Kalamazoo River:
Water Quality Trading Demonstration Project

BACKGROUND:
([Presentation on the Project])
The Kalamazoo River Watershed encompasses over 2,000 square miles in southwest lower Michigan including parts of 10 counties and 76 townships (Figure 1). The river discharges to Lake Michigan and drains a watershed comprised of approximately 57% cropland and pasture, 21% forest, 3% wetland, and 8% urban areas with the remaining lands categorized under other uses.

Presently, there are over fifty NPDES dischargers in the watershed with permit limits for total phosphorus. These are primarily municipal wastewater treatment plants and paper mills. Localized water quality standards in the Kalamazoo River have historically determined water quality based effluent limitations for point source dischargers, especially within the middle reaches of the watershed in the vicinity of the City of Kalamazoo; the area of focus for this trading demonstration project. Water quality based effluent limits were established for phosphorus to reduce instream growths of nuisance attached algae which historically contributed to dissolved oxygen standards violations in selected areas downstream of major wastewater dischargers in these river reaches.

Final Report to Water Environment Research Foundation

Supplemental Report: Post-BMP Implementation Monitoring for an Agricultural Site.

Kalamazoo River.net

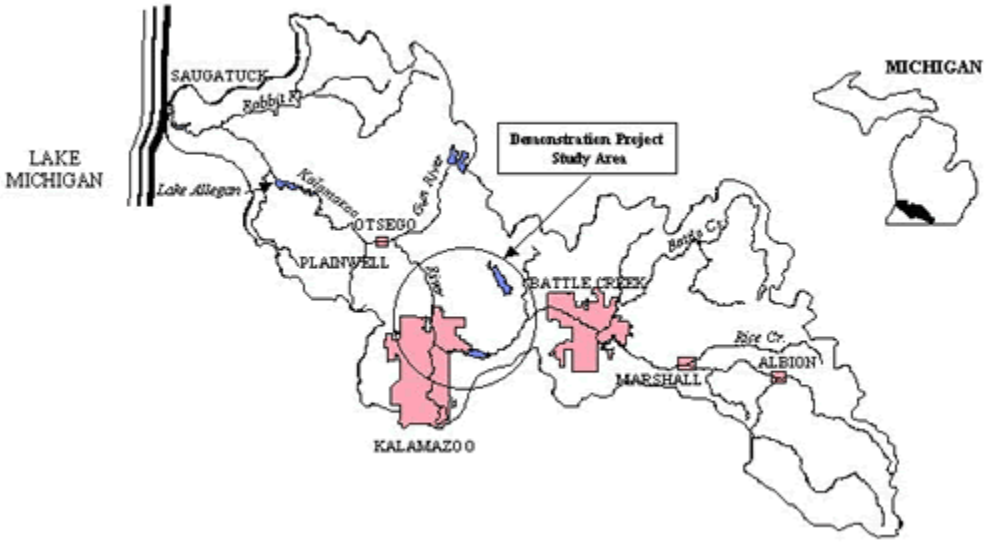

Figure 1. The Kalamazoo River Watershed in Southwest Lower Michigan showing the extent of the Trading Demonstration Project study reach

FUNDAMENTAL DRIVERS FOR THE TRADING PROJECT

Local interest in the concept of water quality trading originated in late 1996 when a voluntary, non-point source (NPS) advisory committee working through the non-profit organization, The Forum of Greater Kalamazoo, was seeking new ways to educate and engage communities on non-point source pollutant issues. The state of Michigan was concurrently completing a market-based program feasibility study that utilized information from a study examining the potential for point/non-point source trading in Saginaw Bay of Lake Huron (MDEQ-SWQD, 1997). The state was seeking to additionally undertake a demonstration project within Michigan to support the development of trading rules.

A potential point/non-point source trading application was identified when a local paper company in the Kalamazoo area (Crown Vantage), expressed interest in the option of purchasing phosphorus trading credits at this same time. This interest was ultimately tied to an anticipated use of credits should their product orders necessitate production at 100% of their operational capacity. At such a production rate, existing wastewater treatment capabilities for maintaining phosphorus discharge limits would be exceeded. As additional end-of-pipe treatment was not feasible without costly facility expansion, non-point source phosphorus reduction credits represented a potentially cost-effective alternative to accommodate business needs and permitting requirements. A need for the equivalent of fifteen pounds of phosphorus per day was identified by the paper company for periods of full operation.

