

# **LEVEL ONE WATER-QUALITY INVENTORY AND MONITORING AT THOMAS STONE NATIONAL HISTORIC SITE, CHARLES COUNTY, MARYLAND**

## **INTRODUCTION**

Inventory and monitoring programs for fauna, flora, mineral, atmospheric, and water resources have been developed in many national parks in response to policies of the National Park Service (NPS). In accordance with the NPS's Strategic Plan for Conducting Level 1 Baseline Natural Resource Inventories in the National Park Service, Level 1 Water-Quality Inventory and Monitoring (WAQIM) activities were conducted for Thomas Stone National Historic Site (THST), in Charles County, Maryland by the U.S. Geological Survey (USGS) in cooperation with the NPS. A general inventory of the water resources of THST is provided in this report to assist in developing management practices that are essential to maintain the themes in the NPS, to ensure that THST has an adequate inventory of its water resources, including basic water-quality parameters, and to make these data available in a data-management system.

## **DESCRIPTION OF THE STUDY AREA**

WAQIM activities involving the collection of basic water-quality parameters are required for key water bodies within the THST in Maryland. The key water bodies within the study area are those that are essential to the central cultural, historical, or natural resources management themes of the park, or that may provide habitats to threatened or endangered fauna and flora.

THST comprises 321.97 acres located about 3.5 miles east of La Plata, Maryland, and about 27 miles south of Washington, D.C. (fig. 1). The park commemorates the life and work of Thomas Stone, a signer of the Declaration of Independence. The park includes a restoration of the original house and surrounding plantation area. The original house, built in 1771, was damaged by fire in 1977. Access to the park is available from Rose Hill Road in Charles County, Maryland.

Water resources within the park consist of a manmade upland pond, scattered springs issuing forth on the slopes of draws cutting into the upland, small streams draining the upland areas of the park, and a perennial stream called Hoghole Run. Hoghole Run is a tributary of Port Tobacco Creek, which flows generally along the western boundary of the park, meandering across park boundaries several times. The stream originates north of the park and flows generally south past the park, receiving the entire drainage from the park area. About 1 mile south and downstream of the park, Hoghole Run empties into Port Tobacco Creek. Shortly thereafter, the flow system becomes tidal and is then known as Port Tobacco River, which continues to flow to the confluence with the Potomac River.

