PART 14 IMPLEMENTATION TASKS AND EVALUATION

October 2008

14.1 SUMMARY OF NINE MINIMUM ELEMENTS

This chapter was added to the existing Rogue River Watershed Management Plan to fulfill the requirements of the United States Environmental Protection Agency (EPA) to have all watershed projects funded under Section 319 of the Clean Water Act be supported by a watershed plan which includes the nine minimum elements. These requirements include (a) an identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the plan, (b) an estimate of load reductions expected for the management measures, (c) a description of the management measures that will need to be implemented to achieve load reductions, (d) an estimate of the amounts of technical and financial assistance needed to implement the plan, (e) an information/education component, (f) a schedule for implementing the management measures, (g) a description of measurable milestones for determining if the management measures are being implemented, (h) a set of criteria that can be used to determine whether load reductions are being achieved over time, and(i) a monitoring component to evaluate the effectiveness of the implementation efforts over time. Without such information to provide focus and direction to the project's implementation, the EPA believes it is much less likely that the project can efficiently and effectively address nonpoint sources of water quality impairments.

14.2 SOURCES THAT NEED TO BE CONTROLLED TO ACHIEVE LOAD REDUCTIONS AND THEIR PRESENCE IN THE WATERSHED (CRITERIA A)

Designated Uses

The primary measurement of water quality is whether the water body meets designated uses. Designated uses are recognized uses of water established by state and federal water quality programs (Brown et al. 2000). All surface waters of the state are designated and protected for these uses. Each of these uses must meet water quality standards established by the state. The purpose of these standards is to establish water quality requirements to protect the public health and welfare, to enhance and maintain the quality of water, and to protect the state's natural resources (MDEQ 2008). Specific water quality criteria for each designated use is include in attachment 1.

Section 4-3 in the watershed management plan discusses the impacted designated uses in the watershed. At the time, full body contact was the only designated use not being met. Local data on this designated use can be found in Section 4-3 and Appendix E.

Impaired Designated Uses
Currently, two designated uses are impaired in the Rogue River Watershed. These designated uses are impaired because of mercury and Polychlorinated biphenyls (PCBs) in the water column and fish tissue.

TABLE 32: IMPAIRED DESIGNATED USES IN THE ROGUE RIVER WATERSHED

Designated Use	Pollutant Causing Impairment*	Areas*
Other Indigenous Aquatic Life	Mercury and PCB in Water Column	Sections of Rogue River, Ranson Creek, Duke Creek, White Creek, Forest Creek, Frost Creek, Walter Creek, Spring Creek, Nash Creek, Ball Creek, Unnamed tributary to Cedar Creek, Becker Creek, Cedar Creek, Unnamed tributary of to Rogue River, Stegman Creek, Shaw Creek, Little Cedar Creek, Barkley Creek, Rum Creek, Unnamed tributary near US 131
Fish Consumption	Mercury and PCB in Water Column and in fish tissue	

* Information taken from the Water Quality and Pollution Control in Michigan 2008 Sections 303(d), 305(b), and 314 Integrated Report

Sources and Causes of Pollutants Causing Impairment
Atmospheric deposition from industry has been found as a contaminant source for mercury. Airborne mercury is eventually deposited to the ground and may ultimately make its way into bodies of water. Researchers are still trying to understand how to control this source of mercury (Hansich 1998).

PCBs are synthetic organic chemicals. There are no known natural sources of PCBs. PCBs were widely used in a variety of equipment and consumer products, such as electrical transformers and capacitors, paint, plastics, and glues, to name just a few. Although PCBs are no longer manufactured in the United States, people can still be exposed to them. Due to resistance to degradation, PCBs persist in the environment for decades (U.S. Public Health Service and U.S. Environmental Protection Agency 2008).

These chemical contaminants persist for long periods in sediments where bottom-dwelling animals accumulate and pass them up the food chain to fish. Levels of these contaminants may increase as they move up the food chain, so top predators in a food chain (such as largemouth bass or walleye) may have levels a million times higher than that in the water (U.S. Public Health Service and U.S. Environmental Protection Agency 2008).

Threatened Designated Uses
There are five designated uses in the Rogue River Watershed that are threatened (Table 33).

Threatened means that the use currently meets water quality standards but might not in the future. This was determined by analyzing previous water quality studies, land use/land cover information, collecting monitoring data and doing a physical inventory as part of the planning project, and data collected as part of the West Michigan Environmental Action Council volunteer monitoring program (Section 4-5). The Rogue River Watershed Council felt that an additional designated use and pollutant needed to be added to this section. The Other Indigenous Aquatic Life designated use was added because toxic substances are suspected as a threat to this use. For the cold water and warm water fishery designated uses, invasive species was added to the list of pollutants.

TABLE 33: THREATENED DESIGNATED USES IN THE ROGUE RIVER WATERSHED

Designated Use	Pollutant Causing Threat	Areas
Cold Water Fishery	Sediment, Nutrients, Temperature, Invasive Species	Duke/Forest/Frost Creek Subwatershed, Duke/White Creek Subwatershed, Cedar Creek Subwatershed, Stegman Creek/Becker Creek Subwatershed, Shaw Creek/Rum Creek/Barkley Creek Subwatershed
Warm Water Fishery	Sediment, Nutrients, Invasive Species	Ranson Creek Subwatershed, Upper Rogue River Subwatershed, Ball Creek Subwatershed, Nash Creek Subwatershed, Spring Creek/Walter Creek Subwatershed, Lower Rogue Subwatershed, and Rogue Mouth
Other Indigenous Aquatic Life	Toxic Substances	Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed
Partial Body Contact	*E. coli* and Fecal Coliform	Lower Rogue Subwatershed, Shaw Creek/Rum Creek/Barkley Creek Subwatershed, Ranson Creek Subwatershed, Upper Rogue Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed, Cedar Creek Subwatershed
Total Body Contact		

Sources and Causes of Pollutants Causing Threat

The pollutants and their sources for the threatened designated uses in the Rogue River Watershed have been identified in Part 4 Table 16 of the management plan. Further explanation of the source and causes of watershed pollutants can also be found in this section. The Rogue River Watershed Council felt that an additional source and cause needed to be added to this section. For the cold water and warm water fishery designated uses, loss of wetlands was added as being

a source of sediment, nutrients, and thermal pollution in the watershed which was caused by land use change (development and agriculture).

Prioritization of Pollutants, Sources, and Causes Causing Impairments and Threats
To address what is impairing and threatening these designated uses, pollutants and there sources and causes were determined (Sections 4.2 and 4.4). The Rogue River Watershed Council ranked the pollutants based on the magnitude of the pollutant in the watershed. The high priority items were determined by thinking about what would result in the greatest pollutant reduction while treating the fewest sources, leading to the greatest water quality benefit for the money.

Table 34 lists the pollutants, sources, and causes identified for the Rogue River Watershed and their ranking. If the origin of a pollutant was verified through monitoring and available information, it is characterized as known (k). Suspected (s) and potential (p) pollutants, sources, and causes haven't been verified but are based on local knowledge and perceptions. It is recommended that monitoring be conducted to verify these suspected and potential pollutants, sources, and causes to determine pollutant loadings and their overall effect on water quality.

A lettering and numbering system has been used to identify known (k), potential (p), and suspected (s) items and their ranking (high—1, moderate—2, low—3). For example, sediment is a known pollutant that is a high priority (identified by k-1).

TABLE 34: PRIORITIZED POLLUTANT, SOURCES, AND CAUSES IN THE ROGUE RIVER WATERSHED

Designated Use and Status	Prioritized Pollutant	Prioritized Sources	Prioritized Causes
Cold Water Fishery - Threatened	Sediment (k-1)	Croplands (k-1)	Row crop cultivation on floodplains (k-1)
		Loss of wetlands (k-1)	Land use change (development and agriculture) (k-1)
		Road Stream Crossings (k-1)	Improperly designed and maintained road stream crossings (k-1)
		Stormwater/Surface Runoff (s-1)	Impervious surfaces (s-1)
		Bank Erosion (k-2)	Poorly maintained public access (k-1)
			Livestock in streams (k-1)
			Boat wakes (s-2)
		Construction Areas (k-2)	Poor site preparation practices (k-2)
	Temperature (k-1)	Lack of Streamside Canopy and upland vegetation (k-1)	Land use change (development, forestry, and agriculture) (k-1)
		Loss of wetlands (k-1)	Land use change (development and agriculture) (k-1)
		Stormwater/Surface Runoff (s-1)	Impervious surfaces (s-1)
		Water Inputs from Drainage Networks (s-2)	Shallow water with nonvegetated banks which increase water temperatures (s-2)
		Water Withdrawals (s-3)	Reduction in stream depth and base flow (s-3)
	Nutrients (k-2)	Animal Waste Runoff (s-1)	Improper application of agricultural fertilizer (s-1)
			Feed lots (s-2)
			Poor irrigation practices (s-3)
		Commercial Fertilizer Use (s-1)	Improper application (s-1)
		Loss of wetlands (k-1)	Land use change (development and agriculture) (k-1)
		Stormwater/Surface Runoff (s)	Impervious surfaces (s-1)
		Septic Systems (p-2)	Improperly designed and maintained septic systems (s-2)
	Invasive Species (k-2)	Human Introduction (k-2)	Improper knowledge of organism (s-2)
Warm Water Fishery - Threatened	Sediment (k-1)	Croplands (k-1)	Row crop cultivation on floodplains (k-1)
		Loss of wetlands (k-1)	Land use change (development and agriculture) (k-1)
		Road Stream Crossings (k-1)	Improperly designed and maintained road stream crossings (k-1)
		Stormwater/Surface Runoff (s-1)	Impervious surfaces (s-1)
		Bank Erosion (k-2)	Poorly maintained public access (k-1)
			Livestock in streams (k-1)
			Boat wakes (s-2)
	Nutrients (k-2)	Animal Waste Runoff (s-1)	Improper application of agricultural fertilizer (s-1)
			Feed lots (s-2)
			Poor irrigation practices (s-3)
		Commercial Fertilizer Use (s-1)	Improper application (s-1)
		Loss of wetlands (k-1)	Land use change (development and agriculture) (k-1)
		Stormwater/Surface Runoff (s)	Impervious surfaces (s-1)
		Septic Systems (p)	Improperly designed and maintained septic systems (s-2)
	Invasive Species (k-2)	Human Introduction (k-2)	Improper knowledge of organism (s-2)

TABLE 34: PRIORITIZED POLLUTANT, SOURCES, AND CAUSES IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use and Status	Prioritized Pollutant	Prioritized Sources	Prioritized Causes
Other Indigenous Aquatic Life – Impaired and Threatened	PCBs and Mercury (k-3)	Atmospheric Deposition (k-1)	Industry (k-1)
	Toxic Substances (s-3)	Stormwater/Surface Runoff (s-1)	Impervious surfaces (s-1)
		Landfill Leachate (p-3)	Improperly designed and maintained disposal areas (s-3)
Partial and Total Body Contact - Threatened	*E. coli* and Fecal Coliform (k-2)	Animal Waste Runoff (p-1)	Improper application of agricultural fertilizer (s-1)
			Livestock in stream (s-2)
		Septic Systems (p-1)	Improperly designed and maintained septic systems (s-1)
		Wastewater Treatment Plants (p-3)	Improperly designed and maintained plants (s-3)
Fish Consumption	PCBs and Mercury (k-3)	Atmospheric Deposition (k-1)	Industry (k-1)

Quantification and Identification of Pollutants, Sources, and Causes

Table 35 below lists the impaired and threatened designated uses, the pollutants affecting the designated use, and quantifies the sources and causes of these pollutants and where in the watershed these pollutants are coming from.

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED

Designated Use	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery	Sediment	Croplands (k)	Row crop cultivation on floodplains (k)	Using the MIRIS land use classifications there are approximately 1,580 acres of crop cultivated on floodplains in the RRW. This was determined using a buffer of 100 feet on the main river and 50 feet on tributaries and drains (MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1998).	Refer to Table 25 and Figure 29 for specific locations. Upper Rogue River Subwatershed, Ranson Creek Subwatershed, Spring/Walter Creek Subwatershed, Cedar Creek Subwatershed, Ball Creek Subwatershed, Nash Creek Subwatershed, Duke/White Creek Subwatershed. Sediment load from this source is 432 tons/yr (estimated using Region 5 load estimation spreadsheet model and pollutant reduction efficiencies from EPA 1993).
		Loss of wetlands (k)	Land use change (development and agriculture) (k)	Pre-settlement wetland conditions indicated there were approximately 38,816 acres of wetlands in the RRW. Using 1978 NWI data, the number of wetland acres was 17,370. Comparing pre-settlement data with 1978 data there has been a total wetland loss of 21,446 acres in the RRW (information provided by MDEQ using 1978 NWI data, Attachment 1).	Refer to attachment 2. Ranson Creek Subwatershed, Upper Rogue River Subwatershed, Cedar Creek Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed. Sediment load from this source is 64 tons/yr (estimated using Region 5 load estimation spreadsheet model).
		Road Stream Crossings (k)	Improperly designed and maintained road stream crossings (k)	There were 9 road stream crossings that were identified as being a slight, moderate, or high potential source of nonpoint source pollutants in the RRW (MDEQ watershed survey conducted in 2000). To date, there have been 4 road stream crossings that have been remediated.	Refer to Table 25 and Figure 29 for specific locations. Stegman/Becker Creek Subwatershed, Shaw/Rum/Barkley Creek Subwatershed, Upper Rogue Subwatershed, Nash Creek Subwatershed, Cedar Creek Subwatershed. Sediment load from this source is 1,491 tons/yr (estimated using load information from 4 implemented road stream crossings and pollutant reduction efficiencies from EPA 1993).
		Stormwater/ Surface Runoff (s)	Impervious surfaces (s)	Approximately 7,500 acres of impervious surfaces in the RRW (AWRI 2001).	Urban areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Sediment load from this source is 1,489 tons/yr (estimated using Region 5 load estimation spreadsheet model).
		Bank Erosion (k)	Poorly maintained public access points, livestock in streams, boat wakes (k)	There are approximately 3,000 feet of eroded stream bank in the RRW (Physical inventory and MDEQ watershed survey, 2000). Some of the large lakes in the RRW that could be a source of sediment from bank erosion from boat wakes include Silver, Bill's, Pettit, Camp, Bella Vista, Myers, Pine Island, Brower, Stoners, and Freska (MDNR, MIRIS, 1978).	Refer to Table 25 and Figure 29 for specific locations. Shaw/Rum/Barkley Creek Subwatershed, Cedar Creek Subwatershed, Lower Rogue. Sediment load from this source is 657 tons/yr (estimated using load information from implemented stream bank stabilization and pollutant reduction efficiencies from DEQ 2003).

