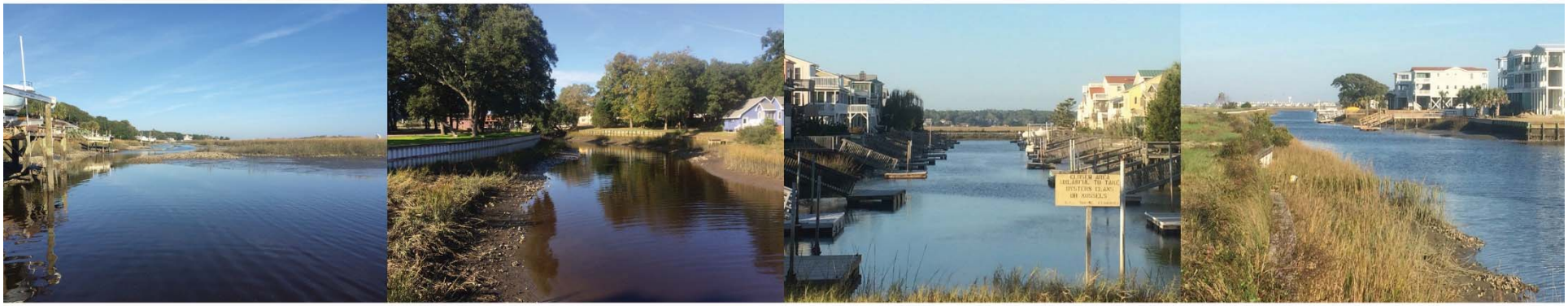
Pre-Dredge Analysis

2nd Agency Coordination Meeting

May 05, 2017



moffatt & nichol

Discussion Outline

1. Project Overview
2. Jinks Creek Hydrodynamic Modeling Analysis
   - Identification of any obviously incomplete or missing data.
   - Potential modifications to the dredge alignment.
   - Recommended additional studies / analyses.
3. Mary's & Turtle Creek Oyster Survey
   - Identification of any potential mitigation / relocation efforts required.
   - Recommended additional studies / analyses.
4. Sediment Composition
   - Testing of recipient beach for compatibility
   - Calcium carbonate requirement
5. Permit Potential for Sediment Placement on OIB
6. Permitting Path Forward
   - CAMA Major & GP291 verification with 408 coordination
   - EFH & BA requirements

