

NONPOINT SOURCE ASSESSMENT REPORT
FOR
THE GRAND TRAVERSE BAND OF OTTAWA
AND CHIPPEWA INDIANS

FINAL

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Prepared for - Grand Traverse Band of Ottawa and Chippewa Indians
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ACRONYMS AND ABBREVIATIONS LIST

ALU	aquatic life use
BIA	Bureau of Indian Affairs
BGS	below ground surface
CDP	census designated place
cfs	cubic feet per second
CMI	Clean Michigan Initiative
CREP	Conservation Reserve Enhancement Program
CSOs	combined sewer overflows
CWA	Clean Water Act
DO	dissolved oxygen
EDC	Economic Development Corporation
FMP	Forest Management Plan
GTB	Grand Traverse Band of Ottawa and Chippewa Indians
HUC	Hydrologic Unit Code
IHS	Indian Health Service
MDARD	Michigan Department of Agriculture and Rural Development
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
mg/L	milligrams per liter
mgd	million gallons per day
MITC	Inter-Tribal Council of Michigan, Inc.
mS/cm	milliSiemen per centimeter
MSU	Michigan State University
NO ₂ NO ₃	nitrate/nitrite
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity units
NWI	National Wetlands Inventory
QA/QC	quality assurance and control
QAPP	quality assurance project plan
RC&D	Resource, Conservation & Development
SBR	sequencing batch reactor
STORET	STorage and RETrieval
TAS	treatment as state
TCC	Turtle Creek Casino
TN	total nitrogen
TP	total phosphorus
µg/L	micrograms per liter
USDA	U.S. Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WQS	Water Quality Standards
WWTP	wastewater treatment plant

SECTION 1 - OVERVIEW

Nonpoint source (NPS) pollution delivers pollutants to surface waters from diffuse origins rather than from one or more discernible point sources. NPS pollution includes runoff from precipitation as well as stressors such as habitat alteration, dams, or channelization. Urban runoff; agricultural runoff; leaking septic tanks; and air pollution are major NPSs (USEPA 2009). NPS pollution is the most significant source of water quality problems in the United States: it is the main reason that approximately 44 percent of surveyed rivers, lakes, and estuaries in 2004 were not clean enough to meet basic uses such as fishing or swimming (USEPA 2009).

This Section 319 NPS Assessment Report for the Grand Traverse Band of Ottawa and Chippewa Indians (GTB) analyzes NPS problems for Tribal waters on GTB's Tribal lands. This report will fulfill the statutory requirement for a Section 319 NPS Assessment Report for development of an approvable Clean Water Act (CWA) Section 319 NPS Management Program Plan for these Tribal waters. In order to qualify for 319 funding a tribe must meet four criteria (USEPA 2010):

1. Be a federally recognized tribe
2. Complete an approved CWA section 319(a) NPS Assessment Report
3. Complete an approved CWA section 319(b) NPS Management Program Plan
4. Be CWA section 518(e) approved for treatment similar to a state ("treatment as a state" or TAS)

Under the CWA, the Tribe received TAS for its historical 1855 reservation boundaries in two distinct areas: in 1998 for CWA Section 106, and in January 2004 for CWA Section 319. The GTB CWA Section 319 program currently covers GTB-owned trust and fee lands purchased before October 10, 2001.

The GTB Section 319 NPS Management Program will focus on the GTB Section 319 NPS Management Program boundary established by the Tribal Council in October 2001. As approved by the Tribal Council, the Section 319 NPS Management Program boundary includes all Tribally-owned parcels purchased prior to October 10, 2001 in the six-county service area. The six-county service area and the location of the parcels that fall under the GTB Section 319 NPS Management Program boundaries are shown in Figure 1. There are other Tribally-owned parcels that the GTB purchased after October 10, 2001 that have the potential to contribute NPS pollution due to the nature of the activities on the parcels (e.g., casino, golf courses), and provide an opportunity for additional NPS BMP implementation activities. If the GTB would like to include these additional parcels under the Section 319 NPS Management Program boundary, GTB staff could work with U.S. Environmental Protection Agency (EPA) to amend the existing TAS documentation that will expand the Section 319 NPS Management Program boundary definition. Doing so would allow GTB to obtain Section 319 funding to conduct NPS management activities on these additional Tribally-owned parcels. GTB staff would then work with EPA to provide an addendum to this Section 319 NPS Management Program Plan to highlight the additional parcels included in the GTB Section 319 NPS Management Program boundary definition through the TAS amendment.

The bodies of water recognized in the GTB CWA Section 106 program are within and adjacent to the 1855 reservation lands, specifically:

- Lake Michigan's Grand Traverse Bay (and its tributaries)
- The eastern portion of Lake Michigan along the Leelanau Peninsula (and its adjoining tributaries)
- Betsie River watershed in Benzie County
- Belanger Creek
- Spencer Creek
- Elk Lake (and its adjoining tributaries)

These surface waters are within two U.S. Geological Survey (USGS) delineated 8-digit hydrologic unit code (HUC) watersheds: Boardman/Charlevoix (04060105) and Betsie-Platte (04060104). Though portions of Manistee County include the Manistee watershed (04060103), there are currently no GTB waters in this watershed.

GTB Tribal government serves the GTB six-county service area in northwest lower Michigan: Antrim, Benzie, Charlevoix, Grand Traverse, Leelanau, and Manistee. The Tribe's federal and Tribe-owned land base is approximately 2,598 acres within the GTB six-county service area. Land cover on the GTB six-county service area is primarily forest (about 50 percent). Eleven percent of the GTB six-county service area is wetlands and 14 percent is shrubs, pasture, grassland, or fallow croplands. Croplands make up 10 percent of the land cover. Orchard crops are 3.5 percent of the crops and are centered in Leelanau, Grand Traverse, and Antrim Counties around Grand Traverse Bay. Developed areas make up just over 8 percent of the land cover. Urban land uses are concentrated around Traverse City, Peshawbestown, Suttons Bay, Frankfort, Charlevoix, and Manistee. Inland lakes and open water make up just over 6 percent of the land cover.

GTB assessed their Tribal waters from 1999 through 2012 and identified several issues of Tribal concern including elevated nutrients, turbidity, and spring lake temperatures. GTB have made it a priority to keep water within the Tribal boundary as pristine as possible for spiritual, cultural, and health reasons.

This report provides additional analysis of the 1999-2009 ten year summary and 2012 assessment of Tribal waters to assess NPS problems and identify the sources of NPS pollutants on GTB lands in the GTB six-county service area. This report fulfills the statutory requirements for a Section 319 NPS Assessment Report and will serve as the basis for targeting reduction of NPS pollution to Tribal waters. Through partnerships, future program expansion, and the completion of a Section 319 NPS Management Program Plan, GTB would like to promote improvements in water quality.

The primary NPS problems on the GTB six-county service area appear to be related to the following:

- Agriculture (specialty crop production)
- Construction
- Historical Logging/Sedimentation
- Landscaping
- Septic Systems
- Road crossings
- Urban Runoff

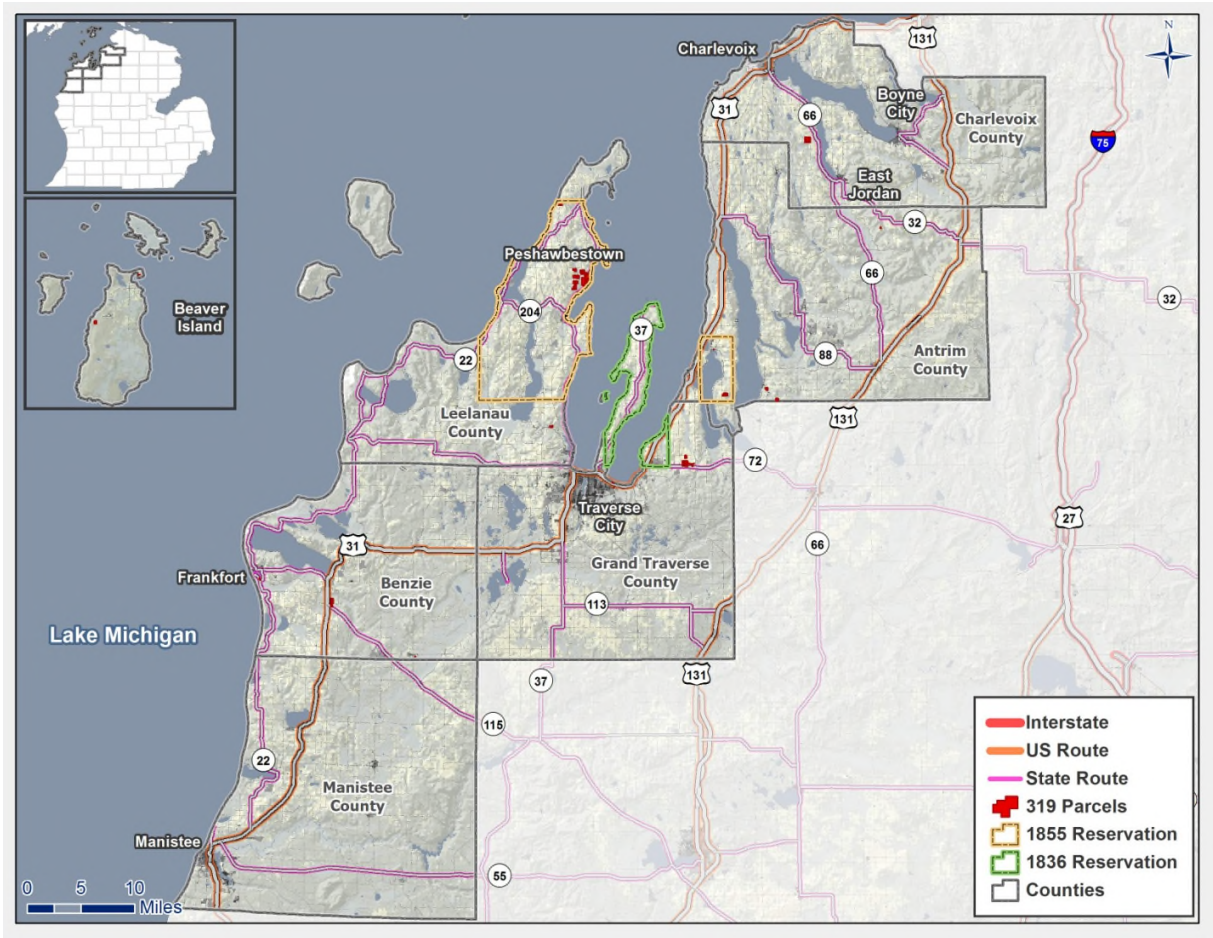


Figure 1. The GTB six-county service area

SECTION 2 - INTRODUCTION

GTB Tribal government serves the GTB six-county service area in the northwest of the lower Michigan peninsula: Antrim, Benzie, Charlevoix, Grand Traverse, Leelanau, and Manistee. The Tribe's federal and Tribe-owned land base is approximately 2,598 acres within the GTB six-county service area. The Tribe consists of approximately 4,200 members with approximately 1,700 members living in the GTB six-county service area. Land draining to GTB water quality sampling sites and fee and trust land (owned by GTB) are assessed in this report.

Historically land in the GTB six-county service area has been used for timber harvesting, agriculture, fishing, recreation, and residency. The predominant use of Tribal land is for private residences and public/administrative buildings. There are approximately 100 structures located within the Tribal boundaries, such as the following public buildings: police department, health department and clinic, Elders complex, Tribal centers, apartment buildings, natural resources department building, gaming commission, administrative buildings, and daycare centers. GTB uses much of its land for the development and management of two casinos, a resort, and a golf course. GTB is concerned with improving surface water quality on the GTB six-county service area to maintain the beneficial uses of Tribal waters.

Water quality monitoring data and local watershed knowledge suggest NPSs of pollution adversely affect water quality, state designated uses, and GTB current uses on streams in the GTB six-county service area. Watershed partners have noted sedimentation problems from historical logging practices throughout the GTB six-county service area. GTB seeks to control NPS pollutants by implementing NPS management practices and modifying behavior.

GTB's primary goal is to expand their NPS pollution control program to address polluted runoff impacts and qualify the tribe for continuation of their Section 319 grant; the Section 319 grant would be designed to expand and continue NPS management efforts to minimize NPS pollution on the GTB six-county service area. In addition GTB wishes to continue to assess and track the condition of its Tribal waters. A third goal is to draft and attain water quality standards. It is also GTB's goal is to attain and protect high quality water standards of GTB Tribal waters.

GTBs primary objectives to achieve these goals are:

- Determine the current condition of surface water and sediment quality at stream mouths to major water bodies that are used by Tribal members.
- Determine status and trends in species composition, richness, and abundance of benthic macroinvertebrates in rivers and river mouths.
- Identify problem areas with poor water quality or the potential to degrade water quality.
- Determine long term trends at sites that have historic data to compare the water quality results with, and develop long term trend analysis to determine water quality of Tribal waters.
- Continue the baseline monitoring study.
- Assess Road Stream Crossings in an effort to prevent erosion and runoff issues to local streams and rivers.

The purpose of this Section 319 NPS Assessment Report is to identify existing and potential water quality problems caused by NPS pollution on the GTB six-county service area, which supports GTB's overall intent to meet Tribal water quality goals in the future. The report identifies the nature, extent, and effect of NPS pollution for Tribal waters on GTB's Tribal lands, as well as the sources of such pollution. The assessment evaluates water quality monitoring data and information from various sources, such as anecdotal information from members of GTB and various documents and reports written for GTB. The report categorizes NPS pollution sources for those individual waters identified as needing control of NPS

pollution. In addition, this report discusses how GTB will identify best management practices (BMPs) needed to control NPS pollution on the GTB six-county service area. The 319 NPS Assessment Report includes a description of existing Tribal, state, federal, and other programs that could be used for helping to control NPS pollution on the GTB six-county service area.

Since 1999, GTB has collected data and information for effective management of their water quality program. This report describes GTB's monitoring program and begins with a discussion of the sampling methodology. The report continues with discussions of the sampling results and evaluations of water quality. The report includes recommendations for future activities. Water quality data for the following parameters were analyzed: ammonia, chlorophyll-*a*, nitrate/nitrite (NO₂NO₃), total phosphorus (TP), total nitrogen (TN), soluble reactive phosphorus (SRP), percent solids, sedimentation, dissolved oxygen (DO), pH, conductivity, temperature, turbidity, mercury, macroinvertebrates, and habitat. Though GTB does not analyze water samples for *Escherichia coli* (*E. coli*), bacteria data are available from Michigan Department of Environmental Quality's (MDEQ's) Michigan BeachGuard System and these data were used to assess current bacteria levels on the GTB six-county service area.

SECTION 3 – METHODOLOGY

Project Area

The GTB six-county service area waters mainly lie within three 8-digit HUC watersheds (Betsie/Platte, Boardman/Charlevoix, and Manistee) and ninety eight 12-digit HUC subwatersheds in addition to parcels on Beaver Island. Small slivers of Charlevoix County and Manistee County lie within the 8-digit HUC Pere Marquette-White and Cheboygan watersheds. GTB has sampled waters in thirteen of the 12-digit HUC subwatersheds. The 1855 Reservation boundaries lie on ten of the 12-digit HUC subwatersheds. The 1836 Reservation boundaries lie on three of the 12-digit HUC subwatersheds. GTB parcels lie on fifteen 12-digit HUC subwatersheds. Table 1 summarizes the 12-digit HUC subwatersheds in the 1855 reservation boundaries and surrounding GTB owned parcels designated as 319 boundaries

Table 1. GTB 1855 Reservation and 319 Parcels Hydrologic Watershed Units (8 and 12-digit HUCs)

8-digit HUC Watershed	Watershed Name	12-digit HUC Subwatershed	Subwatershed Name
04060104	Betsie-Platte	040601040101	Cedar Run
		040601040102	Mebert Creek-Lake Leelanau
		040601040103	Houdek Creek-Lake Leelanau
		040601040304	Dair Creek-Betsie River
		040601040306	Rice Creek-Betsie River
		040601040307	Betsie Lake-Betsie River
		040601040401	Shalda Creek-Frontal Lake Michigan
04060105	Boardman/Charlevoix	040601050202	Severance Creek-Jordan River
		040601050206	South Arm Lake Charlevoix
		040601050303	Cedar River-Intermediate River
		040601050305	Spencer Creek-Torch Lake
		040601050404	Lake Skegemog
		040601050405	Elk Lake-Elk River
		040601050702	Birch Lake-Frontal Grand Traverse Bay
		040601050703	Petobego Pond-Frontal East Arm Grand Traverse Bay
		040601050705	East Branch Mitchell Creek ¹
		040601050706	Prescott Lake-Frontal Grand Traverse Bay
		040601050707	Cedar Creek-Frontal West Arm Grand Traverse Bay
		040601050708	Belanger Creek-Frontal Grand Traverse Bay
Beaver Island ²			

Notes: ¹Mitchell Creek in Grand Traverse County is the waterbody associated with HUC 040601050705

²Beaver Island does not have a USGS delineated HUC watershed, though GTB does own parcels on this Island so it is included in the analysis.

A complete GTB six-county service area list of HUCs is available in Appendix A.

From 1999 through 2009, GTB monitored 10 lake sites and five stream sites to establish baseline conditions, test impairments, and observe trends. Of the 10 lake sites, two sites were on inland lakes and eight lake sites were on Lake Michigan and Grand Traverse Bay. The five stream sites were on Belanger Creek and Ennis Creek. Table 2 summarizes the 1999-2009 GTB sampling sites with associated subwatershed.

Table 2. GTB 1999-2009 Sampling Sites

ID	Station Location	Waterbody Type	HUC12 ID	HUC12 Name
LEN	Leland North	Lake Michigan	040601040401	Shalda Creek-Frontal Lake Michigan
LES	Leland South			
SKG	Skegemog Lake	Grand Traverse Bay/Lake Michigan	040601050404	Lake Skegemog
ELK	Elk Lake	Inland Lake	040601050405	Elk Lake-Elk River
ERP	Elk Rapids			
LEE	Lee Point	Grand Traverse Bay/Lake Michigan	040601050707	Cedar Creek-Frontal West Arm Grand Traverse Bay
BMK	Belanger Creek at McKeese Rd	2nd order creek	040601050708	Belanger Creek-Frontal Grand Traverse Bay
BOM	Belanger Creek at Omena Rd			
BPD	Belanger Creek at Pobuda Rd			
BPT	Belanger Creek at Peshawbestown Rd			
ECH	Ennis Creek at Camp Haven Rd			
NPT	Northport	Grand Traverse Bay/Lake Michigan		
OMN	Omena Bay			
PBT	Peshawbestown Near Shore			
SUT	Suttons Bay			

In 2012, GTB collected surface water quality data at ten new sampling sites. Five of the new sampling sites were on Lake Michigan at the mouths of streams. Three of the new sampling sites were on inland lakes at the mouths of streams. Two of the new sampling sites were on streams upstream of the mouths. GTB evaluates these monitoring sampling sites annually three times per year on a seasonal schedule (spring, summer, and fall). GTB started sampling at these new sites to collect data and information on important nearshore habitat for fish to support their commercial and subsistence fishing uses. GTB wishes to establish baselines and look for trends at these sites. If negative trends are apparent, GTB intends to collect data further upstream into the watersheds to identify sources. Table 3 summarizes the 2012 GTB sampling sites with associated subwatershed.

Table 3. GTB 2012 Sampling Sites

ID	Station Location	Waterbody Type	12-digit HUC	12-digit HUC Name
VIC	Victoria Creek (Lake Leelanau tributary)	In stream	040601040101	Cedar Run
MEC	Mebert Creek (Lake Leelanau tributary)		040601040102	Mebert Creek-Lake Leelanau
LER	Leland River (Lake Michigan)	Stream Mouth	040601040103	Houdek Creek-Lake Leelanau
BER	Betsie River (Betsie Lake)		040601040307	Betsie Lake-Betsie River
CRR	Crystal River (Lake Michigan)		040601040402	Crystal Run
CLR	Clam River (Torch Lake)		040601050304	Clam Lake

ID	Station Location	Waterbody Type	12-digit HUC	12-digit HUC Name
TOR	Torch River (Lake Skegemog)		040601050404	Lake Skegemog
ELR	Elk River (Lake Michigan)		040601050405	Elk Lake-Elk River
BOR	Boardman River (Lake Michigan)		040601050507	Boardman Lake-Boardman River
MIC	Mitchell Creek* (Lake Michigan)		040601050705	East Branch Mitchell Creek

Note: The Mitchell Creek monitoring station is located on Mitchell Creek in Grand Traverse County.

Figure 2 displays the sampling site locations. Table 4 summarizes the years that each parameter was sampled at each sampling site. The watersheds, subwatersheds, data, and water quality standards are described in this section.

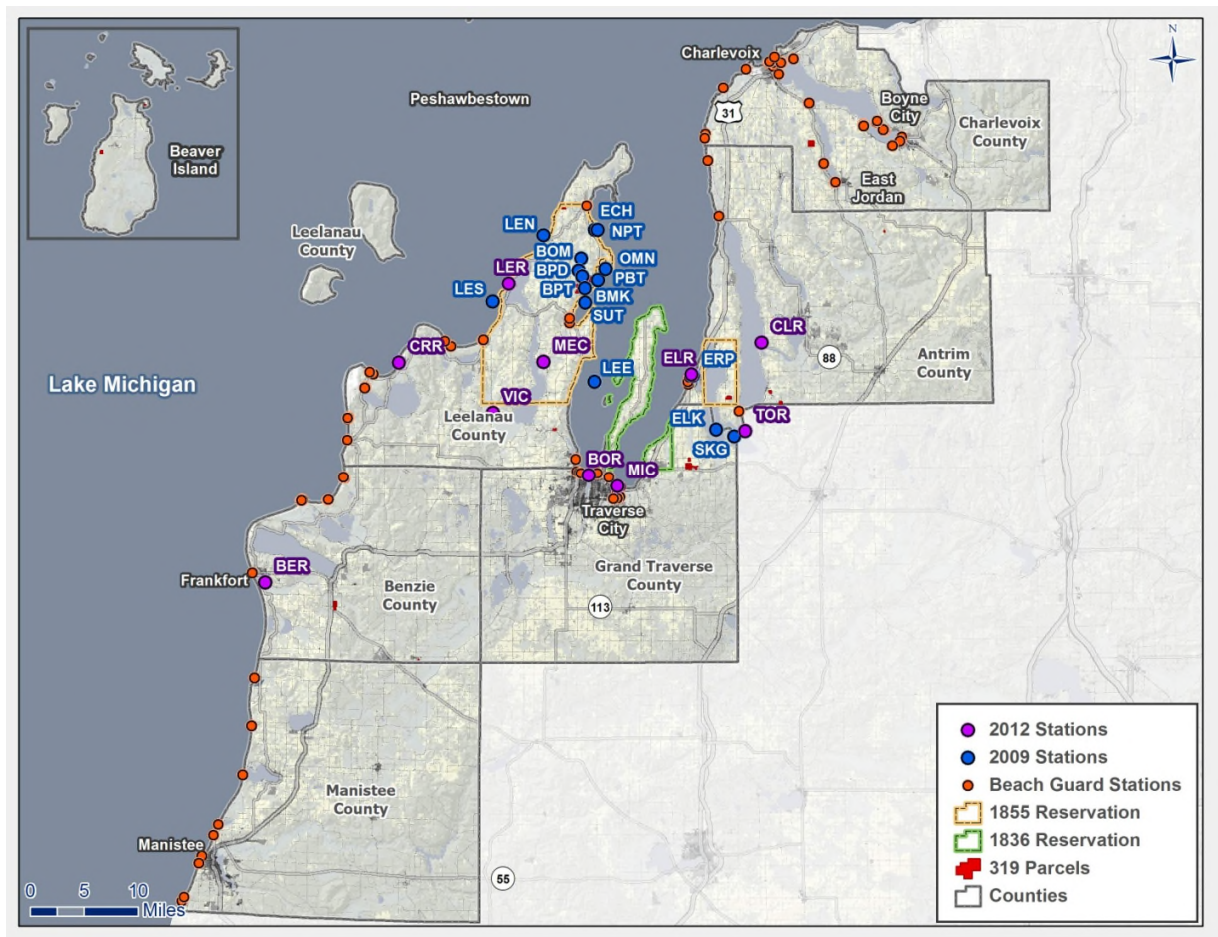


Figure 2. Sampling sites and GTB six-county service area.

Table 4. GTB Sampling Site Summary

ID	% Solids	Alk	NH3	TOC	Chloride	Chl-a	Cond	D.O.	Hard	NO2NO3	Nitrate	pH	TP	TP (sed)	SRP	Secchi	Flow	Temp	TSS	Turb	TN	Mercury	Macro	Habitat
BMK		00-09	04-09	09	03		99-09	99-09	00-09	99-09	07-09	99-09	99-09		03-09		99-05	99-09	03-09	03-09			02-07	03-06
BOM		00-09	04-09	09	03		99-09	99-09	00-09	99-09	07-09	99-09	99-09		03-09		99-05	99-09	03-09	03-09			02-07	03-05
BPD		99-09	04-09	09	03		99-09	99-09	99-09	99-09	07-09	99-09	99-09		03-09		99-05	99-09	03-09	03-09			02-07	03-06
BPT		00-09	04-09	09	03		99-09	99-09	00-09	99-09	07-09	99-09	99-09		03-09		00-05	99-09	03-09	03-09			02-07	03-06
ECH		00-09	04-09	09	03		99-09	99-09	00-09	99-09	07-09	99-09	99-09		03-09		99-05	99-09	03-09	03-09			02-07	03-06
ELK	00-05	03-09	04-09	99-09	05	03-09	03-09	03-09	03-09	03-09	09	03-09	03-09	99-06	03-09	03-09		03-09	05-09	03-09			02-07	
ERP	04-05	04-09	04-09	04-09	05	04-09	04-09	04-09	04-09	04-09	08-09	04-09	04-09	04-06	04-09	04-09		04-09	05-09	04-09			02-07	
LEE	00-05	00-09	05-09	99-09	05	99-09	99-09	99-09	00-09	99-09	08-09	99-09	99-09	99-06	03-09	99-09		99-09	05-09	99-09			02-07	
LEN	00-05	03-09	05-09	99-09	05	03-09	03-09	03-09	03-09	03-09	09	03-09	03-09	99-06	03-09	03-09		03-09	05-09	05-09			02-07	
LES	00-05	03-09	05-09	99-09	05	03-06	03-09	03-09	03-09	03-09	09	03-09	03-09	99-06	03-09	03-09		03-09	05-09	04-09			02-07	
NPT	00-05	00-09	04-09	99-09	05	99-08	99-09	99-09	00-09	99-09	08-09	99-09	99-09	99-06	03-09	99-09		99-09	05-09	99-09			02-07	
OMN	01-05	01-09	04-09	01-09	05-07	01-09	01-09	01-09	01-09	01-09	08-09	01-09	01-09	01-06	03-09	01-09		01-09	05-09	01-09			02-07	
PBT	01-05	01-09	04-09	01-09	05	01-09	01-09	01-09	01-09	01-09	08-09	01-09	01-09	01-06	03-09	01-09		01-09	05-09	01-09			02-07	
SKG	00-05	03-09	04-09	99-09	05	03-09	03-09	03-09	03-09	03-09	09	03-09	03-09	99-06	03-09	03-09		03-09	05-09	03-09			02-07	
SUT	00-05	00-09	04-09	99-09	05	99-09	99-09	99-09	00-09	99-09	08-09	99-09	99-09	99-06	03-09	99-09		99-09	05-09	99-09			02-07	
BER	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
BOR	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
CLR	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
CRR	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
ELR	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
LER	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
MEC	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
MIC	2012					2012	2012	2012				2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
TOR	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012
VIC	2012					2012	2012	2012				2012	2012	2012	2012	2012		2012		2012	2012	2012	2012	2012

Notes:

Alk = Alkalinity
 NH3 = Ammonia (mg/L)
 TOC = Total Organic Carbon (sediment)
 Chl-a = Chlorophyll-a (mg/L)
 Cond = Conductivity (mS/cm)
 D.O. = Dissolved Oxygen (mg/L)
 Hard = Hardness
 TP = Total Phosphorus (µg/L)

TP (sed) = Total Phosphorus (mg/kg)
 SRP = Soluble Reactive Phosphorus (mg/L)
 Secchi = Secchi Depth (m)
 Temp= Temperature in Degrees Celsius
 TSS = Total Suspended Solids (mg/L)
 Turb = Turbidity (NTU)
 TN = Total Nitrogen (mg/L)
 Macro = Macroinvertebrates
 Habitat = Habitat Assessment

Data Collection Methods and Sources

Monitoring Objectives:

A long term baseline monitoring water quality study (GTB 2009b) began in 1998 on waters within or directly affecting the Grand Traverse Band Historic Reservation. Over the next 10 years the objectives of this study were to determine which, if any, water bodies within the GTB six-county service area showed impairment and, if applicable, to determine causes of impairment. The monitoring study had the following secondary objectives:

- Continuation of a baseline monitoring study.
- Development of a long term trends analysis to determine water quality of Tribal waters.
- Road Stream Crossings were assessed in an effort to prevent erosion and runoff issues to local streams and rivers.

The objectives of the 2012 monitoring activities and any future monitoring plans build upon the objectives of the long term baseline water quality study from 1999-2009 (GTB 2009b). The primary objective of the 2012 monitoring plan is to assess the current surface water and sediment quality at streams and stream mouths on Lake Michigan that are hydrologically connected to Tribal lands and waters. The secondary objective is to sample the benthic and shoreline habitats of those stream mouths on Lake Michigan to generate data for evaluation of seasonal changes. Results from such monitoring efforts will allow for detection of trends in the selected parameters. Water, sediment, and habitat quality data will be collected to determine if state designated uses and GTB current uses are being supported. Monitoring efforts may also detect transient perturbations to surface water quality leading investigations to possible sources of contamination.

Current and Future Monitoring Design:

The 2012 sampling efforts were designed to achieve three tasks and all future monitoring plans will also be designed to achieve these three tasks.

Task 1: Site Selection. Eight littoral lake/stream inter-phase sites (stream mouths) and two second order stream sites were monitored three times per year on a seasonal schedule (spring, summer, and fall). These sites were selected based on their historical, ecological, and cultural significance. Site selection is also dependent upon the traditional uses of hunting, fishing, trapping, and gathering activities, as supported and documented in the 2000 and 2007 Consent Decrees.

Lake (collected at stream heads) and in-stream sites were sampled and evaluated for the following laboratory parameters as summarized in Table 4: chlorophyll-*a*, TP (water and sediment), SRP (water), TN (water), mercury (sediment), and macroinvertebrates. The following field measurements were also obtained: specific conductance, dissolved oxygen, pH, temperature, turbidity, and depth. Samples collected from lake sites were evaluated for chlorophyll-*a*; water clarity was also monitored at lake sites. Velocity is measured in Mitchell Creek (Grand Traverse County) and Mebert Creek. A small boat is needed to expand this assessment to other stream sites. Habitat is assessed once annually in the summer at all sampling sites. Stream sites' habitat data were evaluated through comparisons with high quality habitat that is necessary to support cultural and fishery uses.

Task 2: Data Evaluation for Designated Use Support. The baseline assessment data are to be compared with high quality data necessary to support the Tribal designated (traditional) uses of hunting, fishing, trapping, and gathering activities. These uses were documented in the 2000 and 2007 Consent Decrees.

Task 3: Road Stream Crossing Assessments. GTB will perform stream crossing inspections on a minimum of five road/stream (second order) crossings. Road/stream crossings to be inspected will be

selected by reviewing Road/Stream crossings within the 1855 reservation boundaries. These five sites will be inspected once annually and perhaps more frequently based on the severity of the site or discovery of new sites of concern. Staff will utilize visual inspection methods and record pertinent information onto data sheets, such as crossing type (bridge, culvert, double culvert, or triple culvert), adjacent landowners, width at crossing, maintenance, location of low point, existing drainage control, approaches (length, percent slope), ditch/shoulder vegetation, and average width of grade. Culvert description will identify the culvert length, diameter, material (galvanized, concrete, or other), condition of culvert (good, fair, or poor), flow through culvert (clear or obstructed), fish passage; fill depth at the inlet and outlet, and embankment. Stream characteristics will be recorded for average width, depth, and both upstream and downstream current. Stream substrate will be identified (sand, sand/gravel, gravel, and/or muck), and any adjacent wetlands. The current conditions (stream bank erosion, embankment erosion, culvert erosion, pool formation at outlet, shoulder/ditch erosion, sand/soil over crossing), the extent of the erosion (minor, severe, moderate), and recommended treatment will be recorded. A site sketch and a photograph log will be developed. The stream crossing surveys will then be summarized in a report form for submittal to local agencies along with recommendations for improvements. EPA will be copied on these reports in quarterly reports as they become available.

Core Water Quality Indicators:

The core water quality indicators are displayed in Table 4. Further information on the collection and processing of this data may be found in the *Grand Traverse Band of Ottawa and Chippewa Indians Surface Water Quality Monitoring QAPP*, as revised July 2013.

Quality Assurance and Control (QA/QC):

The current surface water monitoring quality assurance project plan (QAPP) is on file with United States Environmental Protection Agency (USEPA) Region 5 and GTB periodically reviews and updates the QAPP as necessary. GTB revises laboratory standard operating procedures (SOPs) in the QAPP after the laboratory adopts the new SOPs. GTB also revises and updates SOPs after new methods are developed and accepted by the scientific community.

Field QA/QC is performed by both the water quality specialist and aquatic biologist. The water quality specialist and aquatic biologist collect samples and perform preliminary data reviews in the field together. Later, the water quality specialist enters the data into spreadsheets and then the aquatic biologist reviews the spreadsheets to ensure accuracy. Hydrolab data are entered into Excel workbooks by the water quality specialist and are then formatted for eventual upload into USEPAs STOrage and RETrieval (STORET) Data warehouse. The water quality specialist is responsible for data management and all of the water quality specialists work is reviewed by the aquatic biologist prior to STORET data upload.

Field and laboratory data are thoroughly reviewed as part of the QA/QC program. Laboratory data are reviewed to ensure that quality objectives are achieved. For example, sample blank results are evaluated to ensure that the laboratory results are non-detects or at very low concentrations. Additionally, nutrient and chlorophyll data are reviewed for exceptionally high results. Results that are calculated using automated spreadsheets are also reviewed, though such spreadsheets were previously developed and evaluated. Both the water quality specialist and aquatic biologist review the data in the automated spreadsheets to ensure that the spreadsheets are operating properly.

Table 5. GTB Quality Assurance Documentation

Type	Title	Grant Number	Completion Date	Approval Date
QAPP	Surface Water Quality Monitoring and Water Pollution Control	BG-98504208-0	July, 2013	Jul-2013
SOP	Marsh Mc Birney Flow Meter	BG-98504208-0	Jan-2011	Apr-2011
SOP	Hydrolab	BG-98504208-0	Jan-2011	Apr-2011
SOP	Habitat Assessment	BG-98504208-0	Jan-2011	Apr-2011
SOP	Benthic Sampling and Indices	BG-98504208-0	Jan-2011	Apr-2011

Note: The QAPP, which contains all of the SOP documents listed above, was approved by EPA in July 2013.

Data Management:

Data are currently stored in Excel and will be uploaded to STORET in fiscal year (FY) 2013 after online and on-site trainings are completed. Data will be uploaded starting with the most recent year, followed by each previous year. All sites and data are geo-referenced by location, longitude/latitude, depth, and waterbody.

Water Quality Standards and Reference Conditions

GTB has not adopted Tribal water quality standards (WQS) for its water bodies, though the GTB goal is for Tribal waters to fully support spiritual, cultural, and domestic uses. GTB will utilize existing water quality data, state standards, and national EPA standards and reference conditions in the future to identify appropriate designated uses, numeric criteria, narrative criteria, and antidegradation provisions for the establishment of Tribal WQS or Tribal water quality goals. GTB has chosen to use Michigan's WQS to assess the state of Tribal waters until Tribal WQS are adopted. Table 3 lists the WQS numeric and narrative criteria for all parameters sampled by GTB. For parameters without current Michigan WQS, USEPA ecoregion, and nationally recognized reference conditions shown in Table 7 were used to assess goal attainment status.

