

Preliminary Draft for the Pamet Harbor Ten Year Master Plan Town of Truro

December 2006



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**Executive Summary
Draft Preliminary Narrative
Ten Year Master Plan
Pamet Harbor
Truro, MA**

The Town of Truro has engaged the professional services of Coastal Engineering Co., Inc. to assist the Town in the preparation of a Ten Year Master Plan for Pamet Harbor.

The purpose of this Master Plan is to assist the Town in evaluating its alternatives for long term planning and budgeting for the implementation of maintenance improvements to the Town's harbor facilities.

The first task of the study was an evaluation assessment of the existing harbor facilities. The initial assessment of the harbor has found the following issues that need to be addressed:

1. Excessive sediment transport into the entrance channel;
2. Potential for a breach at the north jetty;
3. Stormwater control for the parking area;
4. Erosion control of the parking area;
5. Mooring field layout.

In addition to the above issues, the Town has voiced a desire for:

1. A dinghy tie-up and public enjoyment of the water amenity in the way of a boardwalk to be constructed over the west facing parking lot revetment, and
2. Removal of the old revetment stones found within the harbor.

This Draft Preliminary Narrative report identifies Items of Concern for each of the identified issues and delineates recommendations to mitigate the noted issues. The report identifies engineering, permitting, and environmental issues that will need to be addressed with the implementation of the recommendations. Engineering estimates are also included for initial budget planning purposes.

The Town should also consider utilizing the results of this Master Plan study in the development of a comprehensive Harbor Management Plan. This plan would not only serve as a valuable planning and budgetary management tool for the operation of the harbor, but it would also be valuable in assisting the Town in pursuing permits required for the implementation of recommendations identified within the plan.

Following review of this document by the appropriate Town officials and stakeholders, A Draft Master Plan will be developed as part of the required environmental review and permit application process.

**Draft Preliminary Narrative
Ten Year Master Plan
Pamet Harbor
Truro, MA**

PURPOSE

The purpose of this Draft Preliminary Narrative is to provide task information and options to the Town of Truro for inclusion into the Ten-Year Master Plan. Items presented in this Narrative are for consideration by the Town of Truro for ultimate direction in the development of the Master Plan. Upon review by the Town of Truro, it is anticipated that the Town Administration, Committees, and Board of Selectmen will direct the consultant as to Final Scope determination. The consultant would then provide the Town of Truro with the required course of actions in order to proceed with the design, permitting, and implementation of the Master Plan items, after which the consultant would then complete the Master Plan document, for final endorsement and approval, to allow for the implementation of the Plan items.

DISCUSSION

The Ten Year Master Plan

The Master Plan can serve multiple purposes for the Town of Truro. The purposes should be carefully considered by the Town and, after review and endorsement by Town Officials, the Master Plan can be fashioned to meet the purposes chosen.

Capital Expenditure and Implementation Plan

The Master Plan can be incorporated into a Capital Expenditure and Implementation Plan to assist the Town of Truro to forecast budgetary requirements through an upcoming ten year cycle.

This type of plan would provide the Town with periodic maintenance dredging forecasts, as well as Capital Improvement Expenditure Items to address long term issues. This includes jetty repairs/reconstruction; parking lot repairs and storm water management; parking slope armoring repair; and other amenities such as waterside boardwalk and dinghy storage racks.

Long Range Harbor Development Plan

The Master Plan can serve as a tool to assist the Town in the preparation of a Long Range Harbor Development Plan. As a Long Range Harbor Development Plan, the document can be formulated following extensive public input as to the anticipated and desired utilization of the harbor. In such a plan, the topic of the optimization for the mooring field can be addressed. The Town of Truro has investigated various directions and options for both maximizing the mooring/docking capabilities within the harbor, as well as, resolving existing issues regarding overcrowding and swing incompatibilities that may cause damage to moored vessels.

Harbor Management Plan

The Master Plan can serve the functions mentioned above, and with the endorsement by the Secretary of Environmental Affairs, can be adopted as the Town's official Harbor Management Plan. Such a plan would identify environmental concerns within the harbor system, as well as utilization of the harbor system. A Harbor Management Plan would receive regulatory endorsement, thereby minimizing the potential for unforeseen hurdles and complications for future projects that are compatible with the Harbor Management Plan as they proceed through the regulatory permitting process.

