

## **Citizen-based Stream Monitoring Pilot Project**

**A partnership of the Wisconsin Department of Natural Resources and the River Alliance of Wisconsin, in cooperation with the University of Wisconsin-Extension**

**2006 Final Report**

**Submitted by Citizen-based Water Monitoring Sub-team**

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**RIVER ALLIANCE**  
of Wisconsin

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## **Executive Summary**

Water quality and habitat assessment are high priority activities that the Wisconsin Department of Natural Resources (WDNR) undertakes to document and monitor the status and trends of water resources of the state. Accomplishing this objective is an enormous task because of the magnitude of the state's water resources, limited number of staff number and financial resources. Citizen monitors can assist this effort by providing not only valuable data about waters of Wisconsin, but also provide an essential role in helping to protect Wisconsin's natural resources as advocates for streams.

A pilot project (Project) was implemented in 2006 to assess specific questions related to development and management of components of a citizen monitoring program that would enable data collected by them from streams to be useable by WDNR staff for making management decisions. Six goals were set:

1. Assess citizens' interest, willingness, and ability to monitor streams using WDNR methods.
2. Evaluate the viability of a statewide Citizen-based Water Monitoring Network for streams.
3. Obtain data of sufficient quality that they could be used by the Department.
4. Define program structure (e.g., methods, training, quality assurance) for chosen parameters.
5. Assess the time commitments of Department staff to assist with the program.
6. Assess the costs of operating such a program on a statewide scope.

Fourteen citizens' groups were trained to monitor four stream quality parameters (i.e., transparency, dissolved oxygen, pH, and temperature). Thirteen of the 14 groups successfully participated in the Project. Sixteen program components were defined, and attainment goals were set for each. These components related to citizens' ability to calibrate and utilize monitoring equipment, record and submit data, share and return monitoring equipment, and follow a pre-defined monitoring schedule. The components also related to the ability of project staff to train, support, and quality check the citizen monitors. All except two of the goals set for these program components were met within 5% of the pre-defined level of attainment. Citizens felt they received adequate training and support from Project staff. Data were collected from 120 sites statewide and quality checks indicated a high level of confidence and ability on the part of the citizens to perform the methods.

However, administrative and financial support for the program must continue, and grow, in order to allow this level of stream monitoring programming to be sustainable in the long term. This includes support for program coordination, database development and management, and for WDNR staff to act as liaisons to the program (e.g., not having their participation be an "add-on", and building their participation into work planning). Without such support, the program cannot function.

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## Introduction

Water quality and habitat assessment are high priority activities that the Wisconsin Department of Natural Resources (WDNR) undertakes to document and monitor the status and trends of water resources of the state. Accomplishing this objective is an enormous task because of the magnitude of the state's water resources, and limited number of staff number and financial resources. Citizen monitors can assist this effort by providing not only valuable data about waters of Wisconsin, but also playing an essential role in helping to protect Wisconsin's natural resources as advocates for streams.

The Citizen-based Water Monitoring Subteam (Subteam) was formed at the direction of Division Administrator Todd Ambs to develop a proposal for creating and implementing a Citizen-based Water Monitoring Network in Wisconsin. The WDNR and UW-Extension (UWEX) developed a proposal for such a Network during 2005. It had three main goals:

1. Educate citizens about the status of Wisconsin's surface and groundwater resources
2. Build a network of informed citizen advocates for management and protection of Wisconsin's water resources
3. Obtain water resource data useful for Department decision-making

It proposed categorizing citizen-based water monitoring into three levels:

- Level 1: Introductory monitoring; local/educational data use
- Level 2: Status (one year) and trends (two or more years) monitoring; WDNR methods utilized and data usable for WDNR staff to make management decisions; under most circumstances, volunteers must participate in level 1 monitoring before moving to this level
- Level 3: Special research projects and sport fisheries assessments; sponsoring group's methods may be used; results may support specific research projects; under most circumstances, volunteers must participate in level 1 monitoring before moving to this level.

In 2005, level 1 programs existed for lakes (i.e., Citizen Lakes Monitoring Network and Clean Boats, Clean Waters) and streams (i.e., Water Action Volunteers), but level 2 monitoring opportunities existed only for lakes, and not for streams. To address the overall goals of developing a Citizen-based Water Monitoring Network, a pilot project (Project) was implemented in 2006 in partnership with the River Alliance of Wisconsin (River Alliance) and in cooperation with the University of Wisconsin-Extension. The Project was designed to assess specific questions related to development and management of

components of level 2 that would enable data collected from streams to be useable by WDNR staff for making management decisions and to build momentum and acceptance for the Network in WDNR work planning and budgeting.

The Subteam developed the conceptual plan for the Project during 2005, and then worked with the River Alliance to hire a project coordinator (Coordinator) for one year to implement the Project and prepare a report of findings. The general structure of the Project is outlined below:

- I. Hired Coordinator
- II. Selected citizens' groups
- III. Developed monitoring protocols
- IV. Held orientation sessions to get commitment of citizens
- V. Held training sessions in multiple locations across the state
- VI. Quality assurance checked / recertified citizens' groups
- VII. Collected monitoring equipment and data from citizens
- VIII. Developed report with findings and lessons learned

The goals of the Project were to:

1. Assess whether citizens were a) interested, b) willing, and c) successfully able to monitor streams using WDNR methods and sampling plans.
2. Evaluate the viability of a statewide Citizen-based Water Monitoring Network for streams. This includes all aspects of such an effort including recruiting, training, developing user-friendly and accessible data entry and storage systems, evaluation, and feedback (to citizens, Department staff, and political leaders).
3. Obtain data of sufficient quality that they can be used by the Department.
4. Define methods, quality assurance and control checks, a job description, an orientation session and training for the parameters within the water quality suite.
5. Assess the time commitments of Department staff to assist with the program, including with training, site selection and data analysis.
6. Assess the costs of operating such a program on a statewide scope.

In this report, each of the goals is discussed in detail and Subteam recommendations for future implementation of level 2 stream monitoring are reported. Also reported are actions taken by staff and

volunteers during the Project, findings based on each goal, and results of a series of surveys conducted during the Project which included:

- evaluations of orientations and trainings,
- a background survey to determine why each individual was interested in participating and their experience with water monitoring prior to this Project, and
- an end of season survey.

## **Goal 1: Assess whether citizens were interested, willing, and successfully able to monitor waters using WDNR methods and sampling plans.**

### *Assessing Interest/Willingness*

#### Participating Groups

Thirty-seven citizens' groups were recommended or expressed an interest in participating in the Project. Each one was contacted by the Coordinator, and wherever possible, he met with a group representative to explain goals and expectations of the Project. After these preliminary meetings, five groups chose not to participate due to the stringent requirements for participation. Specific reasons for choosing not to participate included:

- That the monitoring needed to be performed on a pre-determined schedule and the schedule needed to be adhered to as closely as possible.
- That the sampling parameters did not support the group's data needs for their stream(s).

Fifteen groups were unable to be contacted or did not respond after initial contact was made by the Coordinator. One group was encouraged to reconsider their participation because their goals were not in alignment with Project goals. Another group was asked to reconsider participating because they were already over-extended with monitoring activities. Eventually, 15 groups were selected to participate in formal orientation sessions for all group members. One of these groups chose not to participate following their orientation because the Project didn't meet their monitoring goals.

In the end, 14 groups (38% of the initial pool) participated in the Project. Every group consisted of between one and eight monitoring "teams", each with between one and 10 citizen monitors. In all, 112 citizen monitors in 41 teams were trained and participated in the Project. The groups were primarily non-governmental organizations (NGOs), and were largely local or regional non-profit river or watershed organizations. Two high schools, one nature center, and one university geosciences club were also selected for the Project. An objective in selecting groups was that they would not only span the state geographically, but in other ways as well. For instance, the selected groups sampled rivers listed on the federal 303(d) "impaired waters" list, as well as those on the Exceptional/Outstanding Resource Waters (ERW/ORW) list, and rivers in urban, suburban, rural and undeveloped areas were sampled. The Project groups included:

**Northern Region:**

Bad River Watershed Association  
Friends of the Jump River  
Friends of the Saint Croix Headwaters  
South Fork Flambeau River Watershed Association

**North East Region:**

Central Wisconsin Trout Unlimited

**South Central Region:**

Argyle Land Ethic Institute (a charter high school)  
Rock River Coalition – Dane County  
Rock River Coalition – Rock County

**South East Region:**

Friends of Milwaukee's Rivers  
Rock River Coalition – Waukesha County  
University of Wisconsin – Parkside: Geosciences Club

