

a. **Summary Information Page.**

- i. **Funding Opportunity Number:** EPA-R5-GL2012-1
Focus Area: Nearshore Health and Nonpoint Source Pollution
Category: I.C.3.-Increasing Technical Expertise to Accelerate Nutrient Reduction
- ii. **Project Title:** Focused Practice Application to Reduce Soluble Reactive Phosphorus
- iii. **Applicant Information:**
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Congressional District: MI-005 & MI-008
DUNS Number: 193247145
- iv. **Type of Organization:** College and University
- v. **Proposed Funding Request:** \$189,377.00
- vi. **Project Duration Period:** Begin October 1, 2012 and end September 30, 2014
- vii. **Brief Project Description:** This project will provide risk mapping technology and support to technicians accelerating reduction of soluble phosphorus loads to specified creeks in the Saginaw Basin. Technical assistance will be delivered through multiple local networks with long-term follow up provided. Conservation practice implementation will be focused on fields with the greatest potential to improve water quality and will include practices not widely used such as cover crops, and management of nutrients and drainage water. New technology will also support school and 4-H water related projects.
- viii. **Project Location:** Saginaw Basin w/focus on Flint River Watershed including concentrated efforts in Swartz Creek and Kearsley Creek watersheds
8 digit HUC: 04080204
Latitude and Longitude:
State: Michigan
Congressional District: MI-005 & MI-008
County: Genesee, Oakland, Lapeer
City: Grand Blanc
5 digit ZIP code: 48480

b. Work Plan.

- i. **Project Summary and Approach:** *What will be done:* The emphasis of this project is to teach technical staff how to use the Focused Practice Application with the enhanced risk mapping tool to achieve a larger beneficial ecological impact than would be attained using current approaches. This project will consist of accelerated and enhanced technical assistance to increase the adoption and implementation of nutrient management strategies and practices that are effective in reducing the amount of soluble reactive phosphorus (SRP) in streams leading to the Great Lakes. There are several components which will be addressed including: (1) identifying specific sites that have the greatest potential to impact lowering of SRP levels in streams; (2) influence actions of land owners/managers of these sites with education, and supportive technical and financial assistance; (3) assist owners/managers with developing an improvement action plan (including nutrient management strategies) to reduce SRP losses; (4) facilitate support for implementing practices contained in the improvement action plan; (5) evaluate the environmental and economic benefits of the implemented practices; (6) assist local schools in their water quality projects by linking water quality to landscape characteristics (thus increasing greater community awareness of problems and the potentials for action); and (7) report the benefits to the broader agricultural community.

We will be working in the Saginaw Basin with focus on the Flint River Watershed including concentrating our efforts on Swartz and Kearsley Creek watersheds. This is an ideal time to increase technical expertise in these two watersheds while maintaining connections for future expansion to the entire Saginaw Basin. Local organizations in the watersheds have been active for several years and there are fully developed watershed plans for both watersheds. Additionally, there are GLRI projects supported in these watersheds.

With whom we will work: This project will include support for implementation and technical assistance. There is a joint Natural Resource Conservation Service (NRCS) and Michigan Department of Agriculture and Rural Development (MDARD) position located in the Swartz and Kearsley Creeks area. This project will increase the technical expertise of this position through training and support of technical tools. In addition, technical assistance and expertise are also being concentrated in these watersheds by the Michigan Department of Agriculture and Rural Development (MDARD) Michigan Agricultural Environmental Assurance Program (MAEAP). The MAEAP Three-Phase Program is an innovative, proactive program that helps farms of all sizes and all commodities voluntarily prevent or minimize agricultural pollution risks. This comprehensive, voluntary, proactive program is designed to reduce farmers' legal and environmental risks through a three-phase process: 1) education; 2) farm-specific risk assessment; and 3) on-farm verification that ensures the farmer has implemented environmentally sound practices. The program's three systems — Cropping, Farmstead and Livestock — each examine different aspects of the farm. Further, linkages exist with the USGS who has monitoring stations and is planning to expand their efforts in these watersheds. There are additional groups that we will partner with who are actively involved in watershed protection and related efforts. Specifically we will work closely with the Flint River Watershed Coalition. They have broad representation and facilitate coordination among organizations in the watersheds. Also, we will work closely with the local MSU Extension that has been supporting watershed education and activities, and with the County Conservation Offices who work regularly with farmers.

How it will be done: A 14-16 person Advisory Committee will be established that includes representatives from the above organizations plus several farmers and a local school representative. The advisory committee will provide both input to guide project development, and will connect products developed back to their organizations. Further, it is anticipated that this

project will help support a person in the Flint River Watershed Coalition to facilitate the project's progress.