Table 6. Michigan Water Quality Standards for parameters sampled by GTB

Parameter	WQS Rule No.	Value
pH	53	6.5 – 9.0
Dissolved Oxygen	64 & 65	Coldwater fisheries must be 7.0 mg/L or above Warmwater fisheries must be 5.0 mg/L or above
Water Temperature	69–75	Warmwater fisheries – for north of a line between Bay City, Midland, Alma, and North Muskegon monthly maximum temps.
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 38 38 41 56 70 80 83 81 74 64 49 39
		Coldwater fisheries monthly maximum temps.
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 38 38 43 54 65 68 68 68 63 56 48 40
		Lake Michigan north of a line due west from the city of Pentwater monthly maximum temps.
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 40 40 40 50 55 70 75 75 75 65 60 45
		Inland Lake monthly maximum temps.
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 45 45 50 60 70 75 80 85 80 70 60 50
Turbidity	50	No numeric value – narrative

Parameter	WQS Rule No.	Value			
Specific Conductivity	51	Specific Conductivity- No numeric value – no narrative			
<i>E. coli</i>	62	Total body contact requires 130 <i>E. coli</i> /100 mL as a 30 day mL geometric mean* and never over 300 <i>E. coli</i> /100 mL at any one time. Partial body contact is 1000 <i>E. coli</i> /100			
Chlorophyll- <i>a</i>	60	No numeric value - narrative			
Total phosphorus	60	At point source dischargers, 1.0 mg/L of total phosphorus as a monthly average			
Total nitrogen	60	No numeric value - narrative			
Mercury	57	HNV	Wildlife	AMV	FCV
		0.0018 µg/L	0.0013 µg/L	1.4 µg/L	0.77 µg/L

Notes: HNV= Human Noncancer Value for drinking and non-drinking water, Wildlife=Water quality value for protection of wildlife, AMV=Aquatic Maximum Values for protection of aquatic life, FCV=Final Chronic Value for protection of aquatic life

Table 7. Proposed Reference Conditions for Parameters with no current Michigan Water Quality Standards

Parameter	Reference	Value
Chlorophyll- <i>a</i>	USEPA Nutrient Ecoregion Reference Conditions (Ecoregion 51)	River: F* - 1.03 µg/L S* - 8.76 µg/L Lake: F* - 2.02 µg/L S* - 5.0 µg/L T* - 5.51 µg/L
Specific Conductivity	USEPA Freshwater (USEPA 2012)	River: 0.15 and 0.5 mS/cm
Total phosphorus	USEPA Nutrient Ecoregion Reference Conditions (Ecoregion 51)	River: 28.75 µg/L Lake: 20 µg/L
NO ₂ NO ₃	USEPA Nutrient Ecoregion Reference Conditions (Ecoregion 51)	River: 0.13 mg/L Lake: 0.008 mg/L
Total nitrogen	USEPA Nutrient Ecoregion Reference Conditions (Ecoregion 51)	River: 0.46 ¹ to 0.71 ² mg/L Lake: 0.66 ¹ to 0.81 ² mg/L
Turbidity	USEPA Nutrient Ecoregion Reference Conditions (Ecoregion 51)	River:0.84 NTU
Mercury	USDOI 1998. Guidelines for Interpretation of the Biological Effects of Mercury in Biota, Water, and Sediment	Acceptable Background Levels in Sediment: 0.065 mg/kg
		Level of Concern in Sediment: 0.15 mg/kg
		Clapper Rail Protection Threshold: 0.2 mg/kg
		Toxic to Guppies: 0.24 mg/kg

Notes: 1: Reference conditions based on calculated total nitrogen concentrations

2: Reference conditions based on reported total nitrogen concentrations

F: Chlorophyll *a* measured by Fluorometric method with acid correction.

S: Chlorophyll *a* measured by Spectrophotometric method with acid correction.

T: Chlorophyll *a b c* measured by Trichromatic method.

Data Collection Observations and Assumptions

Data from 1999 through 2009 were summarized in GTB's 1999-2009 ten-year summary report (GTB 2009). Data from 2012 were analyzed in GTB 2012 Water Quality Assessment Report (GTB 2013). This Section 319 NPS Assessment Report summarizes these analyses and data from 1999-2012 and takes the analysis one step further to link water quality to potential NPSs of each parameter. In general, GTB found several key water quality issues in the Tribal waters during the 1999-2012 water quality sampling. The known issues are as follows:

- Nutrients and Chlorophyll-*a*: Several sites had nutrient levels and chlorophyll-*a* levels above the recommended state and nutrient ecoregion criteria.
- Turbidity: Turbidity levels at all but a few sampling sites are above the recommended state and nutrient ecoregion criteria.
- Habitat: Two sites had marginally rated habitat in 2012. One site had marginal habitat in 2004 and 2005.
- Sedimentation: GTB and watershed partners have noted that sedimentation from historical logging practices is an issue throughout the GTB six-county service area.
- Bacteria: Levels of *E. coli* above the state water quality standards for recreation have recently been exceeded at two beaches near GTB Tribal lands. GTB partners have noted elevated levels of bacteria in Mitchell Creek (Grand Traverse County).

SECTION 4 – WATERSHED CHARACTERIZATION AND LAND USE SUMMARY

This section characterizes the watersheds in the GTB six-county service area. This section describes land use, ecological conditions, and socioeconomics of the GTB six-county service area. A general summary is provided for the entire the GTB six-county service area, and then individual summaries are provided for each of the six counties. A detailed land use map, pie chart, and table summary are provided for the area within the GTB six-county service area for each county. The land use data, provided by the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), was reclassified into broader categories to aid in analysis.

General Setting

The GTB six-county service area shown in Figure 1 and Figure 3 lies in northern Michigan on the Lower Peninsula. GTB owns 2,598 acres of land in trust and fee in Antrim, Benzie, Charlevoix, Grand Traverse, and Leelanau counties. There are an additional 98,000 acres of land designated as the 1855 reservation and 21,000 acres designated as the 1836 reservation. The 1855 Reservation was reserved for GTB when they ceded other areas of the state to the U.S. government in 1855. The 1855 Reservation includes most of Leelanau County and a large tract of land in western Antrim County. The 1836 Treaty guaranteed rights for the signatory tribes to hunt, fish, and trap among other usual privileges of occupancy on lands within the ceded territory that are not needed for settlement. Table 8 details Tribal land ownership within the GTB six-county service area boundaries. Table 9 lists the communities within the GTB six-county service area boundaries and identifies locations with Tribal parcels. Table 10 details Tribal parcel ownership within current 319 boundaries. The 319 parcels make up 1,386 acres of the Tribe's 2,598 owned acres, 1,094 of these acres are currently in trust.

Table 8. Six-County Service Area Land Ownership

Six-county service area parcels	
Holding	Acres
Trust and Fee	2,598
Currently in Trust	1,200
1855 Reservation	98,687
1836 Reservation	21,429

Table 9. Townships, Cities, Villages, and Census Designated Places in the GTB Six-County Service Area

County	Communities	GTB Parcels within Community Boundaries	GTB boundary community lies within
Antrim County	Acme Twp.	N/A	SCSA
	Central Lake Twp.	N/A	SCSA
	Chestonia Twp.	73*	SCSA
	Custer Twp.	N/A	SCSA
	Echo Twp.	N/A	SCSA
	Elk Rapids Twp.	N/A	1855
	Helena Twp.	11, 12	SCSA
	Jordan Twp.	30	SCSA
	Milton Twp.	45, 68	1855
	Warner Twp.	N/A	SCSA
	White Water Twp.	N/A	SCSA
	Village of Bellaire	N/A	SCSA
	Village of Central Lake	N/A	SCSA
	Village of Elk Rapids	N/A	SCSA
	Village of Ellsworth	N/A	SCSA
Village of Mancelona	N/A	SCSA	
Benzie County	City of Frankfort	N/A	SCSA
	Benzonia Twp.	24	SCSA
	Blaine Twp.	N/A	SCSA
	Inland Twp.	N/A	SCSA
	Joyfield Twp.	50	SCSA
	Platte Twp.	N/A	SCSA
	Village of Benzonia	N/A	SCSA
	Village of Beulah	N/A	SCSA
	Village of Elberta	33	SCSA
	Village of Honor	N/A	SCSA
	Village of Lake Ann	N/A	SCSA
	Village of Thompsonville	59	SCSA
Charlevoix County	City of Boyne City	N/A	SCSA
	City of Charlevoix	N/A	SCSA
	City of East Jordan	N/A	SCSA
	Banks Twp.	N/A	SCSA
	Eveline Twp.	23, 28, 48	SCSA
	Norwood Twp.	83*	SCSA
	Peaine Twp.	62	SCSA
	St. James Twp.	55, 70	SCSA
	Village of Boyne Falls	N/A	SCSA
Grand Traverse County	Traverse City	N/A	SCSA
	Acme Twp.	13, 34, 35, 42, 61, 71, 75*, 76*, 80*, 82*	SCSA
	Blair Twp.	N/A	SCSA
	East Bay Twp.	41, 43, 52	SCSA
	Peninsula Twp.	N/A	1836
	White Water Twp.	13, 42, 60, 69, 71, 77*, 78*, 84*	SCSA
	Village of Kingsley	N/A	SCSA
Village of Fife Lake	N/A	SCSA	
Leelanau County	Bingham Twp.	N/A	1855
	Centerville Twp.	N/A	1855
	Cleveland Twp.	N/A	1855
	Elmwood Twp.	38, 66	SCSA

County	Communities	GTB Parcels within Community Boundaries	GTB boundary community lies within
	Empire Twp.	N/A	SCSA
	Kasson Twp.	N/A	SCSA
	Leelanau Twp.	21, 54, 81*	1855
	Leland Twp.	N/A	1855
	Suttons Bay Twp.	Parcels 0-10, 14-22b, 25-29, 31-32, 36, 39-40b, 44, 46, 47, 51, 53, 57, 58, 63, 64, 65, 67, 72, 74*, 79*	1855
	Village of Empire	N/A	1855
	Village of Northport	N/A	1855
	Village of Suttons Bay	N/A	1855
	Greilickville CDP	N/A	SCSA
Manistee County	City of Manistee	N/A	SCSA
	Arcadia Twp.	N/A	SCSA
	Bear Lake Twp.	N/A	SCSA
	Brown Twp.	N/A	SCSA
	Filer Twp.	N/A	SCSA
	Manistee Twp.	N/A	SCSA
	Marilla Twp.	N/A	SCSA
	Onkama Twp.	N/A	SCSA
	Pleasanton Twp.	N/A	SCSA
	Springville Twp.	N/A	SCSA
	Village of Bear Lake	N/A	SCSA
	Village of Copemish	N/A	SCSA
	Village of Eastlake	N/A	SCSA
	Village of Kaleva	N/A	SCSA
	Village of Onkama	N/A	SCSA

Notes: CDP= census designated place, SCSA=GTB six-county service area

This table includes all parcels regardless of trust status (pending, in trust, fee land, GTB trust land)

*This table includes all parcels purchased by the tribe. Those flagged with an * were purchased after October 10, 2001 and are not currently designated for 319 boundaries.

Table 10. GTB 319 Parcel Descriptions

County	HUC 12	Parcels	Parcel Description	Trust Status
Antrim	040601050305	11	40 acres - Alden Camp (kids summer camp)	C
		12	27 acres - rental house	C
		45	70 acres - play area, basketball court, soccer field, baseball field, community garden going in, housing/subdivision on individual septic systems and drain field systems	C
	040601050405	68	0.72 acres GTB community park (pavilion, sheds, beach)	A
	040601050202	30	4.5 acres - empty parcel (had a trailer on it in the past)	A
Benzie	040601040306	24	79.5 acres - housing, pow wow center, community center (30 acres)	C
		50	22 acres - storage building and land	A
	040601040307	33	6.64 acres - vacant frontage	L
	040601040304	59	0.95 acres - vacant residential lot	A
Charlevoix	N/A	55	0.75 acres - dock, marina building	A

County	HUC 12	Parcels	Parcel Description	Trust Status
	N/A	62	34.25 acres - vacant (woods, field)	A
	N/A	70	0.04 acres – strip of land next to the marina and docks	A
	040601050206	23	77.10 acres - housing subdivision, community service center	C
		28	2.90 acres - house	A
48		80 acres - barns, farm land	A	
Grand Traverse	040601050706	52	0.63 acres - rental house, beach front	N/A
	040601050706 and 040601050705	43	4.0 acres - Vacant Beach Front	N/A
	040601050705	41	1.15 acres - Grand Traverse County Office - 3 Mile Office	N/A
		Education Dept.	Education Department	C
	040601050703	13	27.40 acres - Turtle Creek Casino and Hotel	C
		34	38.48 acres - Turtle Creek (West of casino)	C
		35	1.6 acres - Turtle Creek entrance	A
		42	46.83 acres - Turtle Creek SBR Plant	C
		60	21.14 acres - Turtle Creek Old M-72	C
		61	38.50 acres - Turtle Creek (west of casino)	C
		69	0.19 acres- Vacant woods/lot	C
	71	28.31 acres- Abandoned house/barn/woods/field/creek	A	
	Leelanau	040601050707	38	15.55 acres - vacant woods and open space (field)
66			1.50 acres- vacant woods/lot (used to have a trailer)	A
040601040401		54	12.95 acres- House/trailer/overgrown field	A
040601050708		0	12.50 acres - casino to administration buildings and elders park	C
		1	147.50 acres - multiple parcels: elders complex (residential), SBR plant, casino, GTB marina	C
		2	2.46 acres -Old school property. Vacant woods/shrub covered/lakeshore	C
		3	2.94 acres- vacant woods	A
		4	3.79 acres - EDC building and small parcel across from M-22	C
		5	0.49 acres - GTB museum parking lot	C
		6	10.0 acres - rental houses	C
		7	84.0 acres - rental houses	C
		8	10.0 acres - rental houses	C
		9	1.37 acres - Natural Resources Department building	P
		10	0.73 acres- vacant woods/lakeshore	C
		14	22.0 acres - solar housing	C
		15	4.08 acres - duplex housing	C
		16	36.0 acres-behind LS Casino, Eagle's Ridge Conference Center located on a hill off Highway M-22.	P
		17	0.64 acres- vacant woods/lakeshore	P
		18	10.50 acres - Youth Services building	P
		19	8.67 acres - parking lot	C

County	HUC 12	Parcels	Parcel Description	Trust Status
		20	6.0 acres-across from LS Casino, This parcel is the former railroad bed area and a surface runoff retention pond for the Leelanau Sands Casino parking lots was built here. There are trees, shrubs, and grasses.	C
		21	22.5 acres - railroad corridor	C
		22a	0.5 acres - EDC Chalet (rental property)	P
		22b	0.5 acres - Residential house	P
		25	13.0 acres - housing subdivision	C
		26a	148.5 acres - Strongheart Center, Medicine Lodge, Daycare Center, Life Long Learning	P
		26b	22 acres - Empty subdivision/woods	P
		27	10.0 acres - vacant woods/open-semi open space	C
		29	1.10 acres - rental houses	C
		31	0.5 acres - Eagletown Market (gas station)	C
		32	0.5 acres - vacant woods/shrub covered/lakeshore	C
		36	38.7 acres - vacant woods/open space	C
		39	0.92 acres - GTB museum	C
		40a	13 acres - duplex rentals	C
		40b	5 acres - water tower	C
		44	10.81 acres - rental house	C
		46	0.97 acres - vacant woods/shrub covered	C
		47	1.0 acres - vacant woods/shrub covered	C
		51	0.57 acres - vacant woods	C
		53	0.53 acres - EDC Chalet (rental property)	C
		57	5.41 acres - Vacant lot/old farm field/underbrush	C
		58	7.01 acres - Formerly a single family structure removed	C
		63	1.1 acres - vacant woods/open space (formerly had a house on it)	C
		64	2.68 acres - rental house	C
		65	3.24 acres - rental house	C
		67	0.56 acres - Vacant woods	C
		72	27.78 acres - Vacant woods/old field	C

Notes: EDC= Economic Development Corporation, SBR= sequencing batch reactor, C = currently in trust, P = pending trust status, L = GTB Land Trust, A = GTB intends to apply for trust status

Land Use/Land Base

Land cover in the GTB six-county service area is primarily forest (about 50 percent). Eleven percent of the GTB six-county service area is wetlands and 14 percent is shrubs, pasture, grassland, or fallow croplands. Croplands make up 10 percent of the land cover. Orchard crops are 3.5 percent of the crops and are centered in Leelanau, Grand Traverse, and Antrim Counties around Grand Traverse Bay. Developed areas make up just over 8 percent of the land cover. Urban development is concentrated around Traverse City, Peshawbestown, Suttons Bay, Frankfort, Charlevoix, and Manistee. Inland lakes and open water make up just over 6 percent of the land cover. Figure 3 shows the land cover types on the GTB six-county service area.

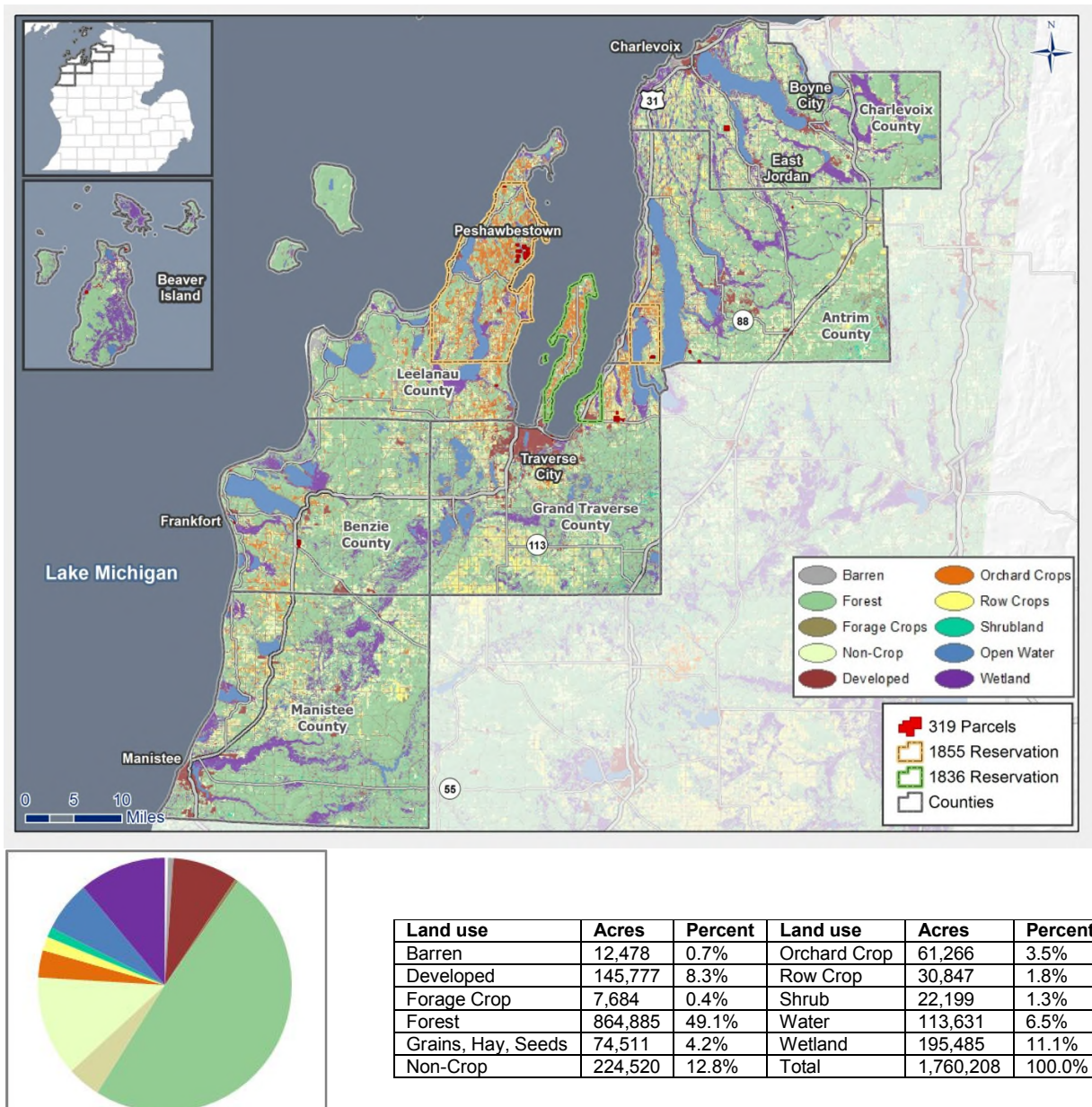


Figure 3. Land Use on the GTB six-county service area (NASS 2012 Crop Data Layer)

Ecoregions, Climate, Topography, Geology, Soils, and Hydrology

Nutrient and Level III Ecoregions for the National Nutrient Strategy

The state of Michigan does not currently have numeric nutrient criteria for surface waters. This document uses the USEPA recommended nutrient and turbidity criteria based on nationally available data nutrient ecoregions. Figure 4 displays the level III ecoregions that fall within the GTB six-county service area boundaries. The majority of the GTB six-county service area is in nutrient ecoregions VII and VIII. GTB sampling sites all lie within level III ecoregion 51. The rest of the GTB six-county service area lies in level III ecoregion 50. Characteristics of each of the level III and nutrient ecoregions in the GTB six-county service area are discussed briefly below (USEPA 2001a-c).

Nutrient Ecoregion VII - Mostly Glaciated Dairy Region

The north western portion of the GTB six-county service area lies in the Mostly Glaciated Dairy Region (VII). This ecoregion has a mix of nutrient-rich and nutrient-poor soils as opposed to the relatively thin, nutrient-poor soils of Region VIII and the south eastern portion of the GTB six-county service area.

Median total phosphorus concentration in the many ecoregion VII lakes are less than half of Region VI's and about twice that of Region VIII's median concentrations. Nutrient concentrations from NPSs are usually above the levels found in ecoregion VIII but below those measured in the Corn Belt and Northern Great Plains ecoregion VI. Livestock, cropland, and urban areas contribute bacteria and nutrients to the ecoregions streams. Surface waters are transitional between the ecoregions to the north and south and have been affected by land use (USEPA 2001c).

51. North Central Hardwood Forests

The North Central Hardwood Forests is a transitional ecoregion between the mostly forested ecoregions to the north and the agricultural ecoregions to the south. The regions potential nutrient NPSs include: cropland agriculture, pasture, and dairy operations (USEPA 2001c).

Nutrient Ecoregion VIII - Nutrient Poor Largely Glaciated Upper Midwest and Northeast

The south western portion of the GTB six-county service area lies in the Nutrient Poor Largely Glaciated Upper Midwest and Northeast (VIII). The ecoregion is mostly forested and has nutrient-poor soils with limited cropland. The ecoregion has many surface waters and marshes and swamps. Bacteria and nutrients in this ecoregions surface waters are typically much lower than in nearby developed ecoregions. Most water quality issues in this ecoregion stem from acid rain, logging, recreational use of lakes, and improperly functioning septic systems. The areas glacial lakes are susceptible to acid rain from upwind industrialized areas which can threaten fish survival (USEPA 2001a).

50. Northern Lakes and Forests

The Northern Lakes and Forests ecoregion has nutrient poor glacial soils. Soils in this ecoregion lack arability of the soils to the south and are thicker than soils to the north. The many lakes in the Northern Lakes and Forests ecoregion are clearer and less production than lakes to the south (USEPA 2001a).

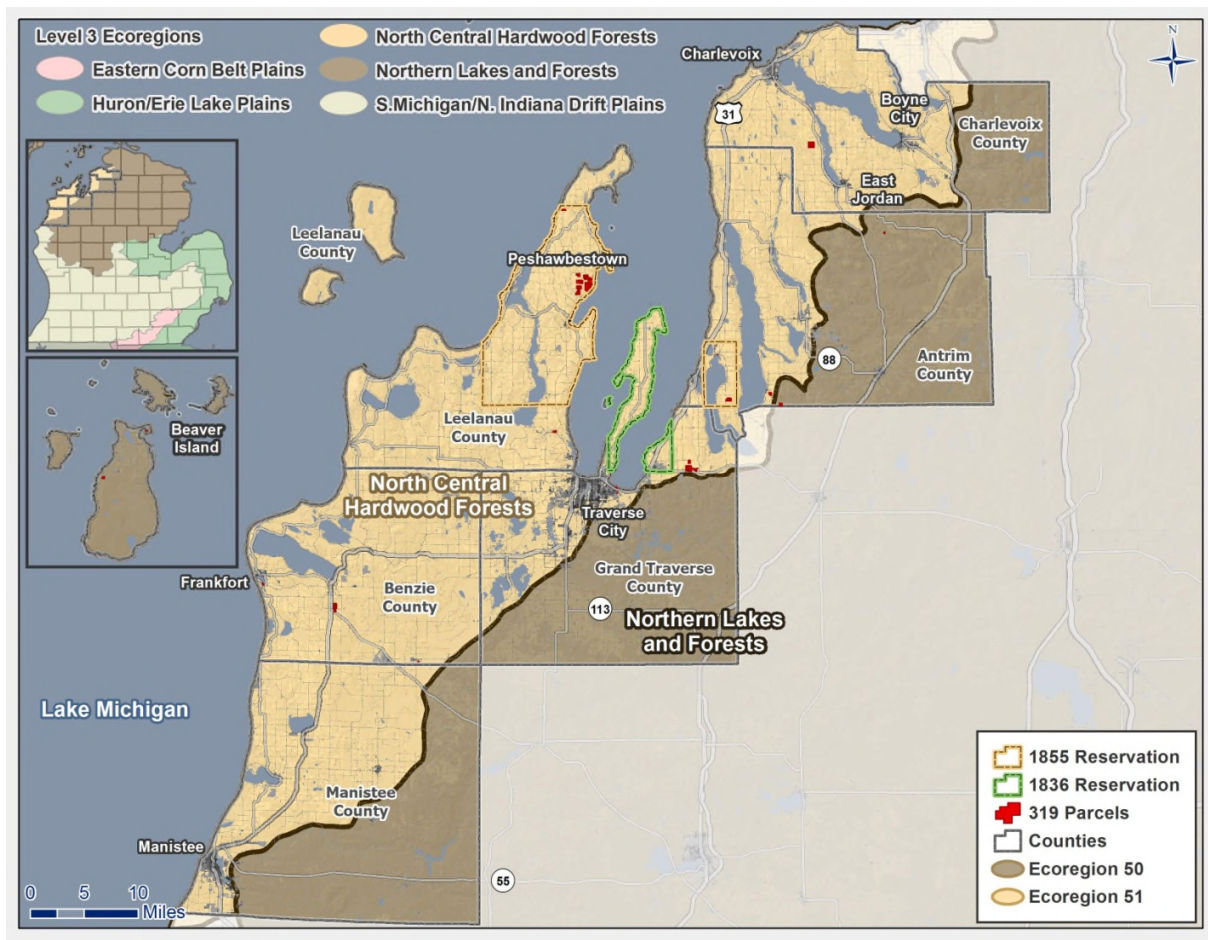


Figure 4. Level III Ecoregions of the GTB six-county service area

Topography

The GTB six-county service area generally grades from the south eastern corners of the counties north and westward into Lake Michigan, as shown in Figure 5. The highest elevation, at 472 meters (1,548 feet), occurs in the southeastern corner of Charlevoix County while the lowest elevation, at 176 meters (577 feet), occurs along the shores of Lake Michigan. Beaver Island grades from 243 meters (797 feet) to 176 meters (577 feet) over a distance of approximately 3 to 5 miles.

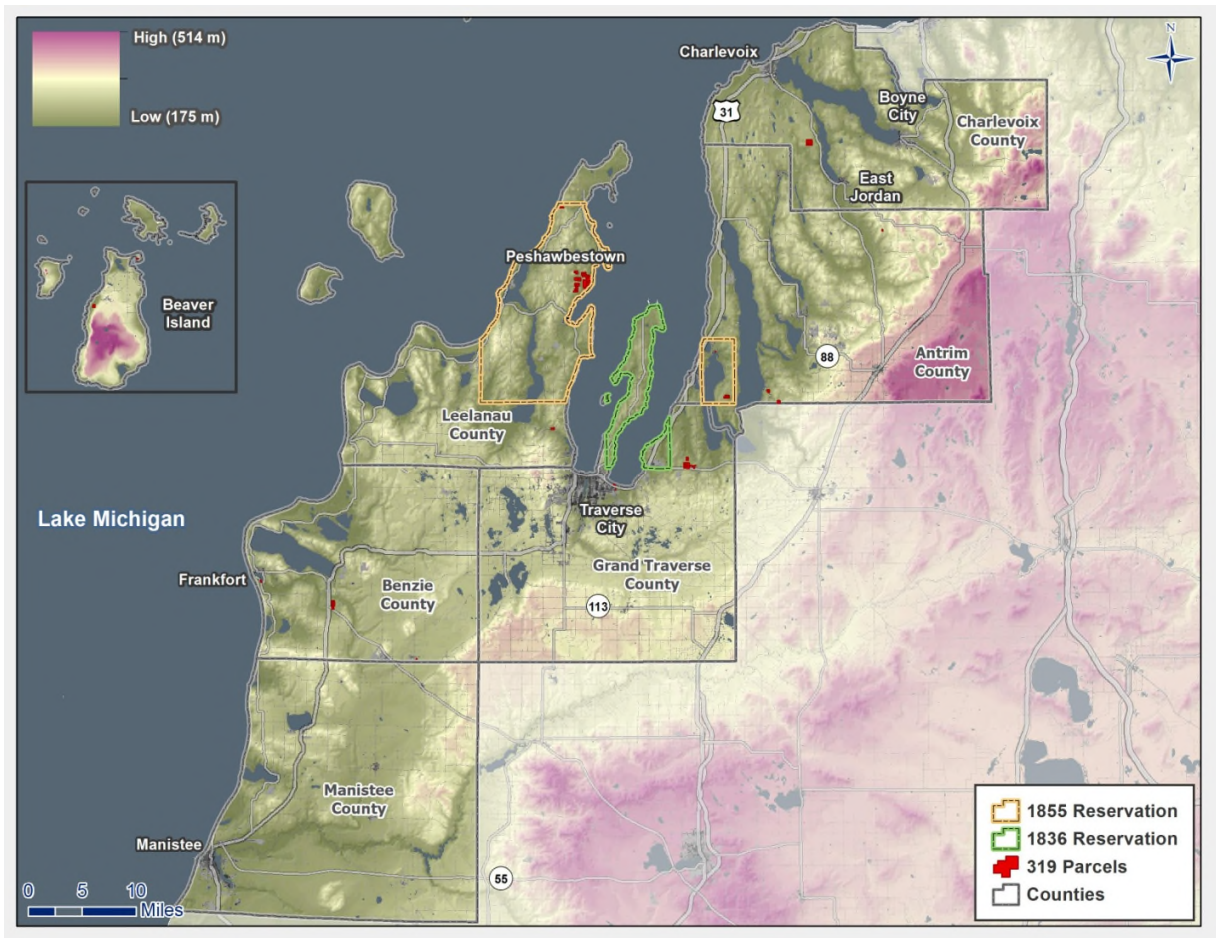


Figure 5. Topography on the GTB six-county service area

Climate

Table 11 contains historic temperature and precipitation data collected at Traverse City Cherry Capital Airport station from 1981 to 2010 at the National Climate Data Center (NCDC) station 14850, as seen in Figure 6. Total annual rainfall is approximately 33.1 inches. Total annual snowfall averages 101.4 inches. Monthly temperature, precipitation, and snowfall are shown in Figure 7.

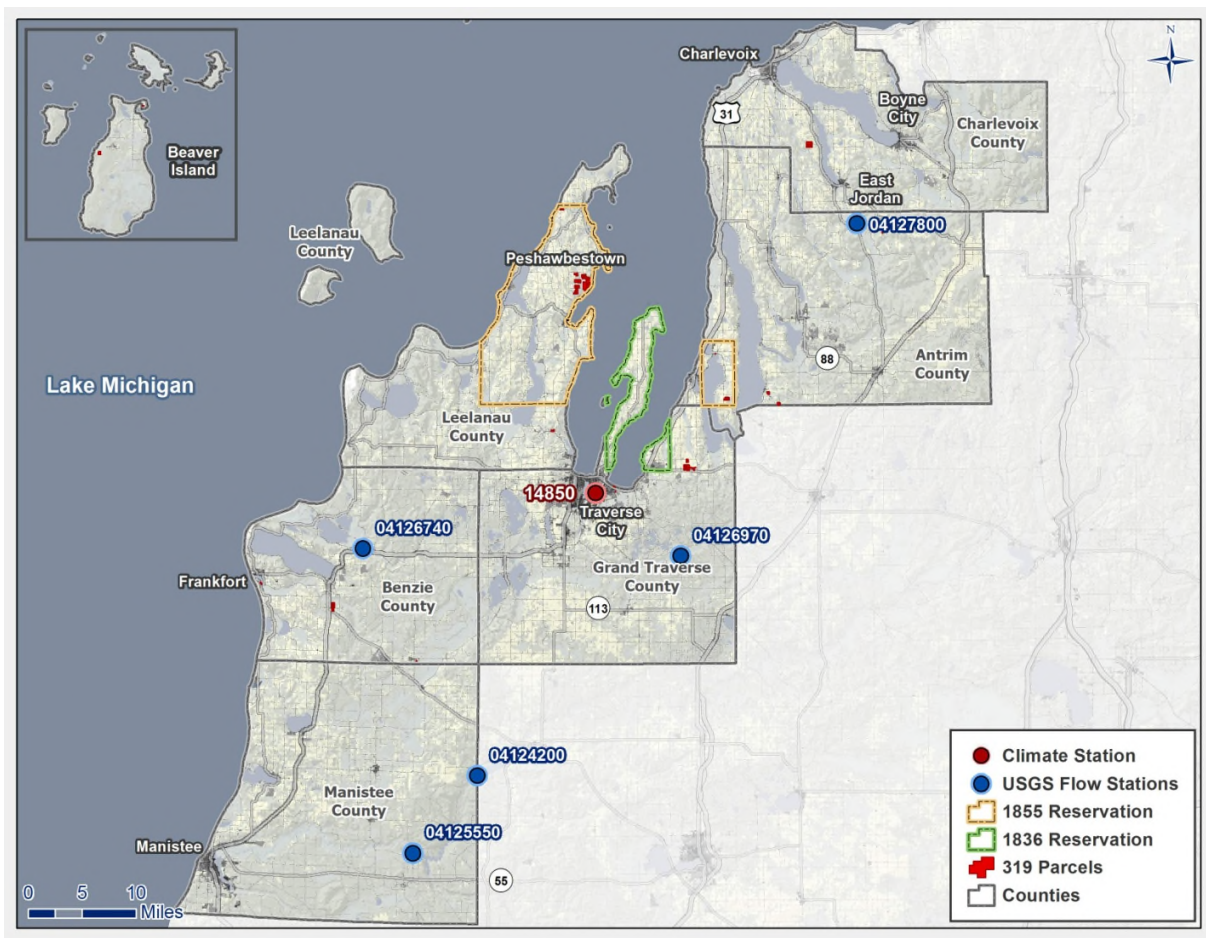


Figure 6. Climate and USGS flow gage location

Examination of precipitation patterns is a key part of watershed characterization. Precipitation events drive runoff from NPS areas to surface waters. Weather data collected between 1981 and 2010 from the Traverse City Cherry Capital Airport weather station show that average monthly precipitation ranged from 1.5 inches to 3.5 inches. Snowfall ranged from 0.1 inches to 33.2 inches during months with snowfall. Average monthly low temperatures ranged from 15 degrees to 57.8 degrees Fahrenheit. Average monthly high temperatures ranged from 27.8 degrees to 80.2 degrees Fahrenheit.

Table 11. Climate Data Summary for Traverse City Cherry Capital Airport.

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp	27.8	30.4	39.9	53.8	65.8	75.6	80.2	77.9	70.0	57.2	44.1	32.3
Low Temp	15.2	15.0	21.6	32.1	41.5	52.3	57.8	56.9	49.7	39.2	30.4	21.0
Precipitation	2.8	1.5	1.9	2.8	2.6	3.2	3.0	3.4	3.5	3.2	2.7	2.5
Snowfall	33.2	18.9	10.7	2.6	0.1	0.0	0.0	0.0	0.0	0.2	9.0	26.7

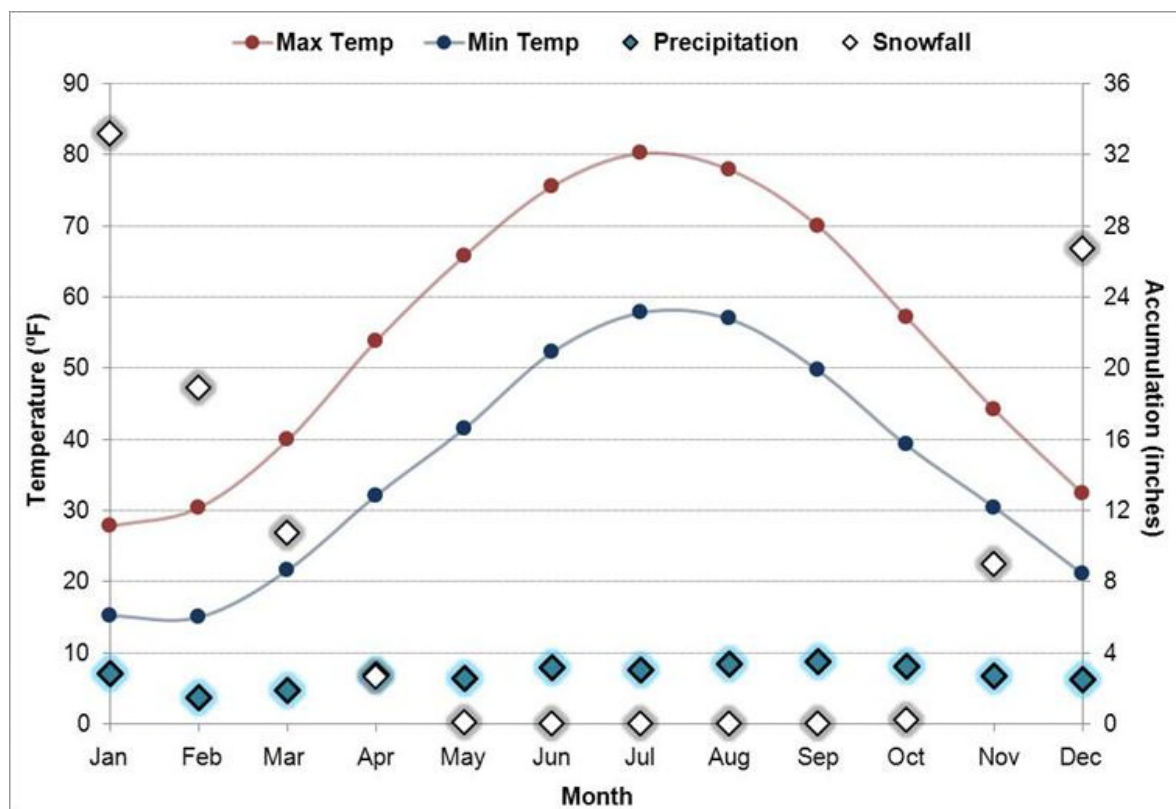


Figure 7. Temperature and precipitation summary – Traverse City Cherry Capital Airport.

