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**ENGINEERING ANALYSIS OF  
NINE SIDE SCAN SONAR TARGETS  
FROM THE THIMBLE SHOAL CHANNEL  
TO THE SOUTH ATLANTIC SEA LANE  
CHESAPEAKE BAY ENTRANCE, VIRGINIA**

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February 1986  
Final Report

Prepared for:

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Norfolk District

Report B- 44

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CONTENTS

	Page
List of Figures.....	i
Preface.....	ii
Introduction.....	1
Analysis of Targets:	
ATL #1.....	4
ATL #2.....	6
ATL #6.....	8
ATL #11.....	10
ATL #12.....	12
ATL #13.....	14
ATL #30.....	17
ATL #31.....	18
ATL #34.....	20
Additional Targets.....	23
Summary.....	24
Appendix A - Daily Field Notes.....	A-1

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Distribution/	
Availability Codes	
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REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION <b>Unclassified</b>		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release, distribution unlimited.	
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE		4. PERFORMING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)		5. MONITORING ORGANIZATION REPORT NUMBER(S) B-44	
6a. NAME OF PERFORMING ORGANIZATION Waterway Surveys and Engineering Ltd.	6b. OFFICE SYMBOL (if applicable)	7a. NAME OF MONITORING ORGANIZATION U.S. Army Corps of Engineers, Norfolk District	
6c. ADDRESS (City, State, and ZIP Code) Virginia Beach, VA 23462		7b. ADDRESS (City, State, and ZIP Code) Norfolk, Virginia 23510-1096	
8a. NAME OF FUNDING / SPONSORING ORGANIZATION U.S. Army Corps of Engineers, Norfolk District	8b. OFFICE SYMBOL (if applicable) NAOPL; NAOEN	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code) Norfolk, Virginia 23510-1096		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Engineering Analysis of Nine Side Scan Sonar Targets From the Thimble Shoal Channel to the South Atlantic Sea Lane, Chesapeake Bay Entrance, Virginia			
12. PERSONAL AUTHOR(S) Greene, J.W.			
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) 1985, February	15. PAGE COUNT 24
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	Norfolk Harbor and Channels Deepening, side scan sonar, target sites, obstructions, dredging, engineering analysis of targets, cultural resource survey	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Target areas which will require removal or further investigation if the Chesapeake Bay Entrance Channel is to be dredged to -55 feet MLW are specifically identified and located (seven identified).			
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Craig L. Seltzer		22b. TELEPHONE (Include Area Code) (804) 441-3767/827-3767	22c. OFFICE SYMBOL NAOPL-R

LIST OF FIGURES

No.		Page
1.	Location Map.....	2
2.	Location of Objects Found at ATL #1.....	5
3.	Location of Object Found at ATL #2.....	7
4.	Location of Object Found at ATL #6.....	9
5.	Location of Object Found at ATL #11.....	11
6.	Location of Object Found at ATL #12.....	13
7.	Location of Object Found at ATL #13.....	15
8.	Typical Profile Views: ATL #13.....	16
9.	Location of Object Found at ALT #31.....	19
10.	Location of Object Found at ATL #34.....	21
11.	Table: Summary of Results.....	24

## PREFACE

This engineering analysis was conducted jointly by two firms for the Norfolk District, Corps of Engineers: Waterway Surveys & Engineering, Ltd. (WS&E) under Contract No. DACW65-82-D-0054 and Crofton Diving, Inc. under Contract No. DACW65-84-C-0054. The work was coordinated by Mr. Steve DeLoach, L.S., P.E., Project Manager, Dredging Management Branch. The field investigation was conducted under the supervision of Mr. Ken Crofton, Crofton Diving and Mr. Jeffrey Greene, Project Engineer (WS&E). This report was written by Mr. Jeffrey W. Greene and reviewed by Mr. John B. Walsh, P.E. of WS&E.

## INTRODUCTION

The current proposal to deepen the port of Hampton Roads from an existing depth of 45 feet to a proposed depth of 55 feet will require additional dredging to deepen the natural channel between the east end of the Thimble Shoal Channel and the east end of the South Atlantic Ocean Sea Lane. This area was swept with side scan sonar by the Corps of Engineers to determine if any obstructions exist that would effect future alignment and deepening of the channel. For purposes of this study, a design depth of 60 feet was established by combining the 55-foot project dredging depth with 3 feet advance maintenance dredging and 2 feet allowable overdepth. Side slopes were assumed at 3 horizontal to one vertical. Channel width is currently 1,000 feet across the Thimble Shoal Channel and 6,000 feet across the South Atlantic Ocean Sea Lane.

Nine side scan sonar targets were selected by the Corps from previous work for detailed investigation under this contract (see Figure 1). The Corps used the Klein 500 KHz Side Scan Sonar along with the Tellurometer MRD-1 for positioning from NGS and Corps Third-Order Control. Each target was located by WS&E using a Del Norte Model 540 Electronic Positioning System using 3 ranges from third-order control stations. All depths included in this report have been reduced to NOS Mean Low Water from the NOS primary tide gauge at the southernmost island of the Chesapeake Bay Bridge-Tunnel.

Each target was initially located using Virginia State Plane coordinates furnished by the Corps of Engineers and marked with an anchor and surface buoy. This enabled Crofton Diving, Inc. to position their boat over the target and perform a thorough search of the area within a 100-foot radius of the anchor buoy. Obstructions were either located by compass bearing and tagline distance from the anchor or a buoy line was attached directly to the object and positioned by plumbing this line from the surface. Least depths were obtained by pneumofathometer at all significant obstructions. Detailed descriptions of each dive were recorded daily by the project engineer in communication with the diver (see Appendix A).



