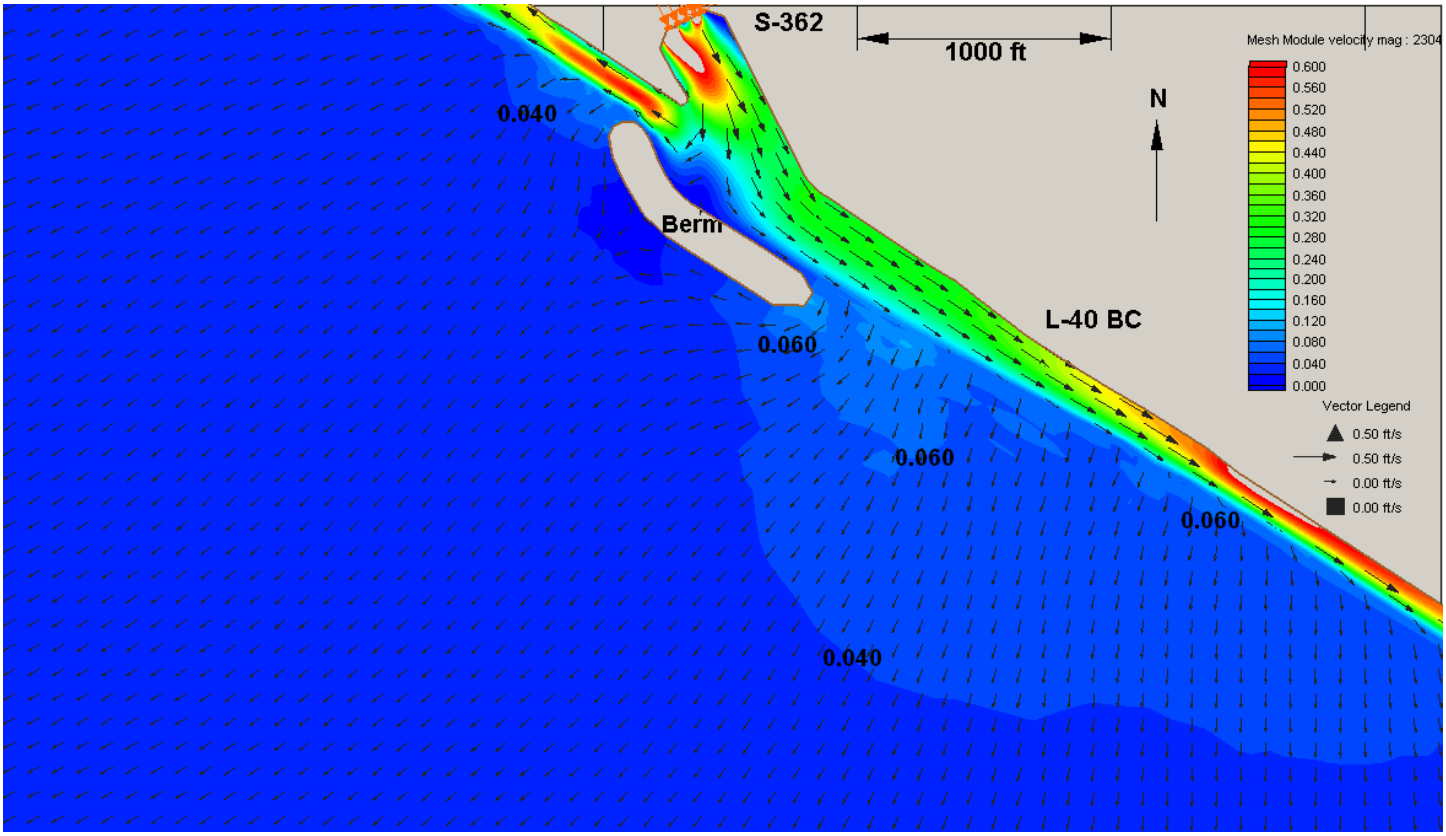



**Figure 13**

# 1920 cfs Discharge

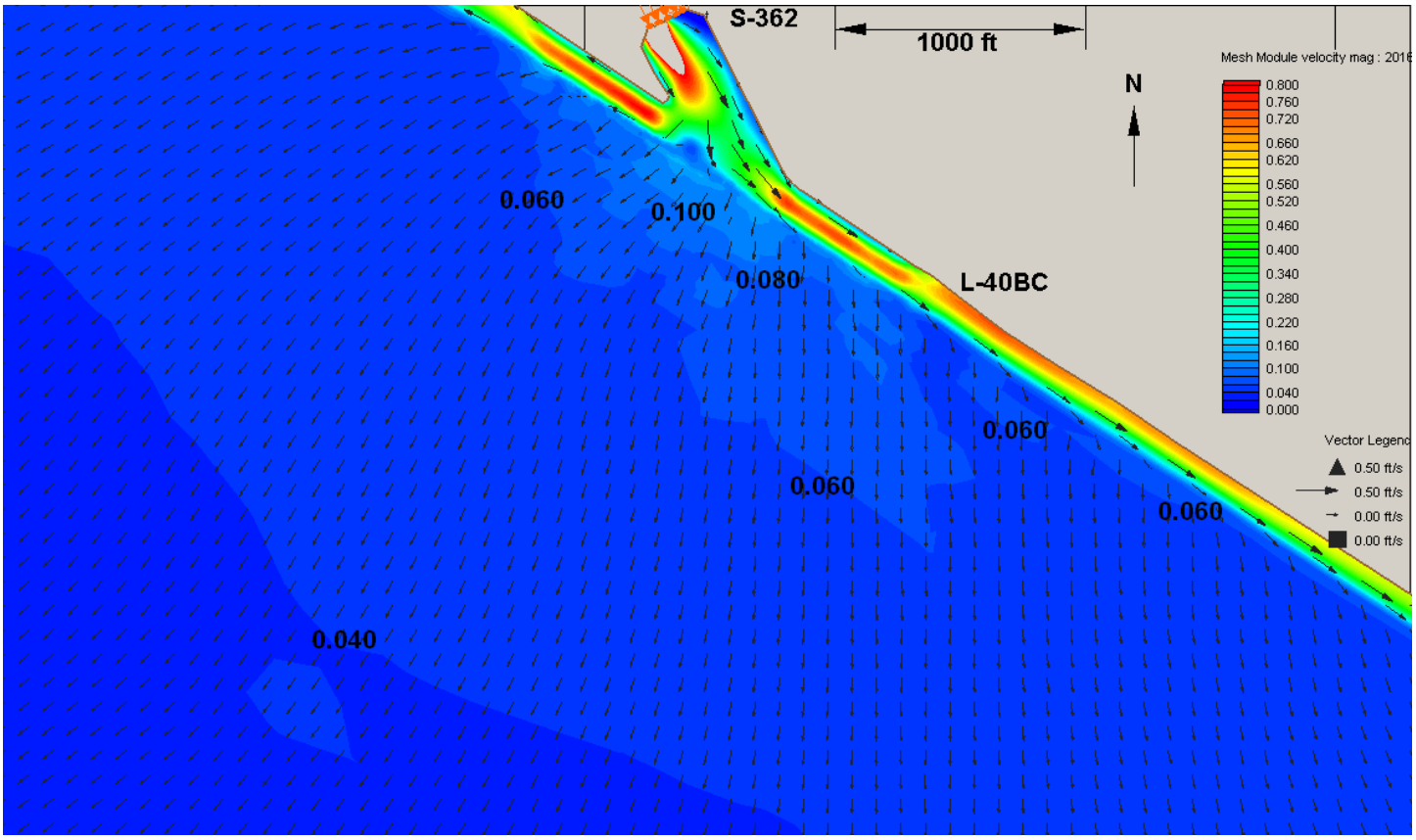



**Figure 14**

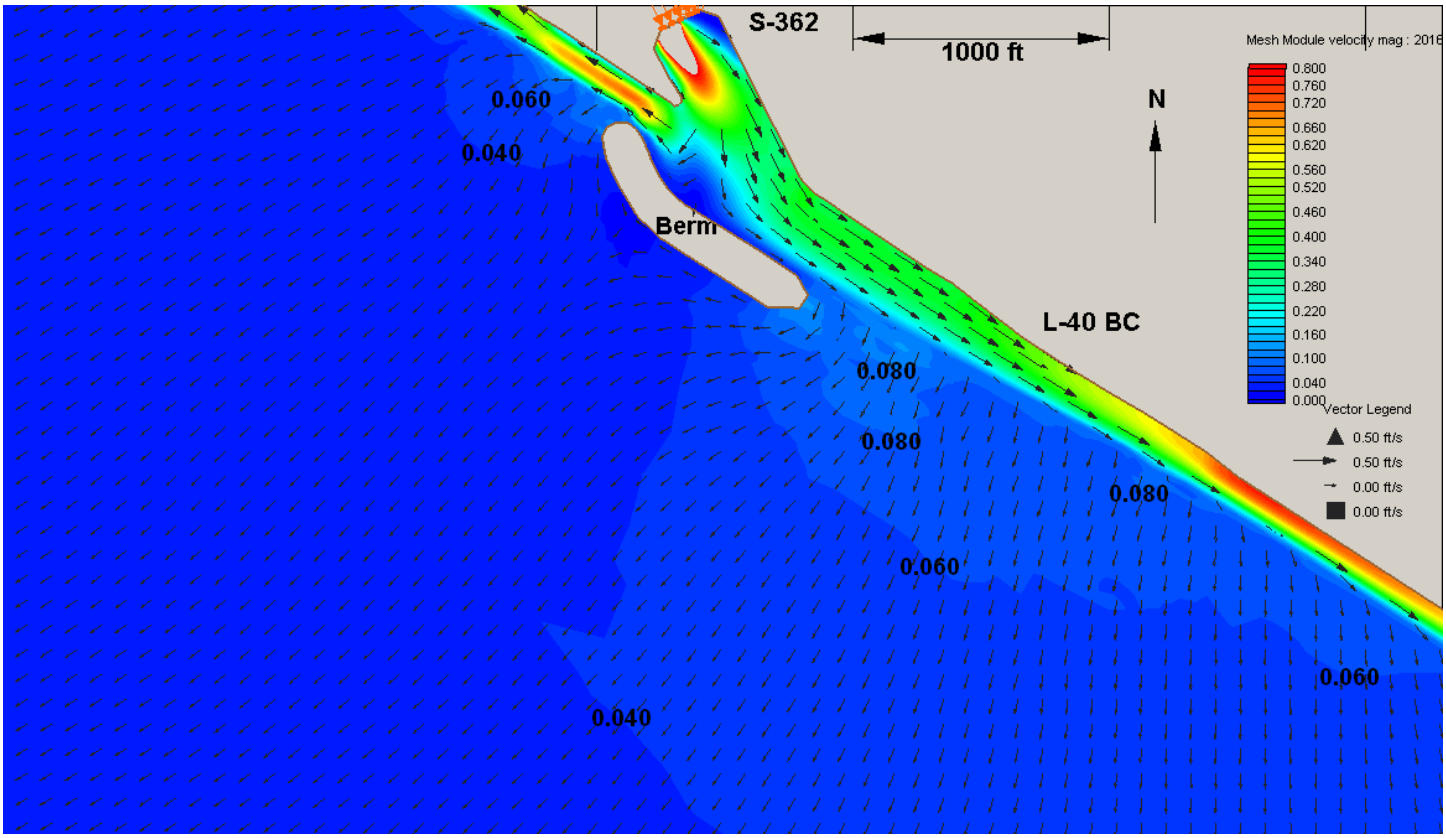



**Figure 15**

# 2060 cfs Discharge

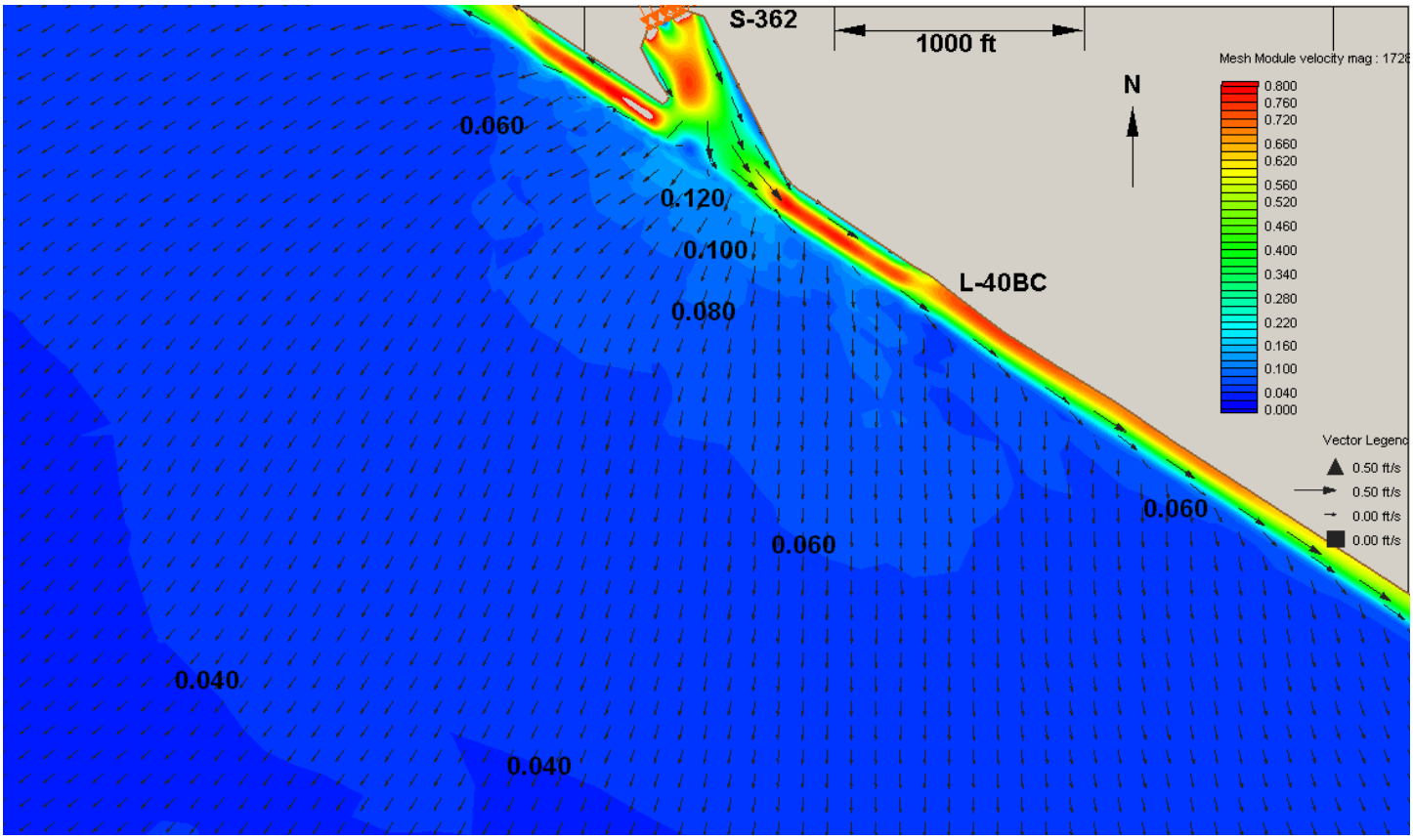



**Figure 16**

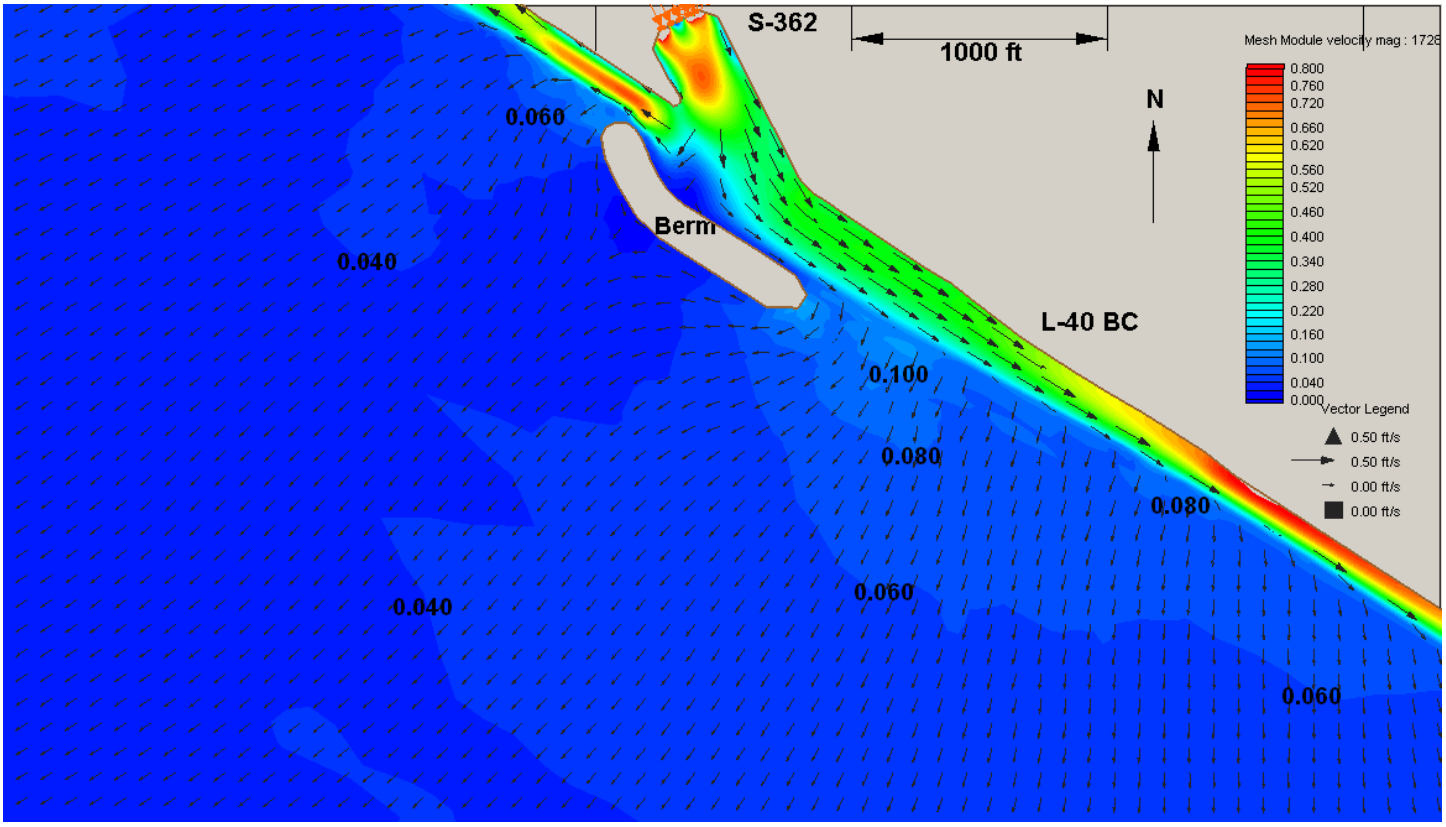



**Figure 17**

# 2470 cfs Discharge

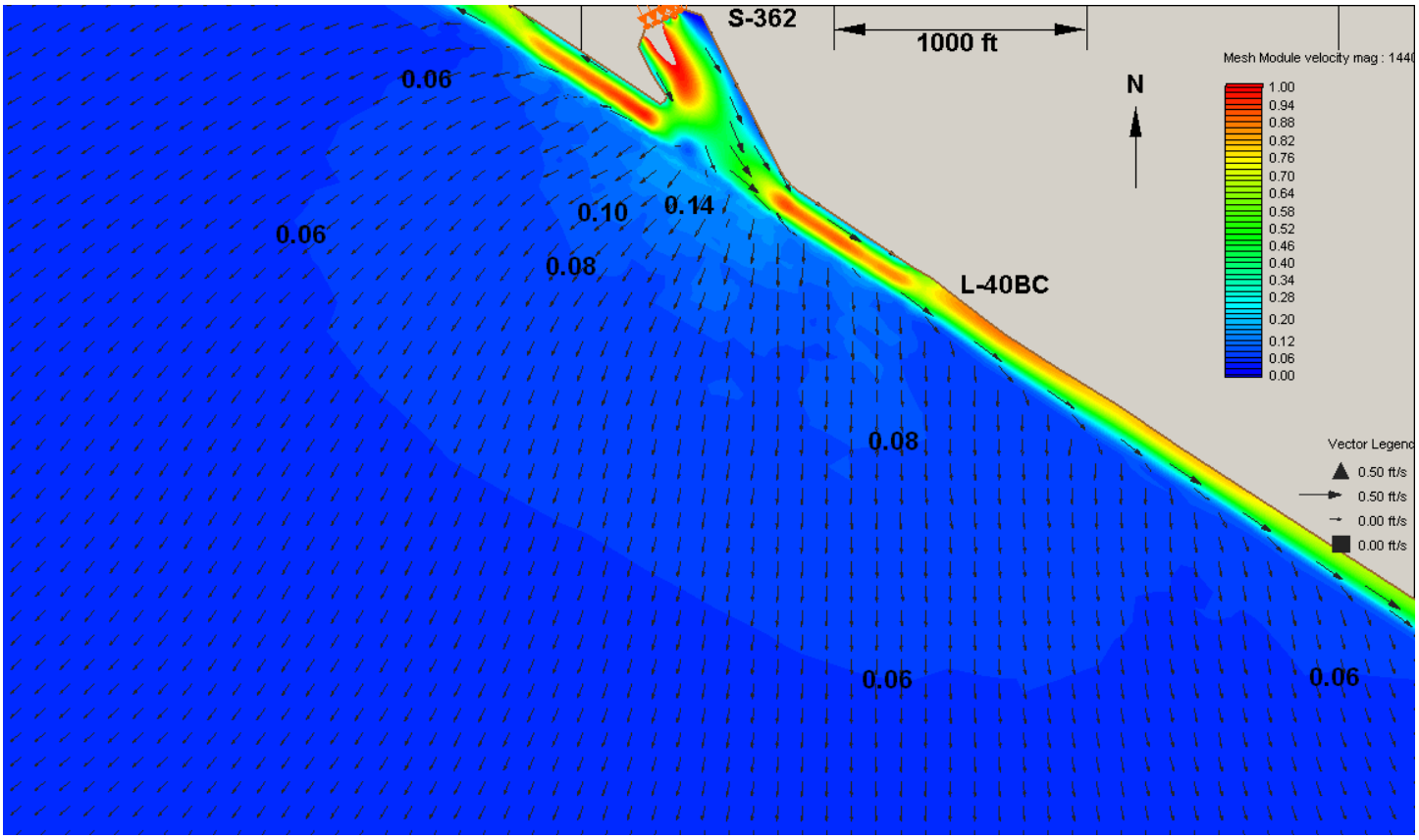



**Figure 18**

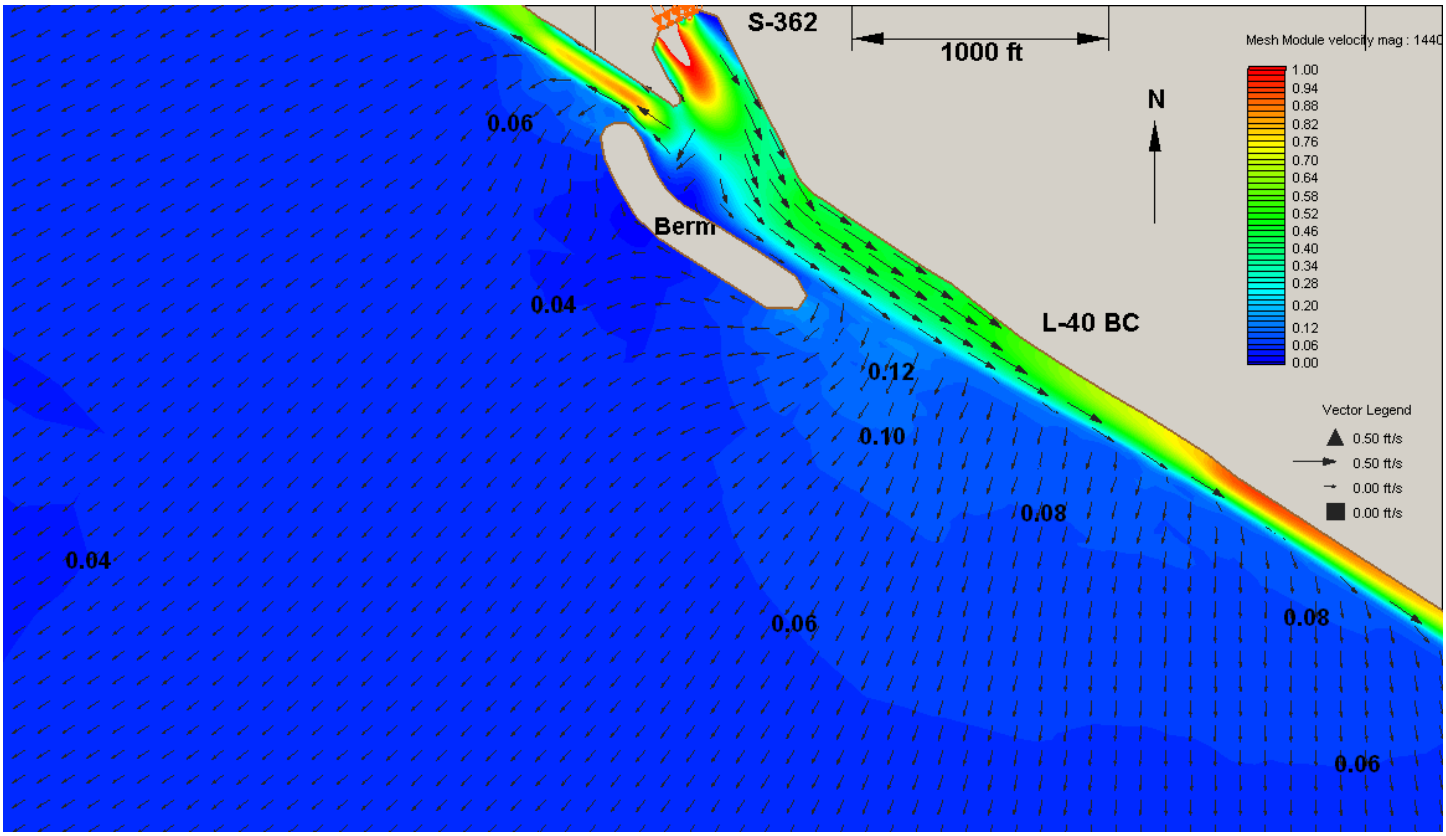



