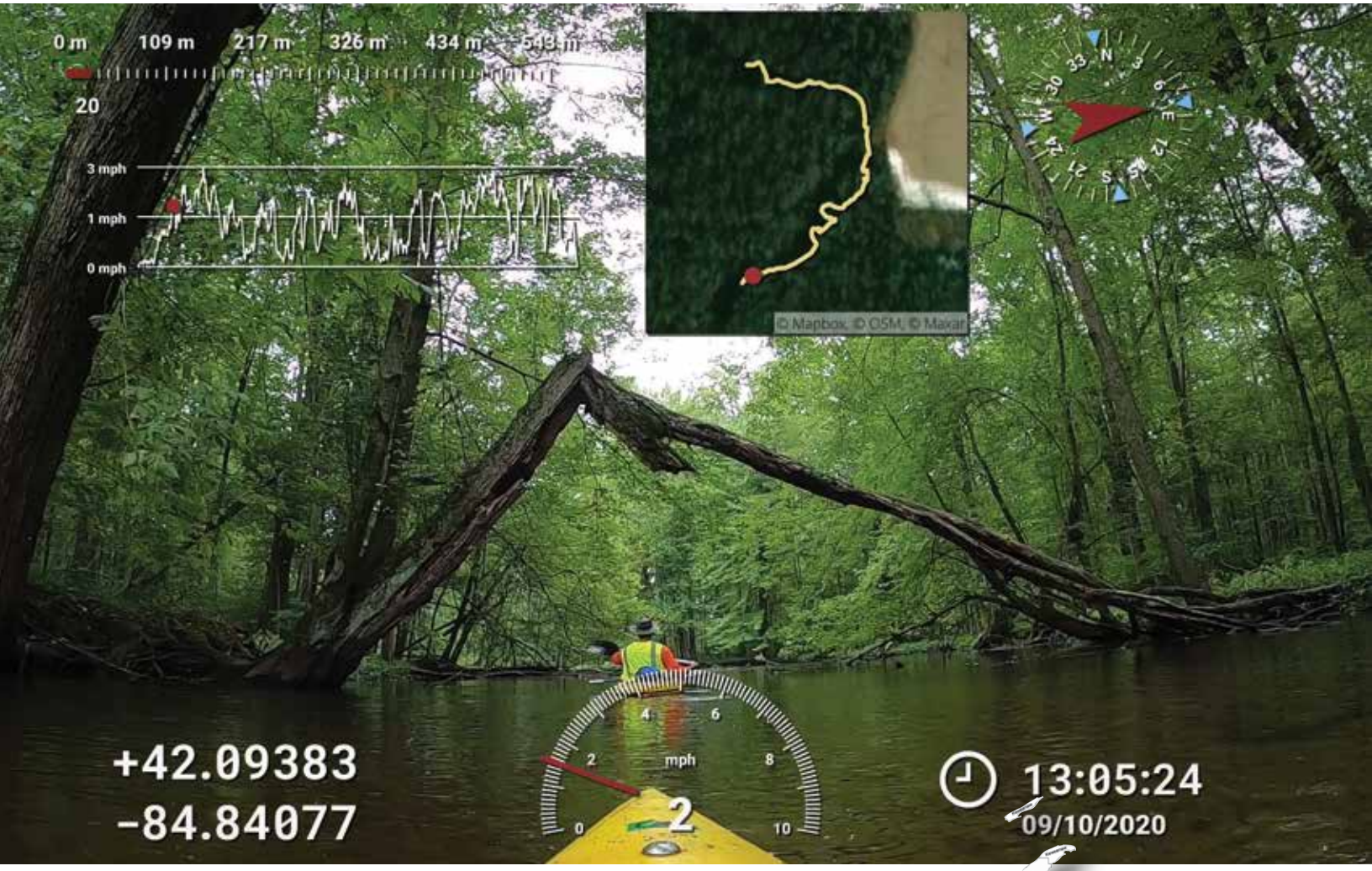

PHOTO CREDIT: DOUG MCLAUGHLIN
SURVEYING THE ST. JOSEPH RIVER NEAR LITCHFIELD, MICHIGAN, SEPTEMBER 10, 2020.

A ST. JOSEPH RIVER INVENTORY

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CAROLYN GRACE | ADMINISTRATOR OF THE ST. JOSEPH COUNTY CONSERVATION DISTRICT

> "A Modern Day Expedition to Better Understand Invasive Species and the River Itself."