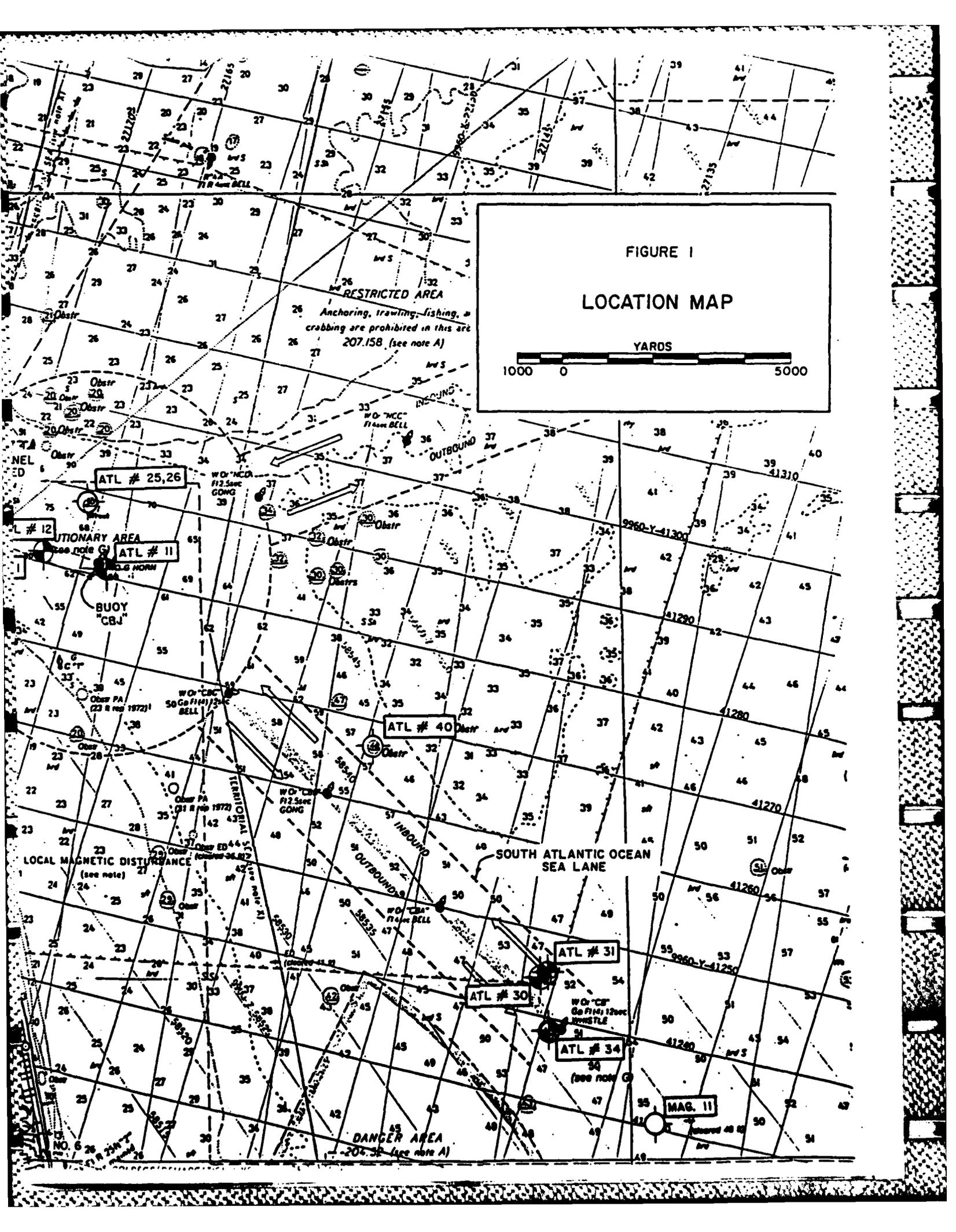


FIGURE I  
LOCATION MAP

YARDS  
1000 0 5000

RESTRICTED AREA  
Anchoring, trawling, fishing, &  
crabbing are prohibited in this area  
207.158 (see note A)

ATL # 25,26

ATL # 11

ATL # 40

ATL # 31

ATL # 30

ATL # 34

MAG. II

DANGER AREA  
204.38 (see note A)

LOCAL MAGNETIC DISTURBANCE  
(see note)

SOUTH ATLANTIC OCEAN  
SEA LANE

CAUTIONARY AREA  
(see note G)

NEL  
ED

Obstr

This report discusses each target individually, in detail, with a scale drawing showing the obstruction's relationship to the deepened channel (buoy line) and surrounding bottom bathymetry. Discussion includes the target's intimidation to shipping considering the deepened Port of Hampton Roads and recommendations for further investigation and/or removal. Also included in this report are 5 additional targets that were detected with the side scan sonar, but were not included in the diving work for this analysis. Most of these targets are already shown on the coast chart as obstructions or wrecks. These targets are mentioned briefly including historical data, distance from the channel, least depths and coordinates.

TARGET: ATL #1

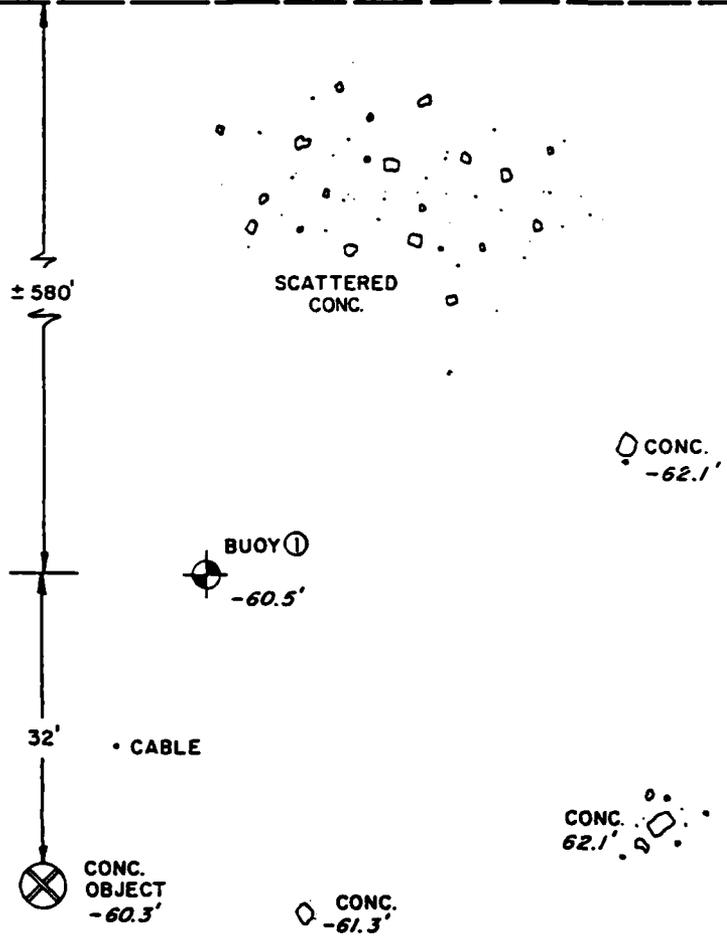
Interpretation of side scan records showed a target 5 feet by 5 feet in 60 feet of water extending 3 feet above the bottom. A 60-foot radial sweep of the bottom around buoy 1 revealed a flat, muddy bottom with scattered concrete up to 2 feet in diameter to the east and south (Figure 2).

Further investigation found a large concrete cylindrical object, 5 feet in diameter and 2.5 feet tall, resting on the bottom. It appears to be a concrete buoy weight, reinforced with steel plate and "I" beams with a steel lifting eye on top (see detail). The least-depth was determined to be -60.3 feet MLW at the lifting eye.

This object lies 610 feet to the south of the southern toe of the Thimble Shoal Channel when extended to the east. The average bottom depth at the object is 62 feet with the depth constantly increasing, up to 80 feet, as you move to the north. Therefore, dredging will not be necessary in this area. The object is outside the "normal" path for an outgoing vessel preparing to enter the outbound lane of the South Atlantic Ocean Sea Lane, but it is in navigable waters, at the -60 foot contour, where an outgoing vessel could choose to transit. This object is not a strong threat to ships using the deepened Port of Hampton Roads, but because it can be removed by conventional methods with little expense when compared to its potential liability, its removal is recommended.