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery	Sediment (cont.)	Construction Areas (k)	Poor site preparation practices (k)	About 35% of construction areas have poor site preparation practices (personal communication with soil erosion officers 2007).	Urban and residential areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Sediment load from this source is 1 ton/yr (estimated using Region 5 load estimation spreadsheet model and pollutant reduction efficiencies from EPA 1993).
	Temperature	Lack of Streamside Canopy and upland vegetation (k)	Land use change (development, forestry, and agriculture) (k)	There are approximately 22,160 feet of vegetative gaps within the riparian area of the Rogue River and its tributaries (AWRI 1999). Using the MIRIS land use classification, there are approximately 1,038 acres of confined feeding or permanent pasture, 52,968 acres of cropland, 8,138 acres of orchard or specialty crop, 9,656 acres of residential, 1,014 acres of commercial/institutional, 383 acres of industrial, and 2,735 acres of other developed lands in the RRW that could be contributing to the lack of streamside and upland vegetation (MDNR, MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1991, 1992, 1996, and 1998).	Refer to Table 25 and Figure 29 for specific locations. Cedar Creek Subwatershed, Stegman/Becker Creek Subwatershed, Shaw/Rum/Barkley Creek Subwatershed, Duke/Forest/Frost Subwatershed. Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. Temperature data for the Rogue can be found in the management plan in Section 4–5.
		Loss of wetlands (k)	Land use change (development and agriculture) (k)	Pre-settlement wetland conditions indicate there were approximately 38,816 acres of wetlands in the RRW. Using 1978 NWI data, the number of wetland acres was 17,370. Comparing pre-settlement data with 1978 data there has been a total wetland loss of 21,446 acres in the RRW (information provided by MDEQ using 1978 NWI data, Attachment 1).	Refer to attachment 2. Ranson Creek Subwatershed, Upper Rogue River Subwatershed, Cedar Creek Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed. Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. Temperature data for the Rogue can be found in the management plan in Section 4–5.

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery (cont.)	Temperature (cont.)	Stormwater/ Surface Runoff (s)	Impervious surfaces (s)	There are approximately 7,500 acres of impervious surfaces in the RRW (AWRI 2001).	It is suspected that stormwater and surface runoff is coming from urban land uses. Urban areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. Temperature data for the Rogue can be found in the management plan in Section 4–5.
		Water Inputs from Drainage Networks (s)	Shallow water with nonvegetated banks which increase water temperatures (s)	There are approximately 94 miles of designated county drains and approximately 185 miles of small drains or intermittent streams in the RRW which could be contributing to thermal pollution. Approximately 26% of all stream length in the Rogue River system is considered designated county drain (MDNR, MIRIS, 1978, designated drain information provided by Kent and Newaygo Drain Commission, 2000).	Refer to Figure 18. Upper Rogue River Subwatershed, Spring Creek/Walter Creek Subwatershed, Ball Creek Subwatershed, Nash Creek Subwatershed. Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. Temperature data for the Rogue can be found in the management plan in Section 4–5.
		Water Withdrawals (s)	Reduction in stream depth and base flow (s)	In the RRW there are approximately 52,968 acres of cropland, 8,138 acres of orchard or specialty crop, 9,656 acres of residential, 1,014 acres of commercial/institutional, 383 acres of industrial, and 2,735 acres of other developed lands that could be contributing to thermal pollution by way of water withdrawals in the watershed (MDNR, MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1991, 1992, 1996, and 1998).	It is suspected that water withdrawals will be coming from heavy agricultural and developed land uses. Upper Rogue River Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed, Cedar Creek Subwatershed, Spring/Walter Creek Subwatershed, Shaw/Rum/Barkley Creek Subwatershed. Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. Temperature data for the Rogue can be found in the management plan in Section 4–5.

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use to be Protected	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery (cont.)	Nutrients	Animal Waste Runoff (s)	Feed lots, improper application of agricultural fertilizer, poor irrigation practices (s)	Using the MIRIS land use classifications there are approximately 1,038 acres of confined feeding or permanent pasture, 52,968 acres of cropland, and 8,138 acres of orchard or specialty crop in the RRW that could be contributing to animal waste runoff. The highest number of acres of agricultural land is in the Upper Rogue River Subwatershed with approximately 12,000 acres (MDNR, MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1991, 1992, 1996, and 1998).	Refer to Table 25 and Figure 29 for specific locations. Upper Rogue River Subwatershed, Ranson Creek Subwatershed, Spring/Walter Creek Subwatershed, Cedar Creek Subwatershed, Ball Creek Subwatershed, Nash Creek Subwatershed, Duke/White Creek Subwatershed, Shaw/Rum/Barkley Creek Subwatershed, Duke/Forest/Frost Subwatershed. Nutrient load from this source is nitrogen 1,476 lbs/yr and phosphorus 804 lbs/yr (estimated using Region 5 load estimation spreadsheet model and pollutant reduction efficiencies from DEQ 2003).
		Loss of wetlands (k)	Land use change (development and agriculture) (k)	Pre-settlement wetland conditions indicate there were approximately 38,816 acres of wetlands in the RRW. Using 1978 NWI data, the number of wetland acres was 17,370. Comparing pre-settlement data with 1978 data there has been a total wetland loss of 21,446 acres in the RRW (information provided by MDEQ using 1978 NWI data, Attachment 1).	Refer to attachment 2. Ranson Creek Subwatershed, Upper Rogue River Subwatershed, Cedar Creek Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed. Nutrient load from this source is nitrogen 1,963 lbs/yr and phosphorus 150 lbs/yr (estimated using Region 5 load estimation spreadsheet model).
		Stormwater/ Surface Runoff (s)	Impervious surfaces (s)	There are approximately 7,500 acres of impervious surfaces in the RRW (AWRI 2001).	It is suspected that stormwater and surface runoff is coming from urban and residential land uses. Urban and residential areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Nutrient load from this source is nitrogen 20 lbs/yr and phosphorus 23 lbs/yr (estimated using Region 5 load estimation spreadsheet model).

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use to be Protected	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery (cont.)	Nutrients (cont.)	Septic Systems (p)	Improperly designed and maintained septic systems (s)	There are approximately 16,000 septic systems in the RRW with a septic failure rate of 1.14% - that is approximately 184 septic systems (based on information collected from Kent County Health Department, District 10 Health Department, and Tetra Tech STEPL Model).	It is suspected that pollutants from septic systems are coming from urban and residential land uses. However, it is recommended that further monitoring be done to determine the locations of nutrients resulting from septic systems. Urban and residential areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Estimated load is 36 kg/p/yr TN and 4.5 kg/p/yr TP (Department of Local Government 2001).
		Commercial Fertilizer Use (s)	Improper application (s)	Agriculture - Liquid or fluid fertilizer use in Michigan has increased steadily over the last 25 years. In 1965, 9% of the total fertilizer sales in Michigan consisted of liquids. In 1988, liquid fertilizers accounted for 28% of the market. Dry fertilizers (solids) still constitute the major part of the fertilizers sold in Michigan. In 1988, 92% of the total dry fertilizer was sold as bulk material, with only 8% in bags (Vitosh 1996). Residential - In a survey of resident attitudes in the Rouge River, about 75% of residents applied fertilizer every year and only 9% conducted soil testing *(*DeYoung, 1997*)*. Using the MIRIS land use classification, there are approximately 52,968 acres of cropland, 8,138 acres of orchard or specialty crop, 9,656 acres of residential, 1,014 acres of commercial/institutional, 383 acres of industrial, and 2,735 acres of other developed lands in the RRW that could be contributing to nutrients in the watershed through the use of commercial fertilizers (MDNR, MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1991, 1992, 1996, and 1998).	It is suspected that commercial fertilizer use is coming from urban and residential land uses. Urban and residential areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Estimated load is 2.57 mg/L TP and 5.9 mg/L TKN (USGS 2002).

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use to be Protected	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Cold Water Fishery Warm Water Fishery (cont.)	Invasive Species	Human Introduction (k)	Improper knowledge of organism (s)	Purple Loosestrife – spotted in Algoma, Cannon, Plainfield, Sparta, and Tyrone Township (Invasive Species Mapping in Michigan, Great Lakes Information Network). Specific areas include two sites in Plainfield Township, 29 sites in Algoma Township, one site in Cannon Township, and one site in Sparta Township. To date, two sites in Plainfield Township, 5 sites in Algoma Township, and one site in Cannon Township have been inoculated with beetles (personal communication with Bob Steigmer – member of Izaak Walton League and RRWC, 2007, Attachment 3).	Refer to attachment 3. Shaw/Rum/Barkley Creek Subwatershed, Stegman/Becker Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, Nash Creek Subwatershed, Ball Creek Subwatershed, Spring/Walter Creek Subwatershed. The RRWC has identified thirty three sites containing purple loosestrife. Eight of these sites have already been inoculated with *Gallerucella calmariensis* beetle.
Other Indigenous Aquatic Life and Wildlife	PCBs and Mercury	Atmospheric Deposition (k)	Industry(k)	The Michigan waters of the Great Lakes, their connecting channels, Saginaw and Grand Traverse Bays, and Lake St. Clair are listed as not supporting the fish consumption designated use due to elevated concentrations of PCBs, DDT, mercury, chlordane, and/or dioxin. Atmospheric deposition is considered to be the major source of these persistent bioaccumulative chemicals (MDEQ 2008).	Sections of Rogue River, Ransom Creek, Duke Creek, White Creek, Forest Creek, Frost Creek, Walter Creek, Spring Creek, Nash Creek, Ball Creek, Unnamed tributary to Cedar Creek, Becker Creek, Cedar Creek, Unnamed tributary of to Rogue River, Stegman Creek, Shaw Creek, Little Cedar Creek, Barkley Creek, Rum Creek, Unnamed tributary near US 131. PCB and mercury concentrations exceed the HCV WQS (0.026 ng/L) and (1.8 ng/L), respectively. Fish tissue mercury concentration exceeds 0.35 mg/kg (MDEQ 2008).
	Toxic Substances	Stormwater/ Surface Runoff (s)	Impervious surfaces (s)	There are approximately 7,500 acres of impervious surfaces in the RRW (AWRI 2001).	It is suspected that stormwater and surface runoff is coming from urban land uses. Urban areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. Toxic substance load from this source is 15 lbs/yr (estimated using Region 5 load estimation spreadsheet model).
	Toxic Substances	Landfill Leachate (p)	Improperly designed and maintained disposal areas (s)	There is one landfill in the RRW which could be a source of toxic substances (MDEQ Report of Solid Waste Land filled in Michigan October 1, 2005 – September 30, 2006).	Nash Creek Subwatershed. This facility had a violation (315(13) Surface Water Drainage) on 8/13/08.

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use to be Protected	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Partial and Total Body Contact	*E. coli* and Fecal Coliform	Animal Waste Runoff (p)	Livestock in stream and off agricultural fields (s)	Using the MIRIS land use classification, there are approximately 1,038 acres of confined feeding or permanent pasture, 52,968 acres of cropland, and 8,138 acres of orchard or specialty crop in the RRW that could be contributing to animal waste runoff. The highest number of acres of agricultural land is in the Upper Rogue River Subwatershed with approximately 12,000 acres (MDNR, MIRIS, 1978 with land use cover updated by AWRI using aerial photography 1991, 1992, 1996, and 1998).	Refer to Table 25 and Figure 29 for specific locations. Upper Rogue River Subwatershed, Ranson Creek Subwatershed, Spring/Walter Creek Subwatershed, Cedar Creek Subwatershed, Ball Creek Subwatershed, Nash Creek Subwatershed, Duke/White Creek Subwatershed, Shaw/Rum/Barkley Creek Subwatershed, This becomes a problem if the *E. coli* exceeds water quality standards - total body contact no more than 130 *E. coli* per 100 milliliters, partial body contact no more than 1000 *E. coli* per 100 milliliters.
		Septic Systems (p)	Improperly designed and maintained septic systems (s)	There are approximately 16,000 septic systems in the RRW with a septic failure rate of 1.14% - that is approximately 184 septic systems (based on information collected from Kent County Health Department, District 10 Health Department, and Tetra Tech STEPL Model).	It is suspected that pollutants from septic systems are coming from urban and residential land uses. However, it is recommended that further monitoring be done to determine the locations of nutrients resulting from septic systems. Urban and residential areas in Ball Creek Subwatershed, Nash Creek Subwatershed, Lower Rogue Subwatershed, Cedar Creek Subwatershed, and Shaw/Rum/Barkley Creek Subwatershed. This becomes a problem if the *E. coli* exceeds water quality standards - total body contact no more than 130 *E. coli* per 100 milliliters, partial body contact no more than 1000 *E. coli* per 100 milliliters.
		Wastewater Treatment Plants (p)	Improperly designed and maintained plants (s)	There are 3 WWTP in the RRW which could be a source of *E. coli* and Fecal Coliform (EPA Water Discharge Permits, 2007).	Ball Creek Subwatershed, Nash Creek Subwatershed, Cedar Creek Subwatershed. The microorganism load from landfill leachate is unknown. This becomes a problem if the *E. coli* exceeds water quality standards - total body contact no more than 130 *E. coli* per 100 milliliters, partial body contact no more than 1000 *E. coli* per 100 milliliters.

TABLE 35: POLLUTANT, SOURCES, CAUSES, AND THEIR PRESENCE FOR EACH DESIGNATED USE IN THE ROGUE RIVER WATERSHED (CONT.)

Designated Use to be Protected	Pollutant	Sources	Causes	Presence in Watershed	Contributing Subwatersheds and Loads
Fish Consumption	PCBs and Mercury	Atmospheric Deposition (k) Historical Industry (k)	Industry(k) Contaminated Sediment (k)	The Michigan waters of the Great Lakes, their connecting channels, Saginaw and Grand Traverse Bays, and Lake St. Clair are listed as not supporting the fish consumption designated use due to elevated concentrations of PCBs, DDT, mercury, chlordane, and/or dioxin. Atmospheric deposition is considered to be the major source of these persistent bioaccumulative chemicals (MDEQ 2008).	Sections of Rogue River, Ransom Creek, Duke Creek, White Creek, Forest Creek, Frost Creek, Walter Creek, Spring Creek, Nash Creek, Ball Creek, Unnamed tributary to Cedar Creek, Becker Creek, Cedar Creek, Unnamed tributary of to Rogue River, Stegman Creek, Shaw Creek, Little Cedar Creek, Barkley Creek, Rum Creek, Unnamed tributary near US 131. PCB and mercury concentrations exceed the HCV WQS (0.026 ng/L) and (1.8 ng/L), respectively. Fish tissue mercury concentration exceeds 0.35 mg/kg (MDEQ 2008).

(k) – known pollutants
(p) – potential pollutant
(s) – suspected pollutant

MDNR – Michigan Department of Natural Resources
MIRIS – Michigan Resource Information System
NWI – National Wetlands Inventory

RRW – Rogue River Watershed
RRWC – Rogue River Watershed Council

14.3 MANAGEMENT MEASURES, POLLUTANT REDUCTION ESTIMATES, AND WATER QUALITY GOALS (CRITERIA B &C)

Management Measures

Best Management Practices (BMPs) are any structural, vegetative, or managerial practices used to protect and improve our surface water and groundwater (MDEQ 1999). For BMPs to be effective, the correct method, installation, and maintenance need to be considered for each site. Addressing each of these factors will result in a conservation practice that can prevent or reduce nonpoint source pollution.

Critical Area and Sites

To identify locations to implement these suggested BMPs, a critical areas analysis was completed. This information is found in Part 5 Section 5.2 and 5.3 of the management plan. Four factors were chosen to determine critical areas in the watershed. These four factors include high development potential (location of existing and proposed water and sewer districts), high erosion potential (K-factor), high groundwater vulnerability (hydrologic soil group and perched and apparent aquifers), and cold water location. These factors were chosen because the Rogue River Watershed Council believed that this information would best characterize the existence of, or potential for, the pollutants perceived as the greatest threat to the Rogue River Watershed (i.e., sediment, nutrients, temperature, toxic substances, *E. coli* and fecal coliform). Sites for BMPs implementation were determined based on an inventory of the sources within the critical areas, monitoring data, and aerial photos (Sections 5.4 and 5.5). Sites are mapped in Figure 29 in the watershed management plan. For managerial BMPs, the practices will be done with targeted audiences rather than identified on a site by site basis (riparian homeowners, riparian farmers, etc.).