A number of new technical efforts and approaches along with enhanced communication techniques for improving water quality have been fully developed for specific watersheds throughout the Great Lakes Basin and upper Mississippi River Basin. Thus, an excellent opportunity exists in the Saginaw Basin to implement these new approaches, make the technology widely available, and facilitate their use. Included will be adequate train-the-trainer efforts to ensure full understanding and use of these new approaches. Technical expertise will be provided to support the organized networks throughout the project. This will also complement and enhance targeted federal and state efforts to reduce and track SRP. With focused practice implementation and, technical expertise, the new planning/prioritization products and communication tools will provide a definite improvement for ongoing efforts. The Focused Practice Application will intelligently guide nutrient reduction efforts that will be a result of the direct assistance through networkers to agricultural producers and to other landowners in the watersheds. The tools and expertise provided through this project will equip local technicians to 1) identify the land areas with the greatest potential to contribute SRP that will be the focus of outreach and technical assistance efforts, and 2) identify land areas best suited to BMPs effective in reducing SRP including precision nutrient management, cover crops and drainage water management. When working one-on-one with land users, the technician will be able to fine-tune factors such as soil test phosphorus levels to more accurately assess the potential ecological impact of BMP implementation.

With the emphasis of this project on reducing SRP, it is important to recognize a few key additional studies that have suggested and evaluated practices to most effectively reduce phosphorus loading into our streams and ultimately the Great Lakes. First is extensive work by Dr. Peter Nowak, Professor of Environmental Studies at the University of Wisconsin. He has studied and emphasized the 80:20 guidance that the majority of polluting nutrients come from 20% of the land. In an area of Wisconsin, similar in many ways to the Flint River Watershed, Dr. Nowak found that 10% of acres produced 47% of the P load, and 32% of the acres produced 76% of the P load. Other investigators have also strongly surmised the need for prioritizing our watershed activities and implementation practices to be focused/targeted in large part on the highest contributing areas. This project is fully designed to empower technical experts with a systematic set of Focused Practices Applications to compliment targeted federal and state efforts for reducing and tracking SRP and other Great Lakes water quality threats.

An additional key asset in the potential support of this proposed project is close coupling with the USGS stream monitoring efforts in the watersheds involved. Because of USGS's extensive real-time nearly continuous monitoring of numerous water quality characteristics including phosphorus, we can examine the potential impacts of ideally placed BMPs and other conserving practices above USGS sampling sites. Then water quality and quantity conditions before and after extensive new practice implementation can be compared. Most importantly the monitoring results can be used as a motivator for farmers and other landowners as they are able to see both the current negative impacts and subsequent positive results they may be having on water quality. They are thus rewarded by knowing the improvements on the surrounding environment that resulted from their practices. The same improvements on the landscape can in a general way be incorporated into school projects that monitor water quality characteristics. Virtually, students can look upstream via the new web accessible information system which will emphasize mapped high risk areas and practices that reduce SRP.

To fully capitalize on the ingenuity of landowners, we must provide access to advanced technology, motivational packages, and ongoing technical support. There is a critically important challenge involved in successfully encouraging farmers with \$6-\$7 dollar/bushel corn and \$10-\$12/hundredweight for soybeans to implement any BMPs that might take land out of production, or on a small scale slightly add to the risk of reduced yields. However, offering financial incentive packages with field based phosphorus and sediment loading risk maps to land owners may result in a higher probability of them implementing new practices tempering the local communities concerns over water quality in the regions streams and lakes. And although there are concerns for the Great Lakes waters, there are greater local concerns over the waters (headwaters in this case) in their neighborhoods.

A key component of the Focused Practice Applications is the integration of numerous models/techniques/tools which will be made operational with local spatial data, and distributed using fully developed, supported, and proven information technologies, web-based systems, and web services. There are six (6) individual tools (models) listed below that will be partially or entirely integrate into the Focused Practice Applications for strengthening organized networks of technical experts.

(1) Digital Watershed (DW) is a web-based mapping application, available for the contiguous United States, that serves as a portal for watershed-scale environmental data and analysis. In addition to displaying custom watershed GIS datasets, DW links to EPA databases, water quality/quantity models developed by leading scientists, and high resolution aerial photography from Google and Microsoft Bing. In our case, the context will be provided by showing the farm within a somewhat larger landscape.

(2) The High Impact Targeting (HIT) system has been used extensively over the entire Great Lakes Basin. HIT allows users to prioritize watersheds, sub-watersheds, and individual fields in terms of erosion, sediment loading, and BMP cost-benefits. HIT is a web-based tool, built upon a Microsoft Bing mapping interface with access to high-resolution aerial photography, analysis capabilities, and low-elevation "birds eye" views of agricultural fields. As a free and user-friendly web-based system, HIT provides a fast and affordable means to prioritize conservation efforts aimed at reducing erosion plus nutrient and sediment loading (O'Neil, 2010¹).