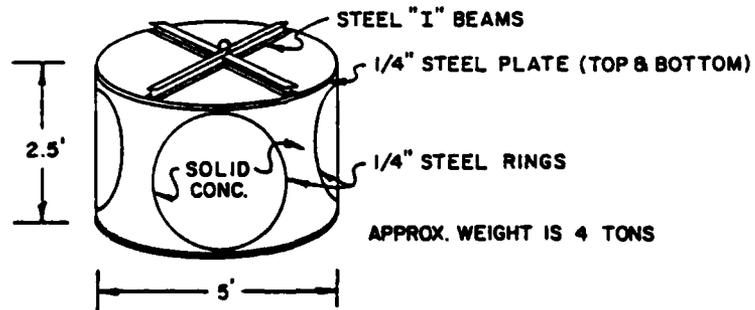
EXISTING LINE BETWEEN CHANNEL BUOYS "1" & "3" - EXTENDED

CO-ORDINATES (FEET):  
 OBJECT : N 230,365  
 E 2,733,555



LOCATION OF OBJECTS FOUND AT ATL # 1

SCALE: 1" = 20'



DETAIL OF CONCRETE OBJECT

(NOT TO SCALE)

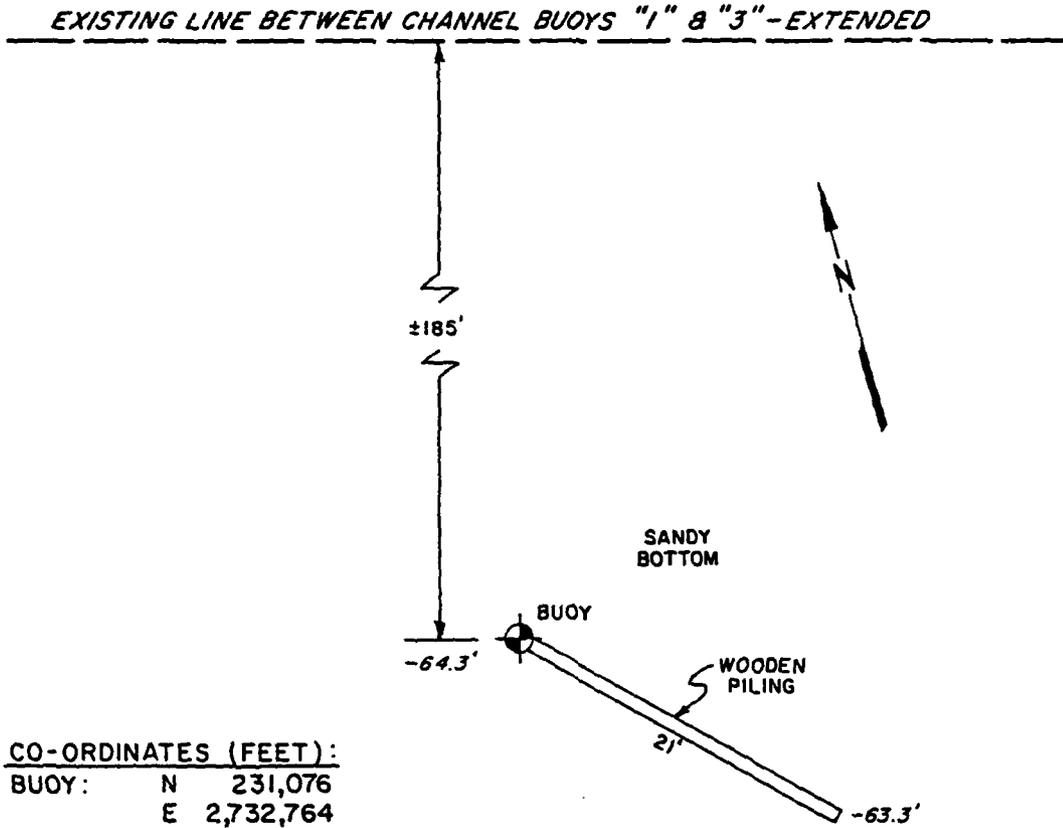
FIGURE 2

TARGET: ATL #2

Interpretation of side scan sonar records showed a target 3 feet wide by 20 feet long in 61 feet of water extending 1.5 feet above the bottom. The buoy anchor was dropped directly onto the object, therefore, a sweep of this area was not necessary.

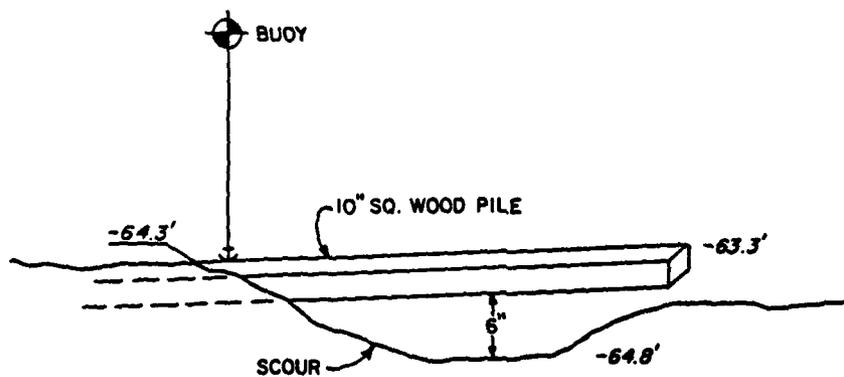
The object appeared to be a 10" x 10" square deteriorating wood pile, 21 feet long, running NW-SE on a sandy bottom (Figure 3). The buoy was located at the NW end of the pile, where the pile dissappeared into the bottom. The SE end of the pile is cantilevered slightly off the bottom with a least depth of -63.3 feet MLW.

This target lies 185 feet south of the southern toe of the Thimble Shoal Channel extended. The average bottom depth at this object is 64 feet with depths increasing to the north, therefore no dredging will be necessary in this area. This object will not intimidate any ships using the deepened Port of Hampton Roads and will not require any further investigation.



LOCATION OF OBJECT FOUND AT ATL #2

SCALE: 1" = 10'



PROFILE VIEW

(NOT TO SCALE)

