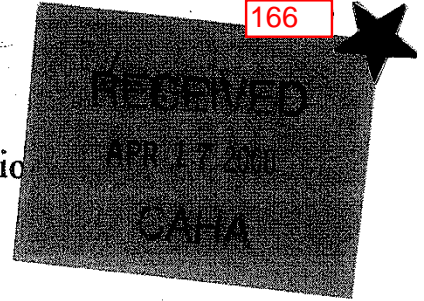




IN REPLY REFER TO:

United States Department of the Interior

NATIONAL PARK SERVICE
 Water Resources Division
 1201 Oak Ridge Drive, Suite 250
 Fort Collins, Colorado 80525-5596



March 28, 2000

L54(2380)
 CAHA/General

Memorandum

To: Superintendent, Cape Hatteras National Seashore

Through: William L. Jackson, Chief, Water Operations Branch

From: Larry Martin, Hydrologist, Water Operations Branch
 Gary Smillie, Hydrologist, Water Operations Branch

Subject: Trip Report for Cape Hatteras National Seashore, March 14-16, 2000

William L. Jackson
Larry Martin
Gary M. Smillie

PURPOSE: The purpose of this trip was to evaluate the network of drainage ditches on the southeast part of Hatteras Island and discuss flooding problems at the campground and on interdunal roads.

SUMMARY: The interdunal roads at Ramps 45 and 49 are flooded several times each year as a result of high water table conditions following periods of heavy rainfall. Since the flooded areas are essentially points of intersection with the local ground water, draining water from these areas is difficult and would affect hydroperiods of nearby areas. For these reasons, it is recommended that roadways be elevated for short distances through the low-lying areas to reduce flooding from high water table conditions. The network of drainage ditches in the southeast part of Hatteras Island, in the vicinity of the Cape Point Campground, can be modified to result in less environmental impact and more efficient drainage of the campground. The drainage ditch west of the floodgate should be dammed to prevent draining surface water from the undeveloped wetland areas west of the campground. Dams should also be placed in the drainage ditch between the ranger station and the campground entrance to eliminate draining surface water from the area south of the lighthouse and west and south of the ranger station. Dams should be constructed of loose sand or sandbags to allow quick and easy removal if unexpected consequences occur. Hydrologic monitoring will continue to evaluate the effectiveness of the drainage ditches.

DISCUSSION:

In general, flooding of low-lying areas of Hatteras Island should not necessarily be considered a result of poorly designed or poorly functioning drainage infrastructure. Most flooding on the island is the result of the intersection of high water table elevations with topographically low areas. High water table conditions are common on the island and result from rainfall percolation during wet periods. Natural drainage of high groundwater levels is accomplished by flow of water through the sand to the ocean. Surface ponding occurs until the drainage of ground water is sufficient to lower the water table to an elevation below the low surface topography. This process is slow compared to surface runoff and is the reason that ponding and inundation of low-lying areas can continue for days after the end of a rainy period.

Providing drainage for "nuisance" surface water (when it is really just an expression of ground water) is more difficult than the more usual storm water drainage problem of removal of excess surface water. The difficulties are caused by a lack of ability to drain surface water into the subsurface and by the replacement of drained surface water by groundwater seepage. On Hatteras Island, utilization of drainage ditches is the most common means of removing flood waters from low-lying areas. However, the relatively low relief of the island limits the opportunity to cut deeper ditches while still maintaining sufficient slope for rapid drainage. Given these factors, it is not surprising that inundation of certain areas of the park occur regularly and can be persistent. However ineffective, the ditches on Hatteras Island do expedite, to some extent, the lowering of ground water and associated surface flood waters. It should be noted, however, that accelerating the rate of water table decline following storms has an impact on hydroperiods (periods of saturation and ponding) in surrounding areas. This has potential to cause adverse impacts to vegetation dependent upon those conditions. For this reason, we believe that the park should attempt to adapt the infrastructure and visitor use patterns to be compatible with natural, periodic, high water conditions wherever possible, rather than provide for unnatural drainage of ground water. This strategy guides the recommendations made in the following sections.