A Harbor Management Plan would also be a result of formal procedural review processes, which would be approved by the Town of Truro for identification of activities that would be consistent with the Harbor Management Plan. The proposed items for inclusion in the Management Plan are shown on Figure 1 and itemized below:

Items of Concern

- Condition of north jetty
- Frequency of channel dredging
- Feasibility of actions to minimize influx of sediment into channel
- Abandoned revetment stones within harbor
- Mooring basin
- Parking lot repairs with storm water management
- Existing armoring of parking lot
- Proposed boardwalk along parking lot westerly side

The evaluation and assessment of each of these Items of Concern are summarized as follows:

Channel Entrance Jetties

The Pamet Harbor Channel requires frequent maintenance dredging, often on an annual basis. The material accumulating within the channel is coarse sand that is indicative of sand which would enter from the bay, and not drawn from the estuary system. The Town has been dealing with the resultant symptoms by frequent dredging of the channel, by-pass dredging of the accumulated sand adjacent to the updrift south jetty, and dredge material deposition adjacent to the downdrift side of the downdrift north jetty, for dune re-establishment in hopes of minimizing potential for overwash and breaches. A plan showing the current condition of the jetties is included in the Appendix A.

Initial evaluation of the jetty systems shows the following concerns:

- The downdrift side of the north jetty has experienced several breaches, and remains vulnerable to future breaches during storm events;
- The north and south jetties are susceptible to erosion within the harbor caused by retreat of surged water and easterly storm events;
- The north jetty is no longer structurally sound;
- The separation between the jetties, approximately 275', is excessive for a 60' wide channel;
- The south jetty appears to be excessively short in seaward length;
- The north jetty also appears to be somewhat short in seaward length;
- There exist partially buried piles of rock on the south side of the channel between the jetties, allowing for collection of sediment entering the channel.

North Jetty

There currently exists an on-going problem and vulnerability that affects the integrity of the channel entrance. The north jetty is vulnerable to potential blowouts at its landward end, which may occur in periodic storm events. The current status of the north jetty is extremely fragile. Figure 2 is a photo taken of the north jetty on November 10, 2006, following a recent storm event. As can be seen in the photo, erosion occurs from both the outer direction, northwesterly wind events, and from the inner direction, southeasterly erosion caused by a combination of wind driven activity, and the retreat of storm surged water levels from the harbor.

The result is that the dune form that desirably connects to the North jetty has been breached/overwashed allowing for considerable sand deposits to enter the harbor channel through that damaged area.

An inspection of the north jetty, following the storm, allowed for viewing of additional stone that had been placed, sometime in the past, to repair past breaches. Figure 3 illustrates the stone formation, which shows a "pile" of

stone, as opposed to a well-constructed jetty structure. The pile of stone that extends landward of the jetty is quite porous and slight in mass. At best, this rock acts as a low breakwater when exposed to low intensity storm events. The additional stones appear to have been placed at separate times, based on the appearance of the placement of the stone, and the crude, bifurcated extension of the jetty. One extension is a continuation of the jetty in the westerly direction; the other extension is in the northerly direction.

These two directions of extensions are consistent to what was observed following this recent storm event. The stones placed in the northerly direction serve as an attempt to mend a washover or breach that occurred by a northwesterly storm event, which are prevalent in the winter months. Whereas, the stones placed in the westerly direction serve as an attempt to mend inner jetty erosion occurring from the retreat of surged waters from the easterly direction.

In recent years, the Town has obtained permits for, and utilized the land directly north of the north jetty, as a dredge material disposal area. These actions have secured the junction area between the dune and the jetty from overwashes and breaches in normal weather conditions. However, it has been observed that the efforts to maintain the dune are quite vulnerable to complete erosion/breach. This can occur in a single storm, or in a series of northwesterly storms, either of which occur between maintenance dredging and re-establishment of the dune by placement of dredge materials.

It is also observed that the existing original north jetty is in poor condition, with dislodged primary stone, and apparent loss of core stone. Repairs and modifications to the north jetty should include consideration for the complete reconstruction of the entire north jetty.

Repair options for the north jetty include:

- Option 1 – Landward extension of north jetty

- Option 2 – Northerly Extension of north jetty

- Option 3 – Same as Option 1 along with northerly relocation of south jetty to narrow channel and seaward extensions of both jetties

- Option 4 – Same as Option 2 along with northerly relocation of south jetty to narrow channel and seaward extensions of both jetties

Figure 4 illustrates the existing condition of the jetties, along with a photo enhanced illustration of Option 1 repairs to the north jetty. Option 1 involves the landward/easterly extension of the north jetty, approximately 470' to meet the inner harbor dune. It appears that approximately 100' of the easterly end of the existing jetty would need complete reconstruction to accommodate this extension. The estimate for the construction cost of this option is approximately \$568,000.

Since the entire north jetty should be considered for reconstruction, the estimated cost for Option 1 with the complete reconstruction of the North Jetty is approximately \$733,000.

Figure 5 illustrates the existing condition of the jetties, along with a photo enhanced illustration of Option 2 repairs to the north jetty. Option 2 involves the northerly extension of the north jetty approximately 380'. Again, approximately 100' of the existing jetty would need complete reconstruction to accommodate the extension. The estimate for the construction cost of this Option is approximately \$474,000.

Since the entire north jetty should be considered for reconstruction, the estimated cost for Option 2 with the complete reconstruction of the north jetty is approximately \$639,000.

