

FINAL PROJECT REPORT to the USEPA Great Lakes Restoration Initiative Projects

Grant or IA Number: GL-00E00865
Project Title: Grand Traverse Bay - East Bay Park Remediation
Principal Investigator: Sarah U'Ren, The Watershed Center Grand Traverse Bay

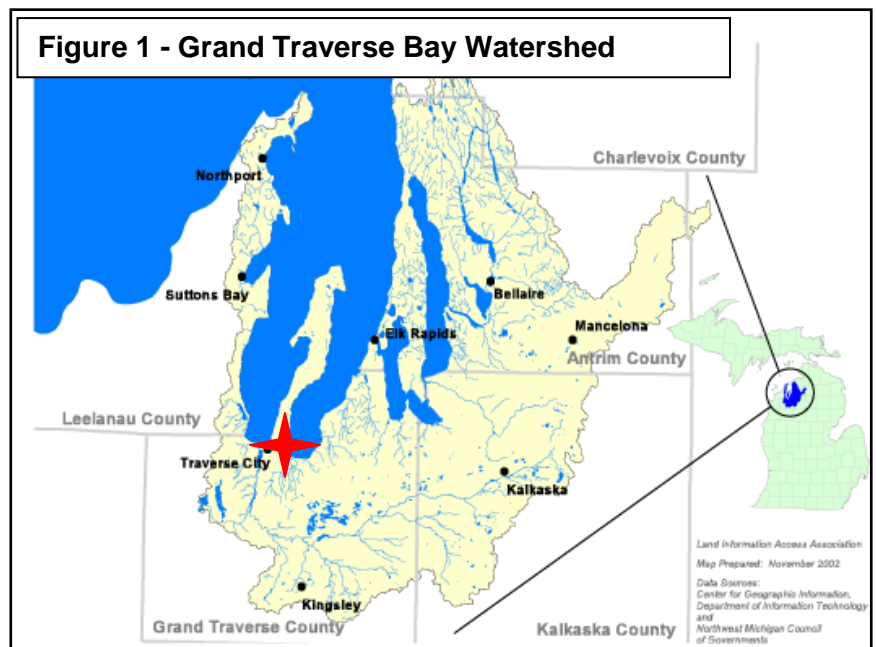
Executive Summary

The Watershed Center Grand Traverse Bay (TWC), in collaboration with the City of Traverse City, implemented a three-step stormwater filtration system at East Bay Park to reduce bacterial contamination at the beach. This project reduces human health risks at this heavily used family swimming beach by taking measures to eliminate the source of bacterial contamination to reduce the number of pathogen indicator organisms to levels below established criteria. Project outputs include a reduction in the number of pollution sources impacting Great Lakes beaches; reduction in the number of Great Lakes beach closures or advisories issued; documentation of mitigation measures taken and outcomes achieved that can be applied at other Great Lakes beaches; and a reduction in nuisance algal blooms and ambient water concentrations of nitrogen and phosphorus in Great Lakes coastal areas.

Accomplished project outcomes include 1) Water quality is improved at Great Lakes beaches due to reductions in bacteriological, algal, and chemical contamination; 2) Protection of public health is improved at Great Lakes beaches; and 3) Holistic watershed approaches to Great Lakes beach management are implemented, supporting a more efficiently directed beach program.

Project Background, Goals, and Objectives

The project took place at East Bay Park in Traverse City, Michigan, located on the southwest area on the east arm of Grand Traverse Bay on Lake Michigan (see starred area in Figure 1). The Grand Traverse Bay watershed, located in Northwest Michigan's Lower Peninsula, drains 976 square miles, covers major portions of four counties, and contains more than 50 municipalities and townships. The area is one of the premier tourist and outdoor recreation regions in the State of Michigan. The DEQ- and EPA-approved Grand Traverse Bay Watershed Protection Plan states that sediment and excessive nutrient loading are the two highest ranking priority pollutants that are threatening the cold water fishery, aquatic life, and other designated uses in the Grand Traverse Bay watershed. Other pollutants that threaten the watershed's designated uses include toxins, invasive species, and pathogens. Priority tasks identified in the plan include outreach and education efforts, establishing riparian buffers in priority areas, and managing stormwater inputs in the watershed. Stormwater inputs are a primary concern throughout the watershed because of the potential to contribute excessive sediment, nutrients, pathogens, and toxins to the bay and its tributaries. In fact, two locations on Grand Traverse Bay were recently on the State's Impaired Waters 303(d) List and were said to be in



“non-attainment” due to excessive amounts of pathogens, most likely caused by heavy stormwater inputs and flushing during rain events and decreased nearshore mixing during summer months. These two sections are at Bryant Park and East Bay Park, both of which are in Traverse City (TMDLs scheduled for 2015 and 2016, respectively).