These three interests came together at the local level to conceive of the Kalamazoo River Water Quality Trading Demonstration Project. The project rapidly evolved over six months into a fully-funded, community-based pilot study by mid-1997 which sought to evaluate and apply, voluntary trading as a flexible, market-based tool capable of producing cost-effective water quality improvements while maintaining the local community and industry's ability to grow.

Phosphorus loading reductions to the Kalamazoo River in this pilot study are achieved through voluntary implementation of non-point source controls and/or management techniques for runoff not presently required by statute, rule or local ordinance. One-half of these reductions can be used by permitted point source dischargers to accommodate operational flexibility and growth. This point/non-point source trade at a project-established 2:1 trading ratio, results in a 50% net reduction in phosphorus loading to the river that would not have occurred with implementation of point source controls alone.

The fundamental objectives of the Kalamazoo Project sought to:

- Establish the local framework, organization and procedures for the pilot project.
- Implement voluntary non-point source reductions.
- Establish and conduct NPS monitoring/quantification protocols to assess effectiveness of the project.
- Conduct a point/non-point source trade for phosphorus.
- Facilitate watershed management planning.

- Identify policy and program issues related to development and implementation of a regional/watershed trading program.
- Obtain design information for a state-wide trading program which could be transferred to other Great Lakes states.
- Identify options for optimizing the cost of reducing nutrient loading to Lake Michigan and connecting waters.

STAKEHOLDER INVOLVEMENT

An ad hoc, multi-disciplinary Steering Committee was formed to direct and oversee the project through regular meetings, agreements and reporting. Participants represented environmental, industrial, municipal, private and agricultural sectors as well as state and local regulatory agencies. Communications with affiliated groups through representatives on the Steering Committee provided for outreach and non-point source partner solicitation. Inter-agency partnerships were established between committee members to promote, design, implement and evaluate non-point source controls chosen by voluntary NPS partners. This type of institutional framework was transferred to the water quality trading program rules developed by the State of Michigan.

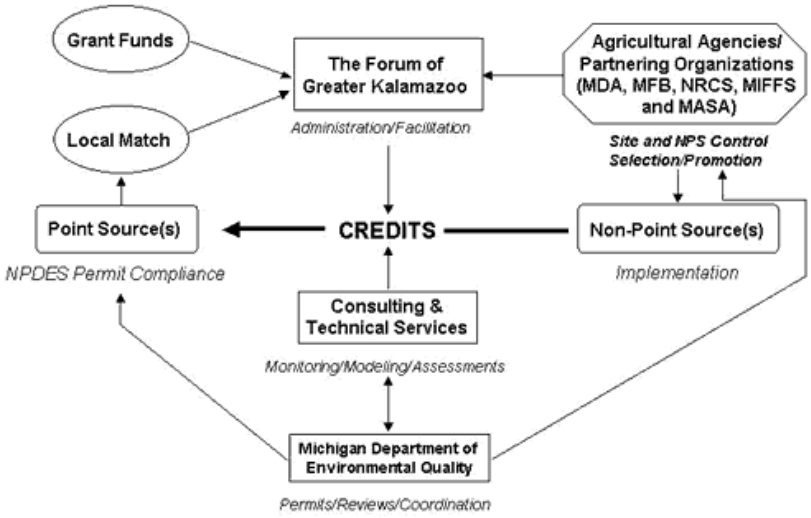

Figure 2. Organizational Framework for the Water Quality Trading Demonstration Project (MDA = Michigan Department of Agriculture; MFB = Michigan Farm Bureau; NRCS = USDA Natural Resources Conservation Service; MIFFS = Michigan Integrated Food & Farming Services; MASA = Michigan Agricultural Stewardship Association).

Early misrepresentations of the project by a few individuals and local groups that declined direct involvement in the project, resulted in unexpected resistance to participation by the municipal and agricultural sectors, and delays implementing NPS controls at selected sites. This problem was neutralized by providing information through the use of brochures, fact sheets and public presentations addressing concerns and dispelling myths about trading. Periodic press releases and local articles by interested journalists helped provide accurate information and focused the issues for the general public. The Steering Committee maintained a constant, positive focus to move the project forward while maintaining accountability to the diverse opinions of community groups. Continuing education about the project and the concept of voluntary point/non-point source trading was essential to accurately convey the demonstration's

goals and objectives. Simple explanations of the process were developed for this public outreach component. Figure 3 illustrates this level of simplicity adopted to make these points.