Option 3, shown on Figure 6, shows the modifications adapted to Option 1 with the full reconstruction of the north jetty, along with the relocation of the south jetty, to narrow the total entrance channel width to 150' between the two jetties. This Option also includes the seaward extension of the south jetty by approximately 250' and the north jetty by approximately 100'. The estimated construction cost for this option is approximately \$1,521,000.

Option 4, shown on Figure 7, shows the modification as adapted to Option 2 with the full reconstruction of the north jetty, along with the relocation of the south jetty, to narrow the total entrance channel width to 150' between the two jetties. This Option also includes the seaward extension of the south jetty by approximately 250' and the north jetty by approximately 100'. The estimated construction cost for this option is approximately \$1,444,000.

NOTE: All of the above estimates for jetty repair assume that the removal of the existing harbor rocks would be included in this project, which would allow for those stones to be utilized to supplement the additional stones required for the construction of the extension. These costs are summarized in Appendix B.

Implementation of Option 3 or Option 4 would remove the stones presently located offshore, towards the channel, of the south jetty.

Regarding environmental implications, it is not anticipated that either option would pose any significant environmental concern, with the exception of standard environmental windows for the performance of the construction. It appears that the logical method to relocate the harbor rocks would be by overland transport at low tide. Short term concerns may be posed by the Division of Marine Fisheries for travel within the Harbor. However, it is believed that this concern could be mitigated if it becomes an issue.

Pamet Harbor Parking Lot

The parking lot resurfacing plan, previously prepared for the Town of Truro, was reviewed for full compliance to the Stormwater Management Policies. The following discrepancies were found:

- The settling tanks as shown are under designed for treating the required 1/2" runoff times the total impervious area of post-development site (first flush) as stated in the Stormwater Management Standards.
- The Department of Environmental Protection (DEP) Best Management Practices recommend that stormwater management standards for 1" first flush rainfall be used for critical areas due to the close proximity to shellfish growing areas.
- It is also recommended that the 2ft. Separation is held from the bottom of the stormwater recharge basins to the "Highest" groundwater elevation surveyed not an average between test holes.
- The infiltration rate of 0.25 GPM/SF is about half the infiltration rate that we would recommend, which would lead to some economy in the stormwater recharge basins.
- The grading and location of catch basins could change reducing the number of catch basins from 4 to 3.

It is recommended that a redesign of the plans for the Parking Lot be conducted, utilizing, to the maximum extent possible, information already available from the previous design.

The estimated cost for the resurfacing of the Parking Lot with associated drainage improvements is approximately \$254,000.

Regarding environmental implications, it is not anticipated that this project would pose environmental concerns. The outcome of this project would be a general improvement to stormwater management for the Harbor.

Pamet Harbor Parking Lot Boardwalk and Revetment Repair

The revetment armoring the side slope of the Parking Lot is fairly sound. However, there are signs of slippage of the armor stones. It is recommended that side slope armoring repairs be implemented at the same time that the Parking Lot improvements are conducted. Additionally, the Town has requested the incorporation of a Boardwalk along the westerly side of the Parking Lot, extending over the rock revetment, see Figure 8.

The Parking Lot portion of the project would not require state or federal permits. However, the Boardwalk would require a Chapter 91 License. The reconstruction of the revetment would require an amendment to the existing Chapter 91 License if the proposed repairs included extension beyond and seaward of the existing licensed footprint.

Therefore, it is recommended that the three facets of the project related to the Parking Lot be permitted as one project. The construction implementation of the total project need not proceed as a singular construction contract.

The estimated cost for the revetment repair is approximately \$82,500. The estimated cost for the Boardwalk construction is approximately \$240,000.

Regarding environmental implications, it is not anticipated that this project would pose environmental concerns.

Mooring Basin

The Town of Truro has previously investigated the options for maximizing docking/mooring capacity within the mooring basin. No action or decisions were made regarding this matter. Currently, the Harbormaster assigns the mooring permits and location based on best understanding of the vessels and the conditions within the mooring basin. The Town has been concerned regarding liability issues, which may arise from damage from colliding moored vessels due to inconsistent swing characteristics. An existing conditions plan is included in the Appendix A. Options that have been evaluated by the Town include Town owned Helical moorings, to control location and swing radii of individual moorings, floating slip system, and reconfiguration and GPS positioning of individual moorings, among other options. We would recommend that a Master Plan for the Harbor include the concerns within the mooring basin, as the basin is a most valuable asset related to the Harbor and the Town.

Permit Status and Requirements

It would be most advantageous for the Town of Truro to minimize individual permits for individual actions within the Harbor system, and to combine them for greater simplicity and managerial control. Attached is a list of actions and permits required for the various facets of the Harbor. The Draft Master Plan will evaluate the actions and timeframes desired by the Town, and present the Town with a permitting strategy that would be most economical, efficient, and with the greatest ease of management.

