



Cape Hatteras National Seashore Buxton and Frisco Flooding Mitigation Planning

Public Scoping Meetings, 10/19/2016 and 10/20/2016

Manteo, N.C. and Buxton N.C.

1. Historical overview of the area
2. Description of past drainage practices
3. Documentation of flooding impacts
4. Review of reports and data surrounding the issue
5. Next steps



Partners

- NOAA
- North Carolina Department of Environmental Quality
- North Carolina Division of Coastal Management
- North Carolina Wildlife Resources Commission
- US Fish and Wildlife Service
- US Army Corp of Engineers

The Challenge

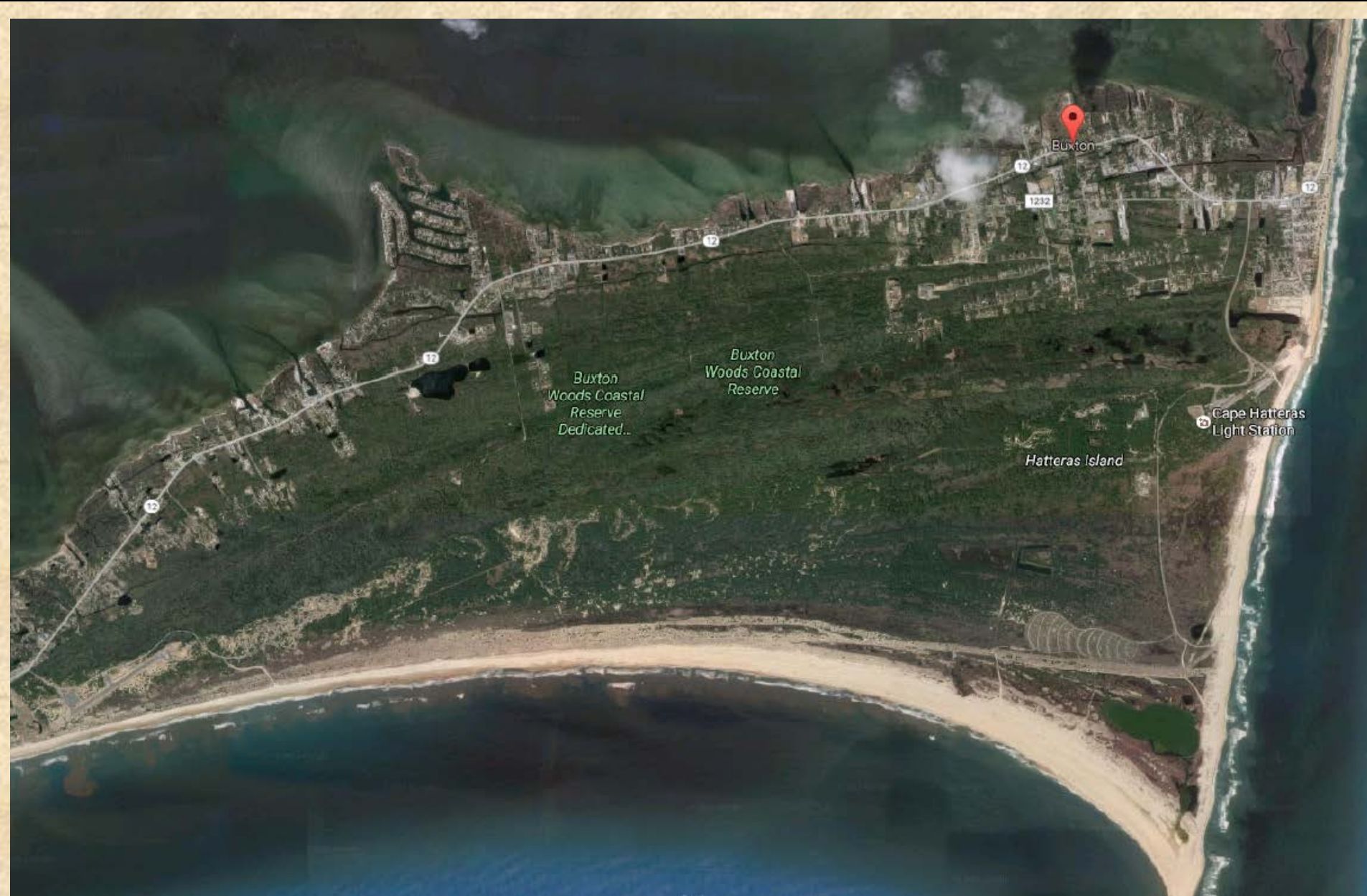
Several locations, including the Cape Point Campground, beach parking lots (near ramp 43 and old ramp 45), the Cape Hatteras Lighthouse parking lot, off-road vehicle ramps 43, 44, and 49, Lighthouse Road, and areas around the Seashore's administrative offices, have experienced persistent flooding over the last decade.

Although most Seashore facilities have remained open while flooded, flooding can diminish the visitor experience and make access to some areas challenging during large rainfall events.

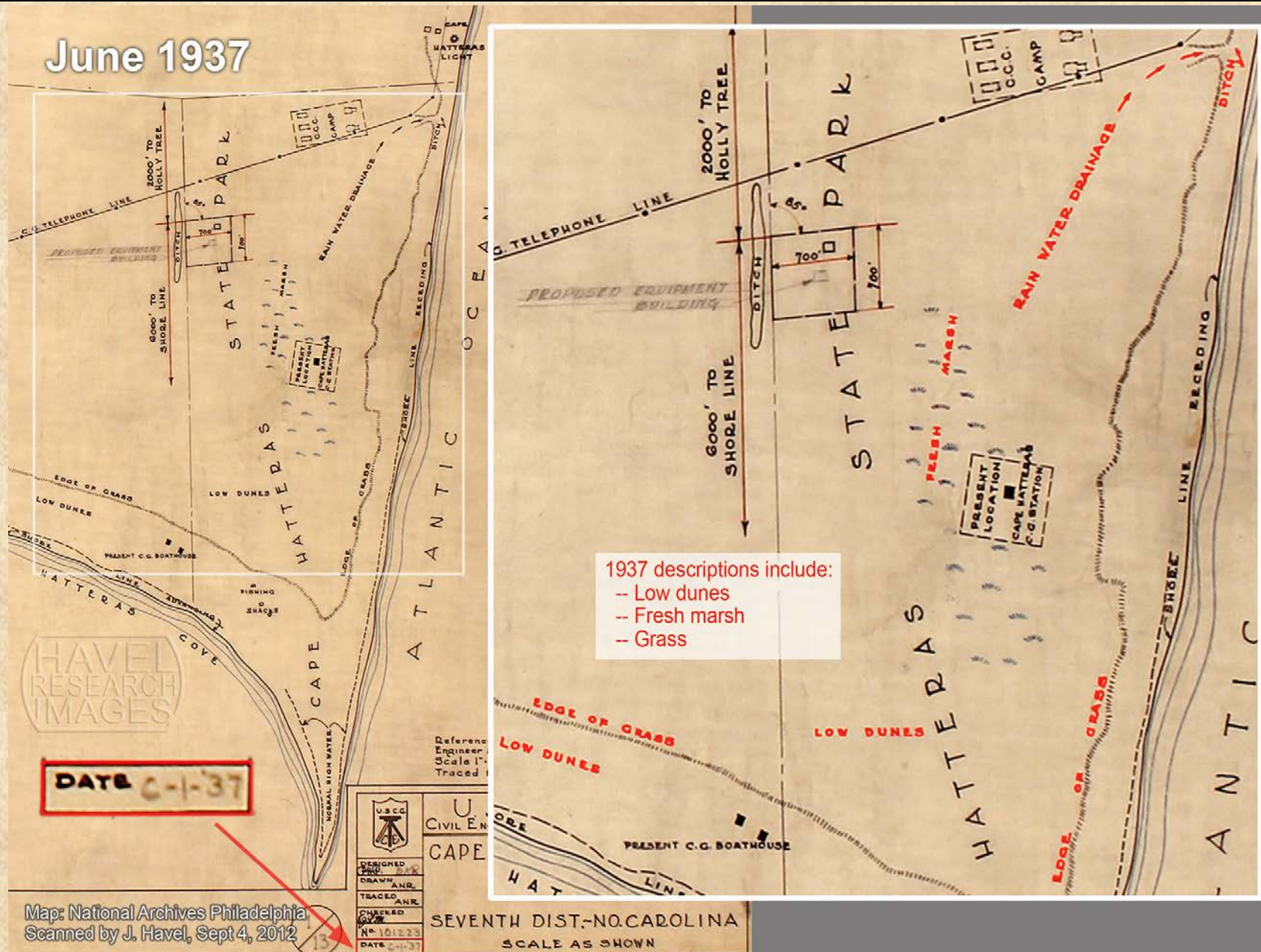
What factors affect flooding in this area?

