

# Appendix C

## Monitoring and Evaluation for Targets and Load Reductions

### Introduction

The Clinton Main Subwatershed Management Group agrees that a well-planned evaluation process will provide measures of the effectiveness of implementing this Subwatershed Management Plan. Measurement and evaluation is an important part of planning because it can indicate whether or not efforts are successful and provide a feedback loop for improving project implementation as new information is gathered over time. Also, if the subwatershed group is able to show results because of an evaluation program, the plan will likely gain more support from the partnering communities and agencies, as well as local decision makers, and increase the likelihood of project sustainability and success.

Monitoring and measuring progress in the subwatershed will be two-tiered. First, individual agencies and communities will monitor certain community and agency projects and programs on the community, watershed council and agency levels to establish effectiveness. For example, a lawn fertilizer education workshop will be assessed and evaluated by that community and the Clinton River Watershed Council. Also, with the implementation of a community project such as establishment of riparian buffers, the individual community responsible for the implementation of that task would monitor water quality/quantity parameters before and after the retrofit to establish the improvements. Secondly, there will be a need to monitor progress and effectiveness on a regional – subwatershed or watershed – level in order to assess the ecological affects of the collective community and agency actions on the health of the river and its tributaries. In continuing to work as a subwatershed toward collective goals for the Clinton River, the Clinton Main Group recognizes the importance of a long-term monitoring program to determine where resources are focused as they progress toward meeting those collective long-term goals.

As part of the development of the Clinton Main Plan, a series of field surveys were conducted (which are described in Chapter 3) in order to establish a baseline set of data, characteristics and indicators of water quality in the Clinton Main River and its tributaries. This baseline data and incorporation of these procedures and sites into the well-established Clinton River Watershed Council volunteer monitoring programs and State of Michigan Monitoring Strategy will serve as the basis for long-term monitoring. Currently the Clinton River Watershed Council monitors six (6) sites within the Clinton-Main (Figure attached) and the State of Michigan completes monitoring within the Clinton River Watershed during the second year of their strategic monitoring plan.

As grant funding becomes available, the group will explore opportunities for conducting water quality sampling and water quantity monitoring/modeling to support the volunteer data and further demonstrate effectiveness of the actions identified in this subwatershed plan. The ultimate goal is to have enough volunteers to conduct similar monitoring at all sites used in the development of this plan.

### Qualitative Program Evaluation Techniques: Tier 1

#### Qualitative Program Evaluation Techniques

As seen in the Action Matrix, there are and will be many programs and projects implemented to improve water quality, water quantity and habitat in the Clinton Main Subwatershed over the short and long term through many different types of programs – from physical in-stream improvements to public education

programs. It is anticipated that most of these actions will be incorporated into individual Storm Water Pollution Prevention Initiatives within the next six (6) months.

Finding creative ways to measure the effectiveness of each of these individual and often unique programs will be recorded for each task under the individual SWPPIs. However, a summary of the methods that are proposed will provide an indication of how these programs might be measured and monitored to evaluate success in both the short and the long term.

Some of these evaluations may be implemented on a subwatershed or watershed basis, such as a public awareness survey to evaluate long-term public education efforts, but most of these activities will be measured at the local, community level. By evaluating the effectiveness of these programs, communities, agencies and the Clinton River Watershed Council will be better informed about public response and success of the programs, how to improve the programs and which programs to continue. Although these methods of measuring progress are not directly tied to measurements in the river, it is assumed that the success of these actions/programs, collectively and over time, will have a positive impact on the in-stream conditions and measurements of the river that are investigated concurrently as described in Tier 2 below. Whereas evaluating these programs and projects on a more qualitative basis is to determine short-term programmatic successes, it is this success that will result in long term, quantitative impacts in the river.

**Table C.1: Clinton Main Summary of Qualitative Program Evaluation Techniques**

<b>Evaluation Methods</b>	<b>Types of programs/projects</b>	<b>What is Measured</b>	<b>Pros and Cons</b>	<b>Implementation</b>
<b>Public Surveys</b>	Any public education or involvement program or project	Knowledge Behaviors Attitudes Awareness Concerns	Moderate cost. Often low response rate.	Pre and post surveys recommended. Mail, telephone, group setting. Could be done on either a local or watershed-wide basis. Repeating same survey on regular basis can show long-term trends.
<b>Written Evaluations</b>	Any public meeting or group education or involvement activity.	Benefit of activity based on increased knowledge and participant feedback.	Good response rate. Low cost. Improves continuing activities.	After an event, meeting, workshop, ask participants to fill out brief evaluation. Ask what was learned, what was missing, what could be done better. Participants return evaluations at site.