ENGINEER ESTIMATES

Appendix B includes the Engineer Estimates for the above referenced project options and items. Appendix B includes Estimated Escalation Costs over a Ten Year period for Capital Planning purposes.

DESIGN AND PERMITTING REQUIREMENTS

The Design and Permitting requirements for performing implementation of the items within the Ten Year Plan are outlined in Appendix B.

SUMMARY

This Preliminary Draft is presented to the Town of Truro for review and consideration of the items discussed. It is hoped that the Town, at this juncture, evaluates and determines the direction that it wishes to follow towards utilization of the Harbor, Harbor improvements and maintenance, and function of the Master Plan.

REQUIRED ACTION PLAN TOWN OF TRURO TEN YEAR PLAN

ITEMS

- A. Parking Lot Resurface and Stormwater Measures
 - B. Parking Lot Boardwalk and Revetment Repair
 - C. Removal of Stone Revetment in Harbor and Landward Extension of North Jetty
 - D. Maintenance Dredging Plan
 - E. South Jetty Bypass Dredging
 - F. Master Harbor Plan
-

A. Parking Lot Resurface and Stormwater Measures

- ◆ Plans for construction were prepared by others.
- ◆ Existing plans inadequate, must be recalculated and redesigned.
- ◆ NOI needs to be filed.
- ◆ Bid package needs to be prepared.
- ◆ Contract management and inspection services.

B. Parking Lot Boardwalk and Revetment Repair

- ◆ Inspect area and obtain additional field Information.
- ◆ NOI plan needs to be drafted.
- ◆ NOI needs to be filed.
- ◆ Chapter 91 license if over MHW.
- ◆ Bid package and specifications need to be prepared.
- ◆ Contract management and inspection services.

C. Removal of Stone Revetment in Harbor and Landward Extension of North Jetty

- ◆ Inspect area and obtain additional field information.
- ◆ ENF will be required (301 CMR 11.03(3)b1a. alteration of coastal dune, barrier beach or coastal bank).
- ◆ NOI Plan Needs to be Drafted.
- ◆ NOI Needs to be filed.
- ◆ Current Condition Survey conducted 11-4-06 indicate Ch 91 License is necessary.
- ◆ Army Corps Permit.
- ◆ Bid Package and Specifications Need to be Prepared.
- ◆ Contract Management and Inspection Services.

D. Maintenance Dredging Plan

- ◆ Maintenance dredging has just been permitted.
- ◆ NOI will need updates.
- ◆ ACOE, Chapter 91 will be needed.
- ◆ Bid documents will be needed.

E. South Jetty Bypass Dredging

- ◆ Permit applications already filed.
- ◆ NOI will need updates.

F. Master Harbor Plan Draft

- ◆ Prepare a draft outline to a Master Plan with coordination with Harbor Committee and Barnstable Dredge.
- ◆ Include above items in the Master Plan.
- ◆ Develop strategy for simplification of permitting for the Town's dredging requirements.
- ◆ File ENF addressing the entire Master Plan items.
- ◆ Master Plan to include budget estimates and timeline for implementation.