- The dredge pond?
- The dune line?
- Campground construction?
- Ditches, dikes, roads?
- Regional groundwater levels?
- Sea level rise?

National Park Service



National Park Service




National Park Service



Circa January-July 1940

HAVEL
RESEARCH
IMAGES

An aerial photograph of Cape Hatteras, North Carolina, showing the coastline and the 1882 Life Saving Station. The station is a small, dark, rectangular building located on a sandy dune. A white arrow points to the station. The coastline is visible on the left, with waves breaking onto the beach. The land is mostly flat and sandy, with some sparse vegetation.

This is the 1882 Cape Hatteras Life Saving Station. At the time this photo was taken, the new Coast Guard Station, situated 1/2-mile northwest, had just been completed or was nearly complete.

Photograph: Outer Banks History Center, Manteo, NC
Alan Eldridge Collection
Scanned by Stuart Parks for John Havel, February 28, 2014

National Park Service



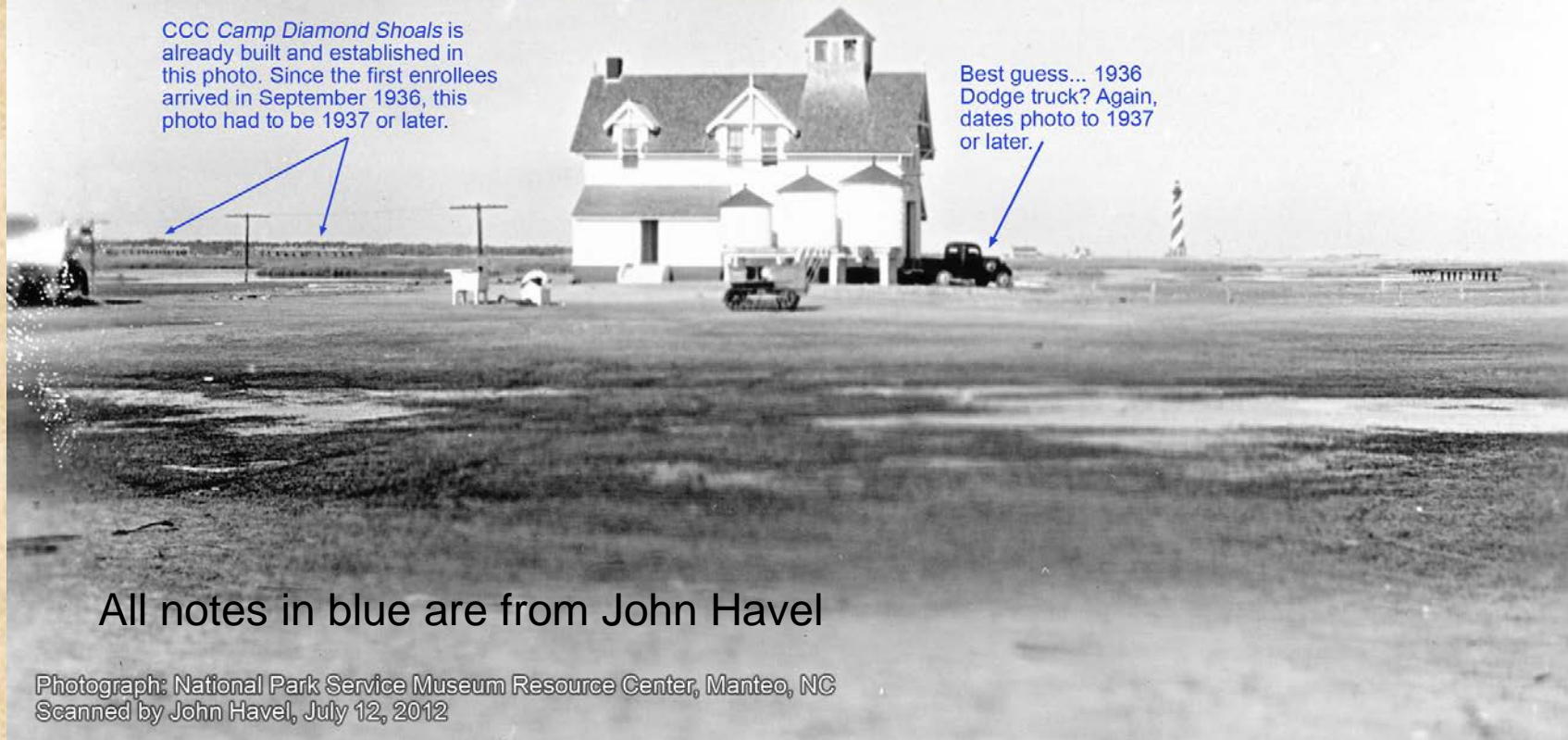
Circa 1937-40



This is the 1882 Hatteras Life Saving Station. It was plagued with flooding, especially bad during the two back-to-back 1933 storms, and was abandoned after the new Coast Guard Station was built 1/2-mile northwest, in 1940. The building remained abandoned and in ruins until 1948 when it was razed, and the new LORAN Station was built at the same location.

CCC Camp Diamond Shoals is already built and established in this photo. Since the first enrollees arrived in September 1936, this photo had to be 1937 or later.

Best guess... 1936 Dodge truck? Again, dates photo to 1937 or later.



All notes in blue are from John Havel

Photograph: National Park Service Museum Resource Center, Manteo, NC
Scanned by John Havel, July 12, 2012

National Park Service



May 1945 Enlargement showing Cape Point landscape

HAVEL
RESEARCH
IMAGES



Photograph: North Carolina State Archives, Raleigh, NC
Bill Sharpe and daughter Susie, May 1945, photo by John Hemmer
Scanned by John Havel, January 12, 2011

April 1945



Winter 1953

Photograph taken in the winter of 1953 pointing north from the top of the 300-ft U.S. Coast Guard Loran transmitting tower by Seaman Electronic Technician Warren Rose. Although the photograph does not show the area south of the Loran Station or that of Cape Point, the general lack of any significant vegetation gives a clear idea of the terrain and topography of the area during the wintertime in this time period.



