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CASE STUDY

WASHINGTON COLLEGE GEOSPATIAL INNOVATION PROGRAM AND TUCKAHOE STATE PARK

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Located southeast of Baltimore, Maryland, Tuckahoe State Park welcomes over 220,000 visitors each year to its hiking trails, waterways, and camp sites.

Customer
Washington College Geospatial Innovation Program

Industries
Education, Parks & Recreation

Challenge
Tuckahoe State Park needed an updated printed map of the park-owned trails for its hundreds of thousands of annual visitors and campers. Since its initial visitors' map creation, many trails had been altered or added.

Solution
Arrow Gold® GNSS receiver, local RTK network, ArcGIS® Field Maps, ArcGIS Online, smartphones

Results
Staff and students from Washington College's Geospatial Innovation Program remapped the park's 19 trails with high accuracy. They developed not only an updated print map but also digital maps that can more easily be updated in the future.

TRAIL MAPPING AT TUCKAHOE STATE PARK

Washington College in Maryland, founded with George Washington's support, excels particularly through its Geospatial Innovation Program (GIP). Established in 2003 and staffed by eight GIS specialists, including Madison Kaye, the program is a standout feature of the college.

"We are a small liberal arts college on the eastern shore of Maryland," Kaye said. "We have only about 1,000 undergraduate students and no graduate students, so the focus of the school is on the undergraduate experience. That's something I really appreciate as a staff member, and I've heard from a lot of students that they appreciate it too."

A key aspect of the GIP is its paid internships, available to all students regardless of prerequisites, regardless of prerequisites. Each semester, about 15-20 students participate, with a smaller group of 7-10 in the summer. Funding comes from contracts and grants, including from the Maryland Highway Safety Office, MDOT, and the Delaware Department of Education. Kaye notes these internships provide valuable GIS experience and help students connect with the local community.

"When you go to college, often you're going to a place where you haven't grown up," Kaye said. "You don't have an attachment to that place outside of college. So, I really like to get students off campus and into the local community with their projects. It gives them a sense of place, and they can feel at home in this place where they're going to spend four years of their lives."

FROM CAMPUS TO CANOPY: GEOSPATIAL INNOVATIONS PROGRAM MAPS A MARYLAND STATE PARK

About 30 minutes south of Washington College is Tuckahoe State Park, a scenic spot for recreation and camping. Since the COVID-19 pandemic, the park has seen a 105 percent increase in visitors, reaching over 210,000 day-use visitors and 17,000 campers in 2023. Many visitors request printed maps of the park's 19 trails.

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"Many people who come into our visitor center are looking for a map that they can hold in their hand," Tuckahoe State Park Assistant Manager Ashlee Reinke said. "Some people don't want to rely on technology while they're out recreating in the woods."

Established in 1975, Tuckahoe State Park has updated its trails continually, but the printed maps became outdated. The park staff had added new trails informally but decided last year to formally update the maps to reflect new trails and amenities like cabins and accessible bathrooms. "We wanted to both make sure our new trails were accurately reflected as well as update the locations of our amenities, such as cabins and accessibility bathrooms," Reinke said.

Inspired by a neighboring park's collaboration with a local university to update trail maps, Tuckahoe State Park contacted Washington College. This led to discussions in February 2023 between Kaye, Reinke, and Tuckahoe State Park Assistant Manager Jessica Conley. "They had heard we could update their trail maps, and we said, 'Yes we can!'" Kaye said. Kaye's team agreed to update the park's printed map and create an online version, making future updates easier.

IN THE FIELD: TWO STUDENTS, GIS, AND GNSS

In the field, Environmental Science major and GIS intern Jessica Borders used Esri's ArcGIS® Field Maps mobile mapping app on a GIP iPad® tablet. The app enabled her to collect data on attributes like surface type, trail name, and blaze color. Using the continuous streaming feature, she mapped trails as line segments, capturing a point every 10 feet and mapping continuously for about a mile. This method, repeated every mile, allowed her to take breaks as the park's trails extend several miles.

Due to Tuckahoe State Park's dense canopy, the iPad's GPS wasn't accurate enough for the park's 15-foot accuracy goal. Kaye trained Borders to use the GIP's Arrow Gold® GNSS receiver, which Bluetooth®-pairs with the iPad for higher accuracy.

Borders and Kaye used a local real-time kinematic (RTK) network for differential corrections, allowing the Arrow Gold to stream accurate locations into ArcGIS Field Maps. Despite the canopy, their accuracy ranged from 10 inches to five feet, meeting the park's standards.

"We've had the Arrow Gold for a few years now, and it's the main GPS unit we use for field work projects," Kaye said.

To maintain RTK connectivity and sync data from ArcGIS Field Maps to ArcGIS Online in real time, Borders used one of Washington College's hotspot devices, ensuring the captured data was available immediately in an ArcGIS Online web map at the office.

IN THE OFFICE: CONNECTING THE DATA

In January 2024, Environmental Science major and GIS intern Dyllan Bishop began his role as the project's student intern. While he collected some field data, most of his work was in the office, collaborating with Kaye and using Borders' data. Bishop first integrated Borders' line segments to form complete trail lines and compared these with those on the old brochure map. He then calculated each trail's total length and color-coded them according to their blaze colors.

Tuckahoe State Park features an arboretum with its own visitor center and a network of shorter trails. The arboretum, managed by a nonprofit, provided its GIS-format trail maps to Bishop, allowing him to merge them into a unified map. Additionally, Bishop incorporated points of interest, such as bathroom facilities and camping spots, into the map.

IN THE FUTURE: RESULTS AND LOOKING AHEAD

In total, the team mapped 19 park-owned trails, including four previously unmapped trails. Along with the arboretum-owned trails, the final web and PDF maps contain a total of 42 trails and pathways in Tuckahoe State Park and Adkins Arboretum.

"Having an accurate trail map is great," Reinke said. "I have called the map 'beautiful' more than once. We are excited to get this version printed and into the hands of our visitors."

In addition to printing the map for visitors, there are discussions to make the map digitally accessible online as well as update in-park bulletin maps.

"We went into this project needing just our printable map updated, but we've discussed posting this to our website and even putting QR codes in the park for quick access to the digital version," Reinke said. "We can certainly consider doing this in some of our more heavily used campgrounds."

Meanwhile, Kaye hopes this project could inspire other nearby parks to update their maps.

"Hopefully we'll be able to map other state parks in the area," Kaye said.

Looking ahead, the team is exploring the possibility of mapping the park's waterways, providing information to visitors interested in kayaking or using small boats within the park.