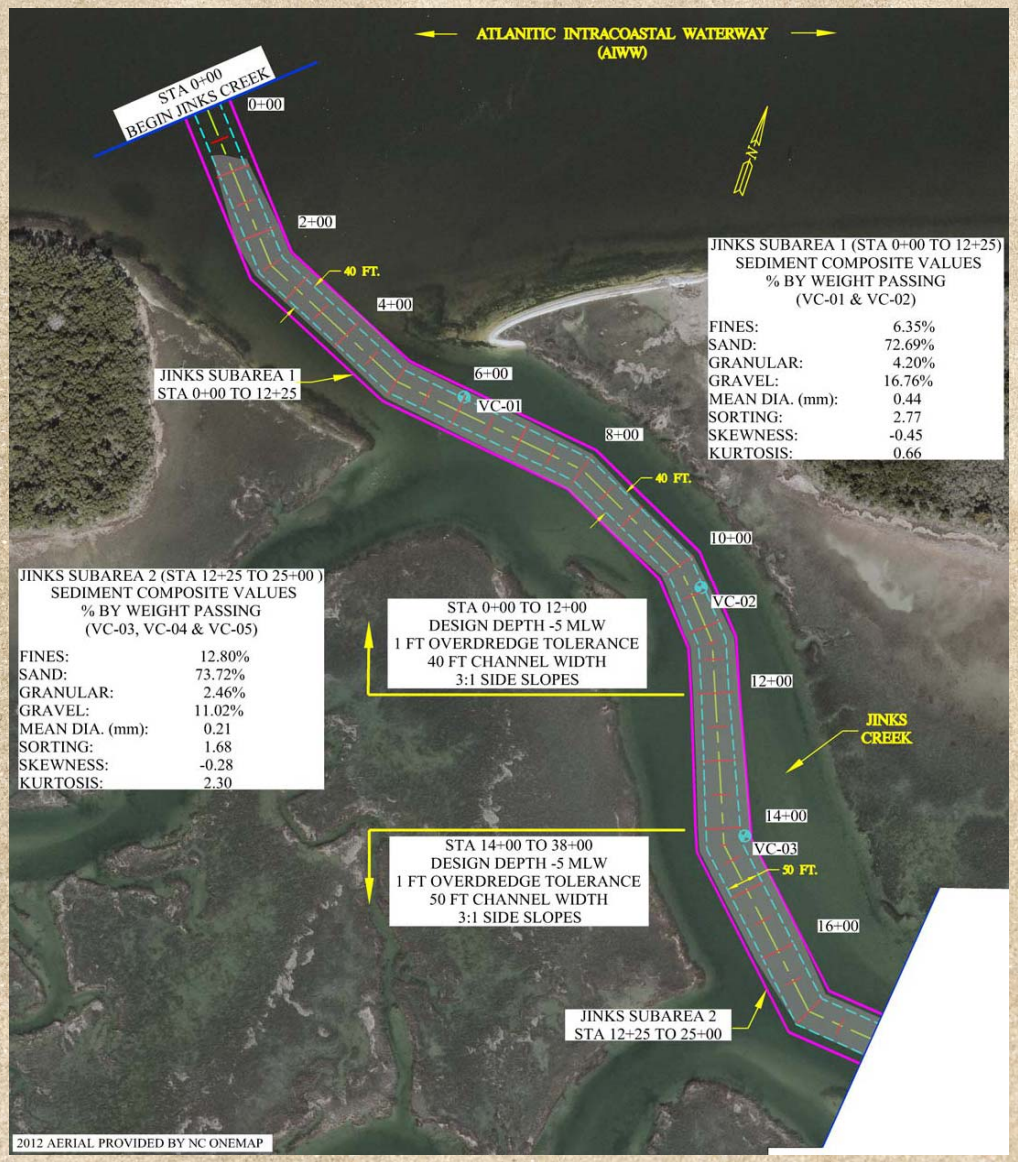
Project Overview

Design Considerations

- Follow Deep Water Conduits Where Feasible to Reduce Dredge Quantities & Potential Impacts.
- Maintain Adequate Width for Vessel Clearance - Minimum of Twice the Expected Beam Width for # of Vessels (Where Conditions Allow).
- Allow Sufficient Design Depth for Vessel Navigation Where Available
  - -6 MLW Where Space Allows.
  - -3 ~ -5 MLW When Space Limited.
- Provide Appropriate Side Slopes to Prevent Sloughing (Typ. 3H:1V).
- Maintain Minimum Construction Clearance of 5 Ft from any Pier, Dock, Piling, or Bulkhead.
- Maintain Consistency with Previous Permits (CAMA 22-02 & 45-02)
- Anticipated Dredge Volume ~ 181,100 CY.
  - 105,200 CY for Beneficial Reuse
  - 75,900 CY for Upland Disposal

Jinks Creek Modeling Analysis

- Builds on a Previous Study to Help Control Cost & Expedite Schedule.
- Helped Develop a Preferred Alignment for Jinks Creek.
- Addresses the Three (3) Concerns Expressed by DCM & USACE
  - Additional Shoaling in the AIWW Confluence with Jinks Creek;
  - Increased Scour Potential along 'S' Curve Alignment;
  - Influence on Tubbs Inlet Shoaling & Migration Patterns.
- Evaluates Extreme Storm Conditions (Hurricane Hugo).
- Considers Additional Alignments to Evaluate how the Designs may Change the Results.



Jinks Creek

Station 0+00 to 18+00

- Design Depth: -5 MLW
- OD Tolerance: 1 ft
- Base Width: 40 ~ 50 ft
- Slope: 3H : 1V

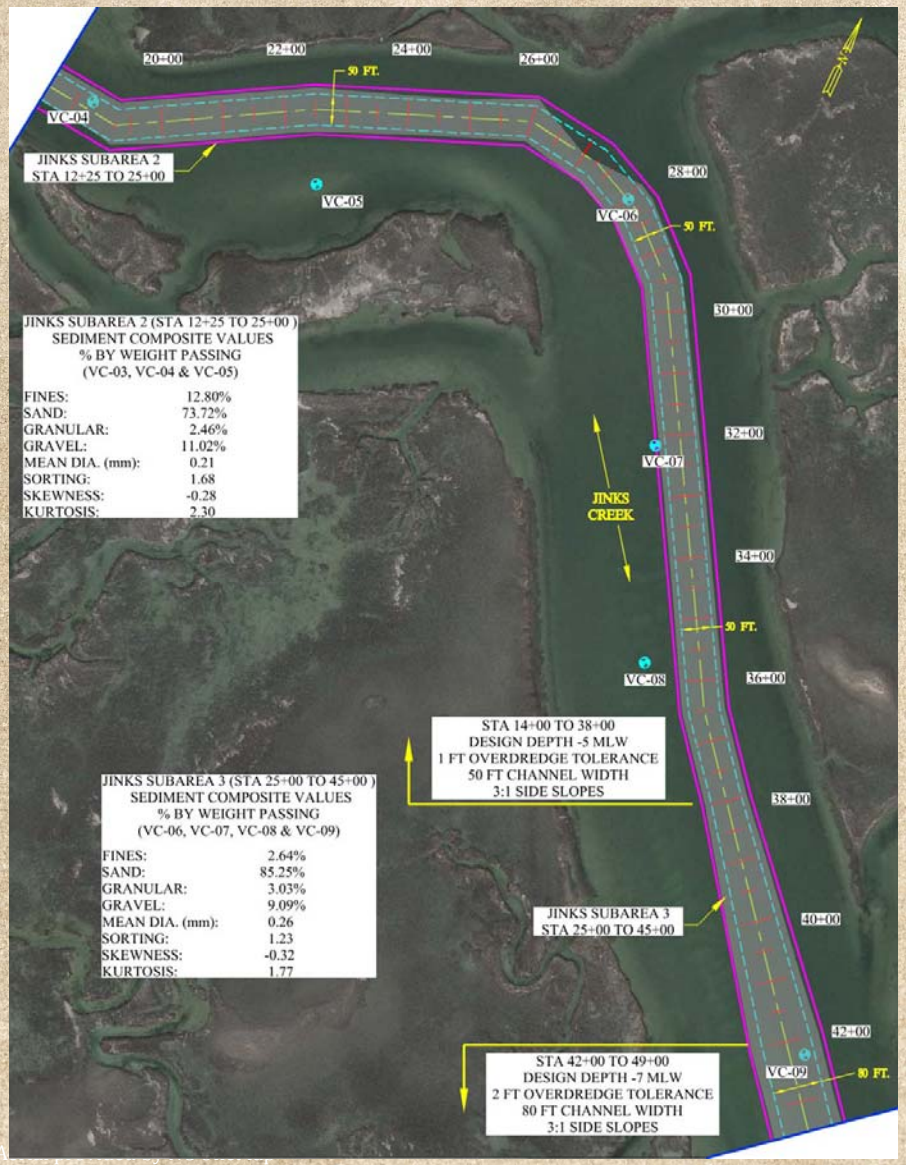
Existing Conditions

- Depth Range: 0 ~ -6 MLW
- Avg. Depth: -2 MLW

The Preferred Alignment transitions from 40 ft wide at -5 MLW to 50 ft wide at -5 MLW between stations 12+00 & 14+00 to add additional channel width within the 'S' curve alignment.