FIGURES



FIGURE 1



PAMET HARBOR - EXISTING CONDITIONS



PAMET HARBOR ENTRANCE JETTIES

FIGURE 2



NORTH JETTY - EXISTING CONDITIONS



**NORTH JETTY - EXISTING LANDWARD
EXTENSIONS**

FIGURE 3



PAMET HARBOR - EXISTING CONDITIONS



OPTION 1 - PAMET HARBOR ENTRANCE JETTIES

FIGURE 4

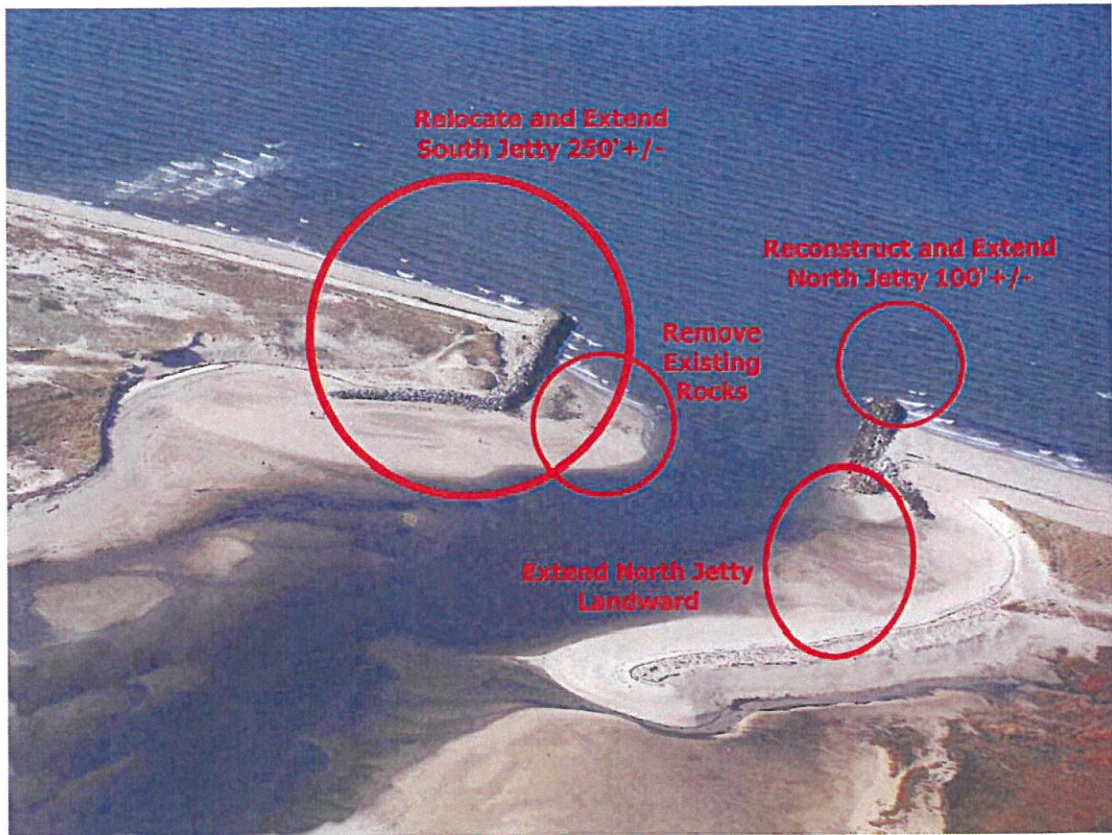


PAMET HARBOR - EXISTING CONDITIONS



OPTION 2 - PAMET HARBOR ENTRANCE JETTIES

FIGURE 5



PAMET HARBOR - EXISTING CONDITIONS



OPTION 3 - PAMET HARBOR ENTRANCE JETTIES

FIGURE 6



PAMET HARBOR - EXISTING CONDITIONS



OPTION 4 - PAMET HARBOR ENTRANCE JETTIES

FIGURE 7



PAMET HARBOR - PARKING LOT



PAMET HARBOR BOARDWALK

FIGURE 8

APPENDIX A

PARKING LOT

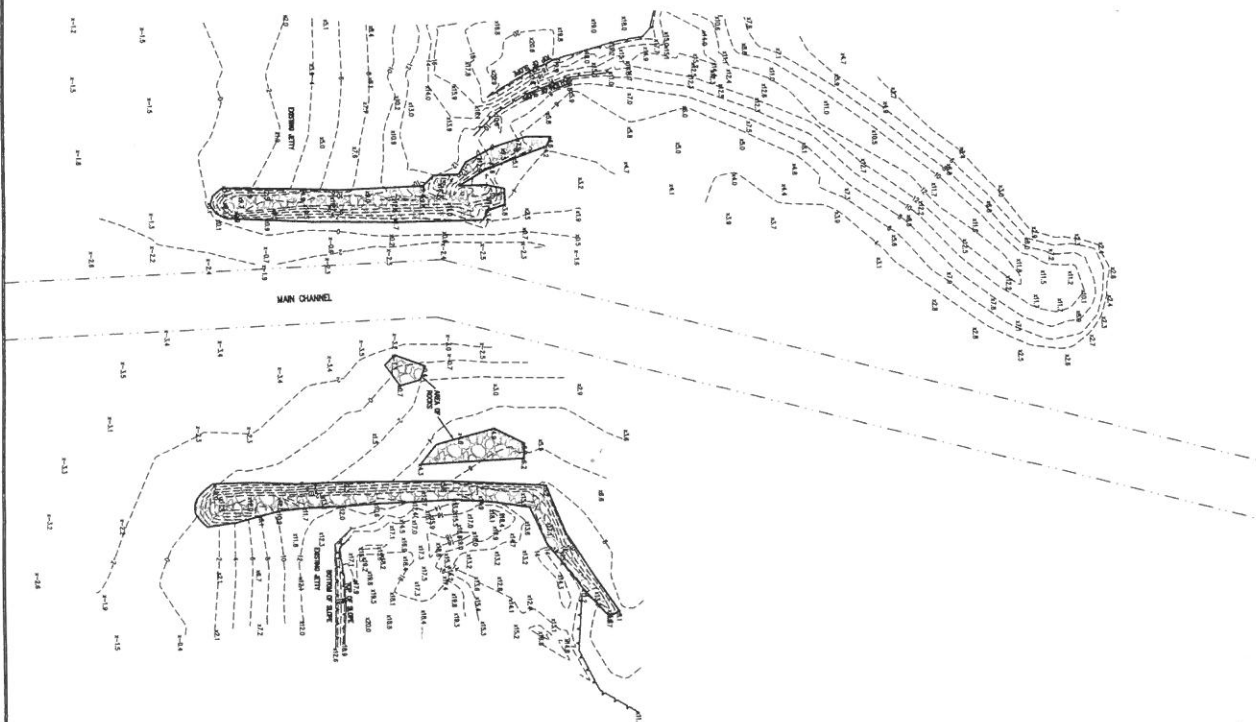
MOORING LAYOUT
SCALE: 1" = 50'