(3) The Soil and Water Assessment Tool (SWAT) is a physically-based watershed model capable of estimating sediment and nutrient loading, groundwater recharge, and surface run-off at watershed scales. It has been utilized extensively in academia and engineering to simulate hydrologic conditions within watersheds, and evaluate BMP effectiveness. Others have modified SWAT to scale its utility down to the field level. In Minnesota, SWAT was used in several watersheds to identify the most critical landscapes for implementation of conservation practices. In the Texas/Oklahoma area (White, et al, 2010²) a methodology evolved from SWAT and other modeling concepts for determination of phosphorus loss from agricultural fields. This approach will be used with appropriate modifications that utilize Midwest field soils and calibration data.

(4) In Michigan IWR has used the recharge component of SWAT in the recharge calculator designed for The Nature Conservancy (TNC) and Coca-Cola as they worked on developing a

¹ O'Neil, G. 2011. Sediment Modeling for the Manitowoc and Twin Rivers Watersheds (Wisconsin), July 2010 – Jun 2011. Final Report prepared for U.S. Army Corps of Engineers, Detroit District, 477 Michigan Avenue, Detroit, MI 48226-2523.

² White, M., et al. 2010. Position Paper: A quantitative phosphorus loss assessment tool for agricultural fields. Published in Environmental Modeling & Software 25, Elsevier Ltd., pp. 1121-1129. www.elsevier.com/locate/envsoft.

water neutral footprint. This model/tool will be incorporated to provide estimates of recharge under different cultural practices, cropping, and soil conditions.

(5) Parker and Bingner (Parker, et al, 2010³) have developed methods to identify ephemeral gully locations. This method will be used to flag these erosion-prone areas for the user/farmer. These areas of concentrated runoff are major contributors of P laden soils and SRP (Galzki et al., 2011⁴).

(6) Networked Neighborhoods for Eco-Conservation Online (NECO) is a web-based tool created by IWR and funded by the Great Lakes Protection Fund. The website helps individuals in the Great Lakes region to map and share green practices (rain barrels, rain gardens) they have put in place or are interested in implementing. NECO uses both social networking and mapping technology to link people together with the common goals of improving the Great Lakes Basin, their watershed, town or their own back yard. The website summarizes the total water managed by these practices and reports pollutant reductions using the Long Term Hydrologic Impact Analysis Tool (L-THIA) for nitrogen, phosphorus, sediment, and fecal coliform. For this project NECO can be used to track the implementation of newly installed practices in the proposed watersheds, with photos, narrative descriptions, and estimated pollutant reductions.

Each of the functions of the above listed tools/models will be integrated into a singular process that will result in a series of physical and digital maps that are web accessible and interactive. The system can assist landowners and technicians in identifying and addressing critical areas (with possible risk reducing options and calculated impacts) related to soluble phosphorus and sediment delivery. Through existing technology (Networked Neighborhoods website) these practices can be mapped and reported at various scales providing a method to track the beneficial impacts of these practices in the watershed.

When it will be done: (see Figure 1: Project Action Plan, Timeline, and Milestones)

- ii. **Results - Outputs and Outcomes:** *Outputs:* Our first activity will be to engage representatives from the numerous local and State organizations working in the targeted watersheds including the MI Department of Agriculture and Rural Development (MDARD), Natural Resource Conservation Service (NRCS), and U.S. Geological Survey (USGS), plus local organizations active in the watersheds including leaders of the watershed plan development teams, local extension office and conservation districts, as well as farmers and/or farmer organization representatives, Native Americans, and environmental/resource groups. There will also be an Advisory Committee of 14-16 individuals from these organizations. Second will be the mapped products of high risk/contributing land areas for sources of SRP, high resolution detailed hydrologic pathways, and high sediment source areas. This information will be available via the web and overlain on high resolution dynamically available Microsoft Bing land cover birds eye views. This information will be available to all computers at involved organizations and for other key leaders. In addition, a special version will be generated that can be downloaded using tablet technologies such as the iPad which will allow viewing of the data while in the field or at a landowners home. Third will be the extensive process of involving key representatives and their technical support staff, key local leaders in education, and the train- the-trainer process to assure

