

**Summary of Assessment of Streams in the  
Presque Isle Bay Watershed  
and  
Recommendations for Abatement  
of Non-Point Source Pollution**

Submitted to:

**Erie County Conservation District**

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## **Introduction**

In July of 2000, the Erie County Conservation District was awarded a Growing Greener grant from the Pennsylvania Department of Environmental Protection to conduct an assessment of the Presque Isle Bay watershed. The primary purpose of this two-year assessment was to provide information on the condition of the major streams flowing into the Bay and determine where significant non-point source pollution (NPSP) problems exist. This information was sought to provide the scientific basis for prioritizing NPSP problem areas, and initiate planning for watershed restoration. The work was partly justified because Erie's Presque Isle Bay is one of 43 Areas of Concern (AOC) in the Great Lakes, and NPSP has been identified as a major source of the contaminants found in Bay sediments.

From August 2000 through June 2002, an assessment team consisting of researchers from Mercyhurst College, Gannon University and Penn State Erie conducted a variety of field studies of the streams flowing to the Bay using Rapid Bioassessment Protocols developed by the U.S. Environmental Protection Agency (1999). The three-fold assessment included analysis of the physical and chemical features of sites selected for study, characterization of the fish communities, and studies of the benthic macroinvertebrate communities that inhabit the stream bottoms. The leaders of each part of the assessment team submitted a detailed report of their findings to the Conservation District in June 2002.

The individual reports (Diz & Johnson 2002, Pyron 2002, and Campbell 2002) contain the basic data which the enclosed summary is based upon, in addition to details of methodology and results which will not be presented herein. The objectives of this report are to highlight the main findings of each of the three studies, characterize how current results compare to historical studies of water quality in the same streams, and suggest priorities for future remediation efforts aimed at abating NPSP in the watershed. It is assumed that restoration goals and site-specific remediation plans based on our recommendations will be developed by watershed organizations, with input from citizens and representatives of the municipalities that will be involved in the restoration work.

The study results will also be useful for restoration work in the watershed by establishing standard assessment methodologies and a data baseline for monitoring future changes in water quality condition resulting from remediation activities. It is suggested that at least some of the same sites within the Presque Isle Bay watershed sampled during the current studies should be utilized for recurrent evaluations about once every five years, until it can be demonstrated that watershed restoration goals have been achieved.

## **I. Summary of Current Assessment Findings**

### **Physical and Chemical Assessment**

The analyses conducted by Gannon University and detailed in Diz & Johnson (2002) included an assessment of the overall habitat of 22 sites, including eight sites on Mill Creek, five locations on Cascade Creek, one site each on Scott Run and Garrison Run, and a total of seven sites on reference streams outside of the Presque Isle Bay watershed (one on Twelvemile Creek two on Sevenmile Creek, and two sites each on streams in the Elk and French Creek watersheds). Four of the Mill Creek locations (MC-1,5,6, & 8) were among the top seven sites with respect to the consolidated Habitat Assessment Score, which took into account substrate features, channel characteristics, and riparian vegetation measures. The other three top scores were for reference sites (one each on Sevenmile, Twelvemile and French Creeks). The Garrison and Scott Run sites, Cascade Creek at Frontier Park, Mill Creek above the Zoo, and reference sites on Sevenmile Creek at the Glinoodo Center and French Creek above Union City Dam received the five lowest overall habitat scores.

Organic pollution was assessed by measurements of 5-day Biochemical Oxygen Demand (BOD) at 24 sites, including all of the sites mentioned above plus one additional site on Cascade Creek and a sample from the Myrtle Street storm sewer outfall (MSS) near Presque Isle Bay. The Garrison Run and CC-4 (West branch of Cascade Creek behind Harding Elementary School) sites produced BOD levels above 20mg/L, which would be considered polluted with organic matter. Levels above 15 mg/L (close to the level considered polluted) were noted at the Scott Run and MSS sites, the Mill Creek site just

above the Mill Creek Tube (MC-1), and at one of each of the reference sites on French and Elk Creeks (RF-5 & 7).

Sediment-associated heavy metals analyzed at the 24 sites were summarized in two ways: 1) by calculation of total metals concentrations, and 2) by summing the low-effect levels (LEL - a measure of toxicity to aquatic organisms). Site rankings based upon each of these summary scores indicated that two Cascade Creek sites on the upper portion of the West branch (CC-5 & 6), Garrison Run, and the Myrtle Street storm sewer outfall sites were the four worst sites with respect to metals. All of the remaining sites on Cascade Creek, and the Mill Creek site at Belle Valley behind the fire station were in the second tier of metals-contaminated locations. All of the reference sites, Scott Run, and Mill Creek sites at Headwaters Park and the west branch (MC-8, 3, & 4) were the ten sites with the lowest (most favorable) scores for sediment-associated metals. Increasing heavy metal contamination was found to be correlated with decreasing Riparian Zone Width score (how wide the areas alongside the stream are occupied by vegetation).