FIGURE 3

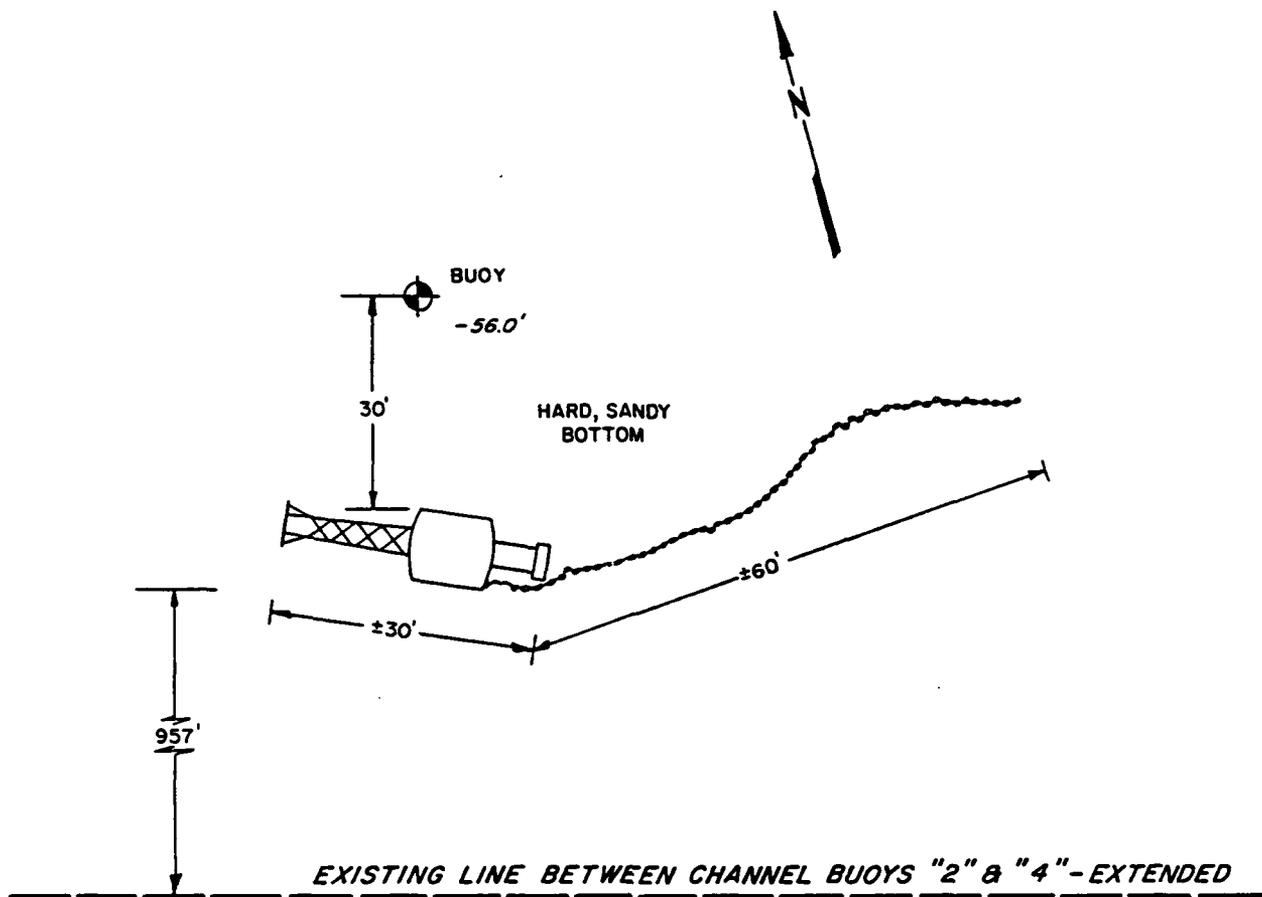
TARGET: ATL #6

Interpretation of side scan sonar records showed a target 6 feet wide by 25 feet long in 50 feet of water, with a maximum height of 6 feet above the bottom. A 40-foot radial sweep of the bottom around the anchor buoy revealed a flat, hard, sandy bottom with scattered, insignificant debris found to the west.

Further investigation found a partially exposed anchor chain (35 feet east of the anchor buoy) with 8-inch links encrusted with barnacles. Following the chain to the west revealed a channel buoy lying WNW-ESE on the bottom, 30 feet south of the anchor buoy. The buoy was approximately 30 feet overall, 8-feet in diameter at the base, with a 14-foot metal framed structure at the NW end (see Figure 4). Its least depth was determined at the NW end to be -46.6 feet MLW, while the average bottom depth is -54 feet.

The buoy lies approximately 960 feet to the north of the existing line between Thimble Shoal Channel buoys "2" & "4" when extended to the east. Assuming the channel is dredged to -60 feet, this target is too far to the north to interface with any dredging and will not intimidate any ships using the deepened Port of Hampton Roads.

The position of the sunken channel buoy was given to the U.S. Coast Guard at their request. They will attempt to retrieve the buoy and will contact the Corps of Engineers to confirm its removal.



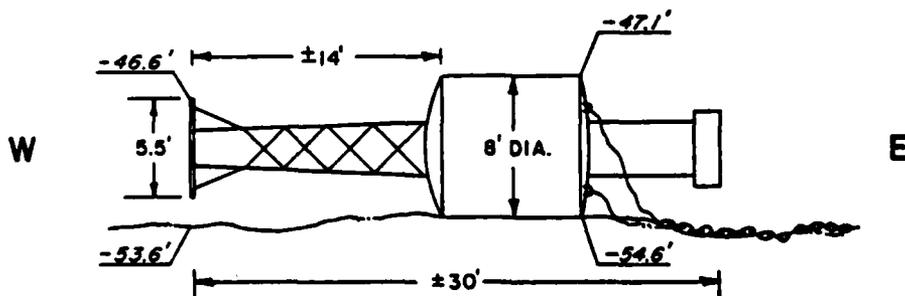
LOCATION OF OBJECT FOUND AT ATL #6

SCALE: 1" = 20'

CO-ORDINATES (FEET):

OBJECT: N 236,200

E 2,722,659



PROFILE VIEW

SCALE: 1" = 10'

FIGURE 4

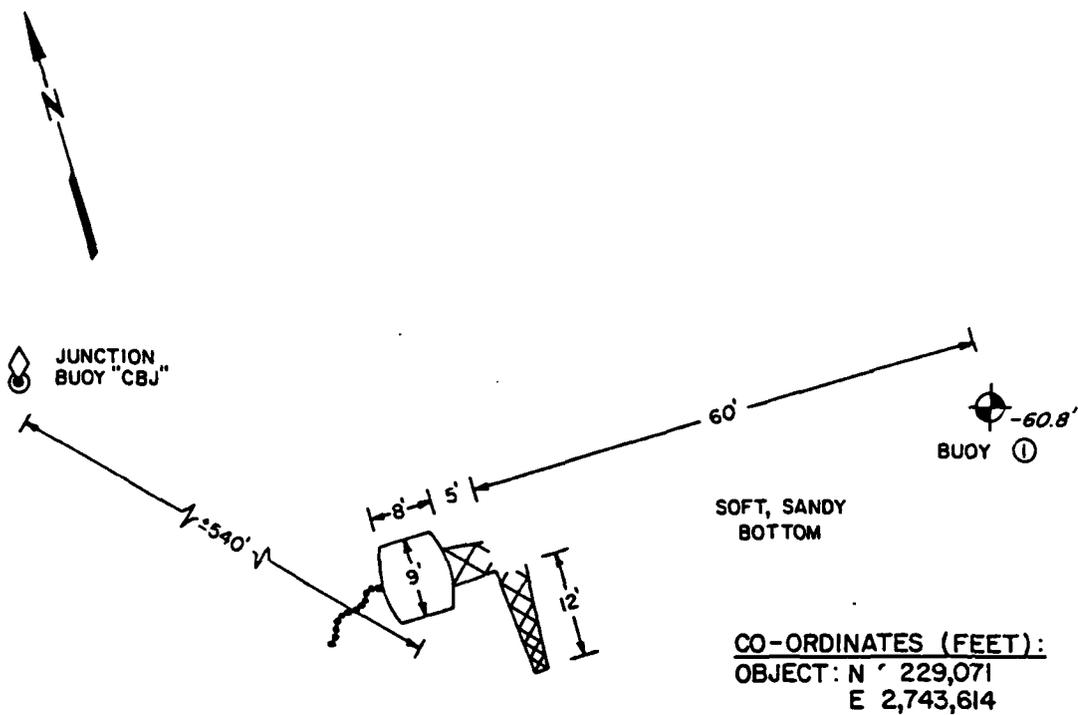
TARGET: ATL #11

Interpretation of side scan sonar records showed a target 5 feet wide by 15 feet long in 65 feet of water, with a maximum height of 8 feet above the bottom. A 60-foot radial sweep of the bottom around buoy 1 revealed a soft sand with scattered shells and an average bottom depth of -62 feet MLW.

A large steel object was found at 60 feet west of buoy 1 (see Figure 5). Further investigation revealed a channel buoy lying on its side in an east-west direction with the upper 12 feet of the steel-framed tower bent 90 degrees to the south. The base of the buoy was 9 feet in diameter and 8 feet tall, with a short length of chain attached to the west end of the buoy. The buoy was probably struck by a ship because it was dented in on one side and ripped open along the bottom.