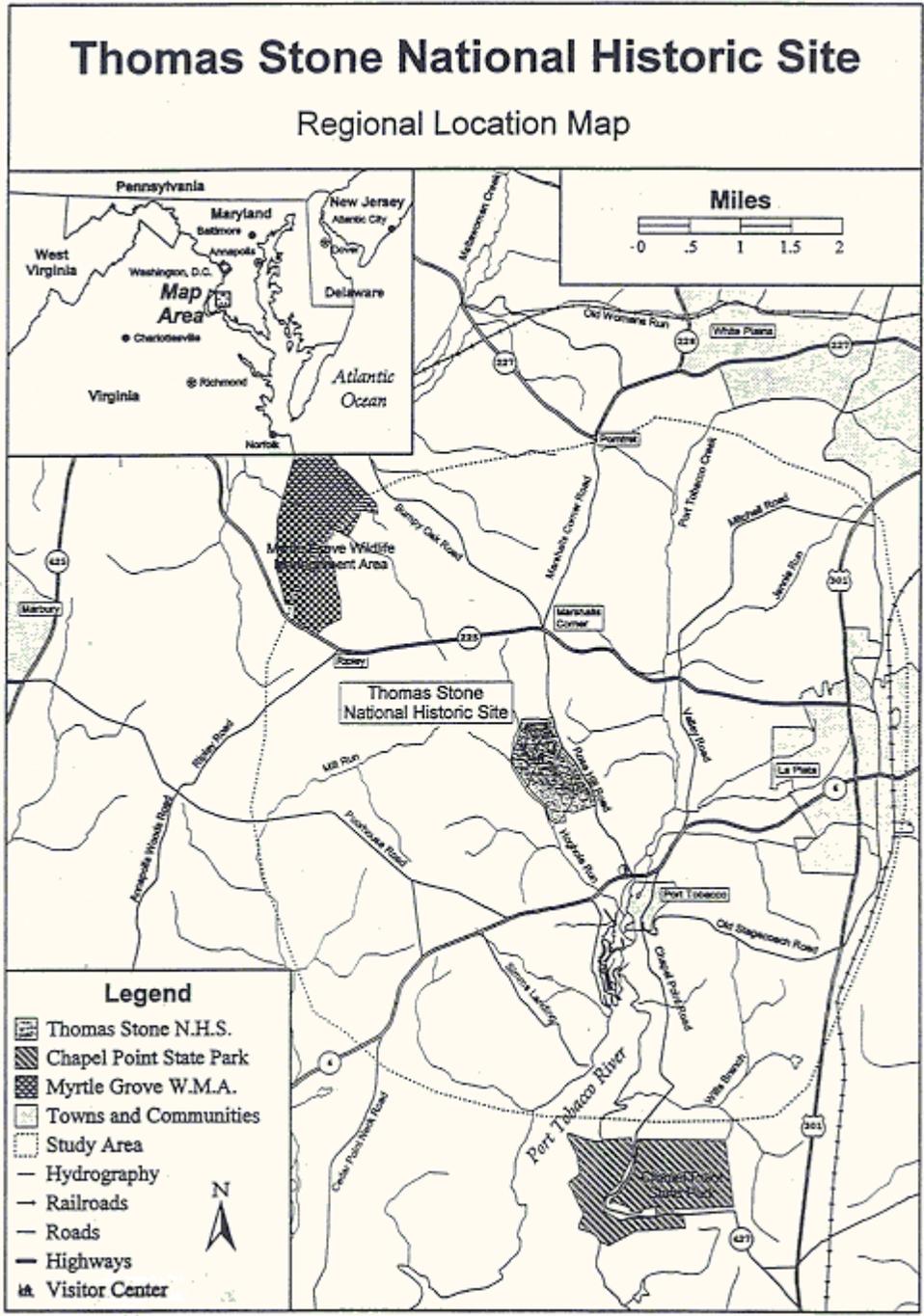


Figure 1. Location of Thomas Stone National Historic Site, Charles County, Maryland (from National Park Service, 1998).

Threats to water quality within the study area include encroaching residential development along Rose Hill Road, which is the eastern boundary of the park, and expanded growth of the town of La Plata, Maryland, part of which lies within the Port Tobacco Creek watershed. The primary issue for water quality is nutrient loading and contamination as a result of increased urban development. Five sites within the park have been selected for sampling for the THST WAQIM program (fig. 2).

### Level One Water-Quality Inventory and Monitoring Sampling Sites

Hoghole Run is the only major permanent stream that flows through the park. It flows generally along the western boundary of the park, entering and exiting lands adjacent to, and flowing a short distance within the park. Although the stream only flows through a small part of the park, it represents the only major source entering the park area that is indicative of water quality from upstream. In addition, it collects the total effluent from the park, and, therefore, contains a combination of water-quality indicators in its downstream reach from both the park and surrounding lands. Its significance to the park as a critical riparian habitat is substantial. The drainage of Hoghole Run includes mostly forested areas interspersed with some grazing and row crop agricultural activities. At the headwaters lies the small community of Marshalls Corner, consisting of a few residential and commercial buildings. Streamflow moves in a predominantly north to south direction through a series of alternating riffles and pools with a sandy gravel substrate.

Five sampling sites were selected for this study and are listed below:

1. Hoghole Run at Marshalls Corner (01660745), one of two sites on Hoghole Run, is located at the northern boundary of the park, where the stream initially enters the park area. The 0.7 mi<sup>2</sup> (square mile) drainage basin consists entirely of area upstream of the park, and includes a part of the community of Marshalls Corner.
2. Hoghole Run at Port Tobacco (0166074540) is located at the southern boundary of the park, where the stream exits the park area. At 1.8 mi<sup>2</sup>, this is the largest drainage area in the WAQIM sampling program for this study. This site encompasses the drainage of all the other sites in the program, and includes the drainage for the entire park area.
3. Hoghole Run tributary near Port Tobacco (0166074520) is a site on a small, unnamed perennial stream with a drainage basin of just over 0.1 mi<sup>2</sup>, and flows through the central part of the park. This stream drains the spring seep area near the Visitor Center, both septic leach fields servicing park facilities, and an inholding with a private residence. This small stream basin contains all of the developed areas within the park.
4. A seepage spring, CH Cd 48, (383052077022701) is located on the wooded hillside adjacent to the Visitor Center. The seepage emanating from the hillside forms a wooded wetland area before collecting in a narrow channel prior to discharging into an unnamed tributary of Hoghole Run. A portable flume with a 90-degree notch was used to measure discharge at this site as flows were too small for conventional current meter measurements. The septic system for the Visitor Center is located within the

