Maps and Tables for chapter 4: Designated Use Table; Desired use table; Critical Areas Map; streambank erosion map per CRA; convert Stressors priority list to table

*Chapter 4:*

**Sources and causes of pollution/ critical areas for mitigation and preservation**

Potential environmental stressors in the Little Manistee Watershed were identified by water quality monitoring and public input. The WMP Steering Committee assessed the relative impact of six potential stressors, and assigned each a priority level from 1 to 3, with 1 denoting the level of greatest significance in this watershed.

The stressors and priority levels are shown below and presented in greater detail in the following section.

While the priority listing indicates which conditions pose the most likely issues at this time, it should be noted that each of the listed stressors has the potential to negatively impact waters in the Little Manistee Watershed.

**Table - Priority Level of Stressors**

**Level 1**

**Thermal Issues**

**Sediments**

**Level 2**

**Excessive nutrients**

**Invasive Species**

**Biological pathogens**

**Level 3**

**Other unspecified pollutants**

Natural processes may be expected to contribute to some level of each of the above stress factors, and in reality this is not always a bad thing. It would, for example, be counter-productive to remove all nutrients from a body of water, or to completely cut off the introduction of fresh sediments.

Further, it is clear that some water bodies are more naturally productive than others. That is, because of soils and other conditions, some lakes and streams contain more nutrients and therefor produce more plant growth. As a general statement, the goal of watershed management is to observe the natural conditions of each water body and, to the extent possible, reduce any excessive or human-caused loadings of pollutants.

The section below provides more detail on the major environmental stressors listed above. Later sections of this chapter will discuss the impacts of these pollutants on segments of the watershed designated as critical sites or priority areas.

**Sediment**

Sediment includes sand, silt, muck and other naturally occurring soils and minerals that may be washed from land into water and/or moved to new locations due to stream flow or wave action.

This type of pollution may arise from a number of sources, including construction sites, shoreline or streambank erosion, road-stream crossings, urban storm runoff, logging operations, unmanaged recreational access sites, and runoff from non-vegetated open or agricultural land.

Once introduced to the surface waters, sediment may cover fish-spawning areas, interfere with benthic invertebrate life cycles, create hindrances to navigation, alter water temperatures or contribute to turbidity. Sediment is perceived as a major stressor in the Little Manistee Watershed because of these potential impacts on the high quality coldwater fishery. The most common sediment concern in the watershed occurs when sandy soils erode into the stream and cover spawning beds and other aquatic habitat on the stream bottom.

Another significant concern is that other pollutants – including phosphorus and nitrates, animal manures, chemicals, and biological pathogens – may adhere to small sediment particles and be washed into surface waters. For this reason, sedimentation almost always contributes to levels of other pollution.

**Thermal Stressors**

Viability and reproduction of many aquatic species are affected by water temperature. For example, sustained temperatures above 68 degrees limit the reproduction and survival of many trout species. This is a significant concern in the little Manistee River Watershed, where the river’s mainstream and all named tributaries are classed as coldwater streams.

Any conditions that tend to increase the temperature of naturally cold water bodies may be considered to be thermal stressors.

Groundwater generally has a temperature of 50-55 degrees. Infusion of this thermally stable supply is often the key factor in maintaining a coldwater stream. Decreases in groundwater flow – for example form overuse of high-capacity irrigation wells – may have a significant impact on surface waters.

Other potential causes of thermal stress are increases of surface runoff, timber cutting that reduces streamside shade, and the influence of dams, which expose impounded areas to additional sunlight and siltation.

The Little Manistee’s distinction as a prime fishery depends on cold, clear water. Maintaining that thermal balance is a goal of the WMP.

**Nutrients**

Nutrient pollution refers to excessive loadings of substances that act as fertilizers to increase plant and algae growth. Aquatic vegetation generally requires the same three primary nutrients as do terrestrial plants: nitrogen, phosphorus and potassium.