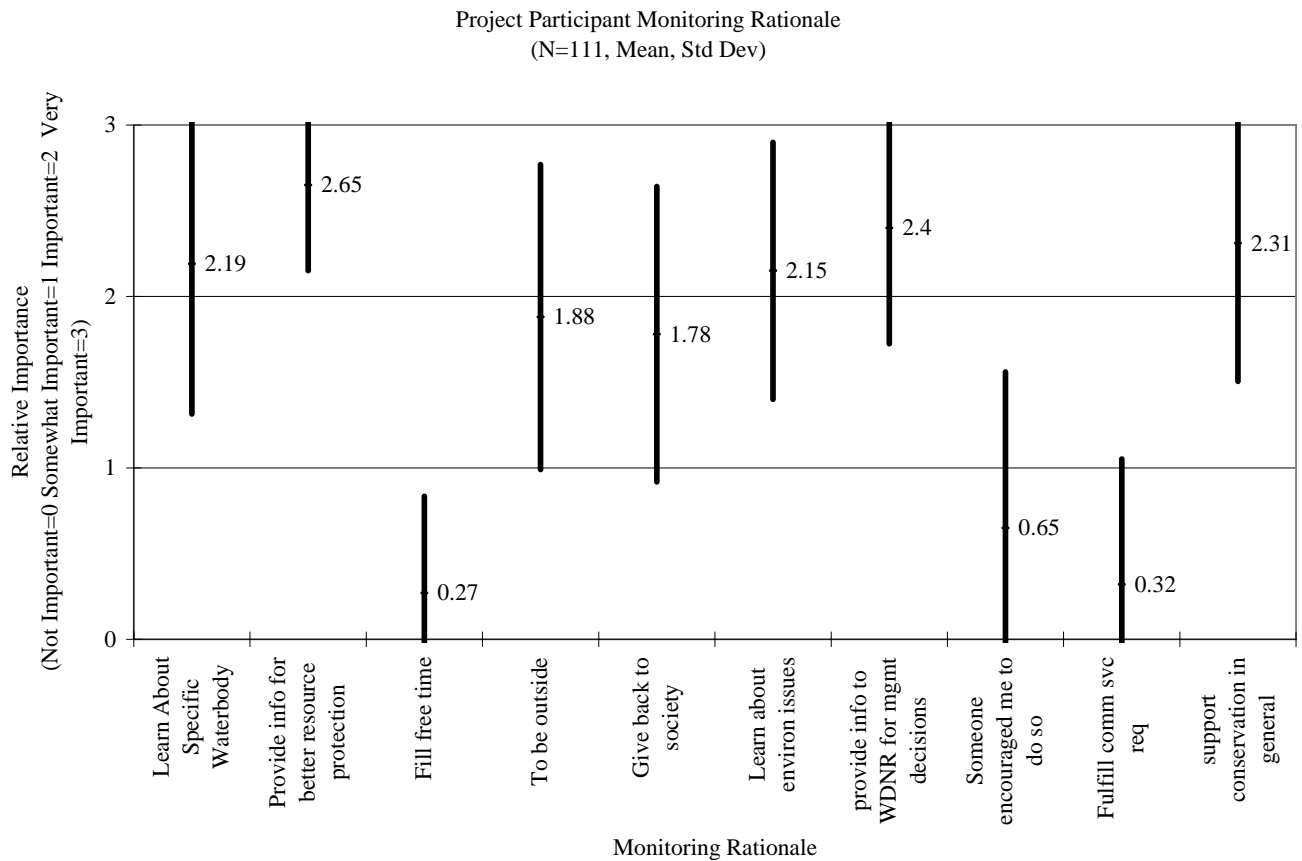
**West Central Region:**

Beaver Creek Citizen Science Center  
Galesville-Ettrick-Trempealeau High School  
Valley Stewardship Network

Motivation for Participating

At the start of the monitoring season, participants were asked about their motivation for joining the Project. Their primary motivations for monitoring were 1) to provide information for better resource protection, and 2) to provide the WDNR with information to assist with management decisions (Figure 1).

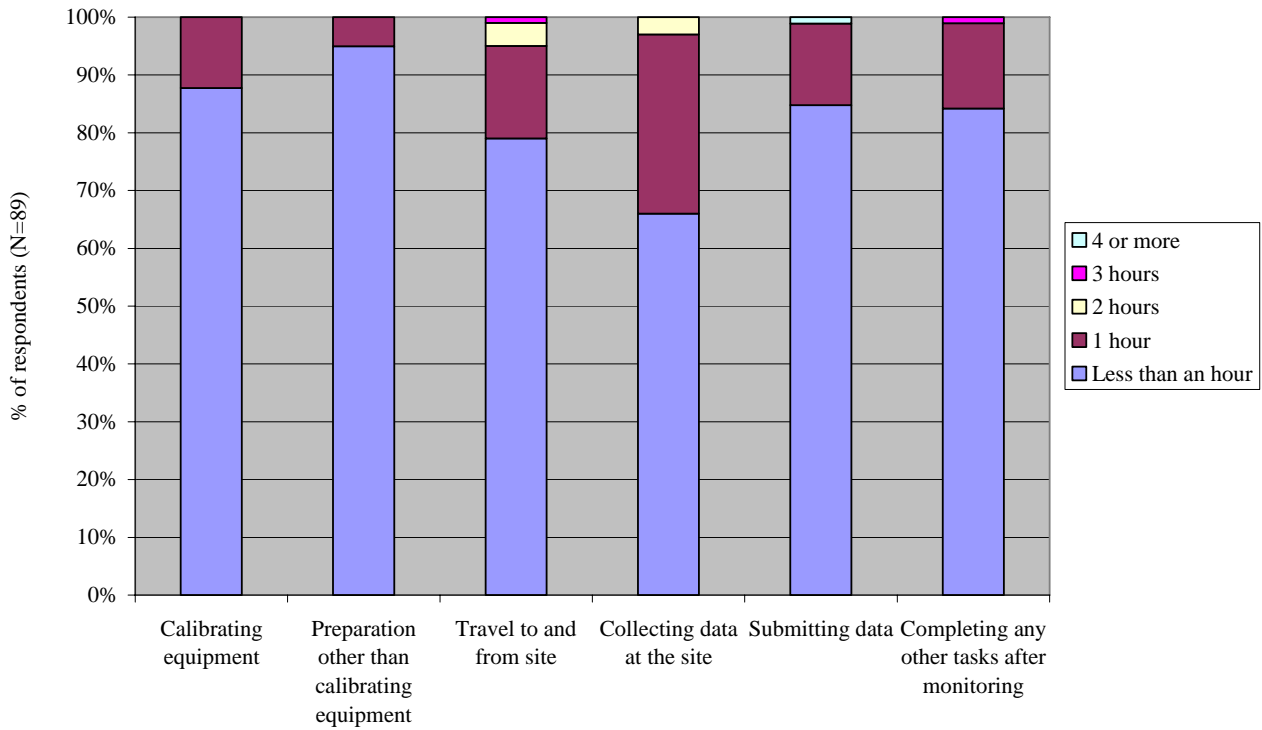
**Figure 1.**



Time Commitment of Volunteers

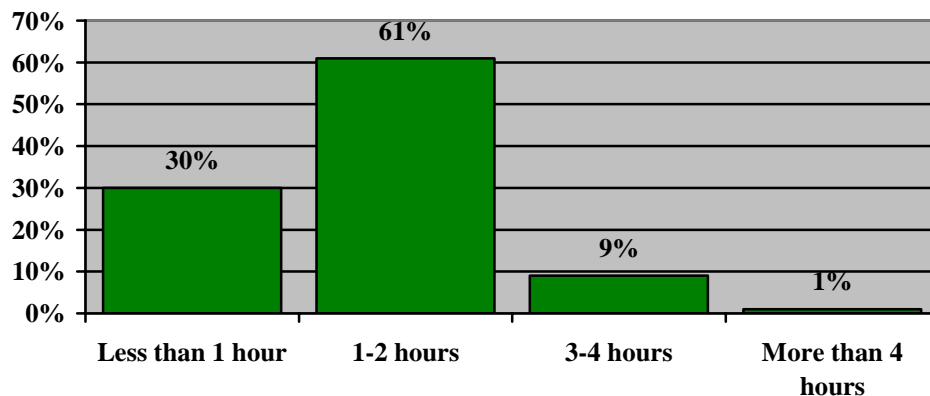
Volunteers generally were able to conduct field monitoring in less than an hour, with additional time to calibrate meters, to travel to/from their monitoring site, to submit data, and to prepare or finalize any other tasks related to the monitoring. The majority of monitors were also able to complete any of these separate tasks in under an hour (Figure 2).

**Figure 2: Approximately how much time did you spend on each of the following involved in any one site visit?**



Due to the Subteam recommendation that volunteers should have successfully participated in a level 1 monitoring program for at least a year before participating in level 2, time commitment of monitors in the Water Action Volunteers Program (WAV) was reviewed (Figure 3). With time spent preparing to monitor (e.g., calibrating meters) and monitoring in the Project, the two programs seem to have similar time commitments by volunteers, with about 1-2 hours committed per site visit for the majority of monitors.