The goal of this project was to investigate and implement a stormwater filtration system at all three storm drains that outlet at East Bay Park to reduce bacterial contamination at the beach, with the ultimate goal of delisting the beach from the State's Impaired Water's list. This project reduces human health risks at this heavily used swimming beach by reducing bacterial contamination and pathogen indicator organisms to levels below established criteria. In addition, East Grand Traverse Bay is the sole drinking water source for Traverse City and surrounding areas. Work to reduce the impact of pathogens and protect public health at this beach will also help protect the drinking water source for more than 15,000 people.



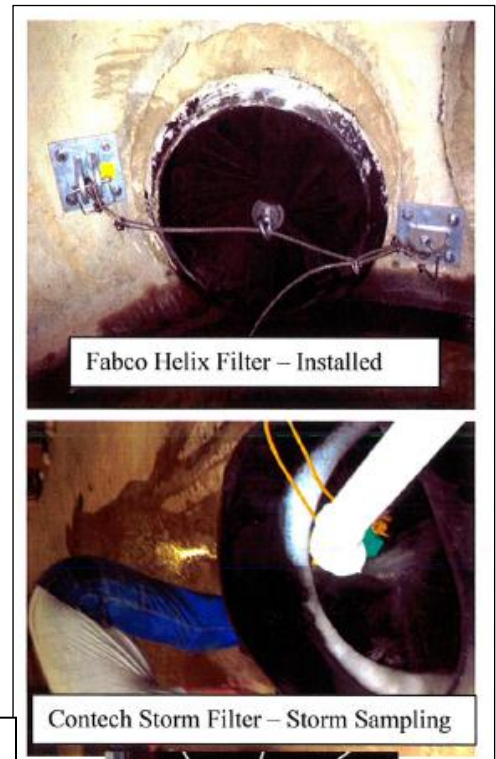
Storm drain outlets at East Bay Park

This project was paid for through a 2011 Great Lakes Restoration Initiative (GLRI) grant awarded to TWC, who worked collaboratively to achieve project goals with the City of Traverse City, who served as a subrecipient of grant funds for project implementation. TWC is a local nonprofit watershed group whose mission is to advocate for clean water in Grand Traverse Bay and protect and preserve the Bay's watershed.

Methodologies Employed

A bench study was commissioned by the City of Traverse City in Summer 2012 to test a number of possible stormwater treatment BMPs for East Bay Park, including ultraviolet disinfection, filtration (Fabco and Contech brand filters), and contact media filters (Fabco Helix Filter). The study was expedited for completion, however, a drier than usual summer led to few rain events where storm water samples could be gathered for testing the treatments, which in turn extended the length of the bench study. Results from this study were encouraging but inconsistent, such that additional testing and monitoring was necessary through Fall 2012.

Using results from the bench study the City investigated several more treatment options including sand filters, canister media filters, UV light, ozone, diversion into the sanitary sewer, smaller treatment zones, underground storage and detention, mechanical filtration, mechanical bathing water aeration, and treatment of inlets in the upper reaches of the system. The final BMP system was chosen based on what options worked best, combined with the available budget and maintenance costs and needs. Per our project agreement, a rationale for this choice was outlined in a report from the City of Traverse City and relayed to the EPA Project Officer in a memo dated 11/12/12.



Fabco Helix Filter – Installed

Contech Storm Filter – Storm Sampling

Pictures from Bench Study Report showing two types of treatment systems tested.

The plans consisted of utilizing an end of the pipe treatment cartridge filter system for stormwater coming from three stormdrains that outlet at the Park (two on north side, and another small one on south edge).