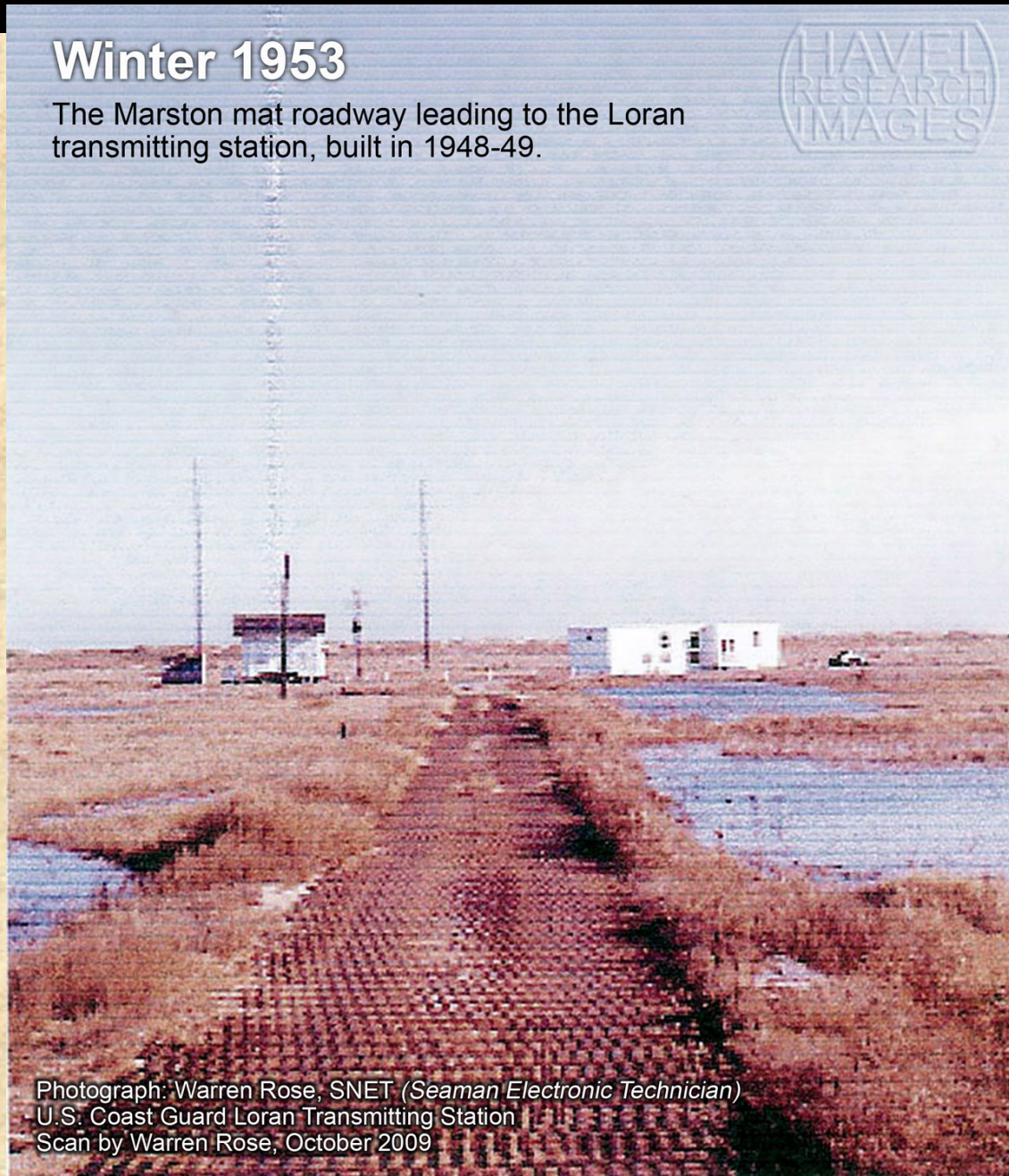
Notes from John Havel

Photograph: Warren Rose, SNET (*Seaman Electronic Technician*)
U.S. Coast Guard Loran Transmitting Station
Scanned from 35mm slide by John Havel, October, 2009



Winter 1953

The Marston mat roadway leading to the Loran transmitting station, built in 1948-49.



Photograph: Warren Rose, SNET (*Seaman Electronic Technician*)
U.S. Coast Guard Loran Transmitting Station
Scan by Warren Rose, October 2009

Nation

March 1955



National Park Service



August 16, 1955



Figure 37.

A view from the top of Cape Hatteras Lighthouse looking southwest. This is an area that is classified as miniature sand dunes or a rolling dry sand flat. The darkest black spots are such plants as live oak, yaupon, or wax-myrtle. The remains of a pine plantation are in the upper third of the picture where the right hand road narrows. The maritime pine was planted in this area.

National Park Service



February 25, 1958

HAVEL
RESEARCH
IMAGES



NEG. NO: 58-347 DATE: 2-25-58 PRINT FILE: A/E.C

GENERAL DESCRIPTION, LOCATION, OTHER PERTINENT DATA

Camp sites Cape Hatteras Campground during construction. Chip surface down and about ready for oil.

Negative by: Watson Large print?

Photograph: NPS Outer Banks Group Museum Resource Center, Manteo, NC
Scan by John Havel July 12, 2012

Nation

August 1959



CAOS 16 AUG 59 W 7531



National Park Service



July 25, 1958

HAVEL
RESEARCH
IMAGES

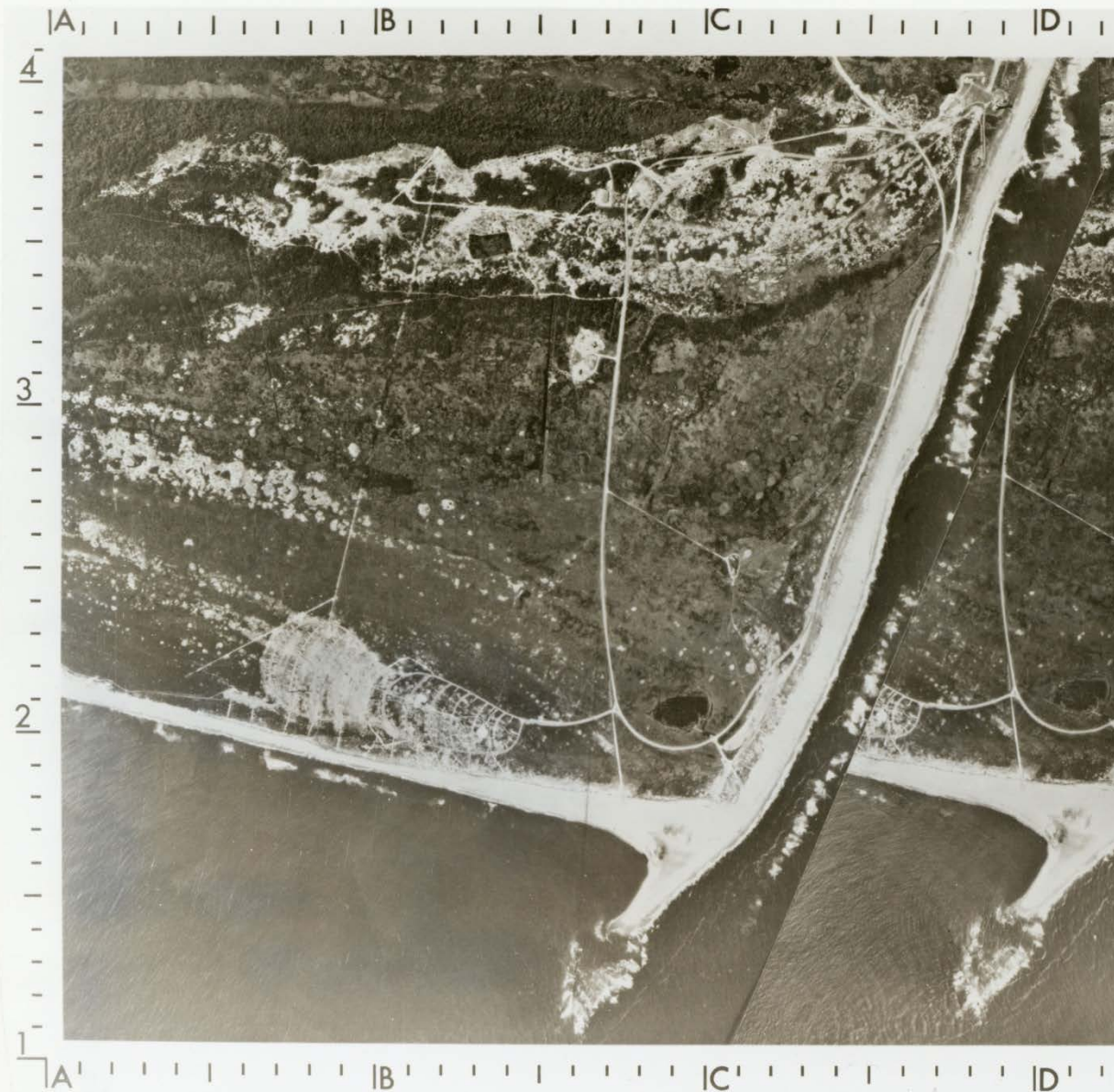


NEG. NO: 58-150 DATE: 7-25-58 PRINT FILE: A/V
GENERAL DESCRIPTION, LOCATION, OTHER PERTINENT DATA

Campers using Cape Hatteras Parking Area
before new campground was ready.

Photograph: NPS Outer Banks Group Museum Resource Center, Manteo, NC
Scan by John Havel July 12, 2012