**Figure 19**

# 2880 cfs Discharge

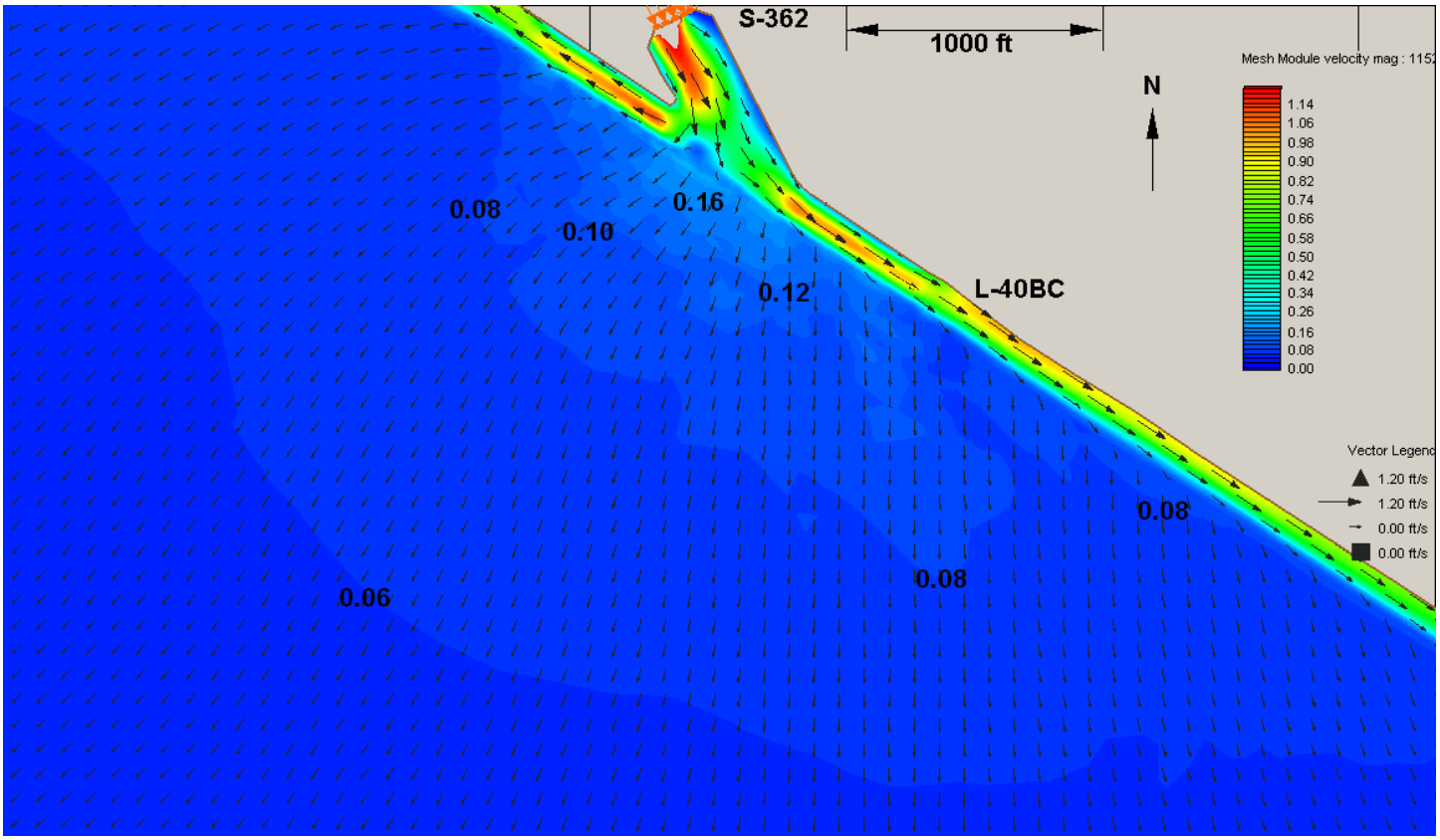



**Figure 20**

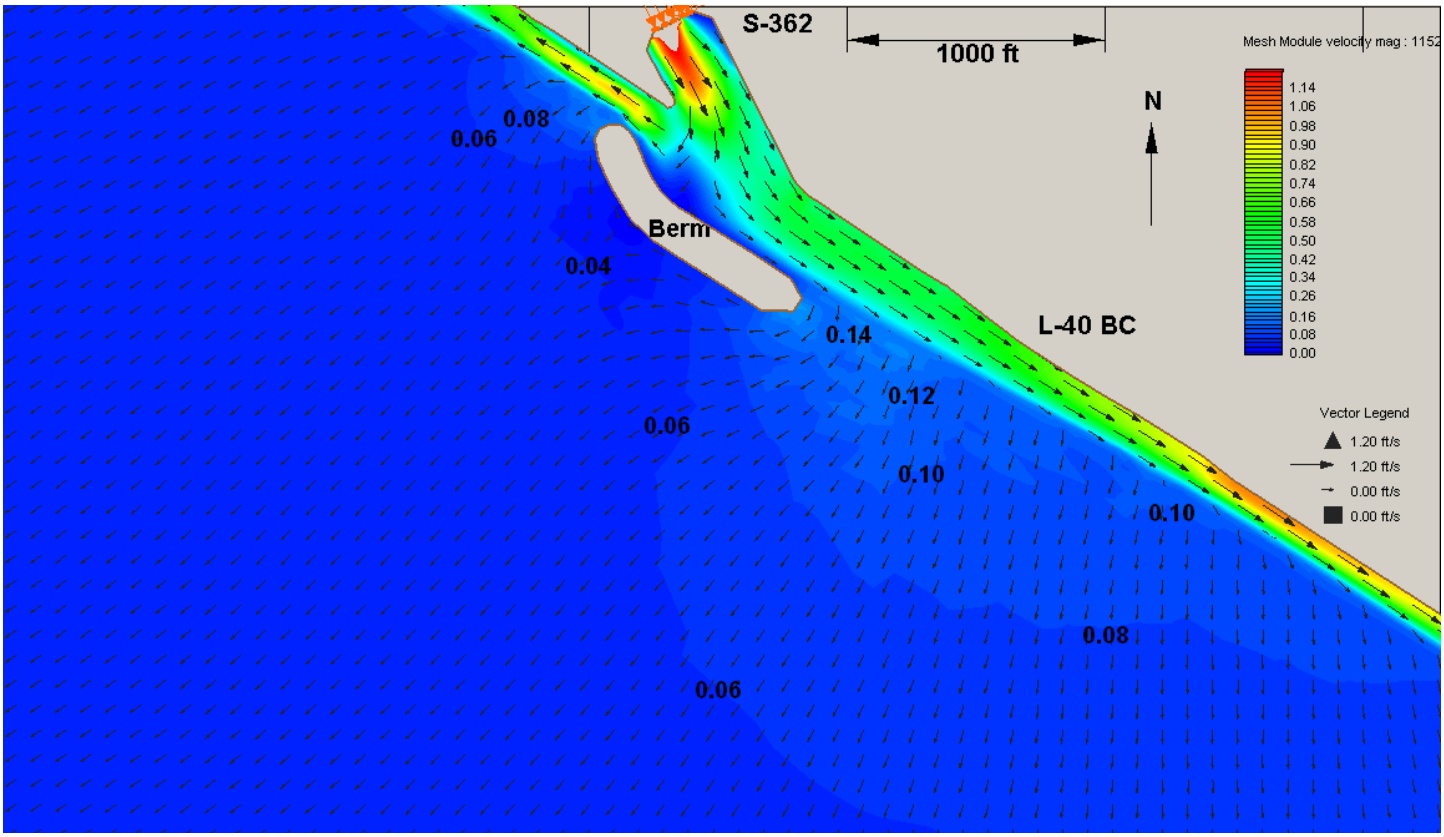
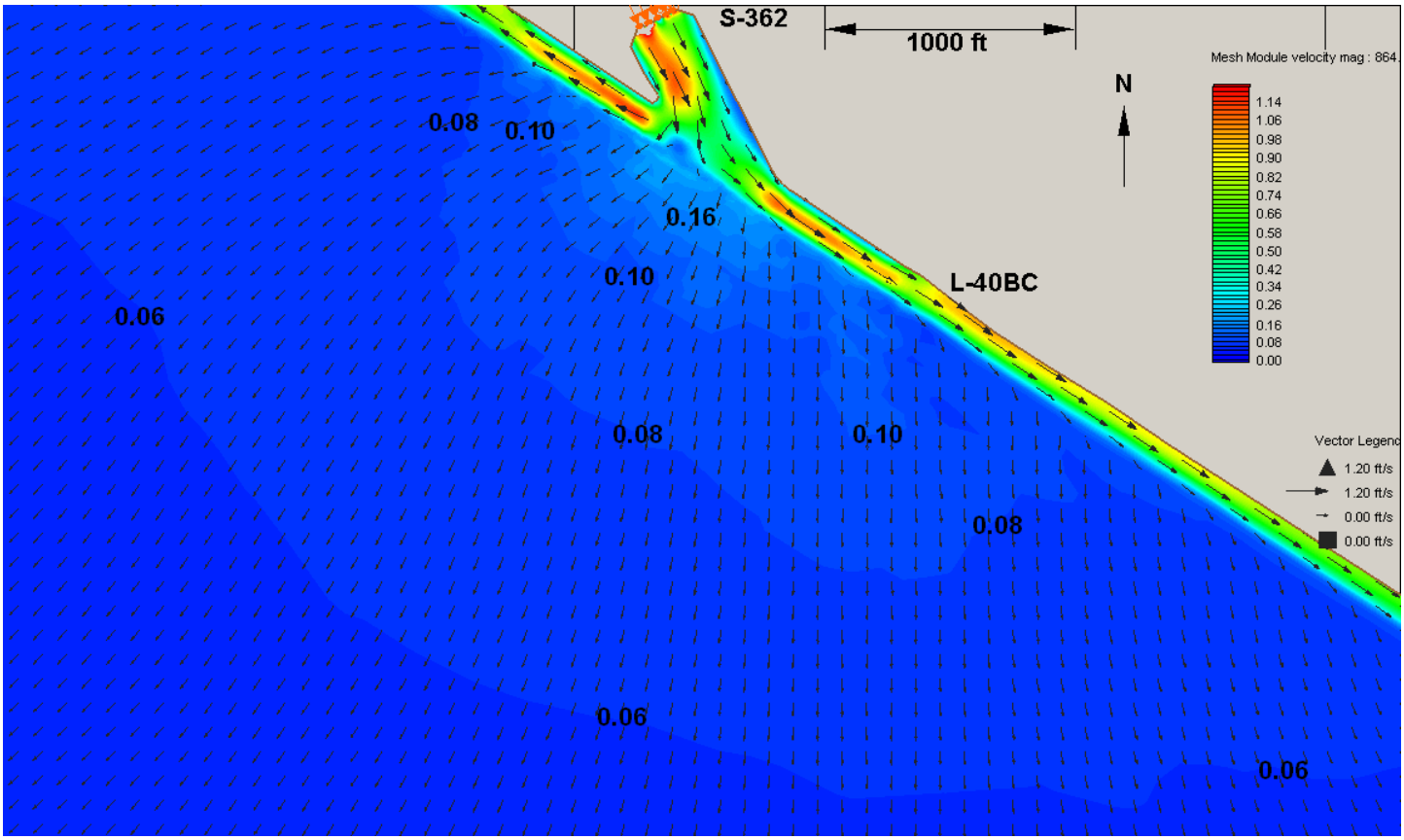



**Figure 21**

# 3020 cfs Discharge

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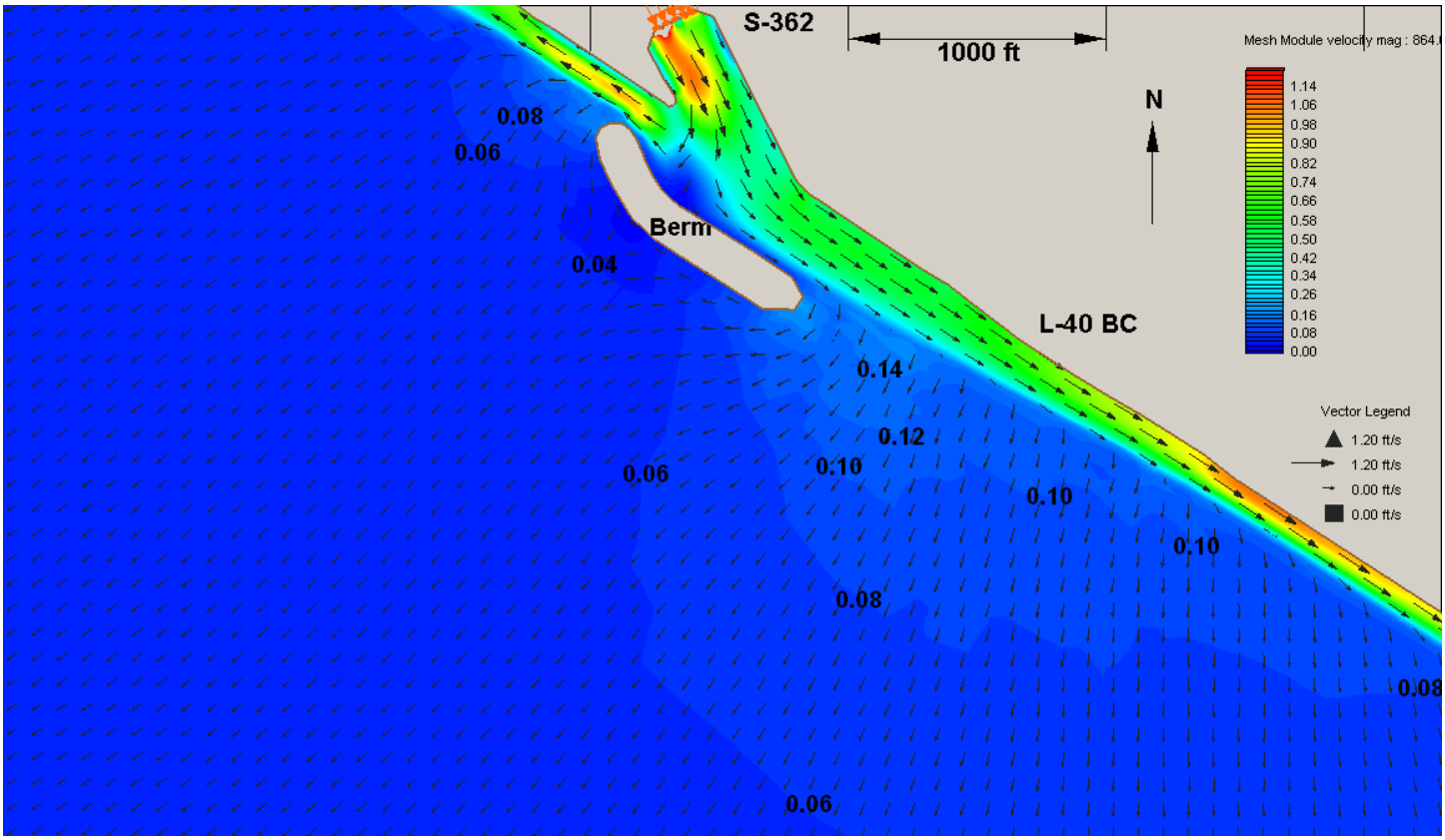
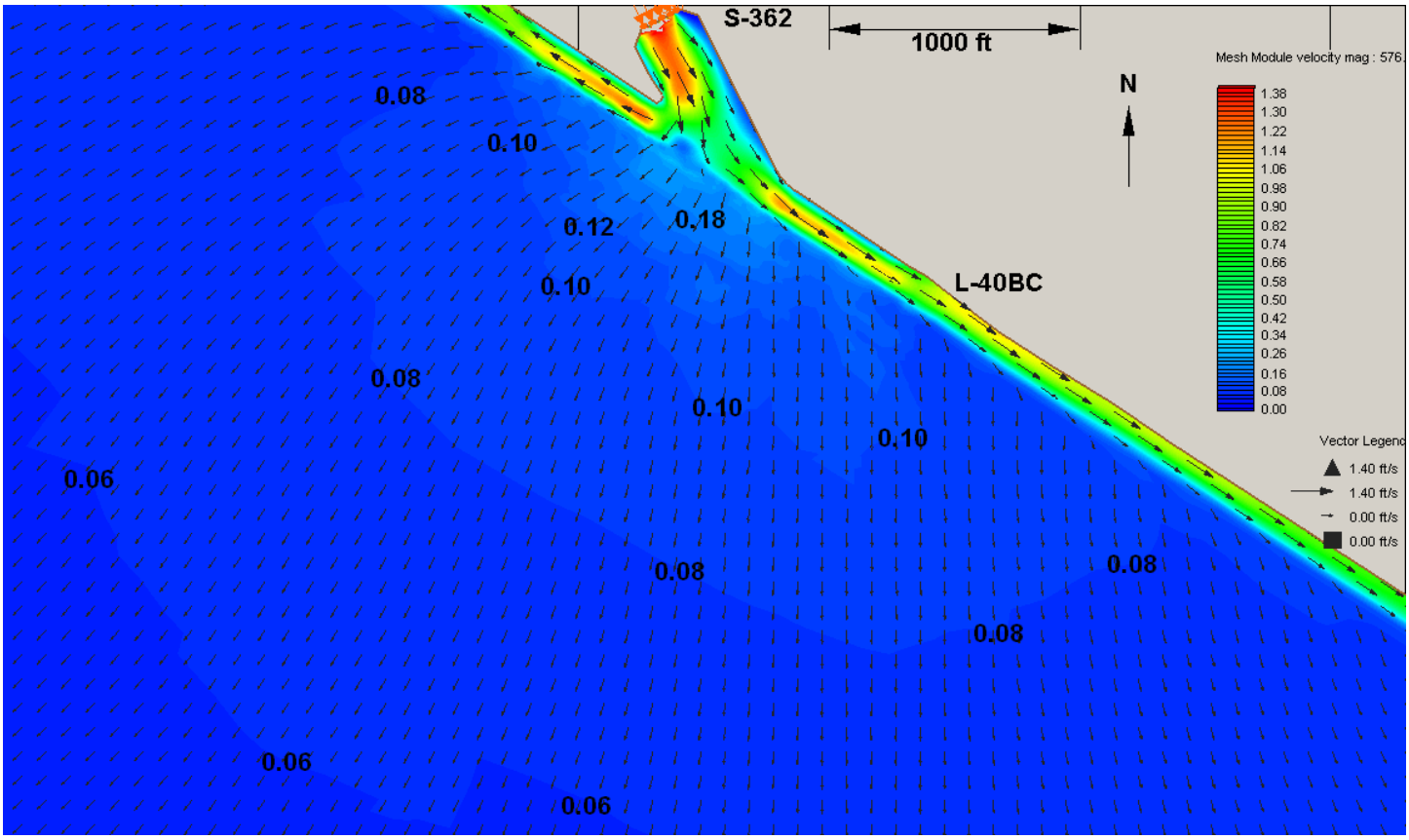



**Figure 23**

# 3430 cfs Discharge

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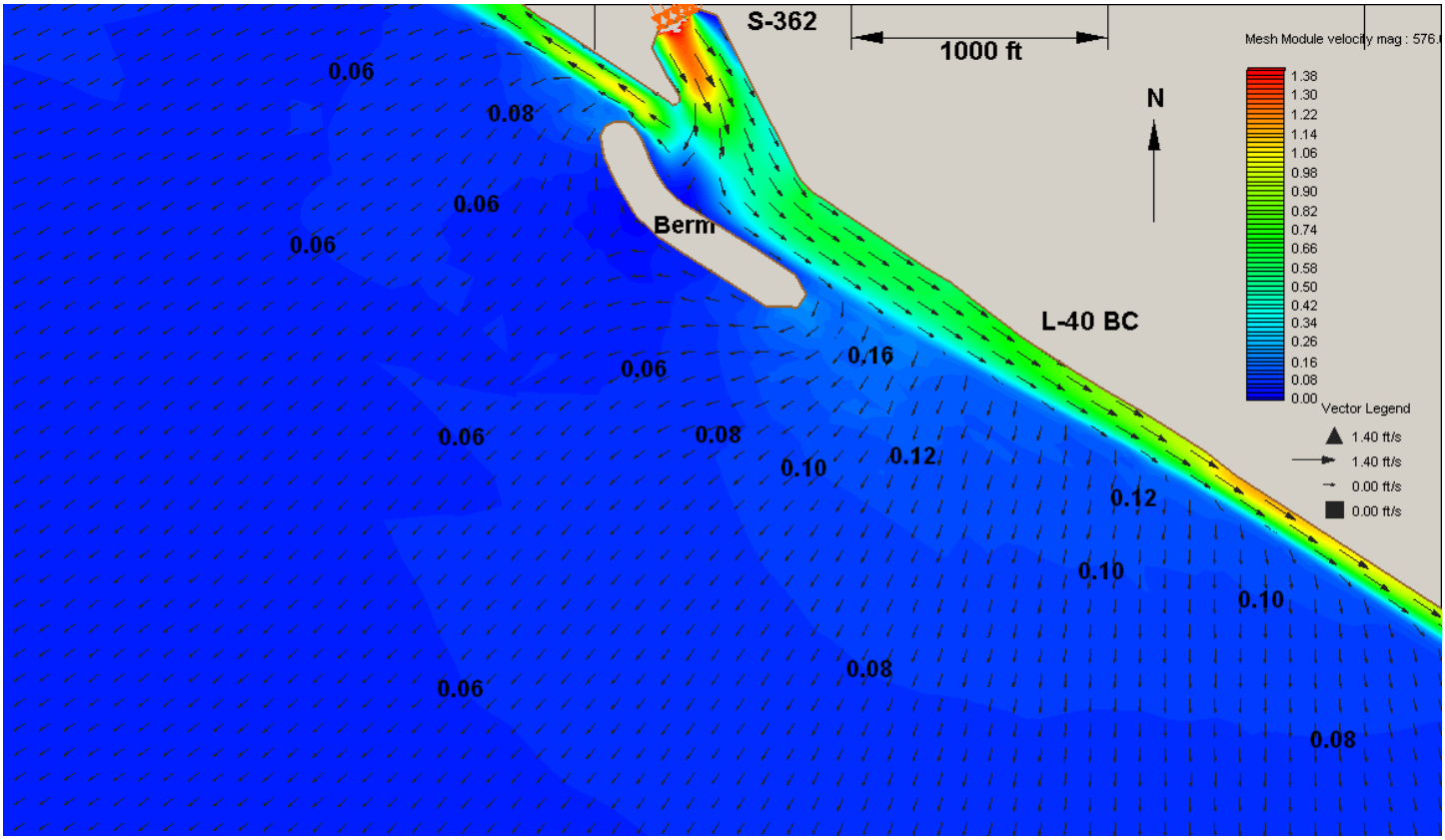