Evaluation Methods	Types of programs/projects	What is Measured	Pros and Cons	Implementation
Stream surveys/walks	Identifying riparian and aquatic improvements. Identifying recreational opportunities and needs.	Aesthetics Log jams Erosion Habitat Recreation potential	Best information from field Investigation. Time consuming.	Identify parameters of interest. Create form for recording observations. Surveyor training for consistency. Compile findings geographically to identify sites of interest and concern.
BMP monitoring	Riparian buffers. Detention basin retrofits. Wetland restoration. Rain barrels. Street sweeping.	Water quality, water quantity improvements from specific BMP.	Site-specific. Quantitative.	Set up isolated BMP area pre and post BMP installation. Determine appropriate storm water parameters for monitoring and determine optimum procedures for documenting improvements.
Photographic documentation	BMP installations, detention pond retrofits, aesthetic alterations (native landscaping, etc.).	Aesthetic changes. Before and after results.	Implementation easy, low cost. Good visual communication, documentation. Limited to visual description.	Visual evidence with photographs. Use photographs in educational pieces, website, etc.
Phone call/complaint records	Education efforts, advertising of contact numbers for complaints/concerns	Number and types of concerns voiced by public. Location of problem areas.	Limited to opinions, input from members of public willing or motivated to contact you.	Persons answering phone, letters, emails track nature of related calls concerns on an ongoing log sheet.
Quantification of participation	Public involvement and participation events.	Amount of people reached. Amount of waste collected.	Easy to calculate. Provides numerical measurement that is easy to understand and track.	Track participation with sign in sheets, registration lists, counts of people, counts of materials collected.

Evaluation Methods	Types of programs/projects	What is Measured	Pros and Cons	Implementation
Focus Groups	Behavior change, education programs.	Perceptions, viewpoints, concerns, barriers, behaviors.	Fast method for identifying motivators and barriers to behavior change. Can introduce new ideas.	Widely solicit for diverse participants, or handpick certain interested people. Could advertise opportunity in newsletter. Should be no more than 6-8 people per group. Plan questions, facilitate. Tape and transcribe discussion.

## In-stream Monitoring Program: Tier 2

### In-Stream Monitoring Program

In addition to measuring the effectiveness of certain specific programs and projects within communities or agencies, there would be a benefit to measuring the long-term progress and effectiveness of the cumulative subwatershed efforts in terms of a water quality, quantity and biological monitoring. Presently the Clinton River Watershed Council conducts volunteer monitoring training and has an extensive monitoring program. *Through previous discussions with MDEQ staff in the update of the Stony Creek Plan, it was considered that the Clinton River Watershed Council Adopt-A-Stream monitoring program could be utilized to provide indicators of the quality and progress of both Clinton Main and Stony/Paint activities.* The Clinton River Watershed Council Adopt-A-Stream program will form the basis of the In-Stream Monitoring Program

A description of this program (as described at [www.crw.org](http://www.crw.org)) is provided as follows:

*Adopt-a-Stream is a volunteer-based program that empowers community members to protect local streams and rivers by monitoring their health. Volunteers are teamed up in Stream Teams, are assigned sites, given equipment, data sheets and protocols, and are sent out to gather information on streamside habitat and macroinvertebrate populations.*

*Twice a year (in May and October), Stream Teams visit their adopted sites and collect data, including physical information (such as extent of stream bank erosion and surrounding land use) and chemical information (such as water temperature and pH). They collect and identify macroinvertebrates (commonly known as "bugs") that live in the streambed and surrounding vegetation. Different bugs need specific conditions in which to survive and reproduce. Some are very pollution sensitive while others can tolerate highly polluted water. A stream's health can be determined by the number and types of bugs that live in it. The data are used by CRWC, municipalities and the state to assess the health of our streams and rivers and make decisions regarding their protection and restoration.*

*Citizen involvement in water quality monitoring activities has resulted in positive change across the nation, the state, and right here in the Clinton River watershed. For example, water quality data collected by volunteers for the Clinton River Coldwater Conservation Project has been used to select*

