

## PROJECT PROFILE

### *Synopsis*

- **Project Title:** Vernal Pools: Place-based Education and Stewardship
- **Grantee Organization:** Michigan State University (MSU), Michigan Natural Features Inventory (MNFI)
- **Project Team:** Peter Badra, Phyllis Higman, Daria Hyde, Yu Man Lee, MSU/MNFI; and Lisa Marckini-Polk, Civic Research Services, Inc.
- **Contact Person:** Yu Man Lee, MSU/MNFI, [leeyum@msu.edu](mailto:leeyum@msu.edu)
- **Grant Amount:** \$90,000
- **Time Frame:** April 1, 2015 – September 30, 2017
- **Focus Areas:** Stewardship
- **Brief Project Summary:** This project launched a pilot program of the "Vernal Pool Patrol," a citizen science and place-based education program adapted for K-12 students and educators to help map and monitor vernal pools in Michigan. Vernal pools are small, temporary wetlands that help maintain healthy forests and provide critical habitat for wildlife. They are vulnerable to degradation and destruction, and little information is available on their status and ecology in Michigan. Students learned about vernal pools and collected data on them. This program increased awareness and knowledge of vernal pools, while addressing STEM learning objectives and cultivating a Great Lakes stewardship ethic.

### *Project in Context*

Vernal pools are small, shallow, seasonally flooded wetlands that provide critical habitat for wildlife, particularly invertebrates and amphibians because they lack fish predators. Vernal pools also provide important ecosystem services such as water storage, infiltration, and groundwater recharge. These wetlands play an important role in maintaining healthy forest ecosystems, and vulnerable to degradation or destruction. Also, little information is available on the status, distribution, and ecology of these wetlands. This information is needed to effectively manage and protect these unique and important wetlands. As a result, the Vernal Pool Patrol program, a statewide vernal pool mapping and monitoring program, was launched in 2012 to help address this need. This program relies on citizen scientists and community partners to help identify and map locations of vernal pools in their local communities, and collect information about them, following a standard protocol. The information is added to a statewide vernal pool database, which can be used by a variety of stakeholders to assess and track the status and distribution of vernal pools, and to manage and protect these important wetlands.

The main goal of this project was to develop and launch a companion Vernal Pool Patrol program for K-12 formal and informal educators and students to get involved with vernal pool mapping and monitoring in Michigan. The program primarily targets middle and high school educators and students, but upper elementary educators and students also can participate in the program. This program provides opportunities for students to serve as citizen scientists by collecting actual research data on vernal pools, while addressing STEM learning objectives and cultivating a Great Lakes Basin stewardship ethic.

## ***Goals of the Effort***

The key goals for this project included the following:

1. Adapt and launch a successful pilot program of the Vernal Pool Patrol (VPP), a statewide citizen science-based vernal pool mapping and monitoring program, for K-12 schools, educators, and students in northern Michigan.
2. Establish a trained network of teachers and community partners to engage students in local vernal pool mapping and monitoring.
3. Engage a network of knowledgeable students, teachers, and community partners in local vernal pool mapping and monitoring.
4. Develop a web-based platform that is utilized for collecting, assessing and sharing local VP monitoring data.
5. Increase understanding of the ecology, function and status of vernal pools in Michigan through the collection, assessment and contribution of field data to the statewide VP database.
6. Help develop a broader Great Lakes stewardship ethic among students, teachers and partners who engage in the Vernal Pool Patrol Program.
7. Foster future collaborations between MNFI and teachers, student, and community partners participating in the Vernal Pool Patrol.

## ***Results***

Key project results and findings include the following:

- The Vernal Pool Patrol, a statewide citizen science- and place-based vernal pool mapping and monitoring program, was adapted for K-12 educators and students, primarily at the upper elementary, middle and high school levels, to get involved with the program.
- A network of 24 teachers and at least 26 community partners (i.e., individuals representing different community partner organizations) in northern Michigan was trained on the Vernal Pool Patrol program and protocol during this project to implement the program and engage students in vernal pool mapping and monitoring.
- A total of 18 teachers/educators and over 740 upper elementary, middle, and high school students from 13 different schools across northern Michigan were trained and participated in the Vernal Pool Patrol pilot program between 2015 and 2017. Over 25 community partners or volunteers also assisted the teachers and students and participated in the pilot program. All the teachers who participated in the program and the evaluation said that they would recommend the program to other teachers. The teachers also said that the students enjoyed and were highly engaged by the program.
- A web-based or online platform (i.e., Google form) was developed for students to enter, view, and download their vernal pool monitoring data as well as data collected by students monitoring other vernal pools in the project area.
- The Vernal Pool Patrol pilot program provided additional information on vernal pools and increased our knowledge and understanding of their status, distribution, and ecology in Michigan. At least 20 new vernal pools were identified, mapped, and monitored by the educators and students. Fairy shrimp, which only live in

vernal pools, was found by the students in at least eight of the vernal pools that were monitored, including perhaps the first documentation of fairy shrimp in a wooded dune and swale natural community. Fairy shrimp are only known from a small number of vernal pools across the state.

- The Vernal Pool Patrol program resulted in significant increases in awareness and understanding of vernal pools and an increase in attitudes towards stewardship.
- The Vernal Pool Patrol program and this project resulted in new collaborations with a number of teachers, students, and community partners, including the GLSI, and stronger and expanded existing partnerships for MNFI in the project area.