Ramp 49

Beach access via Ramp 49, south of the Frisco Campground, is sometimes difficult due to flooding of the road in the interdunal area. The access road to the beach is routed through a low-lying interdunal area between the campground and the beach access at Ramp 49. During wet periods when the water table is high, this area is naturally flooded due to the high water table conditions and the low-lying topography. An attempt could be made to reroute the road on higher ground, but it must almost certainly pass through some low-lying interdunal areas. Continued driving across any route makes the disturbed sand more susceptible to erosion, eventually resulting in lower elevation and flooding along the new route. Other options that are more compatible with periodic, high water tables include hauling in sand or other permeable fill to raise the elevation of the road in low-lying areas or closing beach access in this area when the road is flooded. Road closure is strictly a park management call and its feasibility cannot be assessed here. Elevating the road surface on a porous fill would be effective and result in little or no interference with natural processes. Any attempt to raise the elevation of the roadway through the interdunal area must

include some type of framework, such as posts or beams, to contain the fill material to the elevated portion of the roadway. Otherwise, continued driving across unconsolidated fill material would result in the fill being pushed to the side of the road, eventually working its way back to lower topographic elevations.

There has been some discussion about the possibility of low-lying areas near Ramp 49 being drained by opening ditches further east near the Cape Point Campground. Physical inspection of the area suggests that this is not the case. The distance from the drainage ditches at Cape Point to Ramp 49 is about 2 miles, whereas the distance from the low-lying areas to the ocean is about 1000 feet. Groundwater flow near Ramp 49 is toward the ocean, not parallel to the shoreline. The elevation of the water table at Ramp 49 is controlled by the distance to the ocean, not by a ditch 2 miles away. Any perceived cause and effect relationship between road flooding at Ramp 49 and operation of the headgate on the drainage ditch near the Cape Point Campground is coincidental.

Ramp 45

The roadway south of Ramp 45 is periodically flooded where it passes through a low-lying area northeast of a large pond. This flooding is the result of high water table conditions following heavy rainfall. Flooding problems in this area could be alleviated by building an elevated roadway through the low-lying area, as described above. There may also be an opportunity to reroute the road to avoid the low-lying area by routing the road due east, immediately south of the ramp, and accessing the beach further north than the current access. Detailed surveying would be needed to determine if such an alternate route would provide adequate topography to alleviate flooding of the roadway.

There was some discussion about whether opening the floodgate to drain ditches around the campground could alleviate flooding south of Ramp 45. Flooding at Ramp 45 is caused by high water table conditions. Opening the floodgate would lower the water table in the vicinity of the campground north of Ramp 45, but it would still take some time for the water table south of Ramp 45 to be lowered by seepage of ground water to the ocean. That is, we could intercept ground water upstream and prevent it from flowing toward Ramp 45. Flooding south of Ramp 45 would still be a problem, although for shorter periods. There would be additional environmental impacts associated with opening the floodgate for longer time periods to intercept this "upstream" ground water from flowing south toward the Ramp 45 area.

Cape Point Campground Drainage Ditch Network

The southeast part of Hatteras Island, that part south and southwest of the lighthouse and in the vicinity of the campground, has a network of drainage ditches. These ditches function to drain water from the wetlands and the campground during wet periods when high water table conditions would otherwise result in flooding. Outflow from the drainage ditches is controlled by a headgate where the ditches enter a culvert running under the dune field to the ocean. The headgate is located about half a mile west of the campground. When flooding occurs in the campground area, the headgate is opened, allowing water to drain to the ocean. The network of drainage ditches may be

far more extensive than is needed to drain water from the campground area. For example, it appears that the wetland areas west and east of the ranger station and possibly the area near Horseshoe Pond are being drained. The drainage ditches extend some distance west from the headgate, draining wetland areas where there is no development or infrastructure that could be affected by flooding. Draining these areas causes an unnecessary impact on park resources and increases the time required to drain water from the campground area. If the network of drainage ditches were limited to the campground area only, drainage would occur much faster.

During the past year, water elevations and hydrologic conditions have been monitored at several locations on the drainage ditch network. These data provide a baseline for comparison with data that could be collected to monitor the effectiveness and environmental impact of damming some of the ditches to reduce the area being drained.

The drainage ditch extending west of the headgate should be dammed. Allowing this area to flood would result in restoration of natural hydrologic conditions. And eliminating this area from the drainage network should reduce the amount of time necessary to keep the headgate open.