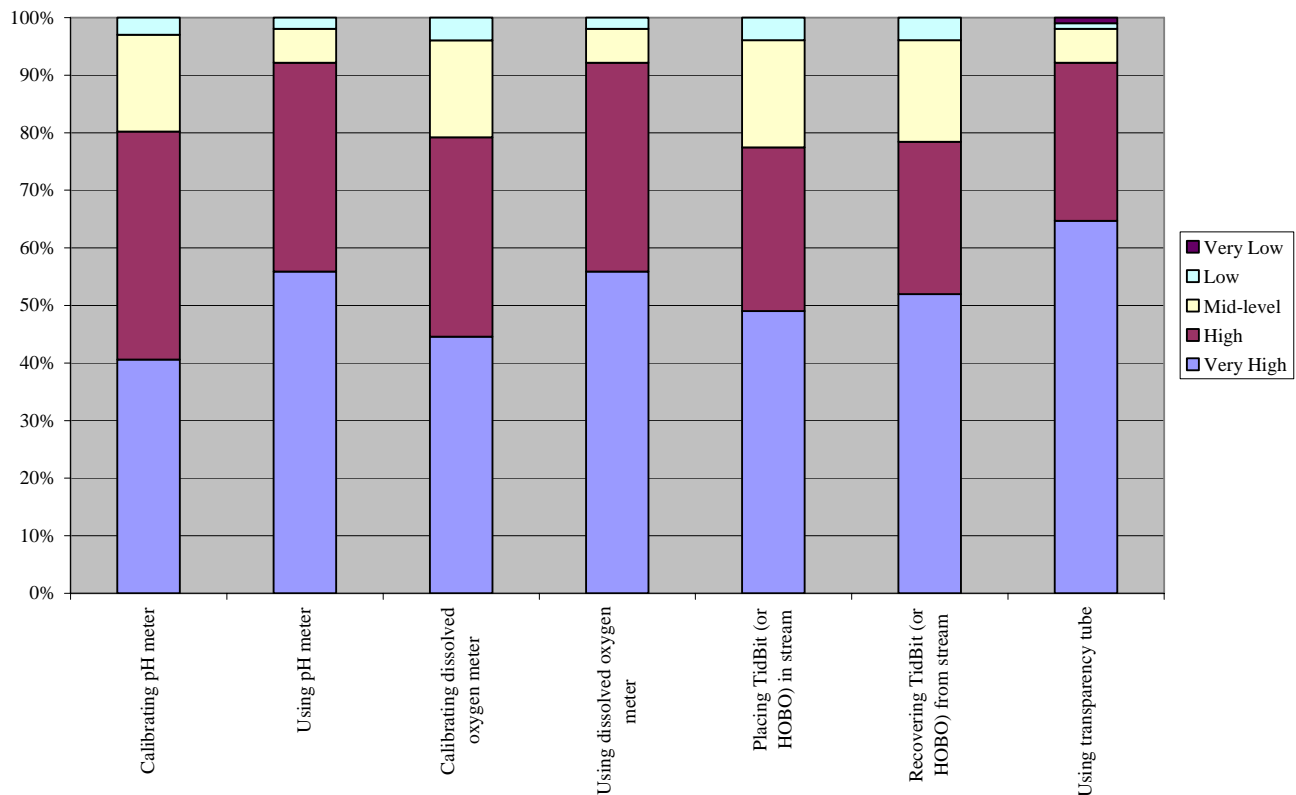
**Figure 3: WAV monitoring time investment**



## Confidence of volunteers

Project participants' confidence was high in every aspect of the monitoring process with 75% or more responding they had a high to very high level of confidence in calibrating and using the equipment (Figure 4). Thermistor deployment and recovery seemed to give respondents the most pause, and most comments regarding thermistors related to trouble locating thermistors once deployed.

Figure 4: How would you rate your current level of confidence to do the following? n=102



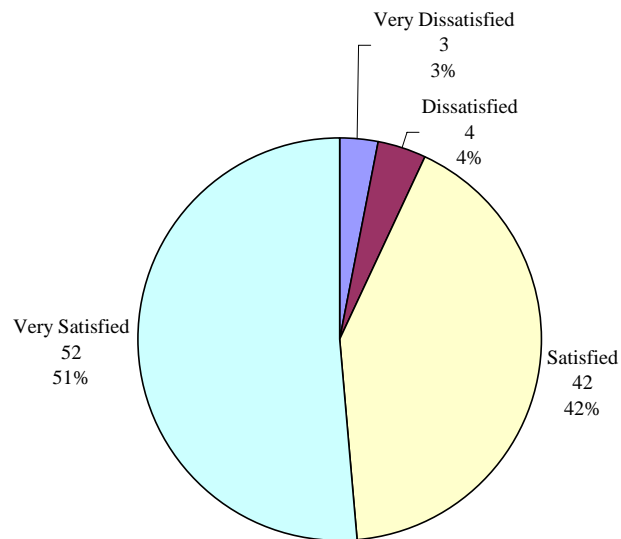
## End of Season Satisfaction Surveys

In October 2006, at the end of the sampling season, participating citizens were surveyed about their satisfaction with the Project. Ninety-one percent (102 of 112) of participants responded to the survey. Overall satisfaction was 92% (Figure 5). Of the seven respondents who indicated they were either dissatisfied or very dissatisfied, five gave reasons. Two people were dissatisfied with the written procedures. The procedures were either adapted from the equipment documentation, or modified from existing WDNR field procedures. As such, the procedures were written/edited by WDNR staff. During training, it became obvious that there were certain assumptions built in to the procedures that would likely be obvious to WDNR staff or other water monitoring professionals, but not necessarily to citizen monitors; especially those with little or no monitoring experience. Two of the other comments could be

attributed to inexperienced monitors; one was from an individual who felt at a disadvantage from other volunteers who had monitoring experience (and thus did not have enough time to practice methods during the training session); the other was from an individual who indicated volunteer monitors needed a better overall understanding of stream ecology. One person indicated they didn't actually get to monitor due to scheduling conflicts, so were dissatisfied with their participation.

**Figure 5.**

How dissatisfied or satisfied do you feel with your overall participation in the monitoring project?

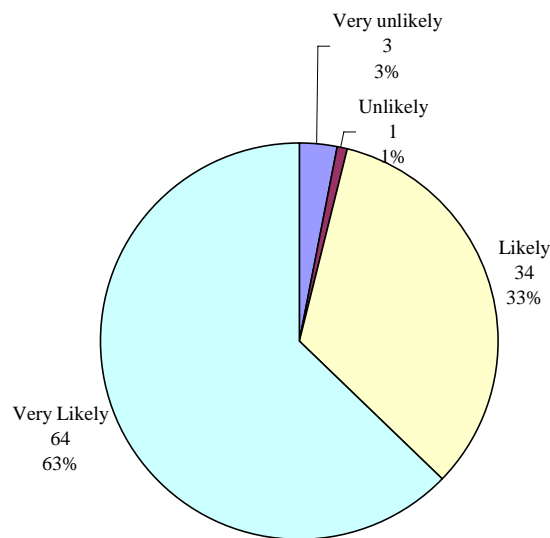


## Future Participation of Volunteers

Most Project participants indicated they would be likely to continue to monitor if the program continues (Figure 6).

**Figure 6.**

How unlikely or likely would you be to participate in this monitoring effort in the future?



## ***Evaluation of the Success of the Pilot Project***

The Subteam established rigorous evaluation criteria a priori. They felt that a very high level of compliance with the various program components was critical for the success of level 2 citizen-based monitoring. In 9 of the 16 program components evaluated, the level of acceptance was set at 100%, with the remainder set at 90% or greater (Table 1). The Subteam recognized in retrospect that these levels of acceptance were unreasonably high as they did not allow for extenuating circumstances that are reasonable to expect in any research study. Further, the Subteam realized that successful monitoring can be achieved with a very high degree of compliance and yet be less than 100%. For 10 of the 16 program components, evaluation criteria were not met, but all except one was within 5% of the predefined level of acceptability (Figures 7 and 8). Further, two of the 10 components (both related to data entry) were not met due to the SWIMS database not being ready for volunteer use during the monitoring season.