LEGEND
- PROPROSED CHANNEL CENTERLINE
- PROPOSED CHANNEL BASE (WIDTH)
- PROPOSED CHANNEL TOP @ MLW
- DREDGE AREA

NOTES:
1. DREDGE ACTIVITIES SHALL MAINTAIN A MIN. 10 FT CLEARANCE FROM ALL EXISTING PILINGS, SEAWALLS, OR SUPPORT STRUCTURES



Jinks Creek

Station 18+00 to 43+50

- Design Depth: -5 ~ -7 MLW
- OD Tolerance (ft): 1 ~ 2 ft
- Base Width: 50 ~ 80 ft
- Side Slope: 3H : 1V

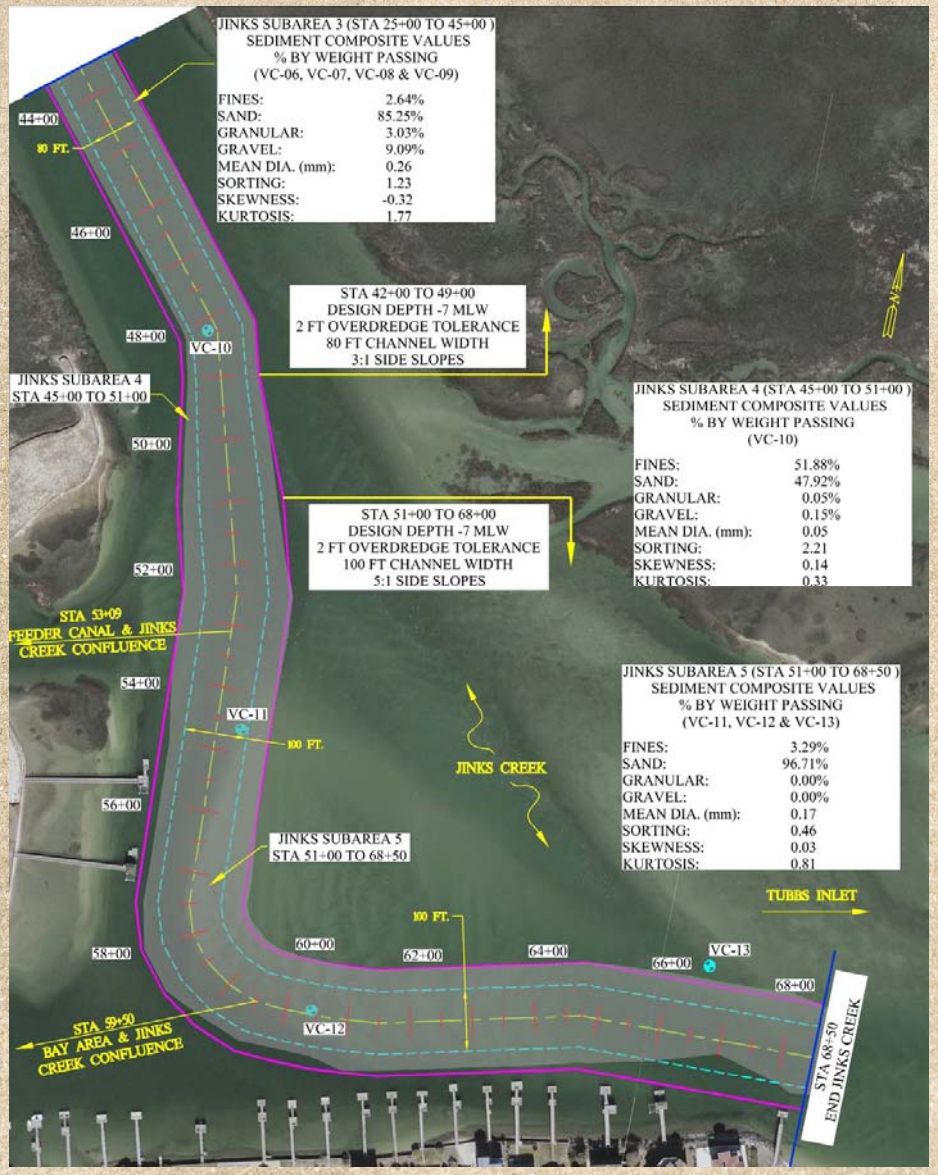
Existing Conditions

- Depth Range: -2 ~ -6 MLW
- Avg. Depth: -4 MLW

The Preferred Alignment transitions from 50 ft wide at -5 MLW to 80 ft wide at -7 MLW between stations 38+00 & 42+00 to compensate for the additional sediment shoaling and vessel congestion expected in southern Jinks Creek.