Overall results from the physical and chemical assessment indicate that loss of streamside riparian habitat is a major factor contributing to degraded water quality in the more developed areas of the Presque Isle Bay watershed. Diz and Johnson (2002) concluded that the restoration of stream banks and riparian zones with natural vegetation (in already developed areas), and limiting construction activities in areas where these habitats are presently intact would be helpful to protect the streams in the watershed from pollution.

### **Fish Community Assessment**

Pyron's (2002) assessment of the fishes in the Presque Isle Bay watershed focused on 15 of the same sites sampled by Diz and Johnson (2002), including one site each on Scott Run, Garrison Run and Twelvemile Creek (RF-3), four sites on Cascade Creek (CC-1, 2, 4 & 6), six sites on Mill Creek (MC-1, 2, 4, 5, 6 & 8) and the two reference sites on Sevenmile Creek (RF-1 & 2). Pyron's data was summarized by calculation of an Index of Biotic Integrity (IBI) score for each site and date, which permitted ranking of the sample locations according to water quality indicated by fish data.

Pyron's analysis indicated that Garrison Run was the worst stream in the watershed (with no fish found on any date), and that three other sites were rated in the "poor" category, including Cascade Creek at Frontier Park (CC-2), the West branch of Cascade at the highest point (CC-6), and a Mill Creek site in the headwaters of the west branch (MC-4). Lower IBI scores were also found for the other site sampled by Pyron on Cascade Creek above the mouth (CC-4) and Scott Run. The best sites for fish in the Presque Isle Bay watershed, as indicated by IBI scores, were the Mill Creek sites just above the Tube (MC-1) and on the main branch of the stream at Route 97 near East Gore Road (MC-5), and on Cascade Creek near its confluence with Presque Isle Bay (CC-1). These three sites compared favorably with the reference sites on Sevenmile and Twelvemile Creeks. The IBI score for CC-1 may not represent the site in a manner comparable the physical/chemical and benthic macroinvertebrate assessments summarized herein, since Pyron's sampling included fish species that apparently moved upstream into Cascade Creek at CC-1 from Presque Isle Bay. Ten of the fish species represented in Pyron's data from CC-1 are specialists for the open water habitats of the bay, rather than streams.

Pyron (2002) concluded that the Mill Creek sites sampled appeared to have less urban impacts than the other streams in the Presque Isle Bay watershed, since most of the Mill Creek sites produced IBI scores in the good or excellent category. The low IBI scores for Cascade Creek sites above the bay and Garrison Run indicate negative impacts of industrial and urban development on these stream sections.

### **Assessment of Benthic Macroinvertebrate Communities**

Campbell's (2002) study of the benthic macroinvertebrate communities of streams focused on the same sites within the Presque Isle Bay watershed (total of 17) and three primary reference sites (RF-1, 2 & 3) that were sampled by Diz and Johnson (2002) and Pyron (2002), plus 29 additional reference sites, mostly to characterize additional sites in the Lake Erie watershed thought to be unimpacted by non-point source pollution. The data was subsequently summarized by computing a Composite Index (CI) score (similar

in principle to Pyron's IBI score), which allows sites to be ranked according to the level of degradation indicated by benthic macroinvertebrates living on the stream bottoms.

Comparison of CI scores indicated that, for the sites sampled, the benthic macroinvertebrate community of Mill Creek was in better condition than what was found in Cascade Creek, Scott Run, or Garrison Run. The best CI score for benthic macroinvertebrates found in the Presque Isle Bay watershed (a rating of "fair") was at MC-5 on the east side of Route 97 near East Gore Road (also among the best sites for fish found by Pyron). The lowest CI scores found anywhere in the Lake Erie watershed were at the sites on Garrison Run (which received the lowest rating possible), the west branch of Cascade Creek at the West Erie Plaza (CC-5), and the Myrtle Street storm sewer outfall. All of the rest of the Cascade Creek sites and Scott Run were ranked in the "very poor" range.

It should be pointed out that CI scores for 7 out of the 8 Mill Creek sites sampled repeatedly were rated as "degraded" or "poor" compared to the reference sites in the Lake Erie watershed outside of the PIB subwatershed. This observation indicates that there is room for improvement with respect to non-point source pollution in all parts of the Presque Isle Bay watershed, including areas that are less developed. Furthermore, the CI score for the reference site on Sevenmile Creek at the Glinodo Center (RF-2) and "poor" rating indicated for a site on Sixteenmile Creek below North East indicate degraded conditions at those locations, another signal that the urbanized sections of the Lake Erie watershed are not the only places where non-point source pollution problems occur.