## ***Products and Resources***

### Websites

- Vernal Pool Patrol webpage (<http://vpppartnership.iescentral.com/index.html>) - This webpage was developed through this project, and is part of the Michigan Vernal Pools Partnership's website (still in development).
- NEMIGLSI Vernal Pool Patrol Project webpage (<http://www.nemiglsi.org/projects.asp?ogt=pv&pid=92>) – This webpage provides basic information about the Vernal Pool Patrol.

### Media Coverage

- NatureChange video story about the Vernal Pool Patrol and Harbor Springs Middle School and Little Traverse Conservancy - <http://naturechange.org/2016/06/09/vernal-pool-middle-school-learning-the-mysteries-of-a-vernal-pool/>
- Petoskey News video – Learning about vernal pools (Harbor Springs Middle School) - [https://www.petoskeynews.com/life/multimedia/video-learning-about-vernal-pools/video\\_0bdf93a-78f5-11e5-be69-cf63c3849e1a.html](https://www.petoskeynews.com/life/multimedia/video-learning-about-vernal-pools/video_0bdf93a-78f5-11e5-be69-cf63c3849e1a.html)
- Onaway Area High School video about vernal pools and the Vernal Pool Patrol - <https://www.youtube.com/watch?v=aDVhu1VS7Js>
- Vernal Pool Patrol article in The Guide - <http://www.nemiglsi.org/proposedprojects.asp?ogt=nv&nid=256&pid=92>
- Great Lakes Echo podcasts on the Vernal Pool Patrol - <http://greatlakesecho.org/2016/01/19/searching-for-woodland-fairies-and-fingernail-clams/> and <http://greatlakesecho.org/2016/05/27/local-learning-field-trip-to-the-neighborhood-vernal-pool/>
- North American Association for Environmental Education – <https://naaee.org/eepro/resources/vernal-pool-middle-school-learning>
- Alpena News article – “Rogers City students help map, monitor vernal pools” - <http://www.thealpenanews.com/news/local-news/2016/04/rc-students-help-map-monitor-vernal-pools/>
- Harbor Light article – Learn Local - Students research ‘vernal pools’ at area Conservancy sites (Harbor Springs Middle School) - [https://issuu.com/littletraversebay/docs/harborlight120215\\_optimized](https://issuu.com/littletraversebay/docs/harborlight120215_optimized)

# Final Narrative Report

## *Background/Overview*

### **1. Briefly summarize the project description as outlined in the original proposal.**

The primary goal of this project was to develop and launch a "Vernal Pool Patrol" program for K-12 (i.e., 6th-12th grade) students and educators to map and monitor vernal pools in Michigan. Vernal pools are small, seasonally flooded wetlands that provide critical habitat for amphibians and other wildlife, and perform important ecosystem services such as water storage, infiltration, and groundwater recharge. Because of their small and seasonal nature, these wetlands are not well-protected under current wetland regulations, and are vulnerable to degradation or destruction. Also, little information is available on the status, distribution, and ecology of these wetlands. This program provides opportunities for students to serve as citizen scientists by collecting actual research data on vernal pools, while addressing multiple STEM learning objectives and cultivating a Great Lakes Basin stewardship ethic. The information collected by the students will be added to the Michigan Vernal Pool Database, and will help us gain a better understanding of vernal pools and help us better manage and protect these wetlands in Michigan and beyond.

### **2. Was the project completed as originally intended? If not, indicate how the final outcome(s) differed from what was anticipated. Does your experience suggest that original expectations were realistic? What factors hindered or helped progress?**

The project was completed as originally intended for the most part. We were able to successfully adapt the Vernal Pool Patrol program for K-12 (primarily 6<sup>th</sup>-12<sup>th</sup> grade) students and educators. We developed the framework, infrastructure, and many of the teaching materials and resources needed to implement the program, including a Vernal Pool Patrol webpage/website. We successfully recruited, trained, and worked with twice as many teachers, students, and community partners as we had originally anticipated for the pilot program. Students, educators, and community partners enjoyed the program, and found it engaging and fun. The program resulted in increased learning and stewardship attitudes among the students, and increased data and knowledge about vernal pool distribution and ecology, including some interesting discoveries. The Vernal Pool Patrol program and this project provided opportunities for MNFI to develop new collaborations and strengthen and expand existing partnerships that will not only help implement and sustain the Vernal Pool Patrol program but also potentially help develop and implement other biodiversity, citizen science, and place-based programs in the future. Teachers can use this program to help teach or reinforce STEM learning objectives and address new science standards. Community partners can implement this program to engage with the educators, students, and the local community.

However, some components of the project were not completed as originally intended. These include the following:

- 1) We had originally intended or anticipated that the same students would participate in the program within an academic year, and would get to visit and collect data on the pools in the fall and in the spring. However, student participation varied depending on the teacher, the format of the class, and whether the school operated

on semesters or trimesters. For example, one of the teachers had the students in her exploratory class participate in the program, and the class changes every trimester. So one class or group of students visited and collected data on the vernal pool in the fall. A second class or group of students collected data on the pool during the first visit in the spring, and a third class or group of students collected data on the pool during the second visit in the spring. So students in this case did not visit or collect data during both dry and wet conditions, whereas other students who participated in the program as part of semester or year-long classes were able to visit and collect data on the pools during both dry and wet conditions. Our original expectations for this may not have been realistic. We need to take this into consideration when implementing and potentially revising this program.