In most Michigan waters, the “limiting” nutrient is phosphorus. That is to say, the other nutrients tend to be available in greater supply in surface water, so that an increase in phosphorus often results in increased production of weeds and algae. Conversely, reductions in phosphorus loadings often result in decreased weed growth, even when the other nutrients are available in ample amounts.

Excessive weed and algae growth may disrupt pre-existing habitats, and may also interfere with recreational uses such as swimming and boating. Some invasive species and undesirable cyanobacteria are believed to thrive and potentially outcompete more desirable plants in waters with high phosphorus levels. (Citation 4-1)

In addition, bacteria involved in the decomposition of dead vegetation make use of dissolved oxygen from the water column. Where heavy blooms of vegetation have occurred, this may deplete the oxygen supply to the point that fish cannot survive.

Michigan has taken steps to reduce phosphorus loading by restricting use of high-phosphorus detergents, and lawn fertilizers containing phosphorus.

Non-point sources of nutrient pollution include on-site septic systems, animal manures, bird droppings, runoff from agricultural and turf areas, and streams or storm sewer inlets into lakes.

As noted above, nutrients may adhere to particles of sediment that are washed into surface waters, so sources of the two pollutants are often related.

**Invasive Species**

Invasive species, for the purposes of this Watershed Management Plan, are those non-native plants and animals which, if allowed to become established, are likely to interfere with designated and desired uses of the water or to cause negative impacts on native ecosystems.

Invasive species of significant concern include: Zebra and quagga mussels; Eurasian milfoil; garlic mustard, non-native or hybrid strains of phragmites, narrow-leaf cattails, purple loosestrife, baby’s breath, reed canary grass, Japanese knotweed, round gobies, spiny water fleas and, potentially, various species of Asian carp.

Many of the above plant species are known to create dense monocultures which displace native vegetation and disrupt existing habitat. Invasive fish and invertebrates have the potential to alter aquatic food chains to the extent that some native species can no longer survive.

The interactions between native and invasive species are often complex. Zebra mussels, for example, are efficient filter feeders, which selectively remove algae from the water column and deposit their own wastes as nutrient in the bottom sediments. The effect may be to dramatically increase the clarity of the water column, while at the same time promoting excessive growth of rooted weeds.

Invasive species are commonly introduced by inadvertent human action, and then may be spread by animals, wind, flowing water, recreational boating, or additional human behaviors.

Michigan law prohibits launching a boat with any non-native plant adhered to the vessel or trailer. Boating and water recreation are important economic and social elements in the local community. The WMP supports expansion of boat washing , in addition to the installation of boot- and wader-cleaning facilities at trailheads and popular river-access sites and other voluntary measures to ensure that invasives are not spread by the public.

It is recognized that much of the region’s existing flora and fauna – from apple trees to steelhead trout and Pacific salmon – are in fact exotic species that were purposefully introduced to the region by humans. Those species have become naturalized in the existing ecosystem, and are not considered “invasive” in this WMP.

**Biological pathogens**

The bacteria *Escherichia coli*, are considered a marker for potential disease-causing pathogens. *E. coli* grow in the intestines of humans and warm-blooded animals, including birds, pets and agricultural livestock.

Water borne *E. coli* typically originates in the digestive systems of humans or warm-blooded animals. It may be deposited directly in the water, as with waterfowl droppings, or transferred from land via storm runoff, erosion, leaking septic systems or other modes of transport.

Rain events may cause elevated *E. coli* counts by washing pollution from the land into storm drains or directly to surface waters, or by increasing stream flow and thereby stirring up contaminated bottom sediments.

When high levels of the bacteria are detected in water sampling, it is generally considered as an indicator that human or animal fecal matter is somehow entering the water. Though most strains of *E. coli* are harmless, the finding of fecal matter in the water increases the probability that disease-causing microorganisms may also be present.

*E. coli* is chosen as the indicator species because it is a familiar organism that is relatively simple to test for in the laboratory. The US-EPA determined that higher *E. coli* counts correlate with greater chances of illness for people using the water. (citation 4-2)

The standard sampling method is to draw a minimum of three samples representative of a given area (for example, the waters just off shore in a public beach area). Laboratory technicians culture those samples and determine the number of “colony forming units” (CFU) per 100 ml of each sample. A geometric mean of the three counts is then calculated for comparison to the health standard.