**Table 1. What constitutes success of the Pilot Projects? Were they successful?**

Program component		Level of Acceptability	Level of Compliance	Success? (Y/N)	Comments
Calibration	Calibration log turned in at end of season	100% compliance required. If not turned in, data are considered to be invalidated	96% (26/27)	N	(ALEA)
	Calibration log fields filled in completely	100% of fields must be filled in to be valid	99.65% (575/577)	N	Both cases were DO mg/L value from chart (same volunteer, two different dates)
	Meters properly calibrated each monitoring day	100% compliance required	98% (631/644)	N	
Sample collection	Sample collected at a minimum of three sites per set of equipment each month	90%+ compliance will be considered success; Also, compare % of sites visited to % sites DNR staff visited – did volunteers have higher % success in visiting the number of sites they set out to?	100%	Y	An extra set was issued to one group (2 sets for 3 sites) due to the distance between their sites
	Sample collected on primary day	90%	94% (605/644)	Y	
	Sample collected on secondary day	99%	98% (632/644)	N	5 were to accommodate re-certification, otherwise it would be 99.07% (638/644)
	All parameters monitored (i.e., D.O., pH, and transparency) each visit	100% of the parameters should be monitored on each visit	97% (623/644)	N	2 instances due to dead meter batteries, one was due to lost pH probe
	Samples collected 20-30 days apart from one another	90%+ of samples collected in this time period will be considered a success	99.69% (642/644)	Y	
	Percent of sites monitored that were recommended by DNR	% of recommended sites monitored will allow us to assess the degree to which we're filling gaps or building advocacy	45% (53/119)	N/A	

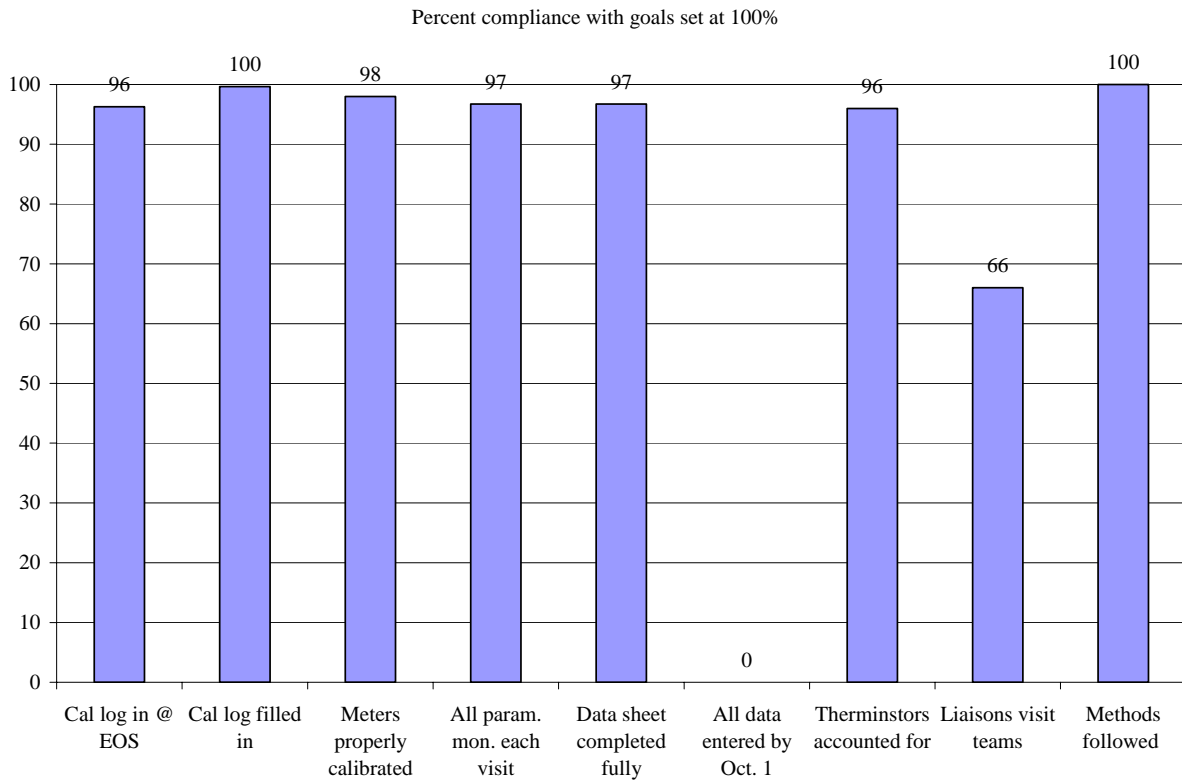
Data sheets / Data entry	Data sheet completed fully	100% compliance required for all monitored parameters, site, stream, team, sampling participants, date, and time; 90%+ completion of complementary information (i.e., weather, water level, water clarity, data entered in SWIMs, weather past two days, current streamside observations); Greyed areas of data sheet preferable to be completed, but not required.	97% (623/644) for sampling data, 68% (441/644) for anecdotal data	N	
	Data entered by end of month	90%+ data are entered by the end of each month	0%	N	SWIMS never Available to volunteers
	All data entered by Oct. 1	100% of data are entered by Oct. 1	0%	N	SWIMS never Available to volunteers
“Stick-to-itiveness”	<i>Individuals</i> who are trained monitor	90%+ people who are trained monitor	89%	Y	
	Trained <i>teams</i> monitor	90%+ of teams should monitor all season	98% (40/41)	Y	Only ALEA did not complete their sampling
Equipment	Thermistors turned in to DNR liaison by October 1	100% of recovered (e.g., not lost, stolen, etc.) thermistors turned in by this date	96%	N	
QA	Liaisons visit with each team once during the field season	100% of teams visited by liaison	66% (27 of 41)	N	
	Methods (calibration and monitoring) followed as described in written procedures	100% compliance with written procedures	100%	Y	No mistakes noted in Re-certification, other than 2 T-tube readings in direct sunlight (corrected before readings recorded)

\* - Many (if not all) volunteers that did not turn in data monthly were confused by discrepancy between the Orientation (where they were told data entry was required by the end of the season), and Training (where they were told data entry was required by end of each month).

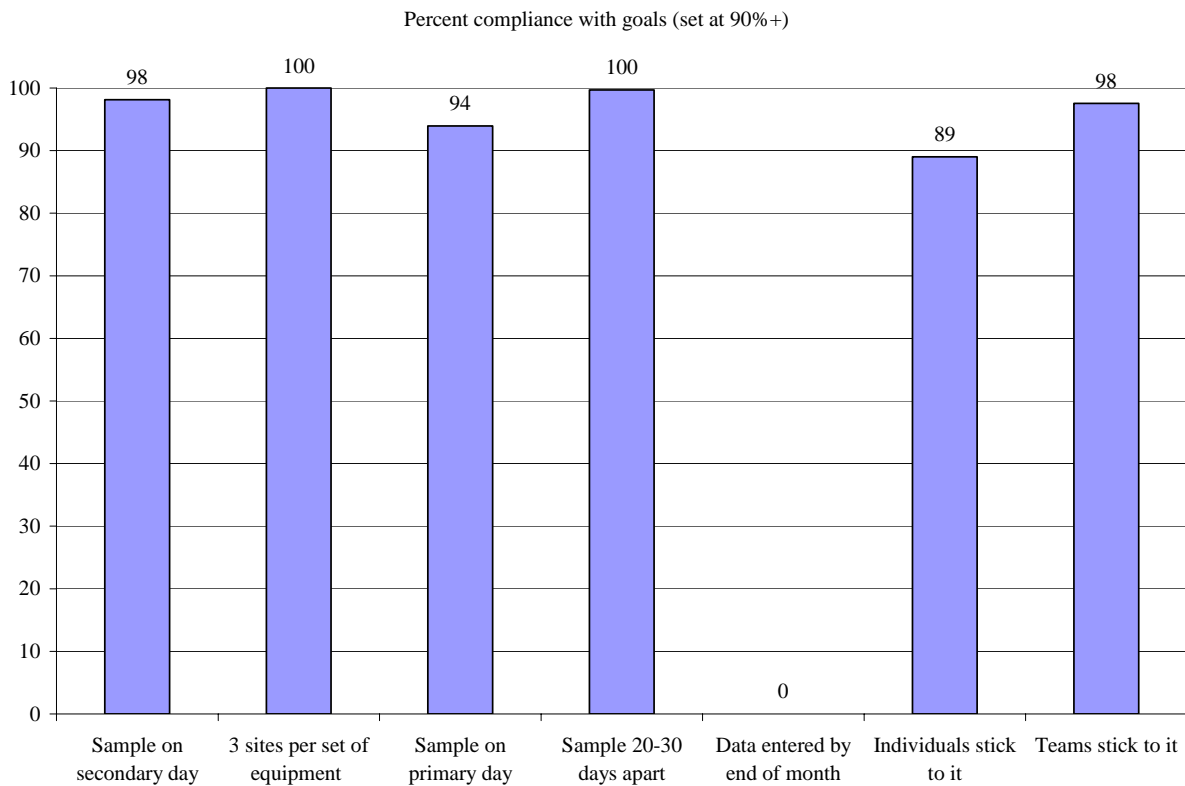
\*\* - Data entry was delayed due to SWIMS availability issues.

\*\*\* - Based on re-certification visits by WDNR Liaisons and CBSM Pilot Coordinator

**Figure 7.**



**Figure 8.**



Two of the three goals dealing with calibration were not met due to citizen monitor performance. The goal that all calibration logs would be turned in at end of season was not met since one team (Argyle Land Ethic Academy) failed to turn in their logs (or any other data). The goal that 100% of fields would be filled in on calibration sheets was not met due to one monitor failing to enter a dissolved oxygen reading (on two occasions) from a calibration chart.

