Mississippi Valley Conservation
Watershed
Report Card

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Mississippi Valley Conservation (MVC) takes pride in the work we do everyday to protect and promote the health of its watershed and subwatersheds. MVC Staff work closely with our member municipalities, stakeholder groups and residents to monitor and manage our nine subwatersheds which sustain the Mississippi River. The first ever MVC Report Card clearly indicates that we are all doing our part.

Full Report 2007

For more information:
Mississippi Valley Conseravtion
4175 Highway 511
Lanark, Ontario, K0G 1K0
Tel.:(613)259-2421
Email: info@mvc.on.ca
Website: www.mvc.on.ca

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1.0 Introduction

The purpose of this report card is to assist in the targeting of rehabilitation and protection programs, improve accountability to stake holders, and support the broader reporting requirements of provincial and federal governments. This document was produced using a province-wide watershed report card system for Conservation Authorities developed by Conservation Ontario in 2003 (*Conservation Ontario, 2003 Watershed Reporting: Improving Public Access to Information*,). It reports on data from 2001 to 2006, focussing on three province wide areas of study, surface water quality, groundwater quality, and forest cover within a standard grading scheme created by Conservation Ontario. By using these standards our watershed can easily be compared to all other watersheds in the province. The data presented in this report is based on our best understanding of current conditions and technologies at hand.

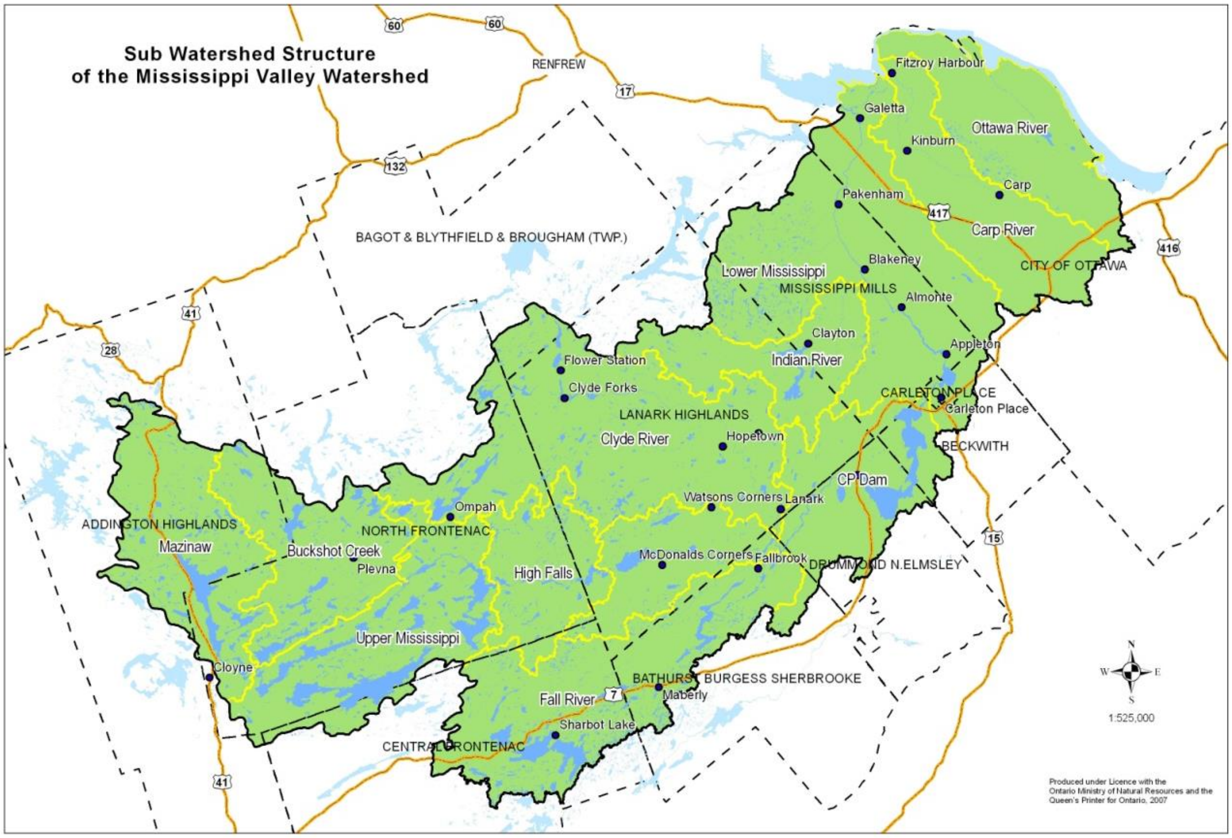
It is important to acknowledge that all data within this report is based on our best understanding of current conditions and technologies at hand. It is our goal that as time passes sampling and reporting measures will be enhanced, and thus more comprehensive conclusions can be drawn. With an increase in the number of years of data collection the effects of natural anomalies such as droughts and floods on our system can be balanced against the ever changing anthropogenic impacts on the watershed such as deforestation and urbanization. With these factors in mind, new report cards will be written on a five year cycle.

1.1 MVC Watershed

The Mississippi Valley watershed, located in south-eastern Ontario, encompasses an area of 4450 km^2 (Figure 1). The Mississippi River itself has its headwaters north of Mazinaw Lake, near Bon Echo Provincial Park, and empties into the Ottawa River, near Fitzroy Harbour. It covers portions of eleven municipalities from the Addington Highlands in the west to the City of Ottawa in the east. As shown in Figure 1, for watershed reporting purposes the Mississippi River watershed has been broken down into nine subwatersheds that are defined by the drainage areas of the major tributaries, as well as by the placement of flood control dams. In addition to these nine there are two more subwatersheds that the Mississippi Valley Conservation Authority (MVCA) manages, the Carp River Watershed and the Ottawa River Tributaries, which instead of flowing into the Mississippi, flow directly into the Ottawa River.

The first part of this document provides a detailed “watershed characterization” of each of the 11 subwatersheds that make up the entire Mississippi Valley Conservation watershed area. It describes the dominant physical character of the subwatershed areas and provides an overview of land use broken down by the percentage of land that is used for agriculture, that is built-up, that is covered by wetland and that is forested. The remainder of the document presents the results of the watershed report assessment, providing the grading of each subwatershed based on analysis of water quality, forest cover and groundwater quality data.

Figure 1: Map of Entire Watershed Showing Subwatersheds



The Mississippi River is over 212 km in length, and spans a drop in elevation of 252 m from the headwaters in the Mazinaw area to its outlet into the Ottawa River. It is fed by five major tributaries (Mississippi-Rideau Source Protection Region 2008). There are more than 250 lakes scattered in the basin with numerous wetlands dotting a variety of land covers including a large expanse of forested lands with small tracks of agricultural and urban areas. The surface geology of the basin ranges from a thin veneer of till over Precambrian rock in the western two-thirds to thick Champlain Sea clays and other sandy, loam soil types near the outlet in the east.

A watershed is an area of land that drains into a common waterbody, such as a river or a lake. This scale was set up for management purposes to bridge the gap between each municipality affected by the common body of water, in turn each municipality has a representative on MVC's Board of Directors. This ensures that the needs of all the rivers stakeholders are represented and practical management solutions can then be implemented.

A subwatershed is a way of using drainage patterns to break the main watershed into manageable portions of similar areas. All the subwatersheds that make up the Mississippi watershed are summarized in Table 1, showing the land use subdivided by agricultural, built-up, wetland, forested and forested interior, expressed in the percent coverage represented by each category within each subwatershed, as well as the total area coverage for each category. Some of these characteristics were used in determining the grades that make up the results of this report, and will be expanded upon later.

Table 1: Summary of Subwatershed Land Use

	Agriculture	Built Up	Wetlands	Forested	Forest Interior
Subwatershed	**Land Use (% of subwatershed area)**				
area (km^2)	area in km^2				
Mazinaw	**1.05**	**0.16**	**1.6**	**72.8**	**36.8**
357.58	3.7	0.66	5.73	260.22	131.55
Buckshot	**1.92**	**1.16**	**2.45**	**75.9**	**38.4**
292.11	5.61	3.38	7.16	221.69	112.29
Upper Mississippi	**2.01**	**0.92**	**6.97**	**59.3**	**23**
232.88	4.67	2.14	16.23	226.1	87.71
High Falls	**3.67**	**0**	**4.66**	**73.2**	**25.1**
202.71	7.43	0	9.46	139.97	48.03
Fall River	**7.78**	**0.03**	**5.48**	**45.2**	**7.4**
490.14	38.14	0.14	26.85	221.64	36.38
Clyde River	**4.59**	**0.61**	**3.83**	**71.4**	**29**
660.88	30.35	4.01	25.32	472.15	191.61
Indian River	**15.59**	**0.23**	**2.56**	**58.9**	**20**
210.87	32.87	0.49	5.4	124.23	42.15
Mississippi Lake	**16.3**	**0.58**	**11.14**	**41.1**	**9.2**
487.91	79.55	2.82	54.33	205.3	45.93
Lower Mississippi	**28.3**	**2.36**	**6.56**	**39.7**	**11.3**
664	187.92	15.68	43.59	263.42	75.18
Carp River	**39.08**	**7.48**	**5.4**	**31.3**	**6.3**
300.47	117.43	22.48	16.24	94.09	18.84
Ottawa River	**34.13**	**9.15**	**8.59**	**34.5**	**6**
286.84	97.91	26.24	24.64	98.86	17.2

Table 2 provides a summary of additional watershed characterization information for each subwatershed including the total subwatershed area, soil types derived from Canada Department of Agriculture, Research Branch - Soil Surveys Mapping *(Canada Department of Agriculture, 1966),* and significant natural features. Significant natural features refers to features that are either significant because they provide specialized habitat to vulnerable or sensitive species and/or because they important for their environmental and social values as a legacy of natural landscapes of an area. They include cold water fisheries, Conservation Areas and Areas of Natural and Scientific Interest (ANSIs) and Provincially Significant Wetlands (PSWs).