Dams could be placed in the ditch along the road between the ranger station and the campground entrance to eliminate draining a large area north and east of the campground. Proposed dam locations include: the box culvert under the road south of the ranger station, the ditch on the west side of the road just south of the box culvert, and the ditch on the west side of the road just north of the campground entrance. Placing dams in these areas should effectively eliminate draining the wetland areas east of the road and south of the lighthouse. It should also greatly reduce drainage from the wetland areas west and south of the ranger station on the west side of the road.

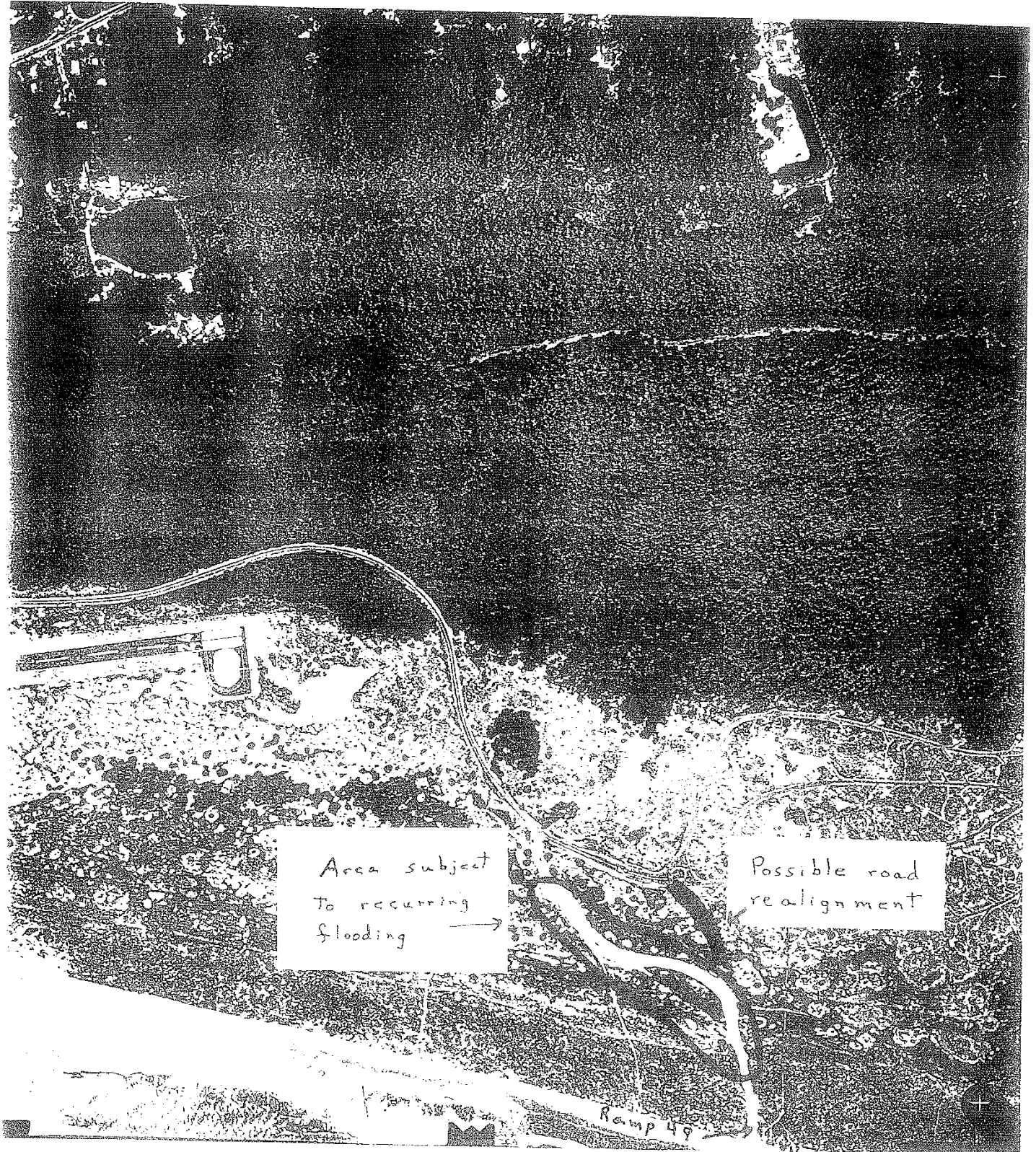
Dams could be constructed by dumping several truckloads of fill material or sandbags in ditches at selected locations. The fill material could quickly and easily be removed with a backhoe, restoring the drainage network to its current configuration, if undesired impacts occur.