The sample collection goal that all parameters were to be monitored (i.e., D.O., pH, and transparency) on each visit was not met (97% of 100% expected) due to mitigating circumstances. In one case, the clamp on the release hose of the transparency tube was lost in the stream, making collection of that parameter impossible. In the other case, the citizen monitor discovered the batteries in the pH meter had died when he was already at the sample site with no replacement batteries.

Goals for data being entered to the Surface Water Integrated Monitoring System (SWIMs) could not be evaluated because development of the system was delayed. This was a circumstance beyond the control of the citizen monitors or Project staff. This goal will be evaluated in the next study phase as the database becomes available.

Only 66% of monitoring teams received follow-up visits for quality assurance (QA) purposes. Several liaisons were unaware of this responsibility as it was not included on the list of responsibilities they received at a Train the Trainer event in March 2006. Another confounding issue was that the WDNR liaisons had not work planned to spend time on this project, thus time availability was a considerable factor in their ability to support it. Having said that, of the twelve liaisons, virtually all had some in-field contact with their group(s) during the sampling season; four recertified their volunteers (other recertifications were done by the Coordinator).

### ***Coordinator's Findings***

A requirement of participation in the Project was that individuals would have participated for at least one year at level 1. However some inexperienced volunteers were allowed to participate to ascertain whether this requirement was necessary. In the end, 68% of the participants had prior monitoring experience, usually through the Water Action Volunteers (WAV) level 1 stream monitoring program, and 12 of the 14 teams had inexperienced monitors participating. These individuals performed well, but they required a higher level of attention from both the Coordinator and their WDNR Liaisons.

Additionally, those groups that had a “lead” or main contact person for logistics and equipment also noted more time spent with “green” citizen monitors.

In general, all of the 14 groups, except one (Argyle Land Ethic Academy) performed at a high level. The teacher/advisor for the group was re-assigned by the school district and was no longer able to perform his duties in regards to the Project. His replacement did not carry out the Project during the remainder of the sampling season, though expressed interest in participating in 2007. The Coordinator recommended that this group be encouraged to complete one year of level 1 monitoring (WAV or equivalent) before being re-admitted to level 2 monitoring.

### ***Summary***

Overall, during training and recertification volunteers did a conscientious job carrying out methods and calibrating equipment. Citizen monitors did not meet all of the very rigorous performance goals set for them, but in most cases there were extenuating circumstances to explain the shortfalls. Improved training for volunteers and staff, as well as a formal Quality Assurance Project Plan (QAPP) are needed. Designated staff time to contribute to the Project needs to be allocated in work plans and supported by WDNR administration and management.

### ***Goal 1 Recommendations***

- Continue the Project in 2007. Every group that participated in 2006 expressed a desire to continue to participate in 2007. Sustaining the Project at its current size will allow the Subteam to evaluate measures related to sustainability of the Project as well as goals not met in 2006.
- All new citizen monitors must have at least one year of monitoring experience to participate in level 2 monitoring.
- Argyle Land Ethic Academy should be dropped from this Project, but encouraged to participate in level 1 monitoring (i.e., WAV) during 2007.
- Modify performance goals to include mitigation language (i.e., “+/- 5%”) to account for factors beyond the control of Project staff or participants.
- Goals not met in 2006 should be focused on during 2007.
- A formal Quality Assurance Project Plan should be developed for level 2 stream monitoring.

**Goal 2: Evaluate the viability of a statewide Citizen-based Water Monitoring Network; including recruiting, training, developing user-friendly and accessible data entry and storage systems, evaluation, and communication to citizens, Department staff, and political leaders.**

***Recruitment and Orientations***

This aspect of the Project was discussed in detail in Goal 1, *Assessing Interest/Willingness* section (page 4). In summary, of 37 citizens' groups recommended, 14 groups participated in the Project (38%).

Project recruitment included:

- Developing a list of potential groups by soliciting input from WDNR, River Alliance of Wisconsin, WAV, Citizen Lakes Monitoring Network, and other citizen-based monitoring program staff across the state,
- Contacting recommended groups (via phone, email and/or in person), and
- Hosting a series of 2-hour orientation sessions to describe the pilot and its expectations of and provisions to the participating citizen monitors

The orientation sessions (based on structure of successful programs across the nation) were held as a way to minimize cost and time expenditures for managing the Project. In essence, they were designed to be a self winnowing process for groups that might not have a sufficiently high level of commitment for the Project or whose goals were not in congruence with those of the Project.

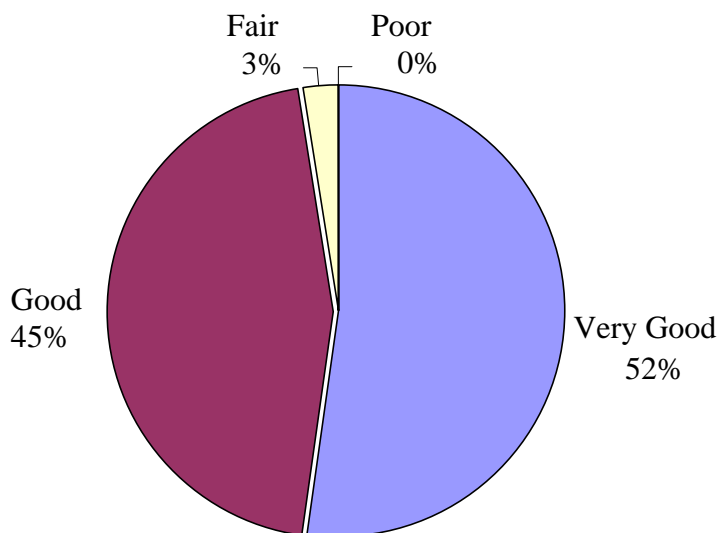
At these sessions, the Coordinator explained the Project and attempted to gauge the commitment and abilities of the group. These initial meetings were vital in paring down the number of groups that eventually proceeded to more formal orientation. Most of the groups that decided not to participate made their decisions based on the information they received at this initial meeting, and/or after deliberation among their group subsequent to the meeting.

The Coordinator, in consultation with the Subteam, made the final determination of which groups to include in the Project. Only two groups had to be refused participation in the Project. In one case, the group became impossible to reach, either by phone or email. In the other, it was determined that the group (a high school group led by a science teacher) was already over-extended with other projects.

At the orientations, each citizen monitor was asked to fill out an evaluation. Results of these evaluations highlighted an issue with the more time-pressed of the citizen monitors. Many were unable to attend the orientation, or had to shuffle their schedules to do so. Several were required to attend orientations for other groups. Participants found the orientation sessions helpful however. Ninety-six percent (112 out of 116) of participants rated the orientation as either “good” or “very good” (Figure 9). The most common response for improvement was to have the equipment available to show the attendees, and allow hands-on examination of it (8 comments).

**Figure 9: Overall Rating of Orientation**

(N=116)



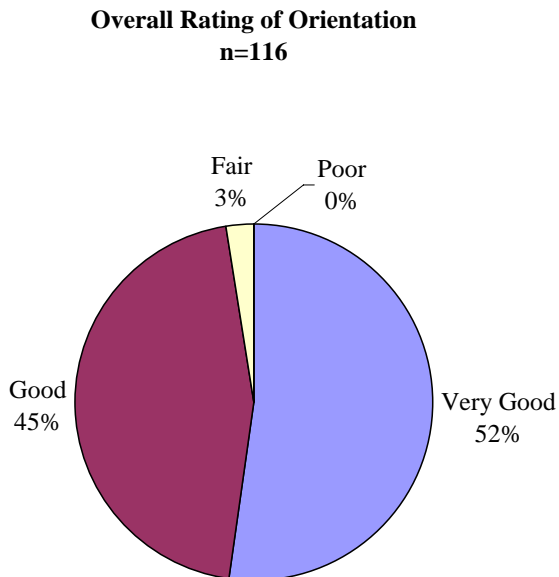
### ***Training***

All volunteers were required to attend a seven hour training (with both classroom and field components) to learn to use the equipment and to follow defined sampling procedures. These were held locally to the volunteer groups and followed either a multi-evening or a day-long schedule.

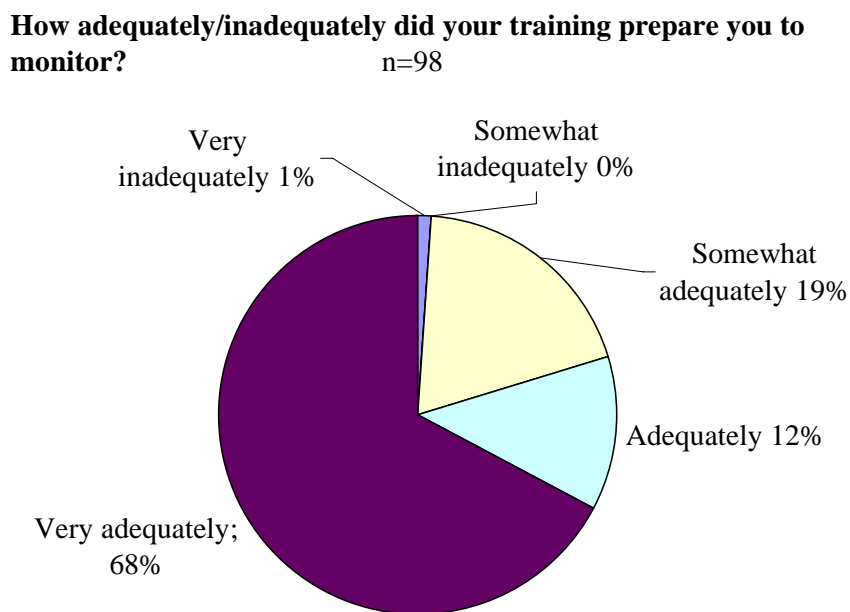
Eleven trainings were held between April 15 and May 20, 2006. The first training was led by Cindy Koperski, WDNR Liaison for the Valley Stewardship Network. The remaining sessions were led by the Coordinator, with assistance from the WDNR liaison for the group(s) being trained. This was done because not all of the WDNR liaisons felt comfortable, nor had the time to prepare to lead the trainings but also to ensure consistency of training across the state.