According to the Michigan standard, a geometric mean of less than 300 CFU on a single testing day indicates the water is OK for full and partial contact recreation. A mean of 300-1,000 CFU indicates the water is acceptable for partial body contact such as wading or paddling, but health officials advise no contact with water above the waist.

A sampling mean above 1,000 CFU triggers a health advisory, with a recommendation to avoid all body contact with the water.

In any advisory situation, the water is retested as soon as possible, and the advisory is removed when new sampling shows E. coli levels below the 300 CFU standard.

According to the Michigan DEQ’s 2016 Integrated Report, a water body can be determined to be “not supporting” of the full body contact designated use, if regular sampling occurs and at least 10 percent of the daily mean values exceed the standard.

The LMWCC has conducted E Coli monitoring at several locations in the Watershed. While some samples have appeared to be elevated from background levels, the samples have not exceeded the standards for full or partial body contact recreation.

**Other unspecified pollutants**

National studies have found low levels of such substances as pesticides, pharmaceutical metabolites, petroleum products, plastic microbeads, PCBs, mercury and others in many surface waters.

Of specific concern in the Little Manistee Watershed, is the possibility that improper disposal of toxic materials could result in contamination of groundwater, which may then flow into surface waters or be taken up by residential water wells.

The region’s deep sandy soils are known to have only limited capacity for filtering water as it percolates from the surface to the water table. The WMP’s Information/Education component (Chapter 7) includes a recommendation for a program to educate residents and property owners of this concern.

PCB’s and mercury are known to be taken up by fish. As a result, Michigan has issued health advisories, limiting the consumption of fish from the state’s waters.

To date, there has not been an analysis of pollutants such as pharmaceuticals or microbeads in the waters of this watershed. If they occur here, it is likely at extremely low levels. There appears to be no scientific consensus as to the impact of such minuscule traces, though some studies have raised concern that they could function as endocrine disruptors or otherwise affect aquatic life.

The potential impact of these pollutants does raise significant concern, worthy of further study but outside the control of the local community and beyond the scope of this Watershed Management Plan.

Fortunately, strategies designed to protect groundwater and reduce loading of sediment, nutrients and pathogens are also likely to minimize the introduction of additional pollutants into surface waters.

Insert Designated use chart

Insert Desired use chart

WMP Critical Areas

(Insert Mapping of Critical Areas)

Critical Areas identified in the WMP are those sites in the Watershed which are most severely affected by existing or potential sources of the pollutants discussed above. The priority section which follows identifies issues that require special attention to preserve designated or desired uses within the watershed. Specific recommendations for addressing these concerns are included in the Implementation sections in Chapter 5.

**Luther Dam and headwaters**

*Potential Issues: Thermal impacts; sediment; fish passage*

The Luther Millpond Dam, in the Village of Luther near the Little Manistee headwaters, has been a source of controversy since at least 1986, when an earlier version of the structure failed during a historic Michigan rainstorm.

The dam and its eight acre millpond have been valued as a community resource by village residents, while fishing groups and the Michigan Department of Natural Resources have expressed a preference for removing the structure and restoring natural stream flow and fish passage.

The timber-cutting era in eastern Lake County began around the year 1880, and the Luther Dam was constructed in 1881 to power a sawmill. The village of Luther, on the boundary between Ellsworth and Newkirk townships, was platted in 1882. The village was soon served by a railroad, and its population reached 1,500 by 1889, according to a local history edited by Doug DeMaw and Franklin Willard.

Most of the local timber had been harvested by 1910, and cutover areas were farmed for potatoes, beans, dairy and other crops. The dam was converted to electrical generation in about 1915. Railroad service ended in 1920 and village population declined to about 400 persons, where it has remained ever since.