- 2) We had originally envisioned and proposed that students participating in the program would enter their data, photos, and monitoring stories using the web-based, online data platform, and that they would view and download data from other vernal pools that were monitored by other students/schools for comparison and analysis. We also had discussed with the teachers the idea of students doing some information sharing or stewardship activity as part of the program (e.g., sharing what they learned with other students in the school, presenting what they learned about vernal pools to the local community, school board, or community partner organization). However, only some of the classes were able to enter their data online. In some cases, the teacher compiled and entered the data. Only one teacher was able to have the students share information or do a stewardship activity. Part of the reason for teachers not doing these components may be because we did not emphasize these components as much, and we were not directly involved in these activities. We provided some suggestions for information sharing and stewardship activities but did not actively help them set this up. Teachers also likely found it challenging to implement these activities due to limited time at the end of the semester/school year. We need to emphasize these components more when we work with the teachers and also need to provide more support to the teachers for setting up these activities. Also, the web-based platform that we set up for entering data was not compatible for uploading photos and stories/text. We are looking at using a different web-based platform for this.
- 3) We had originally planned for several teachers to help us develop a lesson plan or plans for the program. One teacher who is part of the NEMIGLSI and participated in the program developed a lesson plan on vernal pools in general. But we were not able to find teachers who participated in the program to help us develop lesson plans due to their work and family commitments, even with offering financial compensation. They also might not have felt comfortable or familiar enough with the program or vernal pools to develop a lesson plan(s) for the program. We have drafted a lesson plan, and one teacher has agreed to help review and provide comments on it. We plan to look for 1-2 additional teachers to review it as well.
- 4) We also had planned to have a draft version of the Vernal Pool Patrol webpage/website completed earlier in the project so that we could get some feedback from some of the teachers, students, and community partners. But due to issues with the web developer and the delay in completing the webpage, we were not able to get feedback before the end of the project. We do plan on getting some feedback from teachers, students, and community partners.

## **Outcomes**

### **3. What activities were pursued in relationship to intended outcomes, and to what extent did you achieve the following intended outcomes listed in your proposal? (Merge intended outcomes from proposal.)**

**Outcome 1:** The Vernal Pool Patrol, a statewide citizen science- and place-based vernal pool mapping and monitoring program, was adapted for K-12 educators and students, primarily at the upper elementary, middle and high school levels. This effort included revising the vernal pool monitoring protocol; identifying, developing, and/or revising classroom presentations, the vernal pool monitoring manual, data sheet/field form, and additional teaching materials and resources, including a lesson plan(s); determining approaches for working with students in the field to collect the necessary data while minimizing adverse impacts to the pools and keeping students engaged; and developing a supplies list/kit. These products are available through the Vernal Pool Patrol webpage (see below).

**Outcome 2:** A trained network of teachers and community partners is established to engage students in mapping and monitoring of local vernal pools. A network of 24 teachers and at least 26 community partners (i.e., individuals representing different community partner organizations) in northern Michigan was trained on the Vernal Pool Patrol program and protocol during this project to implement the program and engage students in vernal pool mapping and monitoring. We developed and conducted a total of three training workshops on the Vernal Pool Patrol program in Gaylord in April 2015 and April 2016. Training workshops included 2-3 hours of instruction in the classroom, and 2 hours of training at a vernal pool in the field. Classroom instruction presented information on what vernal pools are, how to identify them, plants and animals associated with vernal pools and how to identify them, and the monitoring protocol. Training in the field consisted of visiting and exploring vernal pools in the field, reviewing and practicing the monitoring protocol and data form, and seeing some of the plants and animals in and around the pools and learning how to identify them.

Sixteen of these teachers attended one of the vernal pool training workshops. Eight of the teachers did not attend a training workshop but received training by participating in the program and working with MNFI staff or trained community partners. Almost all of the community partners in 2015 and 2016 attended one of the two training workshops. Two additional teachers and two additional community partners attended a training workshop, but they did not work in the project area. Trained community partners included 5 staff associated with the NE and NW MI and Western Upper Peninsula GLSI regional hubs. Other community partner organizations included the Little Traverse Conservancy, Grand Traverse Regional Land Conservancy, AmeriCorps, U.S. Fish and Wildlife Service, Thunder Bay National Marine Sanctuary, Michigan State University Extension, and Michigan Sea Grant.