May 1962



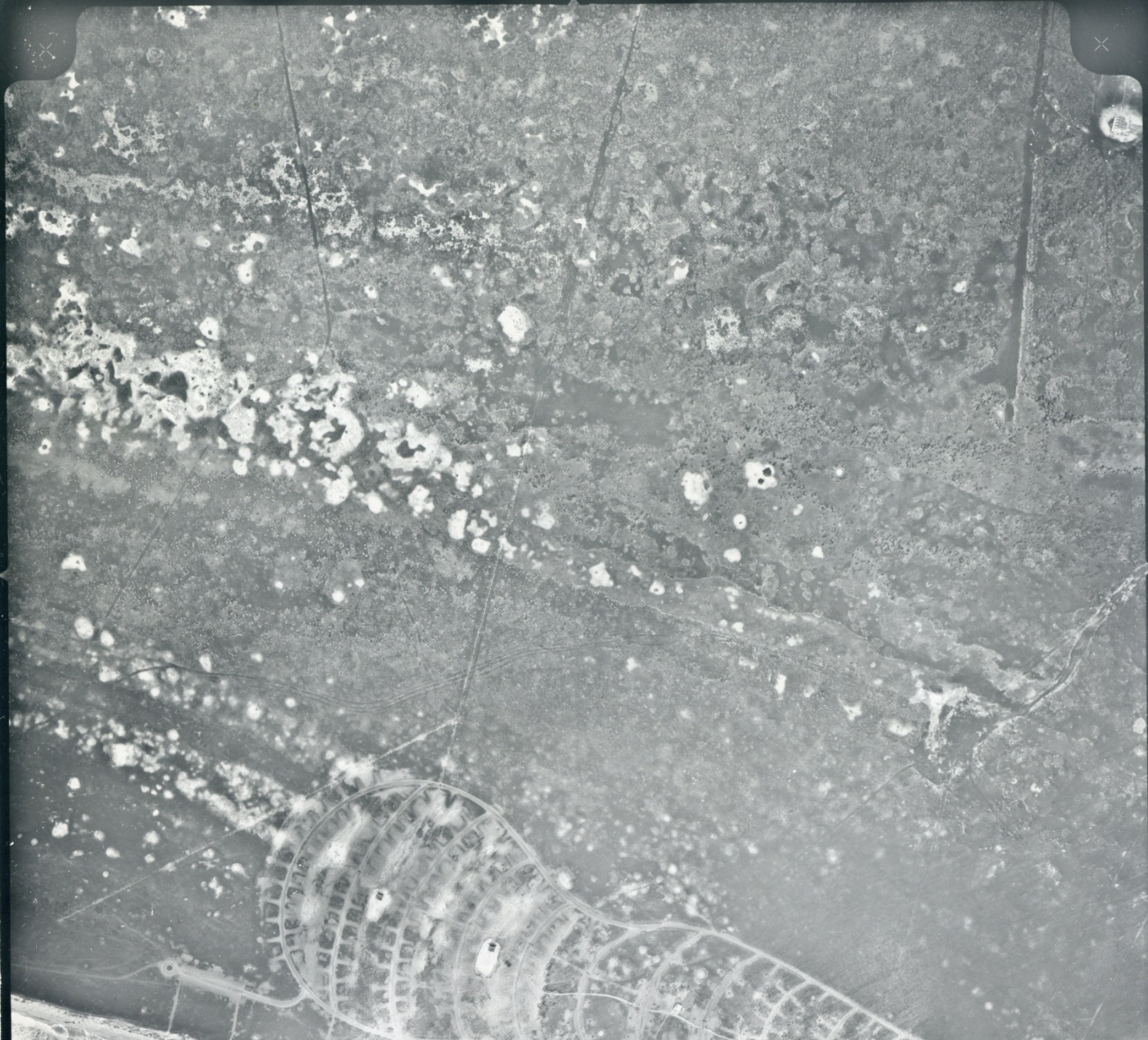
CAPE HATTERAS (1962)
Dare County, North Carolina
May 3, 1962
RF = 1:19,700 H = 10,020

Stereogram No. 611
Prepared from USC & GS P
By the University of Ill
Committee on Aerial Phot