**Figure 25**

# 3980 cfs Discharge

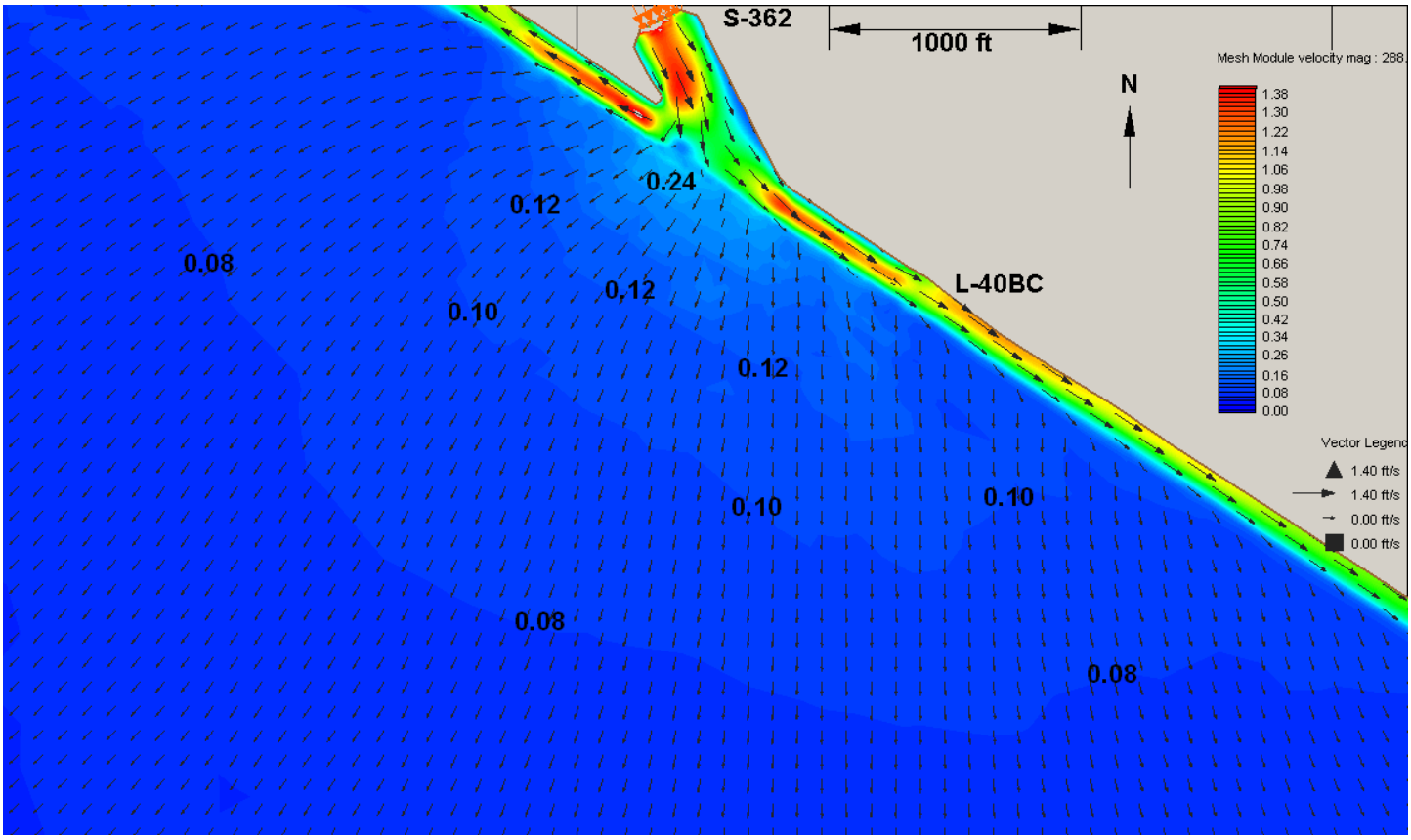


**Figure 26**

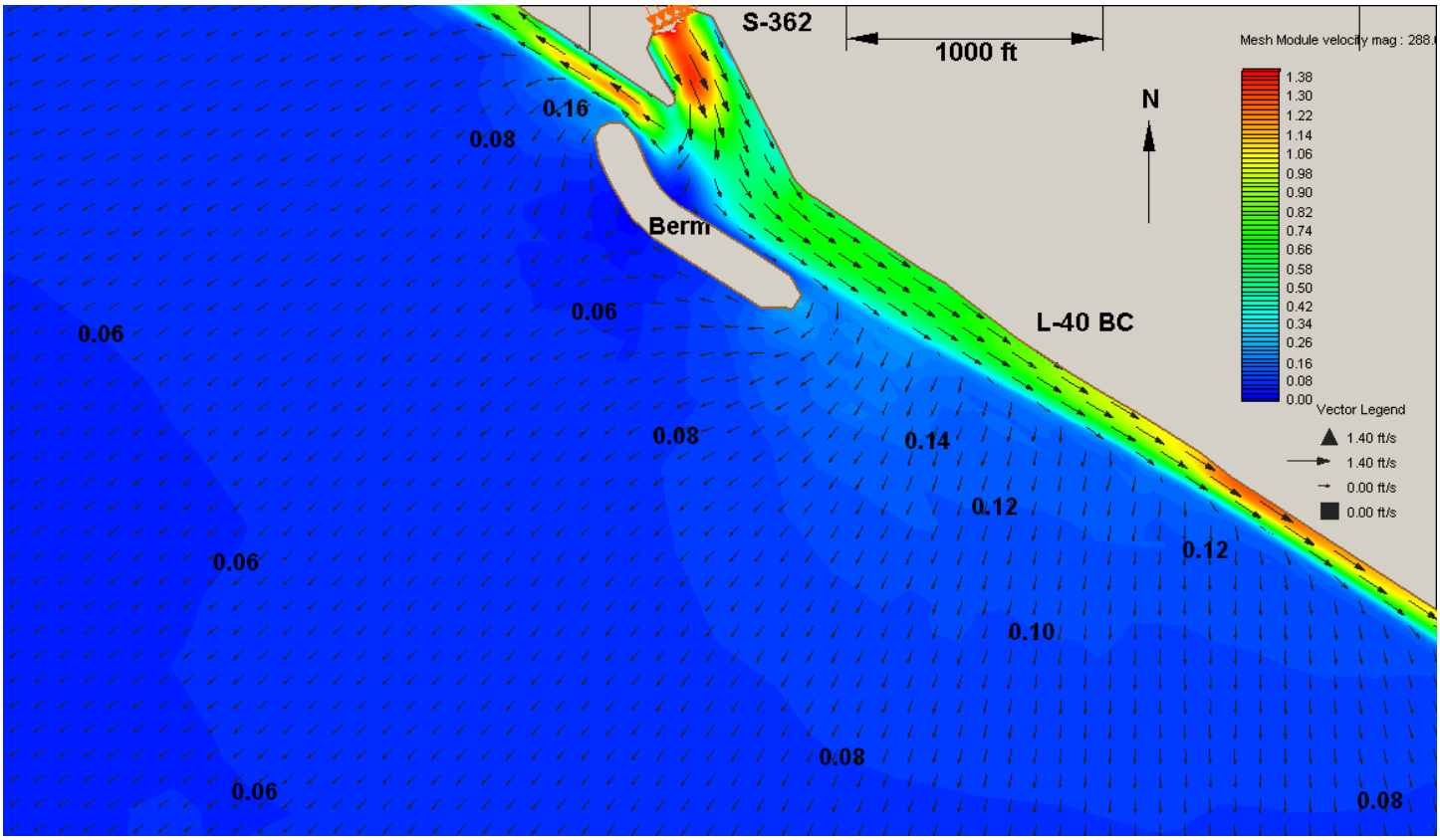


**Figure 27**

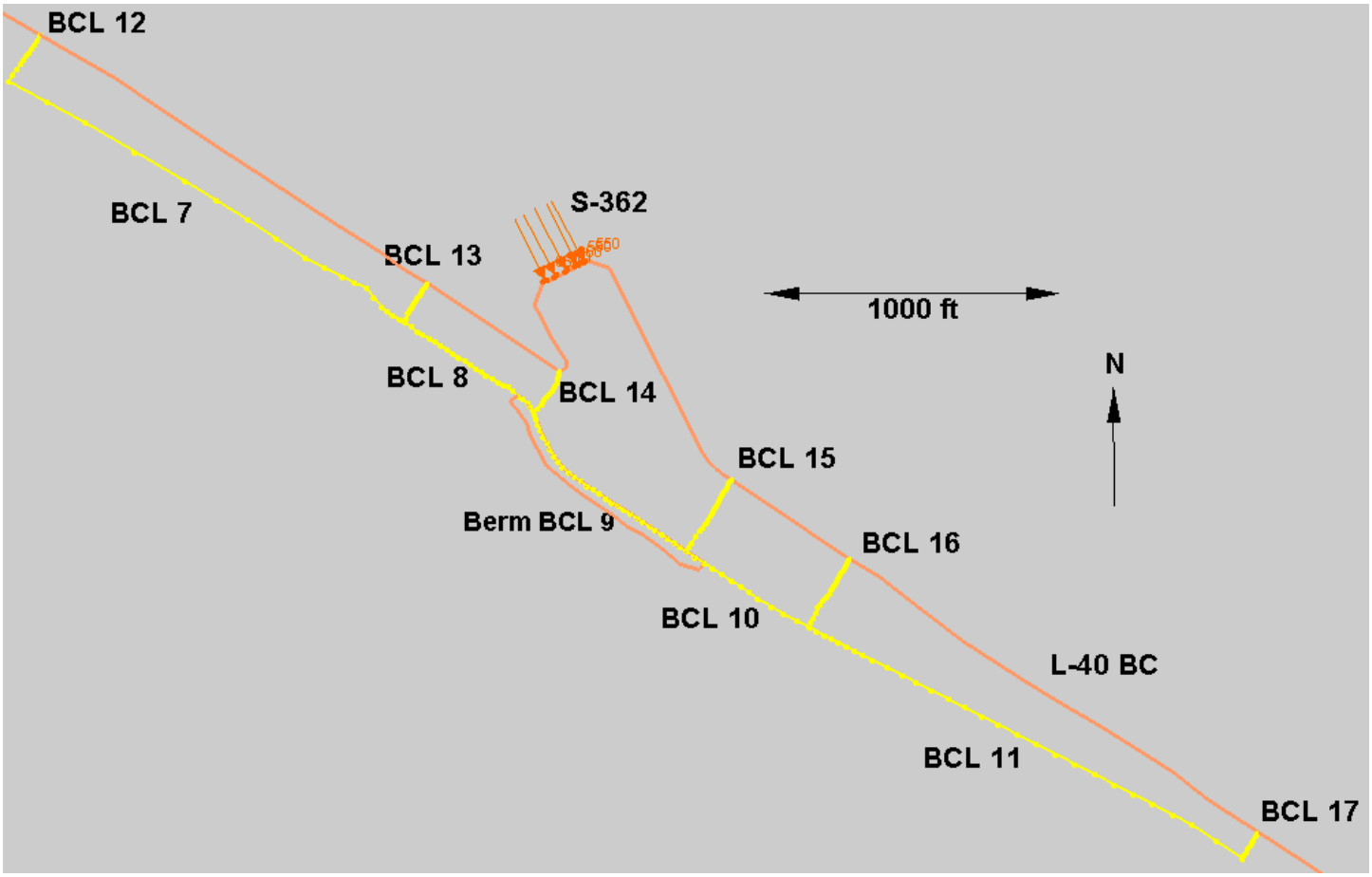


**Figure 28 Flow Transect Locations for Flow Comparison**

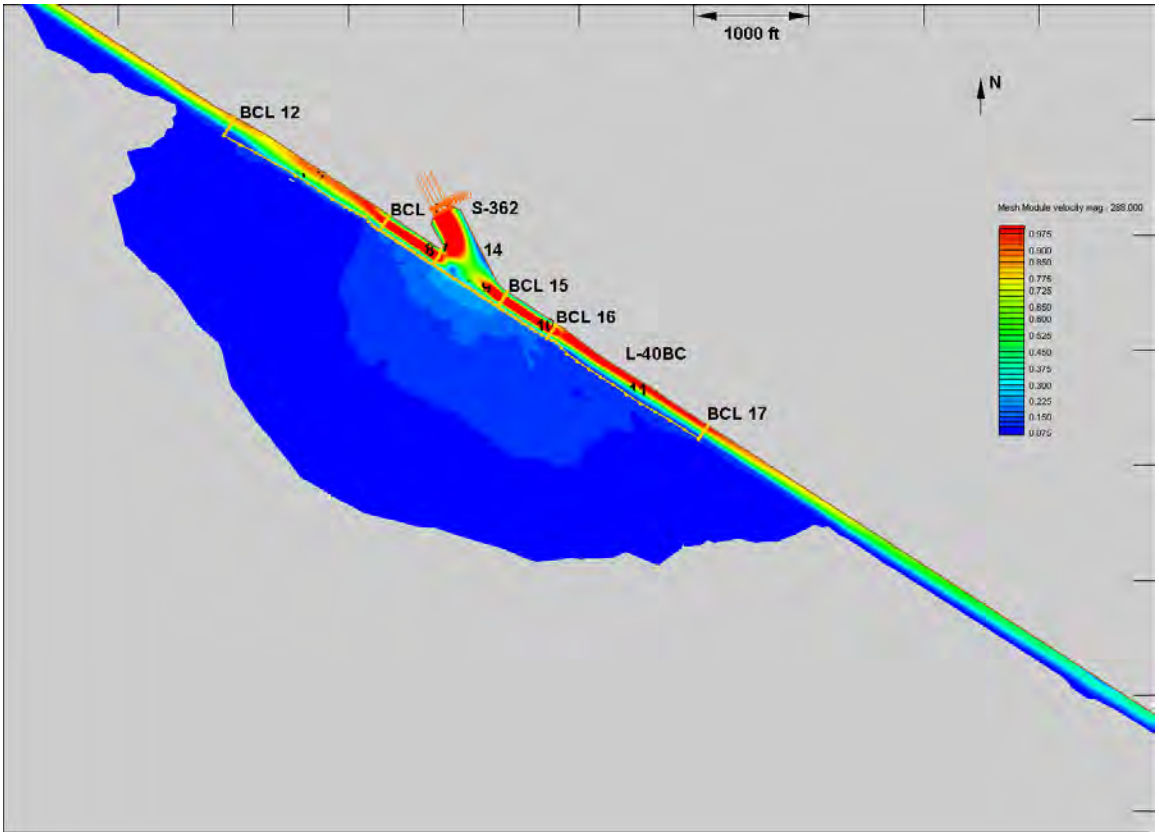


Figure 29 Alternative 2 (Muck Removal)

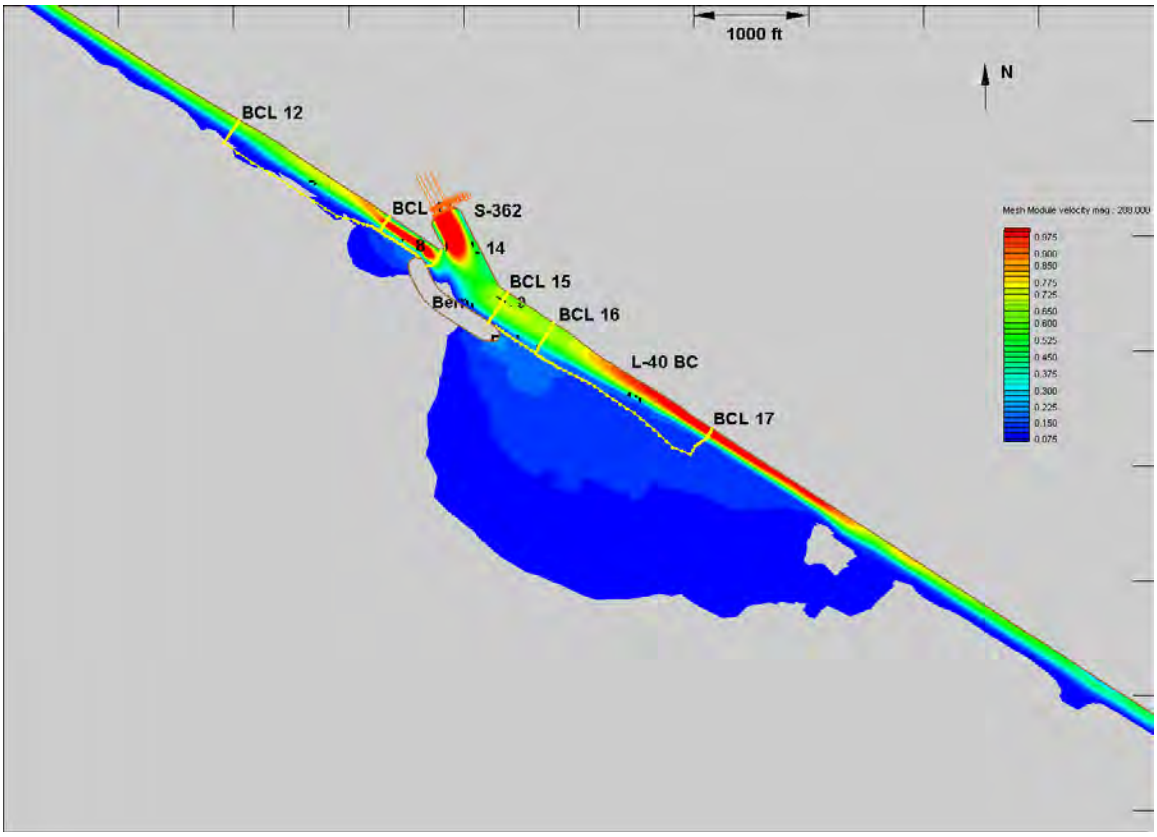


Figure 30 Alternative 3 (200’ Canal with Berm)

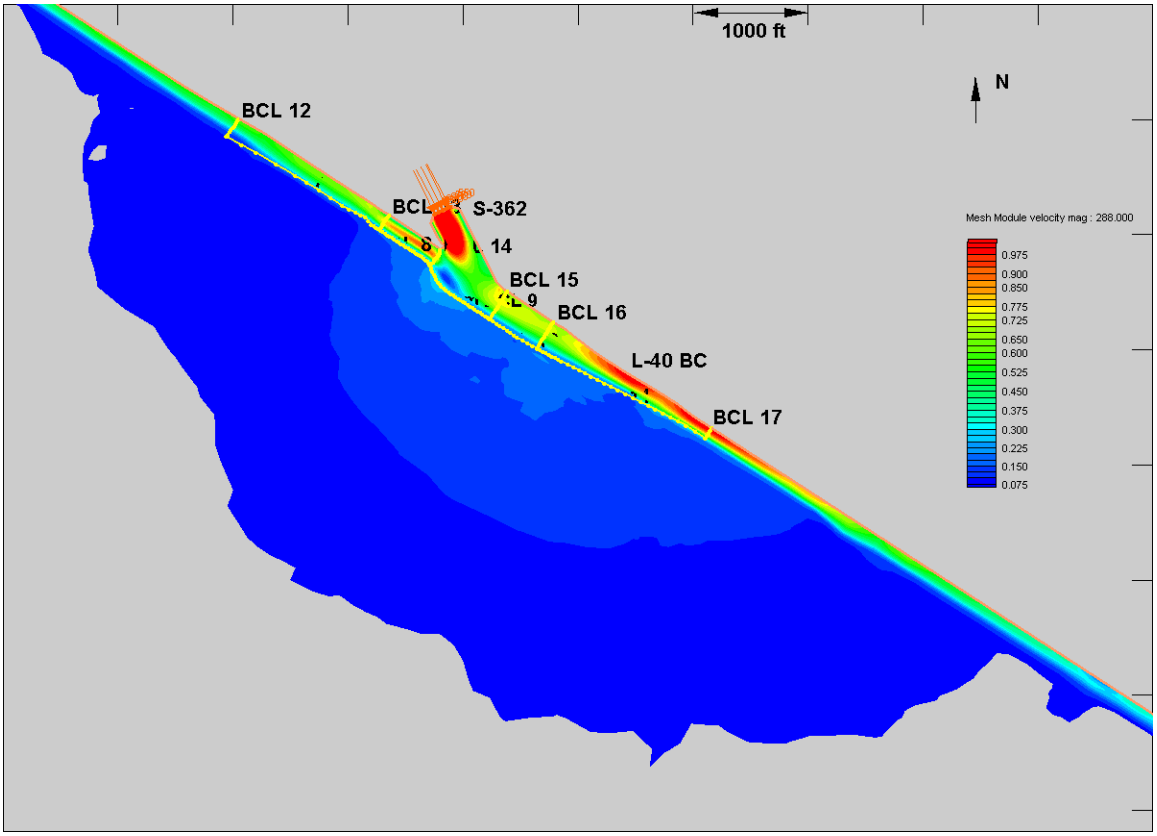


Figure 31 Alternative 4 200’ Canal No Berm

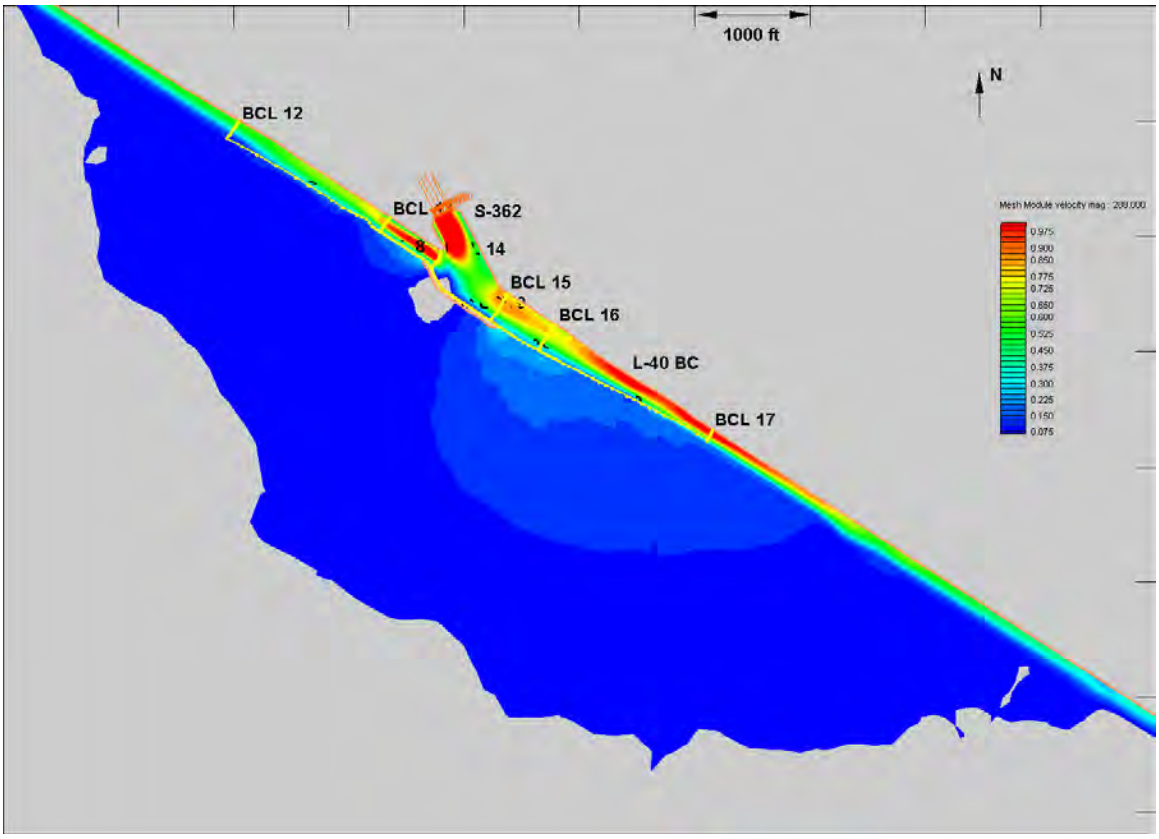


Figure 32 Alternative 5 (150’ Canal with Berm)

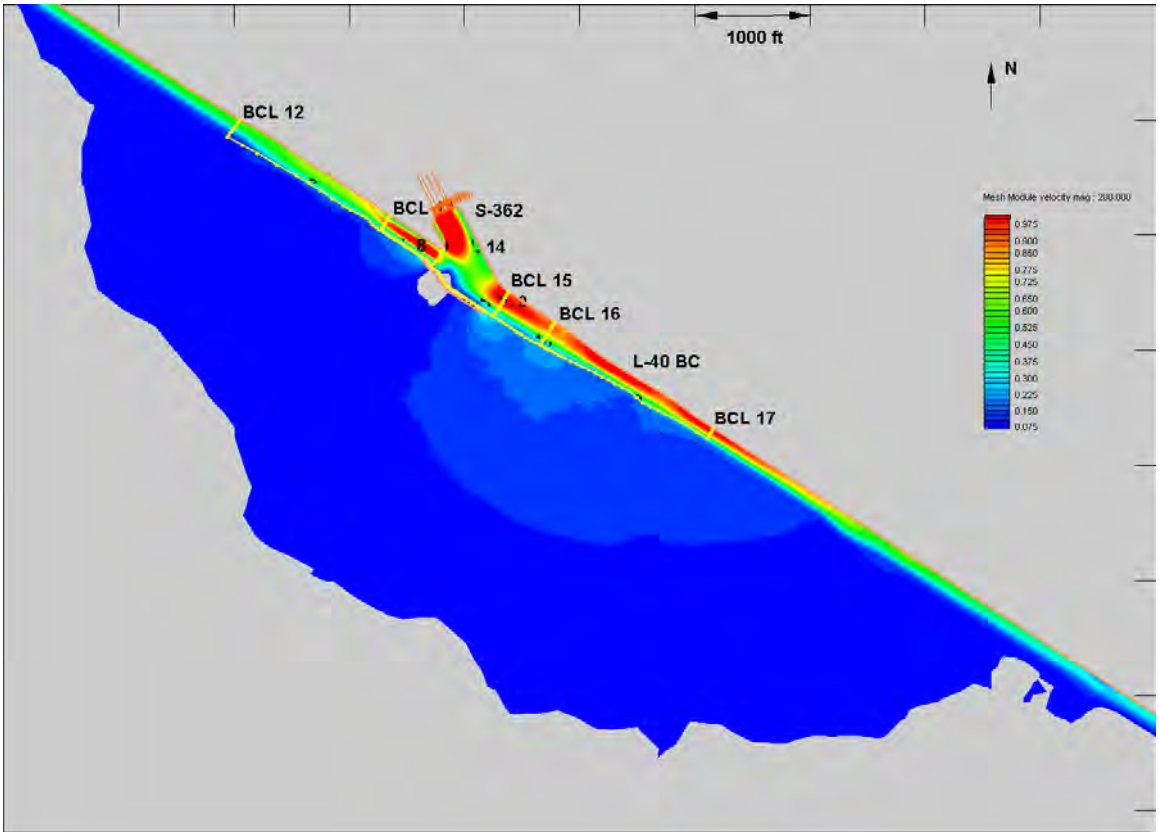


Figure 33 Alternative 6 (100' Canal with Berm)