Suggested structural BMPs to be implemented in the watershed are listed in Part 7, Section 7-2. Additional structural and non-structural BMPs were added to address the loss of wetlands in the watershed and invasive species. Sites for wetland and invasive species BMPs can be found in attachments 2 and 3. Another practice to prevent wetland loss is by establishing conservation easements. Priority areas for conservation easements were determine by doing an extensive analysis. The Land Conservancy of West Michigan worked with land protection partners, The Nature Conservancy as well as the Annis Water Resources Institute, to develop a prioritization process focusing on lands of high hydrologic resources. A comprehensive database and accompanying maps have been created to assist future watershed plan implementation efforts (attachment 4).

Estimated Pollutant Load Reductions

To determine how well the BMPs identified in the Rogue River Watershed will work, pollutant reductions were estimated. The estimated load reductions in Table 36 were determined for structural and vegetative practices using the load estimation tools specified by MDEQ which included “The Simple Method to Calculate Urban Stormwater Loads” by the Stormwater Center and the “Region 5 Load Estimation Spreadsheet Model” developed by Tetra Tech for the EPA. An additional resource used was the Guidance Manual for Total Maximum Daily Load Implementation Plans (DEQ 2003). To quantify pollutant load reductions for the managerial

practices (Table 37), information from the Rocky River Watershed Management Plan (VanDelfzijl 2002), the Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA 1993), and the Guidance Manual for Total Maximum Daily Load Implementation Plans (DEQ 2003) were used. It should be noted that specific measurements to quantify BMP effectiveness should be taken before and after implementation of the practice and for a sufficient length of time to account for natural variability.

TABLE 36. ESTIMATED POLLUTANT LOAD REDUCTIONS FOR ALL IDENTIFIED STRUCTURAL AND VEGETATIVE BMPS IN THE ROGUE RIVER WATERSHED

Structural and Vegetative Practices	Total	Quantity Completed	Pollutant Addressed	Estimated Load Reductions
Road Stream Crossing Improvement	9 culvert replacements	4 culvert replacements	Sediment	Sediment – 1,044 tons/yr (estimated based on average load reductions that resulted from 4 culvert replacements).
Stream Restoration	0.32 square miles	---	Sediment and temperature	Sediment – 1,260 tons/yr (estimated based on load reduction that resulted from stream channel stabilization). Temperature - stable water temperature by controlling the quantity and quality of solar radiation reaching the water surface in lower order streams and controlling the stormwater runoff in this subwatershed.
Filter Strips	46,464 linear feet (75 feet width)	---	Sediment, nutrients, *E. coli* and Fecal Coliform, toxic substances	Sediment – 186 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Nutrients –nitrogen 499 lbs/yr, phosphorus 265 lbs/yr (estimated using Region 5 Load Estimation Spreadsheet Model). *E. coli* and fecal coliform (BOD) – 1,574 lbs/yr, Toxic substances – 8 lbs/yr (estimated using Region 5 Load Estimation Spreadsheet Model).
Recreation trail and walkway	100 feet	53 feet	Sediment	Sediment – 2 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model).
Stream Channel Stabilization	3,000 feet	700 feet	Sediment	Sediment – 473 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model).
Fencing	3,000 feet	---	Sediment, nutrients, *E. coli* and Fecal Coliform	Sediment – 99 tons/yr (estimated using the Pollutants Controlled Calculation and Documentation For Section 319 Watersheds Training Manual) Nutrients – nitrogen 228 lbs/yr, phosphorus 113 lbs/yr (estimated using the Pollutants Controlled Calculation and Documentation For Section 319 Watersheds Training Manual) *E.coli* and fecal coliform – 100% efficiency (Guidance Manual for Total Maximum Daily Load Implementation Plans).
Crop and Green Manure Cover	50 acres	---	Sediment and nutrients	Sediment –110 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Nutrients – nitrogen 188 lbs/yr, phosphorus 94 lbs/yr (estimated using Region 5 Load Estimation Spreadsheet Model).

TABLE 36. ESTIMATED POLLUTANT LOAD REDUCTIONS FOR ALL IDENTIFIED STRUCTURAL AND VEGETATIVE BMPS IN THE ROGUE RIVER WATERSHED (CONT.)

Structural and Vegetative Practices	Total	Quantity Completed	Pollutant Addressed	Estimated Load Reductions
Riparian Buffer Strips	100 acres	1.5 acres	Sediment, nutrients, temperature, *E. coli* and Fecal Coliform, toxic substances	Sediment – 6 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Nutrients –nitrogen 17 lbs/yr, phosphorus 9 lbs/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Temperature – stable water temperature by controlling the quantity and quality of solar radiation reaching the water surface in lower order streams *E. coli* and fecal coliform – 43 – 57% efficiency (Guidance Manual for Total Maximum Daily Load Implementation Plans). Toxic Substances –1 lb/yr (estimated using Region 5 Load Estimation Spreadsheet Model).
Wetland Restoration (focused in the warm water portion of the watershed)	1, 100 acres	300 acres Cedar Creek 2007	Sediment, nutrients, and temperature	Sediment – 50 tons/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Nutrients –nitrogen 393 lbs/yr, phosphorus 66 lbs/yr (estimated using Region 5 Load Estimation Spreadsheet Model). Temperature – stable water temperature by controlling the quantity and quality of solar radiation reaching the water surface in lower order streams and controlling the stormwater runoff in this subwatershed.
Invasive Species Control (Biological Control)	33 sites	8 sites	Invasive Species	Invasive Species – 50% reduction in cover (5 year time frame) (Landis et al. 2003)
Conservation Easements	3,200 acres	272	Nutrients and temperature	Reduction estimates based on if no easements established the land will be developed (new suburban land use) Nutrients –nitrogen 25,834 lbs/yr, phosphorus 2,329 lbs/yr (estimated using The Simple Method to Calculate Urban Stormwater Loads) Temperature - stable water temperature by controlling the quantity and quality of solar radiation reaching the water surface in lower order streams and controlling the stormwater runoff in this watershed.

TABLE 37. ESTIMATED POLLUTANT LOAD REDUCTIONS FOR IDENTIFIED MANAGERIAL PRACTICES FOR THE ROGUE RIVER WATERSHED

Managerial Practices	Total	Quantity Completed	Pollutant Addressed	Estimated Load Reduction
Riparian Homeowners				
Hold landscaping workshops	3 workshops	3 landscaping workshops held in 2002	Temperature and nutrients	Attendees of the workshop are expected to come away with a better understanding of how the management of their property can protect water quality and the option of establishing conservation easements to protect their land. Some of the attendees will change their management practices accordingly. This is expected to result in an improvement to water quality. Rain gardens can reduce nutrients by 40 - 60% (USEPA 1993, VanDelfzijl 2002, DEQ 2003).
Riparian Farmers				
Hold BMP workshops	2 workshops	2 workshops held in 2003	Sediment, nutrients, and *E. coli* and Fecal Coliform	Exposure to new practices and the personal testimonies of colleagues is expected to result in a portion of the attendees changing their current practices. This is expected to improve and maintain water quality. Nutrient management can reduce nutrients by 13 – 25%; animal waste management and fencing can reduce nutrients and bacteria by 75%; range and pasture management can reduce nutrients by 25 - 50%, cover crops and rotation can reduce nutrients by 15 – 35% and sediment by 15%; livestock water crossing facilities can reduce bacteria by 100% (USEPA 1993 and DEQ 2003).
Local Decision-Makers				
Hold targeted workshops such as innovated land-use planning, sediment control at construction sites, and model ordinances	3 workshops	6 workshops held in 2002 and 2004	Sediment, nutrients, temperature, *E. coli* and Fecal Coliform, and toxic substances	Attendees of the workshop are expected to come away with a better understanding of how the management decisions they make at the local level affect water quality and some of the attendees will change their master plan and zoning ordinances accordingly. This is expected to improve or maintain water quality (VanDelfzijl 2002).
Promote the implementation of the revised model ordinance developed for Kent County	---	---	Sediment, nutrients, temperature, *E. coli* and Fecal Coliform, and toxic substances	The adoption of stormwater policies by affected municipalities is expected to improve and/or maintain water quality through the change in practices outlined by the ordinance. Detention ponds can reduce nutrients by 5-10%, bacteria by 25%, and sediment by 10%; grassed swales can reduce nutrients by 40-60%; infiltration basins /trenches can reduce nutrients by 50-70%, bacteria by 50%, and sediment by 90%; porous pavement can reduce nutrients by 50-70% and bacteria by 50%; rain gardens can reduce bacteria by 40%, nutrients by 40 – 60%, and sediment by 85%; wetland creation/enhancement can reduce bacteria by 30% and sediment by 80%. (VanDelfzijl 2002 and DEQ 2003)

TABLE 37. ESTIMATED POLLUTANT LOAD REDUCTIONS FOR IDENTIFIED MANAGERIAL PRACTICES FOR THE ROGUE RIVER WATERSHED (CONT.)

Managerial Practices	Total	Quantity Completed	Pollutant Addressed	Estimated Load Reduction
Local Decision-Makers(cont.)				
Review master plan and zoning ordinances to recommend stormwater BMPs (Low Impact Development Practices)	---	1 community/ year	Temperature, sediment, nutrients, and toxic substances	For each municipality adopting the revised language it is expected that water quality will be improved and/or maintained through the change in practices outlined by the revised master plan and zoning ordinance. Detention ponds can reduce nutrients by 5-10%, bacteria by 25%, and sediment by 10%; grassed swales can reduce nutrients by 40-60%; infiltration basins /trenches can reduce nutrients by 50-70%, bacteria by 50%, and sediment by 90%; porous pavement can reduce nutrients by 50-70% and bacteria by 50%; rain gardens can reduce bacteria by 40%, nutrients by 40 – 60%, and sediment by 85%; wetland creation/enhancement can reduce bacteria by 30% and sediment by 80%. (VanDelfzijl 2002 and DEQ 2003)
Business and Industry				
Training Programs Directed at the Construction Business	3 workshops	---	Sediment	Workshop attendees are expected to come away with an increased knowledge of soil erosion best management practices and the steps involved in complying with soil erosion permits. This should result in a change of practices that will improve and/or maintain water quality. An appropriately installed silt fence can have trapping efficiencies for total suspended solids of 70%, for sand of 80 to 90%, for silt loam of 50 to 80%, and for silty clay loam of 0 to 20% (USEPA 1993 and VanDelfzijl 2002).

Water Quality Goals

The watershed goal as determined by the Project Steering Committee is to maintain and improve water quality and environmental conditions by promoting sound land management decisions in the Rogue River Watershed (Section 6-1). Specific watershed goals are listed in Table 38 for each subwatershed. These goals are based on water quality criteria (attachment 1) for each of the designated uses.

TABLE 38. WATER QUALITY GOALS FOR SUBWATERSHEDS IN THE ROGUE RIVER WATERSHED

Subwatershed	Water Quality Goals
Ranson Creek	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.
Upper Rogue River	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.
Spring/Walter Creeks	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.
Duke/Forest/Frost Creeks	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Cold Water Fishery designated use by addressing sediment, temperature, nutrients, and invasive species.
Duke/White Creek	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Cold Water Fishery designated use by addressing sediment, temperature, nutrients, and invasive species.
Ball Creek	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect Other Indigenous Aquatic Life and Wildlife designated use by addressing toxic substances.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.

TABLE 38. WATER QUALITY GOALS FOR SUBWATERSHEDS IN THE ROGUE RIVER WATERSHED (CONT.)

Subwatershed	Water Quality Goals
Cedar Creek	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect Other Indigenous Aquatic Life and Wildlife designated use by addressing toxic substances.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Cold Water Fishery designated use by addressing sediment, temperature, nutrients, and invasive species.
Nash Creek	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect Other Indigenous Aquatic Life and Wildlife designated use by addressing toxic substances.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.
Lower Rogue	Protect Other Indigenous Aquatic Life and Wildlife designated use by addressing toxic substances.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.
Stegman/Becker Creeks	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Cold Water Fishery designated use by addressing sediment, temperature, nutrients, and invasive species.
Shaw/Rum/Barkley Creeks	Restore Fish Consumption designated use by addressing mercury and PCBs.
	Restore Other Indigenous Aquatic Life and Wildlife designated use by addressing mercury and PCBs.
	Protect the Cold Water Fishery designated use by addressing sediment, temperature, nutrients, and invasive species.
	Protect Other Indigenous Aquatic Life and Wildlife designated use by addressing toxic substances.
	Protect the Partial and Total Body Contact designated use by addressing *E. coli* and fecal coliform.
Rogue Mouth	Protect the Warm Water Fishery designated use by addressing sediment, nutrients, and invasive species.

14.4 TECHNICAL AND FINANCIAL ASSISTANCE NEEDED TO IMPLEMENT MANAGEMENT PLAN AND INFORMATION AND EDUCATION COMPONENT (CRITERIA D & E)

When considering management practices for the Rogue River Watershed it is important to put together a plan before implementation to account for all of the appropriate technical and financial assistance needed. This will result in an effective management strategy that will address the sources of nonpoint source pollution in the watershed. Table 39 lists structural practices for the watershed, with associated costs and necessary technical support to implement the practice. Non-structural (managerial and information/education) practices are listed in Table 40. Costs were based on past implementation projects, Natural Resources Conservation Service estimates, Center for Environmental Study estimates, and the Bear Creek Subwatershed, Mill Creek Watershed, and the Grand Traverse Bay Watershed management plans.

A Rogue River Watershed Information and Education (I & E) Strategy was developed by Tetra Tech, Inc. as part of the Rogue River Watershed Planning Project. Information on the I & E Strategy can be found in Part 7 Section 7.3 and the document is included in Appendix I of the management plan. The strategy lays the foundation for the collaborative development of natural resources programs and educational activities for subwatershed target audiences, community members, and residents. To provide focus to the information and education tasks, Table 40 lists uncompleted tasks in order of importance for each target audience. Completed tasks have also been included as a resource for future events. With the change in land use and increasing development pressure in the watershed, BMPs need to be implemented in conjunction with an I & E Strategy.