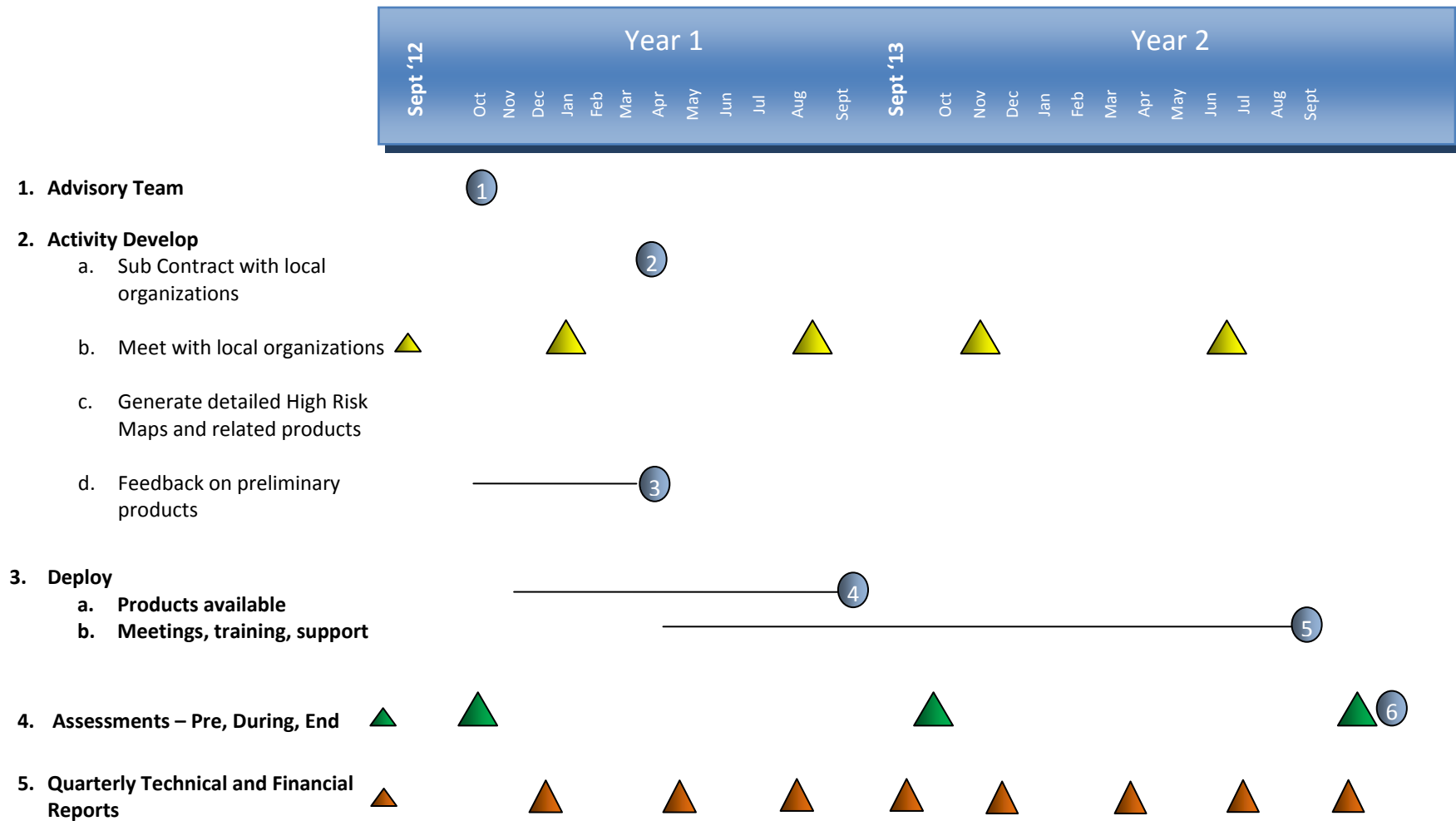
³ Parker, C., et al. 2010. Automated Mapping of the Potential for Ephemeral Gully Formation in Agricultural Watersheds. Presented at the 2nd Joint Federal Interagency Conference, Las Vegas, NV, June 27-July 1.

⁴ Galzki, J., A. S. Birr and D. J. Mulla. 2011. Identifying critical agricultural areas with 3-meter LiDAR elevation data for precision conservation. J. Soil Water Conserv. 66:423-430.

full understanding, interpretation, and ease of utilizing the Focused Practice Applications priority areas mapping technology. This activity will also include information relative to systematically incorporating practices planned and implemented, into a database within the system. Fourth, special efforts will result in the full integration of new spatial products into the MAEAP and ongoing NRCS watershed implementation processes; i.e., this will allow full synergistic efforts within a watershed. Fifth, implementation efforts will be spatially integrated and the predicted cumulative impacts will be assessed in general and in the sub-watersheds above the USGS monitoring locations. This will provide a powerful coupling of implemented results with the monitored impacts measured downstream by USGS. Further, it is at this stage that the cumulative quantitative benefits to water quality, in particular SRP, can be initially assessed.