Geology

Four predominant bedrock layers underlie the GTB six-county service area (Figure 8): Traverse Group, Antrim Shale, Ellsworth Shale, and Coldwater Shale. The Traverse Group is composed of the Traverse Formation overlapping the Detroit River Formation. The Traverse Formation consists of a variety of limestones, some dolomite, and thin shale beds. The Detroit River Formation is composed of dolomite, limestone, and evaporite rocks. The major component of this group is sedimentary limestone, while the minor component is sedimentary shale. The Antrim Shale, which overlies the Traverse Formation, is predominantly brownish-black shale; however, in some places medium-gray calcareous shale or limestone is in the lower part of the unit. Ellsworth Shale is predominantly a silty shale. Siltstone and sandstone are its minor components. Coldwater Shale consists predominantly of gray to bluish gray shale. Its clay minerals are chiefly illite and kaolinite with minor chlorite. Other lithologies occur in the Coldwater and their distributions divide the formation into distinct eastern and western facies. In the eastern half of the basin, beds of silty and sandy shale, siltstone and fine-grained sandstone are common. In the western half of the basin the Coldwater shales are more calcareous and beds of glauconitic, fossiliferous limestone and dolostone occur frequently, especially in the middle and upper portions of the formation (USGS 2012).

Five major quaternary layers make up the surficial geology of the GTB six-county service area (Figure 9): coarse textured glacial till, dune sand, lacustrine sand and gravel, glacial outwash sand and gravel and postglacial alluvium, and end moraines of coarse-textured till. The quaternary geology of the service area is typical of the Great Lakes region.

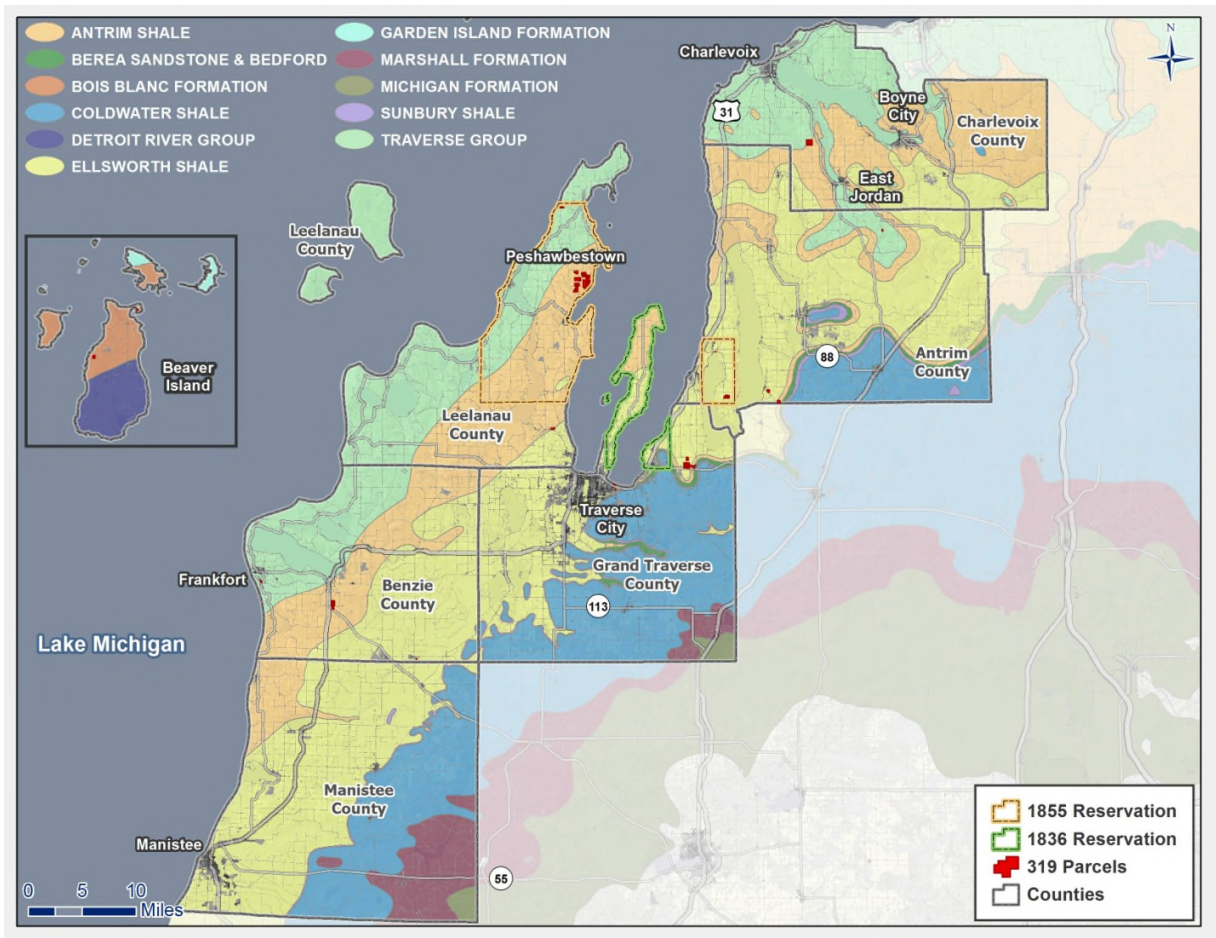


Figure 8. Bedrock geology on the GTB six-county service area

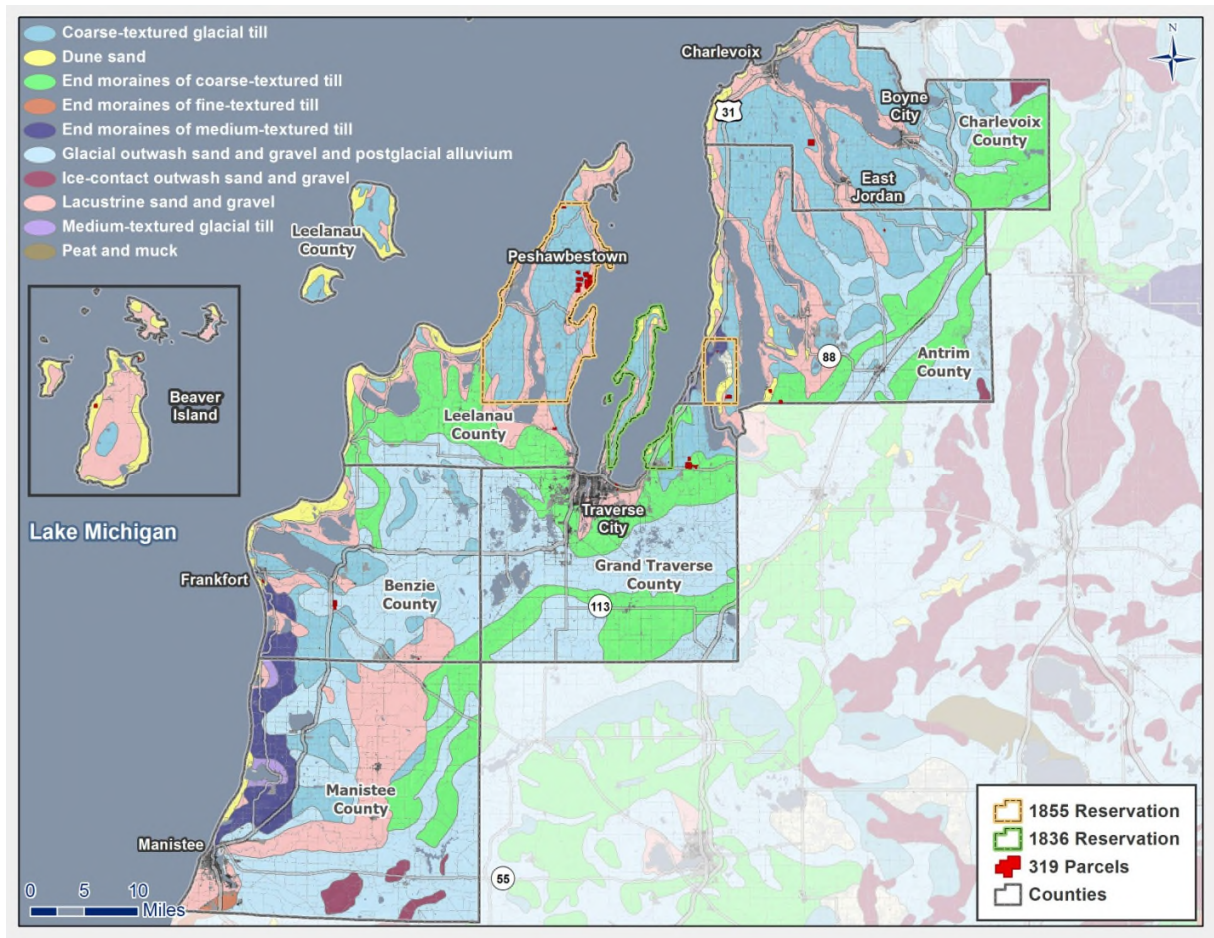


Figure 9. Quaternary geology on the GTB six-county service area.

Soils

The majority of the soils throughout the five counties with GTB parcels consist of Emmet/Omena Association and Leelanau-Mancelona Association. These soils are well drained, nearly level to very steep in slope, with sandy and loamy soils on moraines. The soils are well suited for orchards and cultivated crops with limitations due to surface slope. Steeper sloping areas are susceptible to severe erosional problems if vegetation is disturbed. Steep slopes in the area promote excess runoff during precipitation events and spring melt. The high permeability of the soils promotes infiltration and limits runoff in gently sloping areas (NRCS 2013).

The Peshawbestown area of the GTB six-county service area is part of a physiographic region consisting mainly of glacial till materials. The assessment area is characterized by numerous parallel ridges, known as drumlins, orientated from northwest to southeast and separated by deep V-shaped valleys. Tribal wetlands are typically located in the valleys and along shoreline areas.

The Grand Traverse Bay shoreline region of Peshawbestown consists of Detour Sandy Loam and Lupan-Markey Mucks. Surface runoff can be very slow creating water table fluctuations from 0 inches to 12 inches below ground surface. Low percolation rates and low strength are characteristics of these soil types making these areas poorly suited for septic systems, development, and roads.

The Leelanau County GTB properties are composed of three soil groups: Mancelona-East Lake loamy sand, Emmet-Omena sandy loams, and Leelanau-East Lake loamy sand. The Mancelona-East Lake loamy sands consist of nearly level to gently sloping soils on outwash plains, valley trains, colluvial slopes below steep moraines, and lake terraces. The Emmet-Omena sand loams consist of gently sloping soils

on ridgetops, shelves of drumlins, and on moraines. The Leelanau-East Lake loamy sands consist of moderately steep to very steep soils on moraines.

The Grand Traverse County GTB properties soils are composed of Emmet sandy loam, are nearly level to gently sloping, and have been cleared and farmed over the years.

The Antrim County GTB properties are composed of two soil groups: the Kalkaska-Montcalm soils and Emmet-Montcalm soils. The Kalkaska series consists of excessively drained, rapidly permeable soils on outwash plains, moraines, and old beach ridges. The Emmet series consists of well drained and moderately well drained, moderately permeable soils in glacial till uplands.

The Benzie County GTB property soils consist of flat sandy soil similar to the Kalkaska soils. The United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) has documented a sandy loam layer occurring every 3 inches to 4 inches below ground surface in Benzie County.

The Charlevoix County GTB property soils are composed of Emmet-Onaway sandy loams. These soils are on low knolls, ridges, and foot slopes of the uplands. The soils are used mainly for general crop production, and surface runoff is slow to medium. Controlling water erosion is the main concern with the soils in Charlevoix County.

Manistee County, south of the Manistee River, is covered by nearly level and gently rolling, sandy outwash plains with a few gently rolling to hilly, sandy morainic deposits. The nearly level to steep Port Huron Moraine dominates the eastern part of the county, while a nearly level lake plain extends through the center. Some areas are partially covered by rolling dune formations or beach ridges. The western part of county is covered by a mixture of gently rolling to steep, sandy moraines and nearly level and gently rolling, fine and coarse textured till plains. Some areas are covered by nearly level to gently rolling, sandy outwash plains and lake plains (NRCS 2013).

Hydrology and Water Use

The hydrology of the GTB six-county service area has been altered over time for anthropogenic uses. Dams have been built and removed, wetlands have been filled, streams have been channelized, and logging has disturbed the historical levels of sand in the areas waters. Local hydrology in the GTB six-county service area is impacted by storm water management, public water supply use, and wastewater treatment.

GTB has established retention ponds on its land to contain Tribal stormwater runoff. Storm sewers are in place in the large paved parking lots for the casino, conference center, and medicine lodge which drain to retention ponds just off site. These retention ponds receive typical urban runoff which may contain automobile fluids and road salt which may adversely impact Tribal surface water and groundwater.

GTB operates both a public water supply system and public wastewater treatment system in Peshawbestown. The public water system is supplied with groundwater obtained from three wells located west of the main housing area on McKeese Road. There are currently 154 service connections to the system.

The public wastewater treatment system consists of a 0.12 million gallons per day (mgd) sequencing batch reactor (SBR) system with a tertiary filter followed by ultra-violet disinfection. Solids from the SBR unit are transferred to two aerobic digesters and the sludge from the digesters is then applied by a private contractor to farmland outside of the 1855 reservation.

Approximately 95 residences and 23 commercial buildings are connected to the SBR system. Fifty-six of the residential connections and four commercial structures have septic tank pretreatment systems with the sewage entering the treatment plant as pretreated effluent. The effluent passes through the treatment plant and the treated water is continuously discharged into West Grand Traverse Bay. Approximately

55,000 gallons of sewage pass through the SBR plant daily. The effluent discharge is regulated by the USEPA's National Pollution Discharge Elimination System (NPDES) program, Permit No. MI-0054640-3.

Approximately 30 residences and facilities in the GTB six-county service area remain on private wastewater treatment systems. Performance of some of the on-site private wastewater treatment systems has been poor in the past, with documented system failure and groundwater contamination. Those households were connected to the public system. The Tribe will eventually connect all Tribal homes and administration buildings, in the Peshawbestown area, to the public wastewater treatment system.

The Turtle Creek Casino (TCC) currently has a 0.12 MGD SBR plant with a tertiary filter that discharges to groundwater. No disinfection is required. The drain field is located approximately 400 feet north of the TCC and is approximately 1 acre in size. This SBR treatment plant serves only the TCC and hotel. Solids from the SBR unit are transferred to two aerobic digesters and the bio-solids from the digesters are then applied by a private contractor to farmland on private property.

The wastewater treatment plant serving the TCC is not regulated by the NPDES as it discharges to groundwater. Although the Turtle Creek wastewater treatment plant does not have an NPDES permit, GTB follows all State of Michigan guidelines for testing. Currently the Turtle Creek SBR is treating and discharging approximately 45,000 gallons per day. At this time this SBR does not have plans to connect any additional customers to the Turtle Creek SBR system, but it has that capacity for future development at the TCC site.

Socioeconomic Conditions

The Tribe consists of approximately 4,200 members with approximately 1,700 members living in the GTB six-county service area. About 2,598 acres of allotted land remains in trust or fee status (82 allotments) within the GTB six-county service area boundaries. The largest community near the Tribe is Traverse City, which is located southeast of the Tribal center with a population of 14,894.

Under the Indian Reorganization Act, GTB developed Tribal programs to serve its membership. In 1983, GTB established an Economic Development Corporation and began to establish businesses for the Tribe. GTB owns the Turtle Creek and Leelanau Sand casinos and manages the Turtle Creek Hotel and Eagle Town Market. The majority of the Tribal income is generated at the Turtle Creek Casino, the Leelanau Sands Casino, and the Grand Traverse Resort and Golf Course. Commercial and subsistence fishing are prevalent in the community as well.

Individual County and Parcel Summaries

This section provides a detailed land use summary for the individual counties in the GTB six-county service area. A summary of the land use and major characteristics is provided with a map and table of land use for each county. The individual tables and pie charts demonstrate the predominant land uses in each county listed below:

Antrim County

8-digit HUC 04060103

- 040601030101
- 040601030102
- 040601030103
- 040601030106

8-digit HUC 04060105

- 040601050201
- 040601050202
- 040601050204
- 040601050205
- 040601050206
- 040601050301
- 040601050302
- 040601050303
- 040601050304
- 040601050305
- 040601050401
- 040601050402
- 040601050404
- 040601050405
- 040601050701
- 040601050702
- 040601050703

Benzie County

8-digit HUC 04060103

- 040601030304
- 040601030501
- 040601030502

8-digit HUC 04060104

- 040601040101
- 040601040202
- 040601040203
- 040601040204
- 040601040205
- 040601040206
- 040601040302
- 040601040303
- 040601040304
- 040601040305
- 040601040306
- 040601040307
- 040601040403
- 040601040404
- 040601040406

Charlevoix County

8-digit HUC 04060105

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- 040601050102
- 040601050103
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- 040601050204
- 040601050205
- 040601050206
- 040601050207
- 040601050301
- 040601050302
- 040601050607
- 040601050701

8-digit HUC 04070004

- 040700040103
- 040700040105
- 040700040201
- 040700040202

Manistee County

8-digit HUC 04060101

- 040601010102
- 040601011001
- 040601011002

8-digit HUC 04060103

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- 040601030309
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8-digit HUC 04060104

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Grand Traverse County

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- 040601050706
- 040601050707

Leelanau County

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- 040601040401
- 040601040402
- 040601040403

8-digit HUC 04060105

- 040601050707
- 040601050708

Antrim County

Antrim County lies south of Charlevoix County and contains the eastern portion of the 1855 reservation boundaries as well as several GTB parcels within the current 319 boundaries. GTB parcels in this county include 40 acres for the Alden summer camp, 27 acres for a rental house, 70 acres for a play area, community garden and housing/subdivision, 0.72 acres for a community park north of Elk Lake, and 4.5 acres of an empty parcel that used to have a trailer. The county also has GTB parcels designated for easement and gas easement that are vacant. GTB samples Elk River, Elk Lake, Elk Rapids, Skegemog Lake, Clam River, and Torch River in this county as seen in Figure 10.

Forests are the primary land cover in Antrim County (49.2). Combined agricultural uses represent 10.0 percent of the landscape, while wetlands and open water comprise another 17.8 percent. Developed surfaces cover 7.4 percent of Antrim County.

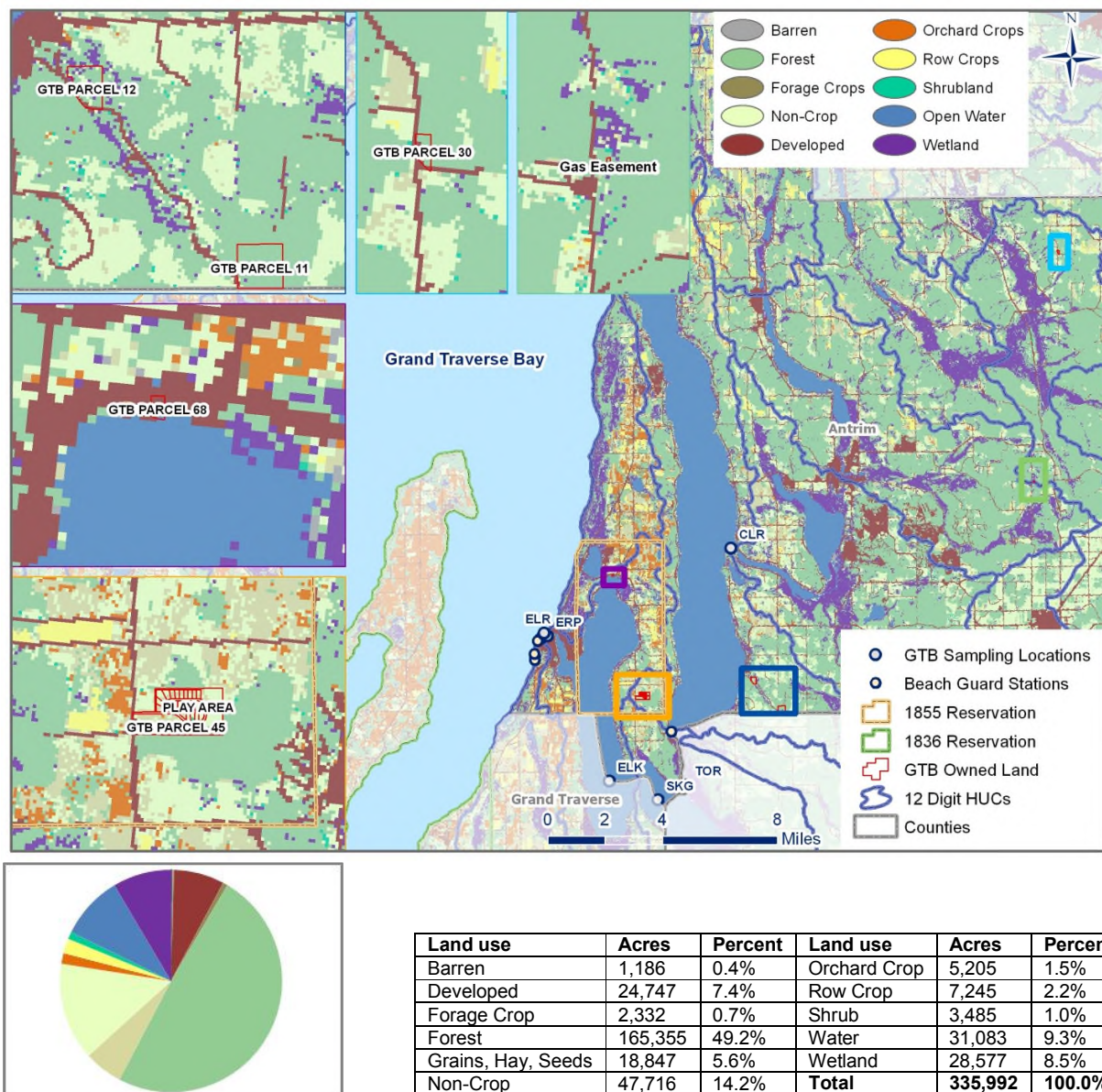


Figure 10. Land Use in Antrim County

Benzie County

Benzie County lies south of Leelanau County and contains several GTB parcels within the Betsie River subwatershed. GTB parcels in this county include a 79.5 acre parcel for housing, a pow wow center and community center. There are two vacant parcels totaling 7.59 acres. A 22 acre parcel for a storage building and land lies just south of a parcel designated for utility easement that is currently vacant. GTB samples Betsie River in this county as seen in Figure 11.

Forests are the primary land cover in Benzie County (56.4 percent). Combined agricultural uses represent only 5.0 percent of the landscape, while wetlands and open water comprise another 17.4 percent. Developed surfaces cover 7.4 percent of Benzie County.

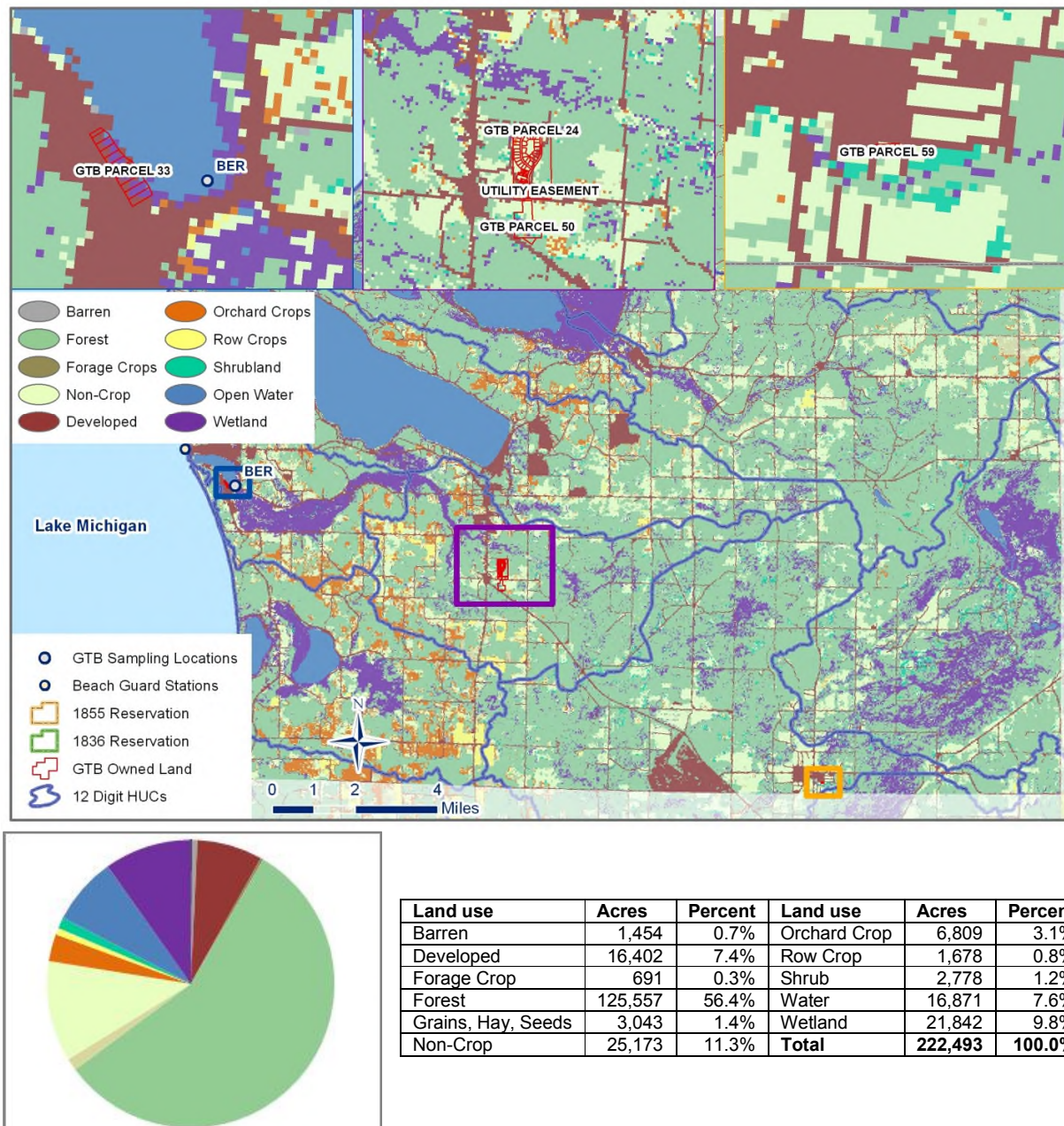


Figure 11. Land Use in Benzie County

Charlevoix County

Charlevoix County lies north of Antrim County and contains GTB parcels on Beaver Island and in the Jordan River subwatershed draining to Lake Charlevoix. GTB parcels in this county include 0.75 acres for a dock and marina building on northeastern Beaver Island, and 34.25 acres of vacant wooded and field covered land on the west side of Beaver Island. There are three parcels south of Lake Charlevoix totaling 160 acres; they include a housing subdivision, a community service center, barns, and farm land. GTB does not currently sample waters in Charlevoix County.

Forests are the primary land cover in Charlevoix County (45.5 percent). Combined agricultural uses represent only 6.0 percent of the landscape, while wetlands and open water comprise another 26.8 percent. Developed surfaces cover 7.3 percent of Charlevoix County as shown in Figure 12.

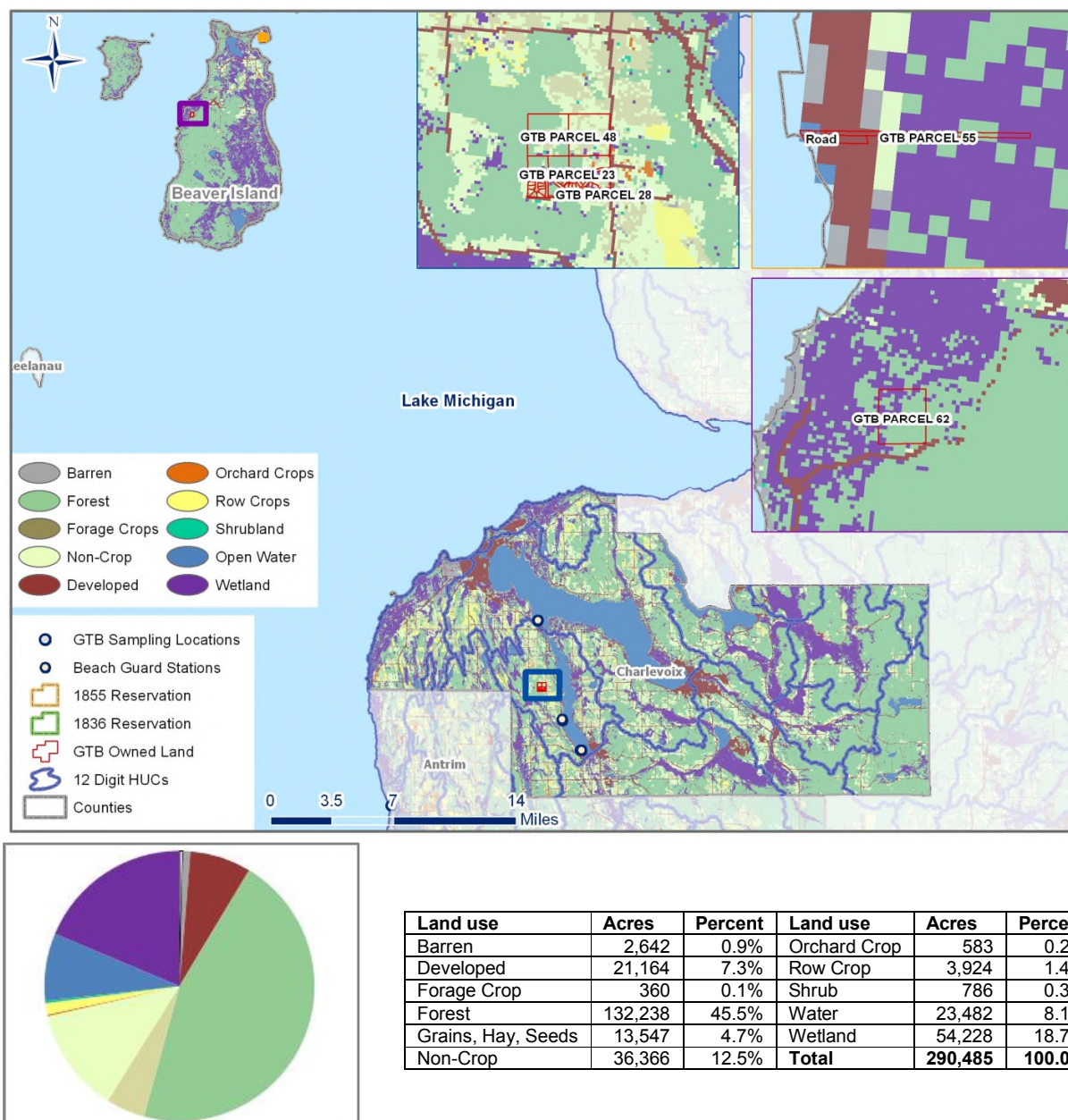


Figure 12. Land Use in Charlevoix County

Grand Traverse County

Grand Traverse County lies between Antrim and Leelanau counties and contains the 1836 reservation boundaries, as well as GTB parcels on Mitchell Creek in Traverse City, and in White Water Township. GTB parcels in this county include 4.63 acres of vacant beachfront property with a rental house. The White Water township parcels (over 200 acres) include the Turtle Creek Casino and hotel as well as the Turtle Creek SBR wastewater treatment plant. GTB samples the Boardman River and Mitchell Creek near their mouths as shown in Figure 13.

Forests are the primary land cover in Grand Traverse County (43.3 percent). Combined agricultural uses represent 15.0 percent of the landscape, while wetlands and open water comprise another 13.7 percent. Developed surfaces cover 12.6 percent of Grand Traverse County and center around Traverse City.

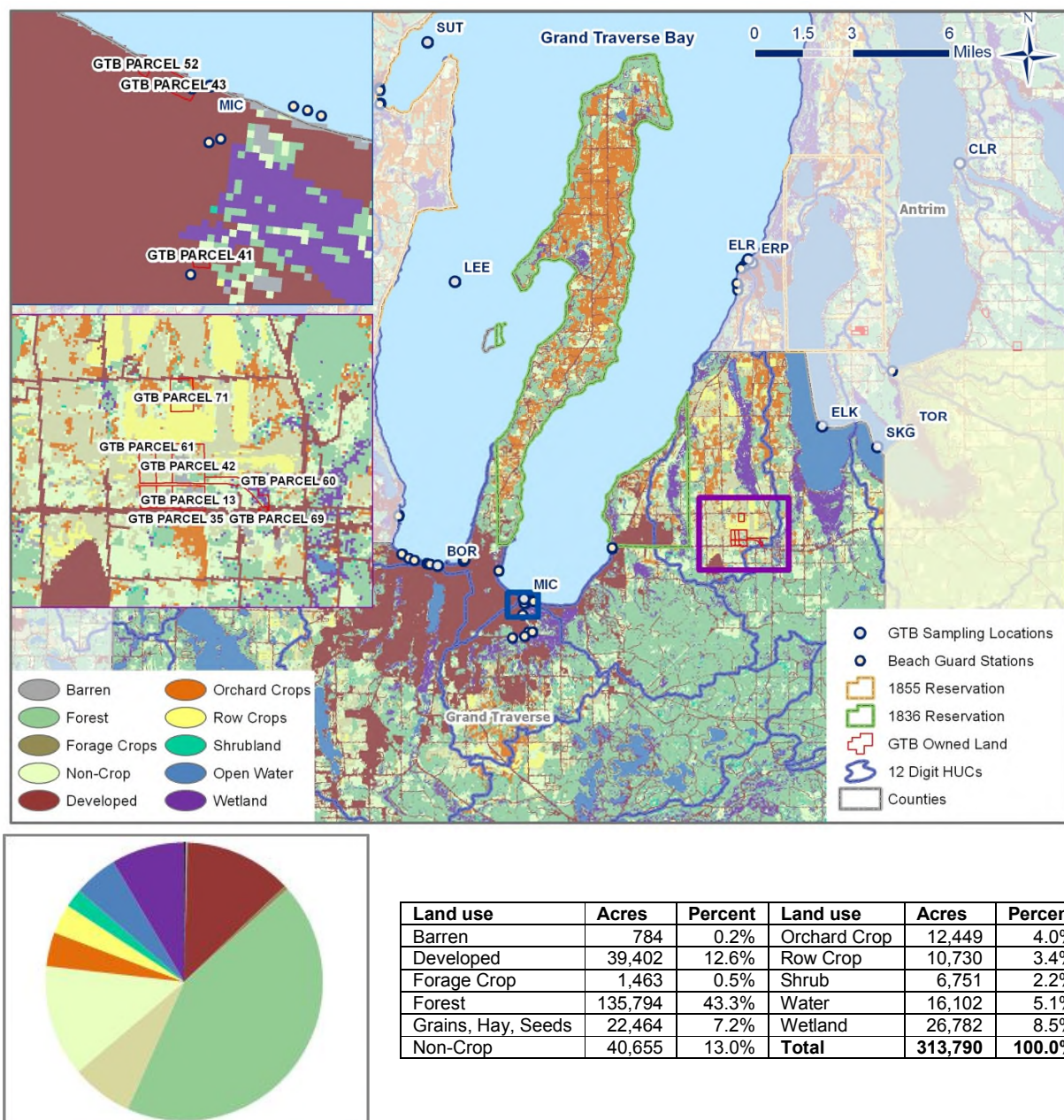


Figure 13. Land Use in Grand Traverse County

Leelanau County

Leelanau County lies north of Benzie County and contains the majority of the 1855 reservation boundaries, as well as GTB parcels in Peshawbestown. GTB parcels in this county include the majority of GTB properties in Peshawbestown. The properties include 52 parcels with a variety of uses. This is the Tribal center and includes many developed properties including: the elders complex, the Strongheart Center, the medicine lodge, the daycare center, the lifelong learning center, the SBR wastewater treatment plant, the casino, the Eagletown Market gas station, GTB museum, rentals and duplex housing, and housing subdivisions. GTB has additional parcels with vacant woods in Elmwood Township. There is parcel in northern Leelanau Township with a house, trailer and overgrown field. In southern Leelanau Township, GTB owns 22.5 acres of railroad corridor. GTB samples several locations in Leelanau County: Belanger Creek, Victoria Creek, Mebert Creek, Leland River, Crystal River, Omena Bay, Suttons Bay, Lee Point, and Lake Michigan north and south of Leland Lake, Northport, and Peshawbestown near shore as shown in Figure 13.