Table 2: Summary of Subwatershed Soil Types and Significant Features

Subwatershed	Area (km2)	Soil Types	Significant Features
Mazinaw	357.58	Monteagle sandy loam, Tweed sandy Loam	Cold water fishery *
Buckshot	292.11	Tweed sandy Loam, Monteagle sandy loam	Some cold water lakes *
Upper Mississippi	232.88	Rocky Tweed sandy Loam, Rocky Monteagle sandy loam	Some cold water lakes 6 ANSI's *
High Falls	202.71	Rocky Tweed sandy Loam, Rocky Monteagle sandy loam	Some cool to cold water lakes 1 ANSI, 1 PSW
Fall River	490.14	Rocky Tweed sandy Loam, Rocky Monteagle sandy loam	Some cold water lakes 2 ANSI's, and 8 PSW's
Clyde River	660.88	Rocky Monteagle sandy loam, Rocky Tweed sandy Loam	Cold to cool water lakes 2 ANSI's, 6 PSW's, Purdon Conservation Area
Indian River	210.87	Rocky Monteagle sandy loam, Tweed sandy loam	Some cold water lakes 3 PSW's Mill of Kintail Conservation Area
Mississippi Lake	487.91	Muck, Rocky Monteagle sandy loam	1 cool water lake 2 ANSI's, 12 PSW's
Lower Mississippi	664	Sandy Loam, clay areas, and rock complexes	Warm water fisheries 5 ANSI's, 3 PSW, Morris Island Conservation Area
Carp River	300.47	Anstruther soils, Precambrian bedrock	Cold water creek, 2 ANSI's, 5 PSW's
Ottawa River	286.84	Fine Sandy Loams, Silt Clay	Cool water lake, 6 ANSI's, 4 PSW's

Sources: *Soil Types (Canada Department of Agriculture 1966)*
ANSI: Area of Natural and Scientific Interest and PSW: Provincially Significant Wetland (Ministry of Natural Resources)
* These areas have not been intensely assessed by MNR and lack ANSI and PSW listings.

2.0 Subwatershed Characterization

The following section provides an overview of the physical characteristics of each of the eleven subwatershed areas and the sampling locations for the parameters reported upon in this document.

2.1 Mazinaw Lake

Description: The Mazinaw Lake subwatershed, shown in Figure 2, is 357.58 km^2 is in area and is located at the upper northwest corner of the watershed creating the headwaters of the rest of the system. Its lower end is the water level regulation dam at the outlet of Mazinaw Lake.

Figure 2: Mazinaw Subwatershed

Municipalities: Addington Highlands, and North Frontenac.

Soils: Monteagle sandy loam, and Tweed sandy loam. Soils are generally thin, coarse-textured and stony. The topography in the Mazinaw Lake subwatershed is irregular, moderately to steeply sloping, reflecting the near presence of the bedrock beneath.

Land use: Very limited agriculture due to soil/bedrock conditions. Agriculture 1.05%, Built up areas 0.16%, Wetlands 1.60%, forested areas 72.8% with 36.8% considered forest interior. There is light development which is mostly made up of seasonal homes, and small permanent communities.

Fishery Resources: Fourteen water bodies in this subwatershed have been recorded as having coldwater fish species (such as lake trout, brook trout and rainbow trout) present, though Mazinaw, Kishkebus and

Shabomeka Lakes are considered the most significant[i]. Seven more systems in the subwatershed have species associated with warm water.

Other interesting features: Bon Echo Provincial Park, a favourite destination for painters and photographers, is renowned for Mazinaw Rock. This 1.5-kilometre sheer rock face rises 100 metres above Mazinaw Lake, one of the deepest lakes in Ontario, and features over 260 native pictographs; the largest visible collection in Canada. The park offers backcountry hiking and canoeing, as well as car camping.

2.2 Buckshot Creek

Description: The Buckshot Creek sub-watershed, shown on Figure 3, is 292.11 km2 in area and encompasses all of Buckshot Creek, Buckshot Lake, and its tributaries, to the point where it flows into the Mississippi just north of Ardoch.

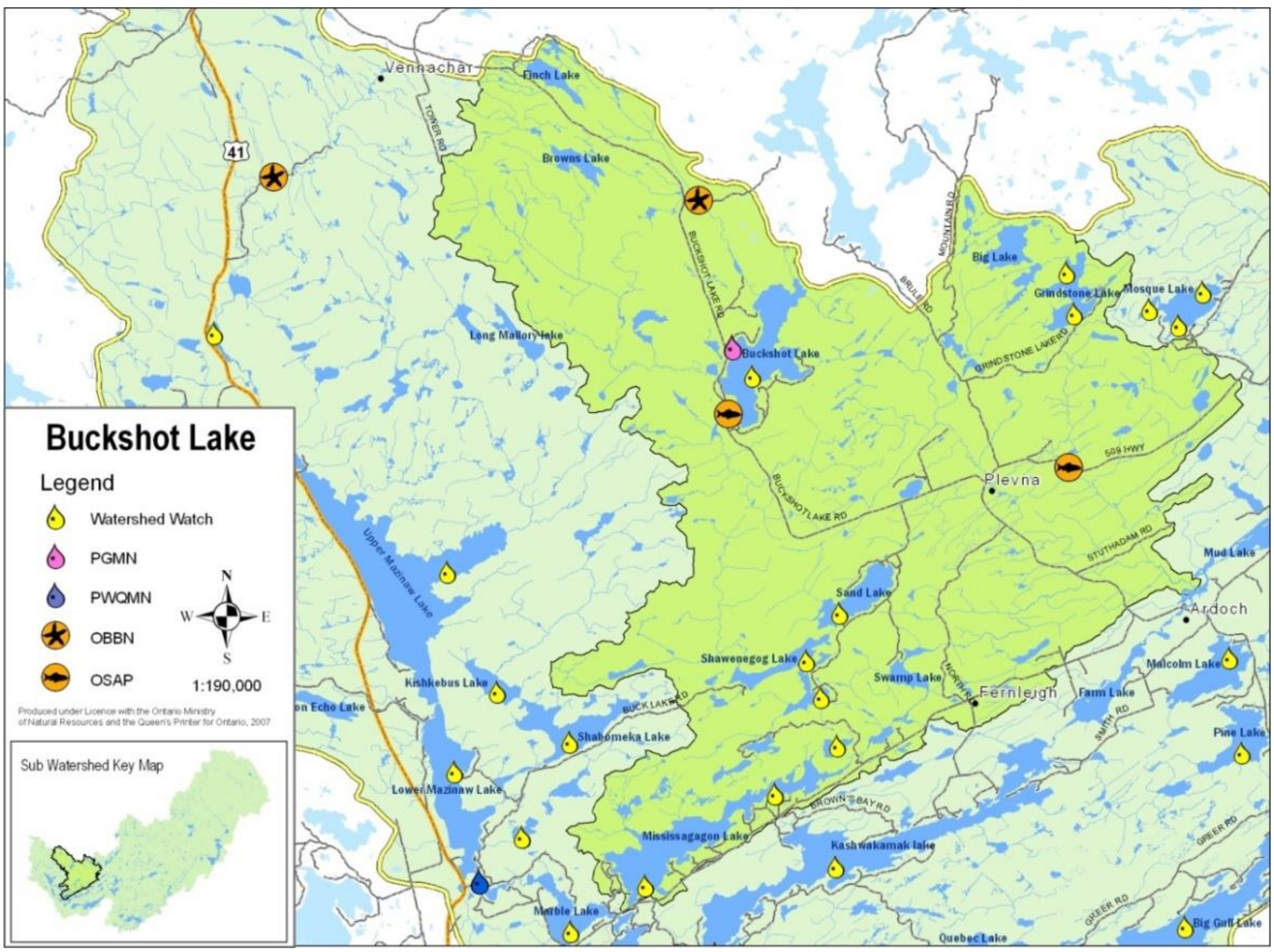


Figure 3: Buckshot Creek Subwatershed

Municipalities: Addington Highlands, and North Frontenac townships.