TABLE 39. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED STRUCTURAL AND VEGETATIVE PRACTICES

Structural and Vegetative Practices	Quantity Completed	Quantity to be Completed	Estimated Material Cost	Estimated Labor Costs	Estimated O &M Costs	Total Costs	Technical Support for Implementation
Road Stream Crossing Improvement	4 culvert replacements	5 culvert replacements	$55,000/ replacement		$90,000 (average of $1,000/year for 10 years)	$365,000	Road Commission and MDOT – engineering, installation, consulting services
Stream Restoration	---	0.32 square miles	$300,000	$85,744	$17,920 ($1,792/ yr for 10 years)	$403,664	Inter-Fluve, Inc., Tetra Tech MPS, OMM Engineering – engineering, installation, consulting services MDEQ – funding, technical support and oversight
Filter Strips	---	46,464 linear feet (75 feet width)	$6,400 ($80/acre)	$13,000	$3,200 ($8/acre/yr for 5 years)	$22,600	USDA, NRCS, Conservation Districts – engineering, installation, funding Pheasants Forever – funding MDEQ- funding, technical support and oversight Drain Commissioners – technical assistance and potential partner
Recreation trail and walkway	53 feet	47 feet	$2,350 ($50/lf)	$2,500	$2,350 ($5/foot/yr for 10 years)	$7,200	NRCS, Conservation Districts, – engineering and technical support Rails to Trails, Local Recreational Organizations – installation and potential partner MDEQ, MDNR - funding, technical support and oversight
Stream Channel Stabilization	700 feet	2,300 feet	$115,000 ($50/lf)	$20,000	$23,000 ($1/feet/yr for 10 years)	$158,000	NRCS, Conservation Districts, Timberland RC & D, Conservation Resource Allicance – engineering and technical support Local Recreational Organizations – installation and potential partner MDEQ - funding, technical support and oversight

TABLE 39. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED STRUCTURAL AND VEGETATIVE PRACTICES (CONT.)

Structural and Vegetative Practices	Quantity Completed	Quantity to be Completed	Estimated Material Cost	Estimated Labor Costs	Estimated O &M Costs	Total Costs	Technical Support for Implementation
Fencing	---	3,000 feet	$6,000 ($2/lf)	$10,000	$3,600 (6% of initial cost - $360/year for 10 years)	$19,600	USDA, MDA, NRCS, Conservation Districts – engineering, funding, and technical support MDEQ - funding, technical support and oversight
Crop and Green Manure Cover	---	50 acres	$1,000 ($20/acre)	$1,000	$500 ($10/acre/yr for 1 year)	$2,500	USDA, NRCS, Conservation Districts– engineering, funding, and technical support
Riparian Buffer Strips	1.5 acres	98.5 acres	$98,5000 ($1,000/acre)	$370,560	$4,925 ($5/acre/yr for 10 years)	$14,925	USDA, MDA, USFS, Conservation Districts – engineering, funding, and technical support MDNR, MDEQ - funding, technical support and oversight greenhouses and native plant dealers – plant materials
Wetland Restoration (focused in the warm water portion of the watershed)	300 acres Cedar Creek 2007	800 acres	$2,200 / acre		$40,000 ($5/acre/yr for 10 years)	$1,800,000	NRCS, USFWS, Timberland RC & D - engineering, funding, and technical support MDEQ, Ducks Unlimited - funding, technical support and oversight greenhouses and native plant dealers – plant materials
Invasive Species Control (Biological Control)	8 sites	25 sites	$100 / site		---	$2,500	Izaak Walton League TNC – resources and technical support

TABLE 39. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED STRUCTURAL AND VEGETATIVE PRACTICES (CONT.)

Structural and Vegetative Practices	Quantity Completed	Quantity to be Completed	Estimated Material Cost	Estimated Labor Costs	Estimated O &M Costs	Total Costs	Technical Support for Implementation
Conservation Easements	272 acres	2,928 acres	$24,750 plus $2,000/acre purchase price	$732,000	$50,000 (average of $5,000/yr for 10 years)	$6,612,750	LCWM – purchasing easement TNC – resources and technical support RRWC – determining areas

(EPA 1993, US Army Corps of Engineers 1999, Bair 2000, Riggs 2003, Jarvis and Auch 2004, Mayer 2005, U'Ren 2005, Weinstein et al. 2007, Land Conservancy of West Michigan 2008)

MDA – Michigan Department of Agriculture
MDEQ – Michigan Department of Environmental Quality
MDNR – Michigan Department of Natural Resources
MDOT – Michigan Department of Transportation
NRCS – Natural Resources Conservation Service
RC & D – Resource Conservation and Development
TNC – The Nature Conservancy
USDA – United States Department of Agriculture
USFS – United States Forest Service
USFWS – United States Fish & Wildlife Service

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
General Public/Stakeholders							
Research and collect data to shape messages that tie into stakeholder values	---	Collection of data on watershed stakeholders	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$10,000	$10,000	$20,000	RRWC, LGROW, GVSU – research and collection of data
Develop and coordinate guidelines for stream stewards and loosestrife control	---	List of guidelines	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substance	---	$100	$100	WMEAC – assistance with guidelines RRWC and AWRI – develop guidelines
Produce subsequent issues of Riffles and Runs Newsletter outlining watershed pollutants and concerns	List of stream steward activities	2 newsletters per year	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$21,000	$9,000	$30,000	RRWC – production newsletter Wolverine World Wide – printing/postage
Submit articles in local newspapers outlining watershed pollutants and concerns		Articles submitted to newspapers	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	---	$450	$450	RRWC – writing articles Rockford Squire, and other media in watershed – printing articles
Update materials on project web site outlining watershed pollutants and concerns	---	Up-to-date website	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	---	$2,700	$2,700	RRWC and AWRI – technical support

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
General Public/Stakeholders(cont.)							
Develop and air PSAs featuring the 10 Did You Know questions on watershed pollutants and concerns	---	Variety of media outputs	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$80,000	$5,000	$85,000	RRWC, AWRI, LGROW – assist in development Rockford Community Television, Rockford Squire, and other local media – airing PSAs
Sponsor photo event to collect watershed photographs and develop a variety of media products on watershed pollutants and concerns	---	variety of media outputs	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$20,000	$3,000	$23,000	RRWC, LGROW, and AWRI – coordination of event and development media products
Develop press kit and list of contacts	1 kit	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	---	$150	$150	Completed - AWRI
Develop graphics for the display outlining watershed pollutants and concerns	Graphics for traveling display created in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$600	$375	$975	Completed - AWRI
Conduct research on audience profiles to obtain economic data to improve messages	General survey and focus groups completed in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$2,000	$5,000	$7,000	Completed - GVSU

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
General Public/Stakeholders(cont.)							
Develop general slide show on watershed pollutants and concerns	1 general slide show presentation developed in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$400	$600	$1,000	Completed - AWRI
Develop general brochure with 10 Did You Know Questions on watershed pollutants	2,000 general brochures completed in 2001 - 2004	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$2,250	$450	$2,700	Completed - AWRI
Develop Rogue River Watershed Placemat outlining watershed pollutants and concerns	5,000 placemats completed in 2002 and distributed	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$1,000	$300	$1,300	Completed - AWRI
Prepare give-away materials such as a refrigerator magnet, stickers with the project logo, and canvas tote bags	1,000 tote bags completed in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$2,250	$240	$2,490	Completed - AWRI
	1,000 magnets completed in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$230	$240	$470	Completed - AWRI
	5,000 stickers completed in 2002	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$350	$240	$590	Completed - AWRI

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
General Public/Stakeholders(cont.)							
Develop materials and conduct a watershed fair outlining watershed pollutants	1 watershed fair held in 2003	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$2,600	$7,200	$9,800	Completed – AWRI & Izaak Walton League
Conduct stream steward training workshops	4 trainings held in 2002 - 2003	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$600	$1,200	$1,800	Completed – AWRI and WMEAC
Hold meetings to promote participation in land-use decisions	2 meetings held in 2003	---	Sediment, nutrients, temperature, invasive species, *E. coli* and fecal coliform, and toxic substances	$200	$1,200	$1,400	Completed – AWRI and GVMC
Riparian Homeowners							
Submit articles in homeowner association newsletters on watershed pollutants	---	Articles submitted to other newsletters	Temperature and nutrients	---	$450	$450	RRWC, LGROW – write articles WMEAC, and Michigan Lakes and Streams Association – publish articles
Presentations to homeowner assoc./schools on watershed pollutants and concerns	---	1 presentation per year	Temperature and nutrients	---	$1,800	$1,800	RRWC, LGROW, and AWRI – develop presentation and present

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
Riparian Homeowners (cont.)							
Develop brochure on homeowner practices such as fertilizer use, septic system maintenance, and maintaining riparian buffers	---	1,000 brochures	Temperature, nutrients, and *E. coli* and fecal coliform	$1,200	$450	$1,650	RRWC, LGROW, AWRI – develop brochure GVMC, TNC, LCWM, NRCS, and local conservation districts – resources and information
Recruit homeowner associations for stream stewards	---	Recruit watershed homeowner associations	Temperature and nutrients	---	$1,200	$1,200	RRWC, LGROW – recruit WMEAC, and the GR Home Builders Association – potential partners
Hold landscaping workshops	3 landscaping workshops held in 2002	---	Temperature and nutrients	$300	$525	$825	Completed – AWRI and LCWM
Riparian Farmers							
Submit articles in professional association newsletters on watershed pollutants and concerns	---	Articles written for other newsletters	Nutrients and *E. coli* and fecal coliform	---	$450	$450	RRWC, LGROW – write articles NRCS, local conservation districts, drain commissioners, and MSU – Extension – publish articles
Presentations to farmer associations and 4-H groups on watershed pollutants and concerns	---	3 presentations	Nutrients and *E. coli* and fecal coliform	$100	$450	$550	RRWC, LGROW, AWRI – develop presentation and present NRCS, local conservation districts, and MSU-Extension - resources and information

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
Riparian Farmers (cont.)							
Develop brochure on financial and technical tools for farmers outlining watershed pollutants and concerns	---	1,000 brochures	Nutrients and *E. coli* and fecal coliform	$1,200	$450	$1,650	RRWC, LGROW, AWRI – develop presentation and present NRCS, local conservation districts, and MSU-Extension - resources and information
Hold BMP workshops on watershed pollutants and concerns	2 workshops held in 2003	---	Nutrients and *E. coli* and fecal coliform	$100	$300	$400	Completed - AWRI
Develop and distribute award to farmers implementing BMPs and minimizing water quality impacts	2 awards given in 2004	---	Nutrients and *E. coli* and fecal coliform	$1,500	$600	$2,100	Completed – AWRI and Kent County Road Commission
Local Government Officials							
Submit articles in local government newsletters on watershed pollutants and concerns	---	Articles for other newsletters	Temperature, sediment, and nutrients	---	$450	$450	RRWC – write articles GVMC – publish articles
Promote the implementation of the revised model ordinance for Kent County	---	Promote in all watershed townships	Temperature, sediment, and nutrients	---	$5,000	$5,000	RRWC, LGROW, MDEQ, AWRI – promote ordinance regulatory authority for ordinances will be individual municipalities

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
Local Government Officials(cont.)							
Develop brochure on land-use decision tools related to watershed pollutants and concerns	---	1,000 brochures	Temperature, sediment, and nutrients	$1,200	$450	$1,650	RRWC, LGROW, and AWRI – develop article GVMC – resources and information
Recruit township officials to become stream stewards	---	Recruit watershed townships	Temperature, sediment, and nutrients	---	$1,200	$1,200	RRWC, LGROW – recruit WMEAC and GMVC - resources and information
Promote the Blueprint award in watershed townships	---	Promote to watershed townships	Temperature, sediment, and nutrients	---	$2,000	$2,000	RRWC, LGROW, and GVMC – promote award
Review master plan and zoning ordinances to recommend stormwater BMPs (Low Impact Development Practices)	---	1 community/ year (20 municipalities in watershed)	Temperature, sediment, nutrients, and toxic substances	---	$13,000/ community	$260,000	RRWC, LGROW – coordinate reviews GVMC, and Grand Rapids Area Planners - resources and information regulatory authority for ordinances will be individual municipalities
Presentations to planning associations and townships on watershed pollutants and concerns	Presentation given in 2003	---	Temperature, sediment, and nutrients	$100	$1,200	$1,300	Completed - RRWC and GVMC

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
Local Government Officials(cont.)							
Hold targeted workshops such as innovated land-use planning, sediment control at construction sites, and model ordinances	6 workshops held in 2002 and 2004	---	Temperature, sediment, and nutrients	$1,500	$1,320	$2,820	Completed – AWRI and GVMC, regulatory authority for soil erosion/sediment control is the Kent County Road Commission and Newaygo County Drain Commission
Business and Industry							
Submit articles in building association newsletters on watershed pollutants and concerns	---	Articles for other newsletters	Sediment	---	$450	$450	RRWC – write articles Greater Grand Rapids Home Builder Association – publish articles
Training Programs Directed at the Construction Business on watershed pollutants and concerns	---	3 workshops	Sediment	$1,000	$1,200	$2,200	RRWC, LGROW, AWRI – coordinate trainings sediment control inspectors (road commission/drain commission) - resources and information
Recreational Users of the Watershed							
Submit articles in recreational newsletters on watershed pollutants and concerns	---	Articles written for other newsletters	Sediment and invasive species	---	$450	$450	RRWC – write articles recreational organizations (WMTU, Steelheaders), businesses (canoe liveries, outdoor shops, etc.), chamber of commerce – publish articles

TABLE 40. ASSOCIATED COSTS AND TECHNICAL SUPPORT FOR RECOMMENDED MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES IN THE ROGUE RIVER WATERSHED (CONT.)

Managerial and I/E Practices	Quantity Completed	Quantity to be Completed	Pollutants Addressed	Estimated Material Cost	Estimated Labor Costs	Total Costs	Technical Support for Implementation
Recreational Users of the Watershed (cont.)							
Presentations to organizations on watershed pollutants and concerns	---	One presentation per year	Sediment and invasive species	---	$1,800	$1,800	RRWC, LGROW, and AWRI - presentations
Sponsor activities held by various recreational groups	---	Sponsor 1 event per year	Sediment and invasive species	$15,000	$9,000	$24,000	RRWC, LGROW, AWRI – sponsor local recreational organizations (WMTU, Steelheaders, etc.) – potential partners
Recruit organizations to become stream stewards	---	Recruit watershed organizations	Sediment and invasive species	---	$1,200	$1,200	RRWC, LGROW – recruit WMEAC - resources and information

(Jarvis and Auch 2004, Riggs 2003, U'Ren 2005)

AWRI – Annis Water Resources Institute
GVMC – Grand Valley Metro Council
GVSU – Grand Valley State University
LCWM – Land Conservancy of West Michigan
LGROW – Lower Grand Organizations of Watersheds
NRCS – Natural Resources Conservation District
RRWC – Rogue River Watershed Council
TNC – The Nature Conservancy
WMTU – West Michigan Trout Unlimited
WMEAC – West Michigan Environmental Action Council

14.5 SCHEDULE FOR IMPLEMENTING MANAGEMENT PRACTICES AND INTERIM MEASURES OF SUCCESS (CRITERIA F & G)

A key consideration when planning the implementation of management practices to address various watershed management goals is how to phase or sequence activities in relation to one another over time. Determining which actions will need to take place before other actions will be important in achieving the full potential of each activity. The best order in which to implement management practices can be based on a number of factors such as ecological factors, length of time for developing the practice, and/or the ranked priority concerns within the watershed.

Tables 41 and 42 list BMPS and managerial practices and information/education tasks to be completed for the Rogue River Watershed. Listed below are three major activity phases under which the recommended practices can be categorized. A phase (I, II, or III) is indicated for each type of management practice described below. This phasing sequence is a recommendation only and individual circumstances may require alternative staging and phasing periods and timelines.

Phase I: Phase I will address practices that can be initiated right away, require minimal cost or planning, usually non-structural practices. Examples include information and education programs, standards adoption, and some master plan revisions/updates. Actions under this category may be completed in 1 to 3 years; however, certain actions may involve continual implementation.