Forests are the primary land cover in Leelanau County (43.9 percent). Combined agricultural uses represent 18.0 percent of the landscape, while wetlands and open water comprise another 15.1 percent. Developed surfaces cover 7.4 percent of Leelanau County.

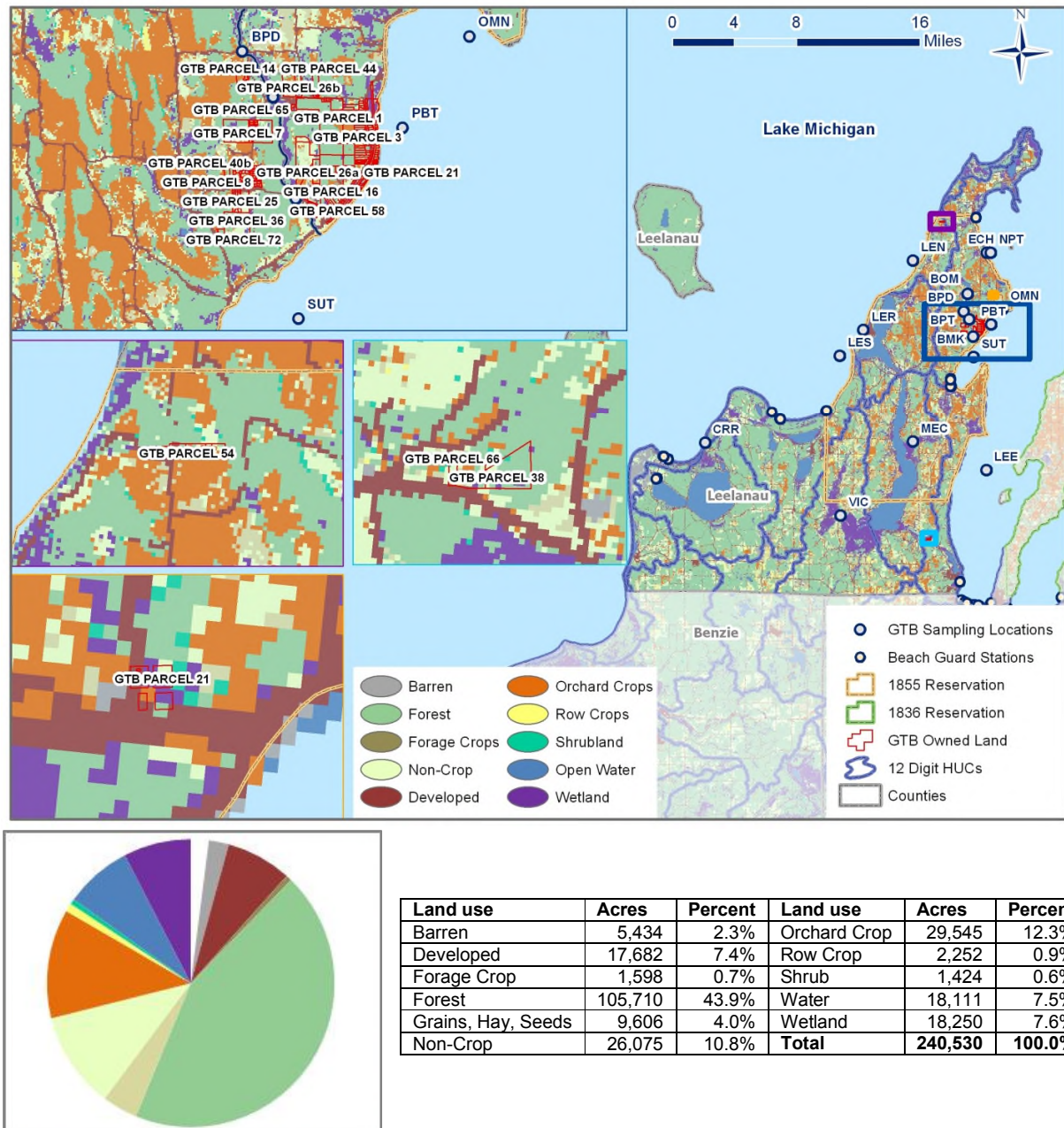
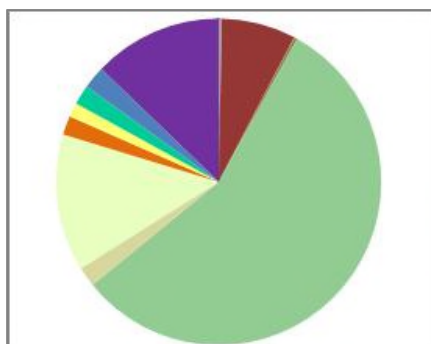
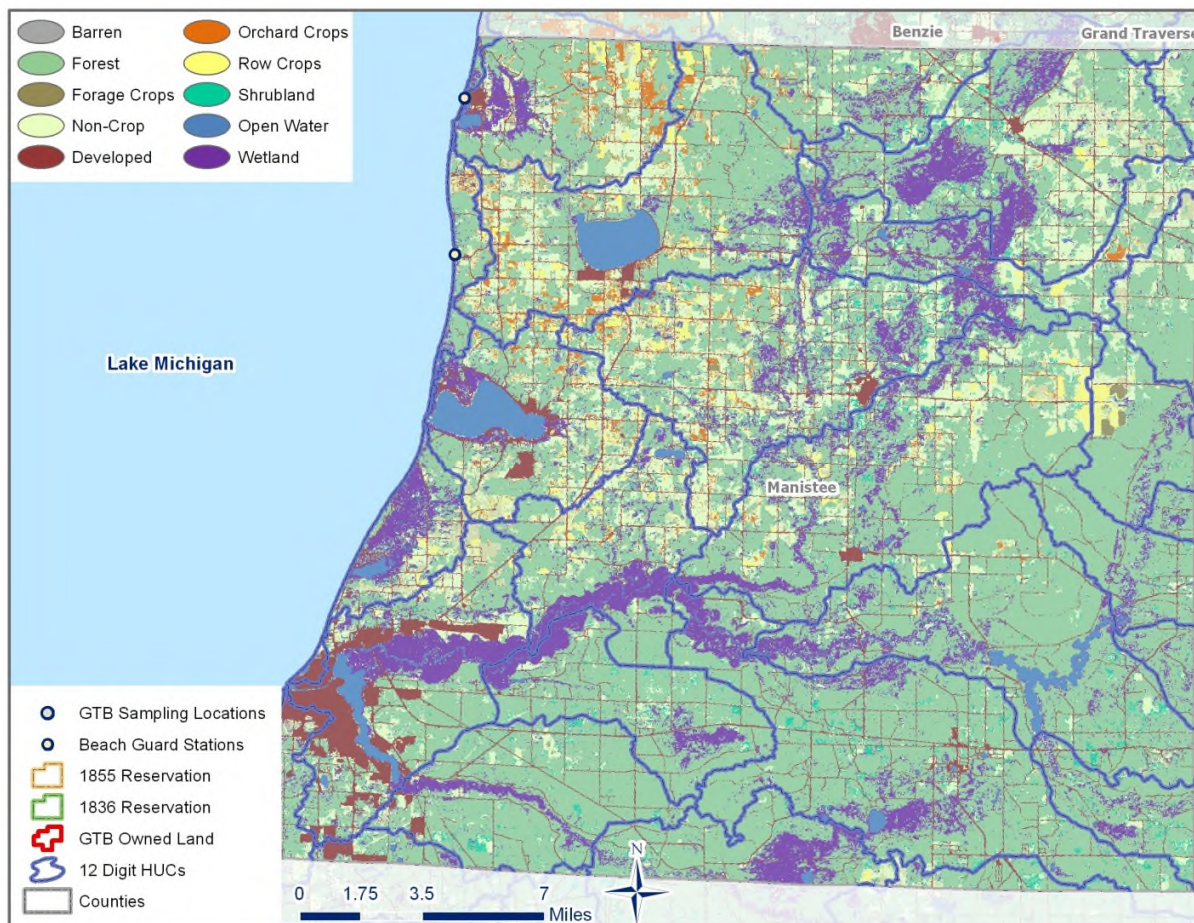


Figure 14. Land Use in Leelanau County

Manistee County

Manistee County lies south of Benzie County in the GTB six-county service area. GTB does not own any 319 parcels in this county. Forests are the primary land cover in Manistee County (56.1 percent). Combined agricultural uses represent 6.0 percent of the landscape, while wetlands and open water comprise another 15.1 percent. Developed surfaces cover 7.4 percent of Leelanau County.



Land use	Acres	Percent	Land use	Acres	Percent
Barren	980	0.3%	Orchard Crop	6,675	1.9%
Developed	26,380	7.4%	Row Crop	5,019	1.4%
Forage Crop	1,240	0.3%	Shrub	6,975	2.0%
Forest	200,231	56.1%	Water	7,981	2.2%
Grains, Hay, Seeds	7,005	2.0%	Wetland	45,805	12.8%
Non-Crop	48,535	13.6%	Total	356,918	100.0%

Figure 15. Land Use in Manistee County

County Land Use and Parcel Summary

The counties in the GTB six-county service area have similar land use attributes. All of the counties are predominantly forested ranging from 43.3 to 56.4 percent of the counties' land cover. Most of the counties have less than 10 percent of land used for agriculture except Grand Traverse and Leelanau counties that have higher agricultural use at 15 percent and 18 percent respectively. Orchard Crops are centered in Grand Traverse and Leelanau counties. Most of the counties have 7.3 to 7.4 percent developed lands, while Grand Traverse County has 12.6 percent developed land, which is centered around Traverse City. All of the counties have open water and wetlands ranging from 13.7 to 26.8 percent of land cover.

GTB parcels are predominantly used for community structures and housing. The casinos, resorts, and golf course make up almost 1,000 acres of Tribal property. Urban areas with community structures and residential housing make up over 1,000 acres of Tribal property. Most of GTBs parcels are centered around Peshawbestown and Whitefish Township. In addition to developed land, GTB owns parcels used for fishing and farming.

SECTION 5 – SURFACE AND GROUND WATER QUALITY

This section summarizes the conditions of surface water and groundwater on the GTB six-county service area.

Surface Water

Nine major watersheds lie within the GTB six-county service area: Manistee River, Betsie River, Platte River, Boardman River, Grand Traverse Bay, Lake Leelanau, Lake Charlevoix, Little Traverse Bay, and the greater watershed of Lake Michigan. The Manistee River watershed drains 1,954 square miles and 31 percent of that watershed lies within the GTB six-county service area. The Betsie River drains to Lake Michigan and all 243 square miles of that watershed lie within the GTB six-county service area. The Platte River extends 193 miles and drains to the GTB six-county service area. The Boardman River drains to the Grand Traverse Bay and 74 percent (175 square miles) of the watershed lies within the GTB six-county service area. The Grand Traverse Bay watershed includes Boardman River, Mitchell Creek (Grand Traverse County), and the Elk River Chain of Lakes watersheds. About 977 square miles of the Grand Traverse Bay watershed lie within the GTB six-county service area. The Lake Leelanau watershed lies within the 1855 reservation boundary and drains 140 square miles to Lake Michigan. Lake Charlevoix drains 33 square miles and 93 percent of the watershed lies within the GTB six-county service area. Little Traverse Bay lies at the north eastern portion of the GTB six-county service area and 73 square miles of the watershed lie within Charlevoix County. The entire the GTB six-county service area drains to the greater Lake Michigan watershed.

Table 12 lists Tribal waterbodies of concern by 12-digit HUC. Several watersheds that GTB samples or owns land in have partner 319 and Clean Michigan Initiative (CMI) Nonpoint Source Pollution Control Grant watershed management plans in place. These include Betsie River, Glen Lake/Crystal River, Grand Traverse Bay, Boardman River, Elk River Chain of Lakes, Mitchell Creek (Grand Traverse County), Lake Charlevoix, and Lake Leelanau. GTB has decided to use these watersheds with existing 319 and CMI watershed management plans when summarizing GTB water quality data and prioritizing NPS management on a watershed basis. Additional surface water information is presented by county in the following section. Water quality and stream characteristics are discussed further in Section 6.

Table 12. Tribal Waters of Concern.

8-digit HUC Name	12-digit HUC Name	Watershed	Waterbody	Sampling Site(s)
Betsie-Platte	Betsie Lake-Betsie River	Betsie River	Betsie Lake at the mouth of Betsie River	BER
	Lower Herring Lake-Frontal Lake Michigan		Lake Michigan	BGSS
	Crystal Run*	Glen Lake/Crystal River	Lake Michigan at the Mouth of Crystal River	CRR
	Cedar Run	Lake Leelanau	Victoria Creek	VIC
	Houdek Creek-Lake Leelanau		Lake Michigan at the mouth of Leland River	LER
	Mebert Creek-Lake Leelanau		Mebert Creek	MEC

8-digit HUC Name	12-digit HUC Name	Watershed	Waterbody	Sampling Site(s)
	Shalda Creek-Frontal Lake Michigan	Lake Michigan	Lake Michigan	LEN, LES
Boardman/ Charlevoix	Acme Creek-Frontal East Arm Grand Traverse Bay*	Grand Traverse Bay	East Arm Grand Traverse Bay	BGSS
	Belanger Creek-Frontal Grand Traverse Bay		Belanger Creek	BMK,BOM,BP D,BPT
			Ennis Creek	ECH
			Northport Bay	NPT
			Omena Bay	OMN
			Suttons Bay	SUT
			West Arm Grand Traverse Bay	PBT, BGSS
	Birch Lake-Frontal Grand Traverse Bay		East Arm Grand Traverse Bay	BGSS
	Cedar Creek-Frontal West Arm Grand Traverse Bay		Lee Creek	BGSS
	Petobego Pond-Frontal East Arm Grand Traverse Bay	East Arm Grand Traverse Bay	BGSS	
	Prescott Lake-Frontal Grand Traverse Bay	Lee Point	LEE	
	Boardman Lake-Boardman River*	Grand Traverse Bay - Boardman River	West Arm Grand Traverse Bay at the mouth of Boardman River	BOR
	Clam Lake	Grand Traverse Bay - Elk River Chain of Lakes	Torch Lake at the mouth of Clam River	CLR
	Elk Lake-Elk River		East Arm Grand Traverse Bay at the mouth of Elk River	ELR
			Elk Lake	ELK
			Elk Rapids	ERP
	Lake Skegemog		Lake Skegemog	SKG
Lake Skegemog at the mouth of Torch River		TOR		

8-digit HUC Name	12-digit HUC Name	Watershed	Waterbody	Sampling Site(s)
	Spencer Creek-Torch Lake		Spencer Creek	Not Sampled
	East Branch Mitchell Creek	Grand Traverse Bay - Mitchell Creek	East Arm Grand Traverse Bay at the mouth of Mitchell Creek	MIC
			Mitchell Creek	BGSS
	South Arm Lake Charlevoix	Lake Charlevoix	South Arm Lake Charlevoix	BGSS
Beaver Island		Lake Michigan	Lake Michigan	Not Sampled

Notes: BGSS= BeachGuard *E. coli* Sampling Site

*Although the Crystal Run, Acme Creek-Frontal East Arm Grand Traverse Bay , and Boardman Lake-Boardman River 12-digit HUC subwatersheds are not part of GTB 319 boundaries or 1855 Reservation they were included in this summary because water quality data may be indicative of upstream GTB 319 management areas.

Antrim County

Antrim County contains twenty-one 12-digit HUC subwatersheds and has five areas containing GTB parcels. These 12-digit HUCs are part of larger watersheds with existing CMI and 319 watershed management plans including: Grand Traverse Bay, Elk River Chain of Lakes, Jordan River, and Lake Charlevoix. The eastern portion of the 1855 Reservation is in Antrim County and contains Elk Lake, which drains to the East Arm of Grand Traverse Bay. Tribal waters of concern in Antrim County include Spencer Creek and the East Arm of Grand Traverse Bay. Other major waterbodies are Jordan River, Cedar River, and Intermediate River. Figure 16 shows an aerial view of the Antrim County 12-digit HUC subwatersheds within the GTB six-county service area.

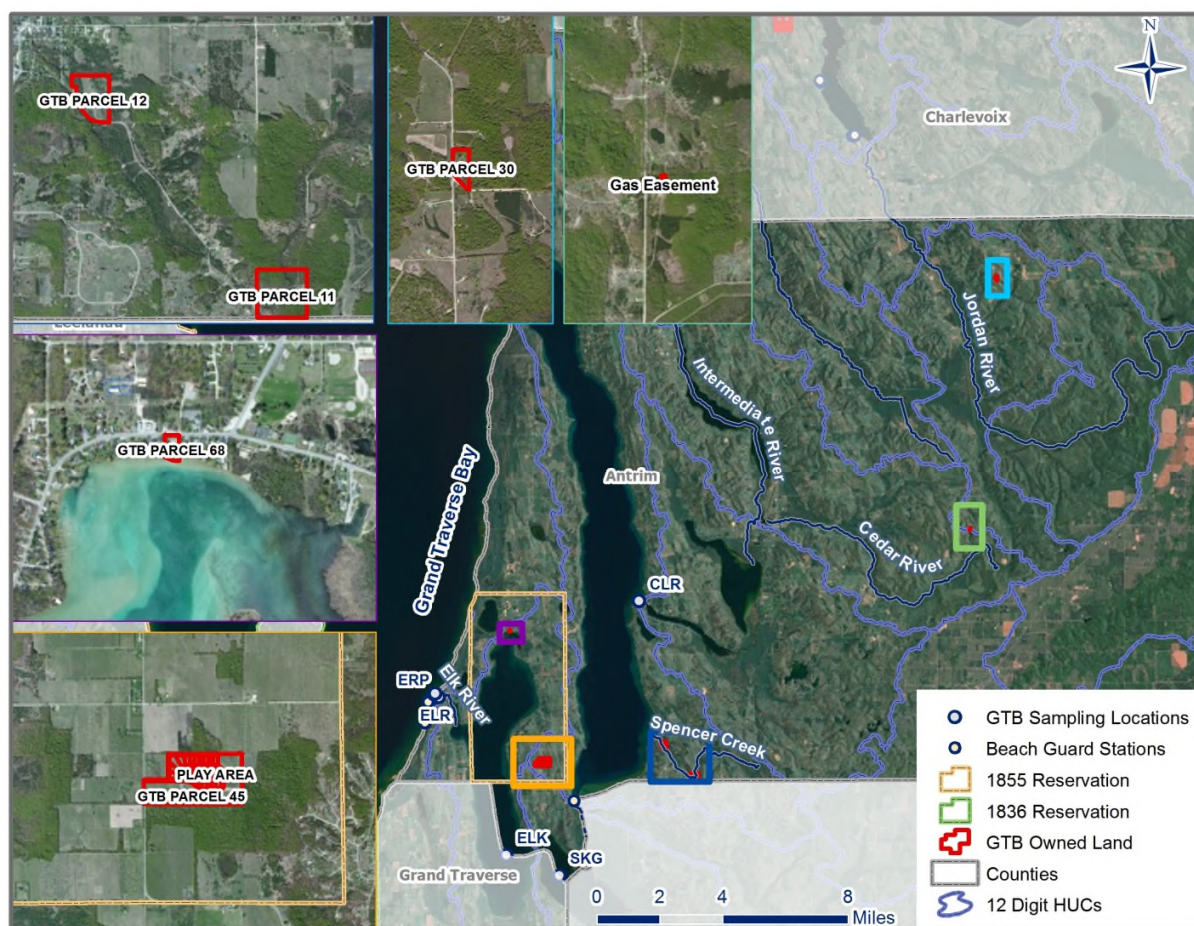


Figure 16. Antrim County 12-digit HUC subwatershed boundaries

Grand Traverse Bay is the principal surface water body adjacent to Tribal lands in Antrim County. The bay is 32 miles long and 10 miles wide and divided by the Old Mission Peninsula. Grand Traverse Bay is an arm of Lake Michigan that provides habitat for a variety of fish, aquatic invertebrates, small mammals, reptiles, amphibians, and birds. The Tribe utilizes the Bay through commercial and sport fishing and recreational uses, such as boating and swimming. The Tribe has conducted water quality studies (see GTB 1994 and GTB 1998) in the area of the Bay where wastewater from the Tribe's sewage treatment plant is discharged. Results of the studies revealed a general decrease in nitrate/nitrite and phosphorus in the area of discharge between 1994 and 1998. Field parameters (pH, dissolved oxygen, and specific conductance) showed no marked difference between 1994 and 1998.

Spencer Creek is the surface water running through the two parcels of Tribal property near Alden. The creek, which is approximately 3 miles long, flows in a northwesterly direction across Tribal property. The

creek meanders and continues in a northwesterly direction and empties into Torch Lake. The creek has a steady flow of water year round and has sand and gravel substrate.

Tribal water quality data for Spencer Creek does not exist at this time. There was, however, an investigation of whether or not there were contaminants in the stream. During 1993, samples from Spencer Creek were analyzed for various constituents such as:

- Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) (less than detection limit)
- Ten Priority Pollutant Metals (chromium, 3.0 µg/L; barium, 0.017 µg/L; and copper, 0.001 µg/L; the other seven metals were below detection limits)
- Chemical and Bacteriological Components (nitrate, 0.21 µg/L; nitrite fecal coliform and strep were below detection limits)
- Polychlorinated biphenyls (PCB) and Pesticide (all were below detection),
- Volatile Organic Chemical (all were below detection limits, except methylene chloride at 0.5 µg/L)

GTB samples Elk River, Elk Lake, Skegemog Lake, Torch Lake, and Clam River, which are a part of a chain of lakes known as the Elk River Chain of Lakes. The Elk River Chain of Lakes is present through 75 miles of Charlevoix, Antrim, Grand Traverse and Kalkaska counties. Historically the watershed was used for logging. The watershed use transitioned to resorts, tourism, and fruit farming which are now the dominant uses of the watershed.

Benzie County

Benzie County contains nineteen 12-digit HUC subwatersheds and has three areas containing GTB-owned parcels. Several of these 12-digit HUCs are part of the larger Betsie River and Platte River watersheds with existing CMI and 319 watershed management plans. Tribal waters of concern in Benzie County are Betsie River, Betsie Lake, and Lake Michigan. The Betsie River originates at Green Lake near the village of Interlochen, Michigan and flows to its outlet into Betsie Lake and Lake Michigan near Elberta and Frankfort. The Michigan Department of Natural Resources (MDNR) noted in their 2004 fishery resource report that this watershed has high summer temperatures from groundwater input (MDNR 2004). Several wastewater treatment plants (WWTPs) lie upstream of the mouth of Betsie River including Frankfort, Betsie Lake UA, and Elberta. Figure 17 shows an aerial view of the Benzie County 12-digit HUC subwatersheds within the GTB six-county service area.

Betsie Lake is in Elberta, is fed by the Betsie River to the east, and empties into Lake Michigan to the west. The Lake, which is approximately 300 acres, is utilized by watercraft travelling in Lake Michigan as a marina and safe mooring area. Many docks are in Betsie Lake that moor boats of all shapes and sizes. Large break-walls are along the mouth where Betsie Lake empties into Lake Michigan to provide safety to watercraft. Historically there has been and continues to be a seasonal recreational salmonid fishery within the lake and the presence of salmonids can be indicative of high water quality. GTB samples Betsie Lake at the mouth of Betsie River.

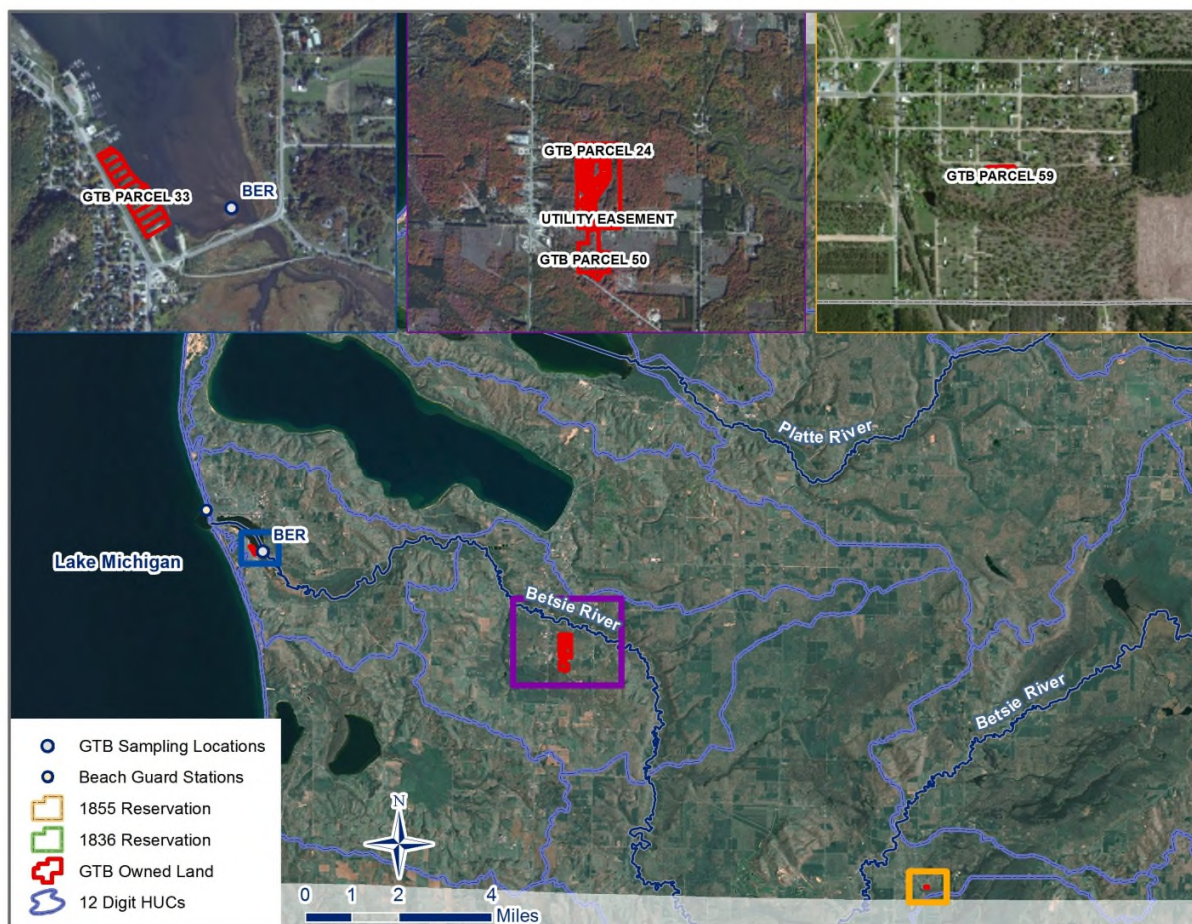


Figure 17. Benzie County 12-digit HUC subwatershed boundaries

Charlevoix County

Charlevoix County contains sixteen 12-digit HUC subwatersheds and has three areas containing GTB-owned parcels. These 12-digit HUCs are part of larger watersheds with existing CMI and 319 watershed management plans including: Lake Charlevoix and Little Traverse Bay. Tribal waters of concern in Charlevoix County include Lake Michigan and the East Arm of Grand Traverse Bay. Other major waterbodies are Lake Charlevoix, Deer Creek and Inwood Creek. GTB does not currently sample waters in Charlevoix County. Figure 18 shows an aerial view of the Charlevoix County 12-digit HUC subwatersheds within the GTB six-county service area.

Lake Charlevoix is the third largest lake in Michigan at over 17,200 acres. Lake Charlevoix is used for recreation and fishing. Jordan River is a state-designated natural river and the largest tributary to Lake Charlevoix. Shoreline development, streambank erosion, and agricultural activities contribute nutrients and sediment to Lake Charlevoix and its tributaries.



Figure 18. Charlevoix County 12-digit HUC subwatershed boundaries

Grand Traverse County

Grand Traverse County contains twenty-eight 12-digit HUC subwatersheds and has two areas containing GTB-owned parcels. These 12-digit HUCs are part of larger watersheds with existing CMI and 319 watershed management plans including: Grand Traverse Bay, Elk River Chain of Lakes, Boardman River, and Mitchell Creek. The eastern portion of the 1836 Reservation is in Grand Traverse County and is surrounded by Grand Traverse Bay. Tribal waters of concern in Grand Traverse County include Mitchell Creek, Boardman River, and Grand Traverse Bay. The Platte River also flows through Grand Traverse County. GTB samples Mitchell Creek and Boardman River. Figure 19 shows an aerial view of the Grand Traverse County 12-digit HUC subwatersheds within the GTB six-county service area.

Mitchell Creek drains 15.8 square miles and receives significant groundwater contributions. The Mitchell Creek watershed has shifted from an agricultural and forested land use to an urban and residential setting. The watershed's impervious surface area continues to increase. The runoff from impervious surfaces combined with anthropogenic channel alteration overtime has distressed this creek.

The Boardman River watershed is the largest tributary to the west arm of Grand Traverse Bay. The watershed is composed of 284 square miles. Traverse City WWTP lies upstream of the Boardman River. The Boardman River is a state designated natural river and state-designated "Blue Ribbon" trout stream. The Boardman River is primarily used for recreational purposes.

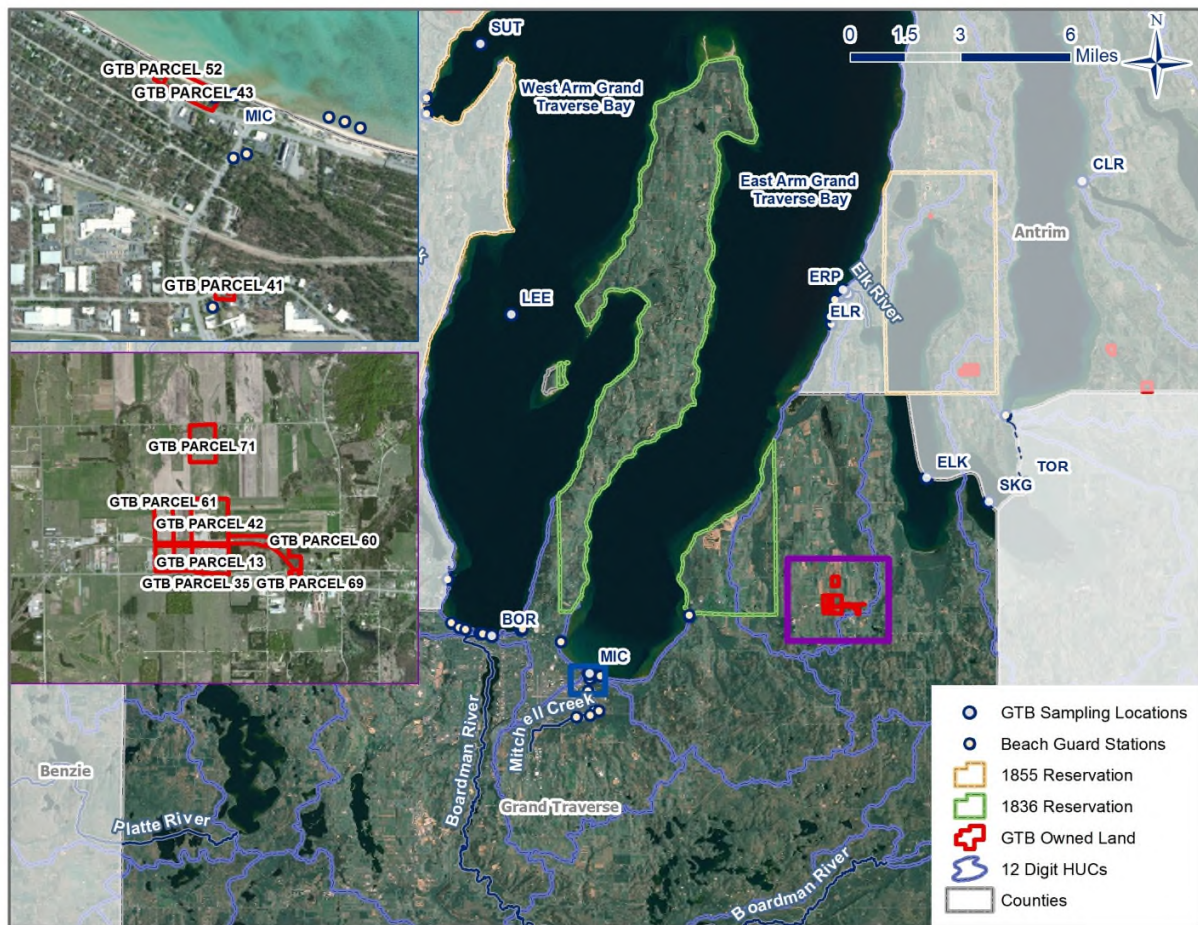


Figure 19. Grand Traverse County 12-digit HUC subwatershed boundaries

Leelanau County

Leelanau County contains twelve 12-digit HUC subwatersheds and has four areas containing GTB-owned parcels. These 12-digit HUCs are part of larger watersheds with existing CMI and 319 watershed management plans including: Grand Traverse Bay, Lake Leelanau, and Glen Lake/Crystal River. Leelanau County is a peninsula surround by Lake Michigan on its western and northern shores with Grand Traverse Bay on its eastern shore. The western portion of the 1855 Reservation is in Leelanau County and contains Belanger Creek, Ennis Creek, Mebert Creek, and Victoria Creek as well as Leland River and Lake. Belanger Creek, Lake Michigan, and the western arm of Grand Traverse Bay are Tribal waters of concern. Other major waterbodies include Glen Lake and Cedar Run.

The Crystal River flows 6.3 miles from Glen Lake through sections of the Sleeping Bear Dunes National Lake Shore to Lake Michigan north of Glen Arbor. The river meanders through swamps over a 1.2 mile straight line from the streams headwaters to the mouth. The river is used recreationally by many fisherman, kayakers, rafters, and canoes. GTB samples Lake Michigan at sampling site CRR near Crystal River's mouth.

Belanger Creek is the only surface water to flow through the Tribal property in Peshawbestown. The creek, which is approximately 4 miles long, flows in a southeasterly direction and empties into Grand Traverse Bay, south of the main 1855 Reservation. The creek has a steady flow of water year round with a gravel substrate.

GTB samples Belanger Creek, Ennis Creek, Mebert Creek, Victoria Creek, Crystal River, Leland River, and Lake Michigan. Victoria Creek drains to Lake Leelanau upstream of Mebert Creek's discharge to the

same lake. Figure 20 shows an aerial view of the Leelanau County 12-digit HUC subwatersheds within the GTB six-county service area.

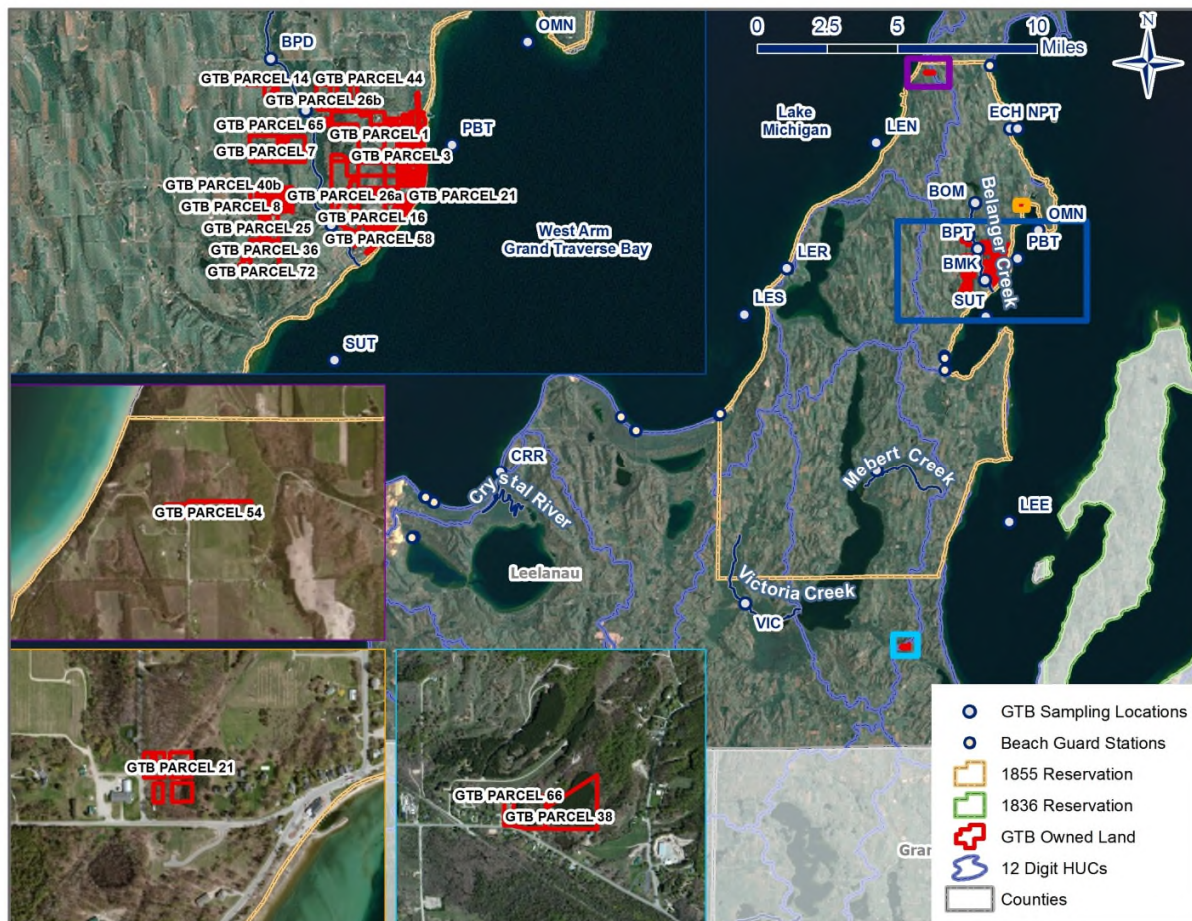


Figure 20. Leelanau County 12-digit HUC subwatershed boundaries

Manistee County

Manistee County contains twenty-nine 12-digit HUC subwatersheds. These 12-digit HUCs are part of larger watersheds with existing CMI and 319 watershed management plans including: Manistee River and Little Manistee River. Currently the Tribe does not have 319 parcels in this county. Major waters flowing through this county include Bear Creek, Pine Creek, Little Manistee River, and Manistee River. Figure 21 shows an aerial view of the Manistee County 12-digit HUC subwatersheds within the GTB six-county service area.