# Thomas Stone National Historic Site

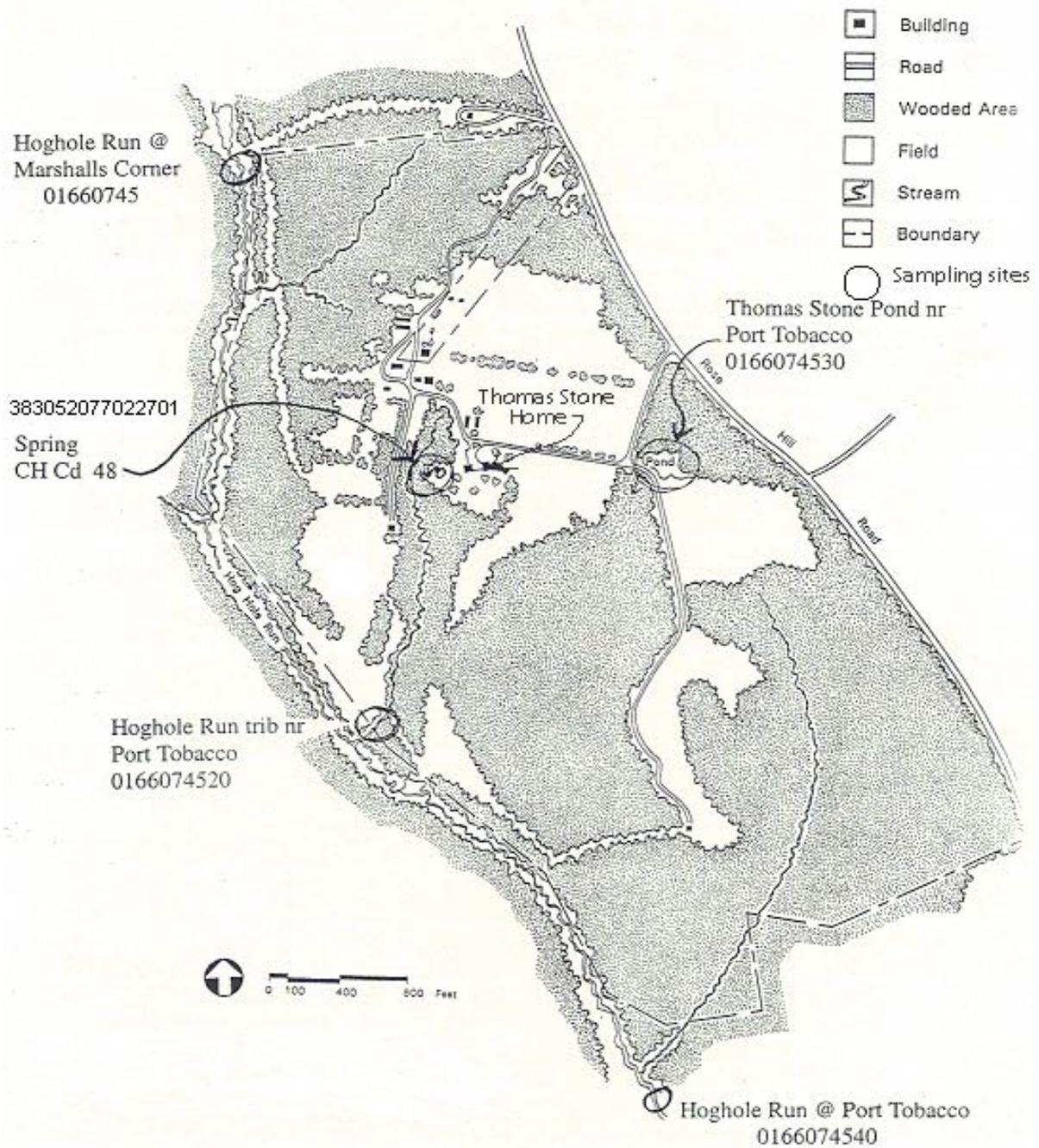


Figure 2. Location of sampling sites at Thomas Stone National Historic Site, Charles County, Maryland.

recharge area of this spring. Prior to the construction of a water-supply well for the park, water from this spring was used to supply the Visitor Center.

5. A manmade pond (0166074530) is approximately ¼ acre in size, and is located near the visitor parking area. The pond depth is believed to be little more than 5 or 6 feet deep. Recharge to the pond is derived mostly from rainfall and surface runoff, but is also reported to be spring fed. The NPS is concerned about the potential impact the pond may present to park visitors. Contact with the pond water by park visitors would occur close to the shore and at or near the pond surface. Therefore, the samples at the pond were collected by wading about 6 feet from shore where the water depth was approximately 4 feet, and sampling was performed by dipping from the surface to about 18 inches deep. This sampling method, used instead of a depth-integrated sample, was developed with NPS input.

## PRINCIPAL INVESTIGATORS

The principal investigators of the WAQIM program at THST included personnel of the USGS, MD-DE-DC District Office in Baltimore, Maryland: James R. Dine, Hydrologist, (410) 238-4225, and Jeffrey J. Kvech, Hydrologic Technician, (410) 238-4244.