The dam reverted to village ownership after electrical generation ceased. Local residents valued the pond as a historical legacy and a casual fishing site. The aging structure washed out in September of 1986 during a torrential rainstorm that also caused the failure of a dozen other dams in Michigan. The washout allowed tons of sediment to move downriver, covering spawning beds and damaging the river’s ecology.

The Michigan Department of Natural Resources opposed reconstruction of the dam, as did the Michigan United Conservation Clubs and Trout Unlimited. However, at the request of village leaders, the Michigan Legislature voted to allow the structure to be rebuilt. A Federal Emergency Management Agency (FEMA) grant of $450,000 paid for the reconstruction.

The new dam had just been placed in operation and the pond was being refilled in 1993, when it failed again. Sand washed out along the side of the concrete control structure and tons of silt again migrated downstream.

The second washout apparently resulted from design or construction errors. Again, the Legislature overruled objections from the DNR. The structure was rebuilt, largely with money from an insurance settlement, and has remained in place ever since.

At Luther, about six miles below the headwaters, the river is quite small, not suitable for canoeing or kayaking. From the dam spillway, it bubbles through a small village park and then flows unfettered for more than 50 miles to the watershed’s exit point at Manistee Lake.

Management of the dam has remained a point of contention, with village officials and the DNR disagreeing over the proper use of a “bottom draw” system designed to pull cooler water from the depths of the pond.

The dam clearly impedes fish passage. There is no “fish ladder,” and steelhead or salmon may often be seen trying unsuccessfully to ascend the concrete spillway.

It is unclear whether there is a significant amount of suitable spawning habitat above the dam, where several miles of headwater streams flow sluggishly through forest and agricultural landscapes. Little water-quality monitoring has been conducted in the millpond or the tributaries of the Little Manistee River upstream of Luther. Monitoring in areas below the dam has not shown significant degradation of the resource in the years since the catastrophic failures.

Similar impoundments are known to increase water temperature in cold water streams, and this is likely the case in Luther. The WMP proposes long-term monitoring to determine if there is an adverse thermal impact.

The millpond itself appears little used. The pond is generally shallow and weedy, with a dark bottom. There is no public launch facility for rowboats or canoes. A designated swim area is overrun with cattails and reeds, and may be too close to the dam for safe use in any case. A wooden fishing platform has been constructed adjacent to an auxiliary concrete spillway.

In summary, the millpond’s primary positive impact is related to its role in village history and local pride of place. Negative impacts include the dam’s blockage to fish passage, the likely thermal impact of the stillwater pond, and the low-probability but high-impact threat of another potential washout.

Careful dewatering of the pond – with removal of the structure and restoration of the streambed – could produce significant benefits, especially if combined with grant funding for village park development.

The focus of the WMP is on water quality and stream ecology. But park-and-stream restoration could also relieve the village of the liability and expense of the dam, increase local usage of the parkland and include elements to memorialize the genuine historic significance of the site.

The WMP recognizes the primacy of the village of Luther in determining the future of the dam and pond. For this reason, two alternatives are included in the plan’s implementation tasks (Chapter 5).

In alternative one, the dam would continue in place. The bottom-draw mechanism would be managed jointly by the village and the DNR to ensure that thermal impacts are minimized; a study would assess the feasibility of fish passage strategies; and all safety measures would be continued and monitored to protect against dam failure.

The second alternative is for the village to seek planning grant funds – in cooperation with other stakeholders – to redevelop the park, dewater the pond and remove the dam.

**Syers Lake Dam**

*Potential Issues: Loss of habitat, fish passage, stream and shoreline erosion*

An ongoing project to remove an aging dam from the outflow of Syers Lake is expected to restore the lake to its natural configuration, with perennial flow into Syers Creek, a tributary to the Little Manistee River.

Funding for the $120,000 plan has come from a number of sources including the U.S. Fish and Wildlife Service; the Little Manistee Watershed Conservation Council; the Little River Band of Ottawa Indians; private property owners; and fishing organizations.

Syers Lake is a 130 acre water body located in a forested area of Eden and Peacock townships within the Little Manistee Watershed, just east of highway M37.