Outcomes: The improved efficiency and effectiveness of existing organizations (many partially funded from GLRI) will be a major outcome. The increasing rate that a variety of practices provide leading to potentially reduced phosphorus loads to streams and the Great Lakes will be determined. The percent of these practices in the highest risk areas will be calculated with concurrent estimates of reduced nutrient loads. With this system in place along with integrated communication networked organizations, programs will be enhanced and more effectively executed to meet water quality improvement goals. The EPA Program STEP-L spreadsheet results will be augmented and made more relevant to water quality outcomes with the priority mapping and water quality assessment system in place. Evaluation will be both normative and summative throughout the duration of the project. We will utilize individuals at MSU who specialize in project evaluation to assist with the evaluation process. Ongoing analysis of the various components of this project will also be obtained via feedback from our Advisory Committee. Results will be provided in all reports throughout the duration of the project and summarized in the final report. It is emphasized that this project is designed to have ongoing feedback from users of the system. This feedback is vital as the systems design characteristics are tweaked to enhance understandability and ease-of-use. The evaluation will lead to changes and improvements throughout the project and aid with any design changes that may be required. Broad expansion of the system across priority GLRI watersheds and the Great Lakes is anticipated following completion of this proposed project.

Figure 1. Project action plan, timeline and milestones:



Milestones ●

1. Form 14-16 member Advisory Team and meet quarterly
2. Sub Contract with local organization for ½ time local facilitator
3. Detailed assessment of preliminary products and specify refinements
4. Have High Risk Maps and related products available on the web
5. Fully assess the success of the integration of web support (maps, products, guidance) into local networks technical operations
6. Assess the success of all phases of the project and emphasize evaluation of activities and results relating to reduction of SRP

- iii. **Collaboration, Partnerships, and Overarching Plans:** This project falls within the Lake Huron Bi-National Partnership Plan, the Saginaw Bay Coastal Initiative, and the Michigan Phosphorus Reduction Strategy. In addition, there are several existing studies, watershed management plans, and an agricultural TMDL for portions of the Flint River watershed. Delivery of this project will utilize existing technical staff within the watershed. The emphasis of this project is to teach technical staff how to use the Focused Practice Application with the enhanced risk mapping tool to achieve a larger beneficial ecological impact than would be attained using current approaches. Existing technical staff include Genesee and Lapeer Conservation District (CD) technicians, Michigan Agriculture Environmental Assurance Program (MAEAP) Water Stewardship Technicians in Lapeer and Shiawassee Counties, USDA Natural Resources Conservation Service (NRCS) field and area staff, a shared CD and NRCS technician, and MSU-Extension agents.

This project will provide tools and training that will aid staff in analyzing crop field characteristics in order to identify appropriate BMPs. Tools and training provided by this project will enhance delivery of technical services by Conservation District technical staff, thus increasing the effectiveness and efficiency of existing staff. This project will complement existing plans and projects by providing an effective means of identifying land units on which to focus limited resources thus improving outreach and education efforts.

Use of the enhanced risk and results mapping technology tools will identify land units with the greatest potential for contributing non-point source agricultural pollutants, including SRP. Technical staff will be trained to use the enhanced technology tools to identify specific sites with the potential to contribute the greatest non-point source pollutants to the stream system and in need of practices such as cover crops, buffer strips, drainage water management, and nutrient management. The advantage of using the enhanced technology tools is that it can be used not only to identify existing problem areas, but it can also be used to identify potential problem areas. This is important in light of the current agricultural climate where lands that had been idle or in long term cover are being brought into production due to high crop prices. Visual inventories, while useful, are limited to the conditions that were on the ground at the time of inventory. The enhanced technology tools can be used to identify sites that are not currently contributing sediment and nutrients yet have in the past and/or will in the near future.

Through training and support of the enhanced technology tools, local technical staff will be able to identify priority sites contributing agricultural NPS pollutants. They will be trained in additional geographic analysis tools that will assist them in locating sites that are most likely to benefit from improved practices.

Portions of projects and studies that this project will complement include:

Lake Huron Bi-National Partnership Plan http://epa.gov/glnpo/lamp/lh_2008/lh_2008.pdf: *The Agricultural Phosphorus Pollution Prevention Workgroup of the Phosphorus Policy Advisory Committee* http://www.michigan.gov/documents/deq/SBCIdirectorletters_283290_7.pdf recommended consistent crop nutrient recommendations supported and promoted by all groups providing direction to farmers; and funding of five Conservation District livestock specialist positions in the Saginaw Bay area to focus on technical assistance to small and medium size livestock operations.

Saginaw Bay Coastal Initiative: *The Phosphorus Committee Report* <http://homepages.wmich.edu/~ckoretsk/FieldGeochemisry/deq-wb-nps-phos-stakeholder-report.pdf> includes the following recommendations:

- **Recommendation 1:** Current outreach and education programs should be evaluated, looking for gaps and areas to improve/expand these programs relative to phosphorus management and control.
- **Recommendation 2:** Technical assistance providers and educators should specifically target agriculture outreach and education efforts to producers in tiled areas of the state to further promote BMPs to reduce phosphorus losses.
- **Recommendation 3:** Technical assistance providers and educators should specifically target outreach and education to reduce wind erosion of phosphorus, and encourage such practices as cover crops, wind rows, and buffer strips.