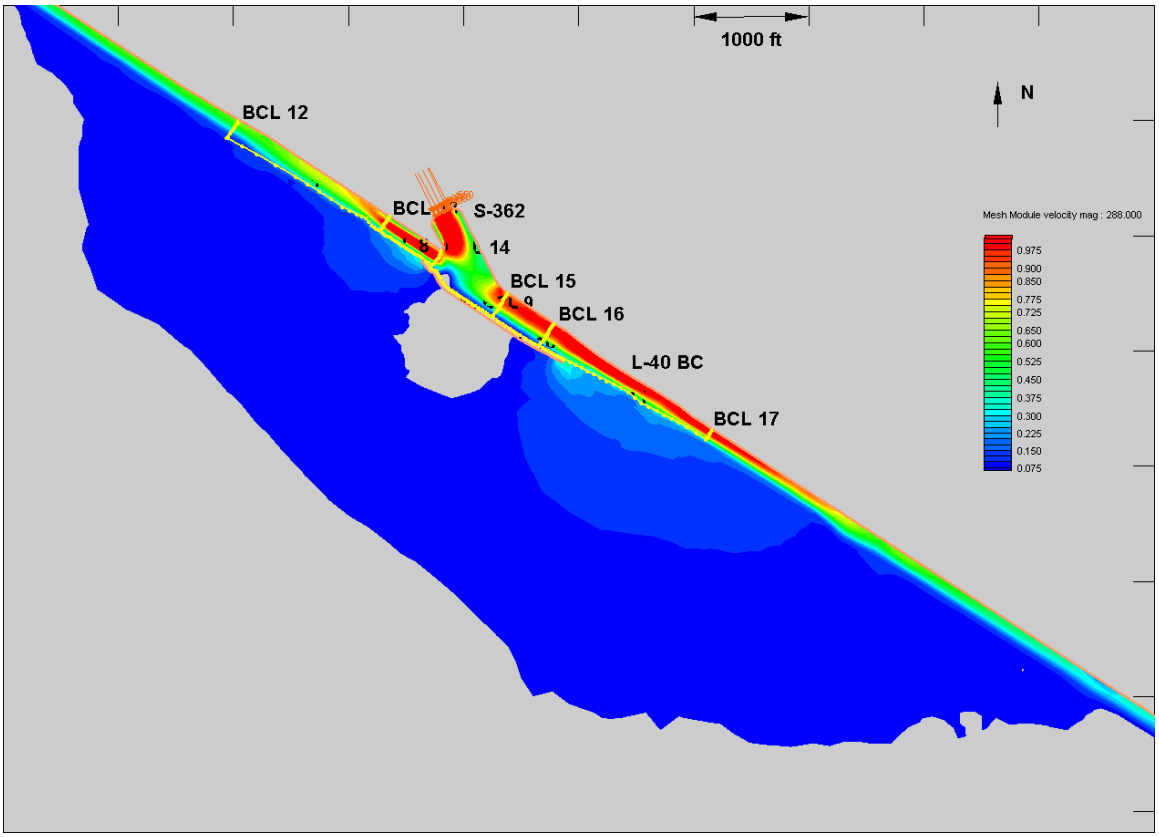


Figure 34 Alternative 7 (100' Canal with (650' Longer) Berm)

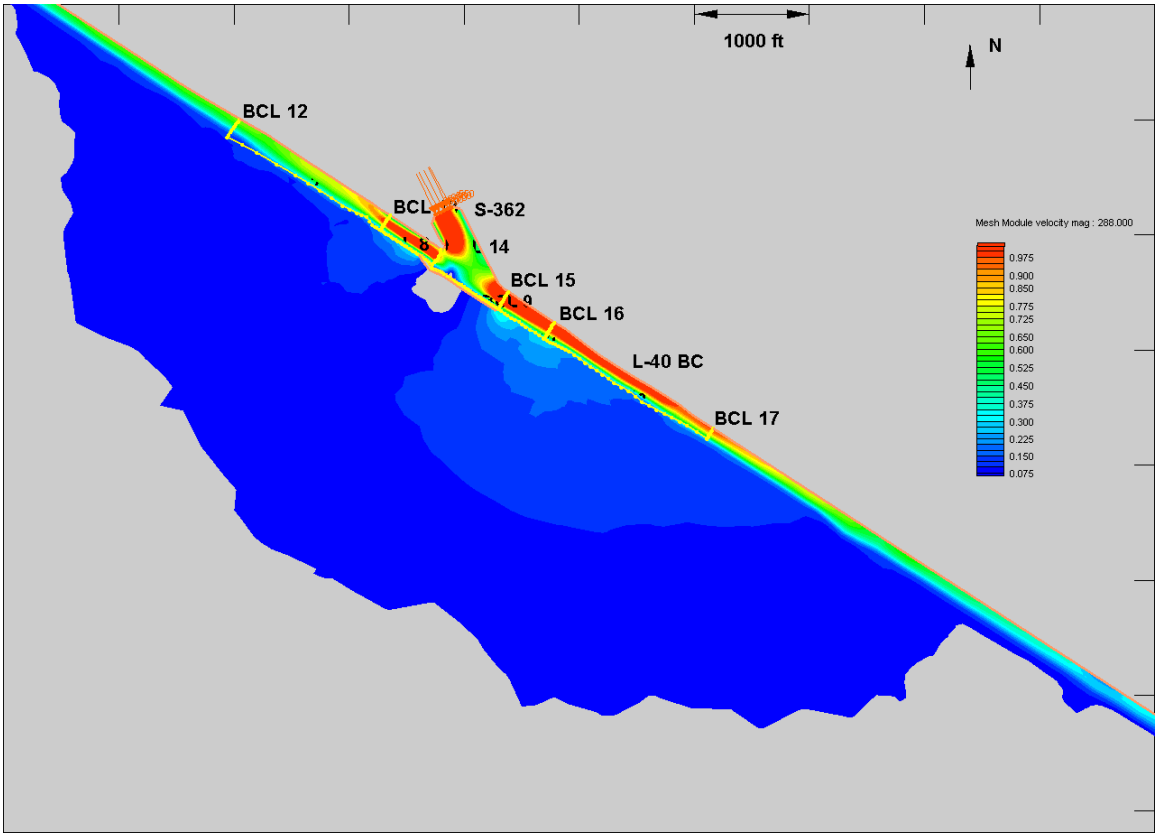


Figure 35 Alternative 8 (75’ Canal with Berm)

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**PRELIMINARY**
**FINDING OF NO SIGNIFICANT IMPACT**
**L-40 Borrow Canal Modifications to C-51 West End Flood Control Project**
**PALM BEACH COUNTY, FLORIDA**

I have reviewed the Environmental Assessment (EA) for the proposed action. This Finding incorporates by reference all discussions and conclusions contained in the Environmental Assessment enclosed hereto. This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Corps' regulation ER-200-2-2 for implementing NEPA on Civil Works actions. Based on information analyzed in the EA, reflecting pertinent information obtained from agencies having jurisdiction by law and/or special expertise, I conclude that the proposed action will not significantly impact the quality of the human environment and does not require an Environmental Impact Statement. Reasons for this conclusion are in summary:

a. The proposed project is a design change to the C-51 West End Flood Control Project and would occur within and adjacent to the L-40 borrow canal. Minimal environmental resources exist in this area. An Environmental Impact Statement and Record of Decision were prepared by the District for the C-51 project in 1998.

b. The Draft Fish and Wildlife Coordination Act Report of September 2, 2005, indicates no objection by the Department of the Interior and anticipates full compliance with the Endangered Species Act, the Coastal Barrier Resources Act, and the Fish and Wildlife Coordination Act.

c. Pending the State's concurrence with the Coastal Zone Consistency (CZM) Determination (Appendix B of the EA) the action is consistent with the State's CZM programs.

d. Consultation with the State Historic Preservation Officer resulted in the determination that sites of cultural or historical significance will not be affected.

e. Measures to eliminate, reduce, or avoid potential impacts to environmental and cultural resources include the following: (1) having an archaeologist on site during construction, (2) completing the appropriate threatened and endangered species surveys and habitat management guidelines, (3) dredging the canal in the dry season, and (4) using measures to avoid turbidity issues when possible.

_____ _____

Robert Carpenter Date
Colonel, U.S. Army
District Engineer

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# ENVIRONMENTAL ASSESSMENT
# L-40 BORROW CANAL MODIFICATIONS
# C-51 WEST END FLOOD CONTROL PROJECT
# PALM BEACH COUNTY, FLORIDA

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# ENVIRONMENTAL ASSESSMENT
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## 1 PROJECT PURPOSE AND NEED

### 1.1 INTRODUCTION

The purpose of this Environmental Assessment (EA) is to supplement the February 1998, Final Environmental Impact Statement (FEIS) for Central and Southern Florida Project (C&SF) Canal 51 (C-51) West End Flood Control Project.

This EA addresses minor design changes to the C-51 West End Flood Control Project. More specifically, this EA addresses modifications to the L- 40 borrow canal (L-40 BC) at the vicinity of pump station 362 (S-362). The objective of the modification is to reduce the direct discharge of S-362 into the Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR or Refuge). It is proposed that the L-40 BC at the vicinity of S-362 be widened to 200 feet, and a 1,000-foot berm be constructed to divert the flow downstream. The berm and widening modification were designed to dramatically reduce flow penetrations into the Refuge from S-362. In addition, the accumulated sediments 3,500 feet upstream and 10,000 feet downstream of S-362 would be removed. It is estimated that approximately 200,000 cubic yards (cy) would be dredged from the L-40 BC.

### 1.2 PROJECT AUTHORITY

The C-51 West End Flood Control Project is a component of the C&SF Flood Control Project and was authorized in Section 315 of the Water Resources Development Act (WRDA) of 1996. Other authorizations for C-51 improvements include the Flood Control Act of 1948 and 1962. Section 315 of WRDA 1996 states:

> The project for flood protection of West Palm Beach, Florida (C–51), authorized by section 203 of the Flood Control Act of 1962 (76 Stat. 1183), is modified to provide for the construction of an enlarged stormwater detention area, Storm Water Treatment Area 1 East, generally in accordance with the plan of improvements described in the February 15, 1994, report entitled ‘‘Everglades Protection Project, Palm Beach County, Florida, Conceptual Design’’, with such modifications as are approved by the Secretary. The additional work authorized by this section shall be accomplished at Federal expense. Operation and maintenance of the stormwater detention area shall be consistent with regulations prescribed by the Secretary for the Central and Southern Florida project, and all costs of such operation and maintenance shall be provided by non-Federal interests.

### 1.3 PROJECT LOCATION

The proposed project is located in central Palm Beach County (see ***Figure 1-1***, vicinity map and plan view) within the northeastern section of Water Conservation Area 1 (WCA-1), otherwise known as the Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR or Refuge). Previously authorized features of the C-51 West End Flood Control Project are located immediately north of the proposed project area (***Figure 1-1***). The project footprint would include

the L-40 levee, L-40 Canal, and marsh areas within LNWR. Components of the project area, which is where the impacts would be anticipated, include Stormwater Treatment Area 1 East (STA-1E), the L-40 Canal, and the LNWR.

## 1.4 DESCRIPTION OF PROPOSED ACTION

The objective of the modification is to reduce the direct discharge from S-362 into the Refuge as well as to remove accumulated sediment from a portion of the L-40 BC. The berm and widening modifications were designed to dramatically reduce flow penetrations into the Refuge from S-362. The dredging modification was designed to remove the sediment (***Figure 2-1***).

The Central and Southern Florida Project, Storm Water Treatment Area 1 East, Levee 40 Borrow Canal Project is located in South Florida in western Palm Beach County, Florida. Work is to be accomplished is within an environmentally sensitive area with stringent permit requirements particularly with respect to turbidity. Scope of work includes widening the existing canal for a distance of approximately 1,520 feet and constructing a berm along the widened portion of the canal for approximately 945 feet. The widening length is approximately 1,500 feet, width approximately 200 feet, and depth to elevation 0. The top width of the berm will be 30 feet with a bottom width of 90 feet. It is currently estimated 84,000 cubic yards of material will be removed for the canal widening. The excavated material from the canal widening will be utilized for berm construction. The volume of material required for the berm design is currently estimated at approximately 25,300 cubic yards. The excess excavated material, amounting to 58,600 cy, will be disposed of in the designated area between L-40 and the STA-1E Discharge Canal, which was previously approved as a disposal site for STA-1E.

The following additional work will be included as an optional bid item. This portion of the work includes removal of phosphorus laden sediment along approximately 13,500 feet of the existing L-40 canal, dewatering dredged material and disposal of dredged material at a designated upland site. The dredged material will be dewatered in the designated area in the northwest corner of the West Distribution Cell of STA-1E; material will also be disposed of in this location. The water resulting from the dewatering will then be pumped to the East Distribution Cell of STA-1E. The dredged material volume is estimated to be 200,000 cubic yards. Components of the project will be reviewed and revised as necessary during the preconstruction engineering and design phase. Pumping distances are estimated to be in the range of 9.5 miles and are subject to change based upon value engineering. Groundwater Monitoring Wells will be required to monitor designated areas outside of the disposal area.

Work will require a high level of construction management and building skills as they relate to working in an environmentally sensitive environment. The Contractor will need substantial resources to react to varying requirements during the project. Reliable equipment and a competent workforce are required to successfully accomplish the work. The contractor should be highly experienced in operating and maintaining heavy construction equipment. Additionally, the contractor should have experience with dredging and dewatering dredged material. Difficulties that might be encountered during performance of contract requirements include, but are not limited to, restricted site access, construction sequencing, working in wet conditions, meeting permit requirements for water quality and protection of equipment and personnel during rapidly changing water surface elevations.

## 1.5 BACKGROUND AND PREVIOUS ENVIRONMENTAL DOCUMENTS

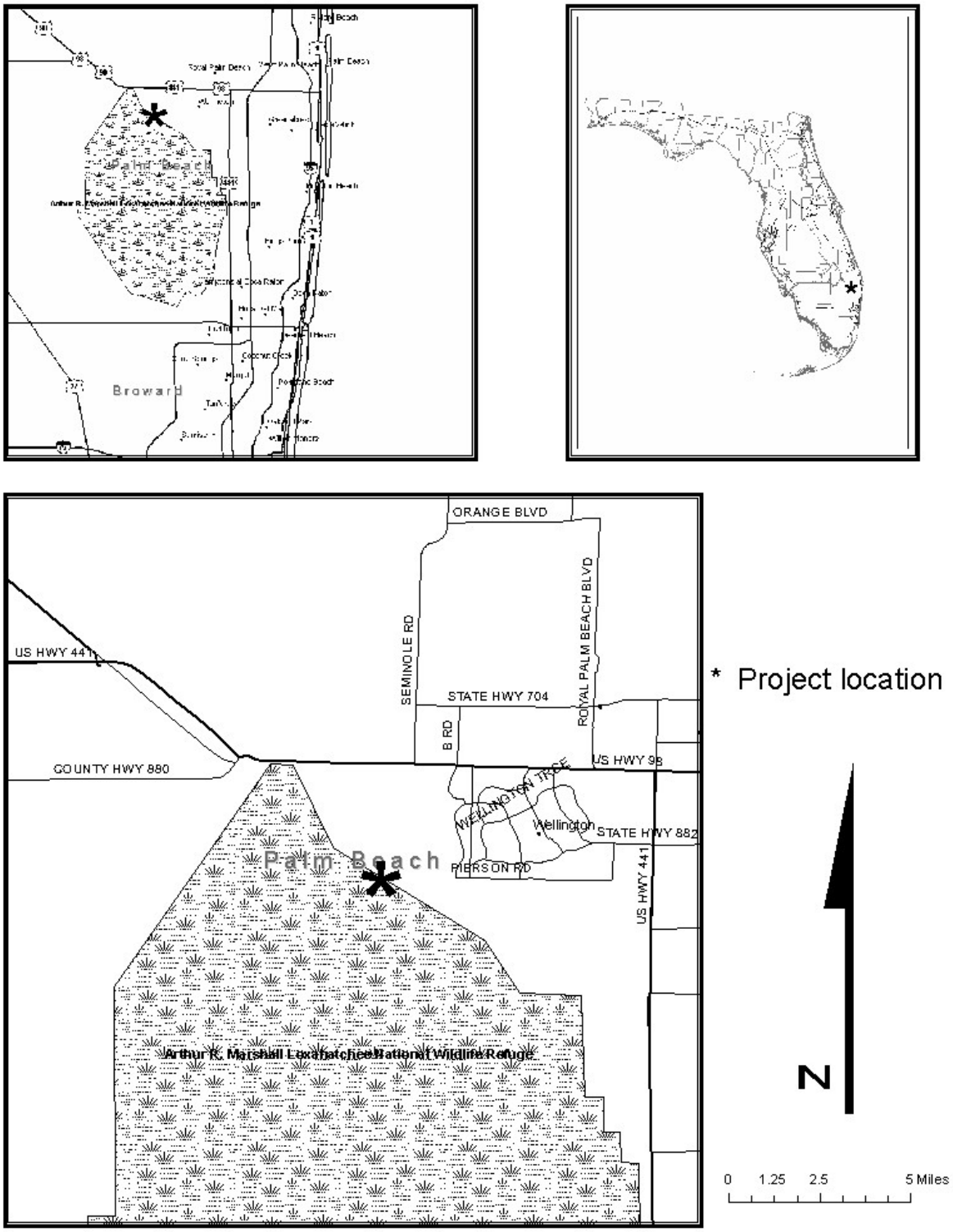
A Final Environmental Impact Statement (FEIS) was completed February 1998 for the C-51 West End Flood Control Project, and the Record of Decision (ROD) was signed October 2, 1998. Where appropriate, certain sections in this EA are referenced back to the FEIS.

The C-51 West End Flood Control Project was designed to enhance the level of flood protection that exists in the C-51 basin, provide additional clean water to WCA-1, and reduce harmful discharges of freshwater to Lake Worth Lagoon. For additional information on the project objectives refer to sections 2.0 and 2.1 in the FEIS. Authorized components of the C-51 West End Flood Control Plan included, but are not limited to, construction of the following: Stormwater Treatment Area 1 East (STA-1E) Works, pump stations 319 and 362, C-51 enlargement, and gated structure 155A.

## 1.6 PROJECT NEED OR OPPORTUNITY

Concerns about the potential impacts of STA1-E discharges to the L-40 BC on WCA-1 arose during the National Pollutant Discharge Elimination System (NPDES) permit evaluation process for STA-1E. The concerns center on the possibility that S-362 discharges will cause benthic sediments to be resuspended from the bottom of L-40 BC and transported to the Refuge by any flow that exceeds the bank of the canal. Such a sediment migration could adversely impact Refuge water quality and habitats in the vicinity of S-362. In addition to the possibility of disturbance of sediment, concerns have been raised about potential flow penetrations into the Refuge at the S-362 discharge junction during high flow events. Based on these newly identified concerns, the U.S. Army Corps of Engineers (USACE or Corps) performed an analysis of the L-40 BC's capacity to prevent overflow into the Refuge and determined that the canal is indeed unable to convey the entire capacity of S-362 within its banks during certain flow conditions (refer to Supplemental DDR in the front of this document). Modification of the L-40 BC is necessary to minimize potential adverse impacts to the Refuge from STA1-E discharges.

**Figure 1-1.** Project location in Palm Beach County, Florida.



## 1.7 AGENCY GOAL OR OBJECTIVE

The USACE is proposing several alternatives to avoid expected adverse impacts to resources in the Refuge as a result of STA1-E discharges. The broad objective of the L-40 BC modification is to maintain L-40 BC flows within the canal's banks, thereby reducing STA1-E discharges as well as canal sediments from flowing into the marsh and adversely impacting interior Refuge water quality and habitats. Specific objectives are:

- Reduce the potential sediment load in the L-40 BC in the vicinity of the S-362
- Block direct discharge at S-362 and divert flows downstream through L-40 BC conveyance
- Reduce potential adverse impacts to the interior marsh of the Refuge from nutrient rich waters

## 1.8 RELATED ENVIRONMENTAL DOCUMENTS

The following is a list of related documents:

1. *Central and Southern Florida Project*, Part V, Supplement 54, Design Memorandum, Addendum 2 (Revised), Coastal Areas South of St. Lucie Canal, Canal 51 West End, Control Structures 155A, 360, Pumping Station 319 and Levee 85, U.S. Army Corps of Engineers, Jacksonville District, February 1998.
2. *Final Environmental Impact Statement*, Central and Southern Florida Project, Canal 51, West End Flood Control Project, U.S. Army Corps of Engineers, Jacksonville District, February 1998.
3. *Arthur R. Marshall Loxahatchee National Wildlife Refuge Comprehensive Conservation Plan*, USFWS, A.R.M. Loxahatchee National Wildlife Refuge, September 2000 (http://loxahatchee.fws.gov/CCP/index.asp).
4. *WCA-1 Water Regulation Schedule* (http://intranet-wc/lib/documents/regulation/ WCA-1.pdf)

## 1.9 DECISIONS TO BE MADE

This Environmental Assessment will evaluate whether to modify the L-40 BC to minimize the impact of STA-1E on WCA-1 and, if so, evaluate alternatives to accomplish that goal.

## 1.10 SCOPING AND ISSUES

A scoping letter was sent out on August 18, 2004 to interested Federal, State, and Local agencies, Indian Tribes, and interested organizations requesting their comments and concerns regarding potential issues to be addressed. Responses to the scoping letter included concerns regarding impacts to interior Refuge plant and periphyton communities, water quality, and threatened and endangered species. Comments were also received related to the technical foundation for selecting an appropriate alternative. Scoping comments can be found in ***Appendix C*** (Pertinent Correspondence).

### 1.10.1 ISSUES EVALUATED IN DETAIL

The following issues were identified as relevant to the proposed action and appropriate for detailed evaluation:

- Area of habitat in Refuge to be negatively influenced by STA-1E discharge
- Threatened and endangered species effects
- Water quality effects
- Wetland effects from construction
- Impacts to Refuge biota
- Dredged material disposal

### 1.10.2 ISSUES ELIMINATED FROM DETAILED ANALYSIS

The following issues were not considered important or relevant to the proposed action and were not evaluated in this EA:

- Air quality
- Climate
- Socioeconomics
- Recreational Resources
- Navigation

## 1.11 PERMITS, LICENSES, AND ENTITLEMENTS

This proposed action will be coordinated with the Florida Department of Environmental Protection (FDEP) pursuant to the Coastal Zone Management Act, 16 U.S.C., 1451-1464, as amended, and will be consistent with the Florida Coastal Management Program. Also, the proposed action is subject to Section 404 of the Clean Water Act since there would be a discharge of dredged or fill material into waters of the United States. Additionally, the proposed action is subject to Section 401 of the Act for certification of water quality by the state of Florida. The U.S. Army Corps of Engineers, Jacksonville District, has submitted an application for a Section 401 Water Quality Certificate (WQC) from Florida Department of Environmental Protection (FDEP). Refer also to section 4.24, Compliance with Environmental Requirements.

# 2 ALTERNATIVES

This section describes in detail the management measures used to determine the alternatives. It then explains the no-action alternative, the proposed action, and other reasonable alternatives that were studied in detail. Then, based on the information and analysis presented in Chapter 3, Affected Environment, and Chapter 4, Environmental Effects, this section presents the beneficial and adverse environmental effects of all alternatives in comparative form (***Table 2-1***), providing a clear basis for choosing among the options for the decision maker and the public.

## 2.1 DESCRIPTION OF MANAGEMENT MEASURES

The planning team evaluated six management measures, which were used to create alternatives, which would accomplish the project objectives. The management measures include channel widening/berm construction, various scales of dredging, dredging techniques, transporting dredged materials, dewatering dredged materials, and disposal sites. ***Figure 2-1*** shows the L-40 BC in the vicinity of the proposed modifications.