**Outcome 3:** A network of knowledgeable students, teachers, and community partners is engaged in local vernal pool mapping and monitoring. A pilot program of the Vernal Pool Patrol was successfully launched and implemented in northern Michigan. A total of 18 teachers/educators and at least 740 students from 13 different schools across northern Michigan were trained and participated in the Vernal Pool Patrol pilot

program between 2015 and 2017. Over 25 community partners or volunteers also assisted the teachers and students and participated in the pilot program. The number of students that participated in the pilot program was higher than 740 students (and potentially significantly higher) because a couple of teachers implemented the program on their own in the spring of 2015 and/or continued to work on their own in 2015 and 2016, and we were unable to get the number of students who participated in the program from these teachers. Also, one of the educators was an informal educator who participated in the program with her 4H group, and we were not able to get an estimate of how many students participated in the program with her. Program participants consisted of upper elementary, middle, and high school students (i.e., grades 4-12). Eight of the teachers participated in the program during both the 2015 and 2016 academic school years. Of the remaining nine teachers who had participated in the program during the 2015-2016 school year, one retired, one left the school district, three were teaching different subjects (non-science), one encountered administrative obstacles, and two we are not sure if they implemented the program during the 2016-2017 school year.

During the first year of the project or the first year a teacher participated in the program, MNFI staff worked with the teachers directly to train students in the classroom and to collect data in the field following the standard monitoring protocol. MNFI presented a total of 29 classroom presentations between the fall of 2015 and spring of 2017. The training provided an overview of vernal pools and some of the plants and animals they might see in their vernal pool, the VPP, data collection methods, and the data form. This was presented to the students prior to going out in the field for the fall and spring monitoring visits. MNFI staff also worked with 18 classes in the field during fall and/or spring monitoring visits. Most of these field visits were in the fall of 2015 and spring of 2016, with only about four of these visits in the fall of 2016 and/or spring of 2017. These field visits helped train the teachers and students on how to collect data in the field using the standard monitoring protocol and data form. During the 2016-2017 academic year, most teachers participating in the program either conducted the fall and spring monitoring visits on their own or with community partners other than MNFI staff.

Community partners primarily provided assistance in the field, helping the students work in small groups to collect the data and identify plants and animals observed in and around the pools. In some cases, classes were large or multiple classes were in the field at the same time, so we had to divide the class(es) into two smaller groups and take turns monitoring the pool. Community partners were invaluable in helping the teachers and students collect data in the field, particularly in these cases.

Pre- and post-program evaluations were developed by Civic Research Services in conjunction with MNFI staff. Evaluations were administered to most of the students participating in the program, except for students associated with teachers working on their own. Overall, the Vernal Pool Patrol was very well-received by the teachers, students, and community partners who participated in the pilot program (see evaluation results below for more details). All the teachers who participated in the program and the evaluation said that they would recommend the program to other teachers. The teachers also said that the students enjoyed and were highly engaged by the program. The students seemed to particularly enjoy spending time outside, exploring the vernal pool, and seeing all the different invertebrates and amphibians in the pool.

**Outcome 4:** A web-based or online platform was developed and utilized by students to enter, compile, assess, and share their local vernal pool monitoring data. They also could use the web-based/online platform to view and download their data as well as data collected by students monitoring other vernal pools. Students could compare and analyze data from their pool and other pools that were monitored by other students/schools, but it is unclear how many classes took advantage of this and conducted any data analysis or comparisons. We developed and used a Google form for the web-based platform. But we are looking into using a different web-based platform (e.g., ArcGIS Collector) for collecting and entering data for the monitoring program in the future.

As part of this outcome, we also contracted with the Michigan Nature Association (MNA) to develop a web-based platform for participants to upload their field data, photos, and monitoring stories. MNA was able to work with their website developer to design and develop a webpage/website for the Vernal Pool Patrol program as part of the Michigan Vernal Pools Partnership website. Unfortunately, at this time, the schools participating in the program are listed on the webpage, but they are not able to upload photos and stories at this time. We are working on developing other venues for sharing photos and stories to help build a sense of community among the Vernal Pool Patrol program participants (e.g., ArcGIS Online applications such as Story Map, or Facebook page).

**Outcome 5:** The Vernal Pool Patrol pilot program provided additional information on vernal pools and increased our knowledge and understanding of their status, distribution, and ecology in Michigan. At least 20 vernal pools were identified, mapped, and monitored by the educators and students who participated in the Vernal Pool Patrol pilot program. Several additional vernal pools were discovered when MNFI staff and/or community partners were helping the teachers find vernal pools for their classes to monitor. All these vernal pools had not been documented or confirmed prior to this project, and were added to the statewide vernal pool database. More importantly, fairy shrimp, which only lives in vernal pools and is entirely dependent on vernal pools for their survival, was found by the students in at least eight of the vernal pools that were monitored. Prior to this project, fairy shrimp had only been documented from a small number of vernal pools across the state, particularly in northern Michigan due to lack of data and surveys. Additionally, fairy shrimp were documented by a MSU Extension 4H educator and the students in her 4H club in several small, wet depressions or swales within a wooded dune and swale complex in 2015 right after she attended the vernal pool training workshop in Gaylord in April. This was an exciting discovery since this may have been the first documentation of fairy shrimp in a wooded dune and swale complex in Michigan (and maybe the first time fairy shrimp have ever been documented in wooded dune and swale habitat). Since 2015, this educator and the students in her 4H club have documented fairy shrimp in a number of swales or vernal pools in the wooded dune and swale complex. The new vernal pool and fairy shrimp locations and the data the students documented during the pilot program are significant contributions to our knowledge of vernal pools in the state and will help us determine how we should manage and protect them.