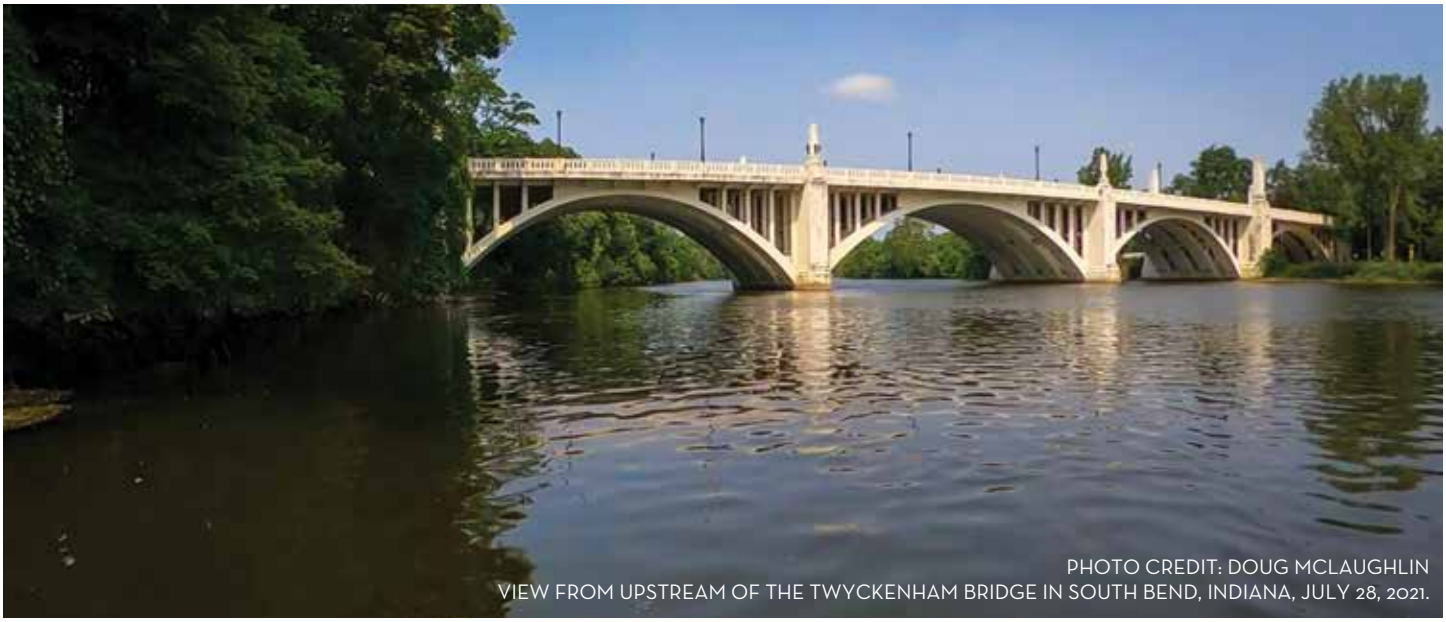

PHOTO CREDIT: DOUG MCLAUGHLIN
VIEW FROM UPSTREAM OF THE TWYCKENHAM BRIDGE IN SOUTH BEND, INDIANA, JULY 28, 2021.

THE INVENTORY

Launching the kayak on River Inventory Day #43, the day we would paddle past the St. Joseph North Pier Lighthouse and into Lake Michigan, the experience still felt like the start of a new adventure. Maybe a little bit like Lewis and Clark felt in 1804 as their "Corps of Discovery" voyage began its journey up the Missouri River, excited to see what was around the next bend; except that we were traveling downstream with the help of the river current after a good night's sleep, a comfortable car ride, and a fresh cup of coffee. This had been the pattern for several days a week during the warmer months, beginning in August 2020 at the headwaters of the St. Joseph River in Hillsdale, Michigan. Now, on August 17, 2021, we were pushing off from Benton Township Park on the last leg of the journey, ready to complete our inventory of invasive aquatic and terrestrial plant species along the St. Joseph River.