Soils: Tweed sandy loam rock complex, with Monteagle sandy loam rock complex. It has irregular topography, moderately to steeply sloping, reflecting the lay of the bedrock just beneath the surface. Due to the shallow soil, underlying bedrock, and abundance of rocks in both soil types, agriculture is limited to small irregular fields and pasture; however it is considered the "best pasture land within the Shield" (Canada Department of Agriculture, 1966) because of its soil make up. These soils are better used for non-agriculture uses such as forestry, and wildlife recreation opportunities.

Land use: Agriculture makes up 1.92%of this subwatershed, built up areas are 1.16%, Wetlands 2.45%, and forests are 75.9% with 38.4% being forest interior. There is light development mostly from small communities and seasonal cottages.

Fishery Resources: Two cold water systems, Grindstone Lake being the most significant. Buckshot Lake has some cold strata and supports lake trout and splake. Six other recorded lakes are warm water, containing mostly smallmouth and largemouth bass *(Ontario Ministry of Natural Resources (OMNR), 2002)*

2.3 Upper Mississippi

Description: The Upper Mississippi Subwatershed, shown in Figure 4, is 232.88 km2 in area extending from the outlet of Mazinaw Lake to the outlet of Crotch Lake, encompassing all of the lakes in that area, including Mississagagon, Kashwakamak, and Big Gull.

Municipalities: Addington Highlands, North Frontenac, and Central Frontenac.

Soils: Monteagle and Tweed sandy loam rock complexes with small localized areas of 'rockland' (areas of 50% or more rock outcrop), and Wendigo loamy sand rocky phase, a thin acidic soil with frequent rock outcrops, found in Kennebec Township. Due to the shallow soil, underlying bedrock, and abundance of rocks in both soil types, agriculture is limited to small irregular fields and pasture. These soils are better used for non-agriculture uses such as forestry, and wildlife recreation opportunities, thus in general the area is made up of various types of poor, thin soil.

Land use: Agriculture 2.01%, Built up 0.92%, Wetlands 6.97%, Forested 59.3% with 23% interior. Light development with small communities and seasonal homes.

Fishery Resources : 6 lakes with coldwater species, most significantly Shoepack Lake and Little Green Lake containing species of interest such as Brook Trout, Lake Trout and Splake. The large lakes in this subwatershed tend to have cold portions such as Crotch, Big Gull, Kashwakamak, Mississagagon, while many others have warm water (*OMNR, 2002, 1999)*

Area of Natural or Scientific Interest (ANSI): Marble Lake Stromatolites, Plevna Cedar Swamp, Palmerston Lake, (Harlowe Bog and Hungry Lake Barrens, partial).

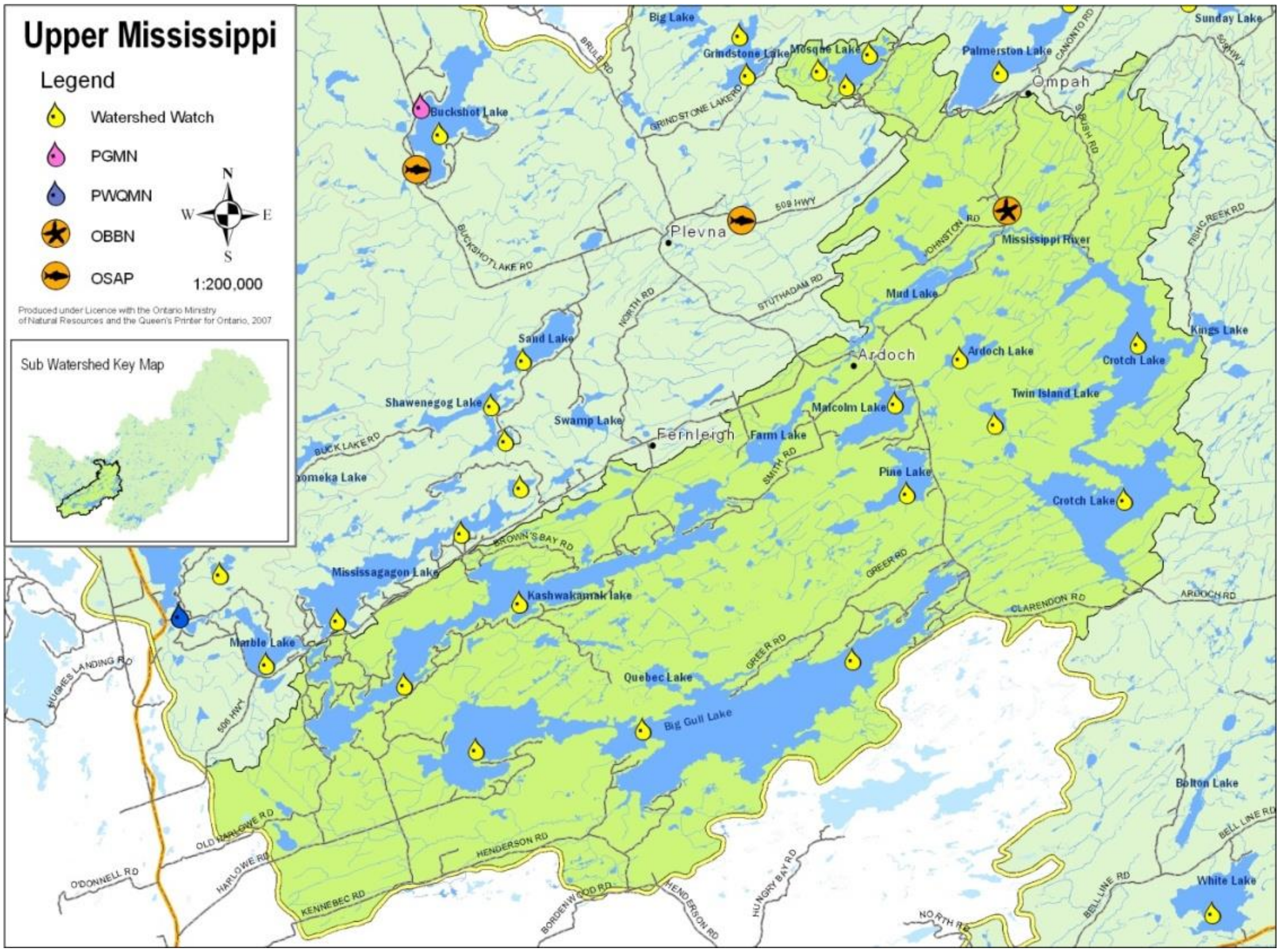


Figure 4: Upper Mississippi River Subwatershed

Other interesting features: The Mississippi River Canoe Route runs from Mazinaw Lake all the way to the outlet, however this end of the route contains a variety of camping opportunities, making it an enjoyable way to experience the beauty of this area.

2.4 High Falls

Description: The High Falls sub-watershed, shown in Figure 5, is 202.71 km^2 in area. It follows the Mississippi River from the Crotch Lake outlet, to the High Falls dam and generation station which is just upstream of the Dalhousie Lake inlet.

Municipalities: North Frontenac, Central Frontenac, and Lanark Highlands.

Soils: Mix of Tweed sandy loam rock complex and Monteagle sandy loam rock complex, with fair-sized pockets of muck especially along the river. Due to the shallow soil, underlying bedrock, and abundance of rocks in both soil types, agriculture is limited to small irregular fields and pastures. These soils are better used for non-agriculture uses such as forestry, and wildlife recreation opportunities.

Land use: Agriculture 3.67%, Built up areas 0.00%, Wetlands 4.66%, and 73.2% is forested with 25.1% of the total area as forest interior.

Fishery Resources: Three lakes are classified as cold water, Bottle Lake, Gibsons Lake, and Pennick Lake, all containing Brook Trout. Caldwell is cool to cold with splake and northern pike, Cranberry Lake is cool with small mouth bass, and Antoine Lake and Twentysix Lake are warm to cool water, supporting walleye and bass. Stump Lake and the Mississippi River are warm water supporting walleye and yellow perch

Area of Natural or Scientific Interest (ANSI): Snow Road Station Esker.

Provincially Significant Wetland: Stump Lake.

Other significant features: MVC is currently trying to acquire the property around Ragged Chutes, a set of rapids providing the biggest drop in the river of 20 meters (MRSP, 200), which has the potential to become one of our conservation areas.

