

SPRINGS AND SEEPS OF COLONIAL NATIONAL HISTORICAL PARK

Groundwater study will help analyze off-site impacts to park ecosystem

By MICHAEL FOCAZIO

THE YORKTOWN UNIT OF COLONIAL National Historical Park is located on the Atlantic coastal plain near the mouth of the York River in southeastern Virginia (fig. 1). In 1994, the park published a water resources management plan¹ that includes background information on the geology and water resources of the park. The plan states that contaminated or altered flow of groundwater could adversely affect the water resources and ecosystems of the park. For example, the Virginia Division of Natural Heritage has identified viable populations of northern spring isopods (tiny crustaceans listed as species of special concern in Virginia) that live in park springs². The plan also indicates that little is known about the groundwater resources of the park and surrounding areas at the level of detail desirable for sound management activities. In 1995, the U.S. Geological Survey (USGS) submitted a proposal to the National Park Service entitled "Investigation of Shallow Ground-Water System at Colonial National Historical Park" outlining the work that would be necessary to achieve the desired level of understanding of the groundwater system. Currently underway is a study that was designed to address one aspect of that original USGS proposal while maintaining a phased approach to the overall investigation.

¹The report was prepared by Colonial National Historical Park, the NPS Water Resources Division, and the Center for Coastal Management and Policy, a contractor to the National Park Service under cooperative agreement # CA4000-1-0018.

²Springs and seeps are both manifestations of groundwater discharge but are defined differently. Seeps can be entire hillsides or other large plots of land where groundwater discharges to the land surface. Springs, on the other hand, are confined to limited areas, often found where small void spaces in the aquifer coincide with land surface.

STUDY DESIGN IMPORTANT

This phase of the study was designed to provide some preliminary information that would be helpful in devising and implementing the overall investigation. Locations of springs in the Yorktown unit of the park and general indicators of water chemistry from the springs were deemed important initial information for the type of hydrogeologic environment found in the park. This preliminary information would be useful in future studies that assess relations of the water resources in the park to the nearby land uses that include residential areas, highways, forests, underground storage tanks, and National-Priorities List/Superfund sites. The information is also useful when assessing relations of water quality with occurrences and distributions of flora and fauna found in the park. Additionally, the knowledge gained from this study can be used for investigations of the surroundings and nearby natural resources such as the Grafton Pond Sinkhole complex. Forty sinkholes of the larger complex are found on park lands and contain hydrogeologic features and associated ecological systems that are unique to this part of Virginia.

INVESTIGATION BEGINS

Investigators located 31 springs within the boundaries of Colonial National Historical Park during a field reconnaissance survey in May and August 1996. Outside the park boundary, we also located five additional springs that feed streams flowing to the park (fig. 2). The location of each spring was recorded with a Global



Figure 1 (right). The study focused on the Yorktown Unit of Colonial National Historical Park, located in southeastern Virginia.

Figure 2 (above). In the reconnaissance map, springs are identified by triangles.

Water from at least one spring shows the possibility of influences from deicing salts in runoff from a nearby road.



Positioning System, and water from each spring was analyzed in May 1996 for pH (a measure of the acidity of the water), specific conductance (a measure of the amount of dissolved substances in the water, or salinity of the water), water temperature, and the amount of oxygen dissolved in the water.

The study focused on the Yorktown unit of the park, and not all streams that originate outside the park were searched for springs and seeps. We found the springs in various landscapes and elevations (fig. 3). Field observations indicate that water from most springs flows through a shallow aquifer system that is predominately comprised of fossil shell material (fig. 4). This shallow aquifer system is extensive and found throughout the park and surrounding land. Springs like these are not typically found in the coastal areas of Virginia and therefore provide unique ecological environments. The original source (recharge area) of the water issuing from these springs cannot be determined by these preliminary results. It is likely that the springs are recharged within the park boundaries and outlying areas. The water from at least one spring indicates that some springs are associated with a more local flow system that does not flow through the shelly aquifer and therefore have recharge areas that are restricted to within park boundaries. Water from another spring shows the possibility of influences from deicing salts in



Figure 3 (left). George Washington Spring, where the general's encampment got its water, is one of many springs surveyed during the study.



Figure 4 (above). Water from most springs flows through a shallow aquifer system that is predominantly composed of fossil shell material.

Figure 5 (below). Different than springs, seeps can be entire hillsides or other large plots of land where groundwater discharges to the land surface. Springs are confined to limited areas, often where small void spaces in the aquifer coincide with land surface.



runoff from a nearby road. Additionally, water from all springs, where measurements were possible, was well oxygenated and had near neutral pH values.

We also found diffuse seeps of groundwater throughout the park (fig. 5). The seeps are located at, or near, headwaters of streams, along valley bottoms, and along-side streams. The locations of the seeps coincide with wetland maps that were previously generated for the park and are stored in the park's geographic information system.

Several springs that were flowing in May were dry in August. More work needs to be done to quantify why these springs dry up while others remain flowing; but it is likely related to topographic position and the aquifer material. The water from the springs was generally warmer, and had slightly lower dissolved oxygen in August than in May, indicating that the water is influenced by seasonal climatic changes. The pH and specific conductance were relatively unchanged between the May and August observations, suggesting that the overall chemistry of most springs did not change over the time period.

Water from eight selected springs was analyzed for chlorofluorocarbon compounds in order to determine modeled recharge dates. The dates from the five springs range from recent (within the past two years) recharge events to recharge that occurred in 1980.

Management of the biodiversity and ecological integrity of the park depends, in large part, on the quantity and quality of surface and groundwater flowing in, and through the park. This reconnaissance study indicates that groundwater that feeds streams within the park can be influenced by off-park and within-park activities. In order to effectively plan for the management of these resources, a more complete understanding of the shallow aquifer system within, and around, the park is needed. This would provide a framework from which relationships of the various local hydrologic environments to the presence and viability of specific targeted organisms (e.g., northern isopods) could be developed in context with potential influencing factors.

P S

Michael Focazio, Ph.D., is a Hydrologist with the USGS Water Resources Division, Office of Water Quality, Reston, Virginia. He is currently on detail with the Environmental Protection Agency in Washington, D.C., and can be reached at (202) 260-3080; e-mail focazio.mike@epamail.epa.gov.