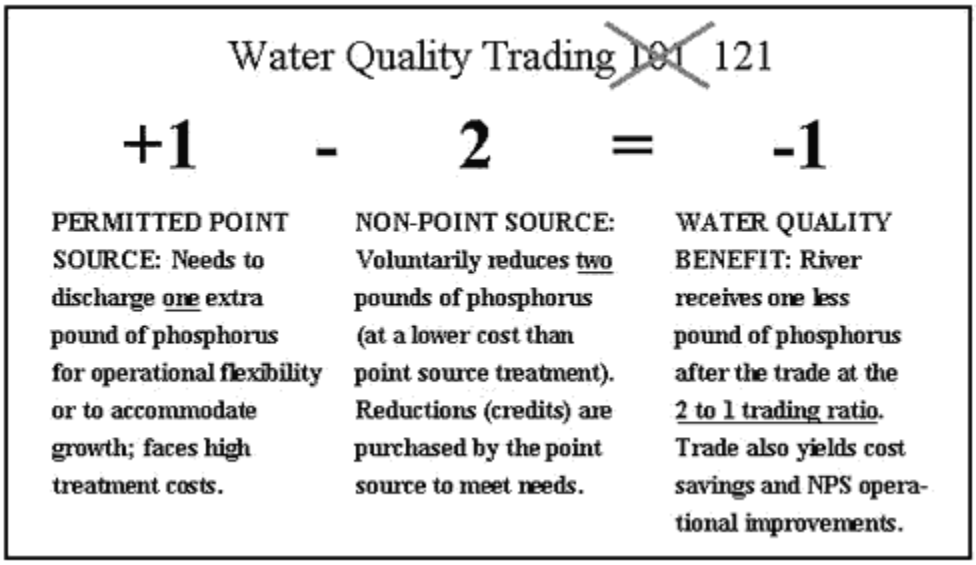

Figure 3. Sample illustration of presentation materials to convey the concept of point/non-point source trading to the watershed community.

Since 1997, the Steering Committee has debated and reached consensus agreements on critical issues and decisions such as: project communications and outreach, establishment of an equitable trading ratio, non-point source site evaluation and monitoring protocols, and a banking and credit allocation strategy. These were initially addressed through Work Groups composed of Steering Committee members most familiar and experienced with these issues. A separate Administrative Work Group comprised of the Co-Principal Investigators served the project funders' contractual and administrative needs.

TECHNICAL, SCIENTIFIC & PERMITTING ISSUES

Phosphorus loading reductions at non-point source partner sites were implemented with both demonstration project funding and local partner match. To date, six non-point source partner sites have voluntarily participated in the Kalamazoo Project. These have included four eroding streambank sites (two industrial, one municipal and one private) and two agricultural sites. (See Figure 4.) Non-point source controls have included:

- Streambank stabilization incorporating bank re-shaping, riprap, seeding and bioaugmentation-biostabilization techniques.
- Improved agricultural and livestock management techniques including animal exclusion from waterways; grassed swales and limestone filters for diversion and treatment of feedlot runoff; and soil fertility sampling to optimize fertilizer applications.

Table 1 summarizes the phosphorus loading conditions for each site, the non-point source controls employed, resulting load reductions and costs per pound of phosphorus

reduced. As of this writing, remaining structural controls are now being completed at the two agricultural sites with those for the Recycled Paperboard Inc. site awaiting a final permit before construction commences. Combined, voluntary non-point source controls completed at the six project sites will account for an annual estimated load reduction to the Kalamazoo River of 2,142 pounds of phosphorus with a corresponding sediment load reduction of nearly 2,300 tons.

