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CAHA/General

Memorandum

To: Superintendent, Cape Hatteras National Seashore

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

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

Subject: Trip Report for travel to Cape Hatteras National Seashore, November 15-17, 2005
Recommendations for reducing flooding in the vicinity of Cape Hatteras

Summary: One of the NPS management objectives in the Cape Point area is reducing flooding of the campground and interdunal roads while minimizing the hydrologic disturbance to adjacent wetland areas. Multiple ORV access routes through the interdunal area are desired to reduce conflicts between ORV use and beach closures for resource protection. The only actions which will provide more reliable ORV access to the beaches are rerouting or raising the roads to an elevation higher than the normal high-water levels or construction of a drainage ditch to effectuate flow of standing water from the interdunal area to the ocean. Drainage of water would cause adverse impacts to wetlands and would be contrary to North Carolina state law. It would also be contrary to NPS management policies.

The hydrology of the Cape Point area has been highly manipulated by construction of drainage ditches, excavation of sand for beach nourishment resulting in formation of ponds, and construction of artificial dunes. The area is very dynamic; undergoing rapid geomorphic change with every nor'easter and hurricane. Rising sea level will likely hasten the rate of geomorphic change in the next few decades. These geomorphic changes may make maintenance of the campground and beach access roads through the interdunal area a moot issue within a few years or decades.

Discussion: Providing ORV access to the beaches at Cape Hatteras has been an issue for several years. The problem is exacerbated by closure of some areas of the beach for resource protection (terns, piping plovers, turtle nests) and flooding of some of the beach access roads. Beach closures and flooded access roads can, separately or in combination, result in limiting access to large areas of the beach and leads to conflicts between visitor access and resource protection. The park desires to have multiple ORV access routes through the interdunal areas to the beach. ORV access is less restricted with multiple access routes if it is necessary to close sections of the beach for resource protection.

There is a network of drainage ditches around the campground and along the road south of the lighthouse toward the Cape. In the past, when the area flooded, the headgate west of the campground would be opened and water would drain through a 36-inch culvert under the dunes (Figure 1). A drainage ditch from the outfall of the culvert to the ocean would be dug to speed the drainage. When the water level in the campground and along the roads had receded, the headgate would be closed and the action of waves would quickly fill the drainage ditch on the beach face.



Figure 1. Major drainage ditches in the vicinity of the Cape Point Campground. When the headgate is open, water is drained from a large area of freshwater wetlands north and west of the campground. Additionally, when a ditch is opened to allow discharge to the ocean, water is drained from marine wetlands in the interdunal area south of the campground.

After Hurricane Isabel in September 2003, the park opened two additional drainage ditches on the east-facing beach south of the lighthouse and north of Ramp 43 to alleviate flooding. The park also opened the headgate west of the campground and opened a drainage ditch from the outfall of the culvert to the ocean on the south beach. Following a complaint from the North

Carolina Coastal Federation, the two drainage ditches on the east-facing beach were closed. The drainage ditch west of the campground continued discharging to the ocean on the south-facing beach. In April of 2004, officials from the North Carolina Division of Water Quality and the U.S. Army Corps of Engineers visited the area and reviewed the drainage ditch system with park staff. The park was subsequently issued a Notice of Violation for draining of wetlands. Park staff closed the headgate and placed sandbags against the headgate to limit the flow of water from the drainage ditches to the interdunal area and the ocean. Wave action on the south beach has completely filled the drainage ditch across the beach face.

Since the closure of the drainage ditch, interdunal roads south of the campground have been flooded almost constantly. Flooding is a result of high water levels in the low-lying areas. Flow of water out of the area (in the absence of the ditch across the beach face) is controlled by the rate at which the water can percolate through the sand dunes and beach sand and flow toward the ocean as groundwater. Because the flooded areas are only a few feet above sea level, the gradient, and therefore the rate of groundwater flow, is very low. The problem is further exacerbated by ponding of water in the areas north and west of the campground that were previously drained by the ditches. With water levels in these areas now maintained at higher levels, it becomes a nearly constant source of groundwater flowing from the interior parts of the island toward the ocean. Higher groundwater levels in the interior part of the island cause groundwater levels in the interdunal area to be higher, causing flooding in the low-lying areas. Under the current conditions (with the headgate closed) the interdunal roads (Salt Pond Road, Ramp 45, and Culvert Ditch Road) will remain flooded nearly all of the time as has occurred during the past 1½ years as illustrated in Figure 2.