### 2.1.1 CHANNEL WIDENING / BERM CONSTRUCTION

The construction of an approximately 945-foot berm at the junction of the S-362 discharge canal and L-40 BC would be combined with widening the L-40 BC for approximately 1,520 feet at the S-362 discharge and L-40 junction (***Figure 2-3***). The intent of this option is to reduce the penetration of nutrient and sediment-laden surface water into the Refuge at the L-40 BC and the S-362 junction during high flow rates. The widening and berm components can be considered one feature as the material for the berm would be built from widening excavation.

### 2.1.2 SCALES OF DREDGING L-40 BC

Sediments from the bottom of the L-40 BC would be dredged to specified templates. The extent of dredging was based on modeling. The modeling determined the linear distance along L-40 BC in which the flow velocities were 0.3 ft/sec or greater, i.e. the velocity when solids are resuspended. The modeling determined that the dredging extent would be placed conservatively at 3,500 feet upstream and 10,000 feet downstream of S-362. The objective is to remove as much phosphorus-loaded sediment as possible.

### 2.1.3 DREDGING TECHNIQUES

The dredging of the L-40 BC would be performed with the equipment which generates the least turbidity because of concerns that the fines and other sediments may flow into the Refuge. The dredging effort would be performed with a suction head dredge rig.

### 2.1.4 METHODS OF TRANSPORTING DREDGED MATERIAL

The two options of transporting the dredged material are 1) with a barge and 2) with a pipeline to STA-1E.

### 2.1.5 METHODS OF DEWATERING

Three options of dewatering the dredged material were considered: 1) gathering the material into cylindrical semi-permeable dewatering membranes (also known as “sausages”), 2) pumping the

dredged material into an impoundment, allowing the sediments to settle, and then discharging the excess water to STA-1E, and 3) using a filter press or cyclone method (for fine sediments). The large quantity of material from the L-40 canal prevent economical dewatering separation using the cylindrical semi-permeable dewatering membrane or using the filter press separation. The impoundment is the only economical method.

### 2.1.6 DISPOSAL AREAS

The three options for disposal of the dredged material included: 1) spreading the material in the northwest corner of the West Distribution Cell (***Figures 2-4 and 2-5***); 2) depositing the material in the area between STA-1E discharge canal and L-40 BC (which is the existing disposal area for STA-1E, also known as Internal Levee 6 or IL-6); and 3) spreading the material in low-lying areas in STA-1E cells. Refer to ***Figure 2-2*** for a map of STA-1E.

**Figure 2-1.** Survey scales of L-40 BC, showing the placement of the widening/berm and dredging.

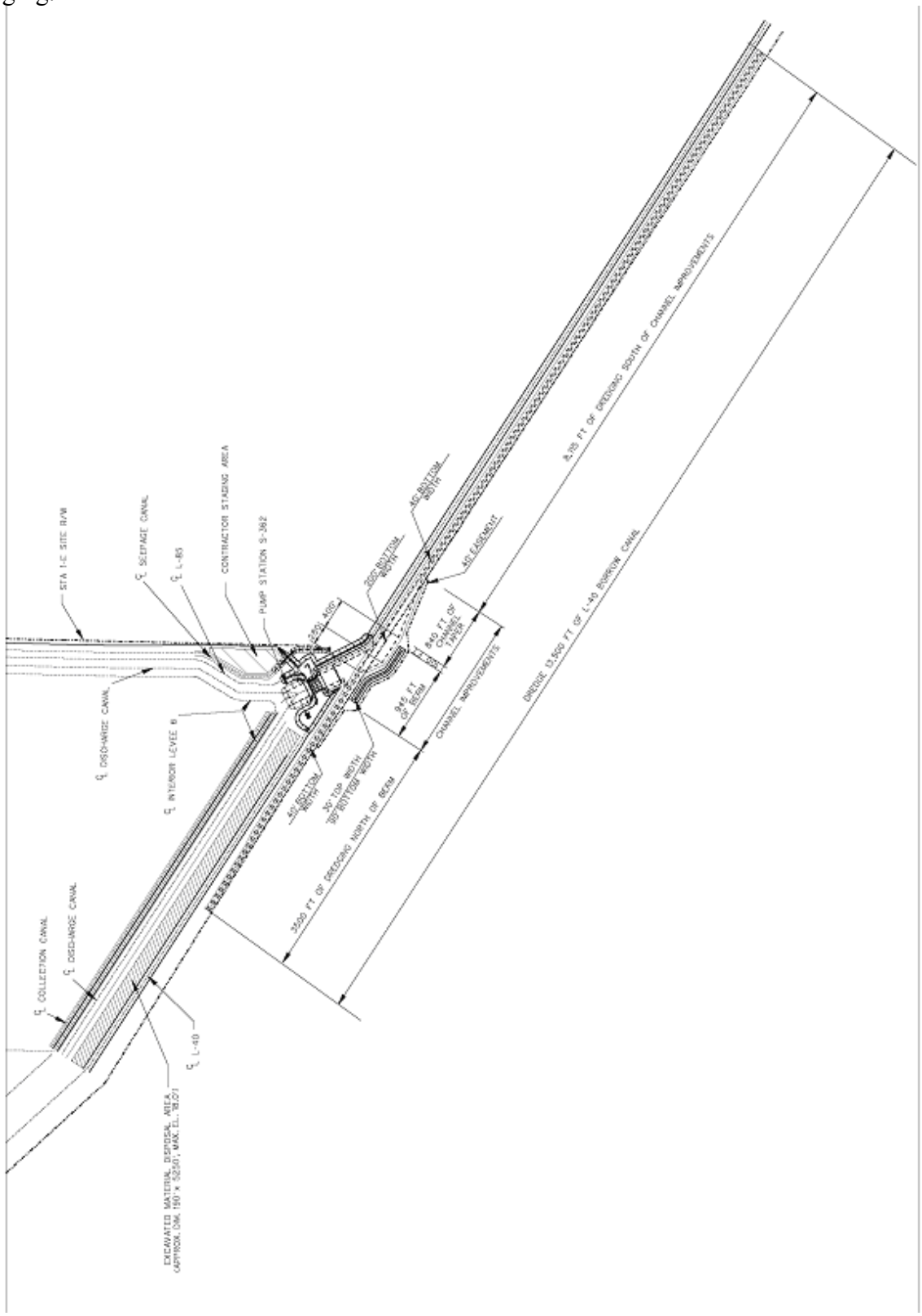


**Figure 2-2.** STA-1E showing dredged material dewatering and disposal area, excavated material (from widening) disposal area, and contractor staging area.

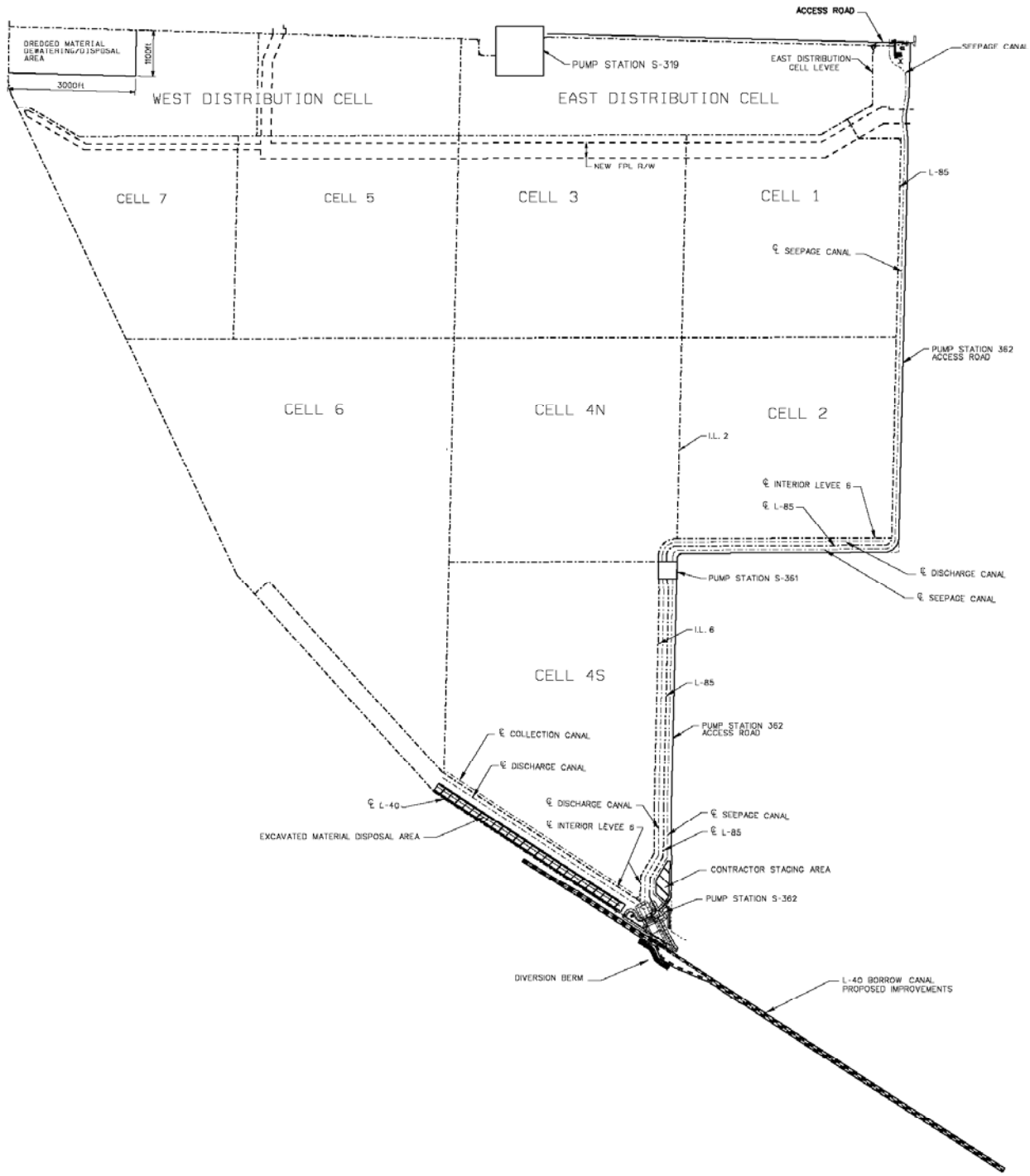


**Figure 2-3.** Typical cross sections of L-40 BC.

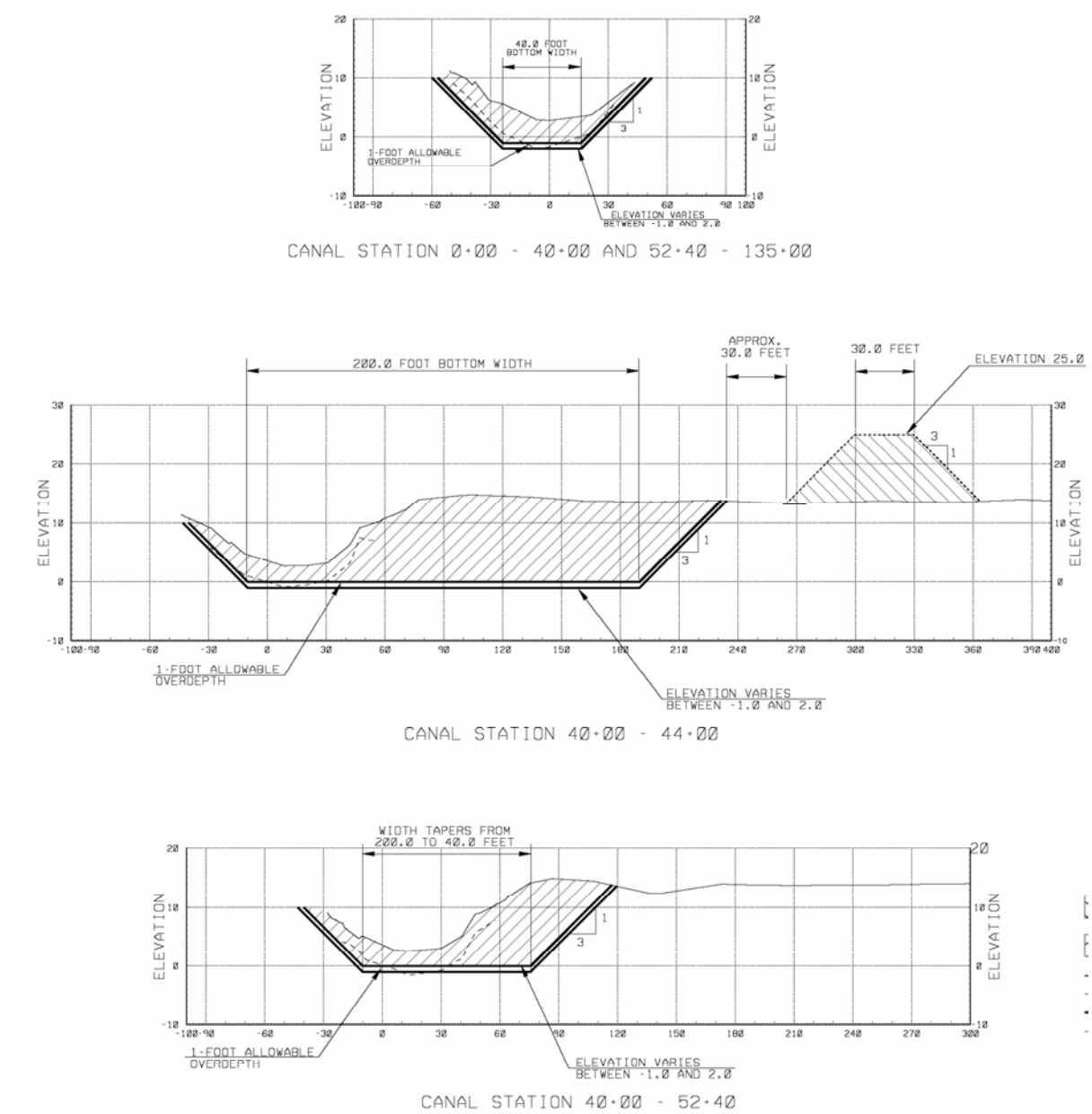
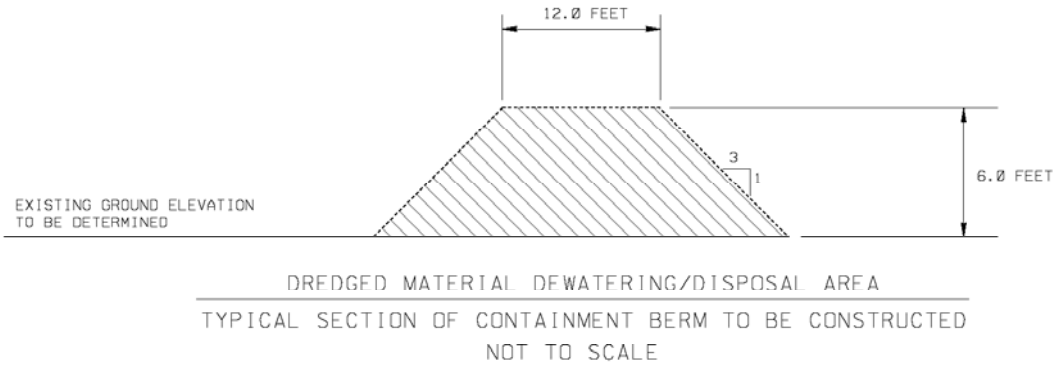
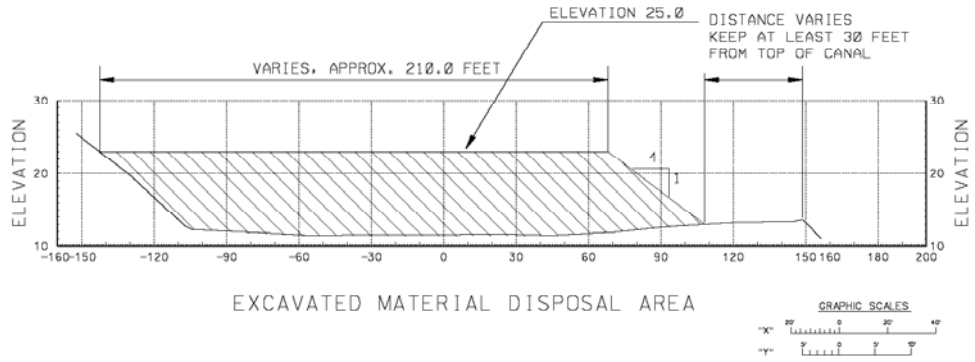


**Figure 2-4.** Dewatering area for dredged material in the West Distribution Cell of STA-1E.

**Figure 2-5.** Typical cross sections of disposal area.




## 2.2 DESCRIPTION OF ALTERNATIVES

For a detailed description of the alternatives evaluated for the C-51 West End Flood Control Project, refer to section 3.0 in the 1998 FEIS. This EA only addresses potential changes to the L-40 BC, to which the C-51 West End Flood Control Project discharges via S-362. Alternatives under consideration were taken from appropriate combinations of management measures from section 2.1. The description of the alternatives for the L-40 BC follows.

### 2.2.1 BERM/WIDENING, DREDGE, & DISPOSAL (ALTERNATIVE 1)

This alternative includes channel widening/berm construction, dredging the canal for a length of 3,500 feet upstream and 10,000 feet downstream of S-362, hydraulic dredging (suctioning) out

the accumulated bottom material, transporting the slurry through a pipeline to the West Distribution Cell of STA-1E, using an impoundment area for dewatering the dredged material, and disposing of the dredged material (after dewatering) within the West Distribution Cell.

### 2.2.2 DREDGE & DISPOSAL (ALTERNATIVE 2)

Under this alternative, the project would include dredging the canal for approximately 3,500 feet upstream and 10,000 feet downstream of S-362, suctioning out the accumulated bottom material, transporting the slurry through a pipeline to the West Distribution Cell of STA-1E, using an impoundment area for dewatering the dredged material, and disposing of the dredged material (after dewatering) within the West Distribution Cell. The only difference between this alternative and the first alternative is the absence of the berm/widening aspect in this one. The berm/widening was left out to determine what added benefits, if any, the berm/widening would provide by comparing this alternative to the first alternative.

### 2.2.3 BERM/WIDENING (ALTERNATIVE 3)

Under this alternative, the project would include the channel widening/berm construction. The only difference between this alternative and the first alternative is the absence of the dredge and disposal aspect in this one.

### 2.2.4 NO ACTION ALTERNATIVE (STATUS QUO)

Under this alternative, the C-51 West End Flood Control Project would be completed as authorized, and STA-1E would discharge into the L-40 BC as that canal presently exists. As a result, approximately 50 % of the STA-1E discharges would penetrate into the Refuge at the S-362 pump station during an extreme storm event discharging at 4,200 cfs.

## 2.3 ISSUES AND BASIS FOR CHOICE

The canal widening was determined based on computing the net flow area below a peak stage with the pump station at full capacity to produce an acceptable velocity (Q=V*A). Purpose of the berm construction is to turn the flow in a southerly direction without adversely impacting the adjacent marsh. The berm was sized to extend just upstream and downstream of the confluence connection from the S-362 Discharge Canal and the L-40 Borrow Canal. The limits of dredging are based on output from a hydrodynamic model (RMA-2) that predicts depth averaged velocities. Once velocities were within the acceptable limits that did not induce concern for the re-suspension of material from the bottom of the canal, the limits of dredging were set. The LNWR, also known as WCA-1, receives the discharge from STA-1E. Therefore, the views and needs of the Refuge are significant in selecting an alternative. Further, impacts to water quality, wetlands, and endangered species as well as other environmental concerns were examined (see section 1.10.1). Cost was also considered.

## 2.4 MANAGEMENT MEASURES ELIMINATED FROM DETAILED EVALUATION

Dredging and material transport using conventional equipment (barge and crane) was eliminated due to issues with increased turbidity caused by the machines. Furthermore, they were not cost-effective. The disposal option of spreading the material in low-lying areas in STA-1E cells was eliminated due to concerns from the Refuge and the construction difficulty concerns. The No Action alternative was rejected since it does not meet the project objective of reducing direct

discharges into the Refuge and preventing sediment entrainment and flow into the marsh, thereby reducing adverse impacts to Refuge water quality and habitat.

## 2.5 PREFERRED ALTERNATIVE

The preferred alternative is Alternative 1, which includes the channel widening/berm construction, dredging the canal for a length of 3,500 feet upstream and 10,000 feet downstream of S-362, hydraulic dredging (suctioning) out the accumulated bottom material, transporting the slurry through a pipeline to the West Distribution Cell of STA-1E, using an impoundment area for dewatering the dredged material, and disposing of the dredged material (after dewatering) within the West Distribution Cell. (See also section 1.4 for further description of proposed project.)

## 2.6 COMPARISON OF ALTERNATIVES

***Table 2-1*** lists alternatives considered and summarizes the major features and consequences of the proposed action and alternatives. See section 4.0, Environmental Effects, for a more detailed discussion of impacts of alternatives.

## 2.7 MITIGATION

The purpose of the proposed action is to reduce or eliminate potential adverse impacts to LNWR due to high-velocity flows during pumping and entrainment of nutrient rich sediments into the Refuge due to these flows. Wetland habitats will be lost due the construction of the L-40 borrow canal modifications and compensation for these losses will be developed in cooperation with the USFWS. Dredging would remove existing nutrient-enriched sediments in the canal, but in itself would not prevent future accumulation or entrainment of new sediments from other areas in the basin. Constructing the berm and widening the canal (Alternative 1) would reduce direct penetration to the Refuge, allowing for greater distribution of inflow points, increased retention time of the water in the canal, and lower phosphorus loading into the Refuge (by spreading out the penetration of discharge). Therefore, with the implementation of Alternative 1 of this project, the interior Refuge habitat is expected to improve. There will also be monitoring after construction to ensure no impacts will occur. In addition to this, wetland mitigation is proposed in the form of exotic plant control in the Refuge. By completing WRAPs at the berm and disposal sites, then comparing the scores with a pristine condition score, the acreage of exotic control actions required to mitigate for wetlands functional losses were calculated. See ***Table 2-2*** for the calculations and WRAP scores. See ***Table 2-3*** for the mitigation acreage calculations. See ***Table 2-4*** for the cost analysis of the mitigation plan.