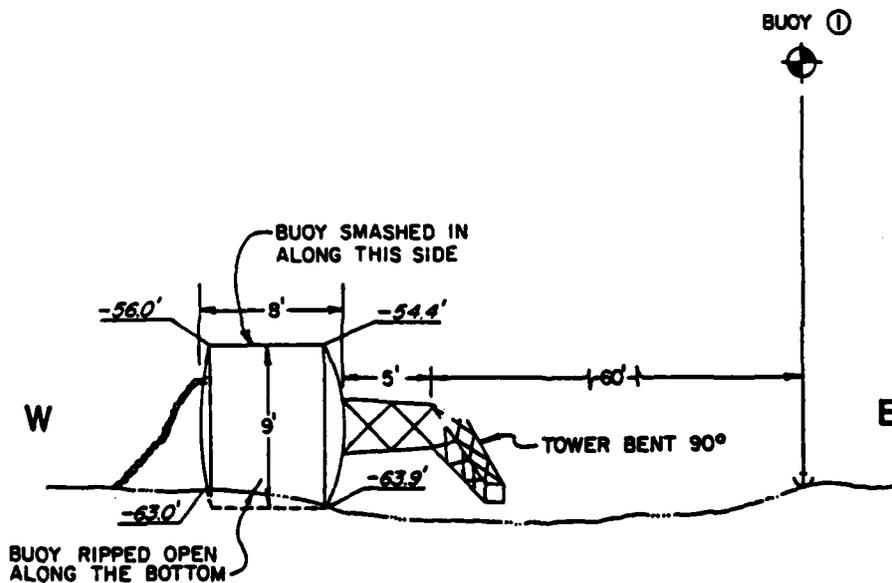
The buoy lies approximately 540 feet southeast of junction buoy "CBJ" which marks the point where the Thimble Shoal Channel intersects with the Atlantic Sea Lanes. The buoy is in direct line with ship traffic entering and exiting the Port of Hampton Roads and should be removed since its least depth is -54.4 feet MLW.

The position of the sunken channel buoy was given to the U.S. Coast Guard at their request. They will attempt to retrieve the buoy and will contact the Corps of Engineers to confirm its removal.



LOCATION OF OBJECT FOUND AT ATL #11

SCALE: 1" = 20'



PROFILE VIEW

SCALE: 1" = 10'

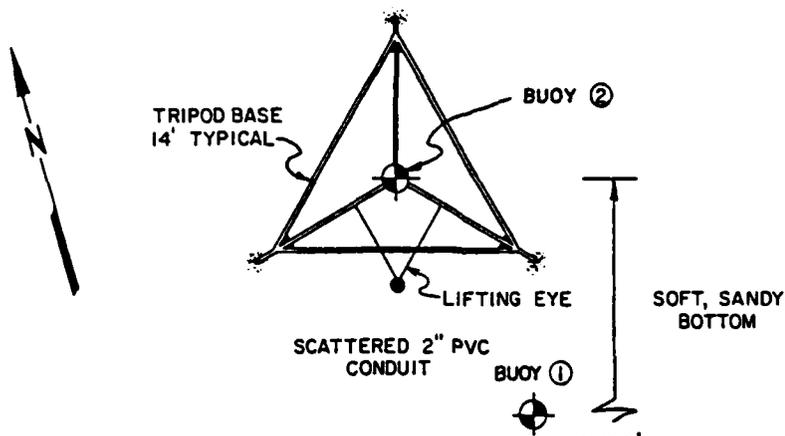
FIGURE 5

TARGET: ATL #12

Interpretation of side scan sonar records showed a target 5 feet wide by 20 feet long in 64 feet of water, with a maximum height of 12 feet above the bottom. The anchor for buoy 1 was dropped amongst a bunch of 2-inch diameter PVC conduit scattered randomly about the bottom. The average bottom depth was -65 feet MLW.

Further investigation found a large steel tripod standing on the bottom approximately 10 feet north of the PVC conduit (Figure 6). The tripod legs are made of 4-inch steel pipe and are 14 feet apart at the base where they enter the sand. A steel cylinder, 2 feet in diameter and 7 feet tall, is mounted on top of the tripod giving it an overall height of 11 feet. Buoy 2 was tied directly to the tripod leg for positioning and a least depth of -54.8 feet MLW was determined to the top of the cylinder.

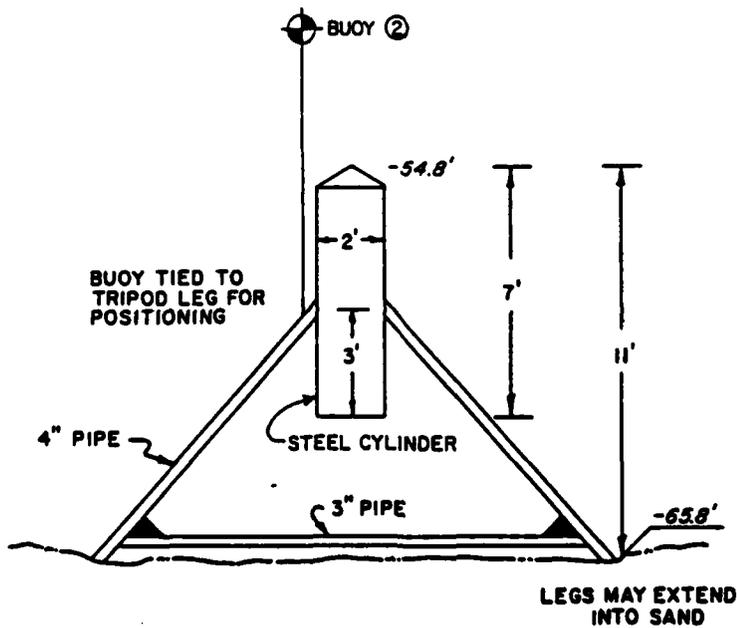
This object lies to the west of junction buoy "CBJ" and in the center of Thimble Shoal Channel when extended to the east. Since the average bottom depth at this target is -65 feet MLW, dredging will not be necessary. The tripod, having a least depth of -54.8 feet MLW, should be removed or relocated because it is in direct line with any ship traffic using the Port of Hampton Roads. Further investigation is recommended to determine the owner and the purpose of this device before any action can be determined.



CO-ORDINATES (FEET):  
 TRIPOD: N 229,767  
 (BUOY 2) E 2,739,168

EXISTING LINE BETWEEN CHANNEL BUOYS "1" & "3" - EXTENDED

LOCATION OF OBJECT FOUND AT ATL #12  
 SCALE: 1" = 10'