At 206 miles long, the mainstem river is the third longest river flowing into Lake Michigan (behind the Grand and the Muskegon), and the fourth longest flowing into any of the North American Great Lakes. Conducting the inventory became a reality in 2020 when the St. Joseph (Michigan) County Conservation District (SJCCD) received a grant from the Great Lakes Restoration Initiative (GLRI). The results of the inventory would help three regional Cooperative Invasive Species Management Areas (CISMAs) in their efforts to protect native habitats, native biodiversity, and water quality known to be negatively impacted by invasive species. The proposed project would build on the CISMA's initial survey efforts in which invasive species had been found in areas both at the headwaters and mouth of the river, resulting in "a clear sign that there are many sites still unmapped" in the St. Joseph River watershed. The new inventory would help support the CISMA's strategic planning process and the development of a bi-state action plan for the watershed in Michigan and Indiana. A priority for the inventory was to find small, more isolated infestations of invasive species that could have a higher likelihood of successful treatment and eradication.

PHOTO CREDIT: DOUG MCLAUGHLIN
THE HEADWATERS OF THE ST. JOSEPH RIVER IN HILLSDALE, MICHIGAN, OCTOBER 15, 2020.

(CONTINUED ON PAGE 18)

ST. JOSEPH RIVER

(CONTINUED FROM PAGE 17)

INVENTORY TOOLS AND METHODS

After initial planning, training, and reconnaissance, SJCCD staff officially began the inventory in Hillsdale, Michigan on August 19, 2020. Originally, the inventory plan focused on using the Midwest Invasive Species Information Network (MISIN) smartphone app to map invasive species observations while paddling the river. The plan quickly evolved to include a GPS-enabled action camera (GoPro or Garmin) on each kayak, and to make verbal observations when invasive species were sighted while the camera not only recorded the verbal comment, but also its location coordinates and the river and shoreline environment. The timestamp and GPS coordinates of all observations were then retrieved later from the recorded video through a series of processing steps that included reviewing videos, transcribing verbal comments onto a spreadsheet, and extracting the GPS data associated with each comment using commercially available software. We frequently checked the GPS coordinates obtained from the action cameras for observations made about fixed structures (e.g., bridges, dams, public boat launches, and our entry and exit points) to verify that they were reliable at least within a few meters, providing confidence that coordinates obtained for invasive species observations also were reliable. GPS sensors performed well both in parts of the river with open sky above and with a tree canopy overhead. Using location highlighting commands built into the action camera software helped reduce the amount of time needed to review each video.

Having a GPS-tracking action camera mounted onboard each kayak gave the paddler/surveyor the opportunity to have a more free-flowing monologue with the camera, creating a running commentary of the day's observations, while still being able to capture the information needed to catalogue, map, and report each invasive species observation. Processing the videos off the river provided the opportunity to send all priority invasive species observations to MISIN in a spreadsheet file with species name, location, and often including information about area and density. In addition, using video cameras also offered a simple way to capture other information relevant to the invasive species inventory, including observations about the surrounding habitat, other natural or man-made features in the area, and the level and type of landscape disturbance present. Combining these observations with other information such as whether invasive species are on public or private land,