**Table 2-1.** Summary of direct and indirect impacts.

| **ALTERNATIVE**<br><br>*ENVIRONMENTAL FACTOR* | **Alternative 1 (Preferred):** Berm/Widening, Dredge To Length 13,500 Feet, & Disposal | **Alternative 2:** Dredge To Length 13,500 Feet & Disposal | **Alternative 3:** Berm/Widening | **No Action** (Status Quo) |
|---|---|---|---|---|
| *SEDIMENTS* | Dredged fine sediments deposited at disposal site, mobilization of contaminants in sediment minimized through use of suction dredge. | Dredged fine sediments deposited at disposal site, mobilization of contaminants in sediment minimized through use of suction dredge. | No impacts expected. | Accumulation of fine sediments in L-40 BC would occur. Phosphorus-laden discharges from STA-1E would impact canal sediment composition and increase P levels in Refuge water column and sediments. |
| *HYDROLOGY* | Greater water flow from S-362 would be directed downstream of L-40 BC because of berm placement; there would be no direct penetration into the Refuge at S-362. Penetrations into the Refuge would be distributed downstream and upstream along the L-40 BC, resulting in gradual sheet flow into the Refuge. | No significant changes to water velocities. | Greater water flow from S-362 would be directed downstream of L-40 BC because of berm placement; there would be no direct penetration into the Refuge at S-362. Penetrations into the Refuge would be distributed downstream and upstream along the L-40 BC, resulting in gradual sheet flow into the Refuge. | Water velocities of 0.3 ft/sec would occur in the L-40 BC at several hundred feet downstream and 0.02 ft/sec would penetrate the Refuge at S-362 with pump station running 550 cfs. |
| *WATER QUALITY* | The berm would distribute the flow downstream and upstream along the L-40 BC as a gradual sheet flow, allowing more time for vegetation to take up phosphorus. Temporary turbidity impacts in the canal during dredging operations. | Temporary turbidity impacts in the canal during dredging operations. | The berm would distribute the flow downstream and upstream along the L-40 BC as a gradual sheet flow, allowing more time for vegetation to take up phosphorus. | During high flow events, discharges from STA-1E would penetrate directly into the Refuge at S-362. The STA-1E water quality (consisting of higher than the target 10 ppb TP) would penetrate the Refuge. |
| *WATER MANAGEMENT* | No impacts expected. | No impacts expected. | No impacts expected. | Water from STA-1E might not be able to meet state/Federal mandated Total P levels. |

| ALTERNATIVE<br><br>*ENVIRONMENTAL FACTOR* | **Alternative 1 (Preferred):** Berm/Widening, Dredge To Length 13,500 Feet, & Disposal | **Alternative 2:** Dredge To Length 13,500 Feet & Disposal | **Alternative 3:** Berm/Widening | **No Action** (Status Quo) |
|---|---|---|---|---|
| *VEGETATION AND COVER TYPES* | The existing Refuge marsh habitat would be less impacted, especially at high discharge rates from S-362. The berm/widening would impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands. Potential for introduction of exotic plant species. | The Refuge marsh would not be impacted by sediments that have been accumulating for several decades. The marsh habitat would thrive and cattail encroachment would be not be fueled by pulses of high-nutrient sediments. Potential for introduction of exotic plant species. | The berm/widening would impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands. | The Refuge marsh community richness and diversity would decrease and P-laden water could impact emergent vegetation, increasing expansion of cattails (while possibly decreasing sawgrass populations). |
| *WETLANDS* | Construction could impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands. High velocities from the pump station could impact 134 acres of the Refuge. | High velocities from the pump station could impact 250 acres of the Refuge. | Construction could impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands. | High velocities from the pump station could impact 250 acres of the Refuge. |
| *FISH AND WILDLIFE* | Temporary impacts to wildlife habitat and foraging. Temporarily increased exposure to contaminants. Berm/widening would impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands habitat. Berm could provide upland habitat for terrestrial species, widened canal could provide habitat to large mouth bass and alligators. | Temporary impacts to wildlife habitat and foraging. Temporarily increased exposure to contaminants. | Berm/widening would impact approximately 10.1 acres of nuisance mixed herbaceous shrub wetlands habitat. Berm could provide upland habitat for terrestrial species, widened canal could provide habitat to large mouth bass and alligators. | Decrease in periphyton would negatively impact the food web at upper trophic levels. |

| ALTERNATIVE<br><br>*ENVIRONMENTAL FACTOR* | **Alternative 1 (Preferred):** Berm/Widening, Dredge To Length 13,500 Feet, & Disposal | **Alternative 2:** Dredge To Length 13,500 Feet & Disposal | **Alternative 3:** Berm/Widening | **No Action** (Status Quo) |
|---|---|---|---|---|
| *THREATENED AND ENDANGERED SPECIES* | Certain T&E species may occur in the study area but are not expected to be adversely affected. Including federally listed wood storks, snail kites (with critical habitat), panthers, indigo snakes, and bald eagles and state listed burrowing owls. Objectives of project may benefit T&E species' habitat and foraging. | Certain T&E species may occur in the study area but are not expected to be adversely affected. Including federally listed wood storks, snail kites (with critical habitat), panthers, indigo snakes, and bald eagles and state listed burrowing owls. Objectives of project may benefit T&E species' habitat and foraging. | | May affect foraging of bald eagles, wood storks, and snail kites. Low level contaminants in L-40 BC sediment could impact T&E species. |
| *NOISE* | Some noise during construction. | Some noise during construction. | Some noise during construction. | No impacts expected. |
| *HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES* | Dredging would remove low level contaminants from L-40 BC. | Dredging would remove low level contaminants from L-40 BC. | Low level contaminants would still be in the L-40 BC. | Low level contaminants would still be in the L-40 BC. |
| *LAND USE* | Addition of a berm placed in Refuge land and an upland site in STA-1E used for dredge disposal. | Upland in STA-1E used for dredge disposal. | Addition of a berm placed in Refuge land | No impacts expected. |
| *AESTHETIC RESOURCES* | Berm would somewhat change aesthetics of Refuge. | No impacts expected. | Berm would somewhat change aesthetics of Refuge. | No impacts expected. |

| ALTERNATIVE<br><br>*ENVIRONMENTAL FACTOR* | **Alternative 1 (Preferred):** Berm/Widening, Dredge To Length 13,500 Feet, & Disposal | **Alternative 2:** Dredge To Length 13,500 Feet & Disposal | **Alternative 3:** Berm/Widening | **No Action** (Status Quo) |
|---|---|---|---|---|
| *CULTURAL RESOURCES* | No impacts expected; archaeologist will be present on site during construction phase. | No impacts expected; archaeologist will be present on site during construction phase. | No impacts expected; archaeologist will be present on site during construction phase. | No impacts expected. |

**Table 2-2.** Calculations and WRAP scores.

| | | |
|---|---|---|
| **L 40 Project Site** | | |
| **Existing Condition** | | |
| Berm site | | |
| WRAP score | 0.65 | |
| Number of acres | 10.1 | |
| Functional Units | **6.57** | |
| | | |
| Disposal site | | |
| WRAP score | 0.56 | |
| Number of acres | 23 | |
| Functional Units | **12.88** | |
| **Total Functional Units** | | **19.45** |
| | | |
| **Mitigation Site** | | |
| **Existing Condition** | | |
| WRAP score | 0.63 | |
| | | |
| **Post Condition** | | |
| WRAP score | 0.93 | |
| | | |
| WRAP score | 0.63 | |
| WRAP score | 0.93 | |
| **Delta WRAP score** | **0.3** | |

**Table 2-3.** Calculations of the mitigation acreages.

| L 40 Project Site<br>Mitigation Acreage Calculations | | | | | | |
|---|---|---|---|---|---|---|
| Berm site | | | | | | |
| WRAP score | x | Number of acres | = | Mitigation Delta | x | Acres |
| 0.65 | | 10.1 | | 0.3 | | ? |
| Functional units | | 6.57 | | | | |
| | | **Acres =** | **21.88** | | | |
| Disposal site | | | | | | |
| WRAP score | x | Number of acres | = | Mitigation Delta | x | Acres |
| 0.56 | | 23 | | 0.3 | | ? |
| Functional units | | 12.88 | | | | |
| | | **Acres =** | **42.93** | | | |
| | | **Total Acres** | **64.82** | | | |

**Table 2-4.** Cost analysis of the mitigation plan.

| Cost Analysis | | | |
|---|---|---|---|
| **Acres** | | **Cost/year** | **Cost/Acre** |
| 64.82 | x | $300.00 | $19,445.00 |
| **Years Treated** | | **Cost/Acre /Year** | **Total Cost** |
| 5 | x | $ 19,445.00 | $97,225.00 |

# 3 AFFECTED ENVIRONMENT

For a comprehensive discussion of the affected environment for the entire C-51 West End Flood Control Project, refer to section 5.0 in the 1998 FEIS. The following subsections deal specifically with the project area for proposed L-40 BC modifications, which would occur entirely within the L-40 BC and 10.1 acres of the Refuge in the immediate vicinity of S-362 (see ***Figure 1-1***). The lone project activity that would occur outside the Refuge is dredge spoil disposal at a designated site in STA-1E.

## 3.1 GENERAL ENVIRONMENTAL SETTING

The L-40 Project is located wholly within the boundaries of the LNWR, which is in Palm Beach County, Florida. The L-40 Borrow Canal (BC) serves as a rim canal to LNWR. The project footprint would include the L-40 levee, L-40 Canal, and marsh areas within LNWR. Components of the project area include STA-1E, the L-40 Canal and the LNWR. STA-1E is a stormwater treatment area located in Palm Beach County adjacent to the northeast section of the LNWR, also known as WCA-1. The LNWR consists of 143,238 acres owned by the State of Florida and leased to the Department of Interior and 2,550 acres adjacent to the WCA-1 owned by the Department of Interior. STA-1E, which discharges via S-362 to the L-40 Canal, is also part of a 57-mile levee/borrow canal system that actually defines the perimeter of LNWR. The L-40 Canal depth is approximately 12 feet, the top width varies from 70-90 feet, and the bottom width is approximately 40 feet in the vicinity of the S-362. Pump Station S-362 has a total pumping capacity of 4,200 cfs.

## 3.2 SEDIMENTS

The sediment on the bottom of the L-40 Borrow Canal is a combination of sand, silt, and clay. Preliminary contaminant sampling and assessment for the project (L-40 Borrow Canal Loxahatchee National Wildlife Refuge Sediment Quality Investigation) were completed in January 2005. Twenty-two samples were collected within the proposed dredging area. ***Table 3-1*** summarizes the sediment contaminants. Included in the analysis are metals, organics, chemistry, and particle size. Results of the L-40 sediment sampling showed that the sediments are not considered hazardous or toxic. However, a few samples exceeded the Sediment Quality Assessment Guidelines (SQAG) (MacDonald et al. 2003). The SQAG guidelines were developed to establish a threshold concentration for contaminants to predict the potential for bio-accumulation by hydration of sediments. There were a few sediment samples that were in the probable effects levels for copper and 4-4'- DDE (dichlorodiphenyldichloroethylene). A close correlation between highly organic matter and high nutrient (phosphorus and nitrogen) concentrations was noted in this analysis. These guidelines are better applied when former agricultural lands are flooded. The Corps proposed to dry the sediments, thereby dramatically reducing the risks of bio-accumulation. When the sediments are kept dry they will not attract birds. If we maintain shallow depth water over the sediments, it would create habitat which may provide food source and would attract wading birds. Without the water, the sediments become acutely toxic for wildlife; with water the bacteria accumulate the toxins and it gradually goes up the food chain.

Another report by the Corps was a Sediment Investigation in March 2006. The conclusion was that there is a high correlation between the amount of fines in the sediment and the phosphorus concentration in the sediment. The greater the percentage of fines, the greater the phosphorus concentration.

**Table 3-1.** Soil analysis from the L-40 BC along certain sample points.

| | Samples SS0001-SS0022 | | | Samples SS0023-SS0034 | | | Samples SS0001-SS0034 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Average | Max | Min | Average | Max | Min | Average | Max | Min |
| Metals | | | | | | | | | |
| Arsenic (mg/kg) | 4.93 | 8.70 | 0.76 | 0.93 | 7.50 | 0.00 | 3.52 | 8.70 | 0.00 |
| Copper (mg/kg) | 30.91 | 66.00 | 0.35 | 7.88 | 42.00 | 0.20 | 22.78 | 66.00 | 0.20 |
| Mercury (mg/kg) | 0.09 | 0.80 | 0.00 | 0.01 | 0.09 | 0.00 | 0.06 | 0.80 | 0.00 |
| Organics | | | | | | | | | |
| 4, 4'-DDD (ug/kg) | 3.14 | 20.00 | 0.00 | 0.28 | 2.90 | 0.00 | 2.13 | 20.00 | 0.00 |
| 4, 4'-DDE (ug/kg) | 14.43 | 70.00 | 0.00 | 1.47 | 16.00 | 0.00 | 9.85 | 70.00 | 0.00 |
| 4, 4'-DDT (ug/kg) | 1.69 | 31.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.09 | 31.00 | 0.00 |
| Chemistry | | | | | | | | | |
| TP (kg/mg) | 376.92 | 880.00 | 8.20 | 68.69 | 550.00 | 5.30 | 268.13 | 880.00 | 5.30 |
| % Solids | 37.50 | 80.00 | 14.00 | 71.00 | 82.00 | 20.00 | 49.32 | 82.00 | 14.00 |
| pH | 7.55 | 8.00 | 7.00 | 7.90 | 8.10 | 7.20 | 7.68 | 8.10 | 7.00 |
| Organic Content | 24.18 | 47.20 | 2.20 | 3.49 | 29.90 | 0.50 | 16.88 | 47.20 | 0.50 |
| Particle Size | | | | | | | | | |
| % Sand | 48.53 | 91.70 | 11.10 | 87.82 | 95.30 | 69.20 | 62.39 | 95.30 | 11.10 |
| % Silt | 26.47 | 58.10 | 2.30 | 2.11 | 9.70 | 0.60 | 17.87 | 58.10 | 0.60 |
| % Clay | 21.75 | 49.40 | 4.10 | 2.01 | 5.00 | 0.50 | 14.78 | 49.40 | 0.50 |

## 3.3 HYDROLOGY

The existing hydrology of the study area is controlled by water management practices as described in section 3.5. Existing velocities discharged at S-362 into the L-40 BC and into the Refuge are shown by hydraulic modeling efforts in a hydrodynamic modeling program called RMA-2 (River Management Associates). Refer to the Supplemental Design Documentation Report (located at the beginning of this document) for detailed information and graphics.

## 3.4 WATER QUALITY

All the surface waters in the project area are Class III waters; additionally, wetlands and surface waters located within the LNWR are deemed as Outstanding Florida Water (OFW), pursuant to Rule 62-302.700 (9)(b) 17, FAC. Water discharged from STA-1E to the LNWR is required to meet the Outstanding Florida Waterbody antidegradation standards. The interior marsh of the Refuge is a unique oligotrophic soft-water (low alkalinity) rainfall-driven ecosystem. Included in this ecosystem are algal species that define the endemic periphyton community, which serves as the base of the ecosystem's food chain. The periphyton community thrives best when phosphorus concentrations are no more than 10 parts per billion (ppb).

Due to hydrologic alterations from construction of extensive drainage networks in South Florida, stormwater runoff and wastewater discharges are now part of the hydrological regime in the Refuge. The water quality in the L-40 canal consists of runoff from the lands north of C-51. The water quality varies seasonally. High nutrient runoff is pumped into STA-1E using the S-319 pump station. Within STA-1E the nutrients are removed by distributing the C-51 water over approximately 5,200 acres of emergent marsh. STA-1E is currently authorized and constructed to achieve 50 ppb Total Phosphorus (TP). Even this substantial reduction in phosphorus is not acceptable to the resources of the Refuge. With discharges of 50 ppb TP, cattails continue to spread deeper into the Refuge from the canals and now cover over 6,000 acres of habitat, displacing the more valuable sawgrass dominated wetlands. Cattails, a native but undesirable and invasive species, are thought to be stimulated to invade most areas where TP ppb is greater than 10 ppm. Cattail stands are of relatively low wildlife habitat value, and the Refuge is managed to minimize cattail spread.

## 3.5 WATER MANAGEMENT

Water levels in the Refuge are determined by a water regulation schedule designed to optimize benefits among such competing interests as flood control, water supply (agricultural, municipal, and industrial), fish and wildlife enhancement, prevention of saltwater intrusion, and water supply to Water Conservation Areas 2 and 3 and Everglades National Park. To produce these benefits, the water level in the Refuge is adjusted by releasing water and/or receiving water from Lake Okeechobee and other sources.

## 3.6 VEGETATION AND COVER TYPES

The vegetation in the vicinity of the proposed 1,000-foot berm included species such as Carolina willow (*Salix caroliniana*), cattails (*Typha sp.*), common reed (*Phragmites australis*), alligatorweed (*Alternanthera philoxeroides*) and scattered button bush (*Cephalanthus occidentalis*). Evidence of wildlife usage of the area included nesting alligators, foraging great egrets, roosting green herons, small mammals such as otter, grackles, gallinules, passerines, turtles, aquatic invertebrates, and small fish.

To the southwest of the L-40 levee is the LNWR. The Refuge contains over 227 square miles of wetland habitats, including sloughs, wet prairies, sawgrass, tree islands, cattail, and cypress swamps. The following vegetation descriptions were taken from the U.S. Fish and Wildlife Service (USFWS, FWS, or Service) Arthur R. Marshall Loxahatchee National Wildlife Refuge Comprehensive Conservation Plan (2000).

- Sloughs are the deepest natural marsh communities in the Everglades. During the rainy season, water depth in sloughs may exceed 3 feet, with the annual average depth about 1 foot. They contain vegetation and submergent plants. Underlying sloughs is peat soil, which supports fish species and aquatic invertebrates.
- In contrast to sloughs, wet prairies have shallower water levels and are characterized by short emergent plants. Wet prairies are the most prevalent vegetative community

(approximately 50 percent land coverage) in much of the central and eastern portions of the Refuge and are generally found between sawgrass marshes and sloughs.

- The sawgrass (*Cladium jamaicense*) community (25 percent land coverage in the Refuge) is characterized by the saw-edged sedge that dominates this type of habitat. Sawgrass may grow in solid stands, mosaics, or interspersed with other species such as wax myrtle (*Myrica cerifera*) and dahoon holly (*Ilex cassine*). Sawgrass areas often border tree islands.
- Tree islands are typically composed of an overstory, dense midstory, and numerous ferns in the understory. Tree islands form when submerged peat patches rise to the water's surface and small plants become established followed by shrubs and trees. During drought conditions, alligators wallow out a circular deep water refugia called "alligator holes."
- Cattail communities consist of dense, new monocultures of *Typha spp*. Cattails are the most visible effect of the nutrient imbalance. However, many detrimental changes in the abundance and diversity of algae, diatoms, desmids, and other microorganisms have already occurred by the time the cattail problem is evident. Changes such as these - starting at the bottom of the food chain - eventually work their way up to the more visible effects.
- The cypress swamp community is composed of pond cypress (*Taxodium ascendens*) trees, pond apple (*Annona glabra*), myrsine (*Rapanea punctata*), lichens, and ferns. The moist microclimate of the cypress swamp also provides for a profusion of epiphytes, or air plants. The cypresss swamp in the Refuge is the largest remaining remnant of this community type on the east side of the Everglades.

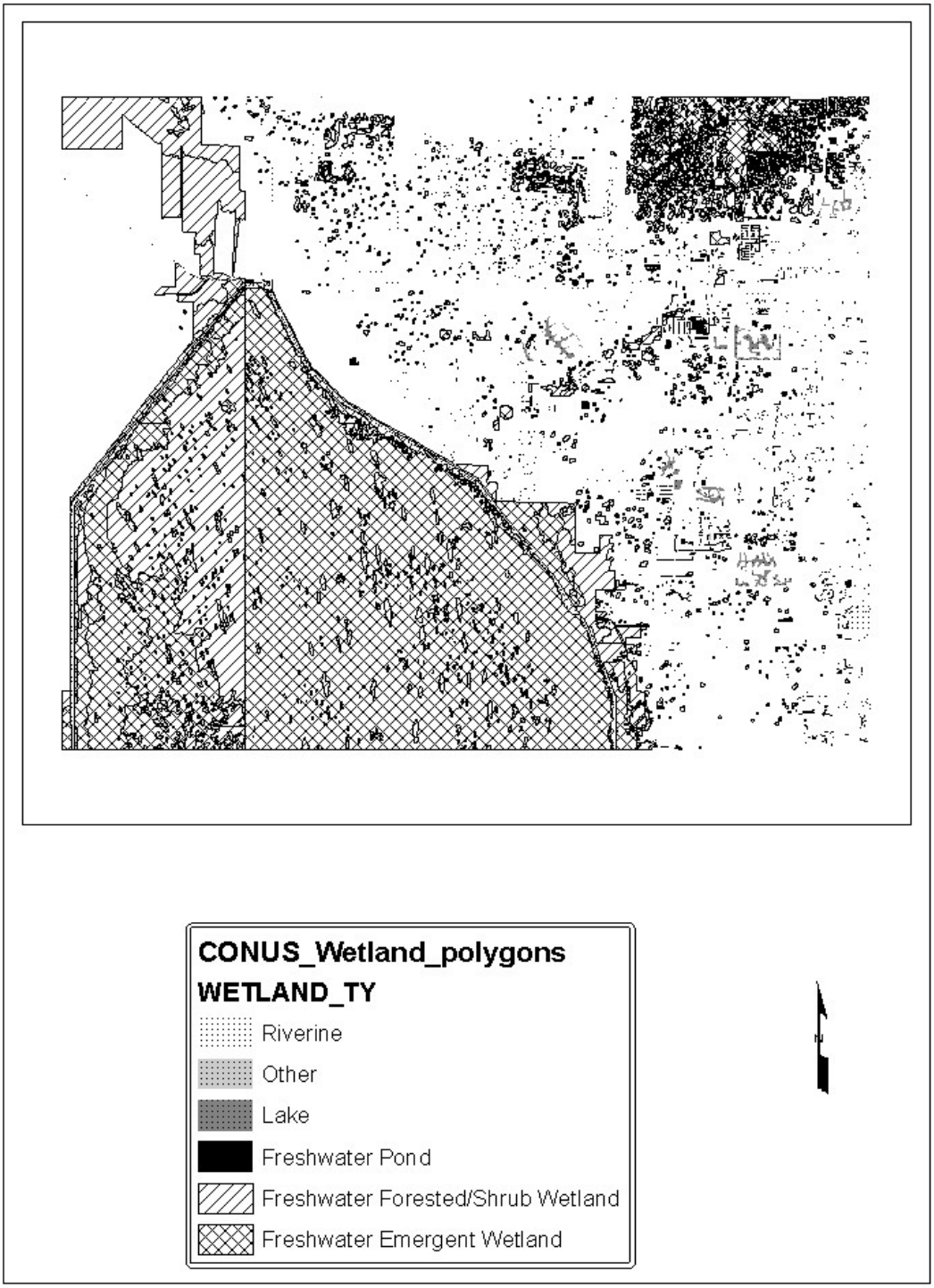
Vegetative communities in the LNWR consist of both native Everglades species and exotic species. Unnatural hydrology, fire regimes and long-term soil disturbance from drainage projects, have caused a variety of changes in vegetative composition and dominance in these communities. These changes have resulted in exotic invasion by Brazilian pepper on upland communities and melaleuca, Australian pine (*Casuarina equisetifolia*), and more recently Old World climbing fern (*Lygodium*) on both upland and aquatic communities.

Percentages of the various communities within the Refuge are given in ***Table 3-2***. The percentages of land cover were determined using FFWCC land cover maps, which are based on Landsat data obtained during 1999 and 2000, as well as a field visit.

**Table 3-2.** Percent of vegetation communities within the Refuge.

| Vegetation Community | Percent Coverage and Acreage |
|---|---|
| Sawgrass marsh | 31 % (2,782 ac) |
| Freshwater marsh & wet prairie | 27 % (2,451 ac) |
| Hardwood hammock/shrub swamp | 3 % (276 ac) |
| Exotics | 3 % (276 ac) |
| Agriculture | 10 % (950 ac) |
| Other upland | 17 % (1,538 ac) |
| Open water | 9 % (781 ac) |

**Figure 3-1.** Wetlands map of the study area in Palm Beach County, Florida.



## 3.7 WETLANDS

A Wetland Rapid Assessment Procedure (WRAP) (Miller and Gunsalus 1999) was conducted by a multi-agency team on July 22, 2005, to assess the pre-project wetland values in the impact area of the LNWR adjacent to the L-40 BC, directly across from the S-362 pump station, for approximately 500 feet downstream and upstream of the pump station. The results are summarized in ***Table 3-3***, and the score sheet and WRAP scoring explanations can be found in ***Appendix D***. The WRAP documents the function and value of the 15 acres of wetlands that were anticipated to be impacted by constructing the berm and widening the canal. Specifically, 10 acres were considered for the berm and 5 acres for the widening.

*Note: These acreages of impacts are reduced (from 15 to 10.1 acres) in section 4.7 due to additional modeling and design modifications completed after the WRAP.*

Essentially all the habitats in the Refuge (discussed in section 3.6 Vegetation and Cover Types) are considered wetlands, including sloughs, wet prairies, sawgrass, cattail, and cypress swamp. ***Figure 3-1*** shows the wetlands in the study area.

**Table 3-3.** Wetland Rapid Assessment Procedure (WRAP) results.

| *Category* | *Pre-construction WRAP scores* (max score) |
|---|---|
| Wildlife Utilization | 2 (3) |
| Wetland Canopy | 2 (3) |
| Field Hydrology | 2.5 (3) |
| Wetland ground cover | 1.5 (3) |
| WQ input and treatment | 2.3 (3) |
| **WRAP score** | **0.675 (1)** |
| Acres Assessed | 15 |

## 3.8 FISH AND WILDLIFE

According to the USFWS Comprehensive Conservation Plan (2000), the Refuge provides nearly 150,000 acres of wetlands habitat for a wide array of species including as many as 257 bird species (93 which are common) including waterfowl and wading birds, 23 species of mammals, 11 frog and toad species, 10 turtle species, as many as 24 snake species, approximately 40 butterfly species, 23 dragonfly species, and 46 fish species. For a list of specific species, refer to the draft Fish and Wildlife Coordination Act (FWCA) report from the USFWS in ***Appendix D.***

## 3.9 THREATENED AND ENDANGERED SPECIES

### 3.9.1 FAUNA

Five federally listed threatened (T) or endangered (E) animal species or their habitats exist in the project area. These include the wood stork (*Mycteria americana*) (E), Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (E) and its critical habitat, bald eagle (*Haliaeetus leucocephalus*) (T), Eastern indigo snake (*Drymarchon corais couperi*) (T), and Florida panther (*Felis concolor coryi*) (E) and Panther Core Area. A description of each species and their habitats can be found below. In addition, numerous state listed species potentially exist in the project area.

State-listed species that are not federally listed potentially occurring within the project footprint include American alligator (*Alligator mississipiensis*), roseate spoonbill (*Ajaia ajaja*), limpkin, little blue heron (*Egretta caerulea*), snowy egret (*E. thula*), tricolored heron, white ibis, Florida sandhill crane (*Grus canadensis pratensis*), and Florida burrowing owl (*Speotyto cunicularia floridana*). The Fish and Wildlife Conservation Commission (FWC) has indicated that the gopher tortoise (*Gopherus poluphemus*) is not likely to occur at the site (***Appendix D***).

#### 3.9.1.1 Wood Stork

The wood stork (*Mycteria americana)* is a long-legged wading bird that typically forages in freshwater marshes, ponds, ditches, tidal creeks and pools, impoundments, pine/cypress depressions, and swamp sloughs (Service 1999). Wood storks prefer to construct nests in tall trees surrounded by open water or within marshes and/or swamps (USFWS 1999). During the non-breeding season, wood storks are found throughout Florida, with interchange between populations within the state as well as between states. The wood stork was federally listed as endangered in February 1984, and is also listed as endangered by the State of Florida. No critical habitat has been designated for this species.