*locations for trout habitat restoration, and students in our Stream Leaders program have helped identify and resolve soil erosion problems.*

The field survey data collected for this subwatershed plan by ECT, Inc. and which is described in Chapter 3 encompasses a number of Adopt-a-Stream program sites. This data will be used as a baseline set of data for monitoring and evaluation of progress. Data from the following surveys assisted in prioritizing critical areas within the subwatershed:

- ❖ MDEQ Road Stream Crossing Survey
- ❖ Bank Erosion Hazard Index
- ❖ Macroinvertebrate Survey
- ❖ Nonpoint Source Pollutant Loading Modeling

As described in Chapter 3, a qualitative ranking was assigned to each of the field survey sites. As volunteers are further included in the CRWC Adopt-A-Stream program, the sites described in Chapter 3 will be added to the Adopt-A-Stream program. In addition, as BMPs are implemented, it will be possible to model reductions in nonpoint source pollutant loading utilizing the baseline data presented in Chapter 3.

This physical sampling and monitoring program may be supplemented by a long-term sampling and monitoring program that may include water quality sampling and water quantity monitoring/modeling. The Adopt-a-Stream volunteer monitoring program provides an excellent source of data that will certainly demonstrate achievements in meeting watershed objectives as well as long term goals; however, conducting more detailed sampling, monitoring and modeling will further demonstrate that the subwatershed is meeting state water quality standards.

### **Establishing Targets and Load Reductions**

When measuring parameters to assess whether or not a goal is being achieved, it is useful to establish targets and associated load reductions against which observed measurements are compared. Targets do define either Water Quality Standards, as set forth by the State of Michigan, or scientifically supported numbers that suggest measurements for achieving water quality, quantity and biological parameters to support state designated uses such as partial or total body contact, and fisheries and wildlife. Using these long term, scientifically based targets as goals for success will assist the subwatershed in deciding how to improve programs to reach preservation and restoration goals and know when these goals have been achieved. These targets are described below.

**Dissolved Oxygen (DO)** has standards established by the Michigan Department of Environmental Quality (MDEQ) as state standards. For DO, the state has established a requirement of no less than 5.0 mg/l for all warm water fisheries. The DO can drop to no less than 7.0 mg/l for coldwater streams. The Administrative Rules state:

*“for waters of the state designated for use for warm water fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(4), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision. For waters of the state*

*designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods, as provided in R 323.1090(4), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision."*

### **Dissolved Oxygen Sampling Results from Lake St. Clair Regional Monitoring Program**

As described in Chapter 3, data from the continuous monitoring station installed by the USGS at the Auburn Road crossing were also evaluated for the non-winter months from September 2004 to November 2005. These data indicate that dissolved oxygen concentrations fluctuate seasonally, as expected, and are generally above 6 mg/L.

As with the data evaluated from the Auburn Road crossing, data from the continuous monitoring station installed by the USGS at the M-59 Road crossing were also evaluated for the non-winter months from September 2004 to November 2005. These data also indicate that the dissolved oxygen concentrations fluctuate seasonally, and are generally above 7 mg/L.

**Based on this data, targets are to maintain current conditions of dissolved oxygen concentrations within the Clinton Main Subwatershed.**

**Bacteria (E. coli)** has standards established by the MDEQ as state standards. For the designated use of total body contact (swimming), the state requires measurements of no more than 130 E. coli per 100 milliliters as a 30 day geometric mean during 5 or more sampling events representatively spread over a 30 day period. Recreational activities requiring total body contact, such as swimming, and partial body contact, such as wading, fishing, and canoeing apply to this subwatershed. The state requires measurements of no more than 1000 E. coli per 100 milliliters based on the geometric mean of 3 or more samples, taken during the same sampling event for partial body contact.