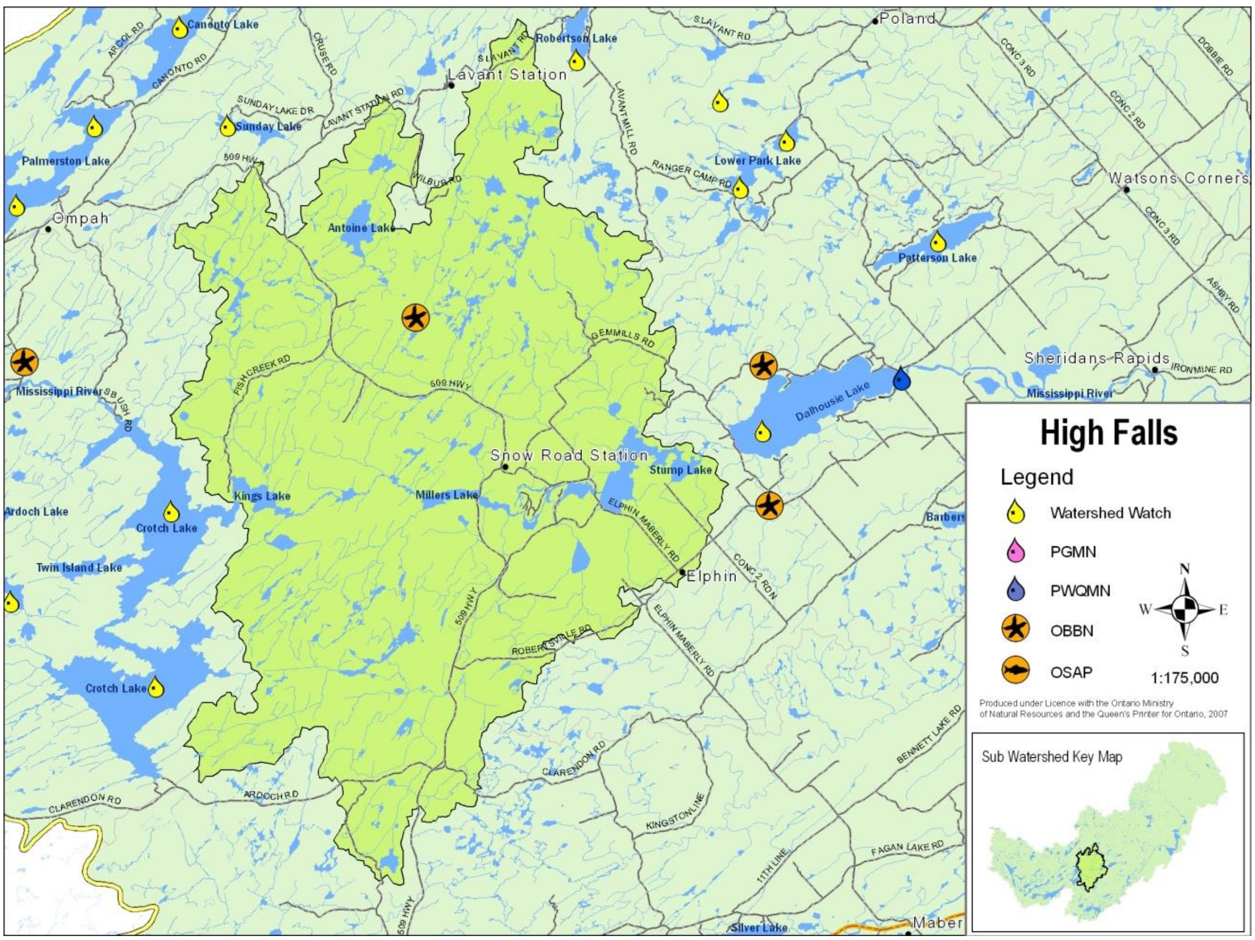


Figure 5: High Falls Subwatershed

2.5 Fall River

Description: The Fall River sub-watershed, shown in Figure 6, is 490.14 km^2 in area and makes up much of the southern border of the MVC watershed. It begins at Sharbot Lake, and goes to the confluence of the Fall River and the Mississippi River east of Fallbrook.

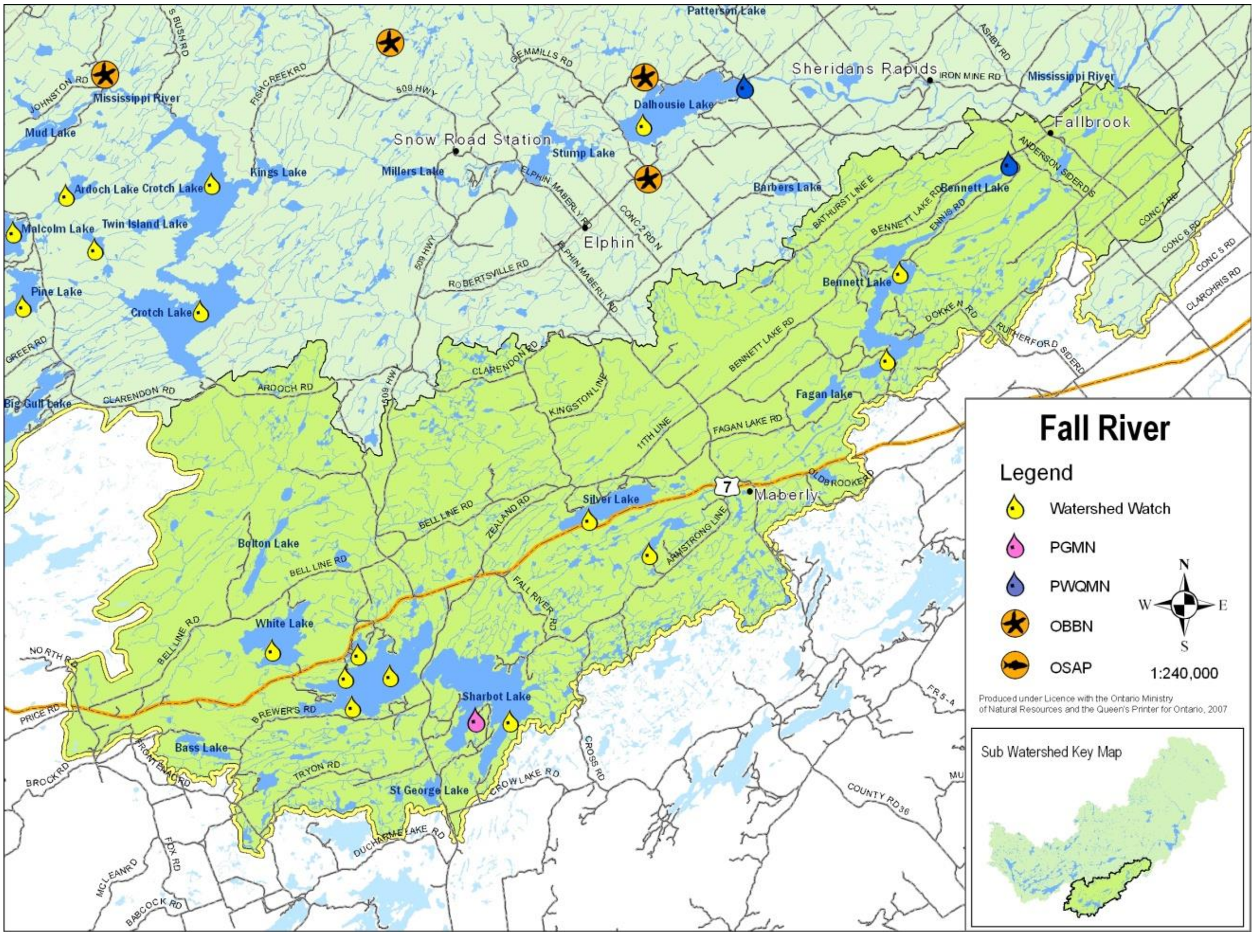


Figure 6: Fall River Subwatershed

Municipalities: Central Frontenac, Bathurst Burgess Sherbrooke, and Lanark Highlands
Soils: Tweed sandy loam rock complex, with Monteagle sandy loam rock complex. These soils are better used for non-agriculture uses such as forestry, and wildlife recreation opportunities. In contrast at the easternmost reaches of the subwatershed the soil types shift away from the Canadian Shield base to a patchwork of many different soil types such as, non-rocky Monteagle sandy loam, muck, and other sandy loam soil types.

Land use: Agriculture 7.78%, Built up 0.03%, Wetlands 5.48%, Forested 45.2% with 7.4% being interior forest.

Fishery Resources: Silver Lake is a cold water lake, and the western basin of Sharbot Lake has coldwater portions. White Lake is warm with some cold and serves as the source water for the White Lake

Provincial Fish Hatchery. While Bennett Lake, Fagan Lake, Bass Lake, and Black Lake all warm water systems (OMNR, 2002).

Area of Natural or Scientific Interest (ANSI): Black Lake Fen, Maberly bog (partial).

Provincially Significant Wetland: Bolton Creek, Upper Fall River, Lower Fall River, Little Mud Lake Wetland, Silver Lake Wetland, Upper and Lower Mud Lake (partial), Bennett lake.

2.6 Clyde River

Description: The Clyde River sub-watershed, shown in Figure 7, is 660.88 km^2 in area comprising a large section of the northern centre of the watershed, including Palmerston and Canonto Lakes. The Clyde River meets the Mississippi just south of Lanark.