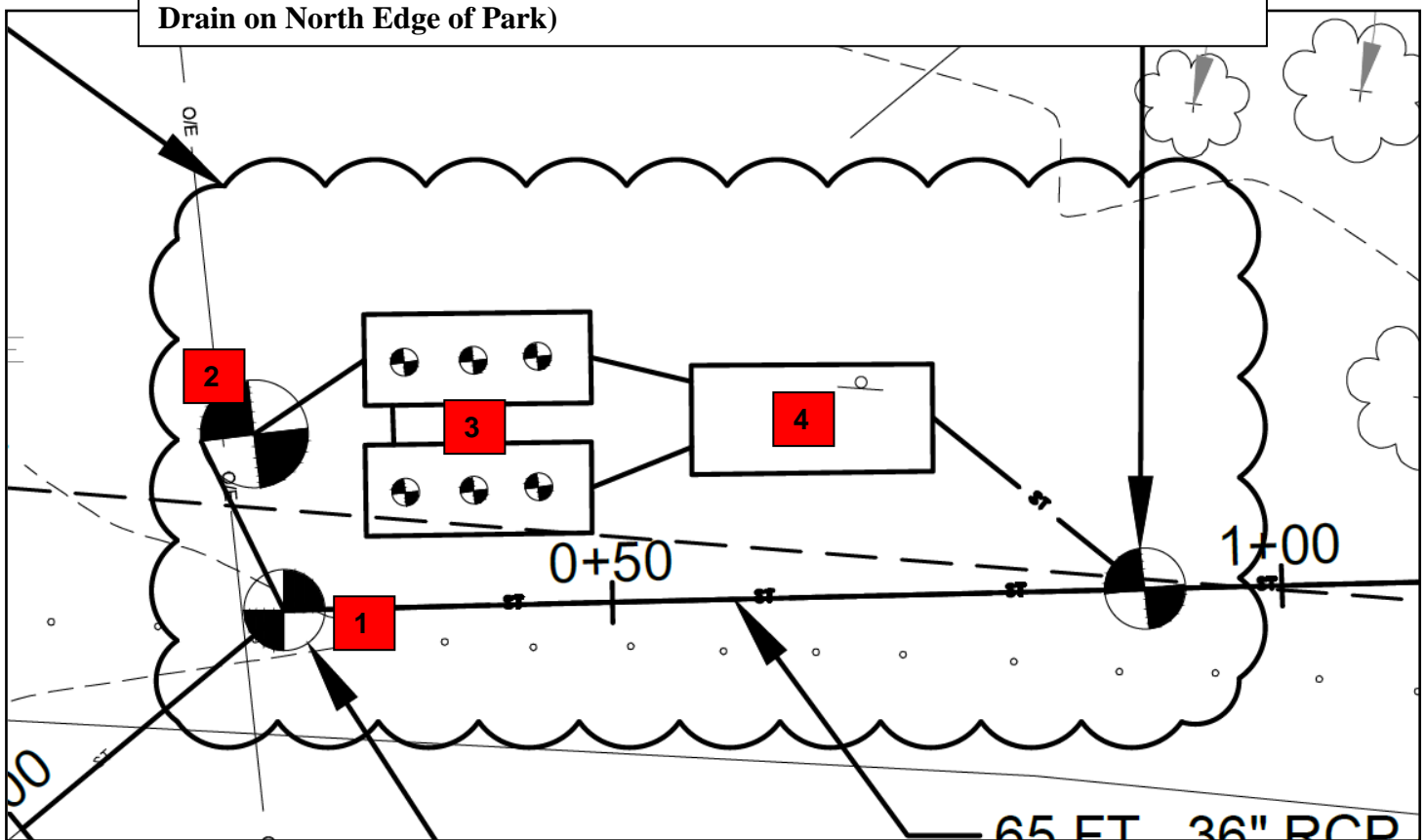
The three drain lines have the following components (Figure 2):

1. Diversion weir to allow for stormwater entry to filter system, and provide for overflow during heavy rain events
2. Oil/grit separator - This component will separate soils and remove grit up to 125 microns
3. Sediment Settling Tanks ('Traverse City Treatment Box') - This component will remove neutrally buoyant material (i.e. cigarettes) and fine sediment. It will also have a 1/4" x 1/4" stainless steel screen and chambers acting as sediment traps.
4. Helix Cartridge Filtration System - These are manufactured, replaceable high flow cartridges effective at treating pathogens using treated foam filter media and increased contact time (through helix design). The cartridges also help remove sediment, hydrocarbons, and nutrients. We chose to use the Fabco Industries' Helix Filter (<http://www.fabco-industries.com>).

The drain lines were then combined to one outlet after treatment, which was located at the southern edge of the park, south of the bathing beach to prevent the outflow from stagnating in the beach's swimming area.

The system was designed to treat the first flush of stormwater volume for 75% of the annual storm events, using rainfall data from NOAA from 2001 - 2010 and creating a cumulative storm occurrence probability curve by rainfall depth. Installation of this system was in Spring 2013.