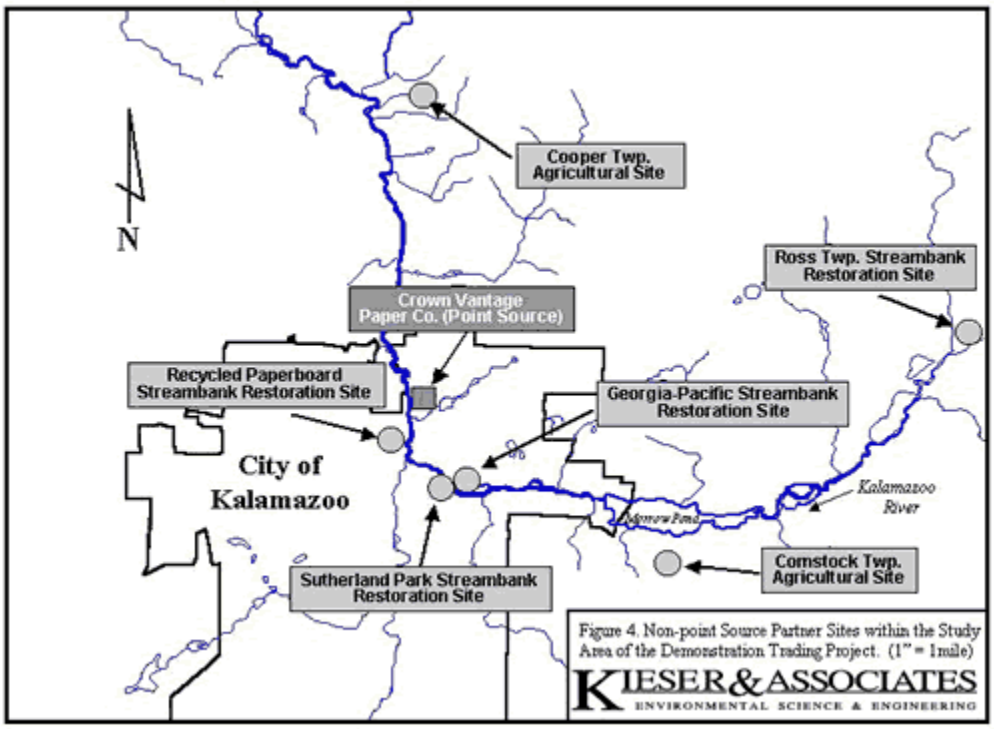

Table 1. Summary of Non-point Source Partner Sites, Phosphorus Loads, Controls, Reductions and Costs (5 and 10-year costs annualized at 6% interest plus 3% inflation per annum). **(Refer to Figure 4 for site locations.)**

	NON-POINT SOURCE PARTNER SITE					
	Georgia-	**Sutherland**	**Ross**	**Comstock**	**Cooper**	**Recycled**
Non-point Source	**Pacific**	**Park**	**Township**	**Township**	**Township**	**Paperboard**
Information	**Streambank**	**Streambank**	**Streambank**	**Ag. BMPs**	**Ag. BMPs**	**Streambank**
				Sheet flow	Animals watering	Eroding
Type of NPS Loads	Eroding	Eroding	Eroding	erosion, Animal	directly in stream,	Streambank,
	Streambank	Streambank	Streambank	grazing, Over	Soil erosion	Sheet flow
				fertilization		erosion

				Filter strips,	New watering	Bank reshaping
	Bank	Bank	Bank	Animal	system &	and stabilization,
Types of	re-shaping,	re-shaping,	re-shaping	exclusion,	Animal	Grassed swales,
Improvements	Stabilization,	Log-deflector,	and Bio-	Fertilizer	exclusion,	Rock chute
	Riprap	Bio-stabilization	stabilization	management	Grassed swale	(prairie grass
						plantings)
Load Before						
Improvements	73	103	71	2,204	37	125
(lbs. P/yr.)						
Load After						
Improvements	0	0	0	432	5	8
(lbs. P/yr.)						
Load Reduction	73	103	71	1,772*	6*	117
(lbs. P/yr.)						
Total Present Value						
Value (PV) of	$27,180	$16,350	$13,823	$14,500	$7,100	$113,250
Site Controls						
Total PV Per	$372.23	$149.03	$194.69	$8.81	$221.88	$3,575.95
lb. of P reduced						
5-year Annualized						
Value Per	$95.72	$29.81	$38.94	$1.64	$57.04	$965.24
lb. of P reduced						
10-year Annualized						
Value Per	$58.02	$14.90	$19.74	$0.82	$34.57	$585.06
lb. of P reduced						

* Whole system reductions at point of delivery to Kalamazoo River.

The paper company originally interested in purchasing credits estimated their first year construction costs for treatment system upgrades to average $292 per pound of phosphorus removed. Corresponding 5-year and 10-year annualized values (accounting for interest and inflation) were $58 and $29.20 per pound of phosphorus, respectively for this end-of-pipe treatment. These estimates can be compared to the broad range of phosphorus control costs for non-point sources shown in Table 1 as shaded.