MOORING DETAIL
NO SCALE

PLAN VIEW
SCALE: 1" = 50'

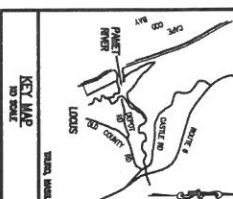
PRELIMINARY PLAN

[illegible]



PLAN REFERENCE:

THESE PLANS, SPECIFICATIONS, CONTRACT, AND BIDDING DOCUMENTS, TOGETHER WITH THE SUPPLEMENTAL SPECIFICATIONS TO THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, SHALL BE KEPT TOGETHER AND SHALL BE USED AS ONE ENTIRE SET OF DOCUMENTS. ANY DISCREPANCY BETWEEN THESE PLANS AND THE STANDARD SPECIFICATIONS SHALL BE REFERENCED TO THE STANDARD SPECIFICATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE STANDARD SPECIFICATIONS FROM THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION, ALBANY, NEW YORK.



LEGEND

EXISTING CHANNEL

NEW CHANNEL

SPUR CHANNEL

REINFORCED JETTY

EXISTING CONDITIONS - JETTY AREA	
NO.	DESCRIPTION
1	EXISTING CHANNEL
2	NEW CHANNEL
3	SPUR CHANNEL
4	REINFORCED JETTY

TOWN OF TRURO

NORTH/SOUTH JETTY MAINTENANCE

COASTAL ENGINEERING

2000 W. 10TH STREET
OCEAN CITY, MARYLAND 21852
(410) 255-8311

EC-1

1 of 1

APPENDIX B

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 1A NORTH JETTY EASTERLY EXTENSION				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	504	HOURS	\$150.00	\$75,600.00
ADDITIONAL ARMOR STONE	12,599	TONS	\$25.00	\$314,975.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	29	DAYS	\$3,200.00	\$92,800.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$49,182.50
			TOTAL	\$541,007.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$27,050.38
ESTIMATED CONSTRUCTION COST			TOTAL	\$568,057.88

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 1B NORTH JETTY EASTERLY EXTENSION AND FULL RECONSTRUCT				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	643	HOURS	\$150.00	\$96,450.00
ADDITIONAL ARMOR STONE	16,069	TONS	\$25.00	\$401,725.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	40	DAYS	\$3,200.00	\$128,000.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$63,462.50
			TOTAL	\$698,087.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$34,904.38
ESTIMATED CONSTRUCTION COST			TOTAL	\$732,991.88

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 2A NORTH JETTY NORTHERLY EXTENSION				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	420	HOURS	\$150.00	\$63,000.00
ADDITIONAL ARMOR STONE	10,491	TONS	\$25.00	\$262,275.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	24	DAYS	\$3,200.00	\$76,800.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$41,052.50
			TOTAL	\$451,577.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$22,578.88
ESTIMATED CONSTRUCTION COST			TOTAL	\$474,156.38

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 2B NORTH JETTY NORTHERLY EXTENSION AND FULL RECONSTRUCT				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	559	HOURS	\$150.00	\$83,850.00
ADDITIONAL ARMOR STONE	13,961	TONS	\$25.00	\$349,025.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	35	DAYS	\$3,200.00	\$112,000.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$55,332.50
			TOTAL	\$608,657.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$30,432.88
ESTIMATED CONSTRUCTION COST			TOTAL	\$639,090.38

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 3 = Option 1B + FULL RECONSTRUCT WITH MOVE SOUTH JETTY				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	643	HOURS	\$150.00	\$96,450.00
ADDITIONAL ARMOR STONE NORTH JETTY	18,489	TONS	\$25.00	\$462,225.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	45	DAYS	\$3,200.00	\$144,000.00
LABOR AND EQUIPMENT TO DELIVER NEW ARMOR SOUTH JETTY	612	HOURS	\$150.00	\$91,800.00
ADDITIONAL ARMOR STONE FOR SOUTH JETTY	15,314	TONS	\$25.00	\$382,850.00
LABOR AND EQUIPMENT TO RELOCATE SOUTH JETTY	41	DAYS	\$3,200.00	\$131,200.00
MOBILIZATION/DEMobilIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$131,697.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)			TOTAL	\$1,448,672.50
ESTIMATED CONSTRUCTION COST			TOTAL	\$1,521,106.13