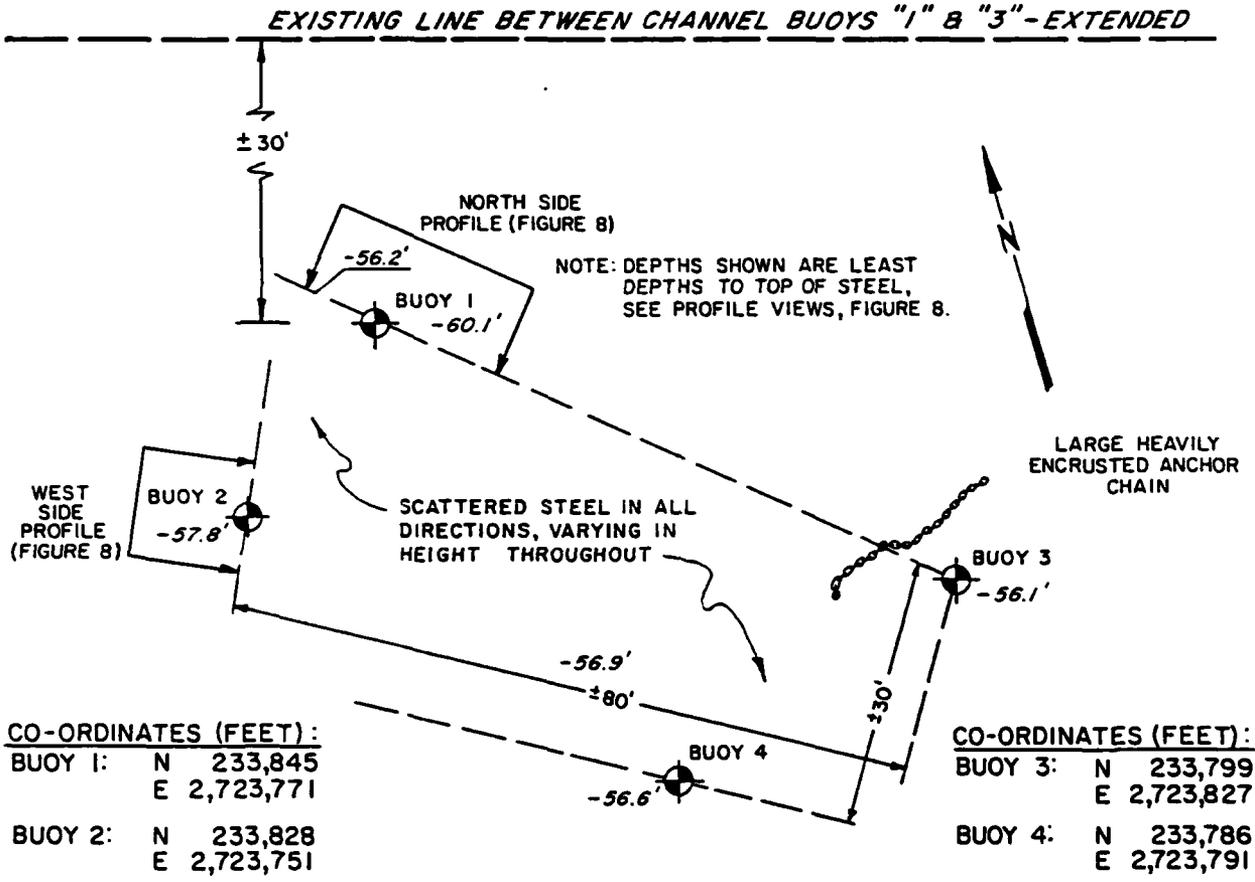
PROFILE VIEW  
 (NOT TO SCALE)  
 FIGURE 6

TARGET: ATL #13

Interpretation of side scan sonar records showed an area 25 feet wide by 140 feet long in 63 feet of water, with a maximum height of 8 feet above the bottom. This area was too heavily obstructed to perform the radial sweep of the bottom which was used on previous targets. The target's outer limits in all four quadrants were located and buoys were placed there for positioning from the surface.

This target consists mainly of a mass of steel ship bulkheads of various thicknesses and heights covering an area approximately 30 feet wide by 80 feet long; obviously a ship wreck. The perimeter of this target consists of vertical bulkheads in continuous alignment, but the interior consists of scattered, jagged bulkheads in all directions and varying heights (see figure 7). The diver found it extremely difficult and dangerous to maneuver amongst the jagged steel without snagging his surface supplied air cable. For this reason, most of the investigation took place around the perimeter. On the north side, buoy 1 was tied off to a porthole found in an 8-foot high flimsy bulkhead running in an east-west direction (see profile view, Figure 8). This bulkhead runs approximately 70 feet to the east, with the bulkhead disappearing occasionally in the sand, to a point where the bulkhead turns in a southerly direction (buoy 3). A similar bulkhead was found on all four sides and marked with a buoy where the least depths occurred. For more details see the daily dive descriptions in Appendix A.

From this information, it is safe to assume that this target is a vessel that sunk many years ago because most of the bulkheads are flimsy and deteriorated. This wreck is probably the same obstruction already shown on the coast chart designated as "49". Least depths were determined at many points across the wreck with the smallest being -56.1 feet MLW. The northernmost point of the wreck lies only 30 feet south of the Thimble Shoal Channel extended, with a least depth of -56.2 feet. The average bottom depth along the north side of the wreck is -65 feet, therefore, dredging will not be necessary in this area. It is recommended that further investigation, possibly in the form of a wire drag, be performed to verify the least depth across the entire target area. This target will intimidate the outbound ships using the deepened Port of Hampton Roads and should be removed or leveled to a minimum depth of -60 feet MLW.

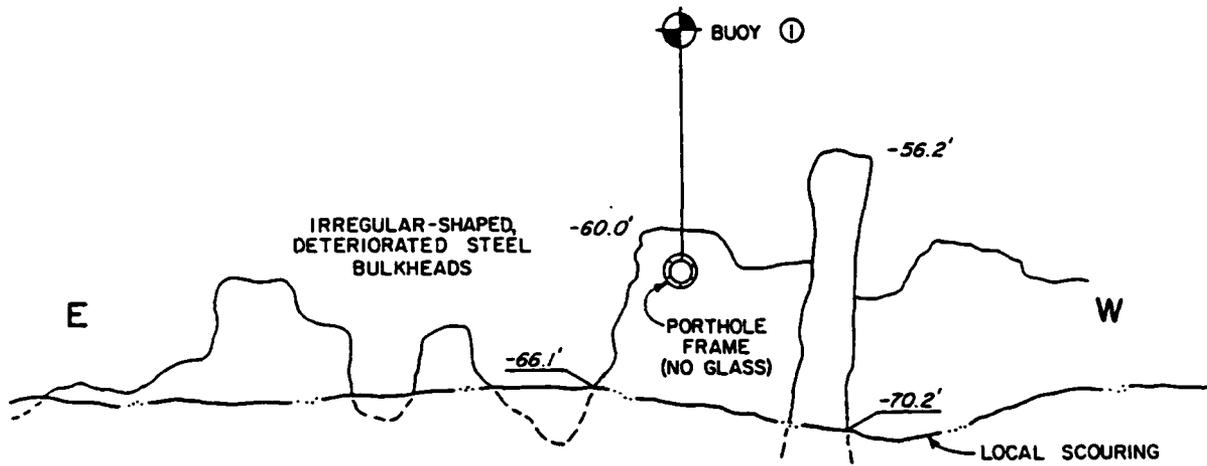


NOTE: LIMITS OF WRECK ARE APPROXIMATE, EACH BUOY WAS PLACED ON THE HIGHEST POINT ON THE WRECK AT EACH EXTREME IN FOUR DIRECTIONS. THE FOUR POINTS ARE ACCURATE, BUT THE DIRECTION OF STEEL BETWEEN POINTS ARE NOT, DUE TO THE DIFFICULTY IN MOVING AMONGST THE JAGGED STEEL THROUGHOUT THE WRECK AND THE INACCURACY OF THE COMPASS WHEN SURROUNDED BY STEEL.