Evaluations of the trainings were positive. All but one respondent rated them as “good” or “very good” (99%; Figure 10). Participants generally felt that they were adequately trained to do the monitoring they were asked to do (Figure 11).

**Figure 10.**



**Figure 11.**

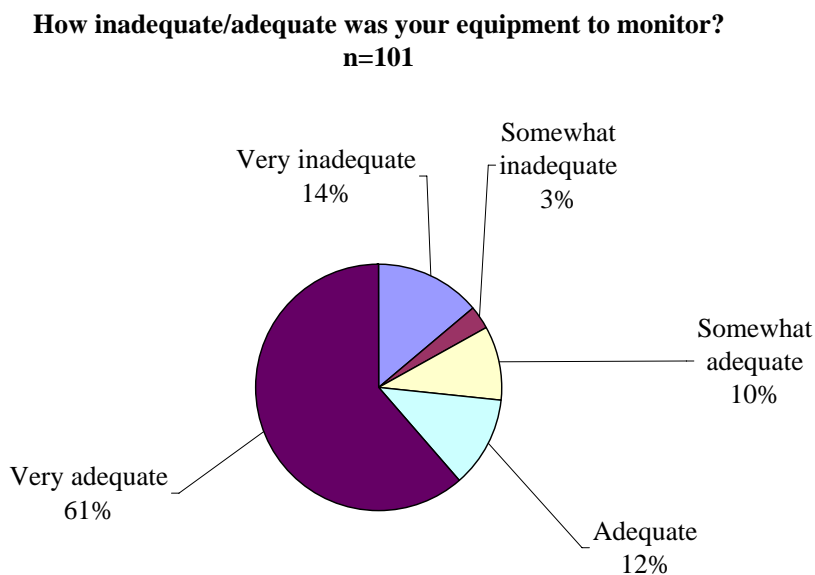


A gap that became evident in terms of training and setting expectations of the citizens was that it was difficult to impress upon citizen monitoring groups (who were eager to initiate science-based initiatives in their watersheds based on their monitoring work) that five months of water quality data are not sufficient to empirically analyze trends in a stream system; a bare minimum of three to six years would be required to even begin to make trend assessments. Further, highly motivated groups can be impatient to move on to more “meaningful” monitoring activities, such as those that would be required for supporting use designation determinations. It can be a hard sell to convince these groups that there is a need to proceed methodically, and that patience will be required to achieve their goals. These issues need to be continually addressed not only at orientation and training sessions, but also during on-going interactions between Project staff and citizen monitors. Further, it is essential to empower these citizen scientists with knowledge to help them use and share the data locally, and not “just give” the data to the WDNR for their use.

### ***Equipment***

When assessing the equipment used in the Project, 73% of participants responding to the end of season survey rated the equipment adequate or very adequate (Figure 12). Similarly, the respondents reported few, if any, problems with the equipment. Sixty-nine percent reported that equipment always worked with little or no problems, and 26% reported it worked most of the time.

**Figure 12.**



### *Developing a user-friendly and accessible data entry and storage system*

For cost savings and the value of integrating Project data with other data collected by WDNR staff and contractors, the Subteam opted not to develop a unique data entry and storage system for the Project. Instead they chose to work with developers of the Surface Water Integrated Monitoring System (SWIMS) that was being created for the WDNR as the Project began to develop components of the system to meet Project needs. It was hoped that SWIMS would be ready in time for the volunteers to enter data to it during the monitoring season. However, due to the nature of developing such a large database system, which was being built to serve many program-areas, as well as delays due to server migrations, the system wasn't ready for volunteers to use for data entry during the 2006 field season. However, the online data entry option in SWIMS will be available to be used by volunteers, and that process assessed, during the 2007 monitoring season.

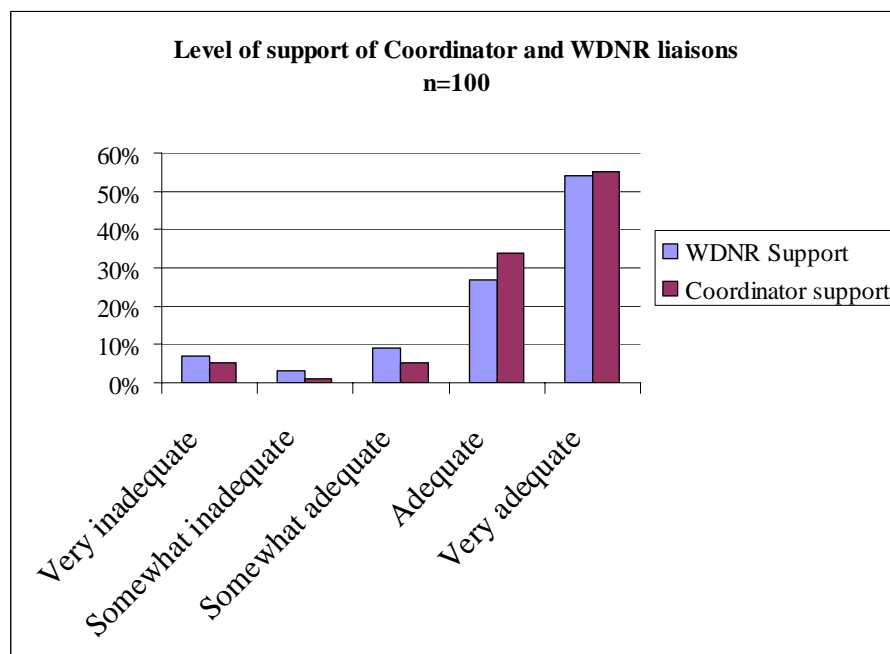
### *Evaluation*

Evaluation forms were developed for all aspects of the Project (i.e., orientation, training, end of season). These provided valuable data for this report and for improvement of the Project.

### *Feedback to citizens, Department staff, and political leaders*

The participants generally gave high marks to the support offered by WDNR staff and the Coordinator to them during the field season. Over 50% rated support as very adequate and 27-33% more participants felt support was adequate (Figure 13).

**Figure 13.**



Feedback to participants following the sampling season was not carried out as planned. Due to delays in development of and data entry to SWIMs, and the priority of the Coordinator to develop a final report about the Project, a report for citizens describing data results from the season was not created. This should be a main priority of the Coordinator in 2007.

In the year-end survey, 78% of participants reported an interest in attending a one-day symposium at which they could share results, meet other Project participants, and learn more about stream ecology. This would be a valuable component of the Project and Network and should also be a priority in 2007.

In terms of feedback to WDNR staff, this report serves as one mechanism of feedback to them. The Subteam also plans to present results of the Project to WDNR staff at a series of regional meetings during 2007. Feedback to WDNR staff is essential because the Project was a pilot effort and staff have a variety of questions and concerns about the endeavor (e.g., source of funding used to support it, staff vs. citizens doing work, time availability of staff to devote to this effort, and having their participation be an unfunded add on to their workload). Sharing results of the Project should be a main priority of the Coordinator and the Subteam during 2007.

Feedback to political leaders should be a future endeavor. However, at this time, a variety of questions remain after the initial year of the Project, many of which may begin to be addressed during a second year of the Project. Focused goals for 2007 should address questions left unanswered during 2006 due to lack of time to develop answers or which have been brought to the surface during this Project.

### ***Goal 2 Recommendations***

- Develop communication strategies to ensure that citizens understand both how the WDNR may use the data the citizens collect as well as how the citizens can utilize the data locally.
- Develop a standardized data report template during a second year of the Project to communicate data results to the participating volunteers.
- Develop and hold a 1 day symposium, or 2-3 regionally-oriented symposiums, for returning groups to share their experiences and present monitoring results.
- Share Project results with WDNR staff with specific focus on issues of concern to staff.
- Continue the Project for a second year to address questions that were left unanswered during 2006 or which rose to the surface during the year and to further improve the effort, build momentum and demand for a Citizen-based Water Monitoring Network.

- Inventory and report on current WDNR-supported citizen-based water monitoring projects throughout the state.