National Park Service



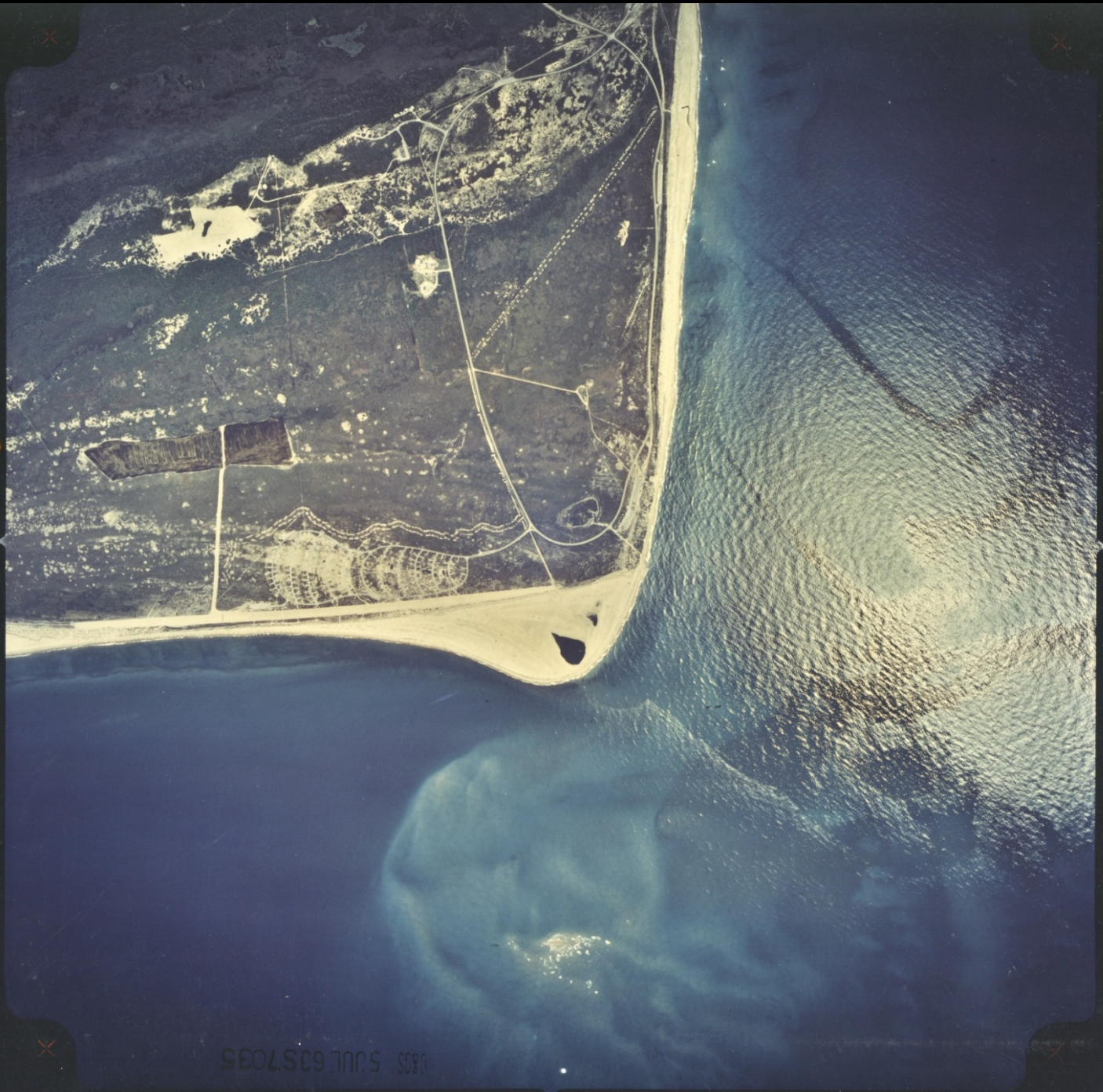
Dec 1962



Nation

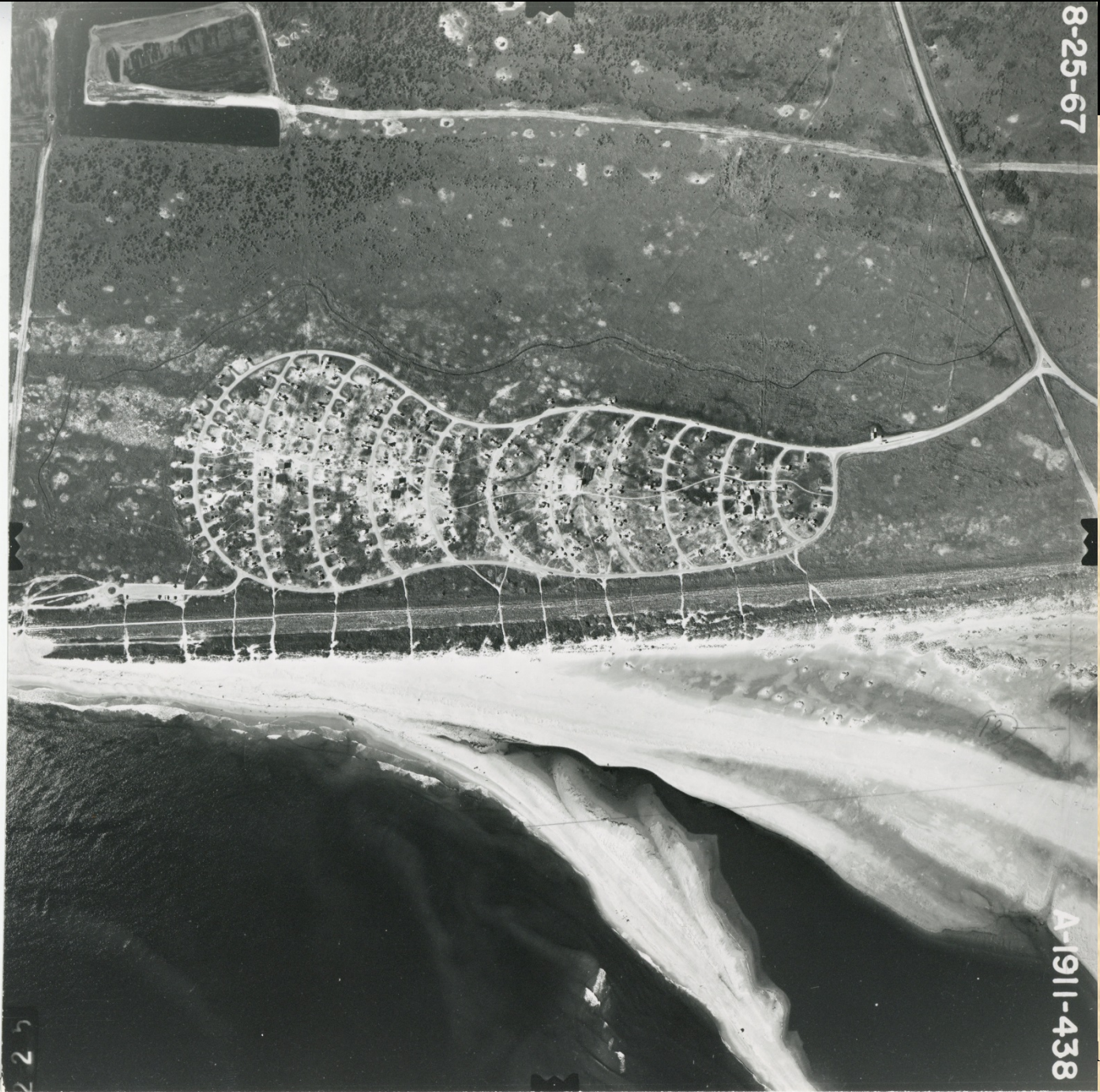
July 1963

100
100
100



Nation

August 1967



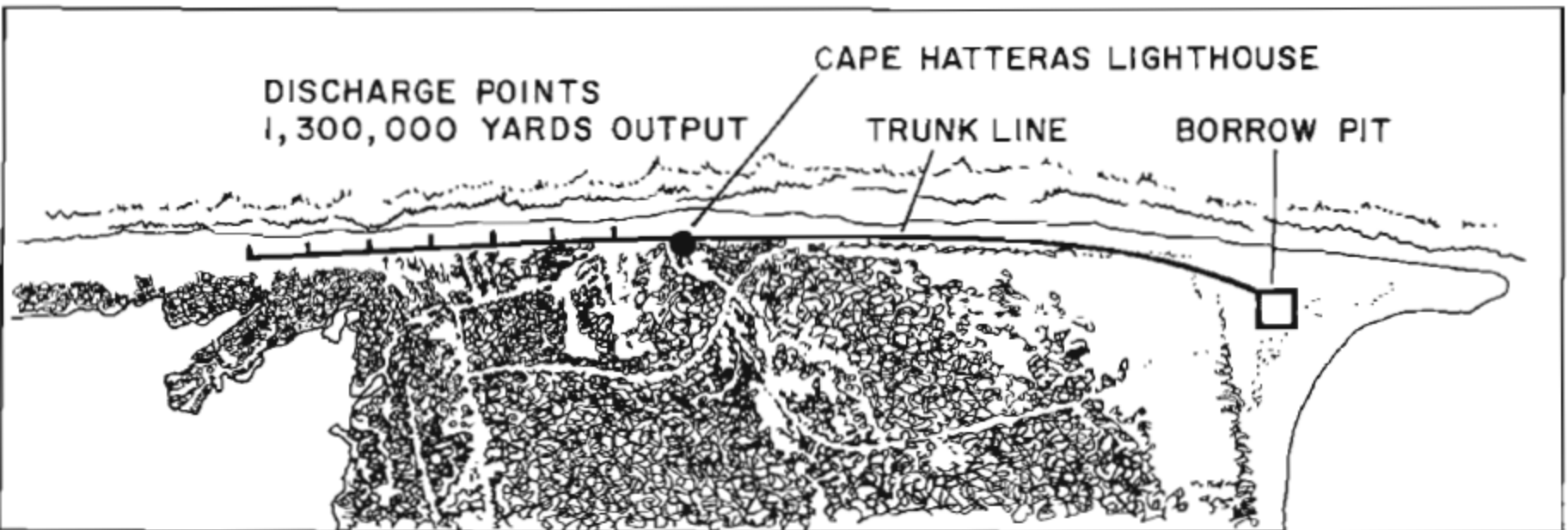
8-25-67

A-1911-438





August 1972



AERIAL PHOTO OF BORROW PIT FRAME NO. 529

DATE: 7/12/73 TIME: 1630

TIDE: High 3.8 ft. (1719) WAVES: NE

WAVE HEIGHT: 1.7 ft.



Over 750,000 yards³ had been excavated from the borrow pit at the time of this photo.

National Park Service



May 1978





FLOOD GATE

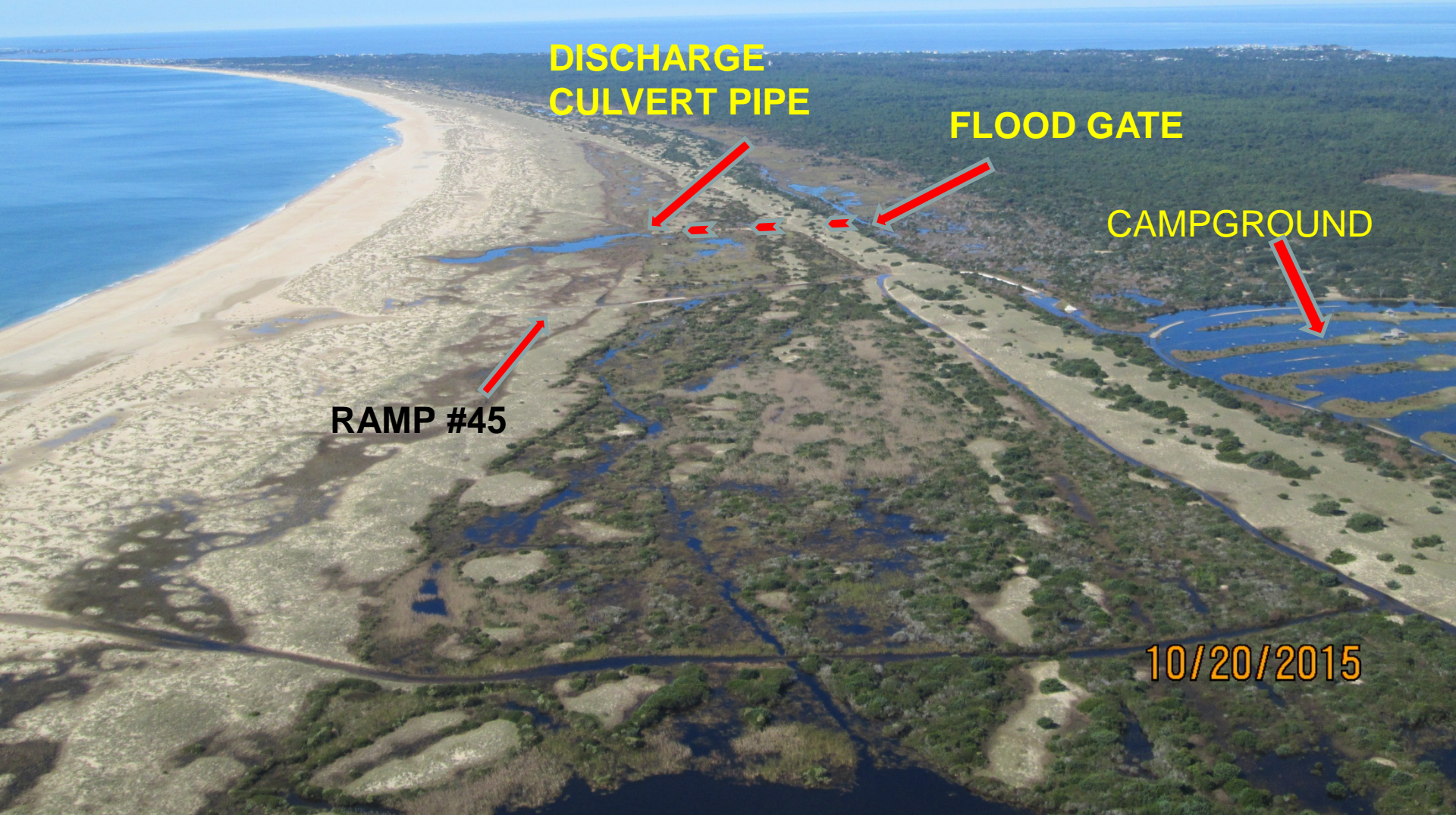
CAMPGROUND

RAMP #45

DISCHARGE

10/20/2015

WHEN GATE IS OPEN WATER FLOWS THROUGH A
CULVERT PIPE THAT RUNS UNDER THE DUNE TO A
DISCHARGE END



**DISCHARGE
CULVERT PIPE**

FLOOD GATE

CAMPGROUND

RAMP #45

10/20/2015



Culvert Pipe
Discharge End

Existing Underground
Culvert Pipe

West of Cape Point Campground



Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klinck, P. E. Director
Division of Water Quality
Colleen H. Sallins, Deputy Director
Division of Water Quality