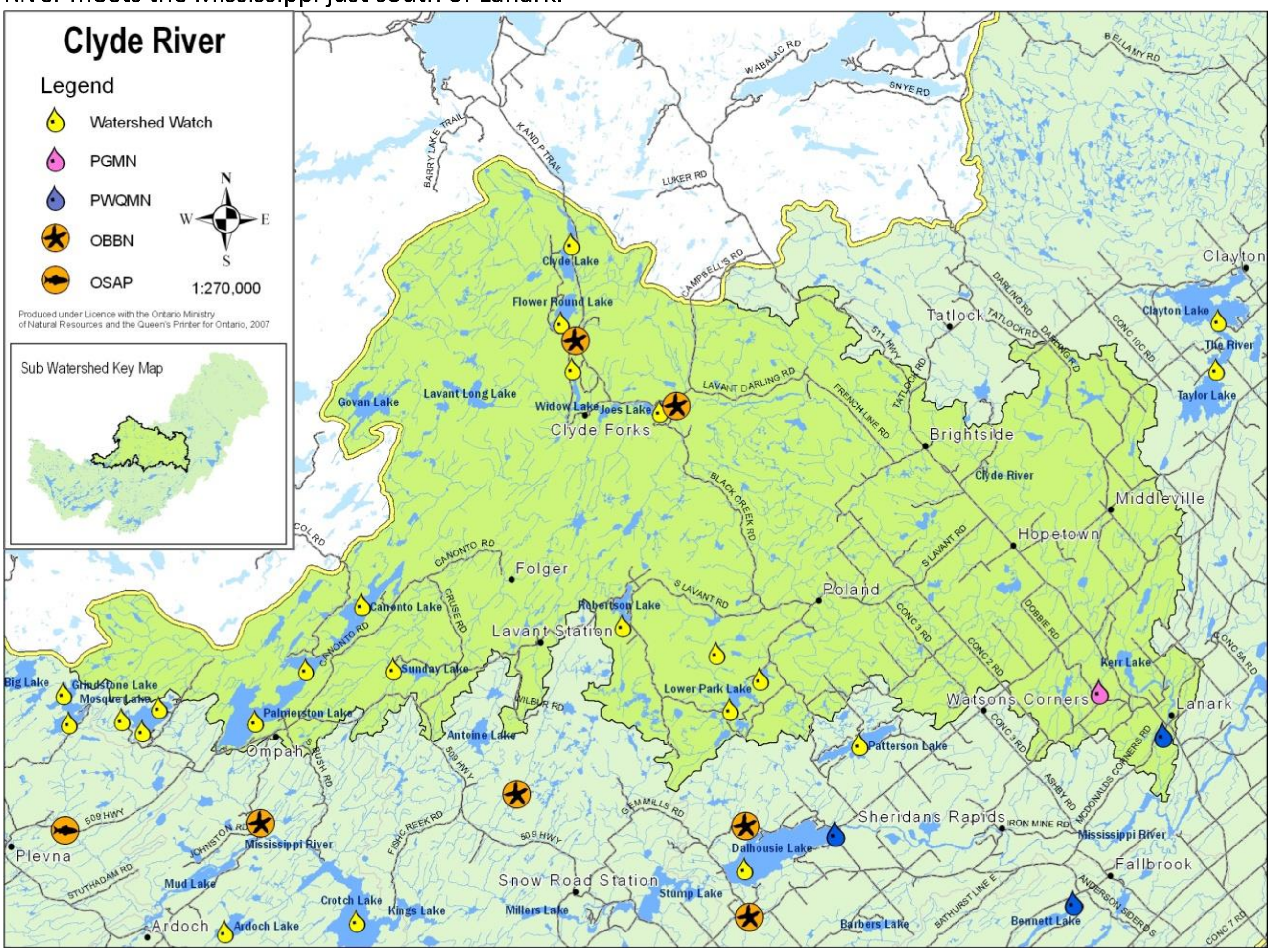


Figure 7: Clyde River Subwatershed

Municipalities: North Frontenac, Greater Madawaska, Lanark Highlands, Drummond/North Elmsley and Tay Valley.

Soils: Monteagle sandy loam rock complex in northern two-thirds (pockets of muck and White lake sandy loam), with Tweed sandy loam rock complex and other minor soil types closer to confluence with

Mississippi. Due to the shallow soil, underlying bedrock, and abundance of rocks in both soil types, agriculture is limited to small irregular fields and pastures. These soils are better used for non-agriculture uses such as forestry, and wildlife recreation opportunities. An item of rarity is the Eganville (rocky phase) soil which is only found in an area of Renfrew county underlain by Ordovician limestone. There is some of this in the far northern part of the Clyde subwatershed.

Land use: Agriculture 4.59%, Built up 0.61%, Wetlands 3.83%, Forested 71.41% with 29% being interior forest.

Fishery Resources: Extensive. Eight listed with cold water species (various trout); significant lakes are Summit Lake, Wolfe Lake, Palmerston Lake. Eastons Creek, Clyde River, and Canonto Lake have cold sections. 22 other lakes possibly typified as cool water which support mostly Northern Pike. 17 lakes have warm water species (OMNR, 2002).

Area of Natural or Scientific Interest (ANSI): Summit Lake (partial), Palmerston Lake (partial).
PSW: Joes Lake, Samuel-Craig-Mackay Lakes Complex, Hopetown Wetland, Kerr Lake, Gillies Lake (partial), Reid lake.

Other significant features: Purdon Conservation Area, located in Township of Lanark Highlands near Dalhousie Lake. Its purpose is to preserve a colony of the rare Showy Lady's-Slipper Orchid, and contains a boardwalk for visitors to gain an up-close view of these and other unique wetland plants.

2.7 Indian River

Description: The Indian River sub-watershed, shown in Figure 8, is 210.87 km^2 in area, flowing from north of Tatlock, through the Mill of Kintail Conservation Area to meet the Mississippi just upstream of Pakenham.

Municipalities: Lanark Highlands, and Mississippi Mills.

Soils: Monteagle sandy loam rock complex and Tweed sandy loam rock complexes, with other sand and sandy loams mixtures making up the rest of the area.

Land use: Agriculture 15.59%, Built up 0.23%, Wetlands 2.56%, Forested 58.9% with 20% interior forest.

Fishery Resources: Five lakes have coldwater species, Peterwhite Lake, Murray Lake, Kate Lake and Dunks Lake, plus the Indian River is considered a cold water system. Clayton/Taylor lakes are warm water bodies (OMNR, 2002).