The Manistee River flows 190 miles to Lake Michigan. The River supports a nationally recognized fishery. The watershed has been affected by historical logging practices and sediment is still a primary concern. Erosion from streambanks and road/stream crossings are impairing the main stem of Manistee River and its coldwater tributaries.

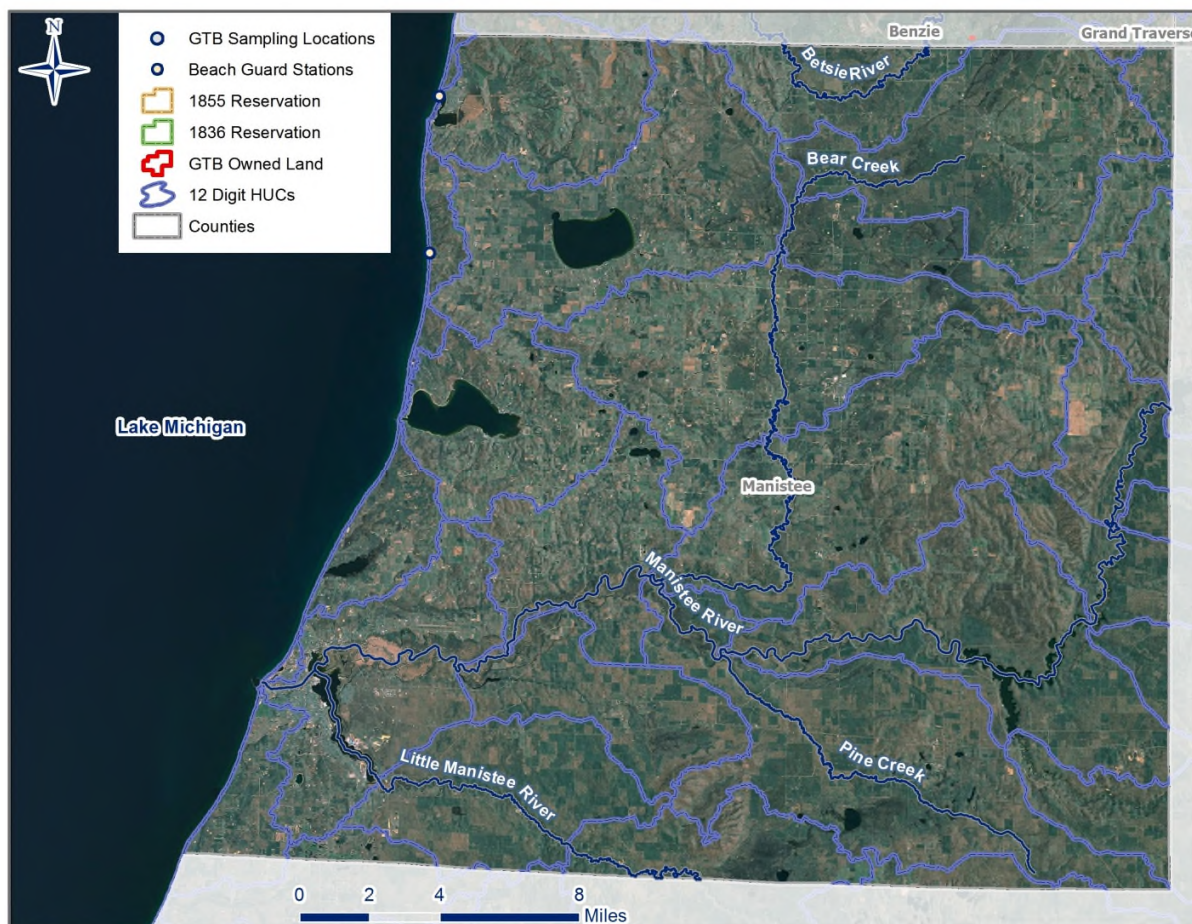


Figure 21. Manistee County 12-digit HUC subwatershed boundaries

Surface Water Flow Data

There are five active USGS gages in the GTB six-county service area as shown in Figure 6. There are gages on Boardman River near Mayfield (04126970), Jordan River near East Jordan (04127800), Manistee River near Wellston (04125550), Manistee River near Mesick (04124200), and Platte River at Honor (04126740). Figure 22 displays the flow duration curves for the gages from 1998-2012. Flow duration curves provide a way to address flow data variability and evaluate flow-related water quality patterns. Duration curves describe the percentage of time during which specified flows are equaled or exceeded (Leopold 1994). Flow duration analysis looks at the cumulative frequency of historic flow data over a specified period, on the basis of measurements taken at uniform intervals (e.g., daily average). Duration analysis results in a curve that relates flow values to the percent of time those values have been met or exceeded.

Duration curves provide the benefit of considering the full range of flow conditions (USEPA 2007). Developing a flow duration curve is typically based on daily average stream discharge data. A typical curve runs from high flows to low flows along the independent axis (x-axis), as illustrated in Figure 22. Note the flow duration interval of 60 associated with a stream discharge of 1,520 cubic feet per second (cfs) at station 04125550 (Manistee River near Wellston, MI) (i.e., 60 percent of all observed stream discharge values equal or exceed 1,520 cfs).

Flow duration curve intervals can be grouped into several broad categories or zones. Those zones provide additional insight about conditions and patterns associated with water quality degradation where hydrology might play a major role. One common method to assess a flow duration curve is by dividing the curve into five zones, as illustrated in Figure 22: high flows (0 to 10 percent), moist conditions (10 to 40

percent), mid-range flows (40 to 60 percent), dry conditions (60 to 90 percent), and low flows (90 to 100 percent).

This approach places the midpoints of the moist, mid-range, and dry zones at the 25th, 50th, and 75th percentiles, respectively (i.e., the quartiles). The high-flow zone is centered at the 5th percentile, while the low-flow zone is centered at the 95th percentile. Stream discharge from 1998 to 2012 on the Manistee River near Wellston ranges from 1,060 cfs to 5,750 cfs as shown in Figure 22. High flows are typically 2,190 cfs or above and low flows are typically 1,310 cfs or below.

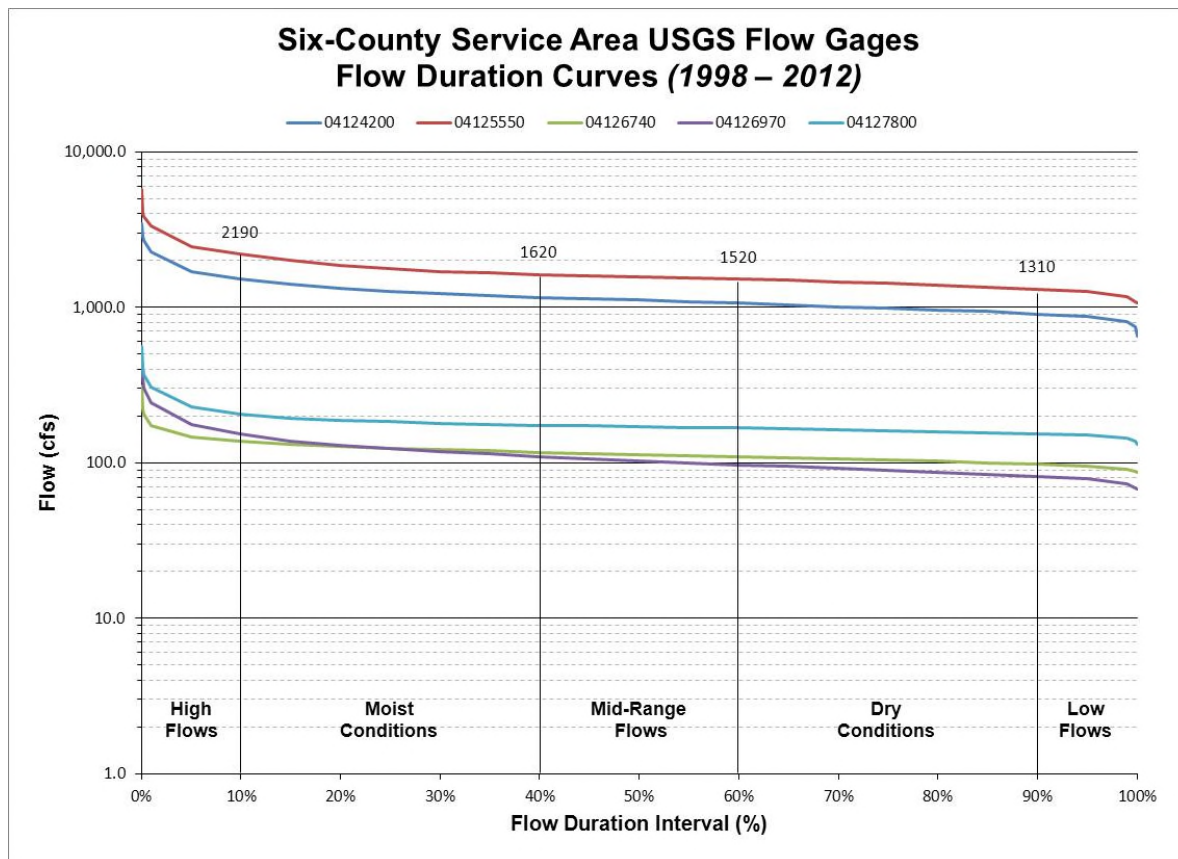


Figure 22. Flow Duration Interval for the USGS gages in the GTB six-county service area

Figure 23 shows an area weighted flow duration curve of the five gages maintained by USGS in the GTB six-county service area. These curves display flow in cubic feet per second per square mile of drainage area. Comparing data on an area-weighted scale allows for a direct comparison of flow patterns regardless of scale. Jordan River near East Jordan drains 68 square miles and ten percent of the time flow at this station is 3 cfs per square mile (or 204 cfs).

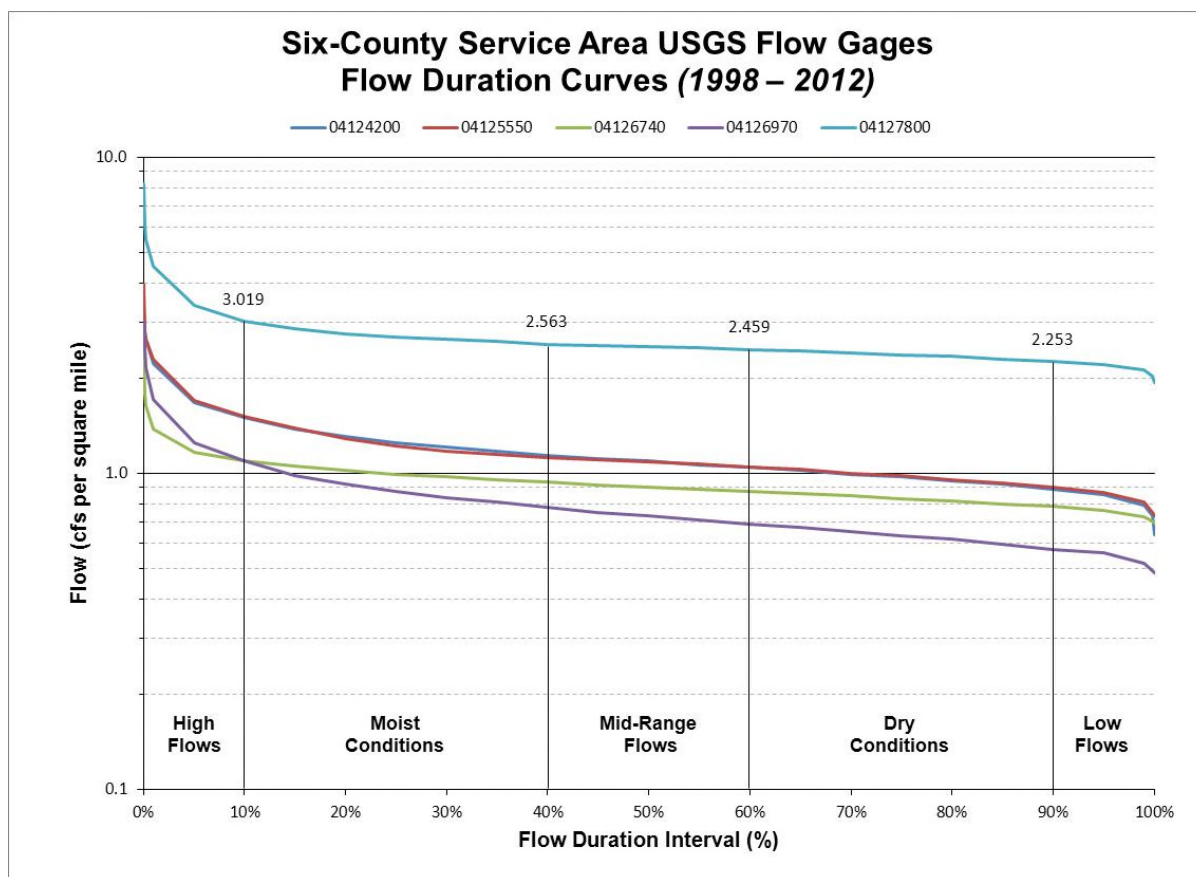


Figure 23. Area weighted flow duration interval for the USGS gages in the GTB six-county service area

GTB monitored flow at its stream sampling sites three times per year from 1999 to 2005. Flow data at Belanger Creek at McKeese Road ranged from 2 cfs to 14 cfs, with an average of 4.98 cfs. Flow at Ennis Creek ranged from 0.21 cfs to 4.56 cfs, with an average of 1.17 cfs. In 2012 GTB monitored flow once at Mitchell Creek in August.

Wetlands

The GTB adopted a wetland protection plan in February of 2003. The Inter-Tribal Council of Michigan, Inc. conducted wetlands identification on all GTB Tribal lands. Wetlands are characterized by the presence of water at a frequency and duration suitable enough to support wetland vegetation or aquatic life. Tribal wetlands may also be referred to as bogs, marshes, or swamps. The Tribe uses wetlands for spiritual and cultural practices.

Most of the Tribal wetlands are intermittent and water levels change with the seasons and precipitation levels. The wetlands have the highest water content in the spring, and then become dryer during the peak of summer.

The Peshawbestown area property contains approximately 20 observed wetlands, composed of an estimated 40 acres related to Belanger Creek, a 5 acre pothole wetland near the Medicine Lodge off McKeese Road, and the Grand Traverse Bay shoreline, which is connected to approximately 300 acres of off-site wetlands. The Alden properties contain approximately 30 acres of on-site wetlands related to Spencer Creek, which is connected to approximately 60 acres of off-site wetlands. There is no knowledge of wetlands on the remaining Tribal properties. The quality of the Tribal wetlands is not known at this time though GTB does evaluate Tribal wetlands through their 106 monitoring program.

Groundwater

Tribal groundwater resources are used as a source of potable water. Many individual wells are present throughout the Tribal lands, as well as three municipal groundwater wells in Peshawbestown and two municipal wells at the TCC in Williamsburg. Well logs recorded during drilling operations indicate the existence of two subsurface water-bearing units.

Groundwater is contained in both the confined and unconfined glacial drift aquifers. GTB acquires water for Peshawbestown municipal use from the lower confined aquifer. The lower confined aquifer is overlain with a glacial clay cap and extends from 368 feet below ground surface (BGS) to an unknown depth. The clay zone acts as a confining cap isolating the lower confined aquifer from the upper unconfined aquifer. The clay zone was encountered at 232 ft. BGS extending to a depth of 368 ft., which yields a 136 foot thick layer between the aquifers. Regional flow, both groundwater and surface water, is southeast towards Grand Traverse Bay.

The unconfined aquifer overlies the confined aquifer formation and receives recharge directly from precipitation. The unconfined aquifer appears to discharge directly to surface water bodies (streams and shoreline). The upper unconfined water-bearing aquifer is classified as a drift aquifer, which exists within an upper layer of glacial till material. The difference in soil type, encountered in the well logs, is minimal, indicating a homogenous geologic system within the upper unconfined aquifer.

A tritium analysis was conducted on GTB municipal water supply on July 15, 1997 by Dwight Sargent of Inter-Tribal Council of Michigan (University of Miami 1997). Results from the analysis documented tritium levels of 0.07 TU indicating that the aquifer is not vulnerable to contamination from the unconfined zone or recharge areas. Although the tritium analysis indicated the lower confined aquifer is not vulnerable, it is important to realize that the potential for contamination still exists (GTB 1997b).

There is a superfund site on Tar Lake in Mancelona Township, Antrim County which may be affecting the potable water aquifer beneath GTB parcel 45. There are currently no monitoring wells on GTB's parcel to test for impacts from Tar Lake. The site is a shallow 4-acre pond which was used to dispose Antrim Iron Co. wastes from the 1880s to 1944. In 1949 the state detected ground water contamination as far as 3 miles away from the Tar Lake site (USEPA 2012d).

Designated Beneficial Uses

This section describes the many uses of Tribal waters designated by the state and the tribe.

Currently GTB has not identified specific designated beneficial uses of GTB's surface water, though traditional and current Tribal surface water uses include recreation, spiritual and cultural uses, subsistence fishing, commercial fishing, hunting, trapping, and gathering.

It was proposed that, for purposes of this report, the beneficial uses established by the state of Michigan were also used to evaluate all Tribal waters. These beneficial uses are available in the *Water Quality and Pollution Control in Michigan, 2010 Sections 303(d), 305(b), and 314 Integrated Report*. Section 4.3 Determination of Designated Use Support:

- At a minimum, all surface waters of the state are designated and protected for all of the following designated uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption [Rule 100; R 323.1100(1)(a)-(g)] of the Part 4 Rules.
- In addition, all surface waters of the state are designated and protected for total body contact recreation from May 1 to October 1 [R 323.1100(2)].
- Specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fisheries [R 323.1100(4)-(7)].

- Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources [R 323.1100(8)].

Table 13 summarizes the designated and beneficial uses to be used while assessing GTB water quality. The table lists the sampling parameters that will be used to assess each waterbodies support of its designated and beneficial uses.

Table 13. GTB Intended Waterbody Uses and Monitoring Priority

State Designated Use or Current Tribal Use	Monitored Parameter(s) to Determine Support of Use or Goal
Agriculture and Navigation	Turbidity, conductivity, pH, BeachGuard <i>E. coli</i>
Contact recreation/swimming/cultural uses	nitrogen, phosphorus, chlorophyll- <i>a</i> , BeachGuard <i>E. coli</i>
Aquatic life and wildlife	DO, temperature, pH, turbidity, mercury, macroinvertebrates, nitrogen, phosphorus, chlorophyll- <i>a</i> , habitat
Drinking water/Public Water Supply	Turbidity, BeachGuard <i>E. coli</i>
Commercial/Subsistence Fishing and Fish consumption	Mercury, BeachGuard <i>E. coli</i>

SECTION 6 – RESULTS

This section presents available data for each waterbody and analyzes the status of the Tribal waters within the GTB six-county service area. Each pollutant is discussed with potential spatial trends, if present. Data are then summarized and goal attainment status is determined.

Water Quality Data Analysis

In this section GTB surface water quality data collected between the years 1999 to 2012 are discussed for the entire GTB six-county service area and then summarized by county and watershed. Statistical data for each pollutant, as well as graphs that compare the data to water quality standards selected as interim Tribal water quality goals and reference conditions for selected parameters are available in GTB 2009b and GTB 2013.

Interpretations of water quality data were based on the comparison of data to applicable state criteria or ecoregion reference conditions (based on beneficial uses) for each waterbody. State beneficial uses and GTB intended uses are shown in Table 14 through Table 32 below by county, watershed, 12-digit HUC subwatershed, waterbody, and sampling site.

NPSs or Impacts from NPS

Several types of general NPSs are present throughout the GTB six-county service area; they are described below. Where specific NPSs were identified for a particular subwatershed, they are identified in the county discussions that follow in Section 7.

Agriculture

Agricultural land use ranges from 5 to 18 percent of all land uses in the six counties, with an average value of 10 percent. Based on GTB parcel descriptions it is estimated that 400 acres or 15 percent of GTB trust and fee land rotates in and out of use for agricultural purposes. A 40 acre crop field and a 70 acre crop field are currently leased to farmers by the Tribe outside of the 319 boundaries. NPS pollutants from agricultural acreage include fertilizer, as well as the potential for pesticides and herbicides. Pollutants are conveyed to surface waters through overland flow.

Specialty Crop Production

Tourism is this region's primary economic resource followed by agriculture (primarily apples, cherries, and berries); specialty crop production on GTB owned lands is limited. Tribal jurisdiction is limited to trust lands. Fee lands are under the jurisdiction of the individual county. A twenty acre apple orchard was leased to farmers by the Tribe but is not currently active. There are considerations for future use of the orchard by GTB. GTB currently leases a small portion of the 104 acre Parcel 79 for agricultural use to cherry grower Don Gregory of Cherry Bay Orchards. The lease includes approximately 2,500 tart cherry trees on a 3-4 year lease. At the present time, the grower is not subject to report any harvest methods, fertilizer use, or herbicide use. In addition, there are residential gardens throughout the 1855 reservation.

NPS pollutants from special crop activities can include nutrients, sediment, bacteria, and pesticides. Degradation of groundwater and surface waters may occur from siltation, and the application of fertilizers and pesticides. Drift from orchard spraying of pesticides and runoff from mixing and loading sites are potential modes of water contamination.

Pasture Land

Pasture lands make up a very small percentage of land use in the GTB six-county service area (less than 1%). NPS pollutants from pasture land in the GTB six-county service area can include nutrients, sediment and bacteria. Pasture land can contribute to increased water temperature and low dissolved oxygen. Specific activities contributing these pollutants include the following:

- Grazing on stream banks can contribute to (1) increased sediment loads from streambank erosion due to hoof shear and removal of riparian vegetation, (2) increased temperature (and corresponding decreases in dissolved oxygen) from removal of riparian vegetation, and (3) increased nutrients and pathogens from manure deposition directly to surface waters and to riparian areas.
- Confinement of livestock can create areas of concentrated nutrients and pathogens from animal manure and can contribute to increased erosion from removal of vegetation in the confinement area. Nutrients, pathogens, and sediment from these confinement areas can enter surface waters through runoff of stormwater and snowmelt.
- Overgrazing of pasture land can create denuded critical areas that can erode and cause rills and gullies to form. These areas can be significant sources of sediment loading.

Construction

Storm water runoff from unregulated construction activities (i.e., those with less than one acre of disturbed area that do not require coverage under an NPDES stormwater construction general permit) can have a significant effect on water quality. Construction runoff may contribute polluted stormwater to streams as well as increase the volume and velocity of water in the streams. As storm water flows over a construction site, it picks up pollutants like sediment, debris, and chemicals. Polluted storm water runoff from active construction can harm or kill fish and other wildlife. For example, sedimentation can destroy aquatic habitat by filling voids in the substrate that aquatic invertebrates live in and fish spawn upon. Pollutants carried by stormwater may be toxic to aquatic life or cause algal growth and eutrophication that reduce dissolved oxygen levels. High volumes of runoff can cause stream bank erosion, which can contribute additional sediment to surface water, and high velocity runoff can stress aquatic organisms that swim.

Construction activities take place in existing subdivisions on a regular basis. Lands along Belanger Creek, Railroad Creek, and Grand Traverse Bay are the areas of primary concerns for development related impacts. The Tribal Council adopted the Grand Traverse Band of Ottawa and Chippewa Indians Soil Erosion and Stormwater Runoff Control Ordinance 97.001, on January 21, 1997 (GTB 1997). The purpose of the Ordinance is to prevent the pollution, impairment, or destruction of a natural resource or the public trust on Tribal lands.

Current and upcoming construction projects in the GTB six-county service area could increase sediment loads in Tribal waters.

GTB is participating in the Grand Vision project, which consists of the community vision for the future of transportation, land use, economic development, and environmental stewardship for our region. The counties included in this project include: Antrim, Benzie, Grand Traverse, Kalkaska, Leelanau, and Wexford. This prediction/projection covers the current conditions through the next fifty years, ending in 2060. As of April 2009, the Grand Vision document (GTB 2009) was completed and work began on a technical transportation studies and implementation planning. This will be a useful tool for estimating the potential future growth and needs of four of the counties in GTB service area. It is the intention of GTB to follow all policies and procedures developed under CWA 319 in future developments.

Forested

Approximately 49.1 percent of land within the GTB six-county service area is forested. The MDNR Gaylord and Traverse City Forest Management Units are responsible for managing the state forest within the GTB six-county service area according to state requirements for timber sales. MDNR provides guidelines for timber sales on privately-owned forested lands.

Logging does not occur on Tribal lands, though historical logging has occurred in GTB watersheds. Should a logging operation be implemented, pre-harvest considerations must be taken into consideration.

The development of pre-harvest plans, pre-harvest maps, a survey of the site, reforestation plans, and sedimentation and siltation control practices will be conducted prior to any large scale logging project.

Historical logging activities have modified habitat and led to changes in natural hydrology. Forest harvesting started in the 1800s in the GTB six-county service area and was the dominant economical industry for the region until the 20th century. Historical logging practices did not use erosion prevention BMPs and the lack of BMPs led to increased sediment and flow in the areas' surface waters. Current forestry practices may include poor road design and maintenance as well as poor harvesting practices that contribute sediment to surface waters. Partner management plans in the GTB six-county service area have suggested the use of properly maintained buffer strips and improved forestry BMPs as a medium priority for reducing sedimentation from logging activities.

Hydrologic and Habitat Modifications

Dams and stream channelization are hydrologic modifications currently occurring in the GTB six-county service area. Dam removal and modification projects are presently underway on the Boardman River. The Sabin, Boardman and Brown Bridge dam owners decided to remove the Sabin, Boardman and Brown Bridge dams and modify the Union Street dam on Boardman River. Grand Traverse County's Mitchell Creek's natural channel has been modified by upstream wetland filling, sand clogging, and an old logging channel and dam. MDEQ would like to perform a hydrogeologic study to determine if dam removal and upstream habitat improvements would bring back the streams natural channel, which would improve habitat downstream in GTB owned parcels.

Land Disposal (Septic Systems)

Some parts of the GTB six-county service area do not provide adequate conditions for the construction of septic systems. Septic systems represent a major potential NPS contamination to Tribal surface water and groundwater. Thirty Tribal and non-Tribal septic systems are located in the Peshawbestown area, two sites at the Alden properties, and the new homes at Charlevoix and Benzie parcels. Tribal lands along Grand Traverse Bay do not demonstrate adequate percolation rates for septic systems. Antiquated or failing septic systems contribute nutrients, bacteria, and chemicals to surface water and groundwater.

Resource Extraction/Exploration/Development

EPAs list of NPSs include oil, grease and toxic chemicals from energy production. Sources of impact or threat from resource extraction have not been identified on Tribal lands to date. However, the area surrounding some of the Tribal lands has gas extraction wells and there is the possibility for gas extraction well development on Tribal lands in the future. Resource extraction often includes impacts from road building, well pad development, materials handling, and water processing operations.

Transportation

Many creeks and rivers across the GTB six-county service area receive runoff from paved and unpaved roadways. The potential exists for delivery of significant sediment loads to surface waters in runoff, particularly from unpaved roads. Grading and other maintenance activities can contribute to erosion of unpaved roads, and roadway construction can also lead to increased sediment loads in runoff. In addition, runoff from paved and unpaved roadways can contain oil and grease, litter, and debris.

Runoff from local highways, roads, and bridges pose a threat to the water quality of surface water and groundwater. Salted roads, automobile fluids, and automobile emissions and wastes would be the main sources of contamination. Runoff from these roadways and salt storage areas are considered a possible source of chemical contamination. The magnitude of pollutants found in highway runoff is site-specific and are affected by the amount of traffic, highway or road design, land use, climate, and accidental spills. For example, the McKeese Road crossing and Peshawbestown Road crossing over Belanger Creek offer very little protection from road runoff to the creek and are slated for correction.

Marina

The Tribal marina is used by the Tribe's commercial fishing fleet, fisheries program, and Tribal conservation enforcement watercraft. Sources of water pollution associated with marinas are boat maintenance, fuel and chemical storage area spills or uncontained runoff, discharge of sewage from boats, storm water runoff from marina parking lots, and the physical alteration of shoreline, wetlands, and aquatic habitat during the operation of marinas. Environmental impacts associated with marinas are as follows: high toxicity in water, increased pollutant concentrations in aquatic organisms and sediments, increased erosion rates, increased nutrients leading to an increase in algae and a decrease in oxygen (eutrophication), and high levels of pathogens.

Urban

Urbanized and developed areas are located throughout the GTB six-county service area. The majority of the 1,700 Tribe members living in the GTB six-county service area reside in Peshawbestown, in Leelanau County. Residents live along Michigan Highway 22 in private residences and small subdivisions that are spread throughout the 1855 reservation. The majority of public buildings are located in Peshawbestown along Michigan Highway 22. Tribal centers are also located on other Tribal properties in Grand Traverse, Benzie, and Charlevoix counties. Tribal property in Grand Traverse County includes the Turtle Creek Casino, which is in Williamsburg along Michigan Highway 72, and Tribal education program offices in Traverse City. Tribal property in Benzie County includes parcels south of Benzonia that has a community center, offices, housing and vacant cleared land. Property in Charlevoix County includes a housing area and a community center. Stormwater runoff from communities and other developed areas flows overland and is channeled toward nearby surface waters.

None of these communities and developed areas are subject to municipal separate storm sewer system (MS4) permit requirements under the NPDES Stormwater Program. While only 8.3 percent of the GTB six-county service area is developed, stormwater runoff from these areas can contribute sediment, oil and grease, solid waste, nutrients, biochemical oxygen demand, toxic substances, and other pollutants to surface waters. Urban runoff can also alter natural stream hydrology and morphology causing increased sediment erosion (see hydrologic/habitat modification). Bacteria contributions from urban runoff in residential areas, specifically from pet waste, could contribute to increased *E.coli* levels in Tribal waters. Other sources of urban runoff include commercial areas, such as parking lots from retail stores, and industrial facilities that are not permitted under MDEQ's multi-sector general permit for industrial stormwater discharges.

Retention ponds have been constructed on Tribal lands to contain stormwater runoff. Storm sewers have been installed in large paved parking lots of the casino, conference center, and Medicine Lodge that empty into retention ponds. Runoff materials trapped in the ponds often contain automobile fluids and road salt, which are types of chemical contamination that could potentially impact the Tribal surface water and groundwater. Currently, GTB does not have an inventory or maintenance protocol for these ponds. Therefore, it is likely these ponds are not functioning properly to protect downstream receiving waters.

Landscaping/Lawn Maintenance

Landscaping activities can contribute to NPS pollution through the application of fertilizers, pesticides, and herbicides. Improperly disposed yard wastes may also elevate nutrient levels in surface runoff. Most households and multi-family units throughout GTB Tribal lands have lawns. The GTB facilities maintenance department services 40 buildings and maintains approximately 60 acres of lawns. Resident and GTB staff education can ensure proper lawn maintenance and fertilization occurs to prevent excess runoff of pesticides and nutrients to surface waters.

Other Natural Sources

As noted in Section 3 areas in the GTB six-county service area have a mix of nutrient-rich and nutrient-poor soils. Nutrient-rich soil conditions on the GTB six-county service area could be contributing to elevated nutrient and specific conductivity concentrations in surface waters across the GTB six-county service area. In addition to natural background soil conditions, deer, birds, and other wildlife can also

contribute to surface water contamination. Birds and other wildlife that live and feed in riparian areas can contribute to elevated nutrients and fecal coliform bacteria in surface waters.

Data Presentation and Analysis

Data is compiled and analyzed in the GTB 1999-2009 ten year summary and their 2012 Water Quality Assessment Report. The findings from those reports are summarized by parameter here.

Ammonia

Though ammonia is an important component of the natural world, at elevated concentrations it can produce harmful effects. Ammonia is toxic to aquatic life, and ammonia nitrification to nitrate creates an oxygen demand that lowers dissolved oxygen levels (USEPA 2002).

Ammonia in streams is toxic to aquatic life, particularly fish. When aquatic life is exposed to elevated levels of ammonia, the internal ammonia concentrations increase affecting internal organs, nervous system function, and respiration. Mammals use various mechanisms to incorporate ammonia into amino acids and can tolerate larger exposures to ammonia.

In addition to toxicity, ammonia can also be an issue when waterbodies are impaired by dissolved oxygen. When low dissolved oxygen concentrations are associated with nitrogen species, it is usually due to the process of nitrification where ammonia is converted to nitrite which is then converted to nitrate (Ohio EPA 1999). Eutrophication itself can affect ammonia levels because excess algae productivity can consume significant amounts of dissolved oxygen (thereby preventing nitrification) and can kill aquatic vegetation that will then decay and release ammonia.

Sources of ammonia include wastewater, animals (e.g. livestock, wildlife), and application of chemicals or manure to crop fields (USEPA 2012b). Before treatment, ammonia and organic nitrogen are the primary nitrogen species in wastewater (USEPA 2002). Thus, a wastewater treatment system that does not provide adequate treatment can discharge high levels of ammonia to surface water or ground water. Ammonia derived from animal waste can enter surface waters through direct deposition of waste to streams or waste deposited in the floodplain can be washed into streams during precipitation events (USEPA 2012b). Similarly, ammonia-containing fertilizers or manure that are applied to crop fields can wash off during precipitation events and enter surface streams.

Ammonia was sampled from 2004 to 2009 at eleven of GTB sampling sites. Concentrations ranged from 0.05 mg/L to 0.77 mg/L. Average ammonia concentrations ranged from 0.08 mg/L to 0.70 mg/L. Ammonia was highest at the Skegemog Lake sampling site. GTB do not currently have ammonia criteria and none of the sample levels were a cause for concern. If GTB decides to monitor ammonia in the future it should be done alongside pH and temperature sampling to compare to USEPA's draft 2009 ammonia freshwater aquatic life criteria which are pH and temperature dependent.

Chlorophyll-a

Chlorophyll is an important link between nutrient levels in water and plant growth. A large amount of algae in a waterbody can cause organisms to change the chemical composition of water by absorbing oxygen. The health of organisms in water decreases as dissolved oxygen levels get too low from algae consumption.

Chlorophyll-a was measured at the ten lake sampling sites from 1999 to 2009. Average sampled chlorophyll-a ranged from 0.00075 mg/L to 0.00155 mg/l. Four of the sampling sites had samples above the USEPA ecoregion 51 reference conditions for chlorophyll-a sampled with the fluorometric method corrected for pheophytin (LEE, PBT, SKG, and SUT). Skegemog Lake and Suttons Bay exceeded the reference conditions more than 10% of the time sampled.

Average sampled chlorophyll-a ranged from 0.00037 mg/L to 0.00168 mg/L at the 10 sites in 2012. One of the ten sampling sites has samples above the USEPA ecoregion 51 reference conditions for chlorophyll-a sampled with the fluorometric method corrected for pheophytin. The highest observed

samples are at the mouths of Betsie River, Boardman River, and Mitchell Creek. Clam River and Torch River each have one sample above the stream reference conditions at their mouths, but are below lake reference conditions. There do not appear to be any temporal trends in the 2012 chlorophyll-*a* data.

Conductivity

Water's ability to pass an electrical current is measured as specific conductivity. Conductivity is affected by dissolved solids in water as well as temperature. In general, geology is the major contributor to surface water conductivity levels. Conductivity in American rivers generally ranges from 0.05 milliSiemen per centimeter (mS/cm) to 1.5 mS/cm. Inland fresh water studies indicate that streams supporting good mixed fisheries have a range between 0.15 mS/cm and 0.5 mS/cm. Certain species of fish or macroinvertebrates may have trouble surviving at ranges outside of this. Some industrial waters range as high as 10 mS/cm (USEPA 2012).

Averaged sampled conductivity ranged from 0.2423 mS/cm to 0.4084 mS/cm at the sites sampled from 1999 to 2009. While there were samples that exceeded the general range of conductivity found within rivers in the United States none of the sites had exceedances more than ten percent of the time sampled. The highest observed percent of exceedances were seen at the Belanger Creek sampling sites BPD and BPT.

Average sampled conductivity ranged from 0.292 mS/cm to 0.459 mS/cm at the ten sites in 2012. Conductivity falls within the recommended range for good mixed fisheries at all sites except Mitchell Creek which has two samples above 0.5 mS/cm. These higher levels of conductivity are still within the general range of conductivity found within rivers in the United States. No spatial or temporal trends are apparent in the conductivity data.