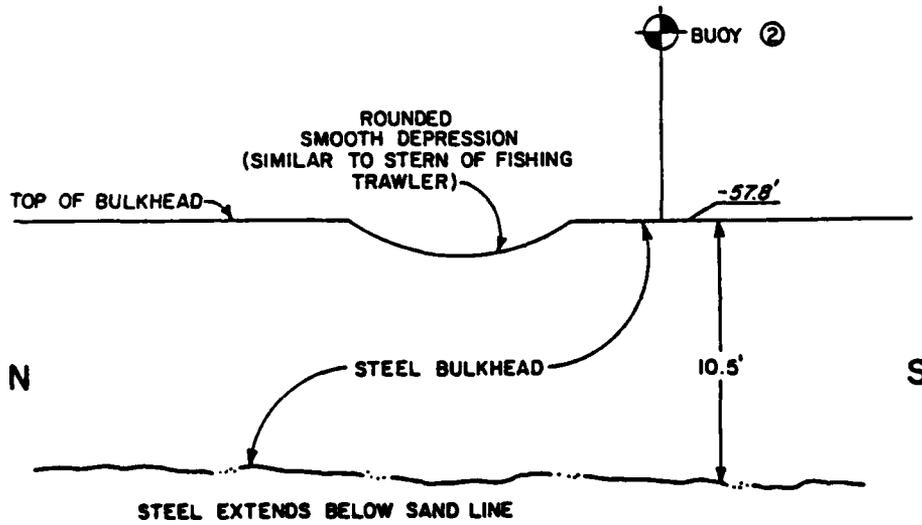
### LOCATION OF OBJECT FOUND AT ATL #13

SCALE: 1" = 20'

FIGURE 7



**NORTH SIDE**  
(NOT TO SCALE)



**WEST SIDE**  
(NOT TO SCALE)

**TYPICAL PROFILE VIEWS: ATL #13**  
FIGURE 8

TARGET: ATL #30

Interpretation of side scan sonar records showed this target to be 3 feet by 5 feet in 51 feet of water, with a maximum height of 1.5 feet above the bottom. A 100-foot radial sweep of the bottom around the anchor buoy revealed nothing but a hard, sandy bottom with an average bottom depth of -51 feet MLW.

The area was swept with a tag line no more than 6 inches above the bottom, at 10-foot intervals out to 60 feet and at 20-foot intervals out to 100 feet. No objects were found. The buoy coordinates were checked in the field and checked again by the Corps of Engineers, they were within 10 feet.

This target area is located in the inbound lane of the South Atlantic Sea Lane just north of the "CB" buoy (See Figure 1). No further investigation is necessary since this target's size is insignificant when compared to the other targets after having developed good confidence in the accuracy of the side scan sonar from previous targets investigated.

TARGET: ATL #31

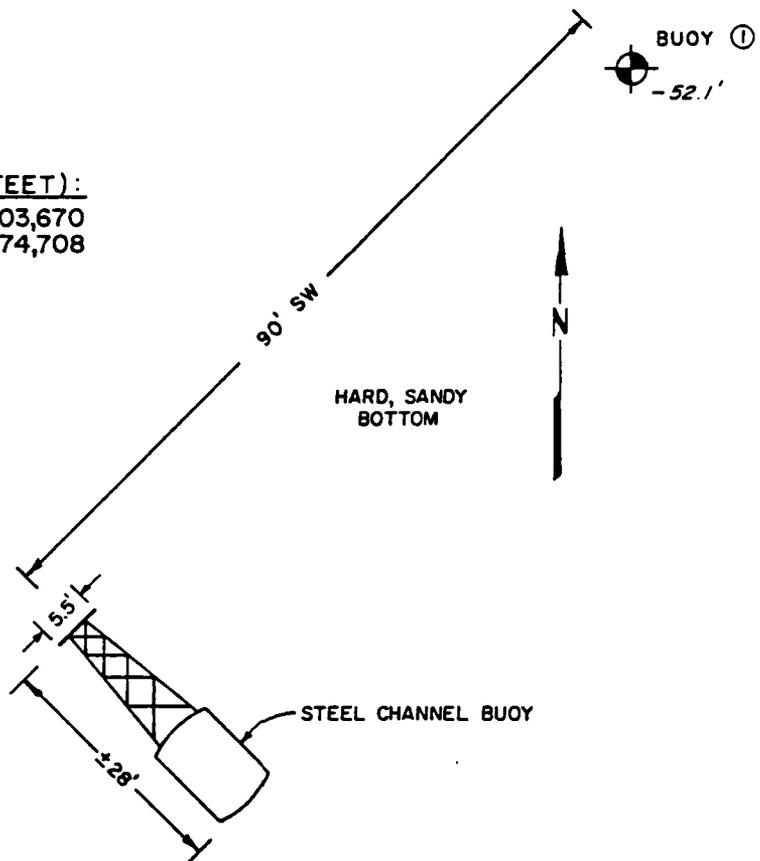
Interpretation of side scan sonar records showed a target 6 feet wide by 45 feet long in 51 feet of water, with a maximum height of 5 feet above the bottom. A 100-foot radial sweep of the bottom around buoy 1 revealed a hard, sand with an average bottom depth of -52 feet MLW.

A large steel object was found 90 feet southwest of buoy 1 (see Figure 9). Further investigation of the object revealed a channel buoy lying on its side in a NW-SE direction. The base of the buoy is 8 feet in diameter and 12 feet tall. The tower structure set atop the base extends 16 feet to the northwest, giving the buoy and overall length of 28 feet. The buoy was positioned on the 5.5-foot diameter steel plate atop the tower at the northwest end.

The object lies in the center and parallel to the inbound lane of the South Atlantic Sea Lane just north of the "CB" buoy (see Figure 1). Dredging will be necessary in this area since the average bottom depth is -52 feet. The channel buoy, having a least depth of -47.9 feet, should be removed because it is in direct line with any ship traffic entering the Port of Hampton Roads.

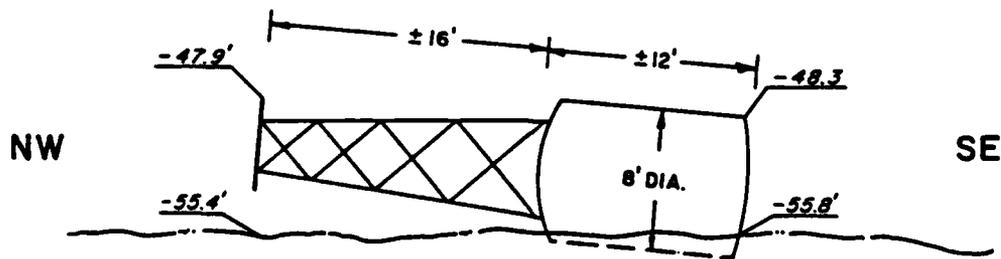
The position of the sunken channel buoy was given to the U.S. Coast Guard at their request. They will attempt to retrieve the buoy and will contact the Corps of Engineers to confirm its removal.

CO-ORDINATES (FEET):  
NW-OBJECT N 203,670  
E 2,774,708



LOCATION OF OBJECT FOUND AT ATL #31

SCALE: 1" = 20'



PROFILE VIEW

(NOT TO SCALE)

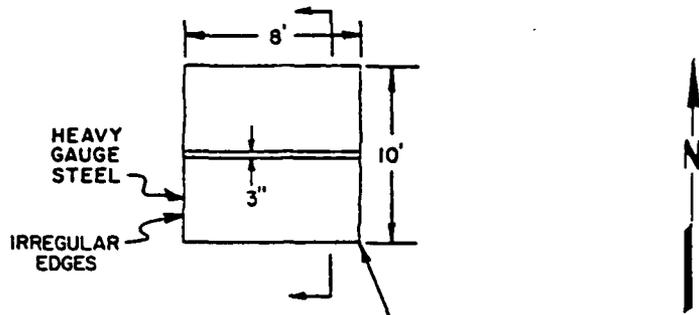
FIGURE 9

TARGET: ATL #34

Interpretation of side scan sonar records showed a target 10 feet wide by 20 feet long in 53 feet of water, with a maximum height of 5 feet above the bottom. The object was found, while backing away from the buoy anchor to a 50-foot radius, at 20 feet NNW of buoy 1 with an average bottom depth of -56 feet MLW.