In the past, the headgate on the drainage ditches would be opened when flooding occurred and the water levels would be quickly lowered to mimic dry conditions with lower water table elevation and dry roads in the interdunal area. Since the headgate is no longer opened, high water conditions persist much longer, with the result that the interdunal roads remain flooded for long periods. The locations of interdunal roads and the general area where flooding is a problem are shown on Figure 3, with a more detailed view of the area in Figure 4.

The only remedies to the flooding of the interdunal roads are to reroute the roads to a higher elevation, raise the elevation of the roads above the typical water level, or to open a ditch to the ocean to allow faster drainage and lower water levels in the interdunal area.

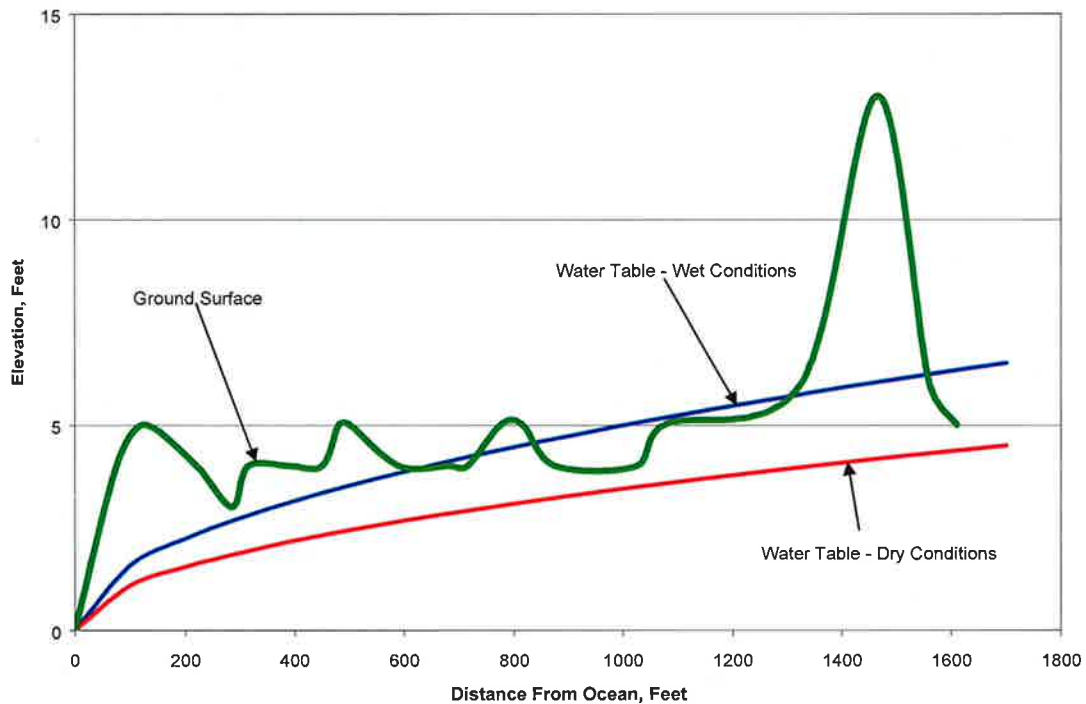


Figure 2. Schematic South to North Cross Section in the vicinity of the drainage ditch outfall and headgate, west of the campground.

When the interdunal roads south of the campground are flooded, ORV access to the beaches is generally limited to the east-facing beach. There is generally no access to the south-facing beach from the east-facing beach. Outflow from the large pond usually creates an impassable barrier around the southernmost tip of the cape.

Raising the elevation of the interdunal roads seems problematic in that it would require several feet of fill on about two miles of road to make all of the roads usable. Fill material is in very short supply on Hatteras Island. Building and maintaining elevated roads would be very expensive. It might be possible to raise selected areas of the interdunal roads, for example Ramp 45, to provide better access in selected areas during high water conditions. Elevated roads may be more susceptible to erosion during storms due to their exposure. Raising the elevation of roads would almost certainly include widening the roads to achieve the desired elevation gain. Placing fill in wetland areas to widen the roads would trigger wetland compliance review by the National Park Service, Corps of Engineers, and the State of North Carolina.



Figure 3. Interdunal Roads and Beach Access in the Cape Point Area.

Constructing a drainage ditch from the pond at the outfall of the existing culvert to the ocean would maintain dry roads through the interdunal area most of the time. There would still be short periods when high water would cause the roads to be closed, but the duration and frequency of flooding would be much less. The drainage system could be designed to remove water from only the interdunal area, or to include drainage of the campground and adjacent areas. A pipe could be buried across the beach face that would facilitate drainage of water from the flooded areas without disrupting ORV access along the beach. Construction of a drainage ditch with discharge to the ocean would result in artificial drainage of wetland areas and therefore be contrary to regulations of the North Carolina Division of Water Quality and NPS management policies.