LEGEND
- PROPROSED CHANNEL CENTERLINE
- PROPOSED CHANNEL BASE (WIDTH)
- PROPOSED CHANNEL TOP @ MLW
- DREDGE AREA

NOTES:
1. DREDGE ACTIVITIES SHALL MAINTAIN A MIN. 10 FT CLEARANCE FROM ALL EXISTING PILINGS, SEAWALLS, OR SUPPORT STRUCTURES



Jinks Creek

Station 43+50 to 68+25

- Design Depth: -7 MLW
- OD Tolerance: 2 ft
- Base Width: 80 ~ 100 ft
- Side Slope: 3H : 1V to 5H :1 V

Existing Conditions

- Depth Range: -2 ~ -10 MLW
- Avg. Depth: -5

The Preferred Alignment increases to 100 ft wide at -7 MLW to compensate for additional sediment shoaling expected within the Tubbs Inlet complex. The shoaling rates are unknown as no studies have been conducted to determine these values.

LEGEND
- PROPROSED CHANNEL CENTERLINE
- PROPOSED CHANNEL BASE (WIDTH)
- PROPOSED CHANNEL TOP @ MLW
- DREDGE AREA

NOTES:
1. DREDGE ACTIVITIES SHALL MAINTAIN A MIN. 10 FT CLEARANCE FROM ALL EXISTING PILINGS, SEAWALLS, OR SUPPORT STRUCTURES

Preferred Alignment

Established 10 new transects to evaluate USACE & DCM concerns.

T1 – T3: Shoaling in AIWW Confluence.
T4 – T6: 'S' Curve Alignment.
T7 – T10: Tubbs Inlet.

Preferred Alignment – Change in Maximum Velocities (Spring Tide Conditions)

Preferred Alignment – % Change in Maximum Velocities (Spring Tide Conditions)

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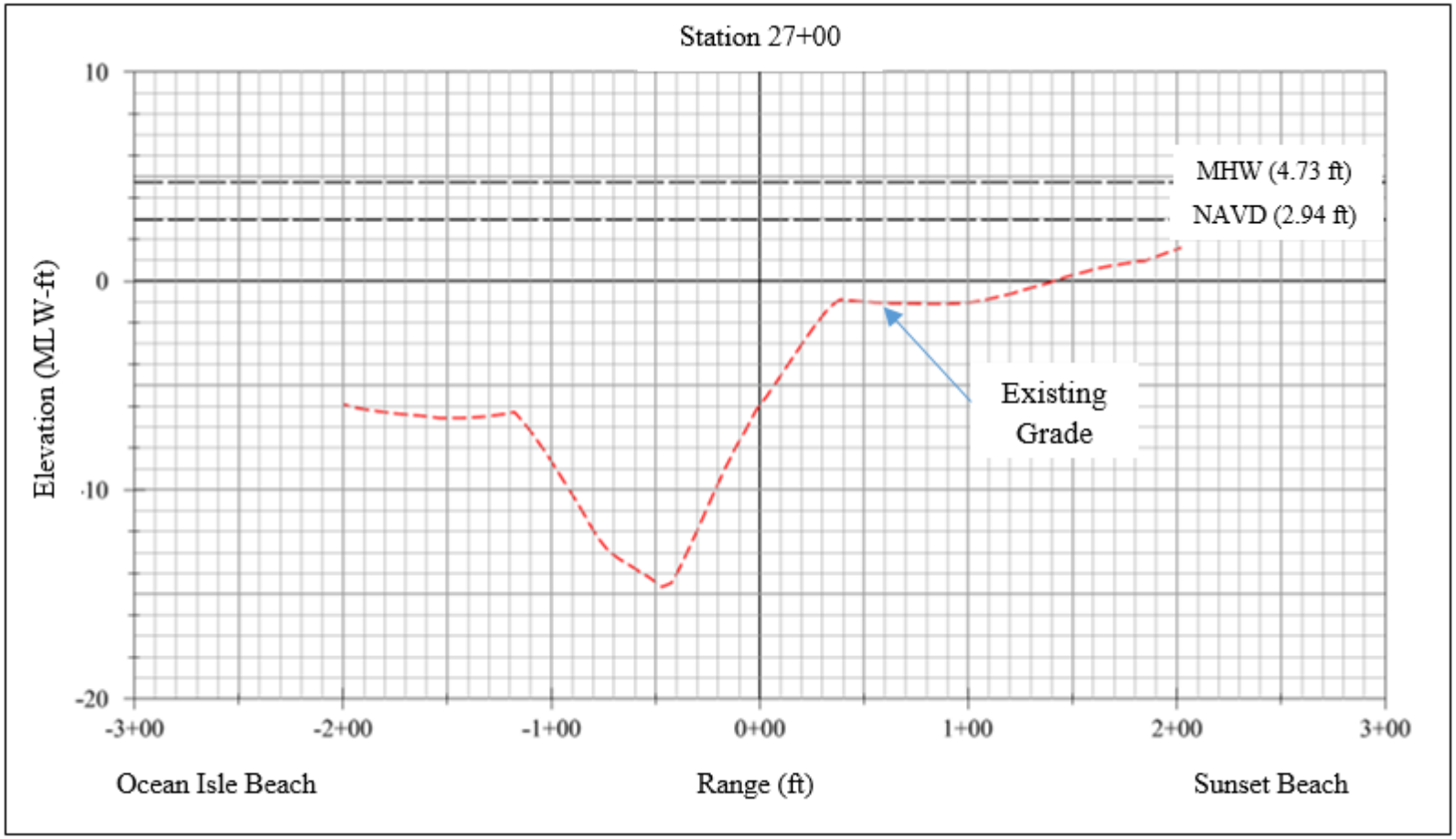
Transect		2016 Existing Conditions	Preferred Alternative	Percent (%) Change
AIWW Confluence	T1	1.53 ft/sec	1.56 ft/sec	1.6%
	T2	1.05 ft/sec	1.06 ft/sec	0.8 %
	T3	2.75 ft/sec	2.82 ft/sec	2.6%
'S' Curve Alignment	T4	3.45 ft/sec	3.46 ft/sec	0.3%
	T5	2.86 ft/sec	2.88 ft/sec	0.7%
	T6	3.01 ft/sec	3.02 ft/sec	0.3%
Tubbs Inlet	T7	2.28 ft/sec	2.30 ft/sec	0.9%
	T8	4.72 ft/sec	4.74 ft/sec	0.4%
	T9	3.69 ft/sec	3.68 ft/sec	-0.3%
	T10	2.45 ft/sec	2.44 ft/sec	-0.4%