Figure 2: Close-up of Site Plans for East Bay Park Filtration System (Storm Drain on North Edge of Park)



Original Storm Drain System at East Bay Park



New Storm Drain System at East Bay Park





Left: Stormwater filtration treatment system installed, south end of East Bay Park

Outlet to Bay

Fabco Helix Stormwater Filter

Sediment Settling Tank

Oil/grit separator



Above and Left: Fabco Helix Filter installation



New outlet for all three drains (approx. 5 months after installation)



Project sign installed during construction

Finished system on south end, installed under parking area



Monitoring Data

Water quality tests were taken according to the approved QAPP on the storm drains at East Bay Park as part of this project to determine levels of pollutants other than strictly E.Coli, which has been documented many times by TWC and other partners previous to this grant (Table 1). Samples were taken three times on the main two drains at the park (north and south).

Table 1: Storm Drain Monitoring Data

Parameter Measured	12/14/11		3/12/12		5/2/12	
	North Drain	South Drain	North Drain	South Drain	North Drain	South Drain
Chloride (mg/L)	326	276	523	531	13	26
E.Coli (col/100mL)	>2419	>2419	445	160	3090	4570
Ammonia (mg/L)	ND	ND	0.28	0.3	0.45	0.51
Nitrate (mg/L)	1.24	0.62	0.27	0.52	0.19	0.33
Nitrite (mg/L)	0.051	0.052	0.027	0.028	0.011	0.015
Oil/Grease (mg/L)	2.5	3.4	2.9	3.9	2.4	ND
pH	7.8	7.8	7.8	7.7	8	8.1
Total Phosphorus (mg/L)	0.25	0.09	ND	0.08	0.1	0.06
Total Suspended Solids (mg/L)	28	38	42	44	104	110
Surfactants (mg/L)	0.11	0.076	0.095	0.014	0.074	0.087
Depth of water in pipe (in.)	3	6	n/a	n/a	8.5	5

The beach at East Bay Park was monitored for E.Coli bacteria in Summer 2012 and 2013 during this project using BEACH Act and GLRI funds, distributed to TWC by the MDEQ. Results from this monitoring followed approved project QAPPs for those grants and can be found on the State's BeachGuard database: <http://www.deq.state.mi.us/beach/>. Advisories were posted once in 2012 and 2013 for East Bay Park and were linked to rain the previous 12 hours. The advisory posted in 2013 was after the East Bay Park stormwater system was installed, however it was after an extreme rain event (a '100-year storm'), where the filtration system was most likely overwhelmed and most of the water was diverted through the bypass system.

East Bay Park beach and swimming area



Project Outcomes and Milestones

All goals and milestones were met successfully and project management and grant administration went smoothly. Communication between TWC and the EPA's Project Officer and Technical Contact was efficient and timely. Project Administration was completed by TWC Program Director Sarah U'Ren, who coordinated all project tasks and completed grant reporting requirements. Budget expenditures were on track for what was projected in the project's budget, with a necessary budget revision at the beginning of the project to move funds because partners realized the way funds would be spent needed to be counted as a 'subaward' to the City of Traverse City. Other minor budget changes were made as necessary and documented with the EPA Project Officer.

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While original project milestones were completed as outlined, they were not completed by the timing originally reflected in the grant application (Table 3). Due to complications with the bench study performed as part of this project, a no-cost project extension was requested and approved in Fall 2012 to extend the project another year. Details for this extension can be found in a memo dated 9/11/12 to the EPA Project Officer. However, all project tasks were successfully completed by the grant's new end date.

Table 3: Project Milestones and Completion Dates

Original Completion Date	Milestone	Actual Completion Date
July 2011 - February 2012	Research potential BMP options and collect necessary data at East Bay Park. Discuss options with Traverse City officials and Beach Stakeholder Committee and make final BMP systems choices. Conduct outreach to public regarding upcoming planned work and how it relates to improved beach health	July 2011 - February 2013
March-April 2012	Finish engineering site plans and send out to bid. Choose contractor for installation	March-April 2013
May-August 2012	Install BMP systems	May-August 2013
September - December 2012	Finish BMP installation. Notify public of finished project. Submit final report to EPA	September - December 2013