**Outcome 6:** Participating in the Vernal Pool Patrol program resulted in significant increases in awareness and understanding of vernal pools and a modest increase or enhancement of attitudes towards Great Lakes stewardship. Results from the student evaluations indicate significant increases in student learning related to vernal pools, with very large effect sizes of more than 1.0, indicating improvements of more than a full standard deviation, in some cases. Scores on another short-answer question related to the benefits of vernal pools, and on a short answer/essay question about adaptations for survival in vernal pools also showed large positive effects of 0.58 and 0.72. Student stewardship gains were less notable than learning gains but some change was evident, particularly in the areas of attitudes about the environment (where an effect size of 0.42 was exhibited) and civic capacity (where an effect size of 0.43 was documented). These effect sizes are moderate, and based on a limited number of items, but suggest that the program is contributing to enhanced stewardship attributes. Please refer to the final evaluation report for more details.

**Outcome 7:** The Vernal Pool Patrol program and this project resulted in new collaborations with a number of teachers, students, and community partners, including the GLSI, and stronger and expanded existing partnerships for MNFI in the project area. We worked with the NW and NE MI GLSI regional hubs to identify teachers and community partners to contact and invite to the vernal pool training workshops. We also contacted a couple of conservation partners to help us identify vernal pools or potential vernal pools for teachers and students to monitor (e.g., Grand Traverse Regional Land Conservancy for the Montessori Children's House-Traverse City and Grand Traverse Academy). These new or enhanced collaborations will be critical to the sustainability and success of the Vernal Pool Patrol as we expand the program and strive to get other educators, students, and community partners involved. The approach that we utilized for this project and the partnerships that we have developed will provide a model or framework for working with teachers, students, and community partners to develop and implement additional citizen science-, biodiversity-, and place-based education programs in the future. For example, we have initiated discussions with the Southeast Michigan Stewardship Initiative (SEMIS) and the Grand Learning Network GLSI hubs to get teachers and students involved in the Vernal Pool Patrol in southeast and south central Michigan. MNFI also recently obtained a National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education (B-WET) grant to develop and pilot a place-based education program focused on healthy watersheds, coastal and rare wetlands, vernal pools, and transportation impacts in Monroe and Wayne counties. We are utilizing the approach we used for this project as a starting point for the B-WET project, and will apply the feedback and lessons learned from this project to the B-WET project and other future place-based education efforts.

**4. What audience(s) were you particularly hopeful of reaching? To what extent did you reach them? Did you receive any feedback?**

We were hoping to reach teachers, students, and community partners in the project area. We were able to reach twice as many teachers, students, and community partners as originally planned. We did receive feedback from them, which was overwhelmingly positive (see evaluation report for detailed results/feedback). Although we did not conduct a formal evaluation of the community partners, we received feedback informally from them, and the feedback was positive. This is also

demonstrated by the community partners continuing to participate in the program working with teachers and students, implementing and expanding the program on their own, and continuing to promote the program.

**5. What relationships or opportunities were developed or strengthened through the work?**

The Vernal Pool Patrol program and this project resulted in new collaborations with a number of teachers, students, and community partners, including the GLSI, and stronger and expanded existing partnerships for MNFI in the project area. These new or enhanced collaborations will be critical to the sustainability and success of the Vernal Pool Patrol as we expand the program and strive to get other educators, students, and community partners involved. The approach that we utilized for this project and the partnerships that we have developed will provide a model or framework for working with teachers, students, and community partners to develop and implement additional citizen science-, biodiversity-, and place-based education programs in the future. For example, we have initiated discussions with the Southeast Michigan Stewardship Initiative (SEMIS) and the Grand Learning Network GLSI hubs to get teachers and students involved in the Vernal Pool Patrol in southeast and south central Michigan. MNFI also recently obtained a National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education (B-WET) grant to develop and pilot a place-based education program focused on healthy watersheds, coastal and rare wetlands, vernal pools, and transportation impacts in Monroe and Wayne counties. We are utilizing the approach we used for this project as a starting point for the B-WET project, and will apply the feedback and lessons learned from this project to the B-WET project and other future place-based education efforts.

**6. Was an evaluation included as part of this project? If so, what were the key findings? (Please attach a copy of the evaluation report).**

An evaluation of the Vernal Pool Patrol program and impacts on student learning/understanding of vernal pools, attitudes towards Great Lakes, and stewardship was conducted by Lisa Marckini-Polk with Civic Research Services (CRS) as part of this project. The key findings and conclusions of the evaluation are as follows (from the evaluation report):

1. Teachers are enthusiastic about the program. They say it delivers science learning benefits in the areas of ecosystem and habitat science, data collection, and exposure to real-world science and scientists. They also say that students are highly engaged, and that both students and teachers benefit from the opportunity to spend time outdoors exploring community resources.
2. Every teacher interviewed said he or she would recommend the program to a friend. Their “pitches” emphasized student engagement and the “fun” factor, the quality of support, that the program is manageable due to the support and its defined nature, and that the work is authentic and “real.”
3. With rare exceptions, teachers depend on either MNFI staff or a knowledgeable local partner to carry the program out, particularly the field work. In year one, most of the teachers interviewed said having MNFI staff present was “necessary for success.” In year two, those teachers able to be interviewed had generally

transitioned from MNFI support to the support of a local partner. Teachers frequently depend on MNFI or the local partner for help overseeing student groups working on varied tasks and for identifying species. In some instances, teachers also felt that MNFI-supplied equipment was helpful, if not essential.