### **Points of Corroboration**

One major point of concurrence of the three different assessments is that Garrison Run is apparently the most severely degraded stream in the watershed. Cascade Creek sites also produced consistently poor indications of water quality in all three studies, and the Mill Creek sites above the Tube were generally found to be in better condition than the other sites.

It is noted that the benthic macroinvertebrate part of the assessment, which compared sites in the Presque Isle Bay watershed to the broadest range of unimpacted reference sites, provided evidence that there are apparent NPSP problems even in the less developed areas of the Mill Creek watershed. This means that there is room for improvement with regard to NPSP in all parts of the Presque Isle Bay watershed.

## **II. Historical Data Regarding Water Quality of Streams**

This section is coming along, but I am still analyzing some additional background data received this week from Bob Wellington. I am also waiting for data from the Fish & Boat Commission person (Tom Sherwinski) who conducted the assessment of PA Lake Erie streams last fall. This information affects sections III and IV. I will summarize a wide variety of past studies, including an early 1970's EPA publication that did a thorough evaluation of Garrison Run, a published paper by Masteller et al. 25 years ago with fish and benthic macroinvertebrate data for streams along the entire , assessment work done by Cooper at Penn State for the bayfront highway project in the early 80's, a number of Bob Wellington's studies in the 1980's and 90's, and a few PA Fish & Boat Commission reports on the streams done by Craig Billingsley. These reports will be evaluated/compared with our current data to determine any trends of change in the last 25 years. It looks like not much has changed, except the main branch of Cascade Creek below the confluence with the West Branch now may be a little bit better, and the west branch looks a bit worse. Garrison Run appears to have always been very bad. I am concerned a bit that the City's corrections to the CSO problem on the east side does not appear to have brought about more improvement recently.

## **III. Non-Point Source Pollution Problems and Prioritization of Areas for Remediation Effort**

### **Identification of Problems**

The findings previously discussed, as well as numerous observations made by the investigators in the areas surrounding sampling sites, were used to rate the relative severity of various kinds of non-point source pollution problems within each of the subwatersheds of Presque Isle Bay. Photodocumentation obtained by the investigators is also available to support this analysis. These illustrations will aid watershed groups in identifying specific sites for restoration projects. The ratings summarized in Table 1 are tentative, qualitative impressions offered for purposes of identifying land use features likely to contribute NPSP to nearby streams.

**Table 1.**

Identification of non-point source pollution problems contributing to the degradation of water quality in streams of the Presque Isle Bay Watershed. Subwatersheds of the Presque Isle Bay watershed evaluated separately include: upper Mill Creek above confluence with its west branch (MCU); lower Mill Creek below the W. branch confluence, including areas draining via storm sewers to the Mill Creek Tube (MCL); West Branch of Cascade Creek (WBC); Main Branch of Cascade Creek (MBC); Garrison Run (GR); and Scott Run (SR). Ratings indicate increasing severity of problem: no problem (0), mild (1), moderate (2), and severe (3).

	MCU	MCL	WBC	MBC	GR	SR
<b>Urban runoff &amp; storm sewers</b>						
High density of streets and impervious cover	1	3	2	3	3	2
<b>Land disposal of wastes</b>						
Uncontained metals: recycling and storage	0	1	2	1	3	1
Fills of demolition waste	1	2	1	1	3	2
Streamside trash dumps or discarded lawn waste	1	2	2	2	3	2
Other specific pollution sources	1	2	2	2	2	1
<b>Hydrologic/habitat destruction</b>						
Probable wetland filling or alteration	1	3	3	3	3	2
Degradation of riparian vegetation/buffer zones	1	3	3	3	3	2
Unstable stream banks and/or accelerated mass wasting	1	2	1	3	2	3
Channelization of stream banks	0	3	3	2	2	1
Containment of stream in pipes or culverts	1	3	2	3	3	2
<b>Atmospheric contamination sources</b>						
	1	2	2	2	3	2
<b>Groundwater contamination sources (e.g. LUST sites)</b>						
	1	2	2	2	3	2
<b>Ratings Total</b>	10	28	25	27	33	22

Not surprisingly, the urbanized areas of the Presque Isle Bay watershed have more ratings of severe than the areas lacking significant portions of urbanized land. Although no



sampling data is available for the lower section of Mill Creek (within the Tube), the foregoing analysis (and common sense) suggests that NPSP entering the Tube from the urban area draining into it would result in water quality degradation similar to what was evident for Cascade Creek.