September 16, 2004

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Jim Ebert
National Resource Manager
National Park Service, Cape Hatteras Group
Manteo, North Carolina 27954

Subject: **Notice of Violation**
Notice of Intent to Enforce
Wetland Draining
Dare County

Dear Mr. Ebert,

On April 28, 2004, Tom Steffens from this office met with you, John Wescott of the National Park Service (NPS) and William Wescott of the U.S. Army Corps of Engineers to discuss the presence of a drainage feature located adjacent to the Cape Hatteras National Seashore Campground. This feature drains through the maritime forest and associated wetlands towards the Atlantic Ocean, under the secondary dune system via a steel culvert, daylight behind the primary dune system and drains directly into the ocean.

Subsequent investigation of this system indicates that the drainage way was opened up by the NPS to allow the waters of the drainage canal to discharge directly into the ocean. Draining of wetlands and subsequent altering of natural hydrology of wetlands is considered a violation of North Carolina Administrative Code 15A NCAC 02B .0231 (b)(5); Wetland Standards; which says:

(5) Hydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands shall be protected to prevent adverse impacts on:

- (A) Water currents, erosion or sedimentation patterns;
- (B) Natural water temperature variations;
- (C) The chemical, nutrient and dissolved oxygen regime of the wetland;
- (D) The movement of aquatic fauna;
- (E) The pH of the wetland; and
- (F) **Water levels or elevations.**

It has been determined by the Division of Water Quality (DWQ) staff that the opening of this drainage way to the ocean and resulting draining of wetlands constitutes a violation of the wetland standard noted above.

July – December of 2015 was a very wet time in North Carolina

<http://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/>

North Carolina Precipitation Rankings, December 2015

« November 2015

January 2016 »

Record Driest	Bottom 1/10	Bottom 1/3	Normal	Top 1/3	Top 1/10	Record Wettest
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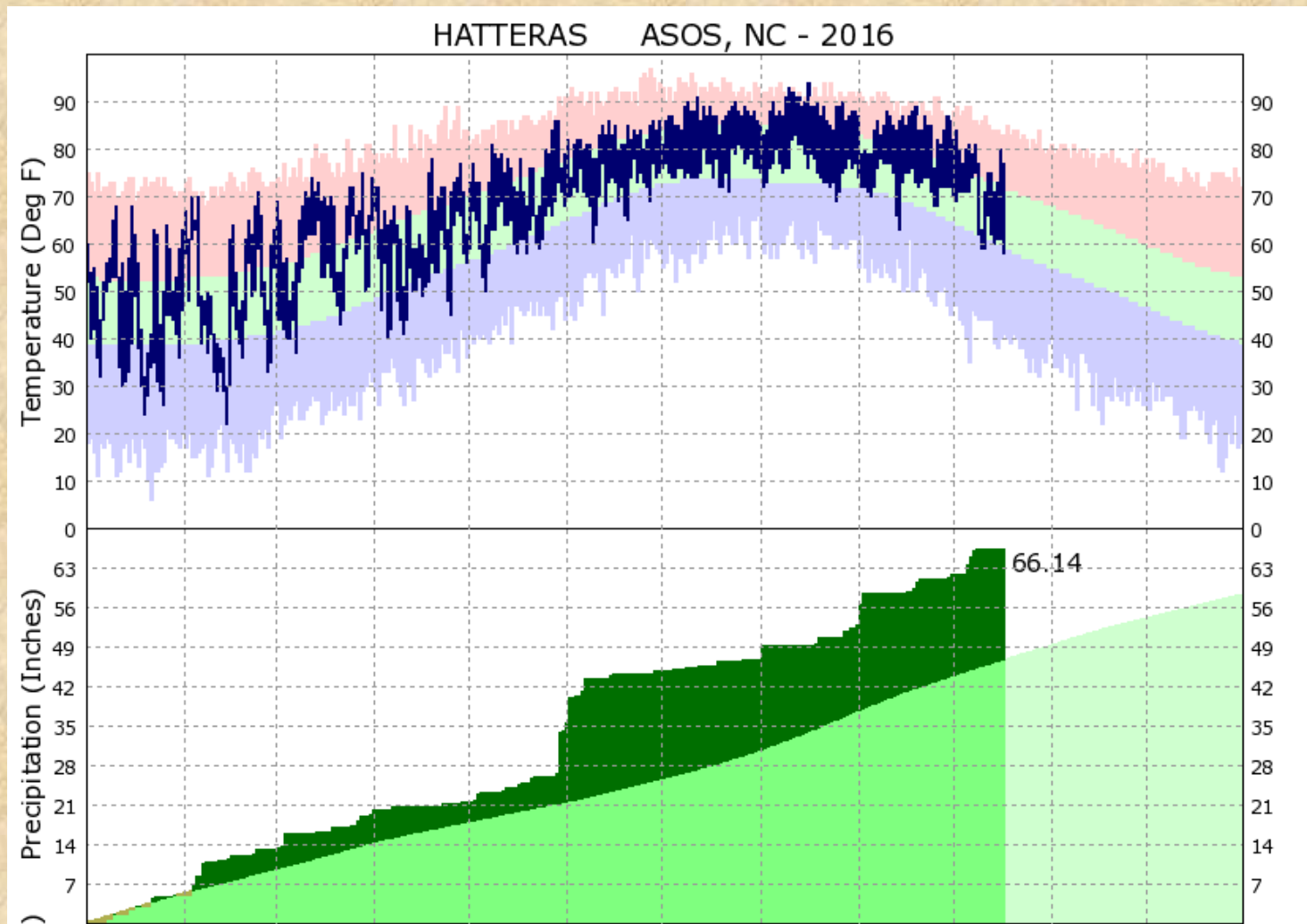
More information on Climatological Rankings

Download: [XML](#)  

PERIOD	PRECIP	20 TH CENTURY AVERAGE	DEPARTURE	RANK	WETTEST/DRIEST SINCE	RECORD
Jul - Dec 2015 6-month period	35.27" (895.86 mm)	25.21" (640.33 mm)	10.06" (255.53 mm)	121 st Driest	Driest since: 2014	2001
				1 st Wettest	Wettest to Date	2015

Precipitation has been above average in 2016

From: National Weather Service: <http://www.weather.gov/images/mhx/KHSE2016plot.png>



An aerial photograph showing a coastal landscape. In the foreground, there is a large area of floodwater interspersed with patches of dry, brownish vegetation. The water appears to be a mix of blue and green, possibly due to algae or submerged plants. In the middle ground, there are more patches of land with some trees and shrubs. In the background, the ocean is visible with white-capped waves breaking against a distant shoreline. The sky is overcast with grey clouds.

FLY OVER 10/20/15

POST STORM FLOOD WATERS
CAPE POINT AND FRISCO

10/06/2015

An aerial photograph showing a large body of water, likely a pond or marsh, with a road running horizontally across the middle. The water is dark blue with patches of brown vegetation. A dirt road or path runs diagonally from the bottom left towards the center. In the background, there are more ponds and a line of trees. A red line points from the text 'HORSE SHOE PONDS' to a small pond in the upper left. The text 'VACINITY OF LORAN STATION ROAD' is centered over the main body of water. The date '10/20/2015' is in the bottom right corner.

**HORSE SHOE
PONDS**

**VACINITY OF LORAN STATION
ROAD**

10/20/2015

RAMP #49 FRISCO



10/20/2015

CAPE POINT CAMPGROUND AND SURROUNDING AREAS



10/20/2015



East Side of Cape Point
Campground



RAMP #44

This aerial photograph captures a coastal landscape. A large, dark blue body of water occupies the upper left. A narrow, winding channel, identified as RAMP #44, flows from the water towards a sandy beach. The beach is light-colored and shows some tracks. In the foreground, the ocean waves are visible, breaking onto the shore. The date 10/20/2015 is printed in the bottom right corner. The aircraft's wing and tail are partially visible at the top and right edges of the frame.