Phase II: Phase II will address practices that require significant planning and development, design specifications, require major additional costs (permits), address sources/causes of a problem, can be structural or non-structural practices. Examples include new projects/programs, ordinances, pilot projects or demonstration sites, studies, and design and construction of BMPs. Actions under this category may be completed in 3 to 7 years; however, certain actions may involve continual implementation.

Phase III: Phase III will address practices for which success may depend on the success of a previously implemented practice, mostly structural BMPs. An example may include instream and streambank restoration projects. Actions under this category may be completed in 7 to 10 years; however, certain actions may require continual implementation.

Interim Measures of Activity Success

To ensure project completion, interim measures are listed as a guide to determine whether the management practices are being implemented on schedule and in a timely manner. The interim measures will provide a dated checklist to refer to as project implementation begins and occurs. Tables 41 and 42 illustrate the implementation activities with the associated project phase and interim measures of success.

TABLE41. IMPLEMENTATION SCHEDULE FOR STRUCTURAL AND VEGETATIVE PRACTICES AND INTERIM MEASURES OF ACTIVITY SUCCESS

Structural and Vegetative Practices	Quantity to be Completed	Activity Phase	Interim Measures of Activity Success
Road Stream Crossing Improvement	5 sites	III	Initial planning completed by year six.
			Twenty five percent of improvements completed by year eight.
			One hundred percent of improvements completed by year ten.
Stream Restoration	1 site	III	Initial planning completed by year six.
			Restoration completed by year ten.
Filter Strips	46,464 linear feet (75 feet width)	III	Initial planning completed by year six.
			Twenty five percent of improvements completed by year eight.
			One hundred percent of improvements completed by year ten.
Recreation Trail and Walkway	47 feet	II	Initial planning of sites completed by year three.
			Fifty percent of trails and walkways completed by the end of year five.
			One hundred percent of trails and walkways completed by the end of year seven.
Stream Channel Stabilization	2,300 feet	III	Initial planning completed by year six.
			Twenty five percent of stabilizations completed by year eight.
			One hundred percent of stabilizations completed by year ten.
Fencing	3,000 feet	III	Initial planning completed by year six.
			Twenty five percent of fencing completed by year eight.
			One hundred percent of fencing completed by year ten.
Crop and Green Manure Cover	50 acres	II	Initial planning of sites completed by year three.
			Fifty percent of acres practicing technique by the end of year five.
			One hundred percent of acres practicing technique by the end of year seven.
Riparian Buffer Strips	98.5 acres	II	Initial planning of sites completed by year three.
			Fifty percent of plantings completed by the end of year five.
			One hundred percent of plantings completed by the end of year seven.
Wetland Restoration	800 acres	III	Initial planning completed by year six.
			Twenty five percent of restorations completed by year eight.
			Restoration completed by year ten.
Invasive Species Control (Biological Control)	25 sites	II	Initial planning completed by year two.
			Fifty percent of improvements completed by year five.
			One hundred percent of improvements completed by year seven.
Conservation Easements	2,928 acres	III	Initial planning completed by year two.
			Twenty five percent of easements implemented by year five.
			One hundred percent of easements implemented by year ten.

TABLE 41. IMPLEMENTATION SCHEDULE FOR MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES AND INTERIM MEASURES OF ACTIVITY SUCCESS

Managerial and I/E Practices	Quantity to be Completed	Activity Phase	Interim Measures of Activity Success
General Public/Stakeholders			
Research and collect data to shape messages that tie into stakeholder values	Collection of data on watershed stakeholders	I	A plan created to collect and conduct research on watershed stakeholders by year one.
			Organized database that provides information on watershed stakeholders by year three.
Develop and coordinate guidelines for stream stewards and loosestrife control	List of stream steward activities	I	Data gathered on other stream steward programs by year one.
			Guidelines developed for watershed stream stewards by year three.
Produce subsequent issues of Riffles and Runs Newsletter outlining watershed pollutants and concerns	2 newsletters per year	I, II, III	Initiated in year one – ongoing newsletters produced.
Submit articles in local newspapers outlining watershed pollutants and concerns	Articles written for newspapers	I, II, III	Initiated in year one – ongoing articles for local newspapers
Update materials on project web site outlining watershed pollutants and concerns	Up-to-date website	I, II, III	Initiated in year one – ongoing enhancement.
Develop and air PSAs featuring the 10 Did You Know questions on watershed pollutants and concerns	Variety of media outputs	II	Initial planning of PSAs completed by year four.
			Airing of PSAs completed by the end of year seven.
Sponsor photo event to collect watershed photographs and develop a variety of media products on watershed pollutants and concerns	variety of media outputs	II	Initial planning of collection of watershed photographs completed by year one.
			Collection of watershed photos and design of media outputs completed by year four.
			Distribution plan and completion of media outputs by year seven.
Riparian Homeowners			
Submit articles in homeowner association newsletters on watershed pollutants	Articles written for other newsletters	I, II, III	Initiated in year one – ongoing articles written for other newsletters
Presentations to homeowner assoc./schools on watershed pollutants and concerns	1 presentation per year	I, II, III	Initial planning of presentations completed by year two.
			One presentation held every year.
Develop brochure on homeowner practices such as fertilizer use, septic system maintenance, and maintaining riparian buffers	1,000 brochures	II	Meeting with LCWM to discuss brochures available and creation of a distribution plan created by the end of year four.
			Design and production of riparian buffer brochures completed by year seven.
Recruit homeowner associations to become stream stewards	Recruit all homeowner associations	I, II, III	Initiated in year one – ongoing recruitment of volunteers to become stream stewards

TABLE 42. IMPLEMENTATION SCHEDULE FOR MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES AND INTERIM MEASURES OF ACTIVITY SUCCESS (CONT.)

Managerial and I/E Practices	Quantity to be Completed	Activity Phase	Interim Measures of Activity Success
Riparian Farmers			
Submit articles in professional association newsletters on watershed pollutants and concerns	Articles written for other newsletters	I, II, III	Initiated in year one – ongoing articles written for other newsletters
Presentations to farmer associations and 4-H groups on watershed pollutants and concerns	3 presentations	II	Initial planning of presentations completed by year two.
			Three presentations completed by the end of year seven.
Develop and distribute brochure on financial and technical tools for farmers	1,000 brochures	II	A distribution plan created by the end of year four.
			Design and production of brochures by year seven.
Local Government Officials			
Submit articles in township and planning association newsletters on watershed pollutants and concerns	Articles for other newsletters	I, II, III	Initiated in year one – ongoing articles written for other newsletters
Promote implementation of the revised model ordinance developed for Kent County	Promote in all watershed municipalities	I, II, III	Initiated in year one – ongoing promotion of revised model ordinance for Kent County
Develop brochure on land-use decision making tools	1,000 brochures	II	A distribution plan created by the end of year four.
			Design and production of brochures completed by year seven.
Recruit township officials to become stream stewards	Recruit all townships officials	I, II, III	Initiated in year one – ongoing recruitment of volunteers to become stream stewards
Promote the Blueprint award in watershed townships	Promote in all townships	I, II, III	Initiated in year one – ongoing promotion of Blueprint award
Review master plan and zoning ordinances to recommend stormwater BMPs (Low Impact Development Practices)	1 municipality/year (20 municipalities in watershed)	III	Initial planning of review and contacting local units of government by year four.
			Twenty five percent of master plan and zoning ordinances review completed by year eight.
			One hundred percent of master plan and zoning ordinances review completed by year ten.
Business and Industry			
Submit articles in building association newsletters on watershed pollutants and concerns	Articles for other newsletters	I, II, III	Initiated in year one – ongoing articles written for other newsletters
Training Programs Directed at the Construction Business on watershed pollutants and concerns	3 workshops	II	Initial planning of presentations completed by year two.
			Three presentations completed by the end of year seven.
Recreational Users of the Watershed			
Submit articles in recreational newsletters on watershed pollutants and concerns	Articles for other newsletters	I, II, III	Initiated in year one – ongoing articles written for other newsletters

TABLE 42. IMPLEMENTATION SCHEDULE FOR MANAGERIAL AND INFORMATION AND EDUCATION PRACTICES AND INTERIM MEASURES OF ACTIVITY SUCCESS (CONT.)

Managerial and I/E Practices	Quantity to be Completed	Activity Phase	Interim Measures of Activity Success
Recreational Users of the Watershed (cont.)			
Presentations to organizations on watershed pollutants and concerns	One presentation/year	I, II, III	Initial planning of presentations completed by year two.
			One presentation held every year.
Sponsor activities held by various recreational groups	Sponsor 1 event per year	I, II, III	Initial planning of events completed by year two.
			One sponsored event every year.
Recruit organizations to become stream stewards	Recruit watershed organizations	I, II, III	Initiated in year one – ongoing recruitment of volunteers to become stream stewards

14.6 SET OF CRITERIA TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED (CRITERIA H)

To evaluate whether loading reductions are being achieved over time, a set of criteria (indicators) was determined for each pollutant and the related sources (Table 43). By using these indicators, we can see if substantial progress is being made towards water quality standards. If progress is not being made towards water quality standards, the management approaches will be revised. The Rogue River Watershed Council will evaluate the existing practices and see if the quantities of practices implemented need to be increased or if alternative practices need to be proposed.

Establishing Targets for Pollutant Loading Reductions

Measuring parameters to evaluate progress toward a goal requires the establishment of targets against which observed measurements are compared. These targets are not necessarily goals themselves, because some of them may not be realistically obtainable. However, where possible the targets define Water Quality Standards, as set forth by the State of Michigan, or are based on current loads and anticipated loads from implementation of management practices. Using these targets to measure success will assist watershed stakeholders in deciding how to improve programs to reach both restoration and preservation goals and know when these goals have been achieved. These targets are described below.

Although all streams carry a natural amount of bed load **sediment**, excessive additions of sediment from uplands can degrade stream habitat. By implementing all of the best management practices recommended in this plan, the sediment load in the watershed can be reduced by 3,230 tons/year. This will be the target to reduce the threat of sediment on the Coldwater Fishery and Warmwater Fishery designated uses.

Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water **temperature** which ranges from 38 – 83 degrees Fahrenheit for the warmwater fishery. For the coldwater fishery, the heat load should not increase water temperature more than 2 degrees Fahrenheit above the existing natural water temperature which ranges from 38 – 63 degrees Fahrenheit. The target will be to keep water temperatures within these ranges which are outlined in the Water Quality Standards for the Coldwater Fishery and Warmwater Fishery designated uses. This is especially important in tributaries that support coldwater fish communities.

The state requires that "**nutrients** shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the waters of the state." By implementing all of the best management practices recommended in this plan, the nutrient load in the watershed can be reduced for nitrogen by 1,325 lbs/year and phosphorus by 547 lbs/year. This will be the target to reduce the threat of nutrients on the Coldwater Fishery and Warmwater Fishery designated uses.

There are no state standards that deal with **non-native invasive species**. Non-native invasive plants and animals can have a dramatic effect on the ecological integrity of a natural balanced system. Invasive species degrade habitat suitability for native species and decrease overall biodiversity. As a target, volunteer management, biological, and other control techniques should help stem the tide of non-native species immigration to the watershed and should reduce any future expansion by limiting their impact on the watershed system. GIS mapping of infected areas will guide managers effectively in the effort to reduce the negative impacts of non-native species. The target to reduce the impacts of purple loosestrife on the Coldwater Fishery and Warmwater Fishery designated uses is a 50% reduction in cover in five years.

State standards are established for **bacteria (*E. coli*)** in surface waters by the MDEQ. For the designated use of total body contact, the state requires measurements of no more than 130 *E. coli* per 100 milliliters as a 30-day geometric mean during 5 or more sampling events representatively spread over a 30-day period. For partial body contact (wading, fishing, and canoeing) the state requires measurements of no more than 1000 *E. coli* per 100 milliliters based on the geometric mean of 3 or more samples, taken during the same sampling event. These uses and standards will be appropriate for and applied to the river and those tributaries with a base flow of, or greater than, 2 cubic feet per second. The target is to stay below the water quality standards to protect the partial and total body contact designated uses.

Urban runoff can carry many toxic and dangerous materials into the waterways. **Toxic substances** include synthetic organic contaminants (e.g. pesticides, herbicides) and volatile organic contaminants (e.g. xylenes, toluene, and benzene). Hydrocarbons are also considered toxic substances and often occur in petroleum, natural gas, coal, and bitumens (asphalt and tar are the most common forms of bitumen). The Rogue River Watershed should be monitored to determine if toxic substances are present at levels which exceed established wildlife values and human cancer values. By implementing all of the best management practices recommended in this plan, the toxic substance load in the watershed can be reduced by 8 lbs/year. This will be the target to reduce the threat of toxic substances on the Other Indigenous Aquatic Life designated use.

State standards are established for **mercury** and **PCBs** in surface waters by the MDEQ. For the fish consumption designated use to be supported, the geometric mean of water column mercury concentration should be less than 1.8 mg/L. The mean fish tissue mercury concentration of the all the fish or fish species that are a top predator should be less than 0.35 mg/kg for the designated use to be supported. For contaminants other than mercury, a water body is considered to not support this use if the Michigan Department of Community Health has issues a site-specific fish consumption advisory for that water body.

TABLE 43. POLLUTANTS AND SOURCES IN THE ROGUE RIVER WATERSHED AND SET OF INDICATORS TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED

Pollutant	Sources	Indicators
Sediment	Croplands	Decreased frequency and degree of dredging of agricultural ditches due to a reduction in sediment (information obtained from Newaygo and Kent County Drain Commissioners).
		To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		An increase in the number of practices implemented (filter strips – target 46,464 linear feet, cover crops – target 50 acres).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
	Loss of wetlands	To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in the number of easements secured in the watershed (target 2,928 acres).
		An increase in the number wetland restoration projects implemented (target 800 acres).
	Road Stream Crossings	To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		Increase in the number of road stream crossing improvements implemented (target 5 culvert replacements).

TABLE 43. POLLUTANTS AND SOURCES IN THE ROGUE RIVER WATERSHED AND SET OF INDICATORS TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED (CONT.)

Pollutant	Sources	Indicators
Sediment (cont.)	Stormwater/Surface Runoff	To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in master plans and zoning ordinances that address stormwater issues and recommend implementation of stormwater BMPs (Low Impact Development Practices) (target 30% municipalities).
		An increase in the miles of stream restored (target 0.32 square miles).
	Bank Erosion	To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in the number of eroded banks stabilized through implementation of streambank stabilization (target 2,300 feet) and recreational trails and walkways (target 47 feet).
	Construction Areas	To maintain the current ratings and improve ratings where possible of embeddedness of the substrate and the bottom deposition due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ).
		Decrease in the amount and frequency of sites with unnatural quantities of turbidity due to a reduction in sediment (measurements taken by the GLEAS protocol habitat assessment conducted by MDEQ and site visits done by the Rogue River Watershed Council).
		Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		A reduction in the number of soil erosion and sediment control permit violations due (information obtained from Newaygo County Drain Commissioner and Kent County Road Commission) (target 50% reduction in violations).
Temperature	Lack of Streamside Canopy and upland vegetation	Increases in the diversity of coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in the number of easements secured in the watershed (target 2,928 acres).

TABLE 43. POLLUTANTS AND SOURCES IN THE ROGUE RIVER WATERSHED AND SET OF INDICATORS TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED (CONT.)