1. Values are depth averaged velocities simulated from Nov. 13, 2004 (13:15) to Nov. 20, 2004 (13:15)

Preferred Alignment – % Change in Maximum Velocities (Spring Tide Conditions)



- Scour Velocities Appear to Already Occur in 'S' Curve Alignment at Station 27+00 (Transect T5).

Preferred Alignment – % Change in Average Flow Rates (Spring Tide Conditions)

Transect		2016 Existing Conditions		Preferred Alignment		Percent (%) Change	
		Ebb	Flood	Ebb	Flood	Ebb	Flood
AIWW Confluence	T1	1,250	3,140	1,270	3,190	1.6%	1.6%
	T2	1,530	1,450	1,560	1,440	2.0%	-0.7%
	T3	1,510	2,450	1,580	2,520	4.6%	2.9%
'S' Curve Alignment	T4	2,320	2,800	2,400	2,880	3.4%	2.9%
	T5	2,600	3,230	2,680	3,300	3.1%	2.2%
	T6	3,250	4,220	3,340	4,290	2.8%	1.7%
Tubbs Inlet	T7	4,400	5,740	4,500	5,840	2.3%	1.7%
	T8	10,600	12,100	10,700	12,200	0.9%	0.8%
	T9	1,530	1,230	1,520	1,230	-0.7%	0.0%
	T10	2,350	2,180	2,350	2,170	0.0%	-0.5%

1. Values represent averaged measurements simulated from Nov. 13, 2004 (13:15) to Nov. 20, 2004 (13:15) tidal conditions.

Extreme Storm Conditions (Hurricane Hugo)

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Table 8. Jinks Creek Maximum Velocity Changes - Extreme Storm Condition (Hurricane Hugo)

Transect	2016 Existing Conditions	Preferred Alternative	Percent (%) Change
T3	2.02 ft/sec	2.07 ft/sec	2.4%
T5	3.07 ft/sec	3.11 ft/sec	1.3%
T7	3.41 ft/sec	3.45 ft/sec	1.2%

1. Values represent depth averaged measurements occurring from September 20, 1989 (10:30) to September 22, 1989 (18:29).

Table 9. Jinks Creek Average Flow Rates - Extreme Storm Condition (Hurricane Hugo)

Transect	Average Ebb Flow (Incoming) cfs		Percent (%) Change	Average Flood Flow (Outgoing) cfs		Percent (%) Change
	2016 Conditions	Preferred Alternative		2016 Conditions	Preferred Alternative	
T3	2,742	2,808	2.4%	3,721	3,793	1.9%
T5	5,162	5,267	2.0%	5,684	5,774	1.5%
T7	13,092	13,267	1.3%	12,132	12,278	1.2%

1. Values represent averaged measurements occurring from September 20, 1989 (10:30) to September 22, 1989 (18:29).

Alternate Designs

- Conceptual - 100' Wide @ -7 MLW (entire channel)
- Maximum - 100' Wide @ -7 MLW (entire channel & Tubbs Inlet)