South Branch Flint River Watershed Plan - <http://flintriver.org/blog/wp-content/uploads/2010/09/South-Branch-Watershed-Report.pdf>. Implementation goals include: Reduce the impact of priority pollutants in restoration critical areas to restore impaired designated uses.

- Increase the use of govt. programs, private land conservation and education programs to encourage and implement buffer strips and improved riparian corridor management
- Mitigate all suspected gully erosion sites
- Mitigate known and suspected road surface runoff locations
- Improve the management of urban and agricultural runoff to reduce sediment introduction to Critical Area stream segments
- Improve the management of “drains” to support designated uses

Swartz Creek Watershed Management Plan http://www.michigan.gov/documents/deq/wb-nps-swartz-wmp_293409_7.pdf lists nutrients as a pollutant, agriculture as one of the sources, and lack of comprehensive nutrient management planning as a known cause.

Flint River TMDL – http://www.michigan.gov/documents/deq/wrd-swas-tmdl-csmottlake_368490_7.pdf. C. S. Mott Lake - Bluebell Beach has a TMDL for E. coli
Recommended voluntary rural activities include:

- Riparian vegetated buffer strips in agricultural areas that are not artificially drained (tiled).
- Water table management (controlled drainage) where manure is applied to artificially drained land.
- Livestock exclusion from riparian areas and providing vegetated buffers between pasture and water.
- Outreach to agricultural community to encourage best management practices on manure storage, composting, and application and the development of nutrient management plans.

Proposed partners and their roles:

MAEAP Water Stewardship Technicians are located in Lapeer and Shiawassee counties. Employed through the local conservation district with funding through MDARD, CD technicians have successfully used the HIT tool. MDARD has committed to requiring Focused Practice Applications mapping use by these individuals if this project is funded (see Appendix II for Commitment Letter).

There is a shared MDARD/NRCS technical position located in Genesee County. Duties include outreach in the watershed as well as support for conservation practice installation. MDARD and NRCS have committed to requiring enhanced Focused Practices Application mapping if this project is funded. MDARD and NRCS have committed to serving on the Advisory Committee for this project. NRCS has committed to evaluating the use of Focused Practice Applications needs,

maps, and enhanced HIT results as a part of the ranking criteria for Environmental Quality Incentives Program (EQIP) funding decisions (see Appendix II for Commitment Letter).

The US Geological Survey (USGS) is conducting environmental research on privately owned farms in the Flint River watershed to demonstrate the effectiveness of agricultural management strategies. USGS has committed to serving on the Advisory Committee for this project (see Appendix II for Commitment Letter).

The Flint River Watershed Coalition is a membership organization that promotes citizen stewardship of natural resources by providing members with the sources, knowledge, and capacity necessary to protect local water quality and watershed habitat. The Coalition has committed to serving on the Advisory Committee for this project as well as incorporating the project into their education efforts with schools and communicating information about the project through their newsletter and other communication methods (see Appendix II for Commitment Letter).

- iv. **Community-Based Focus and Environmental Justice Impacts:** This entire program is focused locally and programs will be delivered in concert with locally-based organizations. The Flint River Coalition will be central for networking with the local organizations they represent. The County Conservation Districts with their locally elected boards will be extensively involved. The partnering with numerous school water quality testing programs and 4-H projects will utilize the high risk mapping system for Focused Practice Application into their studies. We will make every effort to be inclusive with distribution of materials and open meetings.
- v. **Programmatic Capability and Past Performance:** *General Background:* The IWR at MSU is responsible for coordinating research and educational programs on surface water and ground water quality and quantity. Established in 1961 the Institute addresses multi-disciplinary issues arising from the dynamic interaction of land and water resources and strengthens MSU's commitment to finding effective solutions to contemporary water resource Problems. The Institute has developed water-related programs across a wide spectrum of issues. Ongoing support from the USGS, Department of interior, Michigan Ag-Bio Research and MSU Extension helps fund important research and outreach on water issues with regional land national significance. The Institute's goal is to provide the most accurate and complete information on contemporary land and water issues to citizens, stakeholders, government agencies, and resource managers. To achieve this goal, the Institute consistently collaborates and forges partnerships with other research and resource conservation organizations and agencies. The result of these collaborations is the development of science-based information for use by decision makers faced with complex water issues. The increasing use of information technologies and decision-making is a fundamental part of the Institute's mission in the 21st Century.

Programs: The Institute functions in a coordinating role to support education, research, and outreach through partnerships with University departments, agencies, and organizations in the board water arena. Efforts focus on three major areas: (1) integrated watershed systems including both surface and ground-water; (2) extended education and outreach; (3) networking infrastructure.