Bacterial data at the two water quality sampling locations described in Chapter 3 indicated that average dry weather E. coli sampling results were within the 130 E. coli per 100 milliliters standard; however, wet weather results showed significantly higher levels of E. coli. **Targets are to maintain existing dry weather conditions.**

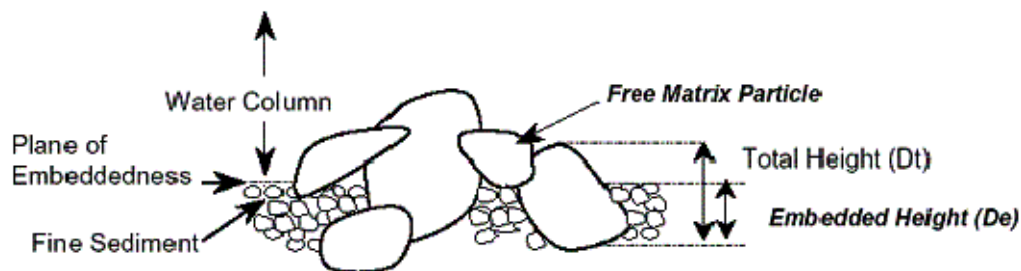
**Phosphorus (TP)** for surface waters does not have a numerical standard set by the state. The state requires, however, that "nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the waters of the state."

As described in Chapter 3, Shoemaker et. al. determined a critical concentration for phosphorus at 0.05 mg/L. Both dry weather and wet weather sampling results indicate much higher concentrations. In addition, the PLOAD model also demonstrated that the Clinton Main subwatershed has higher than the overall Clinton River Watershed average phosphorus loading. **Targets and loading reductions for phosphorus are shown on Map 30 which will achieve a lower overall phosphorus concentration.**

**Nitrogen (N)** in the form of nitrates and nitrites are commonly measured in river systems. Acceptable levels of nitrate are below 4 mg/L and when the concentration exceeds this level, accelerated plant growth occurs. The EPA ecoregional criteria for total nitrogen in rivers and streams of ecoregion VII is 0.54 mg/L

(US EPA 2000). Nitrate less than 90 mg/L has not demonstrated adverse impacts on warm water fish. Nitrite levels less than 5 mg/L have not demonstrated adverse impacts on warm water fish (US EPA 1986). Sources of nitrates come from decomposition of dead plants and animals, fertilizers, animal waste and sewage. **Map 30 shows targeted load totals for nitrates and nitrites in the Clinton Main Subwatershed.**

**Embeddedness** is an alternative measurement to Total Suspended Solids that can be used to determine sediment load. Embeddedness measures the degree to which larger particles are covered with finer particles or to the extent of how much of the stream bottom is covered with fine silts and what percentage of the bottom is covered with soft muck, indicating deposition of fine silts. There is not a numerical standard set by the State, however, **the target for this measurement is to maintain the current ratings and improve ratings where possible.** The baseline data, included in field surveys described in Chapter 3, are rated from “poor” to “excellent”.



Schematic representation of embeddedness.

Another measurement that can be used to determine sediment load is Total suspended solids (TSS) for surface waters does not have a numerical standard set by the state. Waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foam, settleable solids and deposits (Rule 50 Michigan Water Quality Standards (Part 4 of Act 451). To protect the designated uses of fisheries and wildlife habitat, as well as the desired recreational and aesthetic uses of the surface waters in the subwatershed, there are recommended targets established on a scientific basis. From an aesthetics standpoint, it is recommended that TSS less than 25 mg/l is “good”, TSS 25-80 mg/l is “fair” and TSS greater than 80 mg/l is “poor”. **The TSS target, therefore, will be to maintain TSS below 80 mg/l in dry weather conditions. In addition, TSS targeted loading totals are shown on Map 30.**

**Flow Rates (cfs)** for surface waters do not have a numerical standard set by the state. Although this section attempts to define a peak flow target for certain points in the river and tributaries, it is most effective to use the health of the fish and macroinvertebrate communities (process described below) as the ultimate indicators of stream and river health.

The Clinton River Geomorphology Project described in Chapter 3 demonstrates that the Clinton Main flow rates have showed an increasing trend for peak flows, annual mean flowrate and bankfull flows. At the same time, flow rates are also significantly impacted by water level control structures during different times

of the year. As described in Chapter 3, bankfull flows have a significant impact on bank erosion, channel formation and ultimately water quality, habitat and wildlife. Reductions in these flow impacts will be observed thru implementation of BMP retrofits, reductions in impervious surfaces and construction of BMPs for new and redevelopment areas. **Targets are to maintain the current flow rates and reduce to the maximum extent possible any increase in flow.** At the same time, management of the lake level control structures continues to play a significant role in impacting flow and it is through these combined efforts that flow rates will be more effectively managed.