Problems rated as severe on this list for a particular subwatershed should be viewed as good starting points for remediation activities in that area. Since all but one of the subwatershed areas characterized in Table 1 contain significant portions of highly developed land (upper Mill Creek), the same suite of remediation strategies may be employed for restoration work in most of these locations.

### **Prioritization of Locations for Remediation Effort**

The following prioritization of locations for initiating watershed restoration work is based upon the assessment findings. The locations identified first on the list are considered to be most important due to both the extent of water quality degradation and the collective severity of NPSP problems:

- 1) Garrison Run subwatershed;
- 2) Cascade Creek, urbanized areas of Mill Creek watershed below the Tube, urbanized portion of Scott Run, and urbanized areas along the bayfront between Cascade Creek and Mill Creek (all likely requiring the same kinds of BMPs);
- 3) developed portions of Mill Creek watershed from the Tube to the confluence with the west branch and the densely developed portions of the west branch; and
- 4) developed portion of primary tributary feeding the main branch of Mill Creek behind the Belle Valley fire house and developed areas near I-90/Rte. 8 interchange above Headwaters Park.

A high priority should also be placed on protecting existing, intact watershed resources within the presently undeveloped portions of the Mill Creek watershed above Rt. 97, and undeveloped portions of the bayfront west of Cascade Creek. It would be beneficial to future restoration efforts in more severely impacted areas of the watershed if local

government officials could be persuaded to adopt more stringent permitting requirements (than the current DEP regulations) for developments affecting riparian zones and first-order streams (including small ravines). Present DEP regulations allow a small stream to be tubed and filled (and associated streamside vegetation removed) if the stream drains a watershed less than 100 acres and there are no wetlands affected. There is significant, recent scientific evidence indicating that small, first-order streams are more important for nutrient (especially nitrogen) cycling functions than larger streams (Peterson et al. 2001: Science Vol. 292, 6 April 2001, p.86-90). In Erie, these areas are also likely critical refuges for native plants and animals (especially aquatic insects) that can provide “seed” populations for restoring degraded streams nearby. It would not take too much trouble to develop an inventory of such sites within the Presque Isle Bay watershed that could be shared with permitting authorities.

Educating developers and private property owners about the significance of headwaters streams should also be a high priority for watershed organizations, especially if municipal governments are not interested in trying to impose more stringent rules for developers than the state is willing to enforce. Perhaps recommendations concerning the need to better protect small streams and riparian zones should be communicated to our policy- and law-makers at the state level.

#### **IV. Remediation Strategies for the Presque Isle Bay Watershed**

Following are a number of suggestions offered to guide the leadership of watershed groups or others involved in stream restoration projects. As stated previously, site specific plans should be developed only with input from municipal officials, citizens interested in carrying out remediation activities, and owners of properties affected by proposed restoration projects.

- 1) Communicate our findings with watershed groups, provide basic training on watershed and stream ecology principles, and work with various groups to plan site-specific remediation projects (presentations to commence immediately upon

completion of this document and preparation of a Power Point program appropriate for non-technical audiences).

- 2) Restore natural riparian vegetation on stream banks and increase width of buffer zones in all locations possible, especially in sites with already unstable banks and poorly developed riparian vegetation. In some cases, invasive plant species that inhibit the growth of ground cover vegetation (such as Norway Maple) should be replaced with native plants obtained from local plant stocks.
- 3) Develop plans with major property owners and appropriate municipal officials to try to increase storm water retention in developed areas. Educate all parties regarding BMPs and assist as needed to obtain funding to finance construction/installation.
- 4) Work with developers of Brownfields sites and appropriate municipal officials to encourage the installation of passive treatment systems for ubiquitous environmental contaminants (e.g. metals and organic contaminants in air and ground water) in the watershed. Examples of passive treatment systems include landscape plantings with species known to be effective in phytoremediation) and construction of wetlands or ponds stocked with native plant species known to be effective at sequestering metals and other contaminants. Wetlands and ponds have the added benefit of helping to increase storm water detention. Areas of the city along the railroad tracks might be good places to try to do this.
- 5) Consider submitting our data to DEP to propose placing streams in the Presque Isle Bay watershed (Garrison Run in particular) on the 303(d) list (non-attainment of water quality objectives). This may not be the most effective route to clean up our streams, since most of our problems appear to be from non-point sources. However, if there are still some unaddressed CSO's in any parts of the watershed, or if the regulatory community makes available additional resources to address the problems, then listing under 303(d) should definitely be considered.

## **Photodocumentation**

Photographs taken by the investigators have been deposited in the files of the Erie County Conservation District.

## **References**