The project was successful at improving water quality and protecting public health at East Bay Park Beach because the treatment system is designed to kill and remove E. Coli bacteria from the water on its route through the Fabco Helix Filter. The treatment system was fully installed and functional in June 2013, just after beach monitoring began for the summer. After the project's completion bacteria results at East Bay Park met water quality standards 99% of the time (1 advisory over 84 days of sampling - 6/12/13-8/28/13). This meets the measure of progress in the Great Lakes Restoration Initiative Action Plan, which evaluates the percentage of beaches meeting bacteria standards 95% or more of beach days. Also, as noted previously, the single advisory East Bay Park had after the project's installation occurred after an extreme rain event where the system was most likely overwhelmed - we were not surprised that the beach had high E.Coli levels after that much rain. Much of the Traverse City area experienced flooding during that event.

On average, East Bay Park has had at least one advisory posted each summer for the past 10 years, with the exception of 2011 when 6 advisories were posted. Beach sanitary surveys and extensive water monitoring at East Bay Park have shown that advisories at East Bay Park are typically tied to storm events where the runoff from two large drains at the north edge of the beach have very high E.Coli levels. 2011 was an extremely wet summer where many rain events occurred prior to samples being taken, and beaches were being sampled twice/week instead of the usual once/week, so we would expect to see a higher number of advisories posted at that beach that year. Those data support our concerns that since high bacteria counts at East Bay Park are related to storm events, it is likely that there are high bacteria counts after storm events that are not captured during the weekly monitoring. High counts were only found if there happened to be a storm event just prior to sampling. Monitoring data were not available for storm events that occurred on other days. By installing the filtration system at East Bay Park for this project and treating runoff from the stormdrains, E.Coli inputs to the beach will be reduced during all rain events, furthering the protection of public health even on days when beach water quality cannot be tested.

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Continued monitoring at this location is imperative to determine the effectiveness of the implemented BMP and to track its success at reducing E.Coli levels at the beach. TWC has attained funds to monitor both the beach and the water entering and leaving each storm drain treatment system in Summer 2014 and will actively seek funding for additional monitoring of this system beyond 2014.

Future beach and stormdrain monitoring at East Bay Park will support our project outcome that the presence of bacteria, viruses, pathogens, or other risks to human health will be reduced to levels that do not impede human use and enjoyment of the nearshore areas at East Bay Park, specifically:

1. *Water quality is improved at Great Lakes beaches due to reductions in bacteriological, algal, and chemical contamination.*
2. *Protection of public health is improved at Great Lakes beaches.*
3. *Holistic watershed approaches to Great Lakes beach management are implemented, supporting a more efficiently directed beach program.*

Upon project completion the following project outputs have been met:

1. *Reduction in the number of pollution sources impacting Great Lakes beaches.*
 - By treating stormwater at East Bay Park we have reduced a variety of pollution sources including E.Coli bacteria, sediment, and phosphorus.
2. *Reduction in the number of Great Lakes beach closures or advisories issued.*
 - The treatment system at East Bay Park reduces bacterial input from E.Coli, which should reduce beach advisories issued at the park. This should also help keep East Bay Park off the State of Michigan's Impaired Waters List.
3. *Documentation of mitigation measures taken and outcomes achieved, which can be applied at other Great Lakes beaches.*
 - This project was documented very well and TWC staff have already given presentations about this and other GLRI beach restoration projects at national and regional conferences. TWC staff will continue to give presentations at the local, state, and national level regarding ongoing restoration projects in the watershed and will include results from this project in future presentations.
4. *Reduction in nuisance algal blooms and ambient water concentrations of nitrogen and phosphorus in Great Lakes coastal areas.*
 - By treating water coming from the storm drains at East Bay Park, we will not only reduce bacteria counts, but reduce nutrient and sediment contamination typically associated with stormwater runoff as well. The treatment system installed at the park includes two pre-treatment steps before water flows through the anti-bacterial filter designed to reduce sedimentation, so the anti-bacterial filter treatment step functions better. By reducing sediment we will also be reducing nutrients that are attached to sediment particles.

It should also be noted that this project and its goals are consistent with priorities listed in the Great Lakes Restoration Initiative Action Plan's Nearshore Health and Nonpoint Source Pollution section, specifically the following long-term goals:

- **Goal 3:** The presence of bacteria, viruses, pathogens, nuisance growths of plants or animals, objectionable taste or odors, or other risks to human health are reduced to levels in which water quality standards are met and beneficial uses attained to protect human use and enjoyment of the nearshore areas.
- **Goal 4:** High quality bathing beach opportunities are maintained by eliminating impairments from bacterial, algal, and chemical contamination; effective monitoring for pathogens; effective modeling of environmental conditions, where appropriate; and timely communications to the public about beach health and daily swimming conditions.