Integrated Watershed Systems: The Institute continues to development decision support systems that utilize data, models, and spatial analysis to provide an increased understanding of land-water relationships. These systems are made available through interactive web based GIS/graphic tools. Some examples are highlighted below.

General Programs: We believe the above brief description of the Institute's program makes it clear that our operation, with a budget in excess of \$1 million a year, continually works on developing innovative tools using new technologies to assist with improved understanding and assessment of how human activities on the landscape can influence the natural system with emphasis on water quality and quantity. Several examples to highlight these programs follow. We currently have a \$225,000 three-year active project funded by the C.S. Mott Foundation (MOTT) through The Nature Conservancy (TNC) to work in the Saginaw Bay developing a variety of tools to enhance ecological services from the landscape. This GLRI proposed project is of particular importance as it will be a companion effort with the TNC/MOTT project but more importantly, we can tap into a whole array of understanding ecological outcomes from improved water quality resulting from better land-use practices. It is critically important to realize that farmers and other owners of land are likely more motivated to make improvements that will impact the environment; i.e. fish habitat, birds, and recreational use, etc. Thus we can incorporate knowledge from the TNC/MOTT project along with spatial system products, into the education and outreach components of this proposed project. Other examples of IWR work involves an NRCS CIG grant in which we partnered with the Michigan Department of Agriculture and supported half of three conservation technician salaries at three different County Conservation Offices. They were an integral part of the CIG project both at the state and local levels which led to the successful development and subsequent use of the High Impact Targeting (HIT) system now recommended by MDEQ and used by NRCS in many of their activities including prioritization of Farm Bill financial and technical assistance dollars. We have also worked on multiple projects with the Great Lakes Protection Fund. These projects facilitated the early conceptualization and development of the now highly successful Water Withdrawal Assessment Tool developed by IWR in cooperation with many others. This web-based tool is utilized throughout the state for on-line registering of new high-capacity wells. More recently the Great Lakes Protection Fund funded IWRs Networked Neighborhoods project that incorporates new social networking concepts and web-based interactive technologies allowing individual homeowners to easily upload their BMPs (rain barrels, rain gardens, etc.). Since the BMPs are all geo-positioned by the homeowners as they enter the data, the impact that these multiple practices have in any given watershed can be summarized within sub-watersheds providing feedback to the citizens on the combined positive impact they have had in reducing runoff and nutrient loads. These are but a few of IWRs more recent activities each having their own components of outreach and dissemination incorporated into the Institutes ongoing technology transfer and outreach efforts.

Programs Federal: The following are specific examples of federal programs for which IWR has been funded. Multiple grants from the same agency are emphasized as over time we have developed successful partnerships by consistently meeting their expectations and effectively reported both on the program and fiscal responsibility.

A key series of federal grants to the IWR have been from the U.S. Geologic Survey with several consecutive five-year grants each approximately \$500,000. Nearly half of these funds were provided for external grants to faculty at MSU and universities around the state. A significant portion of funds of roughly 30% went for technical assistance plus outreach and education. A second grant of significant size was a Comprehensive Innovation Grant, 2006-2009 for \$82,000.. This grant was in partnership with the Michigan Department of Agriculture. Three half-time positions were funded at three County Conservation District offices. This was a very productive and successful grant that developed technology tools for evaluation of high erosion areas (sediment delivery to streams) and suggested cost effective improvements (BMPs) and farm level action. The results of this three year project yielded what is now termed the High Impact Targeting (HIT) tool to calculate the highest eroding fields and watersheds. This system is now

available throughout the Great Lakes Basin. Michigan Department of Environmental Quality's 319 program is suggesting the HIT system for use in the development of 319 watershed management plans and the system is being used by NRCS for prioritizing higher payments for practices to be placed in the highest risk locations determined with the HIT system. The Army Corps of Engineers through their 516(e) program have funded five projects from 2004 through the present to guide the development of modeling techniques for predicting soil erosion (sediment) loads to the Great Lakes. Subsequently they supported making this information available via the web for users throughout the basin. Because of the project success and providing timely reports, the work continues. Another project that has received multiple funding, in this case from EPA to MDEQ as part of the 319 program for a Social Indicators project. Three phases of this project was funded over a three-year period. This program is now being utilized by all states in the EPA Region 5 area.