4. Students were also generally enthusiastic about the program. When asked to improve it, nearly half offered no recommendations, and many of these indicated the program was “great as it is” and “fun.” The next most common response was to suggest that the program be expanded—with more time in the field, or more related activities in the classroom—indicating that the students wanted more and appreciated what they had experienced. On the post-program survey, students were likely to agree that the data collected through the program will make a difference, and that other students should have the opportunity to participate: both of these items earned an agreement score of more than 4 on a 5-point scale.
5. Student science learning related to vernal pools was evident. Scores on the multiple choice section of the pre/post test and on a short-answer question about the distinguishing features of vernal pools both showed sharp increases, with very large effect sizes of more than 1.0—indicating improvements of more than a full standard deviation. Scores on another short-answer question related to the benefits of vernal pools, and on a short answer/essay question about adaptations for survival in vernal pools also showed large positive effects of 0.58 and 0.72, respectively. Student performance was not extraordinary on the posttest, but learning gains were impressive, indicating that the test is not too easy.
6. Student stewardship gains were less notable than learning gains but some change was evident, particularly in the areas of attitudes about the environment (where an effect size of 0.42 was exhibited) and civic capacity (where an effect size of 0.43 was documented). These effect sizes are moderate, and based on a limited number of items, but suggest that the program is contributing to enhanced stewardship attributes.
7. Wet and dry visits were associated with slightly more positive results. Students who were able to visit a vernal pool both when wet and when dry exhibited slightly stronger pre-to-post impacts than students who did not experience the vernal pool in both the wet and dry condition. Further, students who did not have the opportunity to see the pool both when wet and dry frequently recommended the program be changed to allow this in the future.
8. Many students were unable to visit the vernal pool both when wet and when dry. Barriers reported by teachers included teaching on a semester or trimester basis, difficulty when the weather didn’t align with the intended travel schedule, and challenges with transportation. One teacher conducted the program after school due to a school policy that requires every student in the grade be offered the chance to participate in any field trip. Some teachers joined the program later in the year and only made spring visits.
9. Teacher-recommended enhancements include add-ons and “extenders” and some clarifications about field protocols. Teachers are interested in doing more with the program although the observed pattern indicates few have time to build out their own additional lessons or assessments.

Based on these key findings and conclusions, the recommendations provided by Civic Research Services included the following:

1. MNFI should strive to maintain the core of the program in as-is form.
2. MNFI should seek out sites for implementation where there is an able and willing partner to assume the MNFI role in times when MNFI is not funded to visit schools, deliver PowerPoints, and participate in site visits.
3. Opportunities to strengthen the program may include the following:
  - a. Crosswalking the program to the Next Generation Science Standards, with a particular emphasis on the eight science and engineering practices.
  - b. Developing model, authentic assessments
  - c. Collaborating with stewardship experts to offer optional add-ons that involve students in a service activity related to vernal pools.
  - d. Building a learning community.
  - e. Responding to selected student suggestions.
  - f. Share common misconceptions and limits to learning with program facilitators.
4. MNFI should be continuously cautious about the logistical challenges that teachers face in participating in the program.

**7. Whether they were intended or unintended, what do you consider the most important benefits or outcomes of this stewardship project?**

The most important benefits or outcomes of this stewardship project include the following:

- 1) We were impressed (and pleasantly surprised) by how much the students, teachers, and community partners really enjoyed the program, and how much the students were able to learn and retain about vernal pools. We also appreciated how much the students really enjoyed spending time outside and exploring the vernal pools and surrounding forest. They also indicated that most of their classes do not provide opportunities to go outside and do this kind of science/learning. This emphasized the need and interest in programs like the Vernal Pool Patrol that provide students with opportunities to explore and spent time outside and collect data in the field. The Vernal Pool Patrol also has potential to reinforce science concepts, practices, and skills which are emphasized in the Next Generation Science Standards and Michigan Science Standards. This needs to be further explored and more specific guidance developed and provided to the teachers.
- 2) The new collaborations this project allowed us to build with educators and community partners were and will continue to be invaluable to the success and sustainability of the Vernal Pool Patrol program and other citizen science and/or place-based education programs MNFI develops and implements. The opportunity to work and collaborate with the GLSI regional hubs was especially important and beneficial to the success of the program. We would not have been able to recruit the number and quality of teachers and community partners that we were able to reach without the assistance and support of the NE and NW MI GLSI

- regional hubs. This project has given us the insight and opportunity to develop new partnerships/relationships with other educators, partners, and GLSI regional hubs such as the Southeast Michigan Stewardship Initiative (SEMIS) and Grand Learning Network as we strive to continue to expand the Vernal Pool Patrol program and develop other citizen science- and place-based programs.
- 3) The infrastructure (e.g., Vernal Pool Patrol webpage), framework, and materials that this project allowed us to develop have been instrumental to our ability to implement the Vernal Pool Patrol program statewide.
  - 4) Increased public awareness and understanding of vernal pools generated by this project and the new data the students collected are critical to enhancing efforts to assess, manage, and protect vernal pools.