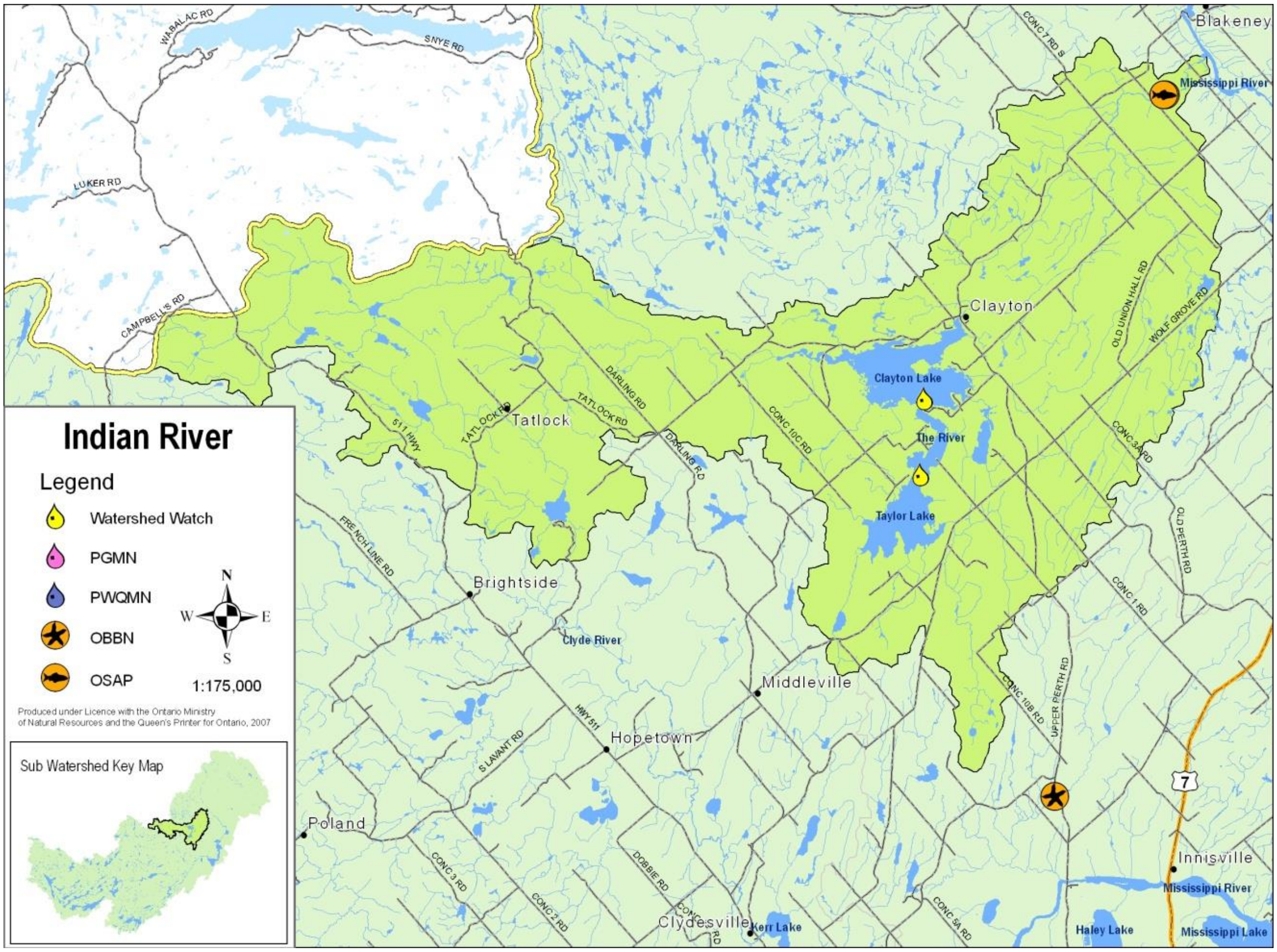


Figure 8: Indian River Subwatershed

Provincially Significant Wetland: Bow Lake, Clayton-Taylor Complex, Wolfe Grove.

Other interesting features: Mill of Kintail Conservation Area is located on the Indian River and is the home base of our outdoor education centre, as well as a museum of the life and works of Robert Tait McKenzie. The property is also host to a network of year-round nature trails.

2.8 Mississippi Lake

Description: The Mississippi Lake sub-watershed, shown in Figure 9, encompasses an area of 487.91 km^2 extending from the High Falls Dam to the Mississippi Lake outlet. The area is also known in some documents as the Carleton Place Dam, because this structure is the dividing point between the Central Mississippi reach and the Lower Mississippi reach.

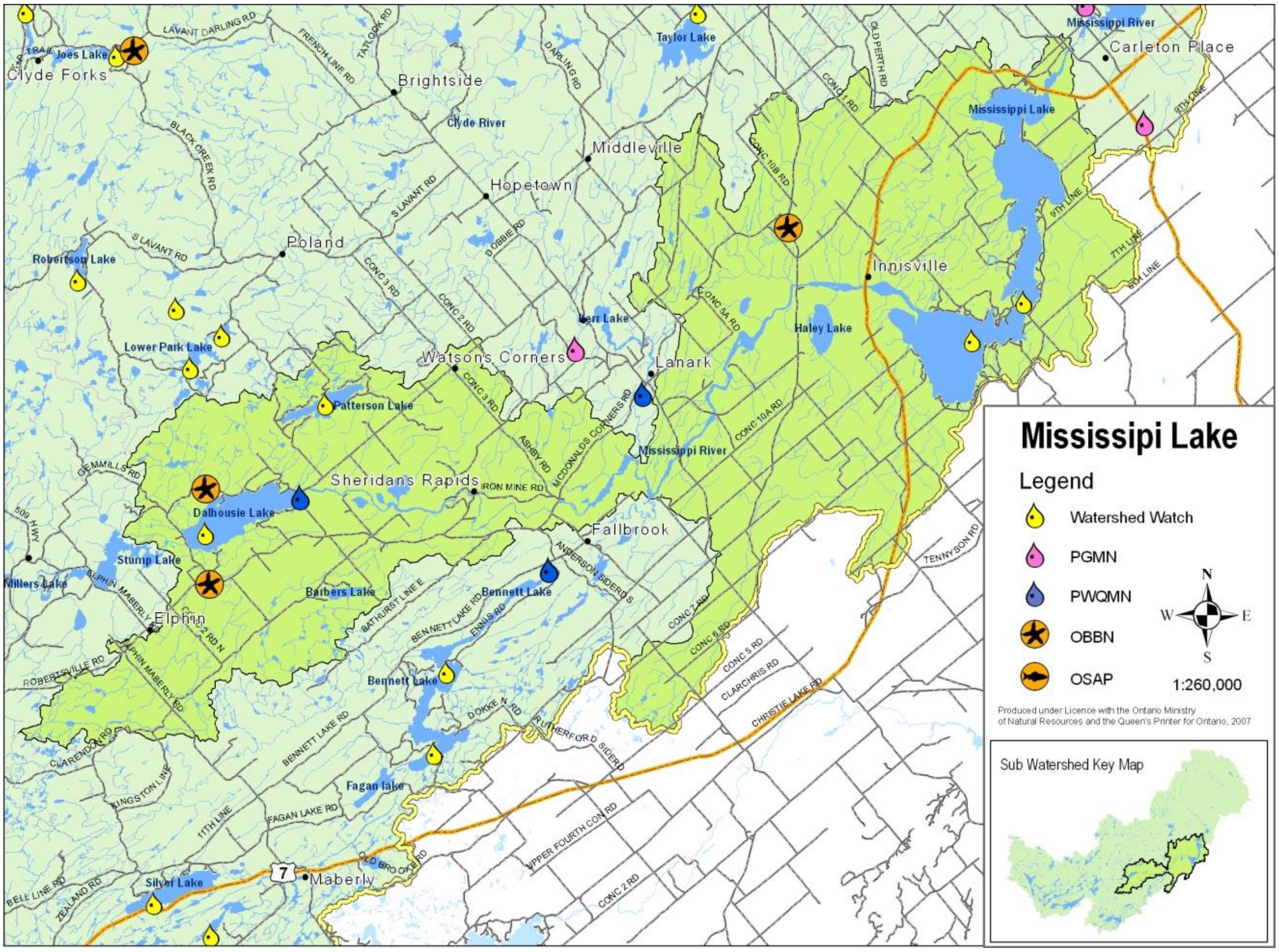


Figure 9: Mississippi Lake Subwatershed

Municipalities: North Frontenac, Central Frontenac, Tay Valley, Drummond/North Elmsley, Beckwith, Lanark Highlands, Town of Carleton Place, and Mississippi Mills.

Soils: Large areas of Muck (organic) soils around Haley and Steward Lakes, and along the shore of Mississippi Lake. Considerable area of Monteagle sandy loam rock complex, with other sandy loams and clay loams.

Land use: Agriculture 16.30%, Built up 0.58%, Wetlands 11.14%, Forested 41.1% with 9.2% interior.

Fishery Resources: With the exception of Patterson Lake having cool waters, the rest of the system has been classified warm water. Mississippi Lake in particular is very shallow and has a recognized warm water fishery of pike, bass, walleye, and panfish. There are issues of concern around Mississippi Lake due to high development and nutrient loading causing algae blooms in the summer *(OMNR, 2002).*

Area of Natural or Scientific Interest (ANSI): Innisville wetland, Perth Blueberry bog.

Provincially Significant Wetland: Gillies lake (partial), Ramsbottom Lake, Campbells Creek Wetland, Steward Lake/Haley lake, Upper and Lower Mud Lake, McEwen Bay Wetland, Mississippi lake, McGibbon Creek, Blueberry Marsh, Scotch Corners Wetland, McCullough's Mud Lake, Playfairville Wetland.

2.9 Lower Mississippi

Description: The Lower Mississippi sub-watershed, shown in Figure 10, is 664 km^2 in area and extends from the downstream side of the Carleton Place Dam, to the confluence with the Ottawa River.