10/20/2015



Cape Point
Campground and
Surrounding Areas



CAPE POINT AREA

10/20/2015



2/5/2016

National Park Service
U.S. Department of the Interior

**Cape Hatteras
National
Seashore**

RAMP

43

Driving Regulations

Observe all posted signs and regulations

- 1. No parking on the beach or dunes
- 2. No driving on the beach or dunes
- 3. No driving on the beach or dunes
- 4. No driving on the beach or dunes
- 5. No driving on the beach or dunes
- 6. No driving on the beach or dunes
- 7. No driving on the beach or dunes
- 8. No driving on the beach or dunes
- 9. No driving on the beach or dunes
- 10. No driving on the beach or dunes

Beach Regulations

Observe all posted signs and regulations

- 1. No swimming
- 2. No swimming
- 3. No swimming
- 4. No swimming
- 5. No swimming
- 6. No swimming
- 7. No swimming
- 8. No swimming
- 9. No swimming
- 10. No swimming

430



ONE WAY

NO
PARKING
ON
GRASS







December 23, 2005

L54(2380)
CAHA/General

Memorandum

To: Superintendent, Cape Hatteras National Seashore

Through: William L. Jackson, Chief, Water Resources Division (WRD) *William L. Jackson*
Gary Rosenlieb, Acting Chief, Water Operations Branch, WRD *Gary Rosenlieb*

From: Larry Martin, Hydrogeologist, Water Operations Branch, WRD *Larry Martin*

Subject: Trip Report for travel to Cape Hatteras National Seashore, November 15-17, 2005

Conclusions:

1. Flooding of roads in the interdunal area is directly related to maintaining high water levels in the interior part of the island, as directed by the NC Division of Water Quality to preserve the hydrological conditions of wetlands.
2. Raising the road elevations in the interdunal area above the normal water level would require large amounts of fill and could be susceptible to erosion during large storms. Wetland compliance review by Park Service, Corps of Engineers, and the State of North Carolina would be required.
3. Water levels in the interdunal area could be lowered by constructing a drain and discharging water directly to the ocean, although this would be contrary to North Carolina law and NPS management policies.
4. Preliminary data indicates that direct discharge to the ocean is a source of pollution and might require closing of beaches and posting of shellfishing and swimming advisories.
5. Rerouting the beach access roads to higher elevation areas could provide more reliable ORV access to the beaches without dewatering wetlands or discharging contaminated water to the ocean. The feasibility of rerouting the roads has not been fully explored.

December 13, 2006

L54(2380)
CAHA/General

Memorandum

To: Thayer Broili, Chief of Resource Management, Cape Hatteras National Seashore

From: Larry Martin, Hydrogeologist, Water Operations Branch, WRD

Subject: Issues related to water quality in the Cape Point area

Conclusions

There is no evidence to indicate the septic leachfields at the Cape Point campground contribute to the presence or concentration of enterococci bacteria in adjacent surface water bodies. Most of the samples are within the range of 10-100 colonies/100 ml. Most of the higher concentrations are correlated to preceding rainfall that might contribute to flushing bacteria into the surface waters, or mobilizing bacteria already present. There are a few samples that appear to be anomalously high, for which no explanation is offered.

The only site that had bacteria concentrations consistently above background was St. Peters Ditch at the intersection of Forest Road and Hwy 12. St. Peters Ditch drains groundwater from heavily-developed, privately-owned areas having individual septic leachfields.

Larry Martin
NPS-WRD
April 2010

Flooding Issues at Cape Point Campground Cape Hatteras National Seashore

In a previous memo to the park (December 23, 2005), I provided a summary of the issue and the hydrology of the Cape Point area. I also presented alternatives to alleviate the impact of flooding on beach access via interdunal roads. Those same alternatives apply to reducing the impact of flooding at the Cape Point campground. Briefly, those alternatives are;

1. Reactivate the system of drainage ditches and discharge flood water to the ocean.
2. Raise the elevation of the campground.
3. Relocate the campground to higher ground.

None of these alternatives seem very reasonable. The only remaining alternative is “no action”. Simply accept the fact that the campground will sometimes be flooded and unusable.

In this report, I will demonstrate that the flooding is primarily a result of high water table conditions following wet periods. I will also show that the frequency and duration of flooding will continue to increase as sea level rises.

Summary

Flooding at the Cape Point campground is the result of natural hydrologic processes. The water table rises during wet periods. When the water table is higher than land surface, the area will be flooded. The frequency and duration of flooding can be expected to increase as sea level rises.

From Martin 2010

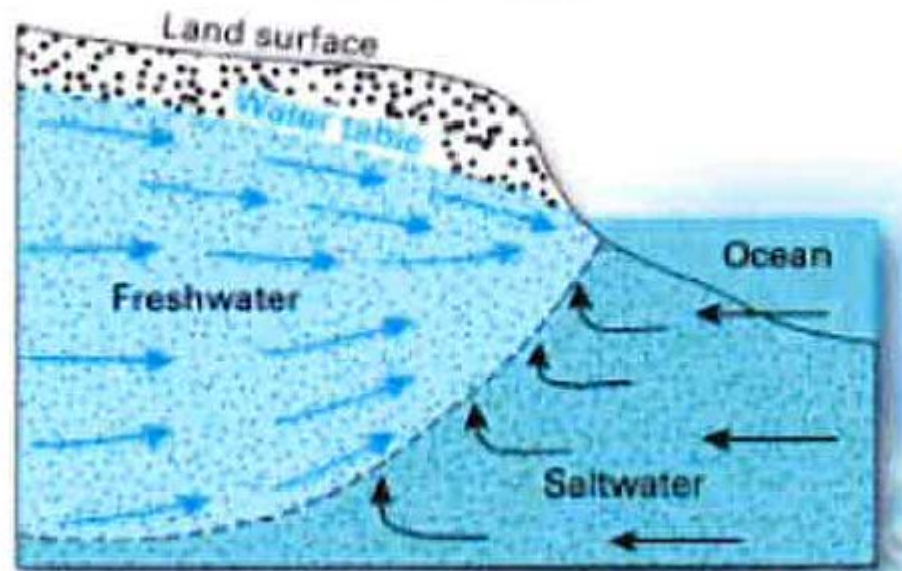
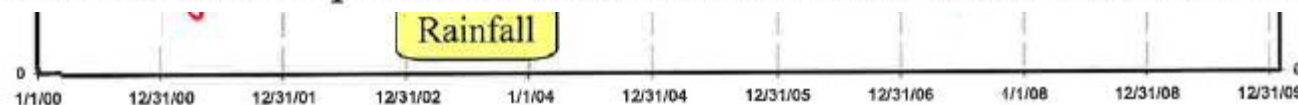


Figure 6. Relationship of freshwater and saltwater at the ocean shoreline.



A highly dynamic area that is eroding

PHOTO INTERPRETATION OF SHORELINE CHANGES BETWEEN CAPES HATTERAS AND FEAR (NORTH CAROLINA)

MOHAMED T. EL-ASHRY AND HAROLD R. WANLESS

TABLE I

DIMENSION CHANGES IN CAPES HATTERAS, LOOKOUT AND FEAR

Marine Geol., 6 (1968) 347-379

<i>Location</i>	<i>Changes in Cape Hatteras (ft.)</i>						<i>net change</i>
	<i>1852- 1872</i>	<i>1872- 1917</i>	<i>1917- 1939</i>	<i>1939- 1945</i>	<i>1949- 1953</i>	<i>1953- 1962</i>	
Beach just north of cape	-700	-1,800	+450	0	+300	0	-1,750
Beach 1/2 mile west of cape	+900	+2,100	0	-1,200	-1,200	-800	-200
Southward extension of cape point	-2,100	+3,200	+900	-4,100	-1,100	+700	-2,500
Eastward extension of cape point	-700	-1,200	-200	+600	+1,600	-2,500	-2,400

National Park Service



April 1963

HAVEL
RESEARCH
IMAGES



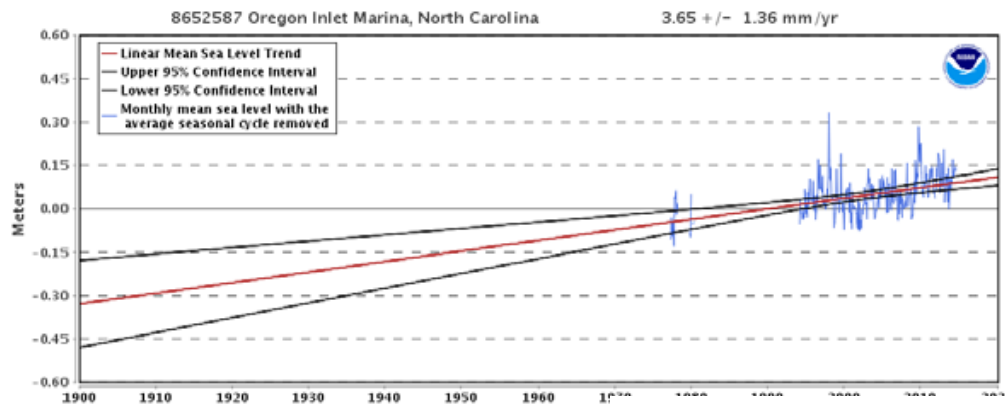
NEG. NO: 63-89 DATE: 4-63 PRINT FILE: A/E, s.f.
GENERAL DESCRIPTION, LOCATION, OTHER PERTINENT DATA

Superintendent Myers observing beach erosion at
Cape Point Amphitheater.