### **Goal 3: Obtain data of sufficient quality that they can be used by the Department.**

#### ***Recertification***

No significant errors in methodology were noted during recertification of the teams. Every team properly calibrated their meters, and showed a high degree of professionalism in both the calibration and sampling process. The volunteers were very careful in their documentation; teams with multiple citizen monitors were very likely to consult on sample readings, transparency values, etc. In fact, the only errors that were noted were two different citizen monitors who began to read their transparency tubes in direct sunlight, until reminded of their mistake, one by his sampling partner, the other by the Coordinator.

This high recertification success rate suggests that a sub-sample of teams could be recertified each year. The Subteam will evaluate this option for 2007. A formal quality assurance project plan would define exactly how this recertification or quality check process would be conducted. Since data are being collected to be used for making management decisions, it is essential that written quality assurance procedures be developed for the Project.

#### ***Side by side monitoring***

##### pH

The Coordinator conducted side-by-side monitoring during recertifications, using identical equipment to the citizen monitors. Results varied for the different types of equipment. All 21 side-by-side tests of the Oakton Acorn pH 5 meters were within the combined error range of 0.6 pH units, and in most cases were either exactly the same or only off by 0.03 pH units or less.

##### Transparency

Transparency readings from the Water Monitoring Equipment & Supply transparency tubes (purchased from Forestry Suppliers) generally resulted in higher transparency readings than the Science First Fieldmaster transparency tubes (purchased from Fisher Scientific). The sample size was too small to produce conclusive results, but the differing transparencies may have been a result of structural differences between the two brands of tubes. The wall thickness of the Science First Fieldmaster tube is thicker and seems to be made of “cloudier” acrylic (Figure 14), resulting in a more opaque tube. The Subteam will evaluate the need for comparison studies of differences between the tube models and to

determine variance between individuals monitoring transparency would enhance credibility of the program and may be necessary to include in a quality assurance project plan for the Project.

### Dissolved Oxygen

In 21 side by side tests with the YSI 550A, five (24%) were outside the combined error range of 0.4 mg/L. Four of those readings were more than twice the combined error range, and one (1.18 mg/L difference) was almost three times the combined error range. In discussions with biologists, this range of error, while not desirable, was found to be acceptable, since water quality ratings determined with the meters were similar regardless of the difference in D.O. assessed.

**Figure 14: Comparative wall thickness and clarity of transparency tubes. In image a, the Fieldmaster tube is on the right. In image b, the Fieldmaster tube is on the left**



### Temperature

The preliminary results of the thermistor data indicate that those that were successfully recovered all performed well. However, during initial test of the thermistors, TidbiTs passed the test at 100% (70 out of 70), while HOBOS had a 20% failure rate (two out of 10). The preliminary test of the thermistors was conducted prior to issuing them to the monitoring groups for deployment. Each was launched and put in an ice-water bath for at least 24 hours, then removed and downloaded to test results. All 70 TidbiTs correctly launched, showed initial water temperature of near 0<sup>0</sup> C, and near identical warm-up as the ice in the water melted. Of the ten HOBOS, two failed to launch; the other eight passed the initial test. The two inoperative HOBOS were returned to Onset Computer Corporation for repair, and were returned, only to have one of the two fail again. The failed unit was eventually replaced by Onset by a HOBOS that did pass its initial test.

### *Stream Sample data*

A total of 120 sites were monitored. In most cases, five months of sampling data were provided from each group. Through communication with the monitors and while doing data entry, the Coordinator developed several recommendations in regards to data sheets (noted below).

Data are being entered to SWIMs for analysis. Summary reports are expected to be produced by April 2007.

### *Goal 3 Recommendations*

- Develop a written quality assurance project plan to help ensure that data being collected are of sufficient quality to be used how they are expected to be used.
- Conduct comparison studies of the different brands of transparency tubes and to assess variance of readings among individual monitors. These studies will help ensure that data collected with this equipment are credible.
- Implement the following recommendations related to equipment:
  - Purchase up to 5 new complete sampling kits (i.e., D.O. meters, pH meters, transparency tubes, thermistors, and related supplies) to accommodate needs of existing groups.
  - Reassess YSI meter discrepancies.
  - Continue to use Oakton Acorn pH 5 meter.
  - Pursuant to results of the transparency tube testing, if statistically significant differences result, opt for one brand of transparency tube only.
  - Purchase additional thermistors to replace those lost and damaged in 2006.
  - Phase out use of HOBOS (as they become lost or damaged) in favor of TidbiTs.
- Implement the following recommendations related to the data sheets:
  - Provide more room on the data sheet for streamside observations.
  - Provide specific recommendations about what data to enter in the streamside observations field.
  - Change “sunny” to “sunny/clear” as an option in the weather field.

**Goal 4: Define methods, quality assurance and control checks, a job description, an orientation session and training for the parameters within the water quality suite.**

Following the Citizen Lakes Monitoring Network model (i.e., to start a program small), a minimum number of parameters were chosen for inclusion in the Project. Monitoring procedures were identical to those used by WDNR staff. Parameters (and methods) included:

- Dissolved oxygen (meter)
- pH (meter)
- Water temp (meter [during site visit sampling])
- Water temp (thermistor [for continuous monitoring])
- Transparency (120 cm tube)

Orientation and training sessions were developed and have been previously mentioned in this report. Sample agendas for each are available upon request from the Coordinator, as are the job description and written methods for the Project.

A few citizens commented that methods were missing some detail. These should be reviewed prior to the 2007 monitoring season and updated based on citizen input.

Some quality assurance procedures were followed during 2006 (e.g., some quality checks of equipment, methodology checks of volunteers), but this aspect of the Project needs better definition in 2007. Such procedures need to be developed (in a quality assurance project plan) to ensure that data are collected at a certain quality level, in this case, so that they can be used in making management decisions, which is a goal of level 2 monitoring. Without written quality assurance procedures, data that are collected have the potential to be suspect to data users. Written quality assurance and quality control procedures will help build credibility for the data and data collectors alike. This should be a focus area for 2007.

Another aspect of the Project that should be reevaluated during 2007 is site selection. Sites were chosen by volunteer groups (56% of sites), by liaisons (15%), and through negotiation between the two (29%). There has been continuing discussion among Subteam members about if the Project should more clearly define how sites are chosen. The catch is that if WDNR staff recommend sites that would most benefit their work, the data collected have the best chance of being used (since the sites being monitored are

already on the “radar screen” of the staff person who recommended the site). However, that option has great potential to stifle volunteer participation since volunteers often have interest in specific sites and could contribute data about sites where WDNR staff simply don’t have time to monitor. In addition, sites WDNR staff select may not be within acceptable driving distance from volunteers homes, so if WDNR chose sites, they may end up not being monitored.

#### ***Goal 4 Recommendations***

- Develop a written quality assurance project plan to help ensure that data being collected are of sufficient quality to be used how they are expected to be used.
- Update methods based on citizen input about aspects that could use clarification.
- Subteam should continue to discuss site selection and pros/cons of recommending sites or having citizen groups select sites strictly of interest to them.

## **Goal 5: Assess the time commitments of Department staff to assist with the program, including with training, site selection and data analysis.**

### *WDNR staff time*

Although WDNR Water Division Administration supported the Project, staff liaisons were not able to work plan their time to participate in the effort. Each liaison had to rework their busy field season schedules to allow for preparation for trainings, interpersonal contact with the volunteers during the sampling season, and in some cases, for quality assurance checks. The amount of time staff were able to commit to the Project varied widely among the liaisons. Overall, according to activity code reporting, individuals spent 3 to 66 hours of time working on the Project with a mean of 28 hours and a median of 25 hours each. According to end of season surveys completed by the liaisons, the breakdown of their time into categories was as follows: The range of hours spent in contact (on the phone, in person or through email) with citizens ranged from 0 to 10 hours, with a median of 4 hours and a mode of 10 hours. The range of hours spent planning for or at training sessions was 2 to 27 hours, with a median of 10.5 hours and modes of 2 hours and 8 hours. The range of hours spent doing quality checks of the citizens' monitoring was 0 to 27 hours with both a median and mode of 0 hours (six of 11 liaisons spent no time on QA). On average, 197 hours were expended to train, support and monitor each volunteer group (including the Coordinator and each of the 12 liaisons' time).

Related to time commitment of staff, in future years, there is potential to be a shortage of liaisons in some WDNR regions that are working with reduced numbers of full-time equivalent staff (FTEs) or who don't have biologists available to be liaisons. For instance, in the Northern Region, a liaison was recruited from outside the Region to act as the liaison for three different groups. The results of the year-end survey of WDNR Liaisons articulated the challenges to regional staff. Eleven liaisons (of 12) responded. When asked how they became liaisons for the Project, four indicated they volunteered, four were asked and readily accepted, and three were told with no choice to decline. Nine indicated they would be willing to be liaisons again next year. Two indicated they would not be willing to do the job again, one referenced being overworked with no additional time to put towards the Project. In addition they noted that although the Project is said to be a high priority of the WDNR, that it is not adequately funded. As an "add-on" to their schedule that was already full from earlier work planning, and with staff cuts to their region, asking staff to participate in the Project was not realistic. Filling lost positions and adding funding to this effort were two suggestions offered to remedy the situation.