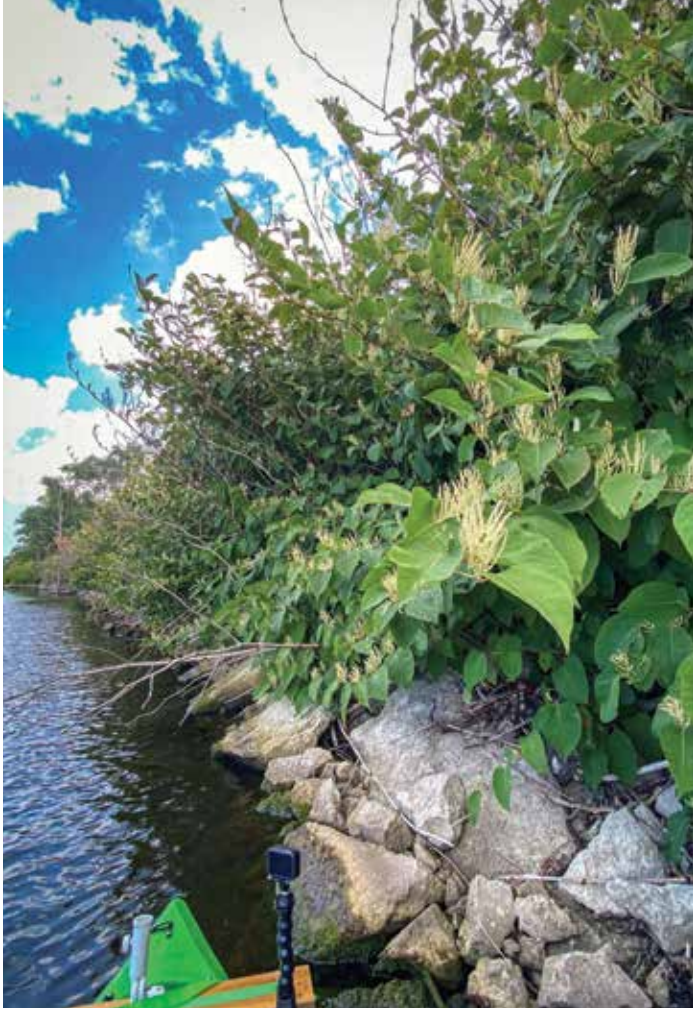

PHOTO CREDIT: DOUG MCLAUGHLIN
JAPANESE KNOTWEED ALONG THE SHORELINE NEAR ST. JOSEPH/ BENTON HARBOR, MICHIGAN, AUGUST 17, 2021.

PHOTO CREDIT: DOUG MCLAUGHLIN
A PIECE OF CAROLINA FANWORT FLOATING ON THE WATER SURFACE ABOVE A LARGE AREA OF SUBMERGED, ROOTED FANWORT IN ELKHART, INDIANA, JULY 14, 2021.

PHOTO CREDIT: DOUG MCLAUGHLIN
ALGAE GROWTH ON THE RIVER SHORE AT BENTON TOWNSHIP PARK, MICHIGAN, AUGUST 16, 2021.

can help explain the distribution of invasive species, shape predictions about where invasive species may occur in the future, and inform strategies for effective treatment, control, and outreach to minimize the spread and impact of invasive species.

BEYOND INVASIVE SPECIES

With cameras on board, the broader vision of a sustainable St. Joseph River in mind, and a desire to support education and outreach efforts throughout the watershed, we were able to record observations of a host of other natural features and potential stressors that we found along the way with very little added effort. As a result, we now have maps of the eagles, ospreys, herons, kingfishers, turtles, snakes, mink, muskrats, mayflies, and many other critters we observed; we have audio recordings of bird calls for birds that we didn't see (which more expert birders, and even some bird apps, can use to identify the bird species); we recorded areas with eroding river banks, some large and many more not so large, and tributary inputs carrying sediment to the river after rainfall events; we recorded beautiful, quiet wooded floodplains where webs of partially exposed tree roots revealed the erosion reduction benefits of wooded shorelines; we recorded locations of accumulated trash, tires, and shopping carts; we recorded miles of hardened shoreline and some good examples of more natural engineered shoreline; we recorded opportunities for fish habitat enhancement through the removal of old dams and other relict structures; and we recorded the distribution of many kinds of algae, documenting impacts of excessive nutrient inputs to the river.

Although measuring water quality wasn't a primary goal of the inventory, we also attached to one of the kayaks an inexpensive set of water quality sensors and a GPS-enabled data logger to collect high frequency water quality readings during our daily river float trips. With sensors placed a few inches below the water surface, measurements of dissolved oxygen (DO), temperature, and specific conductance were recorded every five seconds, tracing water quality conditions along the kayak's path. This type of high frequency data collection offers the opportunity to "see" variations in water quality resulting from rain events, tributary inlets, inputs of stormwater or wastewater, the effects of riffles and dams, proximity to wetlands, etc. Results can help document factors occurring at a smaller spatial scale that alone may not cause dramatic changes to river ecosystem quality, but when repeated over miles of river can add up to explain the condition of the river as a whole.

(CONTINUED ON PAGE 20)

ST. JOSEPH RIVER

(CONTINUED FROM PAGE 19)

INVASIVE SPECIES – FOUND AND NOT FOUND

While our analysis of our invasive species observations continues, several facts are clear. Among them, our invasive species observation counts are dominated by very common species such as purple loosestrife and Eurasian watermilfoil (with hundreds of observations each). Although these species are not necessarily high priority species for this project due to their wide distribution, mapping their locations not only reveals more detail about their distribution along the St. Joseph River, but can help to prioritize larger, denser areas where treatment should occur to help bring back native biodiversity. We also made roughly 300 individual observations of curly leaf pondweed, 100 observations of Carolina fanwort, and 20 observations of starry stonewort. Of the other terrestrial species, we made about 150 observations of Tree of Heaven, 100 of autumn olive, and 40 of invasive Phragmites. We also noted large numbers of multi-flora rose, long expanses of reed canary grass, and fewer but still important observations of oriental bittersweet, Japanese knotweed, and sweet autumn clematis. The most significant non-plant invasive species observation was of one rusty crayfish, found upstream of Union City, Michigan.

Many readers also are aware that Michigan has an invasive species "watch list" of plants, mammals, insects, tree pests, fish, reptiles, and other species that are a high priority for early identification and control because they "have been identified as posing an immediate and significant threat to Michigan's natural resources". Among these species are the red swamp crayfish, nutria, kudzu, and many other species. In our inventory involving over 200 person-hours of on-the-river survey time, we found no watch list species. This is an important inventory result. While it is always possible that we just missed them, our inventory provides a point in time indicating that watch list species, if actually present, are still rare in and along the mainstream St. Joseph River.

WHAT'S NEXT

To our knowledge, no other inventory of the St. Joseph River is as comprehensive, not only regarding invasive species, but also many other natural and man-made features, conditions, and challenges. This inventory helps address several data gaps identified in the St. Joseph River Watershed Management Plan, the Michigan Forest Action plan, the local Band of Potawatomi Tribal management plan, and the GLRI Action Plan II, all of which are important planning and management documents targeting improvements in places like the St. Joseph River watershed. Concentrated efforts to produce detailed inventories of conditions in aquatic ecosystems will continue to be an important part of achieving sustainability goals for waterways and watersheds in the Great Lakes basin. The need for creative ways to carry out these inventories is only growing. In Michigan alone, there are thousands of miles of river and lake shoreline that offer clues about current challenges, and also hold the keys to finding the actions most needed to restore and protect water quality and ecosystem integrity. The St. Joseph River watershed alone has a total area of 4,685 square miles and contains 1,631 miles of significant tributaries. It is clear that, in combination with focused projects like this one, efforts to engage community volunteers through programs like MISIN and MI Paddle Stewards are essential to meeting these challenges. Our rivers and lakes benefit when we all become active stewards of their condition.

As we pushed off from Benton Township Park for one last leg of the GLRI St. Joseph River invasive species inventory journey, we looked forward to the new observations that lay ahead that day, and to leaving behind the roar of traffic on Interstate 94. The feeling was a mixture of excitement and melancholy. The challenging, rewarding, and focused data-gathering outdoor adventure of this inventory effort was ending. But there is excitement in seeing what new stories the

PHOTO CREDIT: DOUG MCLAUGHLIN
APPROACHING THE ST. JOSEPH NORTH PIER LIGHTHOUSE AT THE MOUTH OF THE ST. JOSEPH RIVER AT LAKE MICHIGAN, AUGUST 17, 2021.

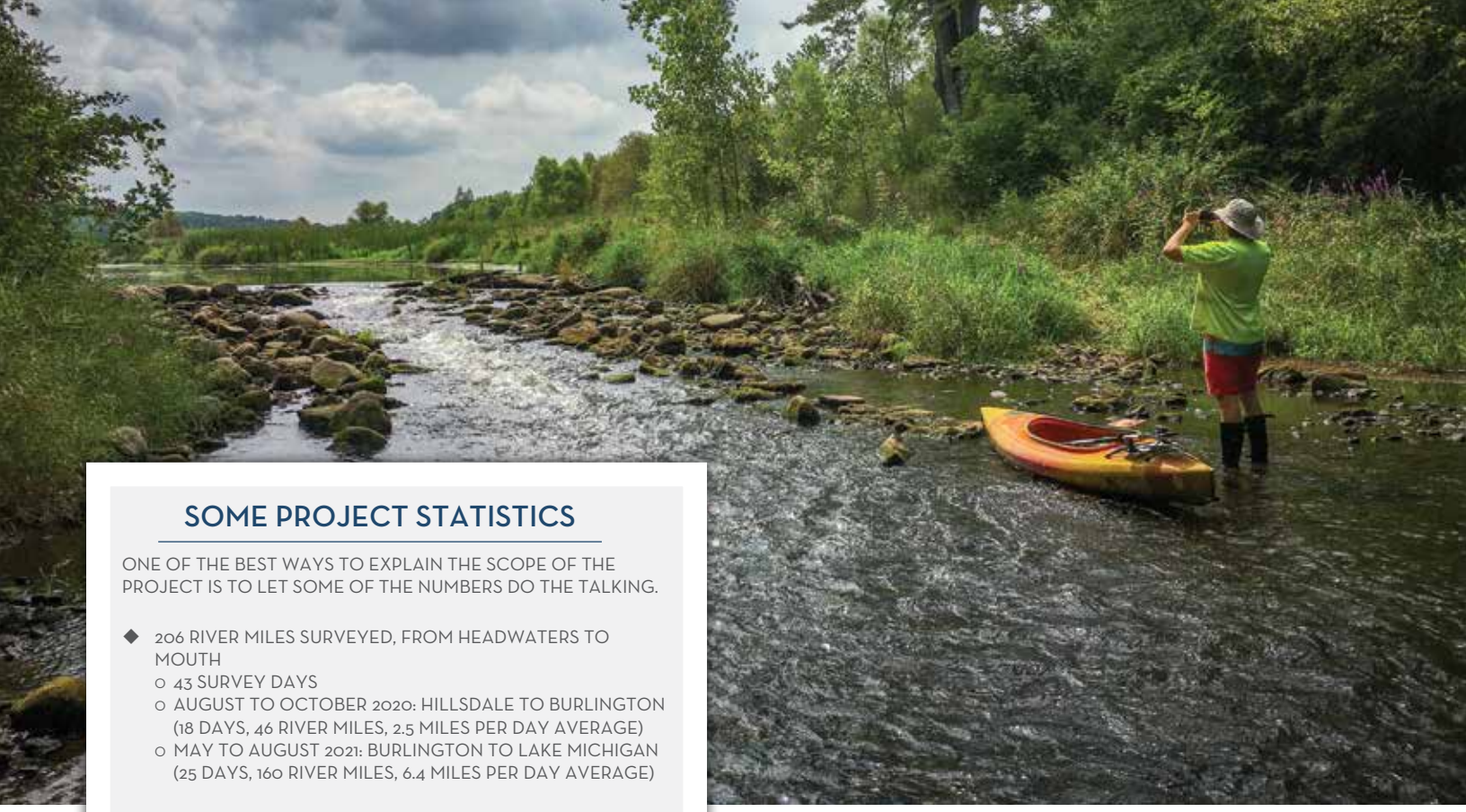

PHOTO CREDIT: DOUG MCLAUGHLIN
LOOKING AT RESTORED RAPIDS AT THE OUTLET OF A FORMER MILL POND NEAR JONESVILLE, MICHIGAN, AUGUST 25, 2020.

SOME PROJECT STATISTICS

ONE OF THE BEST WAYS TO EXPLAIN THE SCOPE OF THE PROJECT IS TO LET SOME OF THE NUMBERS DO THE TALKING.

- 206 RIVER MILES SURVEYED, FROM HEADWATERS TO MOUTH
  - 43 SURVEY DAYS
  - AUGUST TO OCTOBER 2020: HILLSDALE TO BURLINGTON (18 DAYS, 46 RIVER MILES, 2.5 MILES PER DAY AVERAGE)
  - MAY TO AUGUST 2021: BURLINGTON TO LAKE MICHIGAN (25 DAYS, 160 RIVER MILES, 6.4 MILES PER DAY AVERAGE)
- 412 MILES OF SHORELINE VIEWED AND CAPTURED WITH GPS-ENABLED ACTION CAMERA VIDEO, 360° VIDEO USED ON 20 DAYS
- OVER 7 TERABYTES OF VIDEO FILES
- OVER ONE HUNDRED THOUSAND SURFACE WATER TEMPERATURE, SPECIFIC CONDUCTIVITY, AND DISSOLVED OXYGEN MEASUREMENTS, EACH WITH GPS COORDINATES
- OVER 2500 MILES DRIVEN TO CONDUCT DAILY RIVER TRIPS

data would reveal, and the actions that the new information could trigger to move the St. Joseph River watershed toward a more sustainable future. And there is excitement in making plans to gear up again with kayaks, paddles, action cameras, and water quality sensors for the next inventory opportunity.

ACKNOWLEDGEMENTS

The inventory was made possible by a grant from the Great Lakes Restoration Initiative. Additional financial support was provided by the Friends of the St. Joseph River.

Several SJCCD staff also participated in the inventory, including Shaun Grace, Allyson Wentela, Alex Birkman, Jacob Phillips, Caitlin Renehan, and Justin Norgar.

If you are interested in more information about this project, we will publish links in our newsletter and you can contact the lead author, Doug McLaughlin, at dmclaughlin@waterways-sem.com.