 Most of the lake’s western shoreline is owned by the state of Michigan and managed by the Department of Natural Resources as part of the Pere Marquette State Forest. The south and east shorelands are largely private, including a number of camps and several year-round homes.

The natural lake was enlarged about 1970 through construction of a six-foot-high, 120 foot long sand-berm dam that raised the water level by several feet and included a roadway to provide access to private parcels then being developed on the eastern shore.

Syers Creek, a designated trout stream, was partially impeded by the dam, and allowed to flow intermittently through a small culvert.

Over the intervening years, the dam has failed several times and the culvert has often been blocked by debris. Flow in the upper reaches of Syers Creek has been non-existent at times, harming the ecology of the small stream, which is considered to be prime spawning habitat for steelhead and other fish species.

In response to these issues, the Michigan Department of Environmental Quality issued a violation notice, requiring repair or removal of the dam. The Conservation Resource Alliance, a non-profit organization based in Traverse City, is coordinating the project, which will remove the berm, and install a bottomless culvert below a rebuilt access road.

When complete, in 2018 or 2019, the work will lower the lake level by approximately 18 inches and restore natural flow to the stream. Over time, the lake margins are expected to revert to their natural condition, which is a mixture of bog and forest cover. Restoration of the natural stream flow is expected to enhance reproduction of trout in the Little Manistee system.

**Cool Creek**

*Potential issues: Erosion, E. coli, excess nutrients from farm animals*

Cool Creek, a tributary to the Little Manistee River, flows out of Cool Lake in Elk Township and meanders through forest and farmland in northern Lake County before joining Stronach Creek and ultimately the mainstream of the river.

The most problematic segment of the stream occurs at 12 mile Road on the Lake-Manistee county line. Here, Cool Creek passes under the gravel road in a 72 inch culvert, flows for several hundred feet yards through a pasture on the north side of the road, and then flows back through a similar culvert to the south side of the road.

The northern segment, in Manistee County, is open to cattle in the pasture and has been seriously eroded.

While conducting invertebrate sampling in 2014, an MDEQ biologist noted that cattle were trampling the banks at the site, resulting in significant erosion.

The biologist suggested that MDEQ’s non-point source unit should consult with the Department of Agriculture and rural development to consider actions to rectify the problem.

Provisions of Michigan’s right-to-farm act may permit the property owner to continue his management practice of watering cattle in the stream. However, this practice diminishes water quality downstream from the site.

The WMP recommends that agencies work with the owner and develop funding to assist in fencing the stream and implementing an environmentally sound method of providing water to the pastured cattle.

**Streambank Erosion Sites**

**Map of severe sites; image of severe site from inventory**

*Potential Issues: Sedimentation; damage to fish habitat; thermal issues*

Streambank erosion has been identified since at least the 1960s as a source of sediment pollution to the Betsie River. Some bank erosion is a natural process of a free-flowing stream. But, as noted in Chapter 2, excessive erosion on the Little Manistee is often related to past land uses including logging and vegetation removal.

Considerable work to restore the natural resilience of Little Manistee river streambanks was accomplished in recent years through habitat restoration work by the LMWCC and Conservation Resource Alliance. Despite those efforts, unstable banks continue to erode sediment into the stream at a number of locations. Of particular concern are the course sands that can accumulate on the river bottom, potentially covering fish spawning habitat and also creating a shallower and warmer stream.

The sites were scored on the Streambank Erosion Severity Index which assigns numerical values for such variables as: The site’s general condition; vegetation cover; trend toward increasing or decreasing erosion; length and height of eroded bank; current and depth of the river; and other factors. Sites scoring less than 28 points are considered as minor; those with 28-31 points are ranked as moderate; and those scoring 32 or above are classed as severe.

The entire inventory -- including point scores, GPS coordinates, photographic images and recommended mitigation methods – is on-line at [www.northernmichiganstreams.org](http://www.northernmichiganstreams.org)

Because the Little Manistee is eligible for Natural River designation, bank stabilization projects should use native materials and the least obtrusive methods. Placements of whole tree revetments, and/or revegetation are the preferred treatments where applicable.