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
Option 4 = Option 2B + FULL RECONSTRUCT WITH MOVE SOUTH JETTY				
LABOR AND EQUIPMENT RELOCATE HARBOR STONES	23	HOURS	\$150.00	\$3,450.00
LABOR AND EQUIPMENT DELIVER NEW ARMOR	655	HOURS	\$150.00	\$98,250.00
ADDITIONAL ARMOR STONE NORTH JETTY	16,381	TONS	\$25.00	\$409,525.00
LABOR AND EQUIPMENT FOR CONSTRUCTION OF JETTY EXTENSION	40	DAYS	\$3,200.00	\$128,000.00
LABOR AND EQUIPMENT TO DELIVER NEW ARMOR SOUTH JETTY	612	HOURS	\$150.00	\$91,800.00
ADDITIONAL ARMOR STONE FOR SOUTH JETTY	15,314	TONS	\$25.00	\$382,850.00
LABOR AND EQUIPMENT TO RELOCATE SOUTH JETTY	41	DAYS	\$3,200.00	\$131,200.00
MOBILIZATION/DEMobilIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$125,007.50
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)			TOTAL	\$1,375,082.50
ESTIMATED CONSTRUCTION COST			TOTAL	\$1,443,836.63

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
PARKING LOT REVEITEMENT FULL RECONSTRUCT 310'				
LABOR AND EQUIPMENT TO DISMANTLE EXISTING REVETMENT	2	DAYS	\$3,200.00	\$6,400.00
ADDITIONAL ARMOR STONE	700	TONS	\$25.00	\$17,500.00
FILTER FABRIC	6	EACH	\$1,200.00	\$7,200.00
LABOR AND EQUIPMENT TO CONSTRUCT REVETMENT	11	DAYS	\$3,200.00	\$35,200.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$7,130.00
			TOTAL	\$78,430.00
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$3,921.50
ESTIMATED CONSTRUCTION COST			TOTAL	\$82,351.50

DESCRIPTION:	QUANTITY	UNIT	UNIT COST	TOTAL
PARKING LOT RESURFACE AND DRAINAGE				
LABOR AND EQUIPMENT TO DISMANTLE EXISTING ASPHALT	52,000	SF	\$0.75	\$39,000.00
MATERIAL FOR STORMWATER RUNOFF MANAGEMENT	1	LS	\$30,000.00	\$30,000.00
LABOR AND EQUIPMENT FOR STORMWATER RUNOFF/DRAINAGE	5	DAYS	\$3,200.00	\$16,000.00
MATERIAL, LABOR AND EQUIPMENT TO RESURFACE PARKING AREA	52,000	SF	\$2.50	\$130,000.00
MOBILIZATION/DEMOBILIZATION	1	LS	\$5,000.00	\$5,000.00
CONTINGENCY	1	10%		\$22,000.00
			TOTAL	\$242,000.00
DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT (5%)				\$12,100.00
ESTIMATED CONSTRUCTION COST			TOTAL	\$254,100.00

Town of Truro
Pamet Harbor
Jetty Improvements
Projected Escalation Cost

Option 1A NORTH JETTY EASTERLY EXTENSION				
TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF OPTION 1A TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$568,057.88	4%	10	\$22,722.32
	\$590,780.19			\$23,631.21
	\$614,411.40			\$24,576.46
	\$638,987.85			\$25,559.51
	\$664,547.37			\$26,581.89
	\$691,129.26			\$27,645.17
	\$718,774.43			\$28,750.98
	\$747,525.41			\$29,901.02
	\$777,426.43			\$31,097.06
	\$808,523.48			\$32,340.94
FUTURE COST OF OPTION 1 REPAIR IF BUILT IN TEN YEARS				TOTAL
				\$808,523.48

Town of Truro
Pamet Harbor
Jetty Improvements
Estimated Escalation Costs

TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF OPTION 1B FULL REBUILD TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$732,991.88	4%	10	\$29,319.68
	\$762,311.55			\$30,492.46
	\$792,804.01			\$31,712.16
	\$824,516.17			\$32,980.65
	\$857,496.82			\$34,299.87
	\$891,796.69			\$35,671.87
	\$927,468.56			\$37,098.74
	\$964,567.30			\$38,582.69
	\$1,003,149.99			\$40,126.00
	\$1,043,275.99			\$41,731.04
FUTURE COST OF OPTION 1B REBUILD BUILT IN TEN YEARS			TOTAL	\$1,043,275.99

Town of Truro
Pamet Harbor
Jetty Improvements
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS			
TOTAL COST OF OPTION 2A REBUILD TODAY	QUANTITY	RATE	TOTAL
	\$474,156.38	4%	\$18,966.26
	\$493,122.63		\$19,724.91
	\$512,847.54		\$20,513.90
	\$533,361.44		\$21,334.46
	\$554,695.89		\$22,187.84
	\$576,883.73		\$23,075.35
	\$599,959.08		\$23,998.36
	\$623,957.44		\$24,958.30
	\$648,915.74		\$25,956.63
	\$674,872.37		\$26,994.89
FUTURE COST OF OPTION 2A IF BUILT IN TEN YEARS		TOTAL	\$674,872.37