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In addition the project will also help accomplish the following objective listed in the same section - "By 2014, 20 percent of high priority Great Lakes beaches will have begun to implement measures to control, manage or remediate pollution sources identified through the use of sanitary surveys." Improving water quality at this beach will also support Sub-objective 4.3.3 of the EPA's Strategic Plan, which concerns improving the health of Great Lakes ecosystems.

Lessons Learned

As noted above, the project encountered some delays related to the bench study that was performed to determine the best stormwater BMP system to use at the site. Delays for that study resulted in a necessary one-year extension to the project's end date. A lesson learned from this experience is to expect project delays and make sure to initially apply for a long enough time period in which to complete the grant work. If, in the project application to EPA, TWC had made the project period for 2 1/2 years instead of just 1 1/2, then a project extension would not have been necessary. Additionally, the main reason for the delays to the bench study were weather related - simply put, we needed rain events to conduct the bench study and had an extremely dry summer. What rain events did occur were either late at night or on weekends when water quality labs were not available to run necessary tests. For this we have no actual lesson learned since we already know that we cannot control when it rains; our only advice is to be prepared for weather conditions NOT to cooperate with your testing needs.

This project was highly successful in large part due to the willingness of City of Traverse City to take action to protect public health at this beach. Their willingness was due to the good working relationship fostered between the City and TWC over the past 10 years working on a variety of projects related to water quality. Additionally, the city was willing to take on this project due to the low match requirement of the EPA-GLRI program. Typically projects utilizing grant funding require 25% match, which is often a hardship for local governments or grant applicants to find, especially on the scale of this project. A 25% match requirement for this project would have meant that the City and TWC would have had to have found approximately \$187,000 of local funds to match against the project budget of \$760,000.

We have also realized that when you install a stormwater filtration system, effectiveness results cannot be realized immediately. It has been shown that beach conditions at East Bay Park are influenced by the storm drains, so it makes sense to sample for system effectiveness during storm events when those drains are running. It will take a number of years to acquire enough data to readily say that the system is functioning as intended, and for that data to be statistically significant. This is because, in order to test a system like the one installed at East Bay Park, water samples need to be collected at the beginning or middle of a storm event for the actual system (inlet and outlets), and beach samples should be collected during and after a rain event. Additionally, enough samples need to be attained to make the data statistically significant - this could take a multitude of rain events, which in turn could take a number of years to get, keeping in mind the advice above about weather conditions cooperating with testing needs.

Project Sustainability

TWC works to protect Grand Traverse Bay at the watershed-scale and takes a holistic approach to protect the lakes, tributaries, land, beaches, and water that comprise the Grand Traverse Bay watershed. TWC believes that the quality of life in the Grand Traverse Region and the health of the local economy are inextricably linked to the health of our water resources. Therefore, improved water quality and protecting public health at East Bay Park will not only result in improved water quality, but a healthier economy and improved quality of life.

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In 2007 TWC drafted an Action Plan for Healthy Beaches that outlined a plan to reduce health threats and related beach advisories associated with high E.Coli readings. The Action Plan for Healthy Beaches proposed a series of actions to reduce the levels of E.Coli at area beaches in three phases. Phase 1 involves immediate steps such as ordinance development, public education, and behavior change. Phase 2 involves conducting a detailed sanitary survey and source tracking study. Phase 3 involves implementing additional stormwater controls once the sources of contamination are more accurately defined. TWC is committed to carrying out efforts in the Action Plan and has worked to implement portions of the Action Plan since 2007 as part of its Healthy Beaches Program. Activities under this program included a large-scale outreach program including media advertising and educational signage as well as restoration projects at Bryant and East Bay Park Beaches, and the Village of Suttons Bay.



Implementation of TWC's Healthy Beaches Program will continue indefinitely in the Grand Traverse Bay watershed. We will use lessons learned and information gathered during this and our other GLRI Beach Restoration projects for Bryant Park and the Village of Suttons Bay and continue to apply for funding for additional projects. Targeted sites for future restoration projects involving stormwater pollution and potential public health threats include the second storm drain at Bryant Park, West End Beach, and the storm drain at the end of 8th Street in Traverse City.



Examples of Healthy Beaches signs installed at parks in the region