Further investigation revealed a large object made of heavy gauge steel, approximately 3 inches thick (see Figure 10). The object is symmetrically shaped like an inverted "T", with all the edges being irregular, as if cut with a torch. The object is 8 feet by 10 feet at the base and extends 9.5 feet above the sandy bottom. It is possible that this object extends down into the sand from the base plate as shown in the profile view, Figure 10.

This target lies in the outbound lane of the South Atlantic Sea Lane approximately 750 feet west of the "CB" buoy (see Figure 1). This is probably the same obstruction already shown on the coast chart designated as "43". The least depth was determined to be -47.7 feet MLW, therefore, this object should be removed because it is in direct line with ships leaving the Port of Hampton Roads via the South Atlantic Sea Lane. Further investigation of this object is recommended prior to its removal.

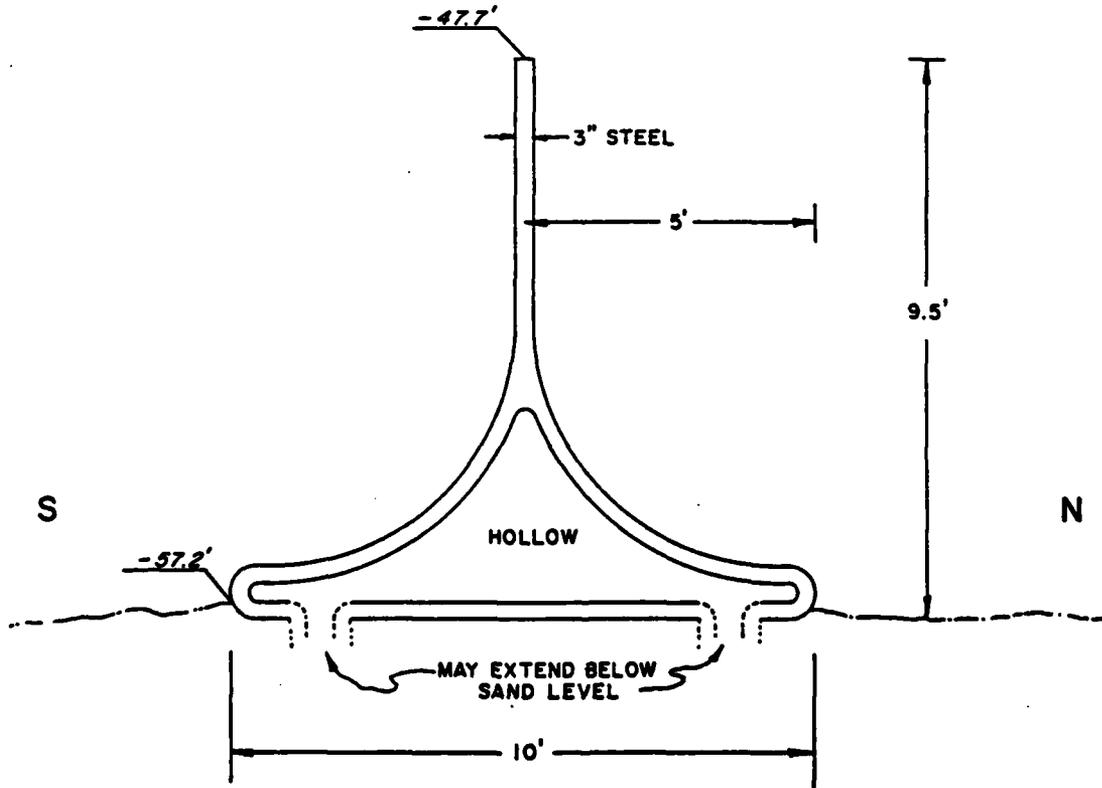


CO-ORDINATES (FEET):  
 OBJECT: N 200,914  
 E 2,774,675

HARD SANDY BOTTOM

BUOY ①  
 -56.1'

LOCATION OF OBJECT FOUND AT ATL #34



CROSS-SECTIONAL VIEW

SCALE: 1" = 3'  
 FIGURE 10

#### ADDITIONAL TARGETS NOT INVESTIGATED

The following paragraphs discuss additional side scan sonar targets that are worthy of mention, but were not included in the diving work for this analysis. These targets are previously reported wrecks and obstructions that are already known and shown on NOAA's coast chart No. 12221 (see Figure 1 for locations).

ATL #8, 23 & 24: This target is shown on the coast chart as "wreck 40", with a least depth of -40 feet MLW. The wreck is approximately 700 yards to the north of the Thimble Shoal Channel extended. No further investigation is necessary. N 237,494 feet, E 2,724,062 feet.

ATL # 16-22: This target is shown on the coast chart as "wreck 37", with a least depth of -37 feet MLW. The wreck is listed as the freight ship "Chilore" that sank on July 15, 1942. It is located approximately 1300 yards to the north of the Thimble Shoal Channel and is marked to the south by the buoy "2CH". No further investigation is necessary. N 237,800 feet, E 2,727,150 feet.

ATL #25 & 26: This target is shown on the coast chart as "wreck 50", with a least depth of -50 feet MLW. This wreck is listed as the vessel "Westmoreland" that sank on Oct. 3, 1939. It is located approximately 1,300 yards to the north of junction buoy "CBJ". No further investigation is necessary. N 233,050 feet, E 2,742,480 feet.

ATL #40: This target is shown on the coast chart as "Obstr. 40", with a least depth of -40 feet MLW. The side scan sonar interpretation shows a 30-foot by 70-foot object in approximately 50 feet of water, with a maximum height of 9 feet above the bottom. This obstruction is approximately 1,400 yards northeast of the fairway buoy "CBB" marking the center of the South Atlantic Sea Lane. No further investigation is necessary. N 218,555 feet, E 2,762,540 feet.

MAG # 11: This target was reported from a magnetometer survey conducted by the Wilmington District, Corps of Engineers in May 1982. It consists of 10-12 Navy WWII "Hedgehogs" (antisubmarine weapons) scattered over roughly 50 square feet in approximately 54 feet of water at low tide. This target is 3,000 yards to the southeast of buoy "CB". No further investigation is necessary. N 195,532 feet, E 2,781,826 feet.

SUMMARY OF RESULTS

<u>TARGET</u>	<u>BRIEF DESCRIPTION</u>	<u>RECOMMENDATIONS</u>
ATL #1	5' DIA. x 2.5' thick concrete cylindrical weight, least depth -60.3'	Remove large diameter concrete weight.
ATL #2	10" x 10" wood pile, 21' long, least depth -63.3'	No further investigation is recommended.
ATL #6	Sunken channel buoy, 8' Dia., 30' long, least depth -46.6'	Remove buoy or salvage by Coast Guard.
ATL #11	Sunken channel buoy, 9' Dia., 25' long, least depth -54.4'	Remove buoy or salvage by Coast Guard.
ATL #12	Large steel tripod, 14' wide and 11' tall, least depth -54.8'	Investigate purpose, owner and operational status before deciding on action. Removal or relocation is recommended.
ATL #13	Steel ship wreck, 30' wide, 80' long, least depth -56.1'	Investigate further to verify least depth; remove or level.
ATL #30	Nothing was found within 100' radius.	No further investigation is recommended.
ATL #31	Sunken channel buoy, 8' Dia. 28' long, least depth -47.9'	Remove buoy or salvage by Coast Guard.
ATL #34	Heavy gauge steel object 8' x 10' x 9.5' tall, least depth -47.7'	Investigate further prior to removal.

**END**

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