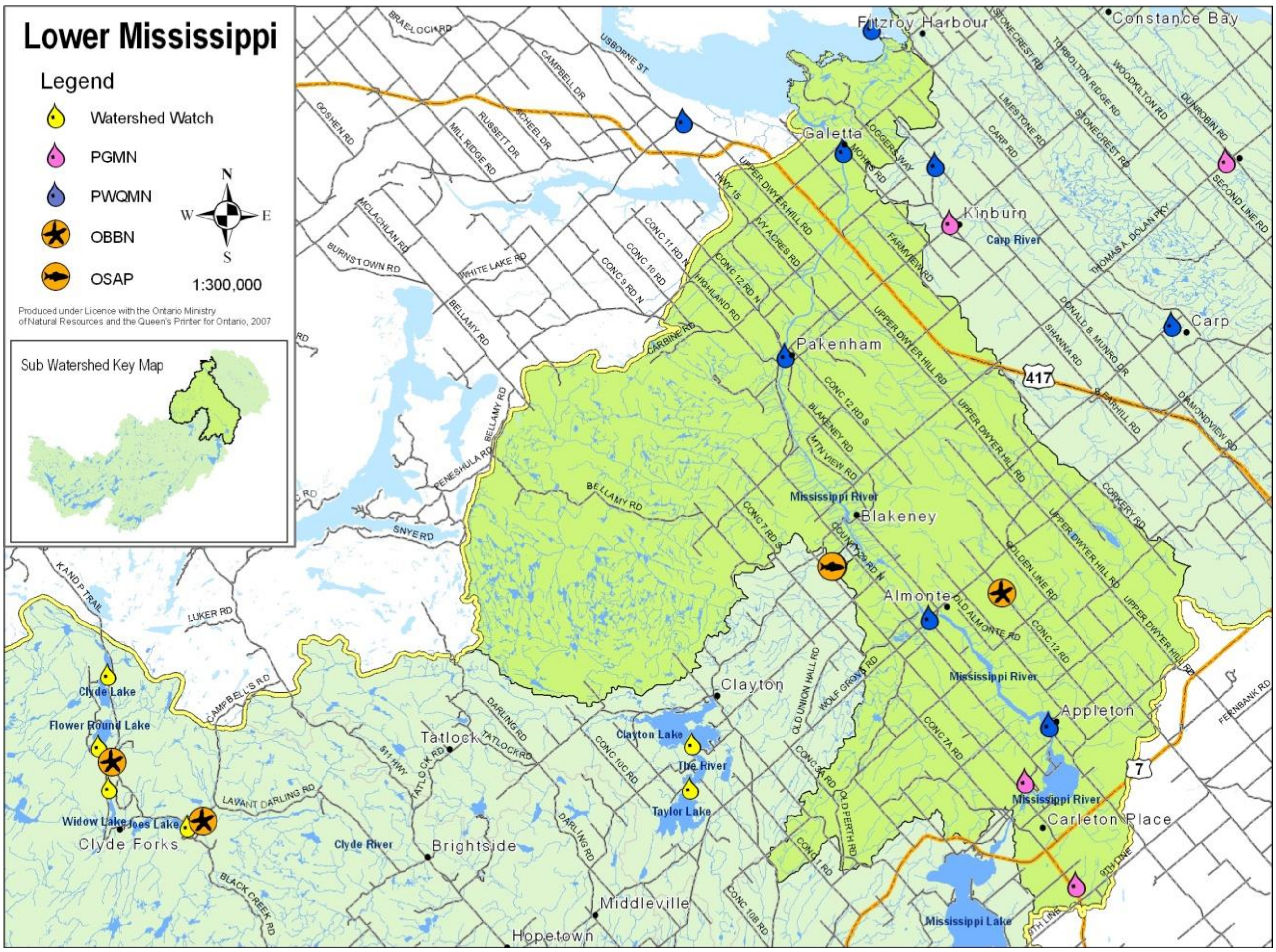


Figure 10: Lower Mississippi Subwatershed

Municipalities: Beckwith, Town of Carleton Place, Mississippi Mills, Lanark Highlands, and the City of Ottawa.

Soils: Highly varied with the usual bedrock in the Pakenham Mountains showing mostly Tweed sandy loam rock complex and Monteagle sandy loam rock complex, Farmington loam and sandy loam around Carleton Place and north, Rideau clay and Dalhousie clay in the lower reaches north of Pakenham towards the Ottawa River. There are mixes right along river of clay loams, silt loams, and sand loams of various types, as well as muck. Farmington series of silt loam soils are shallow with less than one foot of sandy loam till over limestone or sandstone bedrock, well-drained, generally not stony, and are mostly used for grazing.

Land use: Agriculture 28.30%, Built up 2.36%, Wetlands 6.56%, Forested 39.7% with 11.3% being forest interior.

Fishery Resources: Mississippi River, Indian Creek, Madden Lake, and Coyle Lake are all warm water systems *(OMNR, 2002).*

Area of Natural or Scientific Interest (ANSI): Appleton Swamp, Burnt Lands Alvar, Manion Corners Long Swamp Fen, Galetta Black Maple Forest, Mississippi Snye Wetlands, Morris Island Conservation Area

Provincially Significant Wetland: Appleton Wetland, Pakenham Mountain Wetland Complex, Burnt Lands West

Other interesting features: Morris Island Conservation Area is 47 hectares of mainland, and islands along the Ottawa River upstream from the Chats Falls hydrogenation station. There is a network of hiking trails and scenic lookouts to enjoy.

2.10 Carp River

Description: The Carp River watershed, shown in Figure 11, is 300.47 km^2 in area. This area's headwaters are in Stittsville, and then flow though Kanata, past the mall and recent suburban developments, north through rural areas, and then it completes its run at the Ottawa River near Fitzroy Harbour.

Municipalities: City of Ottawa

Soils: Anstruther soils occurring on or in close proximity to "the ridge of Precambrian bedrock with outcrops north of the village of Carp". Coarse textured, considerable amount of granitic material from bedrock origin. The rest of the soils are largely made up of silty clay loams, with pockets of very fine sandy loams, and silt clay mixtures.

Land use: Agriculture 39.08%, Built up 7.48%, Wetlands 5.40%, forested 31.3% with 6.3% forest interior.

Fishery Resources: Smallmouth bass and northern pike are found in the Carp River. Pool Creek in the headwaters is a cold/cool water stream which is stocked with Brook Trout *(OMNR, 2002).*

Area of Natural or Scientific Interest (ANSI): Marathon Forest, Carp River Stromatolites.

Provincially Significant Wetland: Goulbourn complex, Huntley, Scott wetland complex, Corkery Creek, Kilmaurs

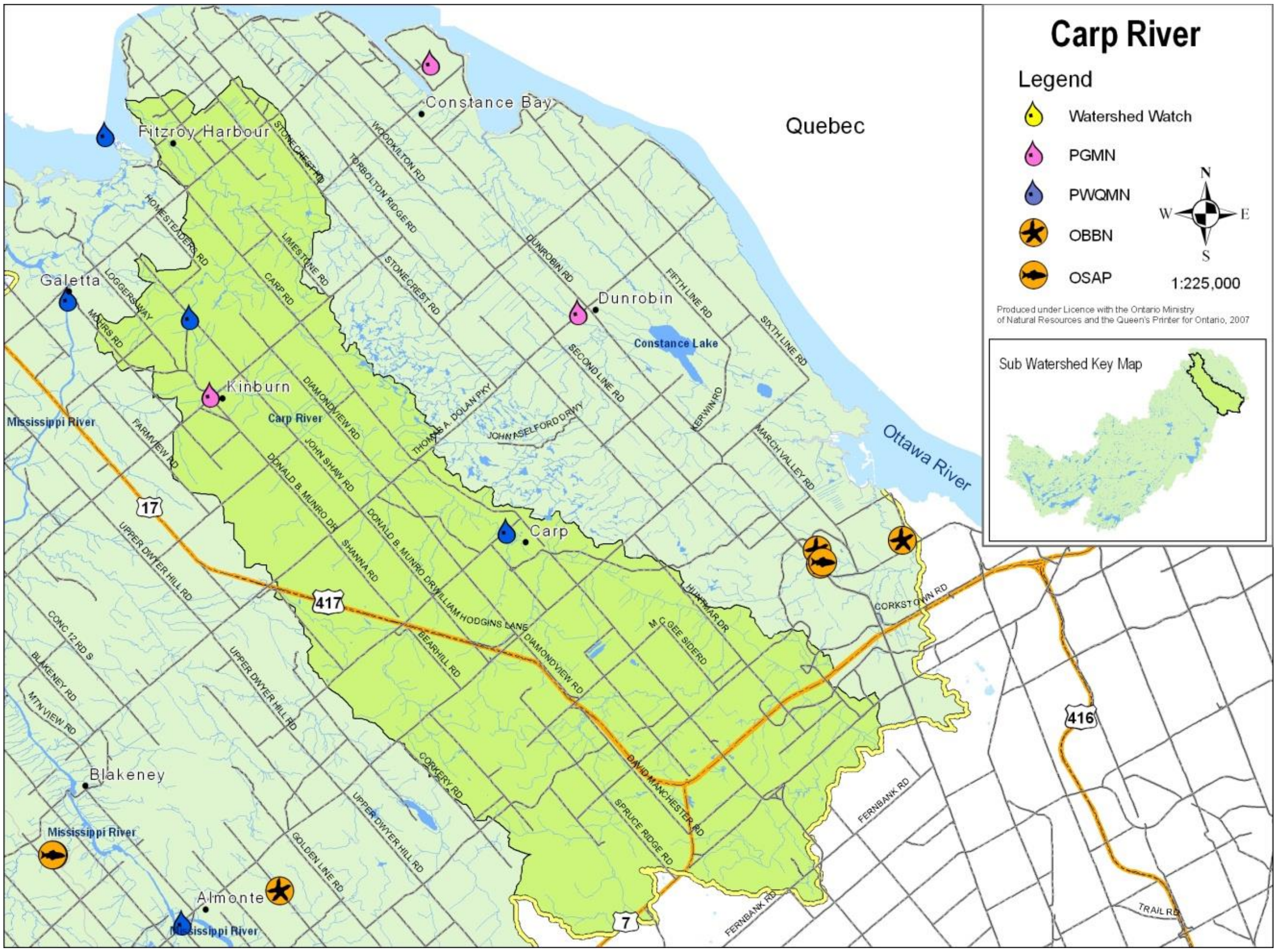


Figure 11: Carp River Subwatershed

2.11 Ottawa River

Description: The area termed the Ottawa River subwatershed (Figure 12) is actually a conglomeration of smaller systems: Shirley's Brook, Kizzel Drain, Watts Creek, and Constance Creek, all of which are located within the boundaries of the City of Ottawa and drain directly into the Ottawa River. These were grouped together for ease of management due to their size and close proximity. The area of this sub-watershed category is 286.84 km^2

Municipalities: City of Ottawa

Soils: Mostly fine sandy soils, especially around the Constance Bay area, the rest is made up of silt clays, or silt clay loam mixtures, making the area very well drained. There are pockets of Leda Clay in this area that come from the pre-glacier Champlain Sea deposits. When triggered by anything from earthquakes, to blasting, placing of heavy buildings or fill on the site, or from heavy rainfall or spring runoff; Leda Clay will turn from its solid form to a liquid causing a landslide (OMNR, 2001).