### ***Related Efforts***

**8. Was this project a stand-alone effort or was there a broader effort beyond the part funded by the GLFT? Have other funders been involved either during the time of your GLFT grant or subsequently?**

This project helped us develop and launch the Vernal Pool Patrol program for K-12 educators and students, and is part of a broader effort to implement this program statewide. This project allowed us to expand the Vernal Pool Patrol program to K-12 educators and students. This program was initially developed and launched in 2012 and 2013 with funding from the U.S. Environmental Protection Agency and the Michigan Department of Environmental Quality. Since 2013, we have been looking for opportunities to continue to expand the Vernal Pool Patrol program and secure additional funding for the program. In addition to this project, we have secured funding from MSU Extension's Greening Michigan Institute, Forestry Program and the 4H Program Development Fund, as well as the Michigan Nature Association, Michigan Sea Grant, community foundations, Meridian Township, Mid-Michigan Stewardship Initiative, Wild Ones, and Friends of Ingham County Parks to expand the Vernal Pool Patrol program (both the regular program and the K-12 program) with the goal of implementing the program statewide. In 2017, we were able to secure a grant from the National Oceanic and Atmospheric Administration's (NOAA's) Bay Watershed Education (B-WET) program which will allow us to expand the Vernal Pool Patrol K-12 program to Monroe and Wayne counties, and we plan to seek additional funding to expand the program and work with more teachers in southeast Michigan, particularly in the Detroit area.

**9. Has there been any spin-off work or follow-on work related to this project?**

Yes, we have a recent project funded by the NOAA B-WET program which will allow us to expand the Vernal Pool Patrol program to work with teachers, students, and community partners in southeast Michigan, particularly in Monroe and Wayne counties, as part of a broader place-based education program focused on watershed health, vulnerable wetland, and transportation impacts. Although we currently do not have funding to continue to work on the Vernal Pool Patrol in northern Michigan, a number of the teachers and community partners we have trained and worked with on this project are continuing to implement the program (e.g., Harbor Springs Middle School, Montessori Children's House in Traverse City, Little Traverse Conservancy, Grand Traverse Regional Land Conservancy, and the NEMIGLSI). The Kalamazoo

Nature Center also has started to implement the program with adult volunteers and students. We are continuing to work on improving and expanding the program and continuing to seek additional funding for these efforts. We would like to improve the program by addressing the recommendations that were provided by Civic Research Services as part of the evaluation.

### ***Communication/Dissemination***

#### **10. List publications, presentations, websites, and other forms of formal dissemination of the project deliverables, tools, or results, including those that are *planned or in process*.**

##### Websites

- Vernal Pool Patrol webpage (<http://vpppartnership.iescentral.com/index.html>) - This webpage was developed through this project, and is part of the Michigan Vernal Pools Partnership's website (still in development). This website provides access to information on the Vernal Pool Patrol program, associated training workshops and educational materials and resources, and a web-based platform for entering, viewing, and downloading data that were developed for educators and students as part of this project. The website also provides a list of schools and community partners who have participated in the program, and general information on vernal pools.
- NEMIGLSI Vernal Pool Patrol Project webpage (<http://www.nemiglsi.org/projects.asp?ogt=pv&pid=92>) – This webpage provides basic information about the Vernal Pool Patrol, what the program entails, and who to contact to learn more about and/or get involved with the program.

##### Media Coverage

- NatureChange video story about the Vernal Pool Patrol and Harbor Springs Middle School and Little Traverse Conservancy - <http://naturechange.org/2016/06/09/vernal-pool-middle-school-learning-the-mysteries-of-a-vernal-pool/>
- Petoskey News video – Learning about vernal pools (Harbor Springs Middle School) - [https://www.petoskeynews.com/life/multimedia/video-learning-about-vernal-pools/video\\_0bdf93a-78f5-11e5-be69-cf63c3849e1a.html](https://www.petoskeynews.com/life/multimedia/video-learning-about-vernal-pools/video_0bdf93a-78f5-11e5-be69-cf63c3849e1a.html)
- Onaway Area High School video about vernal pools and the Vernal Pool Patrol produced in conjunction and with funding from a grant from the Knight Center for Environmental Journalism - <https://www.youtube.com/watch?v=aDVhu1VS7Js>
- Vernal Pool Patrol article in The Guide - <http://www.nemiglsi.org/proposedprojects.asp?ogt=nv&nid=256&pid=92>
- MSU Extension article – “Youths study vernal pools in northern Michigan” - [http://msue.anr.msu.edu/news/youth\\_study\\_vernal\\_pools\\_in\\_northern\\_michigan](http://msue.anr.msu.edu/news/youth_study_vernal_pools_in_northern_michigan)
- MSU Extension article – “Vernal Pool Patrol: Salamanders, frog eggs, and fairy shrimp, oh my!” - [http://msue.anr.msu.edu/news/vernal\\_pool\\_patrol\\_salamanders\\_frog\\_eggs\\_and\\_fairy\\_shrimp\\_oh\\_my](http://msue.anr.msu.edu/news/vernal_pool_patrol_salamanders_frog_eggs_and_fairy_shrimp_oh_my)