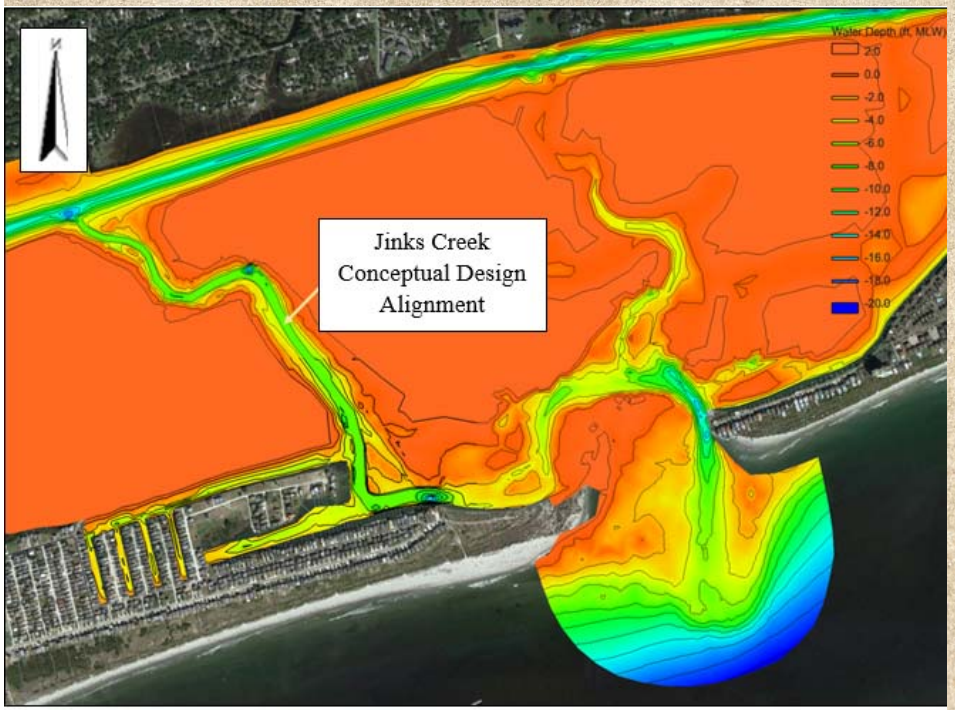


Figure 2. Bathymetry Contours for the Conceptual Design Alternative

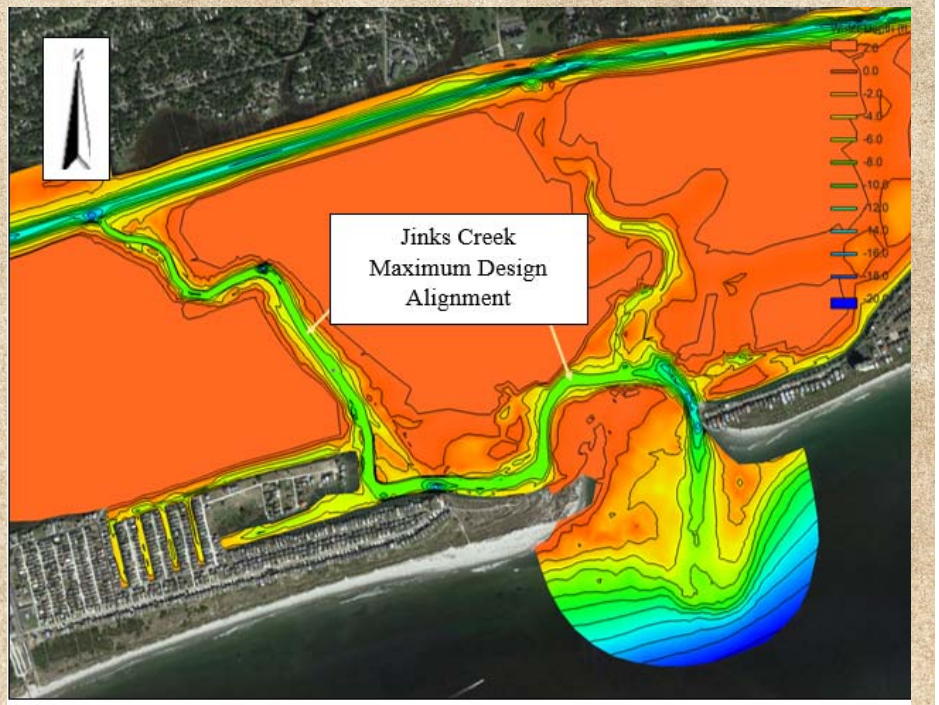


Figure 3. Bathymetry Contours for the Maximum Design Alternative

Alternate Designs – Conceptual & Maximum Alignments

- Flow Rates in Northern Jinks Creek Increase 20% to 40%, Which Suggest Significant Changes May Occur.

Alternative		Average Flood Flow (Incoming) cfs	Percent (%) Change	Average Ebb Flow (Outgoing) cfs	Percent (%) Change
Transect T3 (AIWW Confluence)	2016 Existing Conditions	2,400	-	1,400	-
	Conceptual Design	2,800	17%	1,700	21%
	Maximum Design	2,900	21%	1,900	36%
Transect T5 ('S' Curve)	2016 Existing Conditions	2,500	-	3,100	-
	Conceptual Design	2,900	16%	3,500	13%
	Maximum Design	3,000	20%	3,700	20%
Transect T7 (Tubbs Inlet)	2016 Existing Conditions	5,800	-	4,400	-
	Conceptual Design	6,100	5%	4,600	5%
	Maximum Design	6,100	5%	4,800	9%
Transect T8 (Tubbs Inlet)	2016 Existing Conditions	12,100	-	10,600	-
	Conceptual Design	12,300	2%	10,800	2%
	Maximum Design	12,600	4%	11,000	4%