The endangered wood stork occurs throughout the project area and is know to nest in surrounding areas within the LNWR. Wood storks nest and forage in the LNWR and the proposed project construction activity could affect forage and nesting of wood storks in the vicinity. The USFWS's Geographic Information System (GIS) database records indicate that wood storks nested within the LNWR during 2003 and 2004. It is also important to note that the L-40 Canal and STA-1E are within the Core Foraging Area of these wood stork nesting colonies ***(Figure 3-2).*** The proposed L-40 Project location currently provides few opportunities for wood stork foraging. The wetlands present are degraded and contain nuisance and exotic vegetation.

#### 3.9.1.2 Everglade Snail Kite

The Everglade snail kite (*Rosthrhamus sociabilis plumbeus*) inhabits relatively open freshwater marshes that support adequate populations of its prey species, the apple snail. On March 11, 1967, the Everglade snail kite was designated as an endangered species. Everglade snail kites are known to have nested in the northeastern region of the LNWR, but not in recent years ***(Figure 3-3).***

The Service's GIS database records inclusive to 2003 identified two nest sites; 0.75 miles and 0.87 miles from the project area in 1998. No known nesting locations are presently documented within the project. However, Everglade snail kites will likely forage where appropriate perching habitat and apple snails are found. Both native and exotic apple snails are prey items of Everglade snail kites. Everglade snail kite foraging habitat is present though considered insignificant due to the dense cattail coverage and lack of open water areas (Service 2005). This vegetative cover is not prime apple snail habitat and is less than optimal snail kite foraging habitat.

The proposed L-40 Project is located within the LNWR in a portion of designated Everglade snail kite critical habitat. Critical habitat was designated for the snail kite in 1977 and has not been revised. Critical habitat includes LNWR. A complete description of the critical habitat is available in 50 CFR §17.95. Although the critical habitat was designated for the Everglade snail kite, the primary constituent elements (such as: nesting, foraging, space [size], roosting and perching) of Everglade snail kite designated critical habitat were not defined or described (Service 2005).

#### 3.9.1.3 Bald Eagle

Bald eagles (*Haliaetus leucocephalus*) are found in a variety of habitats, but usually nest in older, taller trees and feed in areas that are in close proximity to water. The bald eagle was designated as an endangered species in March 1967. The species' status was down listed to threatened in 1995, and therefore there are management guidelines specified by the USFWS for maintaining and improving the bald eagle populations. The guidelines specify primary and secondary management zones for protection of nest trees with specific restrictions on human activities within these zones. No critical habitat has been designated for this species.

The bald eagle is protected under the ESA, the Bald and Golden Eagle Protection Act (16 U.S.C. § 668 et seq.), and Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. § 701 et seq.). The USFWS consulted the Florida Fish and Wildlife Conservation Commission's bald eagle nest site locator (http://wld.fwc.state.fl.us/eagle/eaglenests/Default.asp) (USFWS 2005). A search in Palm Beach County indicated no known nest locations are present in the vicinity of the L-40 Project. All known nest locations in Palm Beach County are a minimum of four miles from the site. The proposed L-40 Project also does not have large trees capable of holding bald eagle nests and no evidence of bald eagle nests in man-made structures was identified during site visits. The nearest known nests are located approximately 4.25 miles, (last active in 2003), 8.75 miles, (last active in 1991), and 10.1 miles, (last active in 2003). Bald eagle nesting season in the southeastern United States is from October 1 to May 15 (USFWS 2005).

#### 3.9.1.4 Eastern Indigo Snake

The eastern indigo snake reaches lengths of up to 265 centimeters (Ashton and Ashton 1981). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at midbody. Over most of its range, the eastern indigo snake frequents several habitat types, including pine

flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes need a mosaic of habitats to complete their annual cycle.

Eastern indigo snakes are known to inhabit levees which impound water in south Florida. Based on USFWS records, the endangered eastern indigo snake may be present within and adjacent to the proposed project boundaries. The eastern indigo snake was listed as a threatened species in January 1978. No critical habitat has been designated for this species.

**Figure 3-2.** Locations of wood stork nests and surrounding areas within the 18.6 mile Core Forage Areas. The L-40 Canal is within the Core Foraging Area of wood stork nest colonies.

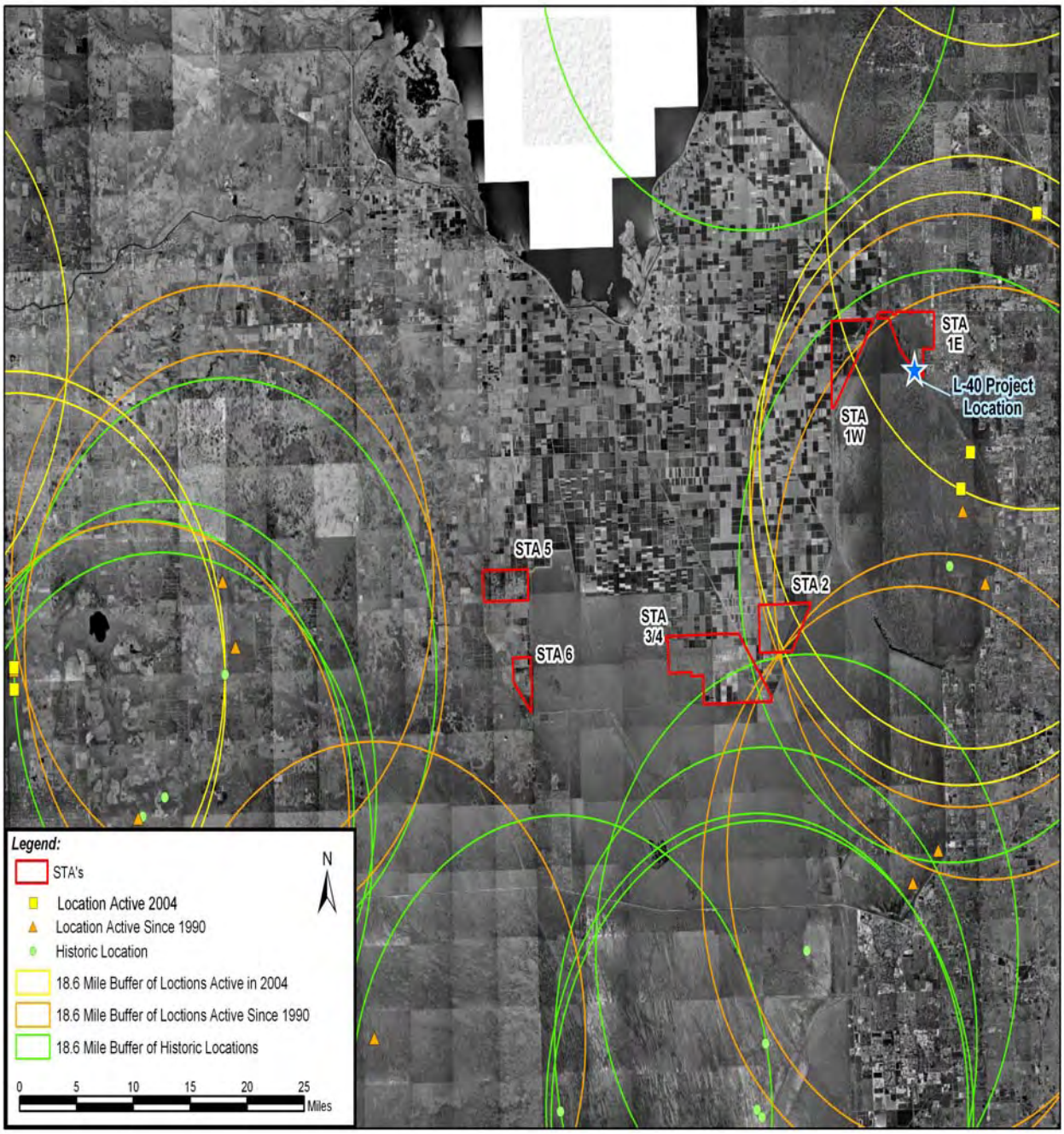
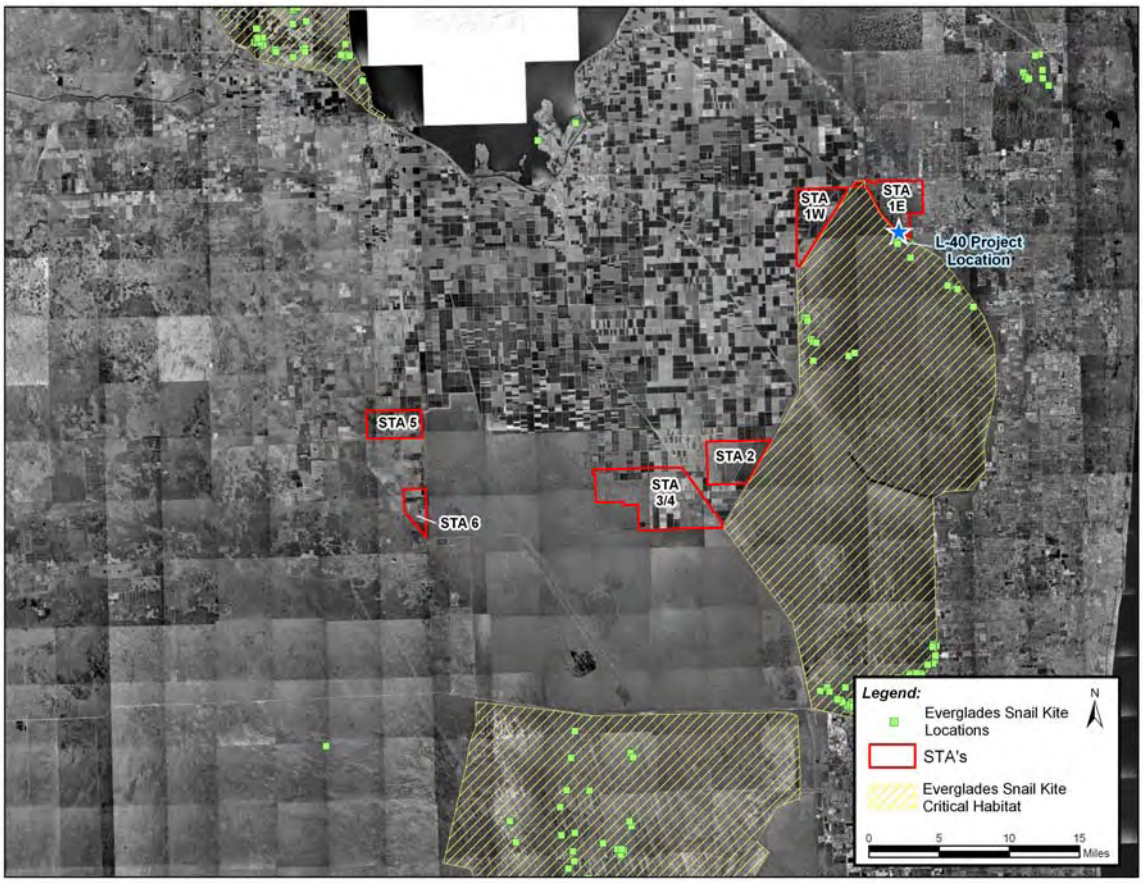


**Figure 3-3.** Everglade snail kite nesting locations and designated critical habitat areas.




3.9.1.5 Florida Panther

The Florida panther (*Felis concolor coryi*), a subspecies of mountain lion (Puma [=Felis] concolor), is one of the most endangered large mammals in the world. They prefer native, upland forests, especially hardwood hammocks and pine flatwoods, over wetlands and disturbed habitats (Service 1999). The most recent population estimate for the Florida panther is a total of 78 individuals, not including denning kittens (McBride 2001). This small population in south Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States.

Panthers are rarely located east of Lake Okeechobee in Palm Beach County and the closest telemetry points are located to the west of Water Conservation Area (WCA) 2A. The project location is separated from the panther consultation area by the WCAs. The L-40 levee may also fragment habitat that could be used by the panther in Palm Beach County. The project area is located within the CERP (Comprehensive Everglades Restoration Plan) Landscape Level

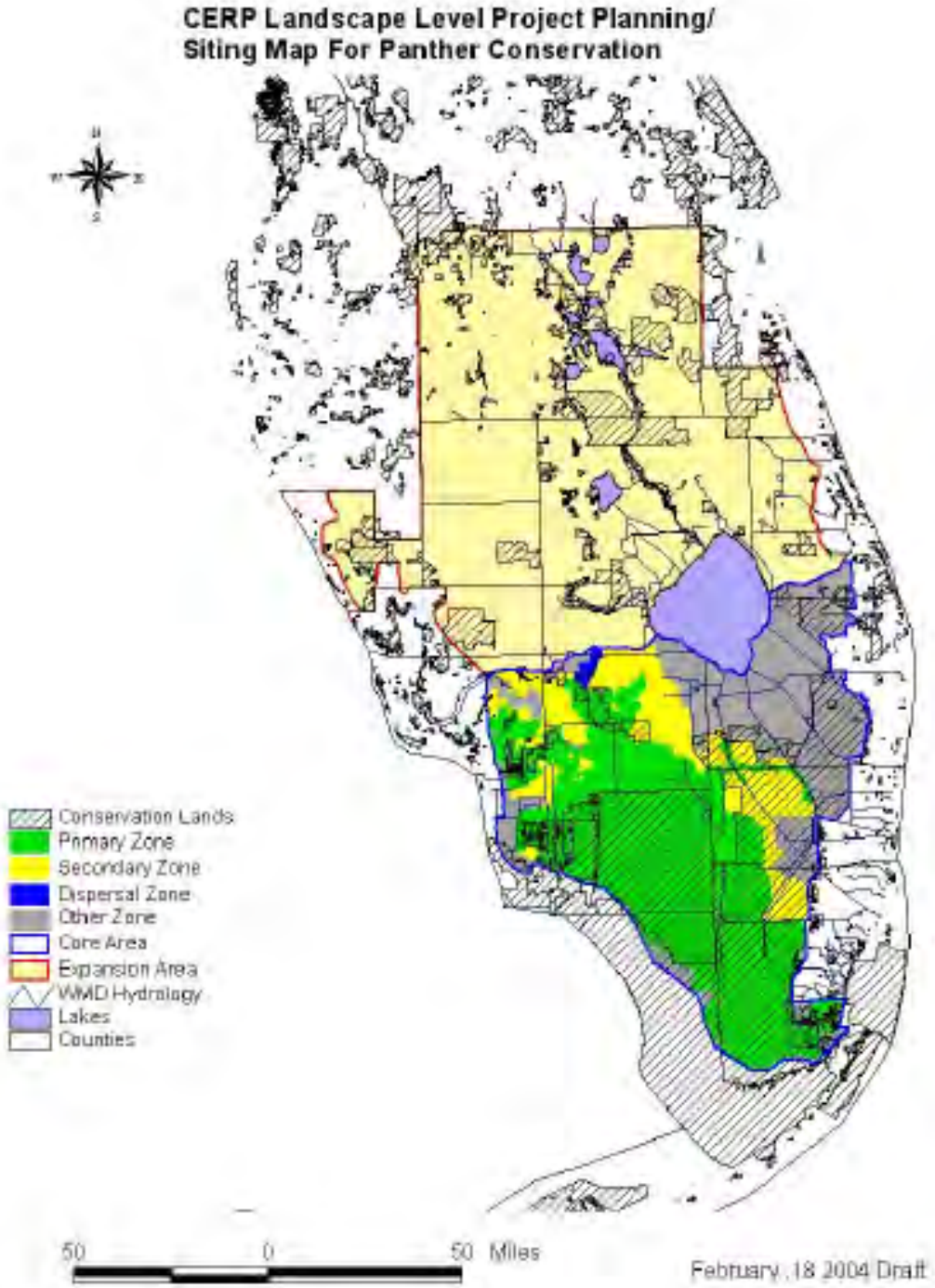



**Figure 3-4.** Panther conservation areas in Florida.

Project Planning Siting Map for Panther Conservation ***(Figure 3-4)*** (USFWS 2004). The Florida panther was historically observed near the LNWR and was assumed to forage in the vicinity. In more recent years, there have been no confirmed sightings although panthers could potentially range along levees near the LNWR. No foraging or breeding activities are expected in the area.

*Note: The L-40 BC is not accessible to manatees and therefore this project would not affect them. There will be no discussion on manatees for this reason.*

### 3.9.2 FLORA

Six plants protected by the State of Florida as endangered species (E), threatened species (T), or species of special concern (SSC) are known to exist or potentially exist within the Refuge: delicate ionopsis (*Ionopsis utricularioides*) (E), three species of aspidium fern (*Thelypteris interrupta*, *T. kunthii*, and *T. palustris*) (each T), ray fern (*Actinostachys pennula*) (E), and royal fern (*Osmunda regalis*). No federally protected plants exist within the Refuge (Service 2000).

## 3.10 NOISE

Existing sources of noise in the study area are limited to vehicles that travel mainly on State Road 80 (US 98/441) and State Road 7 (US 441). Agricultural equipment and activities are an additional source of noise.

## 3.11 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Sediment sampling along the L-40 proposed dredging project area indicate that the sediments are not hazardous, but a low level of agro-chemical contaminants exist (arsenic, copper, and pesticides). These sediments would be removed from the L-40 project area and placed in an uplands disposal area.

## 3.12 LAND USE

For land use in the C-51 Basin, refer to the C-51 1998 FEIS. For Palm Beach County, most of the agricultural production is in the western portion and in the Everglades Agricultural Area, which encircles the Refuge. Important agricultural products in the county include sugarcane, vegetables, melons, ornamental crops, and, to a lesser extent, citrus. Between 1980 and 1990, as the population of the county increased by 50 percent, a large portion of the agricultural land was lost due to urbanization (USFWS 2000).

## 3.13 AESTHETIC RESOURCES

Aesthetic resources existing in the study area include areas mostly in the Refuge. According to the Refuge Comprehensive Conservation Plan (USFWS 2000), the Refuge is a scenic wonder, filled with outstanding Everglades marsh, tree island, and cypress swamp habitats. Clearly, the Refuge has several landscape features that are aesthetically pleasing to guests.

## 3.14 CULTURAL RESOURCES

A review of the Florida Master Site Files and a site visit determined there are no cultural resource concerns, with no potential adverse affect to any historic properties. Consultation with the State Historic Preservation Officer (SHPO) recommends a professional archaeologist be on site during ground-disturbing activities.

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# 4 ENVIRONMENTAL EFFECTS

## 4.1 GENERAL ENVIRONMENTAL EFFECTS

Generally, environmental effects related to construction would be minimal and none seem to be adverse. The primary objective of the L-40 BC project is to reduce the potential for high nutrient and contaminated organic sediments to become resuspended from the L-40 BC and migrate into the interior marsh of LNWR by removing the sediments. The combined benefit of the dredging, berm construction, and canal widening is anticipated to reduce interior Refuge marsh areas impacted by nutrient loads during high velocities related to STA-1E discharges.

## 4.2 SEDIMENTS

*Alternative 1*

The L-40 BC dredging would help remove sediments from 13,500 feet of the L-40 BC bottom, thereby decreasing the potential for migration of these sediments into the interior Refuge marsh and reducing phosphorus-related impacts to the LNWR. The widening of the L-40 BC and construction of the berm would reduce direct discharges into the Refuge. The combined potential benefits of the dredging, canal widening, and berm construction are anticipated to include the reduction of impacts to interior marsh areas by nutrient loads during high velocities related to STA-1E discharges. The L-40 BC Project is located within the boundaries of LNWR, therefore any contaminants that may become mobilized during dredging or construction could temporarily impact the LNWR.

*Alternative 2*

The L-40 BC dredging would help remove sediments from 13,500 feet of the L-40 BC bottom, thereby decreasing the potential for migration of these sediments into the interior marsh and reducing phosphorus-related impacts to the LNWR. The L-40 BC Project is located within the boundaries of LNWR, therefore any contaminants that may become mobilized during dredging or construction could temporarily impact the LNWR.

*Alternative 3*

The widening of the L-40 BC and construction of the berm would reduce direct discharges into the Refuge.

*No Action*

Nutrient laden sediments mobilized by discharged water may impact soil composition. Mobilized sediments from the L-40 BC may be transported to the interior Refuge marsh, contributing to elevated phosphorus concentrations in the water column and over time lead to increased phosphorus levels in the marsh soils and the spread of *Typha* in the Refuge.

## 4.3 HYDROLOGY

*Alternative 1*

Discharges directly into the Refuge at S-362 would be eliminated. STA-1E discharge flows would be better distributed upstream and downstream, resulting in a more sheet flow penetration into the Refuge. Velocities for a with-berm alternative discharging from S-362 into the L-40 BC and over into the Refuge are shown by hydraulic modeling efforts in a hydrodynamic modeling program called RMA-2 (River Management Associates), which is discussed in the Supplemental DDR at the beginning of this document.

*Alternative 2*
There would be no significant changes to velocity. Impacts are negligible.

*Alternative 3*
Discharges directly into the Refuge at S-362 would be eliminated. STA-1E discharge flows would be better distributed upstream and downstream, resulting in a more sheet flow penetration into the Refuge. Velocities for a with-berm alternative discharging from S-362 into the L-40 BC and over into the Refuge are shown by hydraulic modeling efforts in a hydrodynamic modeling program called RMA-2 (River Management Associates), which is discussed in the Supplemental DDR at the beginning of this document.

*No Action*
During large storm events, S-362 discharges would directly flow into the Refuge at the S-362 and L-40 BC junction. This would most likely only happen during 100-year or greater storm events. Velocities for a no-action alternative, where water is discharged from S-362 into the L-40 BC and over into the Refuge, are shown by hydraulic modeling efforts in a hydrodynamic modeling program called RMA-2 (River Management Associates), which is discussed in the Supplemental DDR at the beginning of this document. The Refuge is concerned that additional agricultural and urban development can further degrade natural hydrologic flows, including the amount, timing, and distribution to the LNWR.

## 4.4 WATER QUALITY

*Alternative 1*
The widening and the berm construction would prevent direct penetration into the Refuge and would provide better distribution upstream and downstream along the L-40 BC, resulting in more sheet flow into the Refuge and more time for vegetation to take up phosphorus. Although the water quality is essentially the same in the L-40 BC, the penetration velocities are reduced because the flow is distributed over a greater area along the perimeter of L-40. This alternative would not alter the water quality for the life of the project. During construction, however, it is anticipated that there would be a temporary increase in turbidity for the duration of the dredging and canal widening.

*Alternative 2*
There would be a temporary increase in turbidity during dredging.

*Alternative 3*
The widening and the berm construction would prevent direct penetration into the Refuge and would provide better distribution upstream and downstream along the L-40 BC, resulting in

more sheet flow into the Refuge and more time for vegetation to take up phosphorus. Although the water quality is essentially the same in the L-40 BC, the penetration velocities are reduced because the flow is distributed over a greater extent along the perimeter of L-40. This alternative would not alter the water quality for the life of the project. During construction, however, it is anticipated that there would be a temporary increase in turbidity for the duration of the canal widening.

*No Action*
The current Everglades Forever Act (EFA) state numeric criterion for phosphorus within the Everglades Protection Area (EPA) is 50 ppb total phosphorus. This criterion will be lowered to 10 ppb total phosphorus in December 2006. Treated water discharged into LNWR from STA-1E into the must meet the criteria established for Outstanding Florida Waterbody and the EFA criterion. STA-1E will discharge into the LNWR at a point north of the existing Acme Basin B pump stations. These direct discharges are relatively high in nutrients and can potentially impact the interior marshes of the LNWR. The water quality condition of the water from the STA-1E (consisting of higher than the target 10 ppb TP) is what would be discharged into the canal with the potential to go into the Refuge at high flow conditions, such as 100-year storm or greater storm event. During storm events, about 50 % of the flow enters the Refuge at the S-362 discharge canal and L-40 BC junction.

## 4.5 WATER MANAGEMENT

*Alternatives 1, 2, & 3*
No impacts are expected.

*No Action*
Water from STA-1E might not be able to meet state/Federal mandated Total P levels.

## 4.6 VEGETATION AND COVER TYPES

*Alternative 1*
In the interior Refuge, decreased levels of phosphorus would allow periphyton to thrive and invasive cattails would not out-compete native sawgrass vegetation. There would be impacts to 10.1 acres of nuisance-dominated wetlands within the footprint of the canal widening and berm, and 23 acres of disturbed wetlands would be impacted as a disposal area. The 945-foot berm may provide upland habitat for native terrestrial plants. The general disturbance of soil associated with construction activities may create the potential for introduction and propagation of exotic and nuisance plant species.

*Alternative 2*
In the interior Refuge, decreased levels of phosphorus would allow periphyton to thrive and invasive cattails would not out-compete native vegetation. The general disturbance of soil associated with construction activities may create the potential for introduction and propagation of exotic and nuisance plant species.
*Alternative 3*
There would be impacts to 10.1 acres of nuisance-dominated wetland vegetation within the footprint of the canal widening and berm, and 23 acres of disturbed wetlands would be impacted

as a disposal area. The 945-foot berm may provide upland habitat for native terrestrial plants. The general disturbance of soil associated with construction activities may create the potential for introduction and propagation of exotic and nuisance plant species.