Pollutant	Sources	Indicators
Temperature (cont.)	Lack of Streamside Canopy and upland vegetation (cont.)	An increase in the acres of streamside and upland vegetation (target 98.5 acres).
	Loss of wetlands	Increases in the diversity of coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in the number of easements secured in the watershed (target 2,928 acres).
		An increase in the number wetland restoration projects implemented (target 800 acres).
	Stormwater/Surface Runoff	Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in master plans and zoning ordinances that address stormwater issues and recommend implementation of stormwater BMPs (Low Impact Development Practices) (target 30% municipalities).
	Water Inputs from Drainage Networks	Increases in the diversity of coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in the acres of streamside vegetation along drainage networks (target 98.5 acres).
	Water Withdrawals	Increases in the diversity of coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		Increase in the management measures implemented to protect groundwater (i.e. irrigation water use) (target 15% increase).
Nutrients	Animal Waste Runoff	Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		Increase in installation of fencing (target 3,000 feet) and filter strips (target 46,464 linear feet).
	Commercial Fertilizer Use	Increase in the acres of streamside vegetation (target 98.5 acres).
		Increase in use of soil testing done by landowners (target 15% landowners).
		Decrease in the amount of phosphorus fertilizer used by landowners (target 15% landowners).
	Loss of wetlands	An increase in the number of easements secured in the watershed (target 2,928 acres).
		An increase in the number wetland restoration projects implemented (target 800 acres).
	Stormwater/Surface Runoff	Increases in the diversity of warm water and coldwater fish and diversity of macroinvertebrates demonstrated by MDEQ stream surveys and volunteer monitoring efforts.
		An increase in master plans and zoning ordinances that address stormwater issues and recommend implementation of stormwater BMPs (Low Impact Development Practices) (target 30% municipalities).
		An increase in installation of filter strips (target 46,464 linear feet) and riparian buffer strips (target 98.5 acres).
	Septic Systems	Increase in septic system maintenance practices (target 15% homeowners).
Invasive Species	Human Introduction	Decrease in the percent cover of invasive species (specifically purple loosestrife) which will be tracked by GIS mapping of infected areas and photographs (target 50% reduction in cover at 25 sites).

TABLE 43. POLLUTANTS AND SOURCES IN THE ROGUE RIVER WATERSHED AND SET OF INDICATORS TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED (CONT.)

Pollutant	Sources	Indicators
E. coli and Fecal Coliform (cont.)	Animal Waste Runoff	No *E.Coli* levels exceeding MI and USEPA water quality standards for both single day (>300 *E. coli*/100mL of water) and 30-day geometric mean measurement (>130 *E. coli* /100mL of water in 5 samples over 30 days) monitored by county health departments.
		Increase in installation of fencing (target 3,000 feet) and filter strips (target 46,464 linear feet).
	Septic Systems	No *E.Coli* levels exceeding MI and USEPA water quality standards for both single day (>300 *E. coli*/100mL of water) and 30-day geometric mean measurement (>130 *E. coli* /100mL of water in 5 samples over 30 days) monitored by county health departments.
		Increase in septic system maintenance practices (target 15% homeowners).
	Wastewater Treatment Plants	No *E.Coli* levels exceeding MI and USEPA water quality standards for both single day (>300 *E. coli*/100mL of water) and 30-day geometric mean measurement (>130 *E. coli* /100mL of water in 5 samples over 30 days) monitored by county health departments.
Toxic Substances	Stormwater/Surface Runoff	An increase in master plans and zoning ordinances that address stormwater issues and recommend implementation of stormwater BMPs (Low Impact Development Practices) (target 30% municipalities).
		An increase in installation of filter strips (target 46,464 linear feet) and riparian buffer strips (target 98.5 acres).
	Landfill Leachate	No water quality violations.
PCBs and Mercury	Atmospheric Deposition	MDEQ sampling indicates that the geometric mean of water column mercury concentration should be less than 1.8 mg/L. The mean fish tissue mercury concentration of the all the fish or fish species that are a top predator should be less than 0.35 mg/kg for the designated use to be supported.
	Historical Industry	

14.7 EVALUATION METHODS FOR MONITORING SUCCESS OF IMPLEMENTATION EFFORTS (CRITERIA I)

Significant amounts of time and money are dedicated to implementing watershed management plans. Without a well-planned evaluation process, the success of these implementation efforts is unknown. Establishing monitoring methods allows for a clear picture of whether or not the goals and objectives for water quality improvement are being attained. Results of the evaluation will provide a feedback loop to improve project management and implementation of project tasks, which in turn will gain support from watershed stakeholders. Monitoring and measuring progress in the watershed will likely be conducted at the local level by individual agencies, entities and communities as well as at the watershed and sub-watershed levels (i.e., educational institutions / watershed organizations / groups) in order to assess the ecological affects of the community and agency actions on the overall health of the Rogue River Watershed.

Evaluation is difficult due to the social and technical complexity of watershed projects. Evaluations usually take either a qualitative or quantitative approach, with the two approaches often viewed as alternatives (Kerr and Chung 2001). Qualitative approaches deal with how people understand their experiences (i.e. qualities). An example of using a qualitative approach is sending watershed stakeholders a survey which asks them to provide feedback on water quality in their area. By contrast, quantitative approaches deal with numerical outcomes (i.e. quantities). A quantitative approach would be to select a site in the watershed where macroinvertebrate data are collected and analyzed over a set period of time to determine water quality in that area. Although these methods are presented as if they were in opposition to one another, these approaches can be combined to deal with the complexity inherent in watershed projects. The rising interest in combining methods comes from the recognition that purely qualitative and purely quantitative approaches to evaluation each have limitations, and that the strengths of one often compensate the weaknesses of the other (Kerr and Chung 2001).

A long-term water quality monitoring program that measures qualitative as well as quantitative parameters is essential to determine where resources should be focused and to move towards watershed goals and objectives. Throughout the three major activity phases, continual evaluation methods will be implemented to measure project successes and failures. This will allow for intervention if project goals are not being achieved. Below is a description of quantitative and qualitative methods that will be used to evaluate the effectiveness of implementing the watershed plan and achieving its goals.

Quantitative Evaluation Methods

Quantitative evaluation begins with the premise that the analyst fully understands the nature and determinants of a program's success and/or problem issues and can obtain the data needed to measure and relate them statistically (Kerr and Chung 2001). Statistical analysis also requires a sufficient sample size, generated by some form of randomization, rather than a "convenience sample" of a few sites. But measuring improvements in

natural resource conditions is difficult. First, the conditions of the project site are not likely to be replicated exactly in other sites. Differences in physical, economic and social factors may lead to changes in program outcomes. Second, many watersheds projects do not deal with sample sizes that make randomization a feasible strategy for study design. Details regarding responsible parties, monitoring procedures, sampling sites, and frequency of monitoring for quantitative evaluation techniques will need to be further defined in project work plans as funding resources are secured.

It should be noted that the monitoring procedures are based upon existing programs (Table 44). Most of these programs are volunteer based and have funding constraints. Therefore, the sample frequency and parameters measured are limited. However, the information collected can still be used to indicate change on a watershed scale.

In order to address all of the sources of the pollutants, funds should be obtained for additional monitoring. Recommendations for future monitoring programs are listed below. Funding sources need to be secured to support these programs and/or increase sampling frequencies of existing programs.

Suggested Monitoring Programs

E. coli/fecal coliform – During the Rogue River Watershed Planning Project *E. coli* samples were being collected monthly (April – October) on the Rogue River at Alpine Avenue, Pine Island Drive, Algoma Avenue, and Childsdale Avenue by the Kent County Health Department. Routine testing of surface water for *E. coli* has not continued on the Rogue because of lack of funds (personal communication with Dave Kraker 2007).

In order to assess this parameter in the Rogue River, funding for monitoring should be obtained. Samples should be taken monthly (April – October) during both dry weather and wet weather events. If possible, funding for this monitoring should be funneled through the Kent County Health Department to be the test agency.

Nutrients – Many sources of nutrients are listed as potential or suspected. Therefore, funding for monitoring should be obtained to determine nutrient loadings in the watershed. A monitoring program could be established during the months of April – November. During this sampling period dry weather sampling should be conducted at least one time per month. Wet weather sampling should be conducted for four events during the monitoring period. The wet weather runoff events should be in response to precipitation events of 0.5 inches or greater within 24 hours. A potential test agency for nutrient monitoring in the watershed could be AWRI.

Qualitative Evaluation Methods

Qualitative methods aim to uncover the perspectives of multiple stakeholder groups, learning first hand about the incentives, motivations, and dynamics behind decisions and actions taken as a result of a project. The objective is not to obtain a numerical estimate, but to develop an in-depth understanding of an issue by probing, clarifying, and listening to stakeholders talk about a topic in their own words (Kerr and Chung 2001). The data gathered are the perceptions of the people living in the watershed and the individual

resident is the primary collection instrument. An advantage to qualitative evaluation methods is that it produces in-depth, comprehensive information that focuses on a holistic picture (Key 1997). Qualitative methods can be used to investigate issues and can explore how well project programs are addressing these issues. Details regarding responsible parties, monitoring procedures, sampling sites, and frequency of monitoring for qualitative evaluation techniques will need to be further defined in project work plans as funding resources are secured.

Table 45 lists evaluation methods that should be used to determine the success of implemented managerial and information/education efforts. Another resource that should be used in implementing and evaluating these practices is the "Getting in Step – A Guide for Conducting Watershed Outreach Campaigns" prepared by Tetra Tech, Inc under a contract with the U.S. Environmental Protection Agency. This guide provides the tools needed to develop and implement an effective outreach campaign. It will help understand the audiences in the watershed, create messages that resonate with them, find appropriate ways to communicate the message, and prompt changes in behavior to reduce water pollution.

TABLE 44. EXISTING EVALUATION TECHNIQUES TO MONITOR SUCCESS OF STRUCTURAL AND VEGETATIVE PRACTICES

Monitoring Sites	Parameter Target	Type of Analysis	Protocol	Program been in place	Frequency of Monitoring	Test Agent	Monitoring Schedule
Specific sites to be determined.*	Sediment, Temperature, Nutrients, and Toxic Substances	Stream Habitat Assessment	MDEQ P-51	---	5 yr. interval	MDEQ Water Bureau Staff	2009, 2014, 2019
		Benthic Macroinvertebrates					
		Water Chemistry					
Barkley, Rum, Shaw, and Stegman Creeks on Northland Drive, Becker Creek on Lyons Property, Rogue River at Rector and Jericho, Cedar Creek at Friske, Duke Creek at Division	Sediment and Temperature	Stream Habitat Assessment	MDEQ P-51	2000 - present	2 times/year (spring and fall)	West Michigan Environmental Action Council	2009 - 2019
		Benthic Macroinvertebrates					
Bills Lake, Freska Lake, Big Pine Island Lake, High Lake	Temperature and Nutrients	Total Phosphorus	Cooperative Lakes Monitoring Program	1998 - present	2 times/year (spring/late summer)	Michigan Lakes and Stream Association Members	2009 - 2019
		Chlorophyll a			1/month (May – September)		
		Dissolved Oxygen			Every 2 weeks (May – September)		
		Water Temperature			Every 2 weeks (May – September)		
		Carlson's Trophic State Index (Transparency)			18 weekly measurements (May – September)		
Shaw/Rum/Barkley Creeks Subwatershed, Stegman/Becker Creek Subwatershed, Cedar Creek Subwatershed	Sediment, Temperature, and Nutrients	Riverine macroinvertebrate assemblage integrity (mussel species)**	The Nature Conservancy (Marangelo 2001)	2004 - present	Population monitoring every five years	The Nature Conservancy	2009, 2014, 2019
		Algal assemblage integrity (macroalgae abundance)**	1999 EPA bioassessment manual		1 time/year		2009 - 2019

TABLE 44. EXISTING EVALUATION TECHNIQUES TO MONITOR SUCCESS OF STRUCTURAL AND VEGETATIVE PRACTICES (CONT.)

Monitoring Sites	Parameter Target	Type of Analysis	Protocol	Program been in place	Frequency of Monitoring	Test Agent	Monitoring Schedule
See attachment 3	Invasive Species	Invasive Species Monitoring	Mapping and photographs taken of infested sites and progress after biological control	2007 - present	1 time/year	Rogue River Watershed Council and the Izaak Walton League	2009 - 2019
Long Lake and Myers Lake	*E. coli*	Beach Monitoring	MDEQ	2003 - present	1 time/year: summer	Kent County Health Department	2009 - 2019
Sparta Foundry Waste Facility	Toxic Substances	Groundwater Monitoring	EPA	---	Site specific – based on 40 CFR Part 258, Subpart E-Groundwater Monitoring and Corrective Action	MDEQ and facility operator	2009 - 2019
See Table 32	PCBs and mercury	ambient water column PCB and mercury concentrations and fish tissue data	MDEQ	---	5 yr. interval	MDEQ Water Bureau Staff	2009, 2014, 2019

* The specific sites are determined randomly for statistical significance.
** Details on the "Ecological Integrity Assessment" method by The Nature Conservancy are found in attachment 5.

TABLE 45. RECOMMENDED EVALUATION TECHNIQUES TO MONITOR SUCCESS OF MANAGERIAL AND INFORMATION/EDUCATION PRACTICES

Managerial and I/E Practices	Evaluation Measures
General Public/Stakeholders	
Research and collect data on watershed stakeholder values	Record sources used to determine watershed information; survey stakeholders to see if messages developed from this data is effective.
Develop and coordinate guidelines for stream stewards and loosestrife control	Record number of stream steward and loosestrife control programs used to develop standards, record number of stewardship groups formed and the types of activities.
Produce subsequent issues of Riffles and Runs Newsletter	Record number of people on the mailing list; create a "map" to determine gaps in the watershed where people aren't receiving the newsletter and add them to the mailing list; record number of new entries and their locations in the watershed.
Submit articles in local newspapers	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Update materials on project web site	Record the number of hits on the website before and after enhancement.
Develop and air PSAs featuring the 10 Did You Know questions	Conduct a survey to see how many watershed stakeholders have heard of the Rogue River media products and include questions regarding the 10 did you know questions.
Sponsor photo event to collect watershed photographs and develop a variety of media products	Conduct a survey to see how many watershed stakeholders have retained information presented in the media outlets.
Develop press kit and list of contacts	Review kit and determine if updates are needed and if there are gaps in the information.
Develop graphics for a variety of audiences for the display	Record the number of places that display is exhibited.
Conduct research on audience profiles to obtain economic data to improve messages	Record the number of surveys returned and how awareness and education of watershed stakeholders have changed over time.
Develop general slide show on the Rogue River Watershed Project	Conduct a survey to see how many watershed stakeholders have retained information presented in the general slide show.
Develop general brochure featuring the 10 Did You Know Questions	Conduct a survey to see if watershed stakeholders have heard or seen the Rogue River media products and include questions regarding information on the 10 did you know questions.
Develop Rogue River Watershed Placemat	Conduct a survey to see how many watershed stakeholders have retained information presented in the watershed placemat.
Prepare give-away materials	Record the number of giveaways given out and the events where they were available.
Develop materials and conduct a watershed fair	Conduct a survey to see how many watershed stakeholders have retained information presented at the watershed fair.

TABLE 45. RECOMMENDED EVALUATION TECHNIQUES TO MONITOR SUCCESS OF MANAGERIAL AND INFORMATION/EDUCATION PRACTICES (CONT.)