Dissolved Oxygen

Algae and macrophytes produce and consume oxygen in water. During daylight hours, oxygen is produced by photosynthesis. Plants and algae then consume oxygen from the water column at night (respiration). The entire process is part of the natural cycle of most plants, and this cycle causes dissolved oxygen concentrations to fluctuate throughout the water column in a day. This is called a diurnal oxygen cycle. Various other processes also produce and consume dissolved oxygen in the water column. Processes that consume oxygen include organic decomposition, respiration by fish and invertebrates, and sediment oxygen demand. Additional dissolved oxygen is produced through atmospheric exchange.

Oxygen depletion occurs when the balance between oxygen consumption and production is altered, either causing excessive oxygen consumption or reduced oxygen production. Eutrophication derived from excess levels of nutrients, including total phosphorus and nitrate, tends to lower dissolved oxygen concentrations because of respiration and decay of excessive vegetation.

If the dissolved oxygen concentration in a waterbody becomes too low, it threatens all oxygen-breathing aquatic life. Aquatic organisms need oxygen to live and they can experience nonlethal effects (e.g., lowered reproduction rates) and mortality with lowered dissolved oxygen concentrations. An increase in urban and agricultural runoff can result in low dissolved oxygen as microorganisms consume oxygen to decompose runoff from these sources. Urbanization of an area can increase chemical contaminants, organic material, and nutrients in runoff to surface waters.

Average sampled DO ranged from 8.83 mg/L to 11.22 mg/L at the sites sampled from 1999 to 2009. Dissolved oxygen samples were not meeting Michigan WQS at five sites (BOM, ERP, OMN, PBT, SKG), however the standards were met more than 90 percent of the time sampled. Average sampled DO ranged from 9.66 mg/L to 10.9 mg/L in 2012 at the 10 sites sampled. All measured DO concentrations monitored by GTB in 2012 are meeting the Michigan WQS. DO is highest at all sampling sites in the spring.

E. coli

Microorganisms are ubiquitous across the world and while most are not harmful to humans, pathogens (i.e., disease causing microorganisms) are a small subset of microorganisms that can cause sickness or death when taken into the body (USEPA 2001). Certain bacteria typically indicate the presence of pathogens. *E. coli* is an indicator of pathogenic bacteria and Michigan has established numeric criteria for *E. coli* based upon designated recreation uses.

In-stream pathogen levels decrease over time. The die-off is controlled by factors including: sunlight, temperature, moisture conditions, and salinity (USEPA 2001, p. 2-7). In-stream pathogen levels are dependent upon the die-off rate and the time and distance from the source to the waterbody of interest.

Typical sources of pathogenic bacteria include WWTP and combined sewer overflows (CSOs) (USEPA 2001). Sewage that is not sufficiently treated or that bypasses wastewater treatment (e.g., CSOs) may result in elevated levels of in-stream pathogens when discharged to a surface waterbody. "Other point sources that can contribute substantial loads of pathogens and fecal indicators to waterbodies include concentrated animal feeding operations, slaughterhouses and meat processing facilities; tanning, textile, and pulp and paper factories; and fish and shellfish processing facilities" (USEPA 2001, p. 2-6). Regulated storm water may transport animal excrement deposited by pets or wildlife to nearby streams following precipitation events that result in storm water runoff.

Nonpoint sources of pathogens can be residential (e.g., septic systems, pets), agricultural (e.g., livestock, manure application to crops fields), and natural (e.g., wildlife). Septic systems that are not functioning properly may discharge untreated sewage to downstream waterbodies. Pet excrement deposited in residential areas, wildlife excrement deposited in rural areas, livestock excrement deposited on pastures and barnyards, and manure applied to crop fields or stored improperly may be transported to streams after precipitation events that result in storm water runoff.

Pathogens can also enter the water column when pathogens attached to sediment are re-suspended. Runoff will increase the velocity of water in a stream, which may yield sufficient power to scour the bottom of the stream.

The MDEQ BeachGuard System flags data as individual samples, daily means, or 30 day means. All three sets of data are summarized below for surface waters in and around the GTB six-county service area. None of the beaches near the GTB 1855 and 1836 reservations exceeded the maximum partial body contact standard in 2012, though seven beaches had samples above the maximum total body contact recreation standard (Elmwood/Greilickville Park & Beach, East Bay Park (Milliken Park), Traverse City State Park, Bayside Acme Township Park, Antrim County Day Park South, Barnes Park, and East Jordan Tourist Park). In total the total body contact standard was exceeded nine times. The beach with the highest observed sample was East Jordan Tourist Park on August 7th, 2012. The total body contact standard at Bayside Acme Township Park (Grand Traverse Bay-East) is exceeded 10.7 percent of the time sampling was performed. East Jordan Tourist Park (Lake Charlevoix) exceeds the total body contact standard 10.5 percent of the time sampling is performed. The other beaches experience total body contact standard exceedances less than 10 percent of the time sampled.

Elmwood/Greilickville Park & Beach, Bryant Park Beach, East Bay Park (Milliken Park), Traverse City State Park, Bayside Acme Township Park, Barnes Park, and East Jordan Tourist Park have daily mean data exceeding the total body contact standard in 2012. Eleven exceedances of the total body contact standard occurred. None of the samples exceeded the partial body contact standard. The total body contact standard at Bayside Acme Township Park (Grand Traverse Bay-East) is exceeded 23 percent of the time sampling was performed. East Jordan Tourist Park (Lake Charlevoix) exceeds the total body contact standard 20 percent of the time sampling is performed. The other beaches experience total body contact standard exceedances less than 20 percent of the time sampled.

None of the beaches near GTB 1855 and 1836 reservations exceeded the 30 day mean standard in 2012. The beach with the highest observed 30 day mean was Bayside Acme Township Park on the East arm of Grand Traverse Bay.

Watershed partners have noted a pathogen issue on Mitchell Creek in Grand Traverse County. Future monitoring of *E. coli* at the MIC site is recommended if funding allows.

Habitat Assessment Analysis

GTB uses the MDEQ procedure 51 (Qualitative Biological and Habitat Surveys for Wadeable Streams and Rivers) to assess habitat at their sampling sites. GTB habitat ratings are based on substrate, available cover, pool substrate and variability, sediment deposition, channel flow volume, flow flashiness, channel alteration, channel sinuosity, bank stability, vegetative protection, and riparian vegetative width.

GTB is concerned that habitat in the six-county service area may be negatively impacted by historical sediment loading that buries habitat and fills pools. GTB staff have noted a heavy amount of sand near the mouth of the Betsie River in particular.

GTB assessed habitat at five sampling sites from 1999 to 2009. Habitat at the Belanger Creek Omena road sampling site was rated marginal in 2004 and 2005 as shown in Table 14. In August of 2012 GTB assessed habitat at nine sampling sites. Most of the sites are rated good to excellent, though both Boardman River and Crystal River are rated marginal.

Table 14. Habitat Ratings at GTB Stream Sampling Sites

Sampling Site	2003	2004	2005	2006	2012
BER					Excellent
BMK	Excellent	Good	Excellent	Excellent	
BOM	Good	Marginal	Marginal	No Data	
BOR					Marginal
BPD	Excellent	Excellent	Excellent	Excellent	
BPT	Good	Excellent	Excellent	Excellent	
CLR					Good
CRR					Marginal
ECH	Good	Good	Good	Good	
ELR					Good
LER					Good
MEC					Good
MIC					Excellent
TOR					Excellent
VIC					Good

Macroinvertebrates

GTB collected macroinvertebrates in 2002-2007 and in 2012. Data for streams sampled in 2002 were all rated marginal (Belanger Creek and Ennis Creek). At this time GTB has not rated the macroinvertebrate sampling that occurred on lakes in 2002 or any of the data taken after 2002. Sampling sites in 2012 had a very limited number of taxa; this may be due to the transitional nature of sampling sites located near the mouth of a stream.

Mercury

GTB collected mercury sediment samples in 2012. All of the samples were below the detection limit, which was below all recommended mercury standards for aquatic life and human non-cancer values.

NO₂NO₃

Similar to ammonia, nitrate and nitrite are important components of aquatic ecosystems. Both nitrate and nitrite are dissolved forms of nitrogen that are bioavailable (USEPA 1999). Plants and algae uptake mineralized nitrogen in the form of the nitrate ion. Nitrate is more stable than nitrite, which is typically found in very low levels because it is rapidly converted to more stable forms of nitrogen ions.

The effects of high levels of nitrate in drinking water are well known (e.g., Blue Baby Syndrome); however, nitrate plus nitrite is addressed in this report as related to aquatic life use (ALU) designations. Nitrate is toxic to aquatic life (Camargo et al. 2005; Monson 2010) and contributes to eutrophication, which results in decreased dissolved oxygen levels.

Nitrate toxicity to aquatic life is similar to nitrate toxicity to mammals in that oxygen-carrying compounds are converted to other compounds that cannot carry oxygen (Camargo et al. 2005). In a review of studies, Camargo et al. (2005) found that nitrate toxicity to aquatic invertebrates, fish, and amphibians increased as nitrate concentrations and exposure times increased, while nitrate toxicity decreased with increasing body size and water salinity for aquatic invertebrates.

Sources of nitrate in surface and ground waters include: agricultural runoff, animal or human waste, industrial waste, natural soil inorganic matter, nitrogen fixation, and rain (Camargo et al. 2005; Eby 2004). Both ammonia and nitrate are derived from animal and human waste; bacterial processes control how much of these nitrogen species are reactive. Similar to the ammonia sources, animal waste may enter surface waterbodies via direct deposition (e.g., waterfowl excretion) or through surface runoff (e.g., pet waste deposition on urban lawns, application of manure to crop fields). Sources of human waste are derived from inadequate treatment (e.g., WWTP without tertiary treatment, failing septic systems). In addition to manure application, nitrogen-bearing fertilizers may also be applied to crop fields; runoff from precipitation events may transport fertilizers on crop fields to streams via overland flow or through drain tiles.

NO₂NO₃ data from 1999-2009 were compared to USEPA ecoregion 51 reference conditions. The majority of samples exceeded the NO₂NO₃ criteria for lakes and streams. More than 66 percent of samples exceeded the reference criteria at sampling sites BMK, BOM, BPD, BPT, ECH, ELK, LEE, LEN, NPT, OMN, PBT, and SUT, making this a priority pollutant to address with NPS management. More than 33 percent of samples exceeded the reference condition at ERP and SKG. NO₂NO₃ ranged from 0.001 mg/L to 3.44 mg/L. NO₂NO₃ was highest at the sites along Belanger Creek with slightly lower NO₂NO₃ on Ennis Creek. Average NO₂NO₃ at all sampling sites was 0.51 mg/L.

Percent Solids, Sedimentation, Sand, and TSS

Percent solids are a measure of organic and inorganic components in water. Percent solids can be used as an indicator for sedimentation and siltation impairments. Sedimentation and siltation are controlled by stream hydrology. Streams with high flows can result in channel scour and erosion of the stream channel. Those streams are also able to transport larger sediment particles further distances. Streams that are dominated by lower flow conditions will deposit sediment and associated pollutants resulting in poor quality habitat and loss of spawning beds. In addition, low flowing streams will have lower dissolved oxygen levels. A stream's assimilative capacity for pollutant loads from the watershed will depend on its ability to balance all those factors.

Stream channels develop in response to hydrologic regimes. Urban streams transport many times more sediment than streams in undeveloped areas (Schueler 2004). When urban flow regimes replace natural flow regimes, streams must change and that usually involves increasing the cross-sectional area to accommodate larger flows (Schueler 1994). The urban streams tend to have impervious surfaces that alter the hydrologic regime (e.g., higher magnitude flows, more frequent high flows), which then increases the erosion of the streambed and banks and increases resuspension of bed sediment. Additionally, urban streams can contain sediment that is contaminated with toxic substances (Schueler 2004). Incision, erosion, channel enlargement, and other such alterations that occur in response to the urban hydrologic regime can be produced slowly over a long time or in response to a single large storm water runoff event

(Shaver et al. 2007). Such stream channel alterations result in channel instability that degrades habitat (Schueler 1994).

Primary sources for erosion, sedimentation, and solids in surface waters are agricultural and residential runoff (especially from de-icing agents), leaching of soil contamination and point source water pollution discharge from industrial or sewage treatment plants.

Percent solids sampling was performed at the ten lake sampling sites from 2000 to 2005. The average percent solids ranged from 31.9 to 59.05 percent. The highest observed percent solids were at Omena Bay and Skegemog Lake. GTB performed a single percent solids sampling event in the summer of 2012. Eight of the ten sampling sites have over 68 percent solids. Victoria Creek and Torch River have fewer than 20 percent solids.

TSS sampling was performed at sampling sites from 2003 to 2009. A few TSS samples were above the desired limit for MDEQ permitted points sources of 30 mg/L, but none of the stations exceeded this criteria more than 10 percent of the time sampled. TSS and percent solid samples are representative of sediment in the water column, but do not necessarily represent the possibility of extra sand in a river's bedload.

The GTB six-county service area has a large amount of sand and is covered by glacial deposits ranging from clay to boulder. GTB partners and GTB staff have noted excess sand in streambeds over time. Zorn and Wills assessed the feasibility and applicability of using sand traps to improve stream habitat and flush out extra sand in 2012. The report cites the known issue of excess sand bedloads degrading salmonid habitat and populations in Northern Michigan. Excess sand fills in pools, buries woody habitats, and embeds or covers coarse substrates salmonid and invertebrates need for reproduction and production (Zorn and Wills 2012).

Pesticides

GTB sampled for pesticides in lake sediment and the water column in 2001 and 2002 at their lake sampling sites. No pesticides were detected above the level of detection.

pH

pH affects most chemical and biological processes in water. pH outside of the 6.5 to 9 range reduces biological diversity in streams by stressing many species; it can result in decreased reproduction, decreased growth, disease, or death (USEPA 2012b).

pH sampling by GTB from 1999 to 2009 did not indicate there were pH issues at the sampling sites. pH averages ranged from 7.80 to 8.29 standard units. pH sampling by GTB in 2012 did not indicate any issues with pH on Tribal waters in the GTB six-county service area. All sampled pH levels range from 7.49 to 8.28 standard units. pH is highest at GTB sampling sites in the summer and generally lowest in the fall.

Soluble Reactive Phosphorus

SRP is a measure of orthophosphate. Orthophosphate is the filterable fraction of phosphorus and is readily available for plant (algae) uptake.

Averaged sampled SRP ranged from 0.0017 mg/L to 0.3852 mg/L at sites sampled from 2003 to 2009. Ennis Creek and Belanger Creek had the highest SRP measurements (6.4 and 6.2 mg/L respectively). Average sampled SRP ranged from 0.00148 mg/L to 0.005 mg/L at the 10 sites in 2012. For the most part the SRP levels match those of the total phosphorus sampling although the fall samples at Boardman River and Mitchell Creek are much higher than all other samples taken. There do not appear to be any temporal trends in the 2012 SRP data. There are currently no reference conditions or standards to which these data can be compared.

Temperature

Temperature is one of the factors that defines the structure and function of aquatic systems. It affects solubility of oxygen and other chemicals and rates of nutrient cycling. Temperature can also determine organism survival, growth reproduction, development, behavior, habitat preference, and competition (USEPA 2012b). Increases in waterbody temperatures can occur due to groundwater input, loss of riparian canopy, hydrologic modification from dams, as well as industrial and urban runoff.

Belanger Creek, Betsie River, Boardman River, Ennis Creek, Leland River, Mebert Creek, Mitchell Creek, and Torch River are Michigan designated coldwater trout streams.

Stream and lake temperature samples from 1999 to 2009 are below the maximum warmwater state criteria though some are above those suggested for coldwater fisheries. All stream temperature samples are below the maximum warmwater state criteria though those at Belanger Creek at Omena Road are above those suggested for coldwater fisheries. Temperatures at BOM on Belanger Creek exceeded the coldwater stream standard fifty percent of the time sampled. Spring lake temperatures in Lake Michigan are higher than the recommended monthly maximum temperature at the CRR and BOR sites. These samples are taken at the mouths of Crystal River and Boardman River and may reflect stream temperatures rather than in lake temperatures. These sampling sites are in a transitional zone between the stream and lake, and may be representative of upstream temperatures. Further monitoring is recommended to ensure these sites are meeting temperature recommendations.

Total Nitrogen

Total nitrogen is made up of ammonia/ammonium, organic nitrogen, nitrate, and nitrite. These nitrogen subspecies are part of the nitrogen cycle, which is critical to any ecosystem. USEPA (1999, p. 2-3) describes nitrogen cycling in aquatic ecosystems as follows:

Nitrogen continuously cycles in the aquatic environment, although the rate is temperature-controlled and thus very seasonal. Aquatic organisms incorporate available dissolved inorganic nitrogen into proteinaceous matter. Dead organisms decompose, and nitrogen is released as ammonia ions and then converted to nitrite and nitrate, where the process begins again. If a surface water lacks adequate nitrogen, nitrogen-fixing organisms can convert nitrogen from its gaseous phase to ammonia ions.

Inorganic nitrogen (ammonia/ammonium, nitrate, and nitrite) does not strongly sorb to sediment like phosphorus and can be transported in water either as dissolved ions or as particulates (USEPA 1999). Molecular nitrogen may dissolve directly into surface water while its dissolved forms may be transported through subsurface flow (e.g., interflow, ground water flow). Once nitrogen-species enter surface waters, they can be taken up by algae, macrophytes and micro-organisms (either in the water column or in the benthos); sorbed to organic or inorganic particles in the water and sediment; accumulated or recycled in the sediment; or transformed and released as a gas from the waterbody (denitrification) (USEPA 2000, p. 7).

High nitrogen can harm water quality, food resources and habitats, and it can decrease oxygen needed for aquatic life to survive. Algal blooms can also cause toxicity leading to human illness if in contact with the water or fish that have consumed toxic water. Nitrate in drinking water can cause infant death. Excess atmospheric nitrogen can harm the health of soils, waters and forests. Nitrogen sources include atmospheric deposition, domestic effluents, urban runoff, fertilizer, agricultural runoff, and soil nitrogen.

Total nitrogen was not sampled before 2012. The 2012 TN ranges from 0.05 mg/L to 2.07 mg/L at the 10 sampling sites. Of the three sampling events in 2012 Mebert Creek and Mitchell Creek at the mouth consistently have the highest TN levels. Victoria Creek, Mebert Creek, and Mitchell Creek have concentrations above the reference condition, which is based on measured nitrogen samples in USEPA ecoregion 51; these elevated concentrations above reference conditions potentially indicate impacts of nitrogen sources on the water bodies.

The season with the highest TN concentration per monitoring site varied considerably with no apparent temporal trends in 2012. Four sampling sites each had their highest TN concentrations in fall or spring and two sample sites had their highest concentrations in summer.

Total Phosphorus

Phosphorus is necessary for aquatic life and is needed at some level in a waterbody to sustain life. The natural amount of phosphorus in a waterbody varies depending on the type of system. A pristine mountain spring might have little to almost no phosphorus, whereas a lowland, mature stream flowing through wetland areas might have naturally high concentrations. Phosphorus can be released into the environment through different anthropogenic sources including septic systems, wastewater treatment plants (WWTPs), fertilizer application, and livestock operations. Once released into the environment, phosphorus generally attaches to soil particles and organic matter and is transported with eroded sediments (USEPA 1999).

Phosphorus, like other nutrients, rarely approaches concentrations in the ambient environment that negatively affect aquatic life; in fact, nutrients are essential in minute amounts for properly functioning, healthy, aquatic ecosystems. However, nutrient concentrations in excess of those minute needs can exert negative effects on the aquatic ecosystem by increasing algal and aquatic plant life production (Sharpley et al. 1994). Increased plant production increases turbidity, decreases average dissolved oxygen concentrations, and increases fluctuations in diurnal dissolved oxygen and pH levels. Such changes shift aquatic species composition away from functional assemblages composed of intolerant species, benthic insectivores, and top carnivores that are typical of high-quality streams toward less desirable assemblages of tolerant species, generalists, omnivores, and detritivores that are typical of degraded streams (Ohio EPA 1999). Such a shift in community structure lowers the diversity of the system.

TP sampled from 1999 to 2009 was compared to reference conditions in ecoregion 51. Eleven of the sites sampled had a low level of exceedances (ECH, ELK, ERP, LEE, LEN, LES, NPT, OMN, PBT, SKG, and SUT). TP ranged from 0.0002 to 0.19 mg/L. Values at the Suttons Bay and Peshawbestown Bay sites were the highest. Sampled TP in 2012 ranged from 0.0011 mg/L to 0.0219 mg/L at the ten sites. Two of the sampling sites recorded total phosphorus levels above ecoregion 51 reference conditions for lakes: the Betsie River and Mitchell Creek sampling sites. There do not appear to be any temporal trends in the 2012 phosphorus data.

Turbidity

Turbidity is a measure of water clarity. Turbidity can increase due to increases in algal biomass, as well as erosion and sedimentation. Turbidity readings in Lake Michigan are likely to range from 0.1 Nephelometric Turbidity Units (NTU) to 2.5 NTU (GVSU, 2013). USEPA considers turbidity an early indicator of nutrient enrichment in surface waters (USEPA 2012c).

Average sampled turbidity from 1999 to 2009 ranged from 11.02 NTU to 44.19 NTU at the stream and lakes sites. Turbidity levels sampled by GTB from 1999 to 2009 are above the reference ecoregion criteria at each sampling site. Turbidity was highest in the Belanger Creek and Ennis Creek stream samples.

Average sampled turbidity in 2012 ranged from 0.6 NTU to 11.5 NTU at the ten sites. Summer values at the BOR site were well above the others at 34.1 NTU. Turbidity levels sampled by GTB in 2012 are above the reference ecoregion criteria at each sampling site. Median turbidity values from all GTB samples are at 3.8 NTU or below.

Data Interpretation for each Waterbody

The following section of the report discusses the available water quality data for each sampled site. Data trends and specific pollutant sources are discussed where applicable. Table 17 through Table 19 site the Tribal waterbodies, their beneficial uses, and their goal attainment status. Summary of all water quality data sampled by GTB used in this analysis are provided in GTB 2009 and GTB 2013.

Use Goal Attainment Status Determination

As noted previously in this report, GTB has not yet established Tribal WQS. Until Tribal standards are adopted, WQS developed by the MDEQ will be used as interim Tribal water quality goals or targets to guide NPS and other water quality improvement efforts of GTB. To determine the areas on the GTB six-county service area where goals are not being met, a water quality determination analysis was conducted. Data for each site were compared to applicable state WQS, which were based on beneficial uses identified for each site. Reference conditions from national guidance were used when no state standard was available.

When 10 percent or more of the 1999-2009 samples exceeded the state standard or reference condition a waterbody was designated as “not meeting goals.” With the limitations of one year’s sampling at the 2012 GTB sampling sites it is difficult to determine if the waterbodies are meeting their Tribal goals. Future years’ data will be used to continually assess the status of these waters. To prioritize future management and water quality assessment the data available were used to assign a status to each site. When two or more of the samples exceeded the state standard or reference condition, a waterbody was designated as “not meeting goals.” When 1 of the samples exceeded the state standard or reference condition, the waterbody was designated “threatened.”

Table 16 through Table 24 show the criteria exceeded, goal status, and percent exceedance for each parameter, by sampling site, for threatened or “not meeting goals” sites.

Michigan BeachGuard Beaches were designated as “not meeting goals” if more than 20 percent of daily mean samples exceeded the total body contact standard and more than 10 percent of all samples exceeded the total body contact standard for that beach.

Waterbodies that were threatened or not meeting the goals were further classified according to degree. Waters were assigned a classification of low, medium, or high goal status on the basis of the percentage of samples that exceeded the standard. If between 0 and 33 percent of the samples exceeded the standard, the waterbody goal status was designated “low”; if between 33 and 66 percent of the samples exceeded the standard, the waterbody goal status was designated “medium”; and if more than 66 percent of the samples exceeded the standard, the waterbody was designated as “high” in terms of not meeting goals. For those waterbodies with exceedances further future sampling is recommended. For those waterbodies with pollutants that exceed suggested reference conditions further sampling is suggested as well as determining a Tribal water quality standard.

Antrim County Sampling Site Summaries

GTB samples Elk River, Elk Lake, Elk Rapids, Skegemog Lake, Clam River, and Torch River in Antrim County. All of these sites drain to the Grand Traverse Bay watershed and Elk River Chain of Lakes subwatershed. In general nutrients and turbidity at all of these sites are above the desired reference conditions. GTB NPS in this county are mostly urban runoff and lawn care from the Alden summer camp and subdivision. GTB is concerned with runoff from the dirt road/culvert at the camp and road/stream crossings in this County. As previously reported, forests are the primary land cover in Antrim County (49.2 percent), while wetlands and open water comprise another 17.8 percent. Table 15 summarizes the beneficial uses for GTB waterbodies in this county.

Table 15. Antrim County Waterbodies, Sampling Sites, and Beneficial Uses

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Grand Traverse Bay – Elk River Chain of Lakes	040601050304	Torch Lake	CLR	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
	040601050404	Lake Skegemog	TOR	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
			SKG	
	040601050405	East Arm of Grand Traverse Bay	ELR	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
		Elk Lake	ELK	
		Elk Rapids	ERP	

Note: *GTB current and desired uses highlighted in bold

Table 16 summarizes water quality criteria exceedances at sampling sites in Antrim County. Water quality did not exceed the applicable reference conditions at the CLR sampling site on Torch Lake. Water quality exceeded the applicable criteria or reference conditions for turbidity at the TOR sampling site on the Torch River. Water quality in Skegemog Lake at SKG exceeded reference conditions for chlorophyll-a, total phosphorus, turbidity, and NO₂NO₃. Water quality exceeded the applicable criteria or reference conditions for turbidity at the ELR sampling site on the Elk River. Water quality in Elk Lake at ELK exceeded reference conditions for total phosphorus and NO₂NO₃. Water quality in the Elk Rapids at ERP exceeded reference conditions for total phosphorus, turbidity, and NO₂NO₃.

Table 16. Status for Sampling Sites in Antrim County

Sampling site ID	Characteristic Name	Criteria	Goal Status	Percent Exceedance
ELK	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	83
	TP (µg/L)	> 20	NMG	21
ELR	Turbidity (NTUs)	> 0.84	T	33
ERP	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	65
	TP (µg/L)	> 20	NMG	20
	Turbidity (NTUs)	> 0.84	NMG	20
SKG	Chlorophyll-a	> 2.02	NMG	17
	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	64
	TP (µg/L)	> 20	NMG	31
	Turbidity (NTUs)	> 0.84	NMG	19
TOR	Turbidity (NTUs)	> 0.84	T	33

Notes: NMG=Not Meeting Goals, T=Threatened

Benzie County Sampling Site Summaries

The Betsie Lake-Betsie River 12-digit HUC subwatershed encompasses 9,653 acres. GTB samples one site in this subwatershed on the Betsie River (BER). GTB parcel 33 lies on the south side of Betsie Lake and is a potential site for wetland rehabilitation and invasive species eradication. NPS along this parcel are runoff from the paved road running along the property, marinas located on both sides, and the abandoned railroad right-of-way. As previously discussed, forests are the primary land use in the Betsie Lake-Betsie River subwatershed (40.7 percent). Combined agricultural uses represent 24.4 percent of the landscape with grasslands and pasture hay dominating this land use. Wetlands comprise another 16.3 percent. Developed area covers 14.8 percent of the Betsie Lake-Betsie River subwatershed. Table 17 summarizes the beneficial uses for Betsie Lake.

Table 17. Benzie County Waterbodies, Sampling Site, and Beneficial Uses

Watershed	Subwatershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Lake Michigan	Betsie River	040601040307	Betsie Lake	BER	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)

Note: * GTB current and desired uses highlighted in bold

Table 18 summarizes water quality criteria exceedances at sampling site BER. Water quality exceeded the applicable criteria or reference conditions for TP and turbidity at the BER sampling site in Betsie Lake.

Table 18. Status for Sampling Site BER in Benzie County

Characteristic Name	Criteria	Goal Status	Percent Exceedance
Total Phosphorus (µg/L)	> 20	NMG	75
Turbidity (NTUs)	> 0.84	NMG	100

Notes: NMG=Not Meeting Goals, T=Threatened

Charlevoix County Sampling Site Summaries

The South Arm Lake Charlevoix 12-digit HUC subwatershed encompasses 21,050 acres. As previously discussed, forest is the primary land cover in the South Arm Lake Charlevoix subwatershed (34.0 percent). Combined agricultural uses represent 13.5 percent of the landscape. 13.5 percent of the subwatershed is open water. Developed area covers 8.1 percent of the South Arm Lake Charlevoix subwatershed. The East Jordan Tourist Park beach is sampled for the Michigan BeachGuard System. GTB does not currently sample any waters in Charlevoix County. Table 19 summarizes the beneficial uses for Lake Charlevoix.

Table 19. Charlevoix County Waterbodies, Sampling Site, and Beneficial Uses

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Lake Charlevoix	040601050206	Lake Charlevoix	East Jordan Tourist Park Beach(325)	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)

Note: * GTB current and desired uses highlighted in bold

Table 20 summarizes water quality criteria exceedances at the East Jordan Tourist Park beach. Water quality exceeded the applicable *E. coli* criteria for total body contact at this beach. NPS of bacteria in this area may include agriculture, septic systems, and recreational use.

Table 20. Status for sampling site 325 in Charlevoix County

Characteristic Name	Criteria	Goal Status	Percent Exceedance
<i>E. coli</i> (MPN/100 mL)	> 130		0
	> 300	NMG	20 (Daily Mean) and 10.5 (All Samples)
	> 1000		0

Note: NMG=Not Meeting Goals

Grand Traverse County Sampling Site Summaries

GTB samples three sampling sites in Grand Traverse County and the Bayside Acme Township Park beach is sampled for the Michigan BeachGuard System. GTB owns over 1,200 acres in this county including those used for the Turtle Creek Casino and resort as well as the Turtle Creek SBR wastewater treatment plant. As previously discussed, forests are the primary land cover in Grand Traverse County (43.3 percent). Table 21 summarizes the beneficial uses for GTB waterbodies in this subwatershed.

Table 21. Grand Traverse County Waterbodies, Sampling Sites, and Beneficial Uses

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Grand Traverse Bay – Boardman River	040601050507	West Arm Grand Traverse Bay	BOR	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1) • Public Water Supply Source (Traverse City)
Grand Traverse Bay	040601050704	East Arm Grand Traverse Bay	Bayside Acme Township Park (1799)	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
	In the West arm of Grand Traverse Bay	West Arm Grand Traverse Bay	LEE	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
Grand Traverse Bay – Mitchell Creek	040601050705	Mitchell Creek	MIC	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)

Note: * GTB current and desired uses highlighted in bold

Table 22 summarizes water quality criteria exceedances at Grand Traverse Bay County sampling sites. Water quality exceeded the applicable criteria or reference conditions for turbidity and May temperature at the BOR sampling site on the Boardman River. The habitat assessment score ranked the site as marginal. This river is used by many boats and there is potential for boating pollution. Water Quality exceeded the applicable *E. coli* criteria for total body contact at the Bayside Acme Township Park beach. Water quality at Lee Point in the west arm of Grand Traverse Bay exceeded the reference conditions for nutrients and turbidity. Water quality exceeded the applicable criteria or reference conditions for the following parameters at the MIC sampling site on Mitchell Creek:

- Chlorophyll-a
- Conductivity
- Nitrogen
- Phosphorus
- Turbidity

Mitchell Creek is a priority site for watershed partners with many upstream NPS. Upstream channelization, wetland filling, and an old logging dam have altered the natural channel and embedded the stream with sand.

Table 22. Status for Sampling Sites in Grand Traverse County

Sampling site ID	Characteristic Name	Criteria	Goal Status	Percent Exceedance
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Sampling site ID	Characteristic Name	Criteria	Goal Status	Percent Exceedance
Bayside Acme Township Park (1799)	<i>E. coli</i> (MPN/100 mL)	> 130		0
		> 300	NMG	23 (Daily Mean) and 10.7 (All Samples)
		> 1000		0
BOR	Habitat Assessment Score	Marginal	NMG	
	Temperature (F)	> 55	T	33
	Turbidity (NTUs)	> 0.84	T	33
LEE	NO2NO3 (mg/L)	> 0.008	NMG	67
	TP (µg/L)	> 20	NMG	11
	Turbidity (NTUs)	> 0.84	NMG	11
MIC	Chlorophyll <i>a</i> (µg/L)	> 2.02	T	33
	Conductivity (mS/cm)	> 0.5	NMG	66
	Nitrogen (mg/L)	> 0.81	NMG	100
	TP (µg/L)	> 20	NMG	66
	Turbidity (NTUs)	> 0.84	NMG	66

Notes: NMG=Not Meeting Goals, T=Threatened

Leelanau County Sampling Site Summaries

GTB samples four sites in four different 12-digit HUC subwatersheds in Leelanau County. GTB parcels in this county include the majority of GTB properties in Peshawbestown. The properties include fifty-two parcels with a variety of uses. As previously discussed, forests are the primary land cover in Leelanau County (43.9 percent). Combined agricultural uses represent 18.0 percent of the landscape, while wetlands and open water comprise another 15.1 percent. Developed surfaces cover 7.4 percent of Leelanau County. GTB samples Belanger Creek, Ennis Creek, Mebert Creek, Victoria Creek, Crystal River, Leland River, and Lake Michigan. These sampling sites lie in the Grand Traverse Bay, Lake Leelanau, Glen Lake/Crystal River, and Lake Michigan watersheds. The Peshawbestown area is GTB's number one priority for NPS management on Tribal lands. Table 23 summarizes the beneficial uses for GTB waterbodies in this County.

Table 23. Leelanau County Waterbodies, Sampling Sites, and Beneficial Uses

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Grand Traverse Bay	040601050708	Belanger Creek	BMK	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 –
			BOM	
			BPD	

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
			BPT	October 1)
		Ennis Creek	ECH	
		West Arm of Grand Traverse Bay	NPT	
			OMN	
			PBT	
			SUT	
Glen Lake/Crystal River	040601040402	Lake Michigan	CRR	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
Lake Leelanau	040601040101	Victoria Creek	VIC	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
	040601040102	Mebert Creek	MEC	<ul style="list-style-type: none"> • Agriculture • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
	040601040103	Lake Michigan	LER	<ul style="list-style-type: none"> • Agriculture

Watershed	HUC12 ID	Waterbody	Site ID	State Beneficial Uses and Current Tribal Uses
Lake Michigan	040601040401	Lake Michigan	LEN	<ul style="list-style-type: none"> • Navigation • Industrial water supply • Warmwater Fishery • Other Indigenous aquatic life and wildlife • Partial body contact recreation • Commercial Fishing/Fish Consumption • Subsistence Fishing • Spiritual and Cultural Uses • Total Body Contact Recreation (May 1 – October 1)
			LES	

Note: * GTB current and desired uses highlighted in bold

Table 24 summarizes water quality criteria exceedances at sampling sites in Leelanau County. Water quality exceeded recommended NO₂NO₃ and turbidity criteria at all Belanger Creek sampling sites. Habitat at the Belanger Creek site at Omena Road was rated marginal in 2004 and 2005. Water quality data at Ennis Creek exceeded the reference criteria for NO₂NO₃, TP, and turbidity. Macroinvertebrate sampling in 2002 on Ennis Creek and Belanger Creek rated the sites as marginal. Temperatures in Belanger Creek at Omena road exceeded the coldwater stream standards in March, June, July, and September when sampled. This site has very low flow and is almost stagnant at times which could contribute to higher temperatures. Flow upstream of this site has historically diminished in the summer. There is high erosion and high sedimentation upstream of this site. Water quality exceeded the applicable criteria reference conditions for turbidity and May temperature at the CRR sampling site on the Crystal River. The habitat assessment score ranked the CRR site as marginal. Water quality at Lake Michigan sampling site LEN exceeded the NO₂NO₃ and TP reference criteria. Water Quality did not exceed the applicable reference conditions at the LER sampling site on Lake Michigan. Water quality at the LES sampling sites exceeded reference criteria for NO₂NO₃, TP, and turbidity. Water quality exceeded the applicable criteria or reference conditions for nitrogen and turbidity at the MEC sampling site on the Mebert Creek. Water quality exceeded the NO₂NO₃, TP, and turbidity reference criteria at all of the sampling sites in the west arm of Grand Traverse Bay. Twenty-two percent of samples exceeded the chlorophyll-a reference criteria at the Sutton Bay sampling site. Water quality exceeded the applicable reference conditions for nitrogen and turbidity at the VIC sampling site on the Victoria Creek.