## SAMPLING PLAN

WAQIM activities at THST for the 1999-2000 water years (October 1998 to September 2000) took place on a seasonal basis, to incorporate temporal variability. Ranges of hydrologic conditions (base flow to stormflow) were targeted in this effort. Because of extreme drought conditions occurring during the summer of 1999, a no-flow condition was encountered at the Hoghole Run and tributary sites. Therefore, the sampling schedule previously submitted as a part of the initial Study Plan was delayed by one quarter when flows were once again sufficient for sampling.

All water-quality samples collected as part of the inventory, with the exception of bacteriological and sediment samples, were submitted for analysis to the USGS National Water-Quality Laboratory (NWQL) in Lakewood, Colorado. Bacteriological samples for fecal coliform and fecal streptococci were processed by field personnel at each site and analyzed in the Baltimore office of the USGS. *Escherichia coli* (*E. coli*) samples were chilled on ice and shipped overnight to the Wisconsin State Laboratory of Hygiene, University of Wisconsin Environmental Health Division in Madison, Wisconsin, for analysis. Suspended sediment samples were processed and analyzed at the USGS sediment laboratory in Louisville, Kentucky.

Replicate samples and field blanks were used to assure the precision and accuracy of the data. A replicate sample is a second sample taken from the same collection vessel, processed in a similar manner as the environmental sample, and sent to the lab for analysis as a separate sample. A field blank is a sample prepared in the field using pure

water in place of environmental sample water, processed in a similar manner as the environmental sample, and sent to the lab for analysis as a separate sample. A replicate sample and a field blank were prepared on Feb. 9, 2000 for Hoghole Run at Marshalls Corner, Maryland (01660745) and on August 8, 2000 for Hoghole Run at Port Tobacco, Maryland (0166074540). A list of the schedule and parameters for WAQIM sampling at THST are presented in table 1.

**Table 1.** Sampling schedule and parameters for WAQIM sampling at THST.

Parameter	Month Collected				
	November 1999 <sup>1</sup>	February 2000	March 2000 <sup>2</sup>	June 2000	August 2000
Field parameters	X	X		X	X
Fecal indicators	X	X	X	X	X
Nutrients	X	X		X	X
Major ions	X	X		X	X
Trace metals	X	X		X	X
Sediment	X	X		X	X
QA/QC					
Replicate		X			X
Field blank		X			X

<sup>1</sup>*Escherichia coli* was not analyzed in November 1999.

<sup>2</sup>*Escherichia coli* and fecal streptococci samples were collected March 14, 2000, and fecal coliform samples were collected February 9, 2000.

## FIELD AND ANALYTICAL PROTOCOLS

Complete records of field-sampling activities for all WAQIM visits to THST are archived at the MD-DE-DC District office. Water-quality field forms listing site identification, field measurement data, sampling conditions and sample type, discharge, and climatic and environmental observations were completed for each site. Field parameters (temperature, pH, specific conductance, dissolved oxygen concentration, alkalinity, and discharge) were measured on-site following methods and protocols developed by the USGS (U.S. Geological Survey, 1999; Buchanan, 1969). A 90-degree-notch portable flume was used to measure discharge at the seepage spring site (Rantz, 1982). Instruments used for the measurements were calibrated for each sampling trip and calibration values, adjustments, and comments were documented in logs for the instruments. Environmental samples were collected and analyzed according to standard USGS protocols (USGS, 1999). Point samples or equal-width-increment samples were collected to obtain analytical results that most closely represent the environmental medium. Water-quality samples were processed and preserved on site. Samples (as

required by each analysis) were filtered through a 0.45-micrometer capsule filter for preparation of dissolved constituents, or processed directly from the churn splitter, a vessel containing the sample with agitation or mixing ability, as whole-water samples, and chilled. The samples were then shipped on ice overnight to the NWQL. Sample bottles and measurement equipment were thoroughly cleaned in a Liquinox<sup>1</sup> detergent solution and rinsed in a mild acid solution followed by a deionized water rinse prior to each use. Equipment used for fecal indicators was sterilized in an autoclave prior to each WAQIM visit. Containers used for the *E. coli* samples were shipped pre-sterilized from the Wisconsin State Laboratory of Hygiene. These containers were filled at the sample site, chilled on ice, and returned overnight to the lab for processing. Laboratory methods used to analyze samples are approved and quality-assured, and are reported in Fishman (1993).

## DATA MANAGEMENT AND ARCHIVING

Three Microsoft spreadsheet files titled WQDATA.XLS, PARMETER.XLS, and STATION.XLS were prepared and accompany this Microsoft Word file, README.DOC. WQDATA.XLS contains the results of the WAQIM completed at THST. PARMETER.XLS contains a detailed description of the water-quality parameters determined in the THST WAQIM. The citations listed in the PARMETER.XLS file are abbreviated and the complete citations are referenced at the end of this file. STATION.XLS contains descriptions of the five sampling sites selected for the THST WAQIM.

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<sup>1</sup> The use of trade, product, or firm names in this report is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

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