Managerial and I/E Practices	Evaluation Measures
General Public/Stakeholders (cont)	
Conduct stream steward training workshops	Record the number of trained stewards that come back to lead a volunteer monitoring group on stream day, record findings and track over time.
Hold community meetings to promote participation in land-use decisions	Conduct a survey to see how many watershed stakeholders have retained information presented at the community meeting.
Riparian Landowners	
Submit articles in homeowner association newsletters	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Presentations to homeowner associations and schools	Record number of presentations made to homeowner associations and schools; document new partnerships created as part of these presentations.
Develop targeted brochure on homeowner practices on their land and maintaining riparian buffers	Record number of brochures printed; document where the brochures are being mailed to; create a "map" to determine gaps in the watershed where this information should be sent; conduct a pre/post survey to see if information presented in this brochure was retained.
Recruit homeowner associations to become stream stewards	Record number of current partnerships with homeowners associations; determine gaps in the watershed where partnerships are needed; record number of new partnerships created.
Hold landscaping workshops	Conduct a survey to see how many watershed stakeholders have retained information presented at the landscaping workshops.
Riparian Farmers	
Submit articles in professional association newsletters	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Presentations to farmer associations and 4-H groups	Record number of presentations made to farmer associations and 4-H groups; document new partnerships created as part of these presentations.
Develop and distribute brochure on financial and technical tools available for farmers	Record number of brochures printed; document where the brochures are being mailed to; create a "map" to determine gaps in the watershed where this information should be sent; conduct a pre/post survey to see if information presented in this brochure was retained.
Hold BMP workshops	Conduct a survey to see how many watershed stakeholders have retained information presented at the BMP workshops.
Develop and distribute award to farmers implementing BMPs and minimizing water quality impacts	Contact farmers that were awarded to see if they have implemented anymore BMPs or have worked with their neighbors to implement BMPs on their land.

TABLE 45. RECOMMENDED EVALUATION TECHNIQUES TO MONITOR SUCCESS OF MANAGERIAL AND INFORMATION/EDUCATION PRACTICES (CONT.)

Managerial and I/E Practices	Evaluation Measures
Local Government Officials	
Submit articles in local government newsletters	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Promote the implementation of the model ordinance developed for Kent County	Record number of presentations made to municipalities regarding the ordinance; determine the current number of municipalities that have adopted the ordinance; record new municipalities that adopt because of this effort.
Develop brochure on land-use decision making tools	Record number of brochures printed; document where the brochures are being mailed to; create a "map" to determine gaps in the watershed where this information should be sent; conduct a pre/post survey to see if information presented in this brochure was retained.
Recruit township officials to become stream stewards	Record number of current partnerships with township officials; determine gaps in the watershed where partnerships are needed; record number of new partnerships created.
Promote the Blueprint award in watershed townships	Record presentations made to promote blueprint award; recorded the awards given to organizations for watershed efforts.
Presentations to planning associations and townships	Record number of presentations made to planning associations and townships; document new partnerships created as part of these presentations.
Hold targeted workshops such as innovated land-use planning, sediment control at construction sites, and model ordinances	Conduct a survey to see how many watershed stakeholders have retained information presented at the land-use planning, sediment control, and model ordinance workshops.
Review master plan and zoning ordinances to recommend stormwater BMPs (Low Impact Development Practices)	Record number of presentations made to local decision makers; document municipalities that revised master plans and zoning ordinances; conduct a pre/post survey to determine what local decision makers have learned as part of this process.
Business and Industry	
Submit articles in building association newsletters	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Training Programs Directed at the Construction Business	Record number of people attending trainings; provide pre/post surveys to see what they learned and if it was useful; use the survey information to update format of future trainings.
Recreational Users of the Watershed	
Submit articles in recreational newsletters	Record number of newspapers that the information is going to; create a "map" to determine gaps in the watershed where people aren't receiving information on the watershed and find out their media outlets; record number of new stakeholder outreach tools that are used.
Presentations to organizations	Record number of presentations made to recreational organizations; document new partnerships created as part of these presentations.
Sponsor activities held by various recreational groups	Record the number of events sponsored; record number of new partnerships created.

TABLE 45. RECOMMENDED EVALUATION TECHNIQUES TO MONITOR SUCCESS OF MANAGERIAL AND INFORMATION/EDUCATION PRACTICES (CONT.)

Managerial and I/E Practices	Evaluation Measures
Recreational Users of the Watershed (cont.)	
Recruit organizations to become stream stewards	Record number of current partnerships with township officials; determine gaps in the watershed where partnerships are needed; record number of new partnerships created.

14.8 SUSTAINABILITY

Rogue River Watershed Council

The Rogue River Watershed Council is dedicated to the long-term protection and enhancement of the Rogue River and its tributaries. The council has many responsibilities; it is in charge of policies, public information and education, and water quality protection. Council members were involved in the creation of the original watershed management plan and assisted with the plan update. The group has shown its commitment to accomplishing the goals laid out in the management plan by including information and education tasks and structural practices in their strategic plan. The Council has also created a watershed planning subcommittee to look over the watershed plan and evaluate the successes of implementation efforts.

Lower Grand River Organization of Watersheds

The Grand Valley Metro Council established the Lower Grand River Organization of Watersheds (LGROW) in 2007 to provide basin-wide oversight, implement regional or watershed-wide initiatives, and prioritize water quality concerns. The LGROW operates under, and serves as custodian for, the vision, mission, and the strategic direction developed for the Lower Grand River Watershed. The current board includes 13 members representing local units of government, existing watershed organizations, environmental organizations, and foundations.

According to their strategic plan, the LGROW will serve as an umbrella organization under which subwatershed organizations of the Lower Grand River Watershed can operate. The LGROW will provide the opportunity for subwatershed groups to work together and share information and resources to collectively reach the overall goals and objectives of the Lower Grand River Watershed. LGROW will also facilitate the formation of subwatershed groups that would be capable of creating subwatershed management plans and grassroots level opportunities for local governments and residents. While the LGROW will identify priorities within the Grand River Watershed and facilitate watershed-wide projects that address high priority concerns, the subwatershed organizations would manage operations within the subwatersheds, implement subwatershed management plans, and serve as a liaison between local stakeholders and the LGROW.

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Attachment 1 – Water Quality Criteria for Designated Uses

Designated Uses	Water Quality Criteria*
Agriculture	The MDEQ does not conduct specific assessments to evaluate support of this designated uses. This use is assumed to be supported unless there is site-specific information indicating otherwise.
Navigation	The MDEQ does not conduct specific assessments to evaluate support of this designated uses. This use is assumed to be supported unless there is site-specific information indicating otherwise.
Industrial water supply	The MDEQ does not conduct specific assessments to evaluate support of this designated uses. This use is assumed to be supported unless there is site-specific information indicating otherwise.
Warmwater fishery	A minimum of 5 milligrams per liter of dissolved oxygen shall be maintained in Great Lakes, connecting waters, inland streams, and inland lakes.
	The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature (J-45, F-45, M-45, A-55, M-60, J-70, J-80, A-80, S-80, O-65, N-60, D-50). Inland lakes shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature (J-45, F-45, M-50, A-60, M-70, J-75, J-80, A-85, S-80, O-70, N-60, D-50). Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature (J-38, F-38, M-41, A-56, M-70, J-80, J-83, A-81, S-74, O-64, N-49, D-39).
	The hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 S.U. in all surface waters of the state, except for those waters where the background pH lies outside the range of 6.5 to 9.0 S.U.
	Using MDEQ Procedure 51, fish communities are scored with metrics that rate water bodies from excellent (+5 to +10) to poor (-10 to -5). Fish ratings from -4 to +4 are considered acceptable.

Designated Uses	Water Quality Criteria*
Coldwater fishery	A minimum of 7 milligrams per liter of dissolved oxygen shall be maintained in Great Lakes, connecting waters, inland streams, and inland lakes.
	Rivers, streams, and impoundments shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 2 degrees Fahrenheit above the existing natural water temperature (J-38, F-38, M-43, A-54, M-65, J-68, J-68, A-68, S-63, O-56, N-48, D-40).
	The hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 S.U. in all surface waters of the state, except for those waters where the background pH lies outside the range of 6.5 to 9.0 S.U.
	Fish communities collected from designated coldwater streams using Procedure 51 are determined to support the coldwater fishery designated use if the relative abundance of salmonids is equal to or greater than 1%.
Other indigenous aquatic life and wildlife	For inland lakes, Carlson trophic status index (TSI) in conjunction with aquatic macrophyte surveys is considered to determine designated use support.
	The surface waters of the state shall not have any of the following physical properties in unnatural quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, and deposits. Michigan does not have specific assessment methods or numeric standards for these physical characteristics; therefore, best professional judgment with other assessment types is used to determine if this designated use is supported. Most people consider water with a total suspended solids (TSS) concentration less than 20 mg/l to be clear. Water with TSS levels between 40 and 80 mg/l tends to appear cloudy, while water with concentrations over 150 mg/l usually appears dirty. The nature of the particles that comprise the suspended solids may cause these numbers to vary.
	Michigan uses rapid bioassessment of macroinvertebrate communities in wadeable streams and rivers to determine support for this designated use. Using P51, macroinvertebrate communities are scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Macroinvertebrate ratings from -4 to +4 are considered acceptable. Nonwadeable rivers are assessed using Michigan's Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers. Nonwadeable rivers with macroinvertebrate communities rating excellent, acceptable, or fair (i.e. total community score $\geq$ 25) are determined to support the other indigenous aquatic life and wildlife designated use.

Designated Uses	Water Quality Criteria*
Other indigenous aquatic life and wildlife (continued)	Site-specific visual observation of bacteria, algae, macrophytes, and fungi may be used to make support determination for this designated use. A determination of not supporting may be made if excessive, nuisance growths of algae (particularly *Cladophora, Rhizoclonium*, cyanobacteria) or aquatic macrophytes are present.
Fish consumption	If the geometric mean of water column mercury concentration is >1.8 mg/L the designated use in not supported.
	If the mean fish tissue mercury concentration of the all the fish or fish species that are a top predator is >0.35 mg/kg the designated use is not supported.
	For contaminants other than mercury, a water body is considered to not support this use if the Michigan Department of Community Health has issues a site-specific fish consumption advisory for that water body.
Partial body contact recreation	All water bodies must meet water quality standards of less then 1,000 count/100 mL of *E. coli* all year around for recreational uses of fishing and boating to be safe.
Total body contact recreation	All water bodies must meet water quality standards for less than 130 count/100 mL of E. coli, as a 30-day geometric mean, for areas to be safe for swimming from May 1 to October 31.
Public Water Supply	To determine public water supply designated use support for toxic substances, ambient water column chemical concentrations are compared to the human cancer value and human noncancer value. However support determination for this designated use is problematic and there is generally insufficient information available to make a determination.
	To determine support for this designated use, site-specific complaints of taste and odor causing substances in community source water are considered on a case-by-case basis.

* Water quality criteria taken from Part 4. Water Quality Standards (Promulgated pursuant to Part 31 of the Natural Resources and Environmental Protect Act, 1994 PA 451, as amended), January 13, 2006, MDEQ – Water Bureau

Attachment 2 – Rogue River Watershed Wetland Status and Trends

Data Disclaimer and Limitations

National Wetlands Inventory (NWI)

- Last updated in 1978

Wetland boundaries determined from Aerial Imagery

Limitations to Aerial Photo Interpretation:

- Errors of Omission (forested and drier-end wetlands)
- Errors of Comission (misinterpretation of aerials)

The 1978 NWI data was used in this analysis to report status and trends, as this is currently the best data source available. However, this data may not accurately reflect current conditions on the ground.

THE MDEQ-Land and Water Mgmt Division has begun a joint project with Ducks Unlimited, Inc. to update the 1978 NWI using 1998 aerial imagery and 2005 aerial imagery. The expected completion date is Summer of 2008, and this data will be used for all future Wetland Status and Trends analysis.

Rogue River Watershed Wetland Resources Status and Trends

Pre-settlement Wetland Condition

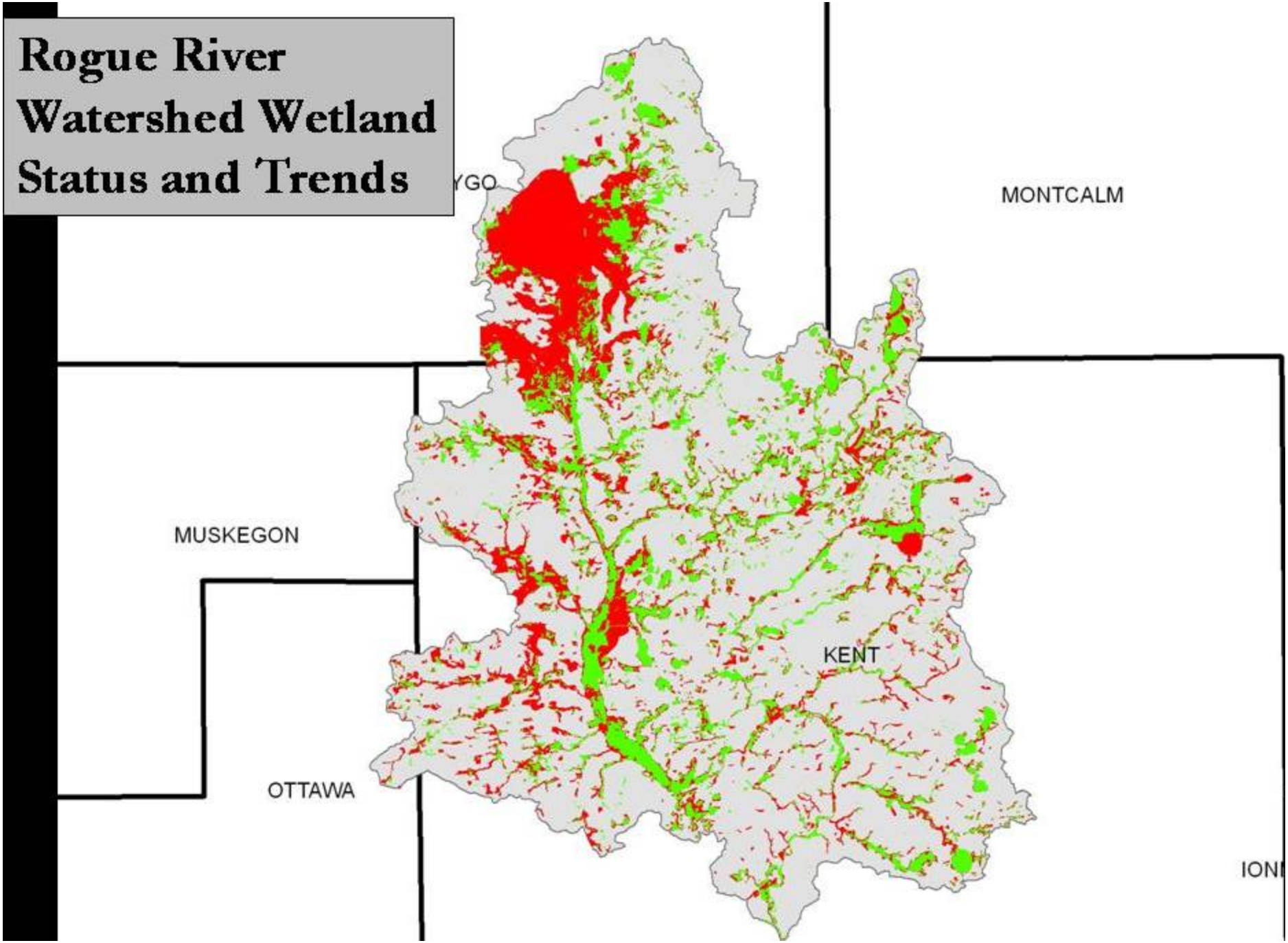
Total Acres of Wetlands = 38,816
Number of Wetlands = 2,737
Average Size = 14

1978 Wetland Condition

Total Acres of Wetland = 17,370
Number of Wetlands = 2,744
Average Size = 6

Percentage of Original Wetlands Remaining: **45%**

Rogue River Watershed Wetland Status and Trends



Attachment 3 – Purple Loosestrife Location in the Rogue River Watershed

This is a summary of documented sites of Purple Loosestrife infestation*. This report is not complete because the townships of Plainfield, Alpine, Sparta, Tyrone, Slone, Nelson and adjacent Newaygo County have not been completely surveyed. It is believed that all of these have significant Purple Loosestrife infestation.