**Biochemical Oxygen Demand (BOD)** represents the amount of dissolved oxygen consumed by aerobic bacteria placed in contact with organic material in the water. End products of the organic decomposition are CO<sub>2</sub> and water. The amount of dissolved oxygen used in this process is the biochemical oxygen demand. It is considered to be a measure of the organic content of the waste. The difference between the DO result and the BOD result is the oxygen available to other aquatic organisms. In slow moving and polluted rivers, bacteria consume much of the available dissolved oxygen. High levels of BOD indicate increased levels of nutrients, which can result from both natural and human-induced activities. BOD is reported as milligrams of oxygen used per liter (mg/L) (US EPA, 2000).

BOD concentrations from the water quality sampling results show both higher and lower concentrations than the critical value of 4 mg/L identified from Shoemaker et. al. **Targets in the long-term are to maintain and ultimately reduce these concentrations. In addition, targeted loading totals for BOD are shown on Map 30.**

**Macroinvertebrates** are small aquatic insects and animals whose presence can indicate certain long term water quality trends. The state has developed and the GLEAS 51 protocol for assessing macroinvertebrate communities. The macroinvertebrate sampling results for the Clinton Main Subwatershed range from "poor" to "excellent". **Targets will be to improve macroinvertebrate survey results above a "poor" designation and maintain those that currently have "good" or "excellent" designations.**

**Temperature** State standard R 323.1075 only lists temperature standards for point source discharges and mixing zones – not ambient water temperatures in surface water. However, recommendations for water temperature can be generated by assessing fish species' tolerance to temperature change and this guidance is recorded in the statute. There are two different kinds of streams with regard to classification of temperature regimes, coldwater and warm water streams. The state standards recommend that temperatures for coldwater fisheries not exceed temperatures greater than the monthly maximum temperatures listed in the table below. **Based on this table targets for the subwatershed is to maintain at least warm water stream recommended temperatures.**

**Recommended Maximum Water Temperatures (°F; Rule 323.1075)**

	J	F	M	A	M	J	J	A	S	O	N	D
Cold Water Streams	38	38	43	54	65	68	68	68	63	56	48	40
Warm Water Streams	41	40	50	63	76	84	85	85	79	68	55	43

**Aesthetics and recreation potential:** There is no state standard for measuring aesthetics or recreation potential. However, the subwatershed believes that an area with high aesthetic qualities will add, in either a passive or active context, recreational opportunities for the public and a greater appreciation or

awareness of the subwatershed's natural resources. That is the purpose for looking at these two parameters over time.

*Aesthetics:* Measuring aesthetics of an area is inherently a qualitative effort. However, progress toward attaining aesthetically pleasing places can be measured and evaluated effectively using a standard tool, such as a survey, at regular intervals in time. Aesthetics are inherently included in the Adopt-A-Stream program and can be noted during the volunteer surveys. Measurements in the survey, dependent upon community and subwatershed priorities, should include assessing water clarity, ambient odors, vegetative diversity, wildlife use, streambank erosion, debris, evidence of public use, and other parameters that indicate positive or negative aesthetic qualities. **Targets for aesthetic include favorable responses during public surveys, and reduced suspended solids and debris within the river.**

*Recreation potential:* Measuring and mapping areas with recreation potential should be a community and a subwatershed effort and should be done by or closely with local or county parks departments and staff. Oakland County is currently preparing a Greenway Plan as described in Action 18 and here as follows:

*Greenway Plans can serve multiple purposes, including natural features protection, alternative transportation, and recreation opportunities. Oakland County is currently working with communities to prepare a map that identifies connections throughout the county utilizing trails, tree corridors, utility corridors and riparian corridors. Organizations such as the Oakland Land Conservancy have an established structure for reaching out to riparian landowners to promote corridor protection measures, such as conservation easements and stewardship projects. Such an effort is underway along the Clinton River corridor in the Rochester area. Based upon the critical area identified in the subwatershed plan, a similar corridor protection effort would be very beneficial to achieving the long-term goals for protecting Clinton Main Subwatershed. Community participation may include attending a visioning session and input to the county.*

**The target is to identify areas in the subwatershed, both along the riparian corridor and on the landscape, that can provide passive recreation (such as photography, resting, bird watching), or active recreation (such as hiking, canoeing, fishing). Within the subwatershed, these areas should be linked where possible to provide linear corridors that connect, or greenways, for both people (hiking, biking trails) and wildlife. This effort could be easily combined with the aesthetics survey effort described above.**