Land use: Agricultural 34.13%, Built up 9.15% Wetlands 8.59%, Forested 34.5% with 6% of the subwatershed is forest interior.

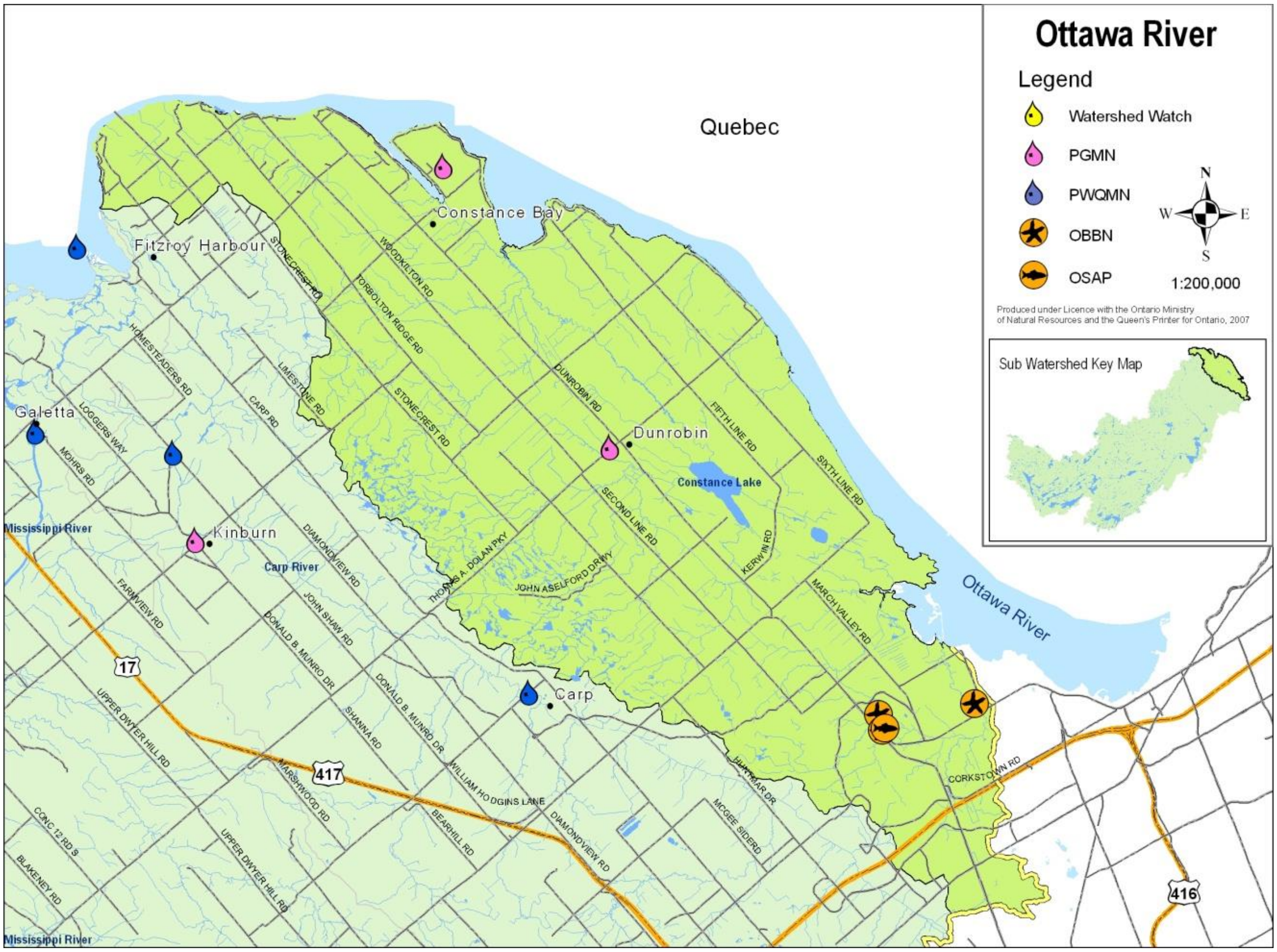


Figure 12: Ottawa River Subwatershed

Fishery Resources: Constance Creek and Constance Lake contain cool water species such as northern pike, and smallmouth bass (OMNR, 2002)

Area of Natural or Scientific Interest (ANSI): Carp Hills/Carp Barrens, South March Highlands, Shirley's Bay, Constance Creek Wetlands, Constance Bay Sandhills, Ottawa River Stromatolites.

Provincially Significant Wetland: Constance Creek, Shirley's Bay, Mud Pond, Stony Swamp Wetland Complex (partial).

3.0 Watershed Report Card Scoring

3.1 Description of Parameters

3.1.1 Forest Conditions

Forests are an integral part of our ecosystem, they provide habitat, shade, clean air, and hold the soil together. Forests also play a role for humans as a place to enjoy nature, or to gain a living, making it very important to understand how much forest we have and its status. The status of the watersheds forests are evaluated by breaking them into two scales, total forested area, and total forest interior, and then applying a grading scheme (Table 3) as outlined in a standardized way by Conservation Ontario. Total forested area is made up of the addition of forest interior and the area known as the forest edge which is covered by a 100m buffer zone that separates a clearing and the interior.

Table 3: Forest Cover and Interior Grading Criteria (Conservation Ontario, 2003)

Forest cover (%)	Forest interior (%)	Point Score	Grade
>25.6	>7.7	5	A
18.8-25.6	5.7-7.7	4	B
11.9-18.7	3.7-5.6	3	C
5.0-11.8	1.7-3.6	2	D
<5.0	<1.7	1	F

Forest interior is what remains when a 100 metre wide buffer is removed from the perimeter of a woodlot (i.e. 100 metres in from the outside edge or from human-made opening like a road). "The 100 metre distance is a minimum because large openings cause changes to forest environments 300 metres or more inside woodlands." The percentage of forest interior is a representation of how much of the entire subwatershed is considered forest interior, not how much is left of the forest area after the buffer is removed.

Forest interior is arguably more important than edge because certain species, especially birds, depend on this undisturbed land for shelter from the effects of wind and sun, it is a more humid environment, has less light, has fewer invasive species to compete for resources with, and fewer predators that are more prevalent in edge, such as raccoons. Due to increasing fragmentation of remaining woodlots, forest interior is becoming increasingly rare, making it a key habitat type for preservation efforts.

Maintaining forest corridors is also a key to preserving forest species by providing a connection to other similar areas to find food, shelter, and a mate. Some animals are not able to travel from one isolated forest to another and so the corridor gives them the required shelter to do so. A corridor can vary from tracks of remnant forest, to simple hedge rows, to a row of groves with small passable gaps between them. Corridors also act as wind breaks reducing erosion, enhance microclimates by being cooler shady areas that moderate the amount of water evaporating from the soil, and providing areas for light recreation such as hiking trails, which all have positive impacts on the wildlife and the humans within the system.

Due to the unique location of our watershed straddling the northern Ontario region defined by the presence of the Canadian Shield, and the Southern Ontario region defined by the lack of Canadian Shield the forest cover and general land use data used for this report had to be created by blending the two data sets that represent these areas (Provincial Land Cover 2000, and Southern Ontario Interim Land Cover), using a standardized procedure and Geographical Information Software techniques.

With reference to Figure 13 the distribution of forest cover within the watershed and its subwatersheds that make up the values in Table 4 can clearly be seen. Two major trends jump out from this figure, the most obvious is that the north eastern section near the Ottawa River is sparsely forested in comparison to the rest of the watershed which shows an abundance of forest in the western end. This highlights the presence of large rural and urban areas to the south and eastern sections of the watershed, in contrast with the cottage country in the north and western sections of the watershed. The second major trend is that the southern edge is showing numerous small clearings, creating an increase in edge forest conditions, and a reduction in the size and abundance of forest interior.