Priority Areas for Protection

 Priority areas within the watershed are those general areas which may not be currently impaired or threatened, but must be protected in order to prevent future degradation of water quality. Watershed Plan goals, presented in Chapter 5, are intended to address these issues in such a way as to protect the designated and desired uses of surface water. Specific recommendations for addressing these concerns are included in the Implementation sections in Chapter 5.

Stream ecology and habitat

*Potential issues: Loss of habitat; decrease in native species diversity*

Preserving the ecology of the Little Manistee River system – that is, the animal, vegetable and mineral features that support the web of life in the stream – is a priority goal of the WMP and of Watershed stakeholders.

All other aspects of the plan relate directly to this priority.

Since its creation in 1996, the Little Manistee Watershed Conservation Council (LMWCC) has been engaged in projects to preserve and enhance the aquatic habitat in the river and tributaries.

The river’s natural condition provides the cold, flowing water necessary for trout to thrive. Enhancement activities have primarily involved placement of “lunker” structures and woody debris to provide diversity and resting areas for fish.

The LMWCC, along with the Little Manistee River Restoration Committee, has used donations, grant funds and both paid and volunteer labor to restore hundreds of feet of eroded streambank and plant thousands of seedlings.

In addition, the groups worked with state and federal agencies to install two “sand traps” to remove excess sediment that entered the river through bank erosion and the failures of the Luther Dam in 1986 and 1993.

Additional funding has been identified for habitat structures – chiefly whole trees and woody debris – to be installed in2018 or 2019. Carefully placed, such structure may improve fish survival and also protects banks for further erosion.

Since 2000, the LMWCC has conducted annual macroinvertebrate studies, a process that involves collecting and analyzing riverbottom insect populations as a marker for water quality. Those studies have consistently indicated good to excellent water quality, as have periodic studies by MDEQ biologists. The WMP recommends continuing the macroinvertebrate studies through the Volunteer Stream Monitoring Program as an effective tool for early detection of problems.

Inland Lakes

*Potential issues: Weed growth, loss of shoreline diversity, reduction of water clarity*

The Little Manistee Watershed has at least 28 named lakes, ranging in size from a few acres to more than 100 acres. While the watershed is best known for its river and streams, these small lakes also provide a diverse set of natural habitats, recreational opportunities and homesites. The lakes should be considered as significant contributors to the quality of the watershed.

Several lakes in the watershed, including Harper and Cool, developed with shoreline cottages and homes, while others, such as Elbow and Syers have a mix of public and private shoreline. All are believed to have a direct connection with the groundwater.

Maintaining clarity, water quality and natural fish habitat on all water bodies will enhance the desired uses of the watershed.

Water clarity on these small bodies of water is significantly impacted by management of the shorelands. Native vegetation at the shoreline protects habitat for invertebrates, fish and wildlife. Careful management of upland property, such as installation of rain gardens and permeable pavements, and avoidance of lawn fertilizer, can help keep phosphorus and nitrogen from leaching into the water.

Conversely, hard-paved surfaces, broad turfgrass lawns and improperly maintained septic systems may allow excessive nutrients to enter a lake, leading to weed growth and eutrophication.

Clear lake water is a benefit for the environment and for property owners. A study in Maine indicated that property values of shoreline property increase along with the clarity of the water.

Educational materials are available from a number of sources, including the Michigan Natural Shoreline Partnership (MNSP). The partnership works along with Michigan State University Extension, MDEQ, Tip of the Mitt Watershed Council and others to demonstrate planting strategies, train contractors and educate landowners in the use of native plants to stabilize shorelines.

The partnership has developed an online tool to help landowners evaluate their shoreline conditions and identify potential improvements. The free project is on the Internet at www.MIshorelandstewards.org.

LMWCC has worked with some lake property-owner groups in the watershed to monitor water quality. The Manistee National Forest contracted with the Manistee Conservation District on a project to evaluate water quality parameters at Elbow Lake and several others.

The WMP envisions an expansion of this work as part of a long-term system of monitoring in the watershed.