When asked the extent to which the liaison's other work responsibilities were affected by participating in the Project, seven indicated their work was affected a little and four said it was not affected at all. When asked their level of satisfaction with their overall experience as a liaison one was very satisfied, four were satisfied, three were neutral, and three were dissatisfied.

### ***SWIMS and Data Management***

As noted earlier in this report, a significant amount of time was spent by WDNR staff developing the SWIMs system for use with this Project. The time that was committed was an add on to those staff members and unfunded by the Project. It is not acceptable or sustainable to continue to operate the Project without financially supporting these efforts. In addition, not only does the database need programming support, but data need to be quality checked to ensure they are acceptable for uses for which they were collected.

### ***Coordinator's time***

The Coordinator worked a total of 2405 hours, averaging 46 hours per week. Certain times of year required a larger time commitment than others (e.g., spring training). Overall, this was 325 hours more than an average full-time employee, and is unsustainable for an extended period of time for one full-time employee.

The Coordinator spent a significant portion of time working on program development (e.g., recruiting volunteers, and development of orientations, methods, training, quality assurance (QA), etc.). The most travel and most number of hours worked were in spring, when the Coordinator averaged 73-hour work-weeks. The sampling season was spent largely dealing with equipment issues and volunteer assistance and follow-up and was less busy than spring. QA activities began in late July and continued until the end of the sampling season. Travel again took up a significant amount of the Coordinator's time during this period as well. Toward the end of the sampling season, data entry, recovery of missing sampling and calibration data, and data QA were the primary time commitments required of the Coordinator.

Further, the work of the Project was not completed during 2006. For instance, data entry was not completed, reports to citizen participants were not developed, and planning for 2007 was behind schedule at the end of the calendar year.

### ***Goal 5 Recommendations***

- Ensure that WDNR Liaisons have their Project duties included in their work plans, and that WDNR regional administration formally supports their efforts.
  - Investigate the possibility of hiring WDNR retirees, and other retired water resources professionals to act as liaisons.
  - Investigate the possibility of offering regions an opportunity to apply for funding from the Subteam to help support coordination of the Project in their regions.
- Fund a river data manager position – to support development of the SWIMs system, and quality check data.
- Hire the Coordinator as a full-time employee, offering benefits as well as some semblance of job security.
- Attempt to hold fewer orientation and training sessions, and in more central (to the region) locations to minimize workload and travel for the Coordinator.
- Preferably hold training at locations with internet access to facilitate SWIMS training, locate new sample locations, access WDNR and other on-line tools, etc.

**Goal 6: Assess the costs of operating such a program on a statewide scope.**

The WDNR and the River Alliance of Wisconsin formed a partnership to jointly fund the Project for 2006 (Table 2). The two organizations directly contributed a total of \$95,000 (\$52,500 from the DNR and \$42,500 from the River Alliance). This included hiring a full time coordinator (through a contract with the River Alliance), purchasing 22 sets of stream monitoring equipment, developing methods and training materials, and supporting travel costs for the Coordinator (Table 1). It cost approximately \$2100 to equip each volunteer monitoring group (including equipment, cases, manuals, data sheets, and software). The Coordinator’s expense budget for travel was about \$5000.

In addition, the WDNR pledged assistance from regional staff to be liaisons to the Project. Liaisons assisted with training, data and equipment retrieval, and other monitoring-related issues, leaving the Coordinator to focus primarily on project-level and logistical issues. Each liaison spent an average of 28 hours (@~\$25/hour) and expended approximately \$95 in travel supporting the Project. This amounted to approximately \$9540 additional contribution from WDNR.

WDNR staff and contractors also worked to coordinate the SWIMs database for the program. This contribution is not accounted for in Table 1. Future programming to finalize development of online data entry, to develop a template report from data entered to the database (see Goal 2), and to maintain and update the system will be required. Additionally, it is imperative that data entered to the system are checked to ensure their quality to meet defined uses (e.g., management decisions). Thus, funding should be allocated for these purposes in future years of the Project.

The University of Wisconsin-Extension (UWEX) contributed extensive staff time to the Project through participation in the Subteam (both leadership to the Subteam and membership on it) and through the UWEX Environmental Resources Center Evaluation Unit, which carried out several evaluations related to the Project. It’s estimated that several hundred hours were contributed from UWEX towards the Project.

**Table 2. Contributions to the CBSM Pilot by WDNR and River Alliance of Wisconsin**

<b>Revenue Source</b>	<b>Intended Use</b>	<b>Budgeted Revenue</b>	<b>Actual Revenue</b>	<b>Actual Expenses</b>	<b>Balance Remaining</b>
Brico Fund via River Alliance	CBSM Coordinator compensation	\$15,000.00	\$15,000.00	\$15,000.00	\$0.00

WDNR	CBSM Coordinator compensation	\$15,000.00	\$25,000.00	\$25,000.00	\$0.00
Alliance for Great Lakes via River Alliance	Miscellaneous	\$0.00	\$2,500.00	\$1,307.16	\$1,192.84
WPSC settlement via River Alliance		\$25,000.00	\$25,000.00		\$4,608.28
	Equipment			\$10,391.72	
	Expenses			\$10,000	
WDNR	CBSM Coordinator Expenses	\$0.00	\$5,000.00	\$5,000.00	\$0.00
<b>TOTAL</b>		<b>\$55,000.00</b>	<b>\$72,500.00</b>	<b>\$66,698.88</b>	<b>\$5,801.12</b>
<b>Additional Project Funds Administered by Wisconsin DNR</b>					
<b>Revenue Source</b>	<b>Intended Use</b>	<b>Budgeted Revenue</b>	<b>Actual Revenue</b>	<b>Actual Expenses</b>	<b>Balance Remaining</b>
WDNR (“Section 106”)	Equipment & Expenses	0	\$20000	\$18619.96	\$1380.04
WDNR	Equipment & Expenses	0	\$2500	\$1,838.42	\$661.58
<b>TOTAL</b>		<b>0</b>	<b>\$22500</b>	<b>\$20458.38</b>	<b>\$2,041.62</b>

Salary for the Coordinator and equipment funding were adequate for 2006. However, largely due to a spike in fuel costs, combined with travel for re-certification and equipment pick-up, the funds for the Coordinator’s expenses were exhausted near the end of the sampling season. It’s likely that with as many or a greater number of groups participating in future years that the travel budget for the Coordinator will only increase, thus additional funds should be allocated for such travel in future years.

2006 Project funding contributions from the River Alliance were from unsustainable sources (e.g., grant and/or settlement funding), and they have expressed that their interest in participating in the Project was to assist the WDNR in assessing the scope and initiating such monitoring efforts, not to contribute to the Project long-term. Further, to develop a sustainable program with consistent staffing, it is essential to hire a full time coordinator and offer them benefits. This will likely cost the supporting agencies more than during 2006 (to account for indirect and overhead costs as well as to support the employee with benefits). Thus, if WDNR is going to sustain the Project, other partners or additional grant resources must be sought to help support it, or else the effort must be supported with additional WDNR funds. Not only can partners help support the Project financially, but they can offer leveraged support. For instance, during the Project, UWEX contributed a significant amount of time towards its evaluation.

The University can also be a linkage for conducting research that can add credibility to the data that are collected.

***Goal 6 Recommendations***

- Continue to support funding the Project at least at the level at which it was funded during 2006, and preferably at a higher level to support SWIMs development, data management, liaison support in the regions, and Coordinator travel.
- Seek partnerships with existing or new partners in order to make the Project sustainable over the long term, to add credibility to the Project, and to leverage funds that the WDNR has to contribute to it.
- Seek additional funding to allow a full-time permanent Coordinator to be hired, allowing sustainability and connectivity of the Project year to year.

## **Conclusion**

The Project was, in general, a success. Citizens were indeed able to be trained to successfully monitor streams of Wisconsin for a variety of parameters commonly monitored during baseline assessments by WDNR staff. They accurately calibrated and utilized equipment, and recorded and submitted their data to the appropriate personnel in a timely fashion. Their level of interest to monitor at sites of interest to WDNR staff was acceptable, and they felt they received adequate training and support from program staff. Further, by the end of the six month field season, they had collected data monthly at 120 stream locations, indicating how widespread their contribution to data collection can be.

To sustain the Project in the future, and allow it to develop into a fully functioning program, Project staffing, including participation by liaisons, program coordination, and data management must be adequately supported and funded by WDNR Administration. In addition, Project funding should be used to support maintenance and upkeep of the SWIMS database, and to develop data summary reports and other features to assist volunteers in using the database system in the future. Such funding and administrative support are absolutely essential for this level of stream monitoring programming to be effective in the long term. Without such support, the program cannot function.