Negative by: Rundell

Photograph: NPS Outer Banks Group Museum Resource Center, Manteo, NC
Scan by John Havel July 12, 2012

Sea level has risen 3.65 mm/year at Oregon Inlet and 4.57 mm/year at Duck over about 37 years.



<https://deq.nc.gov/about/divisions/coastal-management/coastal-resources-commission/sea-level-rise-study-update>

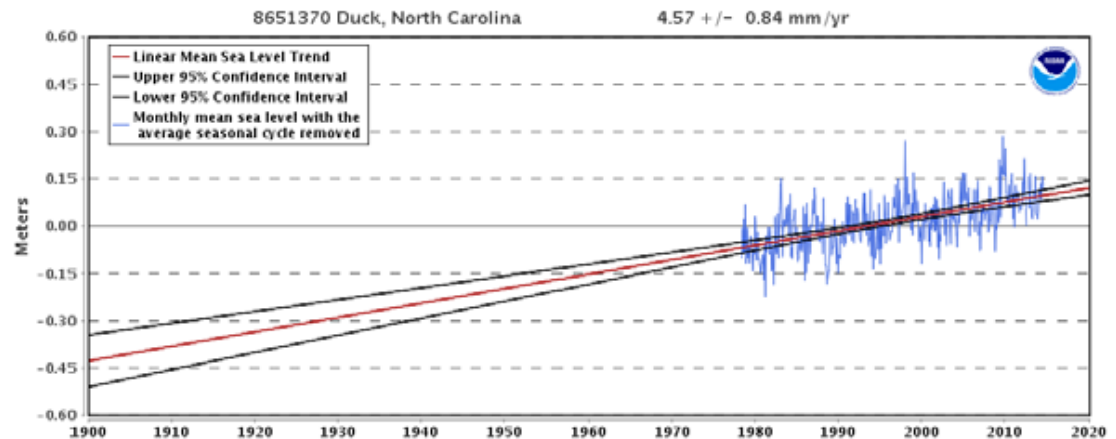


Table from: *N.C. Coastal Resources Commission Science Panel. 2015. Sea Level Rise Assessment Report – 2015 Update to the 2010 report and 2012 addendum.*

Station	Tide Gauge Projections		IPCC RCP 2.6 + VLM		IPCC RCP 8.5 + VLM	
	RSLR in 30 years (inches)		RSLR in 30 years (inches)		RSLR in 30 years (inches)	
	Mean	Range	Mean	Range	Mean	Range
Duck	5.4	4.4-6.4	7.1	4.8-9.4	8.1	5.5-10.6
Oregon Inlet	4.3	2.7-5.9	6.3	3.9-8.7	7.3	4.7-9.9
Beaufort	3.2	2.8-3.6	6.5	4.2-8.7	7.5	5.0-10.0
Wilmington	2.4	2.0-2.8	5.8	3.5-8.0	6.8	4.3-9.3
Southport	2.4	1.9-2.8	5.9	3.7-8.2	6.9	4.4-9.4

**Note: Projections were rounded to the nearest tenth of an inch.*



Goals for our planning process:

1. Review best available data on **hydrology, water quality, and elevation**
2. Understand the **constraints** that may affect the viability of certain management actions
3. Develop a **range of alternatives** that would mitigate impacts of flooding on visitor and administrative facilities
4. Develop a **preferred alternative** that can be **supported by our Interagency Team**

Alternatives to be considered:



- Raising of fa
- Others water management ideas?



Public Scoping Comments

- Deadline November 4
- Fill out comment sheet here or online
- Planning, Environment and Public Comment website:

https://parkplanning.nps.gov/caha_cape_point_flood_mitigation



Timeline

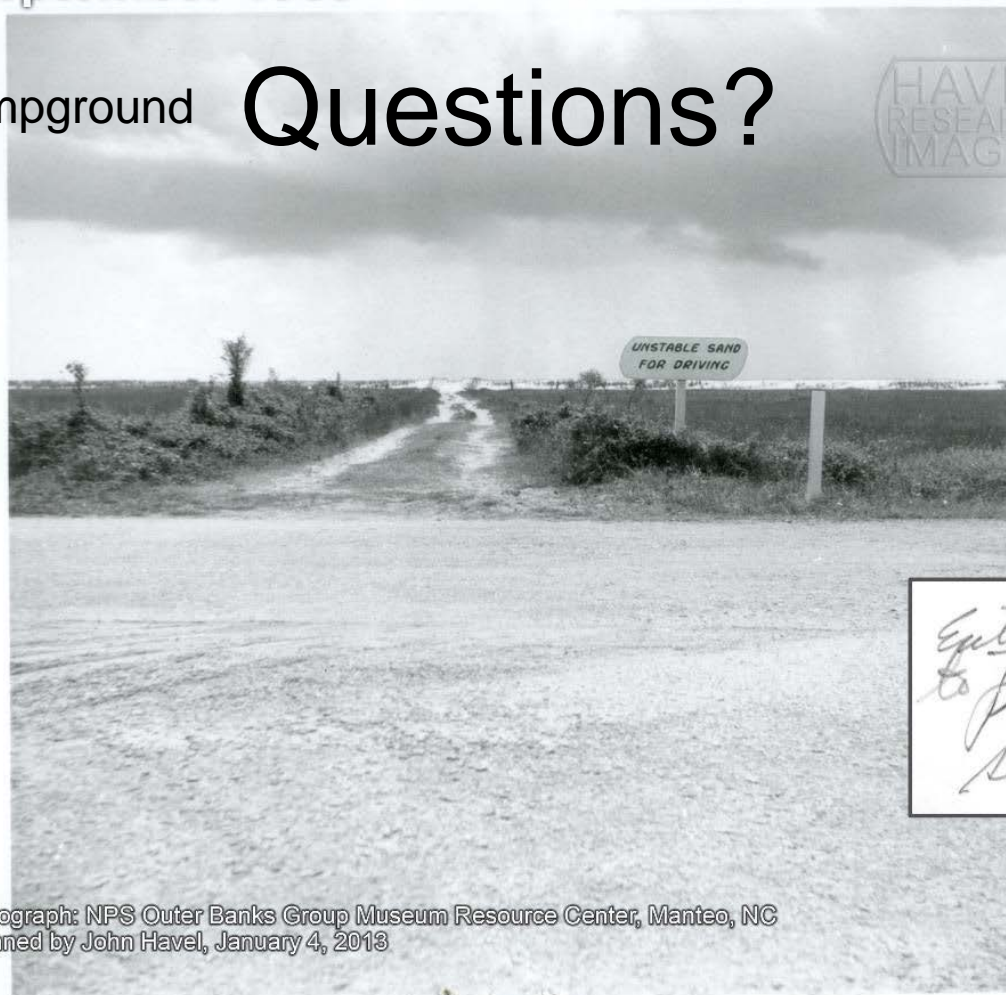
1. Agency Scoping: **Fall 2016**
2. Public Scoping: **Fall 2016**
3. Data Acquisition: **ongoing**
4. Alternatives Planning: **Winter 2016/2017**
5. Environmental Review Document: **Summer/Fall 2017**
6. Decision Document: **Fall/Winter 2017**

Thank you: John Havel, National Weather Service

September 1959

Questions?

HAVEL
RESEARCH
IMAGES



Photograph: NPS Outer Banks Group Museum Resource Center, Manteo, NC
Scanned by John Havel, January 4, 2013

SEPT 1959