**Groundwater**

*Potential issues: Contamination by petroleum products; depletion by overuse in minor aquifers; nutrient contamination from on-site wastewater systems or agricultural operations*

Groundwater is a key resource in the Little Manistee Watershed. Survival and reproduction of trout and salmon are enabled by the stable flow of cold groundwater into the river and tributaries. Groundwater also water for human consumption and for agricultural irrigation.

The 28 named lakes in the watershed are primarily fed by springs and/or direct groundwater flows.

At the present time, groundwater supplies in the watershed are both abundant and of high quality. However, given the vital nature of the resource, steps must be taken to provide total assurance against future degradation.

Groundwater recharge areas must be protected. Farms and residences must employ best management practices to avert any chance of contaminants reaching the water table.

 Mining, mineral extraction, gravel pits and oil and gas production operations – along with their associated infrastructure – must be strictly regulated by state and local governments to provide 100 percent assurance against groundwater contamination.

The Information/Education component of the WMP (Chapter 7) recommends the creation and dissemination of materials to inform landowners and the public about best management practices to minimize the potential for groundwater contamination.

**Rustic and natural character**

*Potential issues: Erosion, loss of diversity; loss of scenic areas*

Visitors and residents are attracted to the Little Manistee Watershed by the region’s outdoor recreation offerings and by the “peace and quiet” of the river, wetlands and forest. Retaining these rustic and natural attributes – along with appropriate access for human enjoyment – is a desired use of the region’s resources.

The present level of development in the watershed appears to meet this desired condition, with unlimited fishing opportunities, scenic forest roads, a network of small campgrounds and dispersed camping sites, and a system of motorized and non-motorized trails.

However, as noted in Chapter 1, the Little Manistee Watershed is less than 50 miles from Michigan’s fastest growing metropolitan area, Grand Rapids, and therefore the possibility of future development should not be ignored.

The WMP recommends a major effort of land use education targeted to the public and township officials, to engage a conversation about potential ways of preserving the desired character of the watershed. Ultimately, this conversation should aim to develop a community consensus on whether to support protective local zoning, natural river designation and/or other strategies.

An additional concern is the loss of forest diversity as result of the emerald ash borer, oak wilt, beech bark disease and other threats to the health of native trees. Thousands of ash trees within the watershed have been destroyed by the emerald ash borer and removed from the forest canopy. While the other diseases have so far been less devastating, they also pose significant threats.

Education, and potentially regulation, about the impacts of moving firewood is an important element in preserving the forest, which comprises more than 75 percent of the watershed’s land cover.

The Watershed’s land base is more than 50 percent publicly owned and managed through state and federal forest agencies. That means that additional land protection may be less of a need here than in other regions. Still, the private sector and non-profit land conservancies have a role to play along with property owners in protecting the desired watershed character.

The Grand Traverse Regional Land Conservancy, in cooperation with other organizations, has developed a set of criteria to identify parcels that are likely to have the greatest impact on water quality and the ecosystem. These “Priority Parcels” should be among the first considered for investment of funds for acquisition of conservation easements, development rights and outright purchase from willing sellers.

The selection criteria include the following: Parcel size (larger parcels are considered to have greater ecological impact); groundwater recharge potential, based on soils and topography; the presence of wetlands; lake or stream frontage; steep slopes; adjacency to previously protected lands; and the presence of endangered or threatened species.

Permanent protection or low-impact development in high priority areas will help ensure the ecological integrity of sensitive areas while preserving water resources throughout the watershed.

Footnotes:

4-1 Rippke, Molly, Senior Aquatic Biologist, MDEQ: “Bacterial Monitoring Results for Michigan Rivers and Streams, 2014;” MDEQ Document released March 2015

4-2 Tonello, Mark, Michigan DNR Fisheries biologist; Cold Creek 2006 Fisheries Survey Report

4-3 McNaught, Scott, “Nutrient sources and biological production in the near shore regions and central basin of Crystal Lake, Benzie Co. Michigan.” Michigan Water Resource Center, Central Michigan University, July, 2004