Town of Truro
Pamet Harbor
Jetty Improvements
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF OPTION 2B FULL REBUILD TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$639,090.38	4%	10	\$25,563.62
	\$664,653.99			\$26,586.16
	\$691,240.15			\$27,649.61
	\$718,889.76			\$28,755.59
	\$747,645.35			\$29,905.81
	\$777,551.16			\$31,102.05
	\$808,653.21			\$32,346.13
	\$840,999.33			\$33,639.97
	\$874,639.31			\$34,985.57
	\$909,624.88			\$36,385.00
FUTURE COST OF OPTION 2B FULL REBUILD IF BUILT IN TEN YEARS	TOTAL			\$909,624.88

Town of Truro
Pamet Harbor
Jetty Improvements
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF OPTION 3 REBUILD TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$1,521,106.13	4%	10	\$60,844.25
	\$1,581,950.37			\$63,278.01
	\$1,645,228.38			\$65,809.14
	\$1,711,037.52			\$68,441.50
	\$1,779,479.02			\$71,179.16
	\$1,850,658.18			\$74,026.33
	\$1,924,684.51			\$76,987.38
	\$2,001,671.89			\$80,066.88
	\$2,081,738.77			\$83,269.55
	\$2,165,008.32			\$86,600.33
FUTURE COST OF OPTION 3 IF BUILT IN TEN YEARS			TOTAL	\$2,165,008.32

Town of Truro
Pamet Harbor
Jetty Improvements
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF OPTION 4 REBUILD TODAY				
	QUANTITY	RATE	YEARS	TOTAL
	\$1,443,836.63	4%	10	\$57,753.47
	\$1,501,590.09			\$60,063.60
	\$1,561,653.69			\$62,466.15
	\$1,624,119.84			\$64,964.79
	\$1,689,084.63			\$67,563.39
	\$1,756,648.02			\$70,265.92
	\$1,826,913.94			\$73,076.56
	\$1,899,990.50			\$75,999.62
	\$1,975,990.12			\$79,039.60
	\$2,055,029.72			\$82,201.19
FUTURE COST OF OPTION 4 IF BUILT IN TEN YEARS				TOTAL
				\$2,055,029.72

Town of Harwich
Pamet Harbor
Parking Lot Revetment Reconstruction
Estimated Escalated Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS		QUANTITY	RATE	YEARS	TOTAL
TOTAL COST OF PARKING LOT REVETMENT TODAY		\$82,351.50	4%	10	\$3,294.06
		\$85,645.56			\$3,425.82
		\$89,071.38			\$3,562.86
		\$92,634.24			\$3,705.37
		\$96,339.61			\$3,853.58
		\$100,193.19			\$4,007.73
		\$104,200.92			\$4,168.04
		\$108,368.96			\$4,334.76
		\$112,703.71			\$4,508.15
		\$117,211.86			\$4,688.47
FUTURE COST OF REVETMENT IF BUILT IN TEN YEARS				TOTAL	\$117,211.86

Town of Truro
Pamet Harbor
Parking Lot Resurface with Stormwater Improvements
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS

TOTAL COST OF PARKING LOT RESURFACE TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$254,100.00	4%	10	\$10,164.00
	\$264,264.00			\$10,570.56
	\$274,834.56			\$10,993.38
	\$285,827.94			\$11,433.12
	\$297,261.06			\$11,890.44
	\$309,151.50			\$12,366.06
	\$321,517.56			\$12,860.70
	\$334,378.27			\$13,375.13
	\$347,753.40			\$13,910.14
	\$361,663.53			\$14,466.54
FUTURE COST OF RESURFACE IF BUILT IN TEN YEARS			TOTAL	\$361,663.53

Town of Truro
Pamet Harbor
Proposed Boardwalk
Estimated Escalation Cost

TOTAL COST USING 4% ESCALATION OVER 10 YEARS				
TOTAL COST OF BOARDWALK TODAY	QUANTITY	RATE	YEARS	TOTAL
	\$239,662.50	4%	10	\$9,586.50
	\$249,249.00			\$9,969.96
	\$259,218.96			\$10,368.76
	\$269,587.72			\$10,783.51
	\$280,371.23			\$11,214.85
	\$291,586.08			\$11,663.44
	\$303,249.52			\$12,129.98
	\$315,379.50			\$12,615.18
	\$327,994.68			\$13,119.79
	\$341,114.47			\$13,644.58
FUTURE COST OF BOARDWALK IF BUILT IN TEN YEARS	TOTAL			\$341,114.47