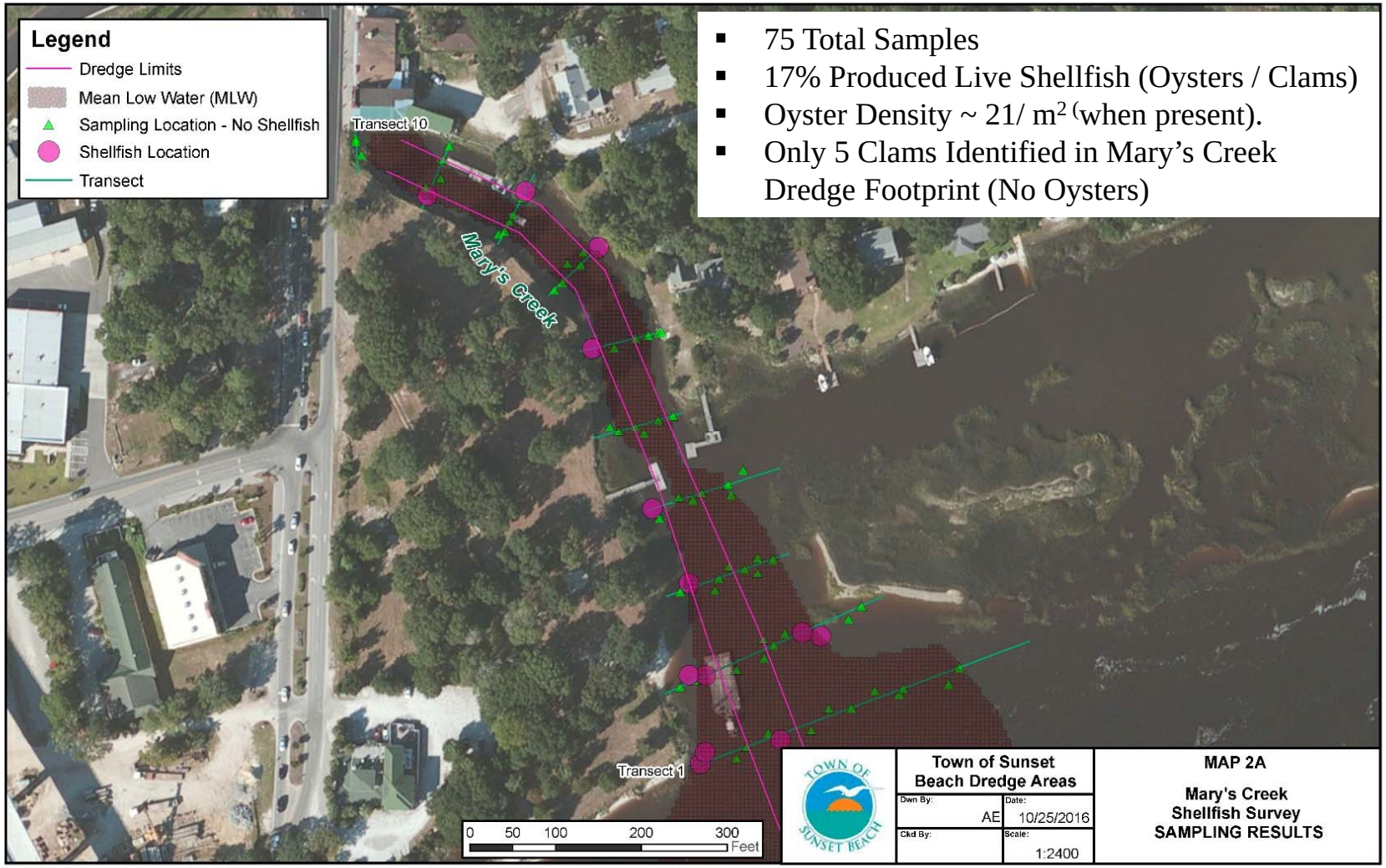
1. Values represent averaged measurements occurring from November 13, 2004 (13:15) to November 20, 2004 (13:15).
2. Percent (%) change measured from the 2016 Conditions results

Modeling Summary

- Preferred Alignment Should Not Create Significant Changes to the Tidal Conditions of Jinks Creek:
    - Maximum Velocities Should Experience <5% Increase.
    - Average Flow Rates Should Experience <5% Increase.

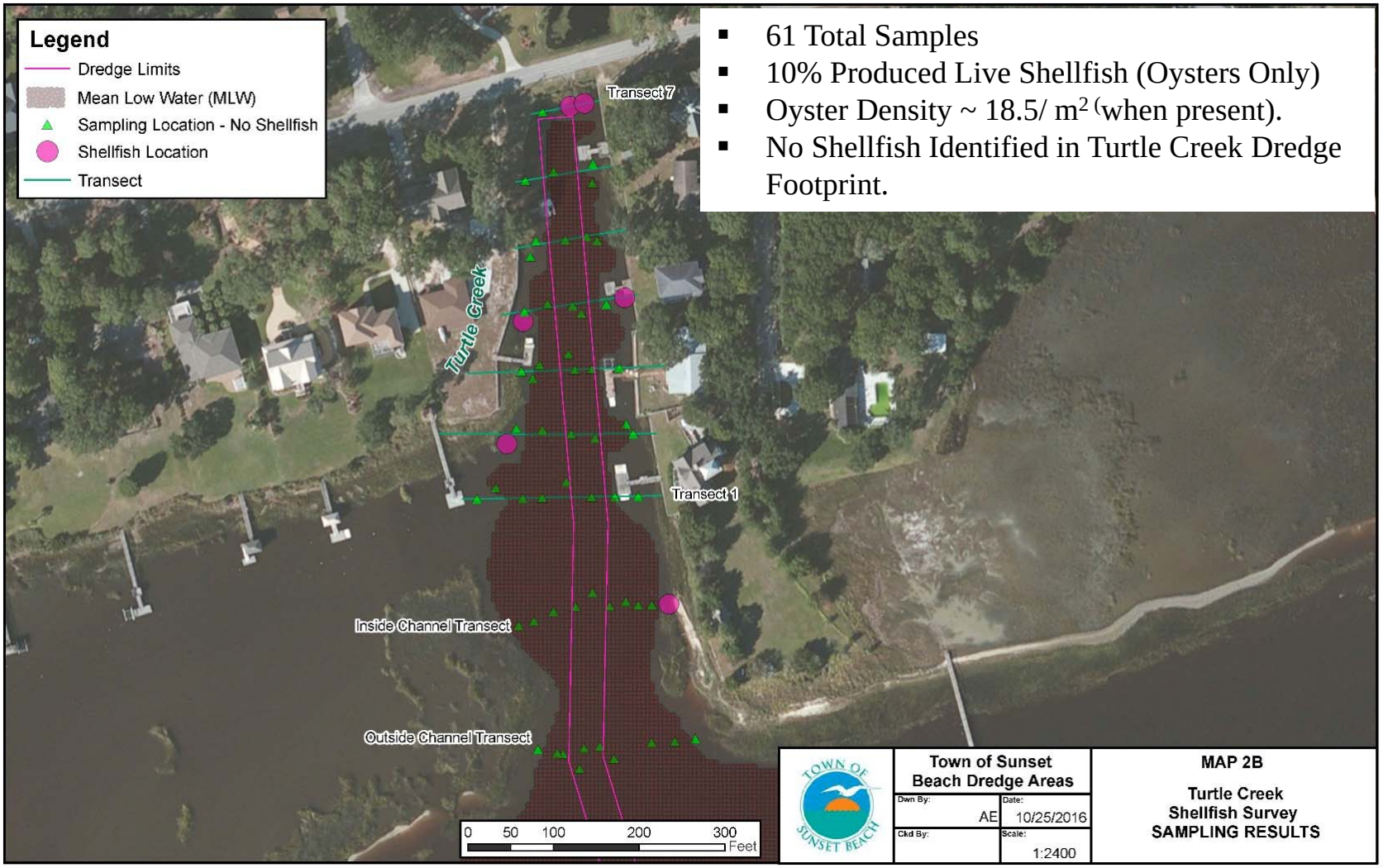
- A Constricted or Minimized Channel Proposed for the Preferred Alignment in Northern Jinks Creek Helps to Reduce the Potential for Increased Tidal Velocities & Flow Rates.