Non-point source controls were typically less expensive for the agricultural operations than other sources. These ranged from first-year costs ("present value") of $8.81 to $221.88 per pound of phosphorus reduced. First-year costs for streambank restoration and other erosion controls at the industrial sites and a municipal park location ranged from $194.69 to $372.23 per pound of phosphorus reduced.

Cost factors and effectiveness of controls are highly variable from site to site based on physical conditions of the location, the nature of the non-point source load, and most importantly, the land owners' choice of controls that they believe best meet their needs to manage their property. These factors ultimately determine whether a potential non-point source will consider generating credits, the "currency" of the trade.

Table 1 also defines the background or baseline levels of non-point source loadings for each of the partners' project sites prior to instituting new controls or improved management techniques. The establishment of baseline conditions is critical to identify potential costs and actual benefits of each non-point source reduction considered in a trade. Site-specific conditions are also evaluated to determine discount factors that would be applied in addition to the 2:1 trading ratio to account for uncertainty, directionality and distance from the point source potentially using these non-point source credits.

Baselines for this project were established through site-specific monitoring and application of readily available, commonly used modeling techniques. The Kalamazoo Demonstration Project was interested in verifying the utility of available loading estimation techniques given that costs for extensive monitoring and sophisticated modeling would make non-point source improvement projects uneconomical within a trading framework. Estimation tools used by the USDA-NRCS for assisting farmers with whole farm planning (e.g., the Revised Universal Soil Loss Equation) and methods commonly adopted for federally-funded 319 Grant programs were utilized (e.g., MDEQ-SWQD, 1999). These tools offered reasonable predictive capabilities within the scope and limitations of the program that sought to encourage voluntary non-point controls through the economic incentive of trading while only allowing a portion of the reductions (50%) to be used in a point/non-point source trade.

Initial project interests in non-point source partner sites focused on agricultural operations. As the project evolved, several opportunities and a corresponding interest by partners and the project Steering Committee, focused on restoration of eroding streambanks on the Kalamazoo River. To quantify streambank erosion, a hierarchy of recommended protocols was established that included:

- Aerial photographic interpretation of losses (current and historic photos).

- Michigan Department of Environmental Quality (MDEQ-SWQD, 1999) lateral recession rate method.
- USDA-NRCS gully erosion equation.

Streambank erosion estimates were coupled with inexpensive soil phosphorus sampling to readily generate site-specific estimates of phosphorus loads to be addressed with site improvements.

Technical assistance on the Demonstration Project was provided to non-point source partners through the Natural Resources Conservation Service, local Soil Conservation District and project Work Groups. All agricultural plans and streambank designs were entrusted to local NRCS personnel that were certified conservation planners through USDA. These individuals developed whole-farm conservation plans with the agricultural producer, performed engineering design, and provided installation oversight and tracking. For reasons of partnership, impartiality and accountability, this was viewed as a valuable approach. However, as the project proceeded, it became evident that this alternative would also yield some of the greatest delays experienced in the project. Timeliness was crucial to every aspect of this project, influenced as it was by a north-temperate climate, seasonally-based agriculture, the expectations of NPS partners and the immediate needs of the potential credit purchaser.

The repetitive inability of an agency to provide timely, necessary contacts, services and continuity proved detrimental to the time frame desired for a trade. By not following through with specified controls on project sites within the most desirable time frames, the credibility of all project partners was placed in jeopardy. Reasons for these temporal failures included other priorities for agency personnel, lack of sufficient personnel to accomplish their workload and a difference in project approach, where rapid and consistent response to a situation were demanded rather than prolonged and casual inputs. The result of NPS partners left waiting, experiencing unacceptable delays in scheduling for approval, permits, construction, and related activities were hard but valuable lessons learned with the project approach selected.

There remains no doubt that the agencies involved could perform the required services; timing was the issue. Prompt actions are required of those involved with trading partners. Those who want to generate credits and those who want to purchase credits most likely have specific timetables to meet. It is imperative that all those who will be providing assistance, clearly commit to fulfilling their role within such timetables. Several potential barriers and scientific/technical issues were identified and addressed during the course of the project. These included:

- It is rare to find accurate, (if any), historical data for specific sites that might impact how baselines and timelines are established. This often resulted in discounting factors applied in addition to the trading ratio to account for uncertainty.
- Credibility of the credit generator and/or the credit marketer is important for a successful market. The non-traditional and lasting partnerships formed during the process transcended many of these related concerns.

