

# Ecosystem Impairment Matrix for the Lower Grand River Watershed

## How to Use the Ecosystem Impairment Matrix

The ecosystem impairment matrix is a summary of the identified ambient stressors in the Lower Grand River Watershed. The matrix was developed from public information included in the Lower Grand River Watershed Management Plan, Toxic Release Inventory database, and the Biennial Reporting System database.

The Matrix correlates the chemicals present in the watershed with resulting ecosystem impairments and identifies possible sources that contribute to these problems. Reading across a row, the multi media nature of the impairments created by some of the pollutants is evident. The column headers represent the ecosystem impairments identified in the Lower Grand River Watershed. The rows represent the sources of and chemicals of concern that are thought to be causing the impairment. The section listed as "Priority" refers to the priority placed on the impairment in the Lower Grand River Watershed Management Plan.

The Matrix can be used as a tool to understand how a facility's actions may contribute to the ambient environment and then to identify and implement more sustainable actions that will have less impact on the local ecosystem. For example, the impairments identified for the Lower Grand River Watershed could be considered when identifying impacts as part of an environmental management system (EMS) with the goal of adopting alternative practices. For example, sedimentation has been identified as an impairment in the Lower Grand River Watershed, controlling stormwater and sediments that flow off-site could become a priority for a company.

	WATER								AIR	LAND	OTHER			
	Poor Fish and Macroinvertebrate Communities	Fish Consumption Advisory	Pathogens	Nutrient Enrichment	Sedimentation	Loss of Habitat	Invasive Species	Hydrologic Flow	Ambient Air	Chemicals (2003 TRI)	Greenhouse Gases	Hazardous Waste (2003 LQG)	Lake Michigan LaMP Priority Pollutants	Binational Toxic Strategy
<b>Impairment priority assigned from the Lower Grand River Management Plan</b>														
			High	Low/Med	High	Med	Med	Low		Low				
<b>Source Contributions</b>														
Industrial Source Emissions		P			P						P	P	P	P
Area Source Emissions		P			P						P	P	P	P
Mobile Source Emissions									P		P		P	P
Atmospheric Deposition		X											P	P
Faulty Septic Systems	P		X	P										
Stormwater Runoff	P	X		P	P								P	P
Urban / Suburban Land Use	P				P	P		P						
Untreated Sewage Discharge	P		X	P										
Agricultural Land Use	P		X	X	P	P		X			P		P	P
<b>Water Quality Indicators</b>														
Dissolved Oxygen	P			P										
Ammonia										X				
E-coli			P											
Nutrients (Phosphorus and Nitrates)	X			X									X	
Pathogens	X												X	
Temperature	X													
Total Suspended Solids	X				P									
<b>Pesticides/Agricultural Chemicals</b>														
Aldrin/dieldrin														X
Atrazine													X	X
Chlordane													X	X
Endrin													X	X
Heptachlor											X		X	X
Hydrazine														

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Lindane													X	X
Mirex														X
Toxaphene														X
<b>Persistent Bioaccumulative Toxics (PBTs)</b>														
Chloroform												X		
DDT (+DDD+DDE)					X								X	X
1,4-dichlorobenzene														X
1,2-dichloroethane											X			
Dioxins and Furans													X	X
Hexachlorobenzene (HCB)														X
Hexachlorobutadiene														X
Octachlorostyrene														X
Pentachlorobenzene														X
Polychlorinated Biphenyls (PCBs)		X											X	X
PCB Substitute Compounds													X	X
<b>Metals</b>														
Alkyl-lead														X
Arsenic											X		X	
Barium									X		X			
Cadmium and cadmium compounds					X						X		X	X
Chromium / chromium compounds					X				X		X		X	
Copper									X				X	
Manganese compounds									X					
Mercury and mercury compounds		X									X		X	X
Lead / lead compounds					X				X				X	X
Nickel compounds					X				X				X	X
Selenium													X	
Tributyl tin														X
Zinc / zinc compounds													X	
<b>Criteria Air Pollutants and Green House Gases</b>														
Carbon Dioxide (CO2)											P			
Carbon Monoxide (CO)														
Methane											P			
NOx														
Ozone								X						
Particulate Matter								P						
Sulfur Dioxide (SO2)														
<b>Hazardous Air Pollutants</b>														
Acetonitrile												X		
Carbon Tetrachloride												X		
Cyanide													X	
3,3'-dichlorobenzidine														X
p-Dioxane														
Ethyl benzene									X					
Formaldehyde									X		X			
Hexachlorocyclohexane														X
4,4'-methylenebis(2-chloroaniline)														X
Methylene chloride												X		
Pentachlorophenol														X

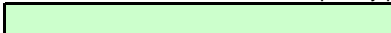
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Phthalic anhydride										X				
Trichloroethylene												X		
<b>Volatile Organic Compounds (VOCs)</b>														
Certain Glycol Ethers										X				
Benzene												X		
Butyl alcohol										X				
Methanol										X				
Methyl ethyl ketone										X		X		
Methyl isobutyl ketone										X				
Styrene										X				
Toluene										X				
Volatile Organic Compounds (VOCs)											X			
Xylene										X				
<b>Hydrocarbons</b>														
16-PAHs													X	X
Benzo(a)pyrene														X
Petroleum Hydrocarbons (e.g. oil, grease, gasoline)														
<b>Other Priority Pollutants</b>														
Dinitropyrene														X
Epoxide													X	
Formic acid										X				
Nitric acid										X				
Priority Organics		X												
Propanone (-2)												X		
Propenoic acid (-2)												X		
Tetrachlorobenzene												X		X

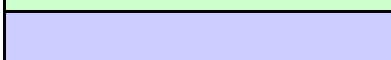
**Key:**

X- The source contribution or priority pollutant was associated with the ecosystem impairment as confirmed in the literature.

P- Probable source contribution or priority pollutant that was identified in the literature but not confirmed with sampling.



- Identified impairment based on an exceedance of a regulatory or guidance standard.



- Sources and priority pollutants that are legally released into the watershed but can, over time, potentially degrade the ecosystem.

**Notes:**

(1) Impairments listed are based on the Lower Grand River Watershed Management Plan, September 2004.

(2) No databases for greenhouse gases is currently available. The priority pollutants listed are those compounds identified in the literature as contributing to greenhouse gas emissions.

(3) The Great Lakes Binational Toxics Strategy (BTS) identifies these pollutants on their Level I or II lists of chemicals considered to be persistent, toxic, or bioaccumulative.

(4) Priorities are based on Table 3.6 of the Lower Grand River Watershed Management Plan, September 2004.

(5) Chemicals released to the air are based on the 2003 Toxic Release Inventory Report ([www.epa.gov/triexplorer](http://www.epa.gov/triexplorer))

(6) Hazardous waste is based on the 2003 Biennial Reporting System of Hazardous Waste for Large Quantity Generators.

(7) All data presented herein is for the counties comprising the Lower Grand River Watershed including:

Ottawa, Muskegon, Kent, Montcalm, Ionia, Barry, and Eaton.