Staff experience/qualifications: In this section we will provide a brief description of the individuals involved, their experience, responsibilities, and time in IWR. *Jon Bartholic* will serve as the overall project manager. He brings several decades of experience in project leadership stemming from the military, USDA's Agricultural Research Service, the University of Florida particularly with NASA projects, and in numerous capacities at MSU including Director of IWR. He has provided overall guidance for over \$15 million in projects from federal and state agencies. His background is in Soil Physics, Hydrology, and Resource Development. *Vicki Anderson* will also provide broad guidance to this project. She has over 20 years of experience serving in various capacities with NRCS including State Resource Conservationist, Great Lakes Coordinator working with eight states on GLRI, District Conservationist, and various other positions. She served as Great Lakes Coordinator before retiring and joining the IWR team. Her experience and understanding of NRCS and GLRI goals plus her numerous contacts within natural resource organizations makes her an outstanding asset to this effort. *Jeremiah Asher* will lead much of the technical development. He possesses a bachelor's degree from Resource Development and has been with IWR for over a decade. He has provided exceptional leadership on numerous projects and frequently secures funding in excess of \$200,000 each from organizations such as the Great Lakes Protection Fund, EPA, USGS, and M DEQ. He led the development of a statewide Water Withdrawal Assessment Tool, a basin-wide project dealing with Networked Neighborhoods involving low-impact development, and with EPAs Watershed Assessment Web-based Tool. *Glenn O'Neil* has an M.S. in Geography and is a PhD candidate at MSU, and also served as a high school teacher. Another exception leader, he led the development of the now well-known HIT (High Impact Targeting) tool that is used across the basin. He has assisted with numerous other developmental and outreach activities and has five years of experience in IWR. *Yi Shi* has a PhD in geography and has led extremely complex technical web-based tool development including the Digital Watershed (DW) with many components funded by EPA. He has also led our activities in downloading web-based mapping information and analysis tools to the iPad platform. His contributions have been immeasurable. *Lois Wolfson* has a PhD in Fisheries and Wildlife and will provide the lead for outreach, education, communication, technology transfer and facilitation. She has over two decades in IWR of working most effectively in this realm. This past year she was presented with MSUs Outstanding Extension Worker Award; a much deserved recognition for her outstanding contributions. Very important to this project is that these individuals have extensive experience to contribute to this project, and also worth noting, each are currently involved with major development activities supporting projects that are complementary and synergistic with the efforts proposed in this GLRI project.

- vi. **Job Creation:** This proposed project will effectively facilitate and/or promote job creation in several concurrent ways. *First* by facilitating the process of identifying areas of high priority for new BMP and other enhanced soil and nutrient conserving practices there will be opportunities

for extensive additional practice payments from NRCS or through MAEAP to farmers and subsequently contractors for the implementation of these practices. The amount is expected to be well in excess of several million dollars. *Secondly* by effectively reducing phosphorus and subsequently other nutrients and sediment to the rivers and lakes in the Flint watershed area the recreational and property value improvements will be enormous. Additional fishing, body contact, boating canoeing and other recreational opportunities will grow. Also, corporations like to expand their operations where good environmental amenities exist. *Third* by having the watershed nutrient high risk areas mapped, detailed materials available via the web will be integrated into the vast number of school programs that are presently involved with water quality sampling, environmental studies, and through 4-H projects. The anticipated result is the students become empowered as they see the positive impacts of their efforts on environmental outcomes providing incentive for them to create Civilian Conservation Corps models for environmental restoration as additional personal projects. It should be noted that the importance of the environment in school system projects have been recognized by General Motors, and they are using their facilities to augment the water testing components of the school projects.

- vii. **Education/Outreach:** This project by its very nature is conducted in a co-creative model where end-users; i.e., individuals in the watersheds; are involved in advisory groups and intermittent teams to address specific development approaches/criteria. Thus, the local individuals represent leadership in the Flint River Watershed Coalition, County Conservation Districts, the local Extension office, representatives from the school districts, as well as our key partners and local components of the NRCS and in our cooperative project with The Nature Conservancy. All of these organizations are involved in one way or another with education and outreach and will be wired into the project so they will have full opportunity to guide the project, to be first users of the generated products, and will have full use of them in their day-to-day organization to support their individual responsibilities. The FRWC has committed to utilizing their established communication and education programs to inform local citizens about the project and its results. MDARD has committed the local MAEAP technicians to utilizing this technology – communication with local land users about the project will take place as these technicians perform their duties, including working one-on-one with local residents and through mass communication about the program. Further, IWR has technology transfer and outreach as major components of its responsibility. Since these are functions we carry-out on a day-to-day basis we will utilize the numerous meetings and speaking opportunities to fully extend the findings, products, and experiences learned from this project. IWR is a member of the Midwest Spatial Decision Support System Partnership organization sponsored by the EPA Region 5 Chicago Office, Software Development Section. This connection along with numerous continuing partners that have responsibilities throughout the Great Lakes will provide natural and effective conduits for education and outreach to disseminate results. Additionally we have four Virtual University three credit courses that can be taken by consultants for a certificate or students for MSU credit in the area of watershed management. The outcomes from this project will be incorporated into these courses and provide an ongoing extension of the findings and experiences to better educate a very critical audience of new professionals in water and environmental management.