*No Action*
In the interior Refuge, periphyton community richness and diversity would decrease. Phosphorus-laden water may adversely impact emergent marsh vegetation by increasing the expansion of invasive cattails. Elevated phosphorus levels have been associated with changes in the vegetative communities allowing the expansion of cattails in the southwestern portions of the Refuge, which were once dominated by sawgrass (Richardson et al. 1990, Stober et al. 2001). Exotic plant species would persist in the project area and may harm or displace native species and alter ecosystem functions. Melaleuca (*Melaleuca quinquenervia)*, Brazilian pepper (*Schinus terebinthifolius*), water hyacinth (*Eichhornia crassipes*), and hydrilla (*Hydrilla verticillata*) are some of the most prolific exotic plants, although other plant and animal species may locally or regionally impact fish and wildlife resources.

## 4.7 WETLANDS

*Alternative 1*
The L-40 BC project would potentially affect approximately 33.1 acres of wetlands. The total acreage for the construction easement is 10.1 acres. Within this acreage, the canal widening consists of 3.8 acres and the berm consists of 2.3 acres. The widening would convert 3.8 acres of nuisance mixed herbaceous marsh dominated by nuisance vegetation, into open water. The widening would eliminate 3.8 acres of wetlands. The berm would convert 2.3 acres of mixed herbaceous marsh, dominated by nuisance vegetation, into upland. The disposal of excavated material would convert 23 acres of disturbed wetland into an upland disposal pile. Therefore, the excavated material disposal site would eliminate 23 acres of wetland. The combined effects of the berm, widening, and use of the excavated material disposal site affects a total of 33.1 acres of wetlands impacted by the L-40 BC project. Also, during a maximum discharge rate of 3,980 cubic feet per second (cfs), modeling showed velocities would reach 0.075 feet per second (fps) into 134 acres of the LNWR.

Alternative 2
During a maximum discharge rate of 3,980 cubic feet per second (cfs), modeling showed velocities would reach 0.075 feet per second (fps) into 250 acres of the LNWR.

*Alternative 3*
The berm/widening would potentially affect approximately 33.1 acres of wetlands. The total acreage for the construction easement is 10.1 acres. Within this acreage, the canal widening consists of 3.8 acres and the berm consists of 2.3 acres. The widening would convert 3.8 acres of nuisance dominated mixed herbaceous shrub wetland into open water. The widening therefore would lose 3.8 acres of wetland. The berm would convert 2.3 acres of nuisance mixed herbaceous marsh into upland. The disposal of excavated material would convert 23 acres of disturbed wetland into an upland disposal pile. Therefore, the excavated material disposal site would lose 23 acres of wetland. The combined effects of the berm, widening, and use of the excavated material disposal site comes to a total of 33.1 acres of wetlands impacted by the L-40

BC project. Also, during a maximum discharge rate of 3,980 cubic feet per second (cfs), modeling showed velocities would reach 0.075 feet per second (fps) into 134 acres of the LNWR.

No Action
During a maximum discharge rate of 3,980 cubic feet per second (cfs), modeling showed velocities would reach 0.075 feet per second (fps) into 250 acres of the LNWR.

## 4.8 FISH AND WILDLIFE

*Alternative 1*
Temporary impacts to fish and wildlife are expected from the project's construction activities. This includes temporary impacts to wildlife habitat and foraging and temporarily increased exposure to contaminants. Approximately 10.1 acres of nuisance dominated mixed herbaceous shrub wetland adjacent to the L-40 BC is expected to be impacted by the construction of the berm and widening of the canal. Approximately 23 acres of disturbed wetlands habitat would be impacted as a disposal area. The proposed 945-foot berm would also provide some upland habitat for terrestrial species such as the indigo snake, and the widened canal would provide habitat to large mouth bass and alligators.

*Alternative 2*
There would be temporary impacts to foraging and habitat of wildlife, including wading birds. Excavation and transport of potentially contaminated sediments during the canal dredging and dewatering operations could increase exposure of fish and wildlife to contaminants.

*Alternative 3*
Temporary impacts to fish and wildlife are expected from the project's construction activities. This includes temporary impacts to wildlife habitat and foraging and temporarily increased exposure to contaminants. Approximately 10.1 acres of nuisance dominated mixed herbaceous shrub wetland adjacent to the L-40 BC is expected to be impacted by the construction of the berm and widening of the canal. Approximately 23 acres of disturbed wetlands habitat would be impacted as a disposal area. The proposed 945-foot berm would also provide some upland habitat for terrestrial species such as the indigo snake, and the widened canal would provide habitat to large mouth bass and alligators.

*No Action*
The interior marsh is a unique oligotrophic soft-water (low alkalinity) rainfall driven ecosystem. The composition of algal species which define the endemic periphyton community is highly susceptible to influences associated with altered water quality (Richardson et al. 1990). Phosphorus concentrations above 10 parts per billion (ppb) are known to reduce the diversity and alter the species composition of this unique periphyton community. Periphyton serves as the base of the food chain. Therefore, alterations affecting periphyton may have impacts to invertebrates such as apple snails (*Pomacea paludusa*) and to wildlife at higher trophic levels supported by this food base (Swift and Nicholas 1987), including Everglade snail kites foraging on apple snails, and wading birds such as wood storks which feed on small fish.

## 4.9 THREATENED AND ENDANGERED SPECIES

*Alternatives 1, 2, & 3*

The USFWS and Corps have determined that five federally listed species, which occur in the vicinity, could be affected by the proposed project. These species are the bald eagle, Everglade snail kite and its critical habitat, wood stork, Florida panther, and Eastern indigo snake. The Corps has determined that the proposed plan, Alternative 1, *may affect but is not likely to adversely affec*t, all five federally listed species and *will not adversely modify* designated critical habitat. The USFWS has concurred with this determination in a letter included in ***Appendix D***.

The FWC indicated that the state listed burrowing owl may also be affected, but the state listed gopher tortoise is not known to occur in the project area. Standard Corps construction conditions regarding the gopher tortoise and burrowing owl will be followed to avoid adverse effect to state protected species. No coastal species (i.e. sea turtles and manatees) will be affected by this project

### 4.9.1 WOOD STORK

The berm and widening part of the project could result in the loss of 10.1 acres of mixed herbaceous shrub swamp, dominated by nuisance vegetation, mixed herbaceous shrub wetland, which is only marginal foraging habitat for the wood stork. The 23 acres of disturbed wetlands that would be impacted as a disposal area could be used as foraging habitat but would provide only marginal to poor quality habitat for the wood stork. However, it is also believed that the wood stork may benefit from the L-40 BC project because high velocity discharges into the Refuge will cease and the project will result in the removal of 200,000 cy of phosphorus-laden and potentially contaminated sediments from the L-40 BC. The interior Refuge would be better protected from further invasive plant spread after the project is constructed. As a result of historical pesticide application, the USFWS expressed concerns with potential pesticide residues in sediments to be dredged. The preferred alternative would minimize suspension of sediments during dredging and transport, and would require they be disposed of on an upland site isolated from Refuge lands. *Therefore, the Corps has determined that the project may affect but is unlikely to adversely affect, the wood stork.*

### 4.9.2 EVERGLADE SNAIL KITE

Everglade snail kite use of the site may be affected by the proposed project. Construction activities associated with the L-40 BC project might affect Everglade snail kite nesting and forage areas. Snail kites have nested during some years in LNWR. However, they have not nested during the past two years. The edges of the Refuge are relatively marginal snail kite habitat due to the presence of undesirable invasive species growing densely. The loss of 10.1 acres of nuisance dominated mixed herbaceous shrub wetland, which is poor foraging habitat for the snail kite, could occur as a result of the berm construction and widening portion of the L-40 BC. The 23 acres of disturbed wetlands that would be impacted as a disposal area could be used as foraging habitat but would provide marginal to poor quality habitat for the snail kite. However, it is also believed that Everglade snail kite foraging habitat may benefit from the L-40 BC project by reducing impacts related to deep penetration of the S-362 discharge into the Refuge interior. Dredging and removal of 200,000 cy of phosphorus-laden and potentially

contaminated impacted sediments will further reduce future nutrient loads in waters overflowing into the Refuge, and inhibit the further spread of invasive species, preventing their future possible migration into Everglade snail kite foraging habitat. *The Corps has determined that the proposed project may affect, but is unlikely to adversely affect, Everglade snail kite populations or habitat in LNWR*.

The LNWR is designated as snail kite critical habitat. The loss of 10.1 acres of poor foraging habitat within this designated Everglade snail kite critical habitat could occur as a result of the berm construction and widening portion of the L-40 BC. The 10.1 acres consist of dominated mixed herbaceous shrub wetland, dominated by nuisance vegetation. It is believed that Everglade snail kite critical habitat may benefit from the L-40 BC project by reducing impacts related to deep penetration of the S-362 discharge into the Refuge interior. *The Corps has determined that the proposed project, L-40 BC modifications, will not adversely modify, Everglade snail kite critical habitat.*

### 4.9.3 FLORIDA PANTHER

The benefits to LNWR should reduce impacts to habitat for Florida panther prey species through a reduction in the rate of expansion of cattails (Service 2005). Although prey habitat quality in the inner Refuge lands will be preserved, no panther foraging or breeding activities are expected in the area. The proposed project is not expected to negatively impact panther populations. *The Corps has determined that the proposed project may affect, but is not likely to adversely affect, the Florida panther or its habitat*.

### 4.9.4 BALD EAGLE

The threatened bald eagle is known to nest within and adjacent to the project boundaries. Bald Eagle nests PB010 and PB013 were active during the 2003 nesting season and nest PB 005 has been inactive since 1992. The L-40 BC project could reduce impacts to bald eagle foraging habitat by decreasing the frequency of 0.075 fps or greater water velocities and removal of 200,000 cy of phosphorus-laden and potentially contaminated sediments from possible migration into LNWR, which should benefit this species. The proposed action would, by reducing nutrient loads to the inner marsh, reduce the rate of expansion of dense Carolina willow and cattail stands, which have no open water foraging areas for eagles. Noise and nighttime lighting associated with construction activities could alter foraging patterns of resident eagles using water bodies in the vicinity. It is likely, however, that bald eagles would become conditioned to ambient noise present during operations (Service 2005). *The Corps has determined that the proposed project may affect, but is not likely to adversely affect, the bald eagle or its habitat*.

### 4.9.5 EASTERN INDIGO SNAKE

Widening of the L-40 BC with the construction of the berm could result in a 10.1-acre loss of nuisance dominated mixed herbaceous shrub wetland, which is only marginal foraging habitat for the indigo snake. The 23 acres of disturbed wetlands that would be impacted as a disposal area could be used as foraging habitat but would provide only marginal to poor quality habitat for the indigo snake. Temporary impacts, including displacement of individual indigo snakes, may occur during construction. With construction of additional access roads for maintenance or

recreational access, additional effects to the Eastern indigo snake could occur through road mortality. However, construction of the 945-foot berm may provide additional upland habitat for the foraging indigo snakes. Standard indigo snake precautions will be included in project specifications for the proposed project. *The Corps has determined that the proposed project may affect, but is not likely to adversely affect, the Eastern indigo snake.*

*No Action*
High phosphorus content in entrained sediments under the no-action alternative might alter the sawgrass habitat at the point opposite the S-362 discharge, accelerating the rate of cattail invasion of LNWR. This would adversely affect the wood stork, snail kite, and bald eagle habitat as the dense Carolina willow and cattail stands have minimal open water areas and are not suitable for the above species' foraging. No-action would have no adverse effects on the eastern indigo snake or Florida panther habitat.

## 4.10 NOISE

*Alternatives 1, 2, & 3*
No impacts to noise for any alternative are expected, except during actual construction time with noise from construction machines. Upon project completion, the structure would be static and there would not be any noise generating components.

*No Action*
No impacts are expected.

## 4.11 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

*Alternatives 1 & 2*
Dredging would remove 200,000 cy of high nutrient organic sediments containing low-level (i.e. below Regulatory levels) copper, arsenic, and pesticides. Refer to section 3.2 for description of soils that would be dredged from the canal.

*Alternative 3*
The high nutrient sediments containing low level contaminants of copper and arsenic would still be in the canal. Refer to section 3.2 for description of soils that would be dredged from the canal.

*No Action*
The high nutrient sediments containing low level contaminants of copper and arsenic would still be in the canal. Refer to section 3.2 for description of soils that would be dredged from the canal.

## 4.12 LAND USE

*Alternative 1*
A certain amount of the Refuge wetlands would be used for the placement of the 945-foot berm. Upland in STA-1E also would be used for dredge disposal.

*Alternative 2*
Upland in STA-1E would be used for dredge disposal.

*Alternative 3*
A certain amount of the Refuge wetlands would be used for the placement of the 945-foot berm.

*No Action*
No impacts are expected.

## 4.13 AESTHETIC RESOURCES

*Alternative 1*
The manmade berm would have a minor change to the pristine view of the Refuge.

*Alternative 2*
No impacts are expected.

*Alternative 3*
The manmade berm would have a minor change to pristine view of the Refuge.

*No Action*
No impacts are expected.

## 4.14 CULTURAL RESOURCES

*Alternatives 1, 2, & 3*
It is the SHPO's opinion from the Florida Department of State Division of Historical Resources the proposed project would have no adverse effect on historical properties. The Corps and SHPO are in concurrence that a professional archaeologist will be present during the initial construction phase in the event that unexpected cultural resources are inadvertently discovered.

*No Action*
No impacts are expected.

## 4.15 CUMULATIVE IMPACTS

The spatial extent of the L-40 Project is relatively small and encompasses 13,500 feet of the L-40 BC, 10.1 acres of wetlands for dredge and fill areas adjacent to the S-362 pump station, and several acres inside STA-1E which would be used for dewatering activities and disposal areas. Primary concerns for cumulative impacts to threatened and endangered species are related to contaminants, construction activities, and impacts to wetland habitat associated with dredging and filling. Approximately 84,000 cubic yards of material would be excavated by the canal widening and 25,300 cy of the same material would be used to build the 1,000-foot berm. It is expected that the proposed project (Alternative 1) would remove 200,000 cubic yards of contaminated sediments from the L-40 BC, thereby keeping this material from entering the interior Refuge marsh.

## 4.16 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

### 4.16.1 IRREVERSIBLE

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Construction of the proposed project would include such features considered permanent. This would include widening the canal and building the berm.

### 4.16.2 IRRETRIEVABLE

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. There are no such irretrievable losses with the implementation of this project.

## 4.17 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Minor temporary turbidity issues associated with the dredging measures are unavoidable. Widening the canal would create open water from 3.8 acres of nuisance-dominated marshland. Also, 2.3 acres of nuisance-dominated wetlands would be filled in for a berm. Approximately 23 acres of disturbed wetland would be used as a disposal site.

## 4.18 LOCAL SHORT-TERM USES AND MAINTENANCE/ENHANCEMENT OF LONG-TERM PRODUCTIVITY

There are no short or long term adverse effects with the implementation of this project.

## 4.19 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

The proposed project is consistent with the overall goals and objectives of the Central and South Florida Project (C&SF Project). It is expected that the proposed action will be consistent with Federal, State, and local plans and objectives. This project, while not a part of the Comprehensive Everglades Restoration Plan, is an environmental restoration initiative on a small scale. Its purpose is to avoid further alteration of habitat conditions inside LNWR by avoiding nutrient stimulation of Carolina willow and cattail invasion.

## 4.20 CONFLICTS AND CONTROVERSY

There are no conflicts or controversy with the implementation of this project.

## 4.21 UNCERTAIN, UNIQUE, OR UNKNOWN RISKS

There are no uncertain, unique, or unknown risks identified with implementation of this project.

## 4.22 PRECEDENT AND PRINCIPLE FOR FUTURE ACTIONS

There might be a need for future maintenance dredging in the canal, depending on re-accumulation of sediments.

## 4.23 ENVIRONMENTAL COMMITMENTS

The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing, or mitigating for adverse effects during construction activities by including commitments in the contract specifications.

### 4.23.1 WATER QUALITY MONITORING PLAN

1. The implementation of a water quality monitoring plan will be done until it is determined that no contaminants are found in the water column.

2. The Corps would monitor for turbidity during the dredging of the L-40 BC by taking samples twice a day.

3. The filtered water discharging into the West Distribution Cell will be monitored weekly using monitoring wells installed upstream and downstream of the area, unless it is determined that no contaminants are present.

### 4.23.2 FISH AND WILDLIFE RESOURCES

4. The Corps would coordinate with the appropriate agencies in the event that colonial or solitary wading bird nests are observed within the construction footprint. A bird observer is also a requirement throughout construction. This observer would also be required to note any snail kite activity in the project footprint.

### 4.23.3 THREATENED AND ENDANGERED SPECIES

5. Habitat management guidelines for the wood stork in the Southeast U.S. will be included in the construction plans and specifications.

6. Habitat management guidelines for the bald eagle in the Southeast U.S. will be included in the construction plans and specifications. In addition, surveys for bald eagles will be conducted prior to construction.

7. Habitat management guidelines for the Eastern indigo snake will be included in the construction plans and specifications.

### 4.23.4 CULTURAL RESOURCES

8. The Corps and SHPO have agreed that there will be a professional archaeologist on site during construction.

### 4.23.5 WETLAND MITIGATION PLAN

9. The Corps is working with the USFWS on developing a mitigation plan.

### 4.23.6 OTHER ISSUES

10. Many of the construction and operation-related details are not available at this time, but will be forthcoming in the detailed design documentation and operations manual.

11. The berm will be appropriately stabilized for erosion control. Exotic and nuisance vegetation will be controlled throughout construction and through operation and maintenance of the project.

12. The L-40 BC Project would be managed in a manner consistent with adaptive management principles. The incorporation of good science through careful monitoring and analysis would support operational and/or other changes to increase and/or improve project benefits to the natural system.

## 4.24 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

### 4.24.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

A scoping letter was sent out on August 18, 2004 to interested Federal, State, and local agencies, Indian Tribes, and interested organizations requesting their comments and concerns regarding potential issues to be addressed. Environmental information on the project has been compiled, and a draft Environmental Assessment has been prepared and will be coordinated with agencies and through the public. The project is in compliance with the National Environmental Policy Act.

### 4.24.2 ENDANGERED SPECIES ACT OF 1973

Consultation was initiated with the USFWS on August 18, 2004. A Biological Assessment was prepared and sent to the USFWS on October 27, 2005, and is included in ***Appendix D***. A concurrence letter was received from the USFWS on December 16, 2005, and is also included in ***Appendix D***. This project was fully coordinated under the Endangered Species Act and is therefore, in full compliance with the Act.

### 4.24.3 FISH AND WILDLIFE COORDINATION ACT OF 1958

This project has been coordinated with the U.S. Fish and Wildlife Service (USFWS). A draft Fish and Wildlife Coordination Act (FWCA) report dated September 1, 2005 (***Appendix D***) was submitted by the USFWS. There has been no significant change in the project design since submittal of the draft FWCA report. This project is in full compliance with the Act.

### 4.24.4 NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA)

(PL 89-665, the Archeology and Historic Preservation Act (PL 93-291), and executive order 11593) Archival research and consultation with the Florida State Historic Preservation Officer (SHPO) have been conducted in accordance with the National Historic Preservation Act, as amended; the Archeological and Historic Preservation Act, as amended and Executive Order 11593. SHPO consultation was initiated November 12, 2004. In a January 25, 2005 response,

the SHPO concurred with the Corps' no adverse effect determination. 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.

### 4.24.5 CLEAN WATER ACT OF 1972

The project is in compliance with this Act. All State water quality standards would be met. A Section 404(b) evaluation is included in this report as ***Appendix A***.

### 4.24.6 CLEAN AIR ACT OF 1972

The existing air quality within South Florida is considered good, and the region attains all National Ambient Air Quality Standards. No air quality permits would be required for this project. This project will be coordinated with U.S. Environmental Protection Agency (EPA) for compliance with Section 309 of the Act.

### 4.24.7 COASTAL ZONE MANAGEMENT ACT OF 1972

A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as ***Appendix B***. State consistency review will be performed during the coordination of the draft EA.

### 4.24.8 FARMLAND PROTECTION POLICY ACT OF 1981

No prime or unique farmland would be impacted by implementation of this project. This act is not applicable.

### 4.24.9 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.

### 4.24.10 MARINE MAMMAL PROTECTION ACT OF 1972

This project does not impact marine mammals (i.e., no "take" meaning harm, harass, injure, or kill) because no marine mammals exist in the project area. Therefore, this act does not apply.

### 4.24.11 ESTUARY PROTECTION ACT OF 1968

No designated estuary would be affected by project activities. This act is not applicable.

### 4.24.12 FEDERAL WATER PROJECT RECREATION ACT

The principles of the Federal Water Project Recreation Act, (Public Law 89-72) as amended, have been fulfilled by complying with the recreation cost sharing criteria as outlined in Section 2 (a), paragraph (2).

### 4.24.13 FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

The project has been coordinated with the National Marine Fisheries Service (NMFS) and is in compliance with the act.

#### 4.24.14 SUBMERGED LANDS ACT OF 1953

The project would not occur on submerged lands of the State of Florida. Therefore, this act does not apply.

#### 4.24.15 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. These acts are not applicable.

#### 4.24.16 RIVERS AND HARBORS ACT OF 1899

The proposed work would not obstruct navigable waters of the United States. The act does not apply.

#### 4.24.17MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

No migratory birds would be affected by project activities. This act does not apply.

#### 4.24.18 MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

The Marine Protection, Research and Sanctuaries Act does not apply to this project. The disposal activities addressed in this EA have been evaluated under Section 404 of the Clean Water Act.

#### 4.24.19 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

This project does not contain any Essential Fish Habitat and therefore this act does not apply.

#### 4.24.20 E.O. 11990, PROTECTION OF WETLANDS

Approximately 10.1 acres of nuisance dominated mixed herbaceous shrub wetlands and 23 acres of disturbed wetlands would be impacted from the construction of this project. However, there would also be numerous benefits to the interior wetlands of the Refuge. This project is in compliance with the goals of this Executive Order.

#### 4.24.21 E.O. 11988, FLOOD PLAIN MANAGEMENT

The project is not in the base flood plain (100-year flood) and has been evaluated in accordance with this Executive Order. Project is in compliance.

#### 4.24.22 E.O. 12898, ENVIRONMENTAL JUSTICE

This project would not result in adverse human health or environmental effects. Therefore this act does not apply.

#### 4.24.23 E.O. 13089, CORAL REEF PROTECTION

This project will not affect "those species, habitats, and other natural resources associated with coral reefs." Therefore, this act does not apply.

4.24.24 E.O. 13112, INVASIVE SPECIES

This project would not remove any invasive species nor would any be introduced. It would help to reduce the spread of invasive plant species in the LNWR. This act does not apply.

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# 5 LIST OF PREPARERS

## 5.1 PREPARERS

**Carrie Bond**, Biologist, Main Preparer
**Ernie Clarke**, Biologist, 2nd Main Preparer
**Peter Besrutschko**, Engineer, Contributor (HTRW, Water Quality, Air Quality, Noise, Alternatives)
**Chuck McManus**, Engineer, Contributor (Performance Measures, Engineering Design)
**Stephanie Jenkins**, Engineer, Contributor (Water Supply, Water Management)
**Luana Freijo-Nef**, Engineer, Contributor (Cross Sections, Sediments, Hydrology)
**Trent Ferguson**, Engineer, Contributor (Hydraulic Modeling)

## 5.2 REVIEWERS

**Yvonne Haberer,** Planning Division
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**Michael Dupes**, Planning Division
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**Brooks Moore**, Office of Counsel
**Jeff Trulick**, Planning Division

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# 6 PUBLIC INVOLVEMENT

## 6.1 SCOPING AND DRAFT EA

A scoping letter dated August 18, 2004 was issued for this action. (See ***Appendix C*** for scoping letter and scoping responses from agencies.) The draft EA and preliminary Finding of No Significant Impact (FONSI) were made available to the public.

## 6.2 AGENCY COORDINATION

Coordination was done with the U.S. Fish and Wildlife Service, Arthur R. Marshall Loxahatchee National Wildlife Refuge, Environmental Protection Agency, Florida Fish and Wildlife Conservation Commission, Division of Historical Resources (State Historic Preservation Officer), Department of Environmental Protection, and South Florida Water Management District. Any agency coordination letters are in ***Appendix C***. Fish and Wildlife Coordination Act letters are in ***Appendix D***.

## 6.3 LIST OF RECIPIENTS

Copies of the draft EA will be mailed to all interested agencies. See ***Appendix E*** for a list of recipients.

## 6.4 COMMENTS RECEIVED AND RESPONSE

Comments received from the scoping letter can be seen in ***Appendix C***. Generally, comments included concern over marsh and wetland impacts, threatened & endangered species, water quality, dredging specifics, impacts to Refuge biota, alternatives, and technical foundation.

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