Figure 4. Detailed view of the area where interdunal roads are most susceptible to flooding. The main drainage ditch can be seen north of the primary dune and north of the campground. On this photo the outfall pond nearly reaches the ocean. In November 2005, the most seaward extent of the outfall pond is about coincident with the vegetation marking the upper extent of the active beach face. The area of primary concern with respect to interdunal road flooding is between the primary dune (the E-W linear feature south of the campground) and the beach face.

There has been no systematic water-quality monitoring of effluent discharged to the ocean during periods when the ditch was flowing to the ocean. Preliminary results of current bacterial testing of water in the drainage ditches in the vicinity of the campground indicates that enterococcus bacteria are sometimes present in concentrations exceeding North Carolina standards for swimming and shellfishing. If this water was discharged to the ocean, it would require posting advisory notices for swimming and shellfishing and possibly closing sections of the beach.

It would be nearly impossible to drain floodwaters from the campground and the paved road east of the campground without also draining adjacent wetland areas. Sections of the drainage ditches beyond the campground could be dammed to limit the area of drainage, but some wetland areas would still be affected. In order for drainage to be effective, it would be necessary to discharge water to the ocean. If water were merely drained from the campground area and discharged in the interdunal area, interdunal roads would remain flooded most of the time.

Rising sea level also contributes to higher water levels in the interdunal area. As sea level rises, the base level for groundwater discharge rises and water levels in the interdunal area, and throughout the island, gets backed up to higher elevations.

Applicable Law and Policy

Draining of wetlands and subsequent altering of the natural hydrology of wetlands is a violation of North Carolina Administrative Code 15A NCAC 02B.0231 (b) (5) (F); Wetland Standards: which states:

- (5) Hydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands shall be protected to prevent adverse impacts on:
 - ...(F) Water levels or elevations

In September 2004, NPS was issued a Notice of Violation from the NC Division of Water Quality for draining the wetland areas in the vicinity of the campground via the ditch system and discharging the water to the ocean. NC Division of Water Quality staff stated (phone conversation with Kyle Barnes) that the permitting process for altering the hydrologic function of the wetlands in the area would begin with NPS submitting a "Preconstruction Notification." The Division of Water Quality would coordinate review of the proposal with the U.S. Army Corps of Engineers and 5 other state agencies along with public review and comment requirements (including preparation of the EA and EIS) of the State Environmental Policy Act of 1971 (SEPA).

The North Carolina Division of Coastal Management would review any proposal for draining wetlands or discharge to the ocean for consistency with the State's coastal management program (<http://dcm2.enr.state.nc.us/Permits/consist.htm>). It is likely that any proposal to drain wetlands or discharge water to the ocean would result in a letter of "objection" from the Division of Coastal Management.

NPS management policy states, "The Service will...avoid, whenever possible, the pollution of park waters...The Service will:...Take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations..." (Section 4.6.3 Water Quality). It

seems pretty clear that point discharge of stormwater containing elevated concentrations of bacteria to the ocean would be contrary to NPS management policies

With respect to wetlands, NPS management policy states that the Service will employ the following sequence:

- Avoid adverse wetland impacts to the extent practicable;
- Minimize impacts that cannot be avoided; and
- Compensate for remaining unavoidable adverse wetland impacts by restoring wetlands that have been previously destroyed or degraded.

Actions that have the potential to impact wetlands must be addressed in an EA or EIS. If the preferred alternative will cause adverse impacts on wetlands, a statement of findings (SOF) must be prepared and approved in accordance with Director's Order #77-1 and the DO 77-1 Procedural Manual (<http://www.nature.nps.gov/wetland/indexpro.html>). The SOF should contain the reasons why the preferred alternative must be located and designed such that it has adverse impacts on wetlands, and why no non-wetland alternatives or those with fewer wetland impacts were chosen. A discussion of the various factors and trade-offs considered in arriving at this decision should be included. Required contents of the SOF are found in Section 5.3.E of the Procedural Manual.

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.

If there are any questions regarding this trip report, please call me at (970) 225-3515.

References

Mallin, Michael A., Matthew R McIver, and Virginia L. Johnson, 2005, *Cape Hatteras National Seashore Water Resources Assessment Report, Phase I*, Center for Marine Science, University of North Carolina Wilmington, Draft Report. 57 pp.

National Park Service Management Policies 2001, NPS D1416, December 2000, 137 pp.

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