

Interagency Cooperation Produces Sedimentation Study

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A three-year sedimentation study of the Quantico Creek in Prince William Forest Park was completed in May, 1985. The study, made possible due to an unprecedented team effort between the National Park Service and the U.S. Geologic Survey (USGS), was necessary in order to identify sources and effects of sedimentation within the watershed of the creek.

Prince William Forest Park straddles the fall line, which is the boundary between the Piedmont Province to the west and Coastal Plain Province to the east. The topography is undulating; with narrow ridge tops and relatively steep-sided valleys. The trend of the valleys and ridges is northwest-southeast. The park contains the major portion of the watersheds of the Quantico Creek, and its major tributary South Fork Quantico Creek. The soils drained by the Quantico Creek are easily disturbed, which has led to severe erosion problems. Increased visitor use of the park and development outside the park boundary, including activities on the neighboring Marine Corps Base, have been suspected of increasing the erosion and

accelerating sediment deposition in the park's four lakes. The sediment deposited in the lakes has degraded water quality. Two of the lakes have become silt laden to such an extent that they have lost their recreational usefulness.

The need for a study of the sedimentation study processes of the Quantico creek had been realized for sometime. Several years ago, the park approached the USGS to undertake the study. The high estimated cost of the study and a shortage of NPS funds made the work impossible at that time. The development of a proposal to share the study effort resulted, in FY 1983, in the start of the Quantico Creek sedimentation study. The park agreed to supply manpower for data collection and laboratory analysis, to build three gaging stations on the creek, and to purchase some field and laboratory equipment, thus reducing the contract price to a level that could be funded by the Servicewide Water Resources Project Account. Park base funds also paid for the park-supplied manpower and some of the equipment.

The USGS supplied the expertise for the study. They surveyed the Quantico Creek and its tributaries and selected 24 sampling sites, installed staff gages at applicable sites, and selected the study design and methods. While some sites were measured for discharge on both a monthly and storm event frequency, others were measured on a monthly basis only. All sites were measured bi-yearly.

A USGS gaging station was already in operation on the South Fork of the Quantico Creek at the park's western boundary. As agreed the park maintenance staff constructed the additional three permanent gaging stations, bringing the total to four. For each of the stations, the USGS provided an Automatic Data Recorder, which records the gage height at 15 minute intervals, and a graphic recorder, which produces a continuous hydrograph. The latter was helpful in visualizing storm events and in calculating daily sediment load. The park purchased one Manning S-4050

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Automatic Sediment Sampler and borrowed several more from the District of Columbia government.

The USGS trained the park's resource management staff to take discharge measurements using a tape measure, calibrated rod, and a velocity meter. Depending on the height and velocity of the water, a pygmy meter or an AA meter attached to the calibrated rod was used. In high flow waters, an AA meter with a 15 or 30 pound weight lowered from a bridge on a handline was necessary. A tape measure was stretched across the creek and the width recorded. The width was then divided into 20 to 25 sampling intervals. At each interval, the distance on the tape measure and depth of water were recorded. Using a stop watch and earphones attached to the meter, the number of revolutions and time in seconds also were recorded.

Each time a discharge measurement was taken, a sediment sample also was collected. In addition, sediment samples needed to be collected at four sites every other day in order to provide base data for the study. This was difficult for the park's small resource management staff to perform on a regular basis. Therefore, members of the park's visitor protection staff, who had expressed an interest or had a background in resource management, were trained to take the samples and incorporated base data sampling into their daily patrols of the park.

An expensive part of such a study is the laboratory analysis of the samples, and project funding was not sufficient to cover all lab costs. Therefore, a laboratory was constructed inside the park. The park's resource management staff was trained by a technician from the USGS Laboratory in Harrisburg, Pa. to perform the laboratory procedure.

Field data were collected from June, 1983 through May, 1985. The USGS has prepared tables of data collected during the project including daily discharge rates and daily sediment loads for the four permanent sites. Graphs showing gage height vs. sediment load and gage height vs. discharge are available for all sites that have staff gages. Graphs showing discharge vs. sediment load are available for all 24 sites. Maps of major drainages and slope erodibility prepared by USGS have already been entered into the park's Geographic Information System to provide a basis on which to develop General Management Plan alternatives regarding suitable locations for trails, fire roads, and picnicking and camping facilities.

The USGS will submit a final report to the park this spring. That report will identify "base flow" sediment which results from natural erosion and indicate where the creek is receiving accelerated sediment loads. It will delineate the time of the year and the types of hydrological conditions that can be expected to produce heavy sediment loads. By identifying sources of sedimentation within the watershed, management action can be implemented at locations where sediment is shown to originate. This will reduce the amount of sediment that enters the lakes.

The U.S. Geologic Survey deserves credit for its flexibility in arranging for this much needed study. Their patience and neverending cooperation is appreciated, as is the assistance of the many others who contributed to this undertaking. It should be noted that a study of this magnitude, even as a joint effort, did require an enormous commitment on the part of the park. That commitment was difficult at times for

the park to sustain. However, not only has this innovative agreement made this three year study possible, the park now has the equipment and trained personnel which enable it to continue analyzing the creek's sedimentation load on an ongoing basis. Further, the park has gained a fully operational lab. This kind of cooperative effort, both within parks and with outside organizations, is making it possible to obtain the scientific data on which effective resource management can be based.

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Park Service Technician measures velocity and depth across the creek bed to determine the discharge at that one point in the Quantico Creek.



One of the four gaging stations along the Quantico Creek in Prince William Forrest Park. It houses water level monitoring equipment and an automatic water sampler.