- Any and all uncertainties must be recognized and addressed to the satisfaction of all parties. Broad-based participation and an open dialogue allowed consensus to be reached on a wide range of programmatic and technical issues.
- Identification of real or potential political and legal obstacles at local, state and national levels must be addressed. Community-based trading initiatives can only succeed if the regulatory framework and clear legal authority are present. The project achieved the former through an open, Steering Committee process; state of Michigan water quality trading rules are now pending which will provide the latter.
- Risks (liability, accountability, etc.) are present for the credit purchaser and generator that often are not readily shared. Service Agreements (private contracts) between user and generator define these issues for both parties, and participation by a third party (e.g., USDA Natural Resources Conservation Service) minimizes these risks.

ENFORCEMENT & FRAMEWORK ISSUES

The Kalamazoo Demonstration Project focuses on voluntary point/non-point source trading for phosphorus. Water quality based effluent limitations established in NPDES permits serve as the baseline for point sources to determine their need for non-point source credits. Use of credits by a point source to come into compliance with an existing limit was not deemed acceptable for the purposes of this project. Point sources can use non-point source reductions (credits) to accommodate growth or to optimize controls when there are economic and operational incentives to do so.

In this project, non-point source loading reductions can be used by point sources when such phosphorus load reductions are made beyond what is minimally required by permit, rule or ordinance. Generation of credits by a non-point source not in compliance with such conditions can only be made after they have corrected their operations or management practices to meet a minimum standard. This represents the baseline for non-point source credit generation and provides equity amongst project partners and within similar non-point source groups (e.g., agriculture). Voluntary improvements in operations or management by unregulated non-point sources can generate credits directly for use by a point source at a 2:1 trading ratio. These non-point source improvements beyond the minimum compliance baseline (regulated), or the level of existing practices (unregulated), are considered 'voluntary'. The driving mechanisms for non-point source improvements therefore become financial, philosophical, environmental, operational and/or managerial benefits rather than a compliance requirement.

Trading is restricted to selected reaches of the Kalamazoo River whereby point source use of credits will not result in localized water quality impacts (see Figure 1). Non-point source reductions can only be made within these reaches in order to avoid this issue. Thus, directionality and distance between trading partners is addressed. Discounting factors in addition to the 2:1 trading ratio may be applied to non-point source reductions to address site-specific considerations of distance of the non-point source site from the river and uncertainty in loading computations and/or data limitations.

Working groups comprised by various Steering Committee members were established to conduct reviews and provide recommendations to the Steering Committee on non-point source site identification and selection, technical and regulatory issues, public relations and project administration. This organization provided technical expertise, oversight and direction to the project.

The role of the USDA National Resources Conservation Service for agricultural partner sites was traditional for this agency. Non-traditional NRCS assistance with the broad array of other non-point source partners provided a mechanism of independent and quasi-regulatory accountability.

A Service Agreement, written simply but clearly, was created without legal assistance as a means of providing security and clarity between each participating NPS partner and the Steering Committee. These agreements also provided direct accountability, without permits, for installation and maintenance of NPS controls. These documents additionally served as an aid to identify and substantiate expectations for specific controls to be completed and the conditions for funding. Individual Service Agreements were modified as necessary between individual partners and the Steering Committee until mutual satisfaction was obtained. The process was deliberately kept as simple as possible to avoid becoming mired in quasi-legal paperwork.

Background or baseline levels of NPS loadings were established through calculations, monitoring or modeling protocols prior to any on-site improvements as discussed previously. Phosphorus reductions and credits generated were evaluated and approved by the Steering Committee before potential use.

Project visibility and public accountability were established as an early objective by the Steering Committee. Documentation of project decisions and actions were frequently provided to Steering Committee members throughout the project in the form of technical reports, committee and work group minutes as well as interim updates for on- and off-site activities with each partner. Monthly Steering Committee and/or bimonthly Work Group meetings were conducted over the three-year history of this effort. Written documentation of the process provided the general public and dissenting groups opportunity to openly track the framework and progress of the project. Few questions could be raised about hidden agendas or the merits and intentions of the project when facts were continuously available for open review.