ACTION ITEMS:

1. Continue to assist the park in evaluating the effect of the existing network of drainage ditches at the Cape Point Campground. Responsible party: L. Martin. To be completed as needed.
2. Continue hydrologic monitoring to evaluate effectiveness and environmental impact of damming. Responsible Party: Park Staff. To Be Completed By: Ongoing.

Attachments: 3

cc:
CAHA - Harrison, Watson, Lyons ✓
2380 - Kimball, Flora

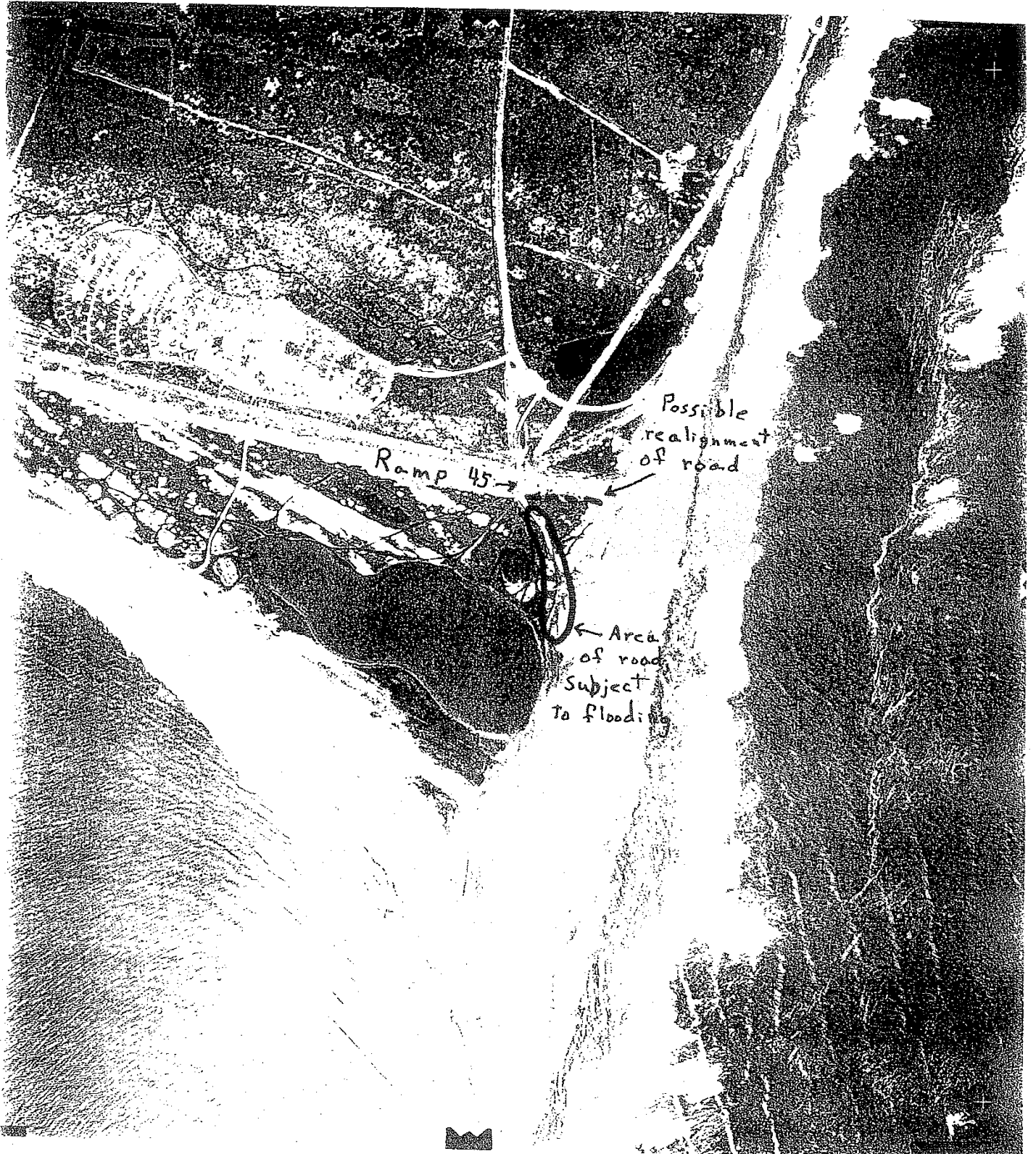


Area subject
to recurring
flooding →

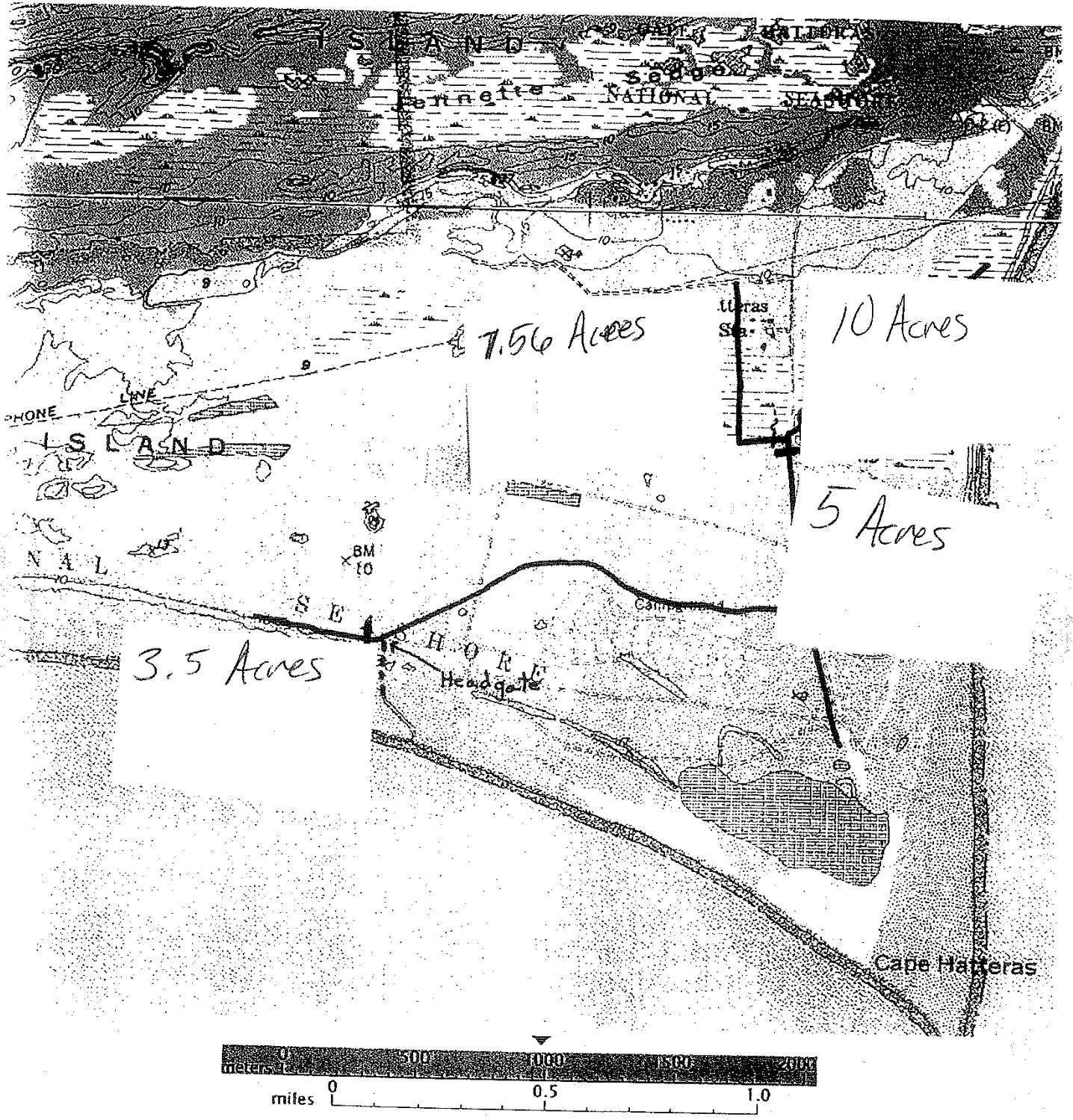
Possible road
realignment

Ramp 49

Ramp 49



Ramp 45



Existing drainage ditches near Cape Point Campground and proposed dam locations