Shellfish Survey – Mary's Creek



- 75 Total Samples
- 17% Produced Live Shellfish (Oysters / Clams)
- Oyster Density ~ 21/ m^2 (when present).
- Only 5 Clams Identified in Mary's Creek Dredge Footprint (No Oysters)

Shellfish Survey – Turtle Creek



- 61 Total Samples
- 10% Produced Live Shellfish (Oysters Only)
- Oyster Density ~ 18.5/ m^2 (when present).
- No Shellfish Identified in Turtle Creek Dredge Footprint.

Sediment Composition

Sediment Composition

SEDIMIENT ANALYSIS SUMMARY TABLE

Work Area	Sub-Area	Stations		Volume (CY)		Composite Summary (% By Wt. Passing)					Mean	Sorting	Skewness	Kurtosis
		Start	Stop	Compatible	Non-Compatible	Fines	Sand	Granular	Gravel	Total	(mm)	(σ)	(α)	(β)
Jinks Creek														
	1	0+00	12+25	6,975		6.35%	72.69%	4.20%	16.76%	100%	0.44	2.77	-0.45	0.66
	2	12+25	25+00	8,342		12.80%	73.72%	2.46%	11.02%	100%	0.21	1.68	-0.28	2.30
	3	25+00	45+00	17,005		2.64%	85.25%	3.03%	9.09%	100%	0.26	1.23	-0.32	1.77
	4	45+00	51+00		13,246	51.88%	47.92%	0.05%	0.15%	100%	0.05	2.21	0.14	0.33
	5	51+00	68+50	68,660		3.29%	96.71%	0.00%	0.00%	100%	0.17	0.46	0.03	0.81
SubTotal		**0+00**	**68+50**	**100,982**	**13,246**	**9.71%**	**86.20%**	**0.89%**	**3.20%**	**100%**	**0.19**	**1.01**	**-0.06**	**0.99**
Sub-Area 1-3 & 5				**100,982**		**4.17%**	**91.22%**	**1.00%**	**3.60%**	**100%**	**0.20**	**0.85**	**-0.08**	**1.08**
Feeder Canal														
	1	Finger Canals			10,659	65.27%	34.54%	0.07%	0.12%	100%	0.04	2.30	-0.05	0.24
	2	8+00	21+50		6,672	50.34%	49.63%	0.03%	0.00%	100%	0.07	1.59	-0.05	0.23
	3	21+50	40+00		11,944	33.34%	66.48%	0.09%	0.09%	100%	0.11	1.16	0.29	0.24
	4	40+00	42+00	3,585		4.40%	95.60%	0.00%	0.00%	100%	0.15	0.57	0.12	0.51
SubTotal		**0+00**	**42+00**	**3,585**	**29,275**	**44%**	**56%**	**0%**	**0%**	**100%**	**0.08**	**1.55**	**0.09**	**0.27**
Bay Area														
	1	-0+50	20+50		17,555	87.08%	12.67%	0.09%	0.17%	100%	0.00	5.92	0.00	0.33
	2	20+50	21+00	645		2.40%	97.60%	0.00%	0.00%	100%	0.17	0.42	0.00	1.27
SubTotal		**-0+50**	**21+00**	**645**	**17,555**	**84.08%**	**15.68%**	**0.08%**	**0.16%**	**100%**	**0.01**	**5.72**	**0.00**	**0.36**
Mary's Creek														
	n/a	**0+00**	**10+75**		**8,066**	-	-	-	-	-	-	-	-	-
Turtle Creek														
	n/a	**0+00**	**11+00**		**7,830**	-	-	-	-	-	-	-	-	-

Notes:

1 Composite values determined by weighted averages.

2 Mary's & Turtle Creek were only tested for chemical analysis. Historically the material from these systems has been placed in an USACE material placement site. Therefore, a grain size analysis was not conducted as the material is assumed to be fine grained and not beach compatible.

3 Conceptual plans include utilizing material from Jinks Creek Subarea 1 & 2 for a marsh restoration project between Mary's & Turtle Creek adjacent to the AIWW.

4 Total volumetric quantities equal 105,212 CY for compatible material and 75,972 CY for non-compatible material.

5 Compatible & non-compatible volumes are estimated and the qualifying statistics must be confirmed with NCDCM. Additional testing of the recipient beach or placement area may be required to confirm the compatibility designations.

Thank you!

Questions and Comments