Table 24. Status for Sampling Sites in Leelanau County

Sampling site ID	Characteristic Name	Criteria	Goal Status	Percent Exceedance
BMK	NO ₂ NO ₃ (mg/L)	> 0.13	NMG	77
	Turbidity (NTUs)	> 0.84	NMG	80
BOM	Habitat Assessment Score	Marginal	NMG	66
	NO ₂ NO ₃ (mg/L)	> 0.13	NMG	27
	Turbidity (NTUs)	> 0.84	NMG	25
	Temperature	> Coldwater criteria in March, June, July, August, and September	NMG	66
BPD	NO ₂ NO ₃ (mg/L)	> 0.13	NMG	75
	Turbidity (NTUs)	> 0.84	NMG	100
BPT	NO ₂ NO ₃ (mg/L)	> 0.13	NMG	71
	Turbidity (NTUs)	> 0.84	NMG	100
CRR	Habitat Assessment Score	Marginal	NMG	
	Temperature (F)	> 55	T	33

Sampling site ID	Characteristic Name	Criteria	Goal Status	Percent Exceedance
	Turbidity (NTUs)	> 0.84	T	33
ECH	NO ₂ NO ₃ (mg/L)	> 0.13	NMG	67
	TP (µg/L)	> 28.75	NMG	13
	Turbidity (NTUs)	> 0.84	NMG	80
LEN	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	84
	TP (µg/L)	> 20	NMG	13
LES	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	84
	TP (µg/L)	> 20	NMG	21
	Turbidity (NTUs)	> 0.84	NMG	13
MEC	Nitrogen (mg/L)	> 0.71	NMG	100
	Turbidity (NTUs)	> 0.84	NMG	66
NPT	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	67
	TP (µg/L)	> 20	NMG	11
OMN	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	76
	TP (µg/L)	> 20	NMG	16
	Turbidity (NTUs)	> 0.84	NMG	15
PBT	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	80
	TP (µg/L)	> 20	NMG	20
	Turbidity (NTUs)	> 0.84	NMG	15
SUT	Chlorophyll-a	> 2.02	NMG	22
	NO ₂ NO ₃ (mg/L)	> 0.008	NMG	77
	TP (µg/L)	> 20	NMG	19
	Turbidity (NTUs)	> 0.84	NMG	10
VIC	Nitrogen (mg/L)	> 0.71	NMG	100
	Turbidity (NTUs)	> 0.84	T	33
Belanger Creek 2002	Macroinvertebrates	Marginal	NMG	
Ennis Creek 2002	Macroinvertebrates	Marginal	NMG	

Notes: NMG=Not Meeting Goals, T=Threatened

SECTION 7 – DISCUSSION

This section provides a detailed interpretation of the results section. Table 25 summarizes the goal attainment status for each sampling site reviewed in SECTION 6 – Results. Based on the percent of exceeding samples, parameters were assigned a priority of low, medium, or high goal impairment status. NO₂NO₃ exceedances are high at most sites sampled from 1999-2009. TN exceedances are high at three of the 2012 sampling sites. Chlorophyll-*a* was exceeded once at the Mitchell Creek sampling site in 2012. TP had medium exceedances at the Mitchell Creek sampling site and high exceedance at the Betsie River site in 2012. Turbidity has a low percentage of goal status exceedances at several sampling sites on the GTB six-county service area as well as medium and high exceedances at a few sampling sites. Conductivity has a medium level of exceedance at the Mitchell Creek sampling site. Three sampling sites have marginal habitat. Two spring temperature samples in Lake Michigan exceeded the recommended maximum for Lake Michigan in 2012. Coldwater stream targets were exceeded at one sampling site on Belanger Creek (BOM) in several months sampled. Two Michigan DEQ BeachGuard sampling sites exceeded total body contact standards for *E. coli* in 2012.

Additional sampling is recommended for all Tribal waters to better characterize water quality conditions in the future. For those waterbodies with goal attainment exceedances, further sampling is recommended to confirm potential impairment and water quality trends. For those waterbodies with pollutants that exceed suggested reference conditions, further sampling is suggested to help determine a Tribal water quality standard. Sampling of all parameters will be consistent with GTB 2013 CWA Section 106 QAPP. A list of recommended sampling for the GTB six-county service area is provided below:

- Continuing the current monitoring program for a minimum of three years for all parameters is recommended at the current GTB sampling sites on an annual basis for trend and impairment analysis.
- *E. coli* monitoring of at least 5 samples over a 30 day period are recommended to compare to the Michigan state numeric criteria for *E. coli* when and if funding becomes available.
- TSS monitoring of streams sites to better identify potential sedimentation and erosion impairments
- Dissolved oxygen and Secchi depth profile sampling of lake sampling sites when and if funding becomes available.
- There are currently no MDEQ numeric criteria for turbidity, TN, TP, SRP, percent solids, or conductivity. It is recommended that follow up sampling is used to help GTB adopt Tribal WQS or Tribal water quality goals for these parameters.
- Stream reference conditions for conductivity and turbidity were used as interim targets for lake sites; it is recommended that follow up sampling is used to help GTB adopt Tribal lake clarity goals.

Table 25. Goal Attainment Status Summary

Sampling site ID	Chlorophyll a (mg/L)	Cond. (mS/cm)	E. Coli (MPN/100 mL)	Habitat Assessment	NO2NO3 (mg/L)	Temperature (F)	TN (mg/L)	TP (µg/L)	Turbidity (NTUs)
	R: > 1.03 LK: > 2.02	> 0.5	Total Body Contact Standard : 300	Marginal	R: > 0.13 LK: > 0.008	Lake Michigan May: 55 CWS: Varies	R: > 0.71 LK: > .81	R: > 28.75 LK: > 20	> 0.84
325			NMG						
1799			NMG						
BER								NMG	NMG
BMK					NMG				NMG
BOM				NMG	NMG	NMG			NMG
BOR				NMG		T			T
BPD					NMG				NMG
BPT					NMG				NMG
CLR									
CRR				NMG		T			T
ECH					NMG			NMG	NMG
ELK					NMG			NMG	
ELR									T
ERP					NMG			NMG	NMG
LEE					NMG			NMG	NMG
LEN					NMG			NMG	
LER									
LES					NMG			NMG	NMG
MEC							NMG		NMG
MIC	T	NMG	T*				NMG	NMG	NMG
NPT					NMG			NMG	
OMN					NMG			NMG	NMG
PBT					NMG			NMG	NMG
SKG	NMG				NMG			NMG	NMG
SUT	NMG				NMG			NMG	NMG
TOR									T
VIC							NMG		T

Notes: **E. coli* is a partner parameter of concern for this watershed
NMG = Not Meeting Goals, T= Threatened, R= River, LK= Lake, CWS = Variable by month coldwater stream standard

The discussion below ties goal attainment status to the potential sources for each major waterbody. Table 26 summarizes the level of goal exceedances as high (>66 percent exceeding the goal status), medium (34 to 66 percent exceeding the goal status), and low (<34 percent exceeding the goal status) for all of GTB sampling sites.

Table 26. Level of Goal Attainment Status Exceedances

Sampling site ID	Chlorophyll a (mg/L)	Cond. (mS/cm)	E. Coli (MPN/100 mL)	Habitat Assessment	NO ₂ NO ₃ (mg/L)	Temperature (F)	TN (mg/L)	TP (µg/L)	Turbidity (NTUs)
	R: > 1.03 LK: > 2.02	> 0.5	Total Body Contact Standard: 300	Marginal	R: > 0.13 LK: > 0.008	Lake Michigan May: 55 CWS: Varies	R: > 0.71 LK: > .81	R: > 28.75 LK: > 20	> 0.84
325			L						
1799			L						
BER								H	H
BMK					H				H
BOM				M	L	H			L
BOR				L		L			L
BPD					H				H
BPT					H				H
CLR									
CRR				L		L			L
ECH					H			L	H
ELK					H			L	
ELR									L
ERP					M			L	L
LEE					H			L	L
LEN					H			L	
LER									
LES					H			L	L
MEC							H		M
MIC	L	M	L*				H	M	M
NPT					H			L	
OMN					H			L	L
PBT					H			L	L
SKG	L				M			L	L
SUT	L				H			L	L
TOR									L
VIC							H		L

Notes: *E. coli is a partner parameter of concern for this watershed
H= High, M= Medium, L= Low, GM= geometric mean, NTE= Total body contact not to exceed standard,
CWS = Variable by month coldwater stream standard

Betsie River

- Priority Water Quality Concerns:
Total Phosphorus (**High**)
Turbidity (**High**)
Sedimentation/Sand (**High**)
- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
- NPS Categories of Concern and Priority Management (GTB Parcels):
Landscaping (24, 59)
Septic Systems (59)
Urban Runoff (24, 33, 50, 59)
Transportation (33)
Road construction, maintenance, and runoff (33)

Glen Lake/Crystal River

- Priority Water Quality Concerns:
Sedimentation/Sand (**High**)
Habitat (**Marginal**)
Temperature (**Low**)
Turbidity (**Low**)
- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
Temperature to help determine source of high spring values
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
- Pollution Categories of Concern and Priority Management:
GTB does not currently own parcels in this watershed

Grand Traverse Bay

- Priority Water Quality Concerns:
NO₂NO₃ (**High**)
Total Nitrogen (**High**)
Turbidity (**High**)
Sedimentation/Sand (**High**)
Conductivity (**Medium**)
Total Phosphorus (**Medium**)
Chlorophyll a (**Low**)
E. coli (**Low**)
Habitat (**Low**)*
Macroinvertebrates (**Low**)*
Temperature (**Low**) (High at one site from 1999-2009 on Belanger Creek, but not impaired downstream)

Note: GTB only has one sample to rank habitat and macroinvertebrate data. If data in following years does not meet standards or criteria GTB will raise the priority of these concerns.

- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
Dissolved oxygen and Secchi depth profile sampling of lake sampling sites when and if funding becomes available.
- Pollution Categories of Concern and Priority Management (GTB Parcels):
Landscaping (0, 6, 7, 8, 12, 13, 15, 25, 29, 44, 45, 53, 58, 64, 65, 22a, 22b, 26a, 26b, 40a)
Agriculture/Specialty Crop Production (57, 71)
Construction (1)
Marinas (1)
Hydrologic/Habitat Modifications (0, 13, 20, 26a)
Flow Regulation/Modification (13)
Septic Systems (12, 45, 52)
Urban Runoff (0, 1, 2, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16, 18, 19, 25, 29, 31, 34, 35, 39, 41, 42, 44, 45, 52, 53, 60, 61, 64, 65, 68, 22a, 22b, 26a, 26b, 40a, 40b)
Transportation (11, 20, 21)
Road construction, maintenance, and runoff (11)
Railroads (20, 21)
Snow maintenance (11)

Boardman River

- Priority Water Quality Concerns:
Sedimentation/Sand (**High**)
Habitat (**Low**)*
Temperature (**Low**)
Turbidity (**Low**)

Note: GTB only has one sample to rank habitat and macroinvertebrate data. If data in following years does not meet standards or criteria GTB will raise the priority of these concerns.

- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
GTB should continue temperature monitoring to help determine if the BOR site should meet coldwater stream standards.
- Pollution Categories of Concern and Priority Management:
GTB does not currently own parcels in the Boardman River watershed

Elk River Chain of Lakes

- Priority Water Quality Concerns:
NO₂NO₃ (**High**)
Sedimentation/Sand (**High**)
Chlorophyll-a (**Low**)
TP (**Low**)
Turbidity (**Low**)
- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids

E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.

Dissolved oxygen and Secchi depth profile sampling of lake sampling sites when and if funding becomes available.

Future sampling of Spencer Creek is recommended if funding allows.

- Pollution Categories of Concern and Priority Management (GTB Parcels):
 - Landscaping (12, 45)
 - Septic Systems (12)
 - Urban Runoff (12, 45, 68)
 - Transportation (11)
 - Road construction, maintenance, and runoff (11)
 - Snow maintenance (11)

Mitchell Creek (Grand Traverse County)

- Priority Water Quality Concerns:
 - Total Nitrogen (**High**)
 - Sedimentation/Sand (**High**)
 - Conductivity (**Medium**)
 - Total Phosphorus (**Medium**)
 - Turbidity (**Medium**)
 - Chlorophyll a (**Low**)
 - E. coli* (**Low**)
- Recommended Sampling:
 - Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
 - E. coli* sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
 - GTB should continue temperature monitoring to help determine if the MIC site should meet coldwater stream standards.
- Pollution Categories of Concern and Priority Management (GTB Parcels):
 - Hydrologic/Habitat Modifications*
 - Flow Regulation/Modification*
 - Urban Runoff (41)

* These pollution categories are not on GTB parcels, though they do lie upstream and affect Tribal waters, there is partner support for a hydrogeologic study to repair the Mitchell Creek Channel upstream of GTB parcels.

Lake Charlevoix

- Priority Water Quality Concerns:
 - Sedimentation/Sand (**High**)
 - E. coli* (**Low**)
- Recommended Sampling:
 - E. coli* sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
- Pollution Categories of Concern and Priority Management (GTB Parcels):
 - Landscaping (23, 28)
 - Agriculture/Specialty Crop Production (48)
 - Septic Systems (30)
 - Urban Runoff (30)

Lake Leelanau

- Priority Water Quality Concerns:
Total Nitrogen (**High**)
Sedimentation/Sand (**High**)
Turbidity (**Medium**)
- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
TSS monitoring to better identify potential sedimentation and erosion impairments
- Pollution Categories of Concern and Priority Management:
GTB does not currently have parcels with priority management in this watershed

Lake Michigan

- Priority Water Quality Concerns:
NO₂NO₃ (**High**)
Sedimentation/Sand (**High**)
Turbidity (**High**)
Total Phosphorus (**Medium**)
Habitat (**Low**)*
Temperature (**Low**)

Note: GTB only has one sample to rank habitat and macroinvertebrate data. If data in following years does not meet standards or criteria GTB will raise the priority of these concerns.

- Recommended Sampling:
Continued monitoring of all parameters, specifically dissolved oxygen, pH, turbidity, total nitrogen, total phosphorus, conductivity, and percent solids
Temperature to help determine source of high spring values
E. coli sampling that meets the MDEQ five-day geometric mean criteria if funding becomes available.
- Pollution Categories of Concern and Priority Management (GTB Parcels):
Construction (55)
Landscaping (54)
Marinas (55)
Urban Runoff (54)

For the most part samples at GTB sites met recommended water quality criteria though nutrients, turbidity, and sediment are sometimes higher than desired. Based on the water quality assessment several GTB monitoring and assessment priorities are outlined below including priority management of Belanger and Mitchell Creeks and priority follow up sampling and source management where turbidity, nitrogen, phosphorus, habitat, *E. coli*, and spring lake temperatures were not meeting goals.

Peshawbestown Area:

The entire Peshawbestown area is a priority management area for GTB. The majority of GTB members live in this area and Belanger Creek runs directly through the town. From 1999-2009 Belanger Creek showed signs of potential nutrient and turbidity impairment. This area is one where GTB can see the most benefit from managing at the 319 parcel level.

Lake Michigan at Mitchell Creek:

MIC is a priority site with the most standard or reference criteria exceedances in 2012. This site is downstream of a moderately developed residential area before it enters Lake Michigan. The stream has a history of environmental concerns including dam development, chlorine fish kills, and channel diversion. In August of 2012 DNR sampled the Mitchell Creek fishery and provided management direction. GTB was included in a list of partners that should work to address culverts and road crossings on Mitchell Creek that are restricting fish movement and modifying the streams thermal regime (MDNR 2012).

Turbidity:

Turbidity levels were high at all sampling sites. Turbidity levels can increase in stream due to streambank disturbance from erosion, grazing activities, and runoff from dirt roads, crop fields, urban areas, and construction activities.

Nutrients:

NO₂NO₃ levels were high at all sampling sites sampled from 1999 through 2009. Total nitrogen levels were high at both stream sites as well as at the Mitchell Creek site in 2012. Total phosphorus levels were high at the BER and MIC sampling sites in 2012. Total phosphorus levels were high at all lake sites sampled from 1999 through 2009. Runoff from storm sewers and WWTP outfalls can contribute to higher nutrient levels in these waterbodies. Nonpoint sources of nutrients in the GTB six-county service area include agricultural runoff, unregulated urban runoff, inadequate or failing septic systems, erosion of soils naturally high in nutrients, and wildlife.

Habitat:

Habitat at the Crystal River, Boardman River, and Omena road Belanger Creek sites was rated marginal. GTB will prioritize cooperation with watershed partners to bring this habitat back to the desired high quality habitat.

E. coli:

E. coli levels can increase due to inadequate or failing septic systems, recreational waterbody use, wildlife, and urban runoff. A low level of *E. coli* exceedances is seen at several beaches, two of which exceeded the total body contact standard more than 10 percent of the sampled time.

Spring Temperatures:

Spring temperature levels at two Lake Michigan sites were higher than the state recommendations for Lake Michigan (CRR and BOR). Water temperatures from upstream dams, drains, groundwater, and septic systems could also influence these spring lake temperatures. Temperature levels at Omena road on Belanger Creek were higher than coldwater stream standards in several sampled months. This site is downstream of Bass Lake and has historical low flows, especially in summer, which could contribute to high temperatures.

SECTION 8 – SELECTION OF NPS BMPs

This section discusses GTB's process for selecting best management practices (BMPs) to address the NPS water pollution issues discussed in Section 7 of this report. It provides details outlining GTB's programmatic capability and legal right to manage NPS pollution of Tribal waters. It also provides an overview of the core participants in GTB's BMP selection process and the approaches for public participation and governmental coordination during the selection process. In addition, this section identifies existing BMPs and the process for selecting BMPs in the future to address NPS of pollution identified in Section 7. Implementation of BMPs will be addressed in GTB's Section 319 NPS Management Program Plan.

Mission Statement and Boundary Description

GTB's Natural Resources Departmental Mission Statement serves as a basis for the proper management of water resources within GTB's GTB six-county service area.

The Grand Traverse Band Natural Resources Department will protect and enhance the natural resources and environment entrusted to us by the Creator for managed and respected utilization by Anishinabek for past, present, and future generations.

GTB's Section 319 NPS Management Program will play a key role in protecting and enhancing water quality within the GTB six-county service area by identifying existing and potential NPS causes and sources and collaborating with Tribal and non-Tribal partners to address NPS challenges. As mentioned in Section 1, GTB's Section 319 NPS Management Program boundaries were established by GTB Tribal Council to include all Tribally-owned parcels purchased before October 10, 2001. The list of parcels included in the Section 319 NPS Management Program is found in Table 10 in Section 4. GTB has had on-going internal discussions about modifying the Section 319 NPS Management Program boundary to include other portions of GTB's the GTB six-county service area to allow GTB to better address NPS sources, recognizing that the NPS contributions from the parcels purchased before October 10, 2001 are likely not the most significant sources of NPS pollutants to GTB's water resources.

Core Participants

GTB intends to lead a cooperative effort to identify NPS challenges and select BMPs best suited to address nonpoint source pollution within the GTB six-county service area, specifically on the parcels that fall under the current GTB Section 319 NPS Management Program boundary. However, GTB will continue to work in collaboration with key partners, depending on the nature of the BMP and the geographic location targeted for implementation. Key partners include local, state, and federal agencies that could provide technical assistance, consultation, aid in education, implement demonstration projects, or provide financial assistance to promote BMP implementation.

Table 27 presents the core participants, the mission of these agencies and organizations, and the role during BMP selection and implementation. Figure 24 and Figure 25 show the organizational flow of GTB and its non-Tribal partnerships for addressing NPS pollution. The process for BMP selection with aid from these participants is described in detail below.

Table 27. Core Participants, Mission, and Associated Role in GTB NPS BMP Selection

Participant	Mission	Role in BMP Selection and Implementation
Grand Traverse Band		
Tribal Council	Authorizes activities and establishes policies.	Final approval of BMP selection
Division III Manager, Government Support Services	Oversees staff responsible for administering GTB's surface water programs, as well as fish and wildlife programs	Lead role in final BMP selection, siting, coordination, and implementation
Environmental Services Coordinator	Oversees environmental protection efforts on lands within GTB's jurisdiction, including surface water monitoring and NPS Management Program.	Lead role in final BMP selection, siting, coordination, and implementation
Water Quality Specialist	Responsible for the CWA Sections 106 water quality and 319 NPS programs. No oversight.	Lead role in final BMP selection, siting, coordination, and implementation
Environmental Response Coordinator	Manages GTB's Brownfields program	Provides input on BMP selection, siting, coordination, and implementation
Aquatic Biologist	Responsible for the CWA Section 106 Tribal Water Quality Program within the 1855 Treaty Ceded Territories. Also assists Water Quality Specialist with the CWA Section 319 program.	Lead role in final BMP selection, siting, coordination, and implementation
Legal Department	Handles all Tribal legal matters and oversees the development of Tribal ordinances and regulations	Lead role in development of BMPs involving new or revised ordinances
Public Works	Charged with providing reliable wastewater collection and treatment for discharge into the Grand Traverse Bay and ground water	Participant in BMP selection and implementation, where applicable
GTB Automotive	Provides quality automotive repair services for Tribal members and fleet repair services for the Government and EDC vehicles.	Participant in BMP selection and, as needed, implementation
Conservation	Issues fishing and hunting licenses; conducts fisheries habitat surveys; operates commercial marina; provides mapping and technical assistance	Participant in BMP selection, siting, and implementation by providing mapping support
Green Committee	Is comprised of voluntary GTB Governmental staff that provide "green" concepts, programs, and educational information to GTB staff via global e-mailings and to the GTB community via GTB newsletter articles.	Participant in BMP selection and implementation, where applicable.
Housing Department	Provides the people of GTB Community with quality services, housing opportunities, and community development with the goal of perpetual self-sufficiency. Provides support for well/septic applications.	Participant in BMP selection and implementation, where applicable

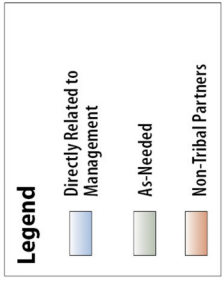
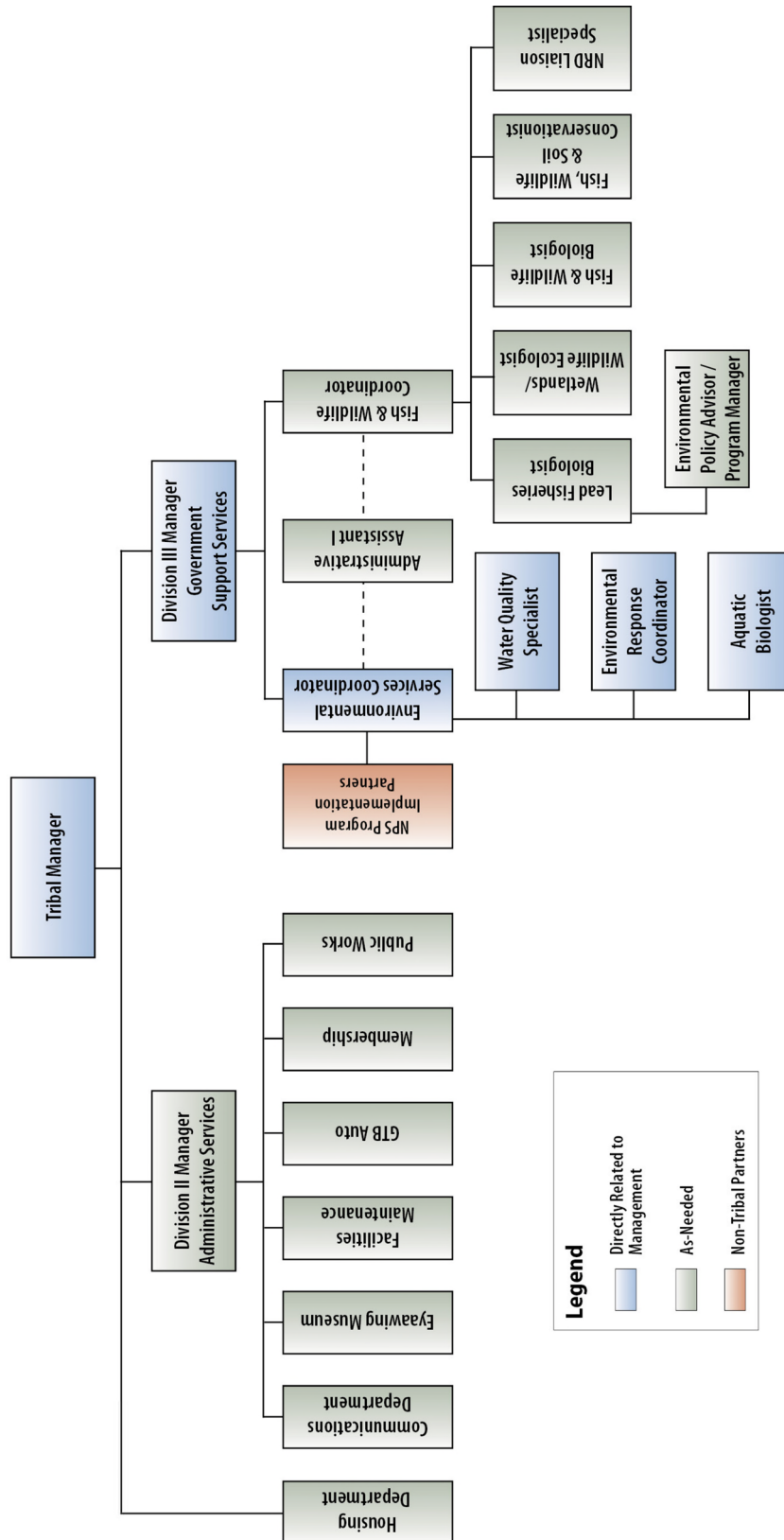
Participant	Mission	Role in BMP Selection and Implementation
Communications	Provide GTB Member households with information about Department Operations, Membership Services, and overall Tribal Government. GTB Newspaper is a monthly publication of the Tribal Government for the purpose of informing Tribal members about department operations and membership services.	Participant in providing coverage on activities related to BMP selection and helping to implement BMPs, particularly those related to NPS education
Tribal Public Safety	Encompasses Tribal fire and police departments	Participant in BMP selection and, as needed, implementation
Facilities Maintenance	Provide the highest quality services to insure the health, safety and well-being of Tribal Members, employees, community members and Tribal Property while preserving the integrity of our natural resources. Services 40 buildings and maintains approximately 60 acres of lawns	Participate in BMP selection and, as needed, implementation
Indian Education	Provides educational opportunities and guidance to be successful lifelong learners through parental, staff, and community involvement by preparing all Tribal members of all ages to be successful through support and promotion of the use of traditional culture and language.	Participant in BMP selection and implementation, particularly for BMPs related to NPS education
Eyaawing Museum and Cultural Center	To establish, gather, interpret, and maintain a record of the history of the Grand Traverse Band of Anishinabek with respect for the circle of life, honor for our families, and the telling of the tribe's true heritage	Participant in BMP selection and implementation, particularly for BMPs related to NPS education
Non-Tribal Partners		
Environmental Health Services Division, Health Department of Northwest Michigan	Responsible for evaluating proposed building sites and issuing construction permits for sewage systems and wells; plays a vital role in the planning of building sites. Covers Antrim and Charlevoix.	Technical assistance
Grand Traverse County Health Department	Responsible for evaluating proposed building sites and issuing construction permits for sewage systems and wells; plays a vital role in the planning of building sites. Covers Grand Traverse.	Technical assistance
Benzie – Leelanau District Health Department	Responsible for evaluating proposed building sites and issuing construction permits for sewage systems and wells; plays a vital role in the planning of building sites. Covers Benzie and Leelanau counties.	Technical assistance

Participant	Mission	Role in BMP Selection and Implementation
District Health Department #10	Responsible for evaluating proposed building sites and issuing construction permits for sewage systems and wells; plays a vital role in the planning of building sites. Covers Manistee County.	Technical assistance
County Drain Commissioners	Administers Michigan laws related to flood protection, stormwater management, and erosion control within Leelanau, Grand Traverse, Antrim, Benzie, Charlevoix, and Manistee counties	Technical assistance, consultation
Conservation Districts	Works in partnership with USDA NRCS to address soil conservation issues within Leelanau, Grand Traverse, Antrim, Benzie, Charlevoix, and Manistee counties	Technical assistance, consultation, landowner participation, and BMP education
County Road Commissions	Responsible for county road construction and maintenance within Leelanau, Grand Traverse, Antrim, Benzie, Charlevoix, and Manistee counties.	Technical assistance, BMP implementation
Conservation Resource Alliance	Mission is to foster locally-driven solutions that will preserve or develop land in a positive manner for all parties involved. Instead of promoting further regulations or lawsuits, aim to foster partnerships in order to understand consequences, alter behavior, and create win-win cooperative efforts. Established in 1968 as part of a nationwide network of Resource Conservation and Development Councils. Covers GTB six-county service area.	Technical assistance, BMP education
Grand Traverse Regional Land Conservancy	Protect significant natural, scenic, and farm lands, and advance stewardship, now and for future generations. Service area includes Antrim, Benzie, Grand Traverse, Kalkaska and Manistee Counties.	Technical assistance, BMP education, identification of potential sites/parcels for BMP implementation
Leelanau Conservancy	Nonprofit land trust established to support, in a balanced manner, the preservation of the natural beauty, ecological integrity and working farms of the Leelanau Peninsula	Technical assistance, BMP education, identification of potential sites/parcels for BMP implementation
Michigan Department of Agriculture and Rural Development (MDARD)	Priorities include assuring food safety, protecting animal and plant health, sustaining environmental stewardship, providing consumer protection, enabling rural development, and fostering efficient administrative operations.	Technical Assistance
Michigan DEQ Nonpoint Source Program	State water agency responsible for addressing NPS issues in areas surrounding GTB lands. Provides education, technical assistance, coordination, and other services.	Technical assistance, BMP education, consultation
Michigan DEQ NPDES Program	State water agency responsible for issuing permits to point sources of pollution. Regulates industrial and construction site stormwater discharges, conducts education and training programs.	Technical assistance, consultation

Participant	Mission	Role in BMP Selection and Implementation
Michigan DNR Traverse City Forest Management Unit	Manages state forest lands in Benzie, Grand Traverse, Leelanau, and Manistee counties.	Technical assistance, consultation
Michigan DNR Gaylord Forest Management Unit	Manages state forest lands in Antrim and Charlevoix counties.	Technical assistance, consultation
Michigan Department of Transportation (MDOT)	Responsible for Michigan's highway system, including U.S. Routes 22 and 204 that run through Tribal boundaries	Technical assistance, consultation, potential financial assistance, BMP implementation
Municipalities	Responsible for land and wastewater management	Technical assistance, financial assistance,
Northwest Michigan Council of Governments	Northwest Michigan Council of Governments is a regional organization serving units of government, businesses, non-profits, community organizations, and individuals. Provides a variety of programs and services within the region, with particular emphasis on partnerships, economy of scale, and leveraging resources to address common concerns among multiple organizations or across sectors. Primary service categories are: workforce development; business & economic development; regional planning & community development; community safety. Covers the GTB six-county service area.	Technical assistance, Education
Bureau of Indian Affairs	The Bureau of Indian Affairs (BIA) appropriates funds to tribes of Michigan under 25 CFR Part 150-250. Funds may be used for resource protection activities including water resources and environmental quality services. The BIA has access to Great Lakes Restoration Initiative funds that may be utilized for suitable GTB projects.	Technical assistance, funding
Indian Health Service	The Indian Health Service (IHS) provides support to federally recognized tribes related to NPS control. IHS can assist tribes with construction site assessments and septic system installations.	Engineering and technical assistance and funding for septic systems
Inter-Tribal Council of Michigan	The Inter-Tribal Council of Michigan, Inc. (MITC), Environmental Services Division, is organized to provide environmental and environmental health related technical assistance and consultation services. Environmental specialists from the council can work with GTB on wastewater, municipal water, environmental permitting, and funding issues.	Technical assistance, consultation
U.S. Department of Agriculture, Natural Resources Conservation Service	Works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems. Supports Resource, Conservation, and Development (RC&D) Councils	Technical and financial assistance, consultation

Participant	Mission	Role in BMP Selection and Implementation
U.S. Department of Agriculture, Farm Service Agency	Works with agricultural landowners through conservation programs, such as the Conservation Reserve Program, to provide financial incentives to install specific conservation practices that help protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water.	Technical and financial assistance, consultation
U.S. Environmental Protection Agency Region 5	Oversight of water resources programs under the Clean Water Act in Michigan; administers the Section 319 Nonpoint Source Management program. USEPA also oversees the Section 106 Program. This program funds GTB's surface water monitoring program.	Technical and financial assistance. Oversight of water resource monitoring and drinking water programs.
U.S. Army Corps of Engineers	Promoting water resource protection and ecosystem restoration in the Great Lakes region.	Technical and financial assistance
U.S. Fish and Wildlife	Provide assistance to Tribes for development and implementation of programs that benefit fish and wildlife resources and their habitat, including: planning for wildlife and habitat conservation, fish and wildlife conservation and management actions, fish and wildlife related research, habitat mapping, field surveys and population monitoring, habitat protection, and public education.	Technical and financial assistance
The Watershed Center Grand Traverse Bay	Advocates for clean water in Grand Traverse Bay and acts to protect and preserve the Bay's watershed; developed and implements the Grand Traverse Bay Watershed Protection Plan	Technical assistance

Key GTB Divisions for CWA Section 319 NPS Management Program Implementation



** Nothing in this Organizational Chart shall supersede confidentiality, privacy rules under HIPAA, provisions of Tribal, State and Federal law, licensing processes or Tribal Statutes enacted by Tribal Council **

Figure 24. Key GTB divisions for CWA Section 319 NPS Management Program Implementation

GTB's CWA Section 319 NPS Management Program Partners

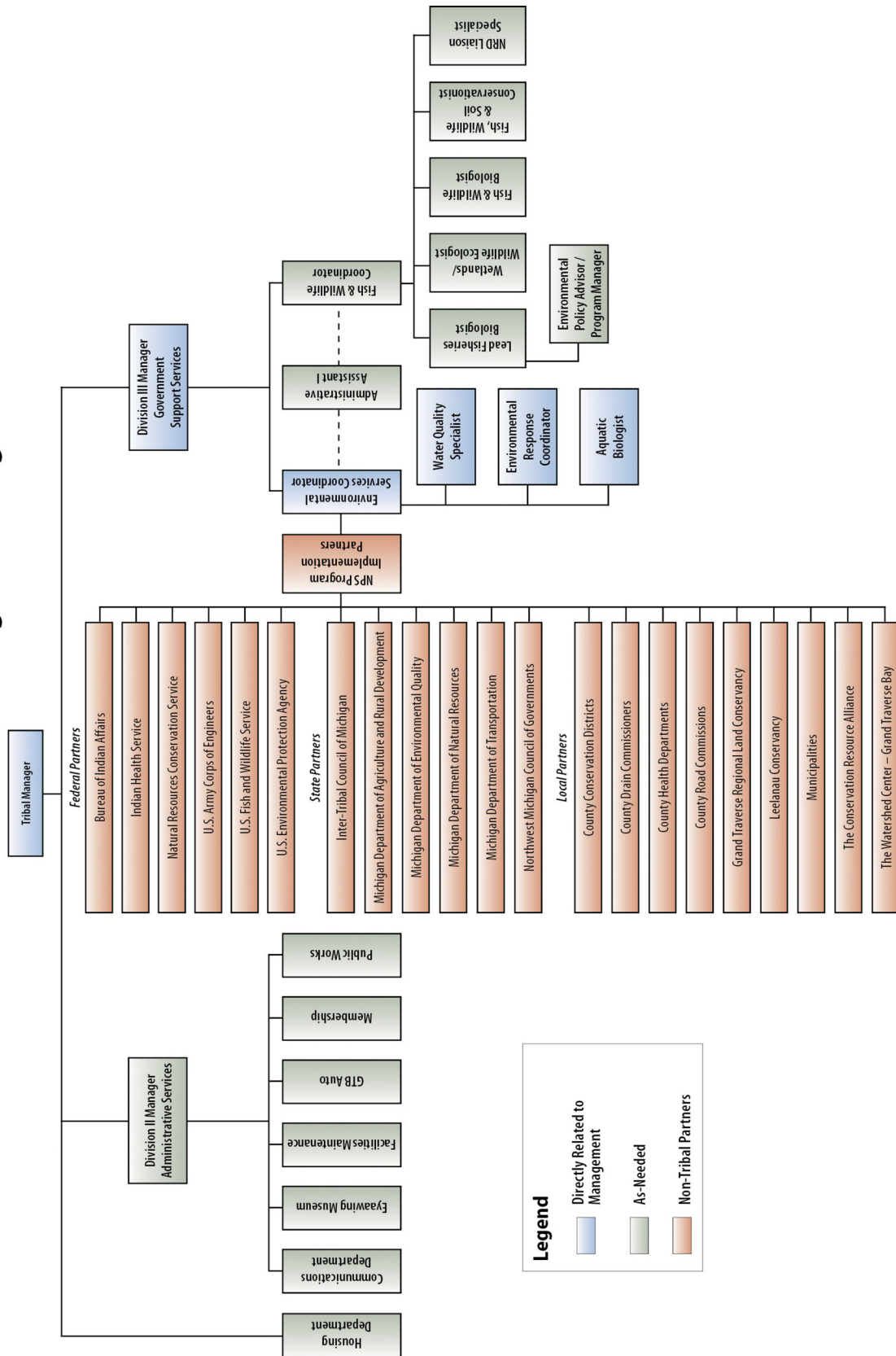


Figure 25. GTB's CWA Section 319 NPS Management Program partners

** Nothing in this Organizational Chart shall supersede confidentiality, privacy rules under HIPAA, provisions of Tribal, State and Federal law, licensing processes or Tribal Statutes enacted by Tribal Council **

The list in Table 27 represents key participants, but it by no means captures all of GTB's potential partners in addressing NPS pollution on the GTB six-county service area. There are other potential partners working in the area, including academia and other watershed organizations, which might also play a role depending on the nature of the BMP project and the associated goals.