Of the three most commonly solicited non-point source partners (municipal, industrial and agricultural), the most challenging and often frustrating attempts were with a municipality, followed by efforts with agriculturally related sites. Difficulty in reaching agreement amongst a City's administrative hierarchy, municipal concern for not being able to fund similar approaches if requested for other areas in their jurisdiction, and a general desire to wait before doing anything that might impact pending regulations, resulted in unproductive meetings and no activity on urban stormwater controls.
For the agricultural sector, the concepts of: a) having recognized and trusted contacts to serve as the communicators for the project, and; b) providing a degree of anonymity for site owners proved largely successful. Approaches that stress what is in the best interest

of the farm, the farmer and the landowner are likely to be well received. Anything else will be typically viewed as inappropriate and thus not likely successful. Agricultural improvements, potentially funded through outside sources, can provide financial benefits to on-farm operations as well as credits that become a marketable commodity. Commodities are well understood by agriculture. Publicity (good or bad) for the farming community, however, tends to make producers shy away from programs that are regulatory in nature, especially as they may pertain to their operations and defined environmental impacts. Private contracts with trading credit users, rather than the inclusion of the farmer in a point source permit, are a much preferred approach for agriculture to participate in trading.

All non-point source reductions generated by the Kalamazoo Project are 'banked' with the Steering Committee. Point sources providing financial assistance to the Project receive a portion of generated credits through an allocation scheme established by the Steering Committee. Point source use of the credits is at their discretion and would be accommodated through an NPDES permit modification prior to use for this project. Other point sources could purchase remaining credits banked by the Steering Committee at the discretion of the group. The state of Michigan is proposing that the use of trading credits be accomplished through a permit by rule framework as compared to individual permit modifications targeted by this pilot study in the absence of state-wide or federal rules.

No actual point/non-point source trades have occurred to date on the project. The local paper company that was interested in buying phosphorus credits to offset higher discharges associated with projected increases in production, recently announced the layoff of approximately 28% of the local mill's workforce. The Steering Committee, having seen this downturn in the paper industry over the last two years, established the credit bank for non-point source reductions that could be used by other point sources and that could serve as a model for future watershed trading. Credits generated during this project will be retired to benefit water quality in the river if not used before the formal completion date of the project.

SUMMARY

The Kalamazoo River Water Quality Trading Demonstration Project has identified a number of important benefits of trading and the successful elements for establishing a community-driven approach. These include:

- Voluntary point/non-point source water quality trading encourages performance-based incentives for sustainable agricultural practices rather than mandatory management practices.
- Trading outside of a Total Maximum Daily Load allows market forces to capitalize on the most cost-effective improvements to water quality without regulatory caps or requirements.
- Non-traditional partnerships can be established which transcend traditional barriers to cooperative watershed management by establishing common goals with economic mechanisms to achieve environmental improvements.

- An improvement in water quality stemming from a trade, can be a recognized goal for all participants despite the individual objectives of each trading participant or community stakeholder.
- Lessons learned have identified that effective partnerships are most critical; flexibility is key to successful arrangements; NPS prescriptions and a "one size fit all" approach will not work.
- For agriculture to participate in trading, the emphasis must be on what works in the most sustainable manner for the farm, for the owners of the property and for the future benefit of both.
- NPS accountability can be achieved through contractual obligations rather than traditional "command and control" regulation.
- Necessary elements for trading (i.e., baselines, currency, banking, equity, regulatory authority, accountability) were achieved in this community-driven process through non-traditional partnerships.

ACKNOWLEDGEMENTS
The author gratefully acknowledges the dedication of the many individuals and organizations that participated in this project. Especially noteworthy are the other project co-principal investigators, Mr. David J. Batchelor, Program Specialist, Michigan Department of Environmental Quality, and Mr. William Reed, Executive Director, The Forum of Greater Kalamazoo. Staff of Kieser & Associates have dedicated thousands of hours of in-kind and professional services to this project that without such support, the full benefits of this endeavor would not be realized. Mr. Michael Tenenbaum deserves special thanks in these regards. Early financial support for this project was provided by the Kalamazoo Foundation's Sustainable Community Watershed Fund and contributions from a local paper company. Substantial project funding was provided by the Great Lakes Protection Fund and the Water Environment Research Foundation (including EPA Assistance Agreement # X824468).

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