The following sites have been inoculated with Gallerucella calmariensis beetles in 2007:

Algoma Township
Sec. 34: a large wetland off of 10 Mile Road on the north side of the road 3/8th of a mile west of Wolven Avenue in Sect 34
Sec. 23: lowland of the Rogue River at the southwest corner of Summit Avenue and Rector Street
Sec. 16: along the bank of Cedar Creek
Sec. 15: along the bank of Cedar Creek
Sec. 22: area northwest of the intersection of 11 Mile Road and Friske Drive

Cannon Township
Sec. 9: road ditch (small stream coming from Silver Lake) at the southwest corner of 9 Mile Road and Myers Lake Avenue

Plainfield Township
Sec. 14: a wetland near the Rogue River in the northwest corner
Sec. 17 and 18: at Barkley Creek and Lake Bella Vista Dam on Blakley Avenue east line of Section 18 and west line of Section 17

Sites that are believed not to have been inoculated with Gallerucella calmariensis beetles:

Algoma, presently 60% surveyed.
Sec. 6: south side of Indian Lakes Road, for 1/2 mile east from Lymburner Avenue
Sec.10: three sites on the east side of the road adjacent to Cedar Creek, from ¼ mile north of 14 Mile Road to ¾ mile north.
Sec. 17 & 20: north and south sides of 13 Mile Road for 1/2mile east from Pine Island Avenue
Sec. 15 & 16: Both sides of Algoma Avenue, ½ mile north of 13 mile Road on the south side of Cedar Creek
Sec. 14: at the northeast corner of the intersection of 13 mile Road and Edgerton Avenue
Sec. 19: along Division Avenue from ¼ mile to ½ mile north of 12 mile Road on the east side
Sec. 22: along 13 mile Road from .3 to .5 miles east from Algoma Avenue
Sec.23: north along Edgerton Avenue for .5 miles from 12 mile Road
Sec. 23: site .3 miles north of 12 mile Road along the east side of the US 131 freeway
Sec. 23 along the north side of 12 mile Road from .4 miles to .5 miles
Sec. 24: sites for .3 miles north along Summit Avenue, both sides of Summit
Sec. 30: sites on both sides of Division Avenue for the first .5 miles north from 11 mile Road
Sec. 30: sites on both sides of Fonger Street for .5 miles from Division Avenue to Arends Avenue
Sec. 30: one site at the northeast corner of the section at Division and 12 mile Road

Sec. 28: one site at the southeast corner of the section at the intersection of 11 mile Road and Algoma Avenue
Sect 27: sites all along 12 mile Road beginning .2 miles east of Algoma Road and running all of the way to Wolven Avenue
Sec. 25: at the northwest corner of the section on both side of the Rogue River
Sec. 31: along the east side of Division Avenue at a point .3 miles north of 10 Mile Road
Sec. 32: site for .4 miles east of Nester Avenue on both the north and south sides of the 10 mile Road
Sec. 32: one site at the southeast corner of section 32
Sec. 33: two sites on the north side of 10 Mile Road, .2 to .3 miles west of Jewell Avenue
Sec. 34: Two sites along the east side of US 131 freeway .3 miles north of 10 mile Road
Sec. 35: Sites on both the north and south sides of 10 Mile Road .25 miles east of Wolven Avenue
Sec. 35: one site at the south corner of the section on the north side of 10 mile Road

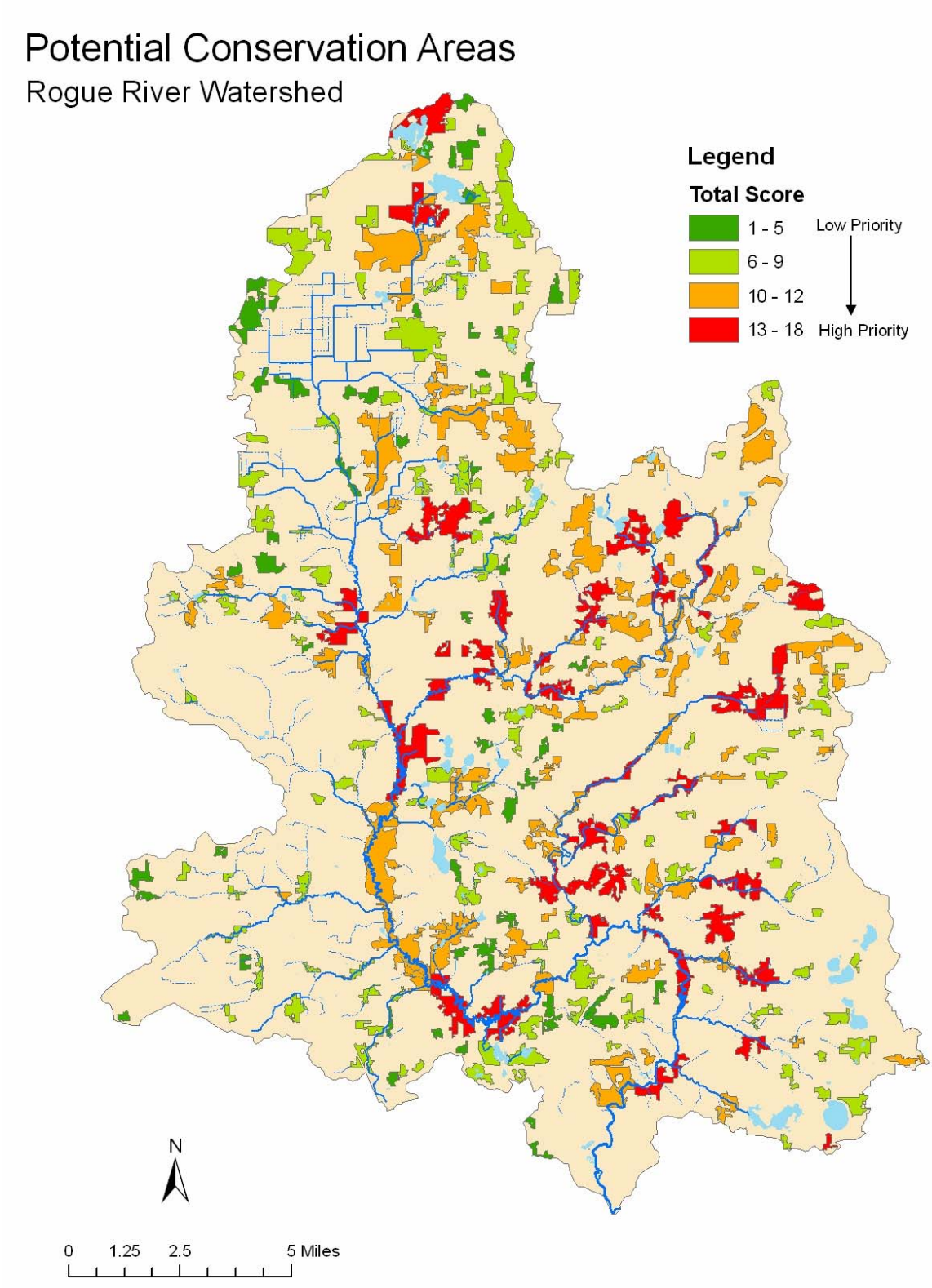
Sparta; (only slightly surveyed)
Sec. 1: multiple sites on both sides of Indian Lakes Road from the east county line to Long Lake Road

* Submitted by Bob Steigmer, Rogue River Watershed Council member and Izaak Walton League member.

Attachment 4 – Rogue River Watershed Conservation Easement Priority Areas

With support from the DEQ Clean Michigan Initiative, the Land Conservancy of West Michigan (LCWM) underwent an extensive analysis to identify the highest priority natural lands within the Rogue River Watershed. The LCWM worked with land protection partners, The Nature Conservancy as well as the Annis Water Resources Institute, to develop a prioritization process focusing on lands of high hydrologic resources. The partners brought together a team of biologists, geographers, mapping experts and others to rank all the land within the watershed based on scientific criteria including: soil permeability, wetland features, proximity to protected lands, parcel size, proximity to the Rogue mainstem and tributaries as well as whether the land is within the cold or warm water sections of the river. A comprehensive database and accompanying maps have been created to assist future watershed plan implementation efforts.

Criteria	Description	Weights
1) Patch Size	A larger patch of potential natural areas (PNA) tend to benefit water quality, and is an important factor for viability of species and ecosystem health.	20 – 60 acres = 1 61 – 110 acres = 2 111 – 190 acres = 3 191 – 250 acres = 4 > 250 acres = 5
2) Patch Connectivity	Proximity to protected natural lands and other PNA's. Patches directly adjacent to, or in close proximity to preserved natural lands (existing parks, preserves) or in close proximity (within 100 feet) to other PNA's will be given a higher score than those in isolated areas.	No connections = 0 1 connection = 1 2-3 connections = 2 >3 connections = 3 Directly adjacent to protected natural lands = 4
3) Patch Location	If patches within the "cold water subbasins" of the Rogue River watershed are developed, they have the potential to have a negative impact on overall stream temperature. Therefore, patches within these areas are given a higher score.	Warm water subbasin = 0 Cold water subbasin = 4
4) Riparian Corridor	Riparian areas along streams provide a water/land interface that promotes productive habitats and also provide shade to streams that protects water temperature. Patches that contain a natural riparian area along major streams are given a higher score.	No riparian corridor = 0 Riparian corridor = 2
5) Patch Composition	Wetlands provide numerous environmental benefits. Most notable water quality factors include cleaning and filtering of water, groundwater recharge, and stream temperature protection. Patches with wetlands are given a higher score.	No wetlands = 0 Contain wetlands = 3
6) Patch Groundwater Recharge Potential	Patches with hydrologic soil group (HSG) A soils have the potential to provide excellent ground water recharge services to the area. Patches that contain a majority of A soils are given a higher score.	Not a majority of area in A hydrologic soil group = 0 Majority of area is in A hydrologic soil group = 2
7) Ownership Fragmentation	Patches that consist of numerous parcels typically are more difficult to protect and manage than patches with fewer parcels. Patches with fewer parcels are given a higher score.	> 15 parcels = 0 11 to 15 parcels = 1 6 to 10 parcels = 2 0 to 5 parcels = 3


Potential Conservation Areas
Rogue River Watershed
Legend
Total Score
1 - 5
6 - 9
10 - 12
13 - 18
Low Priority
High Priority
N
0
1.25
2.5
5 Miles

Attachment 5 – The Nature Conservancy's "Ecological Integrity Assessment" method

Project Goals

1. Develop and put into place an ongoing, accurate assessment of ecological state of the Rogue River, based on The Nature Conservancy's "Ecological Integrity Assessment" method that will be responsive to ecological changes over time.
2. Develop and put into place a public outreach strategy that communicates the results of the EIA as a "Healthscreen" that will be informative to the public and influential to decision makers.
3. Assess the transferability of both methods to other areas of the Lower Grand River watershed and other Michigan watersheds.

Tasks

1. Funding

a. Determine who would participate in the project, and what roles would be.
b. Develop realistic budget for project.
c. Identify reasonable funding sources and investigate feasibility.
d. Determine best organization to assume central financial role on the grant, and apply for funding.

2. Monitoring

a. Consider setting up as sub-committee.
b. Decide on priority monitoring topics (considering in part those recommended by Paul Marangelo, former TNC aquatic ecologist – see attached memo).
c. Determine which have monitoring data already being collected (DNR, AWRI, WMEAC) and which would require additional data gathering. For new data needed, determine whether volunteers could be organized to collect it, or whether other systems need to be developed. Determine which organization, and who within it, would be appropriate to bring together and manage the monitoring data during the course of the project. Determine what cycle each of the types of data will need to be collected on (annual etc.)
d. Reconsider/improve method for collapsing data into meaningful categories for the Healthscreen.
e. Identify groups/individuals who would head up these tasks for the grant.

3. Outreach

a. Consider setting up as sub-committee.
b. Draft methods for grant describing steps to refine Healthscreen for better communicability.
c. Draft methods for grant describing media strategy for communicating the Healthscreen locally and regionally.
d. Draft methods for grant on how to measure impact/awareness of use of Healthscreen on public officials and watershed residents (using earlier Rogue River study?)
e. Identify groups/individuals who would head up these tasks for the grant.

4. Assessment of EIA Methodology

a. Draft methods for grant of how we would assess the transferability of the Rogue EIA/Healthscreen to other river systems; and assess the methodology in comparison to other techniques.

b. Identify groups/individuals who would head up these tasks for the grant.

Key Factor	Indicator	Poor	Fair	Good	Very good	source data	implementatio
Riverine macro-invertebrate assemblage integrity	Mussel species mainstream diversity	No native unionids	native unionids limited to <50% of historical distribution, < 60% of historical species present	All native unionids present, with a population of each species in at least one reach of mainstem or tributaries.	*All native unionids present, with a viable population of each species present in multiple reaches of mainstem*	TNC survey (Marangelo 2001), historical records	population monitoring every 5 years
Riverine macro-invertebrate assemblage integrity	Mussel species spatial distribution	Native unionids found only in mainstem	Population sources present outside mainstem for a few native unionids	Population sources present outside mainstem for most native unionids	*Population sources present outside mainstem for all native unionids*	TNC survey (Marangelo 2001), historical records	population monitoring every 5 years
Riverine macro-invertebrate assemblage integrity	Benthic macroinvertebrate multi-habitat richness metric	P51 macroinvertebrate score <=-2 or 319 monitoring score <19	P51 macroinvertebrate score -1=>x=>2 or 319 monitoring score 19-33	P51 macroinvertebrate score 3=>x=>5 or 319 monitoring score 34-48	*P51 macroinvertebrate score 6=>x=>9; or 319 monitoring score > 48*	P51, 319 project	yearly
Algal assemblage integrity	*macroalgae abundance*	> 65% gird dots covered by macroalgae	35 - 65% of grid dots covered by marcoalgae	10 - 34% of grid dots covered by macroalgae	*< 10% of grid dots covered by macroalgae.*		annually
Algal assemblage integrity	mean density (thickness rank) of microalgae on suitable substrate	thickness rank 4 or greater	thickness rank = 3	thickness rank = 2	*thickness rank 0-1*		annually