Existing BMPs

The GTB Section 319 NPS Management Program was initiated in 2004. Over the past decade, GTB has used Section 319 funding to support NPS-focused education and outreach, as well as road-stream crossing improvement projects. Numerous NPS BMPs and control measures are in place that affect GTB-owned parcels within the GTB six-county service area. On non-Tribal lands, existing BMPs to address NPS pollution are implemented through the on-going work of key partners listed in Table 27. GTB does not have a comprehensive list of BMPs taking place on lands within the GTB six-county service area that fall outside of the current Section 319 NPS Management Program boundary. This section provides a brief summary of the existing BMPs under the agricultural, forest, urban, septic systems, and natural resource extraction that are currently implemented by GTB on Tribally-owned parcels within GTB's Section 319 NPS Management Program boundary.

Agricultural

To date, GTB does not have a comprehensive list of existing agricultural BMPs taking place on Tribal lands though GTB works with NRCS to engage landowners in Farm Bill programs and provides technical assistance for habitat enhancement on approximately 4,000 acres.

Construction

The Tribal Council adopted the Grand Traverse Band of Ottawa and Chippewa Indians Soil Erosion and Stormwater Runoff Control (SESRC) Ordinance 97.001, on January 21, 1997. The purpose of the Ordinance is to prevent the pollution, impairment, or destruction of a natural resource or the public trust on tribal lands. While the SESRC Ordinance is in place, GTB staff indicate that it isn't consistently applied to all tribal construction projects.

Forested (Natural)

In December 2010, the Department of Interior Bureau of Indian Affairs (BIA) developed a Forest Management Plan for the Grand Traverse Reservation. The Forest Management Plan (FMP) states that the GTB prefers to conduct no commercial harvesting at the reservation. The FMP states that the GTB Reservation contains 423 forested trust land and 650 acres of non-forested trust land (BIA 2010). The information contained in the FMP presents forested stand inventories organized by compartment. This information does not readily align with the GTB parcel information used to define the Section 319 NPS Management Program boundaries. In addition, it is likely that forested stands exist on GTB parcels that are classified under other uses, such as commercial or housing. For purposes of the NPS Assessment Report, approximately 17 Tribally-owned parcels (147 acres) readily identified as natural or wooded (or vacant). These parcels are maintained by GTB's facilities maintenance department. The FMP states that "forest activity areas will be managed to maintain and enhance both surface and groundwater resources and in compliance with the Clean Water Act (BIA 2010)."

Hydrologic and Habitat Modifications

GTB NRD staff evaluate wetlands on Tribally-owned lands and riparian wetlands associated with the Tribe's Stream mouth habitat and small stream evaluation under the Section 106 monitoring strategy in the CWA Section 106 work plan and monitoring strategy. In 2003, GTB developed and adopted the *Wetland Inventory and Management and Protection Plan* and updated this plan in 2008. The 2008 revised plan identifies current activities, including valuation of wetlands in the six-county service area. It does not specify wetland restoration work projects.

Septic systems

The GTB consultant engineer is responsible for siting septic systems, and the GTB Housing Department is responsible for maintaining these systems. The GTB Housing Department recently initiated a free pump-out service and is currently attempting to get all septic systems on a regular maintenance schedule.

Resource Extraction/Exploration/Development

There are no documented BMPs under this NPS Category to date.

Transportation

The majority of the roads within the GTB six-county service area are county-owned. Those that are tribally-owned are under a maintenance agreement with the county road commissions. Where road construction projects take place, the GTB expects contractors to comply with the requirements of county road commissions and the GTB SESRC Ordinance. These projects pertain to parking area runoff including sedimentation depressions, grassed swales, rip/rap, curbs, and surface water drains.

Urban

In 2003, GTB developed a comprehensive Stormwater Inventory report and initiated annual inspections of approximately 17 Tribally-owned parcels identified in the 2003 report. The annual inspections report contains recommendations to the Tribal Maintenance Staff on measures to correct any deficiencies identified at the time of the inspection. GTB Environmental Stewardship Program Staff last performed the inventory in 2012 and will continue to perform this annual inspection and reporting process. The BMPs documented in the 2012 Stormwater Inventory report include restoring vegetation to eroding areas, cleaning stormwater management infrastructure, and clearing sand and debris from winter snow maintenance operations.

GTB also participated in the Grand Vision project, which consists of the community vision for the future of transportation, land use, economic development, and environmental stewardship for the region. The counties included in this project include: Antrim, Benzie, Grand Traverse, Kalkaska, Leelanau, and Wexford. This prediction/projection covers the current conditions through the next fifty years, ending in 2060. The Grand Vision document was completed in 2009 and work began on a technical transportation studies and implementation planning. This will be a useful tool for estimating the potential future growth and needs of four of the counties in GTB service area.

Future BMP Selection to Reduce NPS Pollution

This section discusses GTB's process for selecting BMPs to address the sources of NPS pollution on the parcels that fall under GTB's Section 319 NPS Management Program as discussed in Section 6, as well as the process for public participation and governmental coordination.

Proposed BMP Selection Process

GTB will undertake a multi-step process for evaluating and selecting BMPs to address NPS pollution from sources discussed in Section 6. The steps are as follows:

- Prioritize parcels based on water quality status (i.e., whether the waterbody meets Tribal water quality goals) for each subwatershed by pollutant using monitoring data, as presented in Section 6. According to Section 6, nutrients, sediments, and turbidity are priority pollutants across Tribal lands. To a lesser extent *E. coli* is a priority pollutant at East Jordan Tourist Park Beach and Bayside Acme Township Park beaches and Mitchell Creek. Based on the assessment results, priority watersheds for BMP implementation include Belanger Creek, Mitchell Creek, and the Grand Traverse Bay subwatersheds.

- Consult with GTB staff and non-Tribal partners regarding the prioritization list, key NPS pollutants, relative magnitude in each subwatershed, and possible opportunities for addressing them.
- Identify applicable BMPs appropriate for the type and source of NPS pollution, with the assistance of technical assistance and consultation partners. BMPs eligible for implementation through GTB's Section 319 NPS Management Program include those found in the following:

Michigan DEQ Guidebook of BMPs (http://www.michigan.gov/deq/0,4561,7-135-3313_3682_3714-118554--,00.html)

Michigan State University Planning and Zoning Center's Rural Water Quality Protection Guidebook (http://www.landpolicy.msu.edu/modules.php?name=Pages&sp_id=664)

Conservation Reserve Enhancement Program (CREP) authorized conservation practices (http://www.michigan.gov/mdard/0,4610,7-125-1599_1603---,00.html)

Michigan Agricultural Environmental Assurance Program (MAEAP) standards (http://www.michigan.gov/mdard/0,4610,7-125-1599_25432---,00.html)

Any BMP listed within an MDEQ-approved NPS Watershed Plan within GTB's six-county service area (http://www.michigan.gov/documents/deq/wrd-nps-approved-watershed-plans_431188_7.pdf?20130830133304)

EPA's National Management Measures to Control NPS from Agricultural Sources (http://water.epa.gov/polwaste/nps/agriculture/agmm_index.cfm)

EPA's National Management Measures to Control NPS from Forestry (http://water.epa.gov/polwaste/nps/forestry/forestrymgmt_index.cfm)

EPA's National Management Measures to Control NPS from Marinas and Recreational Boating (<http://www.epa.gov/owow/nps/mmsp/index.html>)

EPA's National Management Measures to Control NPS from Hydromodification (<http://www.epa.gov/owow/nps/hydromod/index.htm>)

EPA's National Management Measures to Control NPS from Urban Areas (<http://water.epa.gov/polwaste/nps/urban/index.cfm>)

EPA's National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution (<http://water.epa.gov/polwaste/nps/wetmeasures/index.cfm>)

EPA's Onsite Wastewater Systems Manual (http://www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf)

SEMCOG's online Low Impact Development database and manual (<http://www.semcoq.org/Data/lid.cfm> and <http://library.semcoq.org/InmagicGenie/DocumentFolder/LIDManualWeb.pdf>)

- Narrow the list of applicable BMPs using evaluation factors of scale, environmental conditions, and estimated effectiveness.
- Initiate one-to-one discussions with key landowners/land managers, producer groups, and other potentially involved parties to review water quality data and possible BMP implementation opportunities.

- Work with key partners to rank narrowed list of BMPs according to expected performance and feasibility.
- Identify BMPs that have potential for collaborative, coordinated implementation with key partners.
- Present BMP options to GTB Tribal Council for further refinement.
- Present BMP options approved by Tribal Council to Tribal members and other stakeholders for comment.
- Pursue funding for approved suite of BMPs with Tribal Council, Tribal member, and public support.
- Promote BMPs to targeted audiences for possible implementation.

Public Participation and Government Coordination

As demonstrated in the proposed BMP selection process, GTB intends to work closely with the key partners that currently implement both agricultural and urban BMPs within the GTB six-county service area. For agricultural BMPs, GTB will consult and coordinate with county conservation districts, as well as NRCS, the Farm Service Agency, and individual producers leasing land from GTB. For urban BMPs, GTB will consult and coordinate with county drain commissioners, watershed organizations with green infrastructure and low impact development BMP implementation experience, and local governments working within the GTB six-county service area.

GTB met with some of these key Tribal and non-Tribal partners on June 27, 2013 to discuss priority areas and possible BMPs to address NPS pollutants. Table 36 provides a summary of potential BMPs GTB would like to implement to address NPS pollution within the current (and potentially expanded) Section 319 NPS Management Program boundaries. At this point in time, BMPs would apply only to parcels within GTB's existing Section 319 NPS Management Program boundaries, but could apply to other areas within the GTB six-county service area if Tribal Council were to expand the boundaries in the near-term. If Tribal Council approved a boundary expansion, GTB staff would work with non-Tribal partners in the GTB six-county service area to identify additional BMPs that would be high priority for GTB to implement under the Section 319 NPS Management Program.

Table 28. Preliminary Future BMPs Selected by GTB by NPS Category

BMP Description by NPS Category	Priority		
	High	Medium	Low
Urban			
Develop outreach materials and training materials for tribal members and GTB departmental staff that focus on ways to reduce NPS pollutants associated with specific types of facilities and practices	X		
Distribute educational materials to GTB members and departmental staff, including update on GTB website, publication of educational articles and brochures in the GTB Newsletter; development and distribution of educational materials at community events and meetings.	X		
Provide GTB departmental staff training opportunities, including annual review of the NPS Management Plan with all NRD staff and other key GTB department staff	X		
Review 1997 SESRC Ordinance to identify potential modifications for promoting infiltration and on-site stormwater management through Green Infrastructure and Low Impact Development	X		
Modify 1997 SESRC Ordinance to promote Green Infrastructure and Low Impact Development based on review findings and adopt updated ordinance	X		
Develop GTB Project Review Team	X		
Develop site plan review process and checklist	X		
Provide training to GTB staff, design engineers, and contractors on new site design requirements and procedures	X		

BMP Description by NPS Category	Priority		
	High	Medium	Low
Conduct site plan reviews for new development and redevelopment on GTB parcels using approved site plan checklist to ensure compliance with updated SESRC Ordinance	X		
Provide training on the use of rain barrels, rain gardens, and other green infrastructure practices to promote infiltration and reduction of NPS pollutants from urban areas		X	
Conduct GTB parcel stormwater retrofit opportunity audit		X	
Implement stormwater retrofit demonstration project to train GTB staff and engineers on green infrastructure/low impact development techniques based on retrofit opportunity audit findings		X	
Construction			
Develop and provide soil and erosion control training to GTB staff and non-tribal staff involved in construction activities	X		
Provide technical assistance to the Leelanau County Road Commission during road stream crossing projects to reduce NPS pollution	X		
Develop system to track planned and ongoing construction activities	X		
Review planned construction project soil erosion control plans under SESRC Ordinance requirements	X		
Inspect ongoing construction activities to determine effectiveness of soil erosion controls	X		
Monitoring road stream crossing improvement project sites in Leelanau County during and after construction activity	X		
Transportation			
Inspect and document a minimum of five road/stream crossings annually as part of the annual stormwater inventory process	X		
Provide road stream crossing and other roads-related O&M needs (e.g., catch basin cleaning) to the GTB Facilities Maintenance Department. Report any road/stream crossings in need of repair to the Leelanau County Road Commission.	X		
Establish a list of road construction contractors constructing and maintaining roads within the six-county service area	X		
Develop and implement a plan for regular communication and information sharing among GTB departments, county road commissions, cities, and MDOT to keep track of proposed road construction and maintenance projects	X		
Establish and maintain road construction/ maintenance project list to facilitate soil erosion control inspections	X		
Require all road construction contractors working within GTB six-county service area to control soil erosion according to SESRC Ordinance and county standards/specifications.	X		
Work with road contractors on-site to ensure soil erosion BMP implementation	X		
Hydrologic/Habitat Modification			
Add identifying and mapping stream bank erosion sites to existing field work (e.g., stormwater inventory, wetland assessment, road stream crossing inventory)	X		
Develop criteria for ranking stream bank stabilization sites	X		
Rank stream bank stabilization sites from high to low restoration priority	X		
Identify outside funding sources for stream bank stabilization	X		
Design stabilization plans for high-priority sites using approved BMPs	X		
Contract to have stabilization activities completed	X		
Participate in a hydrologic study of Mitchell Creek with non-tribal partners to determine the cause of flow changes and identify alternatives to restore		X	
Develop flow restoration action items based on findings of hydrologic study		X	
Implement flow restoration action items, if feasible		X	
Identify high-quality riparian acreage for protection via permanent conservation easements	X		
Place high-quality riparian acreage into permanent conservation easements	X		
Continue to assess wetlands and update 2003 Wetland Inventory and Management and Protection Plan	X		
Identify areas with hydrologic and habitat modification that could promote spread of invasive species that affect health of natural riparian vegetation and wetland function			X
Conduct invasive species control in targeted restoration areas			X
Septic Systems			
Create a database of all septic systems on GTB-owned parcels. Septic systems will be identified by operator's name, address, and latitude/longitude.	X		

BMP Description by NPS Category	Priority		
	High	Medium	Low
Distribute educational materials on proper septic system maintenance to homes with septic systems	X		
Increase awareness of GTB Housing Department's free pump-out program and dumping service for tribal residents on septic systems	X		
Determine need for potential tribal ordinance to improve septic system inspection and maintenance authority	X		
Establish criteria for determining and identifying poorly sited systems	X		
Identify high risk areas to prioritize system replacement	X		
Identify sources of funding and technical assistance for septic system improvements.	X		
Establish tribal protocols on proper siting and environmental review of new septic system installation on GTB-owned parcels	X		
Document procedures for using database to implement environmental review permits for new septic systems	X		
Agricultural			
Work with NRCS to promote enrollment in conservation cost-share programs including CREP and EQIP		X	
Establish BMP requirements for GTB-owned parcels leased for agricultural purposes to control agricultural NPS runoff		X	
Conduct annual assessment crop types, planting and harvest methods, fertilizer and herbicide use, and impact to surrounding water resources prior to the implementation of a BMP program	X		
Develop an Integrated Pest Management Plan for GTB leased agriculture property	X		
Work with landowners and users to identify appropriate BMPs (fencing, stream crossings, alternative watering systems)		X	
Work with landowners and users to identify additional funding sources		X	
Work with landowners and users to implement the identified BMPs		X	
Provide training to agricultural land users on sensitive land application procedures		X	
Forestry/Natural Land			
Provide input in local and regional watershed planning to ensure that the watershed plans include GTB's efforts to reduce NPS pollution and consider unique Tribal interests in water quality, particularly related to forestry BMP education and implementation intended to reduce sediment	X		
Natural Resource Extraction			
Develop Tribal policies and protocols regarding natural gas extraction well development, including criteria for well siting to protect surface and groundwater resources			X

SECTION 9 – EXISTING GTB NPS CONTROL PROGRAMS

The GTB Section 319 NPS Management Program will enlist the support of the internal and external programs, resources, and entities listed in this section to develop and build upon its NPS management program. Under this approach, environmental and water quality staff from GTB’s Division III Government Support Services Environmental Services will use this Section 319 NPS Assessment Report and the associated Section 319 NPS Management Program Plan as a guide for organizing available resources to address the NPS challenges identified in this document. The approach involves a coordinated, cooperative effort led by key GTB staff and supported by other Tribal departments and non-Tribal partners.

Available Programs for Controlling NPS Pollution

A wide range of local, state, and federal programs exist that GTB can consider using to help address NPS pollution within GTB’s Section 319 NPS Management Program boundaries. Table 29 presents an overview of these programs and the source of NPS pollution addressed by each program.

Table 29. NPS Related Programs

NPS Related Program Description	NPS Category							
	Agriculture	Construction	Forestry	Hydrologic/Habitat Modifications	Septic Systems	Natural Resource Extraction	Transportation	Urban
GTB Section 319 NPS Management Program. Staff from GTB’s Government Support Services (Division III), under the direction of the Tribal Council and assisted by other Tribal departments as needed, is primarily responsible for developing and implementing GTB Section 319 NPS Management Program.	X	X	X	X	X	X	X	X
GTB Housing Department Septic system Pump-Out Program. Provides free system pump-out and dumping to Tribal residents.					X			
Bureau of Indian Affairs Water Resource Grants. This program, funded through the Indian Self-Determination and Education Assistance Act, provides grants for the collection and analysis of baseline data.	X				X			
Clean Water State Revolving Fund. The Clean Water SRF program was established to provide low-interest loans to governmental entities for clean water and NPS pollution control projects.	X			X	X			
Consolidated Water Facilities Construction Program. This program was established to provide grants and loans for water-related projects. The amount of funds available is dependent on the amount appropriated by the legislature and the amount of funds previously awarded.	X							

NPS Related Program Description	NPS Category							
	Agriculture	Construction	Forestry	Hydrologic/Habitat Modifications	Septic Systems	Natural Resource Extraction	Transportation	Urban
Corps of Engineers Section 404 Dredge and Fill Permit Program. This program regulates the discharge of fill or dredged material into lakes, rivers, and wetlands.	X							
Drinking Water State Revolving Fund. The Drinking Water SRF program was established to provide low-interest loans for drinking water projects. The amount of funds available is dependent on the amount of appropriations from the U.S. Congress and the amount of repayment of funds previously loaned.					X			
Michigan DEQ, MDARD, Michigan State University (MSU) Extension Biosolids Program. MDARD plays an educational and technical assistance role in the Michigan's Biosolids Program, which is administered by MDEQ. MDEQ and MDARD have partnered with Michigan State University Extension and the Michigan Water Environment Association to form a Michigan Biosolids Team to provide leadership and promote beneficial uses of biosolids and to make Michigan a national leader in environmentally sound biosolids processes and products.			X					
Michigan DEQ NPS Program. Michigan DEQ is responsible for addressing NPS issues on non-Tribal lands in the areas surrounding GTB lands. GTB has good relationships with state DEQ staff, and will communicate with them as needed to address common interests regarding NPS control measures which affect water quality on Tribal lands.	X	X	X	X	X		X	X
Michigan DEQ Office of Oil, Gas, and Minerals. Michigan DEQ promotes the best use of Michigan's non-renewable geological resources for their social and economic benefits while protecting associated resource values, property rights, the environment, and public health and safety. Develops policies, issues permits, provides technical assistance.						X		
Michigan DNR Gaylord and Traverse City Management Units. Manages state forest within the GTB six-county service area according to state requirements for timber sales. MDNR provides guidelines for timber sales on privately-owned forested lands.			X	X				

NPS Related Program Description	NPS Category							
	Agriculture	Construction	Forestry	Hydrologic/Habitat Modifications	Septic Systems	Natural Resource Extraction	Transportation	Urban
MDOT Soil Erosion and Sediment Control Program. MDOT administers a Soil Erosion and Sediment Control (SESC) Program that includes an environmental stewardship commitment throughout the agency, SESC training for staff, earth change planning requirements, and policies and procedures documented in MDOT's SESC Manual.							X	
Natural Resources Conservation Service Farm Bill Programs. NRCS has several funding programs, including, Wetland Reserve Program, conservation of private grazing lands, the Farmland Protection Program, and the conservation farm option.	X							
USDA, FSA Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP). The CRP and CREP offer long-term rental payments and cost-share assistance to establish long-term, resource-conserving cover to reduce soil erosion and improve water quality.	X							
USDA, NRCS Environmental Quality Incentives Program. EQIP was created to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible goals. The program offers technical, financial, and educational assistance for approved farm improvement practices	X							
USDA Rural Development Administration. The RDA supports the construction of new water and waste water systems and the improvement of existing systems	X				X			
USDA Sustainable Agriculture Research and Education. In the SARE program, the funding is aimed at reducing the use of chemical pesticides, fertilizers, and toxic materials in agricultural production.	X							
USDA, NRCS Forest Management Plan (FMP). The Environmental Quality Incentives Program (EQIP) has funding available to support the development of site-specific plans that are developed based on landowner's management objectives and professional expertise of a skilled forester to achieve long-term forest management goals.			X	X				

NPS Related Program Description	NPS Category							
	Agriculture	Construction	Forestry	Hydrologic/Habitat Modifications	Septic Systems	Natural Resource Extraction	Transportation	Urban
USEPA Section 106 Program. This program assists in establishing and maintaining adequate measures for preventing and controlling surface and groundwater pollution.	X		X	X	X	X	X	X
USEPA Section 319 Program. This program assists in implementing USEPA-approved section 319 NPS management programs.	X	X	X	X	X	X	X	X

Existing NPS Pollution Reduction Programs for GTB's Section 319 NPS Management Program

Several programs that address NPS pollution, directly or indirectly, are in place on the GTB six-county service area, many of which affect the parcels currently addressed under the GTB Section 319 NPS Management Program. These projects are implemented through various NRCS programs under the Farm Bill, septic system management provided by GTB and county health departments, GTB's *Soil Erosion and Stormwater Runoff Control Ordinance* and water quality monitoring conducted by GTB Government Support Services (Division III) staff. These programs are identified in Table 29 above.

Finally, GTB is working with USEPA to continue development of GTB's Section 319 NPS Management Program funded under Section 319 of the Clean Water Act. This Section 319 NPS Assessment Report and the associated Section 319 NPS Management Program Plan will help to fulfill requirements for funding. The funding will be used to continue implementation of GTB's Section 319 NPS Management Program. With the new Section 319 NPS Management Program Plan in place, GTB will have the ability to better coordinate these various ongoing programs to meet the goals of the Section 319 NPS Management Program.

SECTION 10 – CONCLUSIONS

With the information contained in this NPS Assessment report, GTB is better equipped to move forward in developing and implementing a NPS management program for Tribal lands.

The NPS pollution issues that affect GTB's Tribal lands, as described in Sections 6 and 7 of this report, include nutrients, turbidity, conductivity, marginal habitat, sedimentation, and *E. coli*. Also of concern are elevated coldwater stream temperatures and spring Lake Michigan temperatures. Table 30 provides a summary of the key findings and recommendations by watershed.

Table 30. NPS Assessment Key Findings and Recommendations by Watershed

Watershed/Subwatershed	Associated GTB Parcels	Key Findings	Recommendations
Betsie River	24, 33, 50, 59	Both turbidity and sedimentation are a high level GTB priority	Focus BMPs on lawns, urban runoff, roads, and septic systems. Future sampling of Betsie River should include <i>E. coli</i> sampling that meets the MDEQ five-day geometric mean criteria, and continued annual sampling to determine Tribal standards.
Glen Lake/Crystal River	N/A GTB currently samples here	Sedimentation and improved habitat are GTB priorities for this watershed	GTB does not currently own land in this watershed, management efforts of watershed partners should be monitored. Crystal River would benefit from <i>E. coli</i> sampling that meets the MDEQ five-day geometric mean criteria, and continued annual sampling to determine Tribal standards.
Grand Traverse Bay	Parcels 0-22b, 25-29, 31-32, 34-36, 38-40b, 41-47, 51-53, 57, 58, 60, 61, 63-69, 71, 72	Nitrogen, turbidity and sedimentation are high level GTB priorities in this watershed	Focus BMPs on agriculture, construction, marinas, hydrologic/Habitat modifications, flow regulation/modification, septic systems, urban runoff, and transportation Continued sampling of all parameters in the Grand Traverse Bay watershed is recommended to further analyze beneficial use attainment.
Boardman River	N/A GTB currently samples here	Sedimentation and improved habitat are GTB priorities for this watershed	GTB does not currently own land in this watershed, management efforts of watershed partners should be monitored. Boardman River would benefit from <i>E. coli</i> sampling that meets the MDEQ five-day geometric mean criteria, and continued annual sampling to determine Tribal standards. GTB should continue to monitor temperature to decide if this site should meet coldwater stream standards.

Watershed/Subwatershed	Associated GTB Parcels	Key Findings	Recommendations
Elk River Chain of Lakes	11, 12, 45, 68	Sedimentation and nitrogen are GTB priorities for this watershed	Focus BMPs on urban runoff and transportation. Continued sampling of all parameters in the Elk River Chain of Lakes watershed is recommended to further analyze beneficial use attainment. Future sampling of Spencer Creek is recommended.
Mitchell Creek	43, 41	Sedimentation and nitrogen are GTB priorities for this watershed	Focus BMPs on urban runoff. An upstream hydrogeologic study is desired by watershed partners. Continued sampling of all parameters on Mitchell Creek is recommended to further analyze beneficial use attainment. Mitchell Creek would benefit from <i>E. coli</i> sampling that meets the MDEQ five-day geometric mean criteria. GTB should continue to monitor temperature to decide if this site should meet coldwater stream standards.
Lake Charlevoix	23, 28, 30, 48	Sedimentation is a high level GTB priority	Focus BMP efforts on urban runoff, agriculture, and septic systems. GTB does not currently sample in the Lake Charlevoix watershed.
Lake Leelanau	N/A GTB currently samples here	Sedimentation and nitrogen are GTB priorities for this watershed	GTB does not currently own land in this watershed, management efforts of watershed partners should be monitored. Continued sampling of all parameters in the Lake Leelanau watershed is recommended to further analyze beneficial use attainment.
Lake Michigan	54, 55, 62, 70 *All parcels eventually drain to Lake Michigan	Nitrogen, turbidity and sedimentation are high level GTB priorities in this watershed	Focus BMPs on construction and marinas on Beaver Island. Continued sampling of all parameters at the LER sampling site is recommended to further analyze beneficial use attainment. This site would benefit from <i>E. coli</i> sampling that meets the MDEQ five-day geometric mean criteria

Based on the key findings for the watersheds, it appears that nutrients, sediment, and turbidity are priority pollutants across Tribal lands. To a lesser extent *E. coli* is a priority pollutant at East Jordan Tourist Park Beach and Bayside Acme Township Park beaches and Mitchell Creek. The NPS categories that are likely to contribute to elevated nutrients, sediment, and turbidity include urban runoff, construction, failing or antiquated septic systems, and agricultural runoff. Nonpoint sources contributing to elevated *E. coli* levels could include failing or antiquated septic systems, urban runoff, agricultural practices associated with livestock on pasture lands (e.g., access to streams and manure management) and crops (e.g., land application of manure). Based on the assessment results, priority watersheds for BMP implementation

include Belanger Creek, Mitchell Creek, and the Grand Traverse Bay subwatersheds. Spencer Creek is a future monitoring priority.

As discussed in Section 8, GTB is currently working with local, state, and federal partners to support BMP implementation and to develop a Section 319 NPS Management Program Plan. GTB is committed to public participation throughout the development and implementation of the NPS Management Program. Public participation in the development of the Section 319 NPS Assessment Report was done in conjunction with the Section 319 NPS Management Program Plan. To date, GTB has conducted water quality monitoring of Tribal waters necessary to support the development of a Section 319 NPS Assessment Report. Further work included more collaboration and coordination with local, state, and federal partners on identifying, evaluating, and selecting NPS priorities on Tribal lands. For a detailed description of public involvement activities, please see the GTB Section 319 NPS Management Program Plan.

Once the updated NPS Management Program Plan is in place, GTB intends to address nutrient and erosion issues affecting Tribal waters first. Many of the BMPs that GTB anticipates would be implemented to address erosion and nutrients from urban sources would also help to reduce chlorophyll-*a* and conductivity. BMPs that improve aquatic habitat near road-stream crossings are also a priority.

It should be noted that an overall goal of GTB is to protect high quality waters (i.e. those that significantly meet the criteria for their designated use) for protection. Water quality protection measures will include identification of high quality waters, public outreach to raise awareness of where they are and the importance of maintaining existing levels of high water quality, identification of any relevant water quality threats, and the adoption of measures tailored to address any threats identified. Water quality protection measures may include preservation or expansion of vegetated riparian buffers, setbacks for septic systems and other activities, and other practices similar to the BMPs listed in this document intended to reduce nonpoint sources of pollution.

GTB has met all eligibility requirements for Section 319 funding and are updating their Section 319 NPS Assessment Report and Program Management Plan for continued funding. A summary of how these requirements are being fulfilled is provided below.

1. **Be a federally recognized tribe.** GTB is a federally recognized tribe.
2. **Complete an approved CWA section 319(a) NPS Assessment Report.** Once approved by EPA Region 5, this report fulfills this eligibility requirement.
3. **Complete an approved CWA section 319(b) NPS Management Program Plan.** GTB initiated the development of their updated Section 319 NPS Management Program Plan in July 2013.
4. **Be CWA section 518(e) approved for treatment similar to a state (“treatment as a state” or TAS).** GTB has received TAS status.

The next step is development of the Section 319 NPS Management Program Plan that details the activities GTB will take with non-Tribal partners to protect its valuable water resources from further NPS pollution. The plan will build off of the information contained in this Section 319 NPS Assessment Report to ensure that GTB waters support a healthy aquatic ecosystem for current and future community use.

GLOSSARY

Beneficial uses – Designations made by states or tribes regarding how a particular waterbody is expected to be used and for what it is to be managed. Examples: cold water fishery, drinking, swimming.

Best management practices (BMPs) – Practices, measures, or actions that are commonly recommended to prevent, reduce, or mitigate pollution from NPSs.

Census designated place (CDP) – A United States Census Bureau designated concentration of population identified for statistical purposes. CDPs are delineated for each decennial census as the statistical counterparts of incorporated places such as cities, towns and villages. CDPs are populated areas that lack separate municipal government, but which otherwise physically resemble incorporated places.

Cultural issues – Knowledge, belief, behavior, or set of shared attitudes, values, goals, and practices of a specific group. For Native American cultures, some attributes to consider: respect for the natural world, spirituality, elders and children, clans and kinship, leadership and decision-making, history, governance structures, protocols, and laws.

E. coli (Escherichia coli) – A gram negative bacterium that is commonly found in the lower intestine of warm-blooded animals.

Fee Lands – Tribally owned lands that are not held in trust by the U.S. government for a tribe.

Hydrologic Unit Code (HUC) – A 2- to 12- digit number assigned by the U.S. Geological Survey as part of its surface waterbody classification system.

Indicator – Entity, process, or community whose characteristics show the presence of specific environmental conditions.

Narrative criteria – Statements that describe the desired water quality goal, such as waters being *free from* pollutants or substances that can harm people and fish; an approach used for pollutants for which numeric criteria are difficult to establish because of inherent subjectivity.

NPS pollution – Pollution not discharged from a point source. This generally consists of pollution from diffuse sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land as a result of precipitation events (rainfall, snowmelt).

Nonprofit/nongovernmental organizations – Sometimes seen as NPO or NGO. A group organized for purposes other than generating profit and in which no part of the organization's income is distributed to its members, directors, or officers. This is established at the time of formation, and only approved activities under this designation are allowed; no official governmental representatives are governing members.

Numeric criteria – A number standard for limiting a particular pollutant that protects a specific use designation; can be load- or concentration-based.

Partnership – A cooperative relationship between people or groups that agree to share responsibility for achieving some specific goal.

Point source – A stationary location or fixed facility from which pollutants are discharged through a conveyance system; any single identifiable source of pollution, such as a pipe, ditch, ship, ore pit, or factory smokestack.

Public participation – A principle or practice that seeks out and facilitates the involvement of those potentially affected by or interested in a decision. The full range of actions employed to engage people in current or proposed activities. Implies that the public's contribution will influence the decision-making process.

Riparian areas – Areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.

Trust lands – Lands held in trust by the U.S. government for a tribe.

Water quality criteria – Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water quality goal – A long-term perspective on the evaluation of water resource conditions that describes an eventual desired future condition and implies actions toward meeting a targeted improvement in or maintenance of current high quality of the waters.

Water quality standards – State/tribe-adopted and EPA-approved ambient standards for waterbodies. There are four parts to an individual water quality standard: designated use, numeric criteria, narrative criteria, and antidegradation provisions. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect state designated uses and GTB current uses.

Waterbody – Any surface water resource.

Watershed – The land area that drains into a stream, wetland, lake, or coastal waterbody. The watershed for a major river could encompass a number of smaller watersheds that ultimately combine at a common point.

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APPENDICES

Appendix A: 12-digit HUC Subwatersheds in the GTB six-county service area

8 Digit HUC Watershed	Watershed Name	12-digit HUC Subwatershed	Subwatershed Name
04060101	Pere Marquette-White	040601010102	Ritters Creek-Big Sable River
		040601011001	Gurney Creek
		040601011002	Cooper Creek-Frontal Lake Michigan
04060103	Manistee	040601030101	Frenchman Creek-Manistee River
		040601030102	Goose Creek
		040601030103	Lost Lake-Manistee River
		040601030106	Manistee Lake-North Branch Manistee River
		040601030205	Hopkins Creek-Manistee River
		040601030206	Fife Lake Outlet
		040601030208	Manton Creek-Manistee River
		040601030209	Buttermilk Creek-Manistee River
		040601030301	Anderson Creek
		040601030302	Soper Creek-Manistee River
		040601030304	Fletcher Creek
		040601030305	Burkett Creek-Manistee River
		040601030306	Hodenpyl Dam Pond-Manistee River
		040601030307	Slagle Creek
		040601030308	Eddington Creek-Manistee River
		040601030309	Peterson Creek
		040601030310	Hinton Creek-Manistee River
		040601030406	Wildcat Swamp-Pine River
		040601030501	Dutchman Creek-Bear Creek
		040601030502	Little Bear Creek
		040601030503	Lemon Creek-Bear Creek
		040601030504	Little Beaver Creek-Bear Creek
		040601030505	Boswell Creek-Bear Creek
		040601030603	Stronach Creek
		040601030605	Tank Creek-Little Manistee River
		040601030606	Old Stronach Cemetery-Little Manistee River
040601030701	Tippy Dam Pond-Manistee River		
040601030702	Pine Creek-Manistee River		
040601030703	Larson Creek-Manistee River		
040601030704	Claybank Creek-Manistee River		
040601030705	Manistee Lake-Manistee River		
04060104	Betsie-Platte	040601040101	Cedar Run
		040601040102	Mebert Creek-Lake Leelanau
		040601040103	Houdek Creek-Lake Leelanau
		040601040201	Long Lake-Platte River

8 Digit HUC Watershed	Watershed Name	12-digit HUC Subwatershed	Subwatershed Name
		040601040202	Bronson Lake-Platte River
		040601040203	Pearl Lake
		040601040204	North Branch Platte River
		040601040205	Collison Creek-Platte River
		040601040206	Platte Lake-Platte River
		040601040301	Duck Lake
		040601040302	Green Lake
		040601040303	Little Betsie River-Betsie River
		040601040304	Dair Creek-Betsie River
		040601040305	Crystal Lake Outlet
		040601040306	Rice Creek-Betsie River
		040601040307	Betsie Lake-Betsie River
		040601040401	Shalda Creek-Frontal Lake Michigan
		040601040402	Crystal Run
		040601040403	Otter Creek-Frontal Lake Michigan
		040601040404	Arcadia Lake
		040601040405	Portage Lake
040601040406	Lower Herring Lake-Frontal Lake Michigan		
04060105	Boardman-Charlevoix	040601050101	Spring Brook
		040601050102	Walloon Lake-Bear River
		040601050103	Maple Hill Cemetery-Bear River
		040601050201	Stevens Creek-Jordan River
		040601050202	Severance Creek-Jordan River
		040601050203	North Branch Boyne River
		040601050204	Jordan River
		040601050205	Boyne River
		040601050206	South Arm Lake Charlevoix
		040601050207	Loeb Creek-Lake Charlevoix
		040601050301	Saint Clair Lake
		040601050302	Hanley Lake
		040601050303	Cedar River-Intermediate River
		040601050304	Clam Lake
		040601050305	Spencer Creek-Torch Lake
		040601050401	Wetzel Lake
		040601050402	Headwaters Rapid River
		040601050404	Lake Skegemog
		040601050405	Elk Lake-Elk River
		040601050502	South Branch Boardman River
040601050503	North Branch Boardman River		
040601050504	Brown Bridge Pond-Boardman River		
040601050505	East Creek		

8 Digit HUC Watershed	Watershed Name	12-digit HUC Subwatershed	Subwatershed Name
		040601050506	Jaxon Creek-Boardman River
		040601050507	Boardman Lake-Boardman River
		040601050607	Susan Creek-Frontal Lake Michigan
		040601050701	McGeach Creek-Frontal Grand Traverse Bay
		040601050702	Birch Lake-Frontal Grand Traverse Bay
		040601050703	Petobego Pond-Frontal East Arm Grand Traverse Bay
		040601050704	Acme Creek-Frontal East Arm Grand Traverse Bay
		040601050705	East Branch Mitchell Creek
		040601050706	Prescott Lake-Frontal Grand Traverse Bay
		040601050707	Cedar Creek-Frontal West Arm Grand Traverse Bay
04070004	Cheboygan	040700040103	Thumb Lake-West Branch Sturgeon River
		040700040105	West Branch Sturgeon River
		040700040201	Minnehaha Creek
		040700040202	Pickereel Lake