- Great Lakes Echo podcasts on the Vernal Pool Patrol - <http://greatlakesecho.org/2016/01/19/searching-for-woodland-fairies-and-fingernail-clams/> and <http://greatlakesecho.org/2016/05/27/local-learning-field-trip-to-the-neighborhood-vernal-pool/>
- North American Association for Environmental Education – <https://naaee.org/eepro/resources/vernal-pool-middle-school-learning>
- Alpena News article – “Rogers City students help map, monitor vernal pools” - <http://www.thealpenanews.com/news/local-news/2016/04/rc-students-help-map-monitor-vernal-pools/>
- Harbor Light article – Learn Local - Students research ‘vernal pools’ at area Conservancy sites (Harbor Springs Middle School) - [https://issuu.com/littletraversebay/docs/harborlight120215\\_optimized](https://issuu.com/littletraversebay/docs/harborlight120215_optimized)

#### Conference and Meeting Presentations

- Michigan Alliance for Environmental and Outdoor Educators’ Annual Conference 2016
- Great Lakes Stewardship Initiative Place-based Education Conference 2017
- Michigan Science Teachers Association Annual Conference – Accepted for 2018
- Michigan Alliance for Environmental and Outdoor Educators’ Annual Conference – Asked to present at 2018 conference
- Presented numerous talks on vernal pools including the Vernal Pool Patrol K-12 program to a variety of groups in 201 and 2017

#### **11. Please characterize your efforts to distribute and encourage use of products, processes, programs, etc. developed through this grant.**

Our efforts have focused primarily on presentations at professional conferences and other relevant meetings (e.g., teacher professional development opportunities presented by GLSI regional hubs), as well as word of mouth. The Vernal Pool Patrol program also has gotten quite a bit of media coverage, and as the program has grown, more teachers are hearing about the program and have contacted us about how to get involved. We also are continuing to look for ways to expand the program and work with new partners.

#### ***Reflections***

#### **12. Please describe any unanticipated benefits, challenges or surprises, and/or important lessons learned over the course of the project.**

We have learned several important lessons and have experienced some challenges and surprises working with the teachers and students as part of the VPP program to date.

These include:

- 1) After presenting the fall and spring classroom presentations, we think that it would be better to divide the material/presentations into 3-4 smaller presentations/lessons. This would allow more time to cover the information, and opportunity to make the presentations/lessons more interactive and allow for more

- discussion and thought regarding not only vernal pools and the VPP but also about research and data collection in general, the scientific process, and stewardship. We think this would also enhance the program's ability to align with NGSS and increase learning.
- 2) We found that even though some of the students seemed bored or uninterested during the classroom presentation, the students did seem to be listening and retaining the information based on their ability to correctly answer the questions we asked during the classroom presentation and during the field visit. The students often asked us very good questions about vernal pools. The students also demonstrated a high rate of information retention between the fall classroom and field visits and the spring classroom and field visits. We also received feedback from the teachers as well as thank you letters from students in one of the classes that indicated the students really enjoyed and appreciated the vernal pool presentation and field visits.
  - 3) We continued to realize that the VPP program is fairly involved in terms of the training required by teachers and students to accurately collect the data we need, and what is involved with taking students out in the field and having them accurately collect the data needed for the VPP program. There is quite a bit of planning involved for teachers to insure they have the required supplies and additional help needed to assist students in the field in order to successfully conduct the field monitoring and data collection. For this reason, not all teachers may be able to participate in the VPP program, especially without some assistance in the field. But we are confident that most teachers that are interested in getting involved with the VPP will be able to participate, and that we and community partners can work with them to make it happen. We originally thought we could provide vernal pool monitoring supply kits to the NE and NW GLSI hubs and teachers could check out the kits when they were going out to monitor vernal pools with their students. But since equipment needs to be disinfected and washed between vernal pools/visits, this may not be practical or feasible. As a result, in addition to providing vernal pool supply kits to the NE and NW GLSI regional hubs, we also secured some additional funds and have purchased and provided supply kits to 6 different teachers/schools in the program so that they can continue to participate in the program.
  - 4) We continue to learn that the logistics of working with multiple schools, teachers, and classes is much more involved and challenging than we had originally expected. We had originally thought we could combine working with some of the teachers and classes for the classroom training presentations and/or field visits on the same days and/or consecutive days. But this turned out not to be possible most of the time given the distances between schools and the different teachers' schedules and availability. This required us to make more trips than we had originally anticipated. We also had developed and designed the training presentation and field monitoring visits based on a certain amount of time available for the training (i.e., 1 hour) and the field visits (i.e., 2 hours). But we



found out that different teachers and classes had different amounts of time available for the classroom presentation and/or field visit (e.g., class periods ranged from about 50 – 70 minutes for the classroom training, and 50 – 120 minutes for the field visit). So we found we had to revise and tailor the classroom training and field visits for each class.

- 5) Finally, the teachers that have participated in the VPP training and in the program with their students have also really enjoyed learning about vernal pools and participating in the program! It has been such a pleasure to work with these teachers, and to see how excited and supportive they are of the project and how much they appreciate working with us and the opportunity for them and their students to get involved with the VPP program.

**13. What recommendations (if any) would you make to other project directors working on similar efforts or to the GLFT?**

We need to find additional funding and opportunities to support and institutionalize place-based education efforts. It works, and the teachers and students really enjoy it! We also need to find ways to support teachers in these efforts.

***Attachments***

14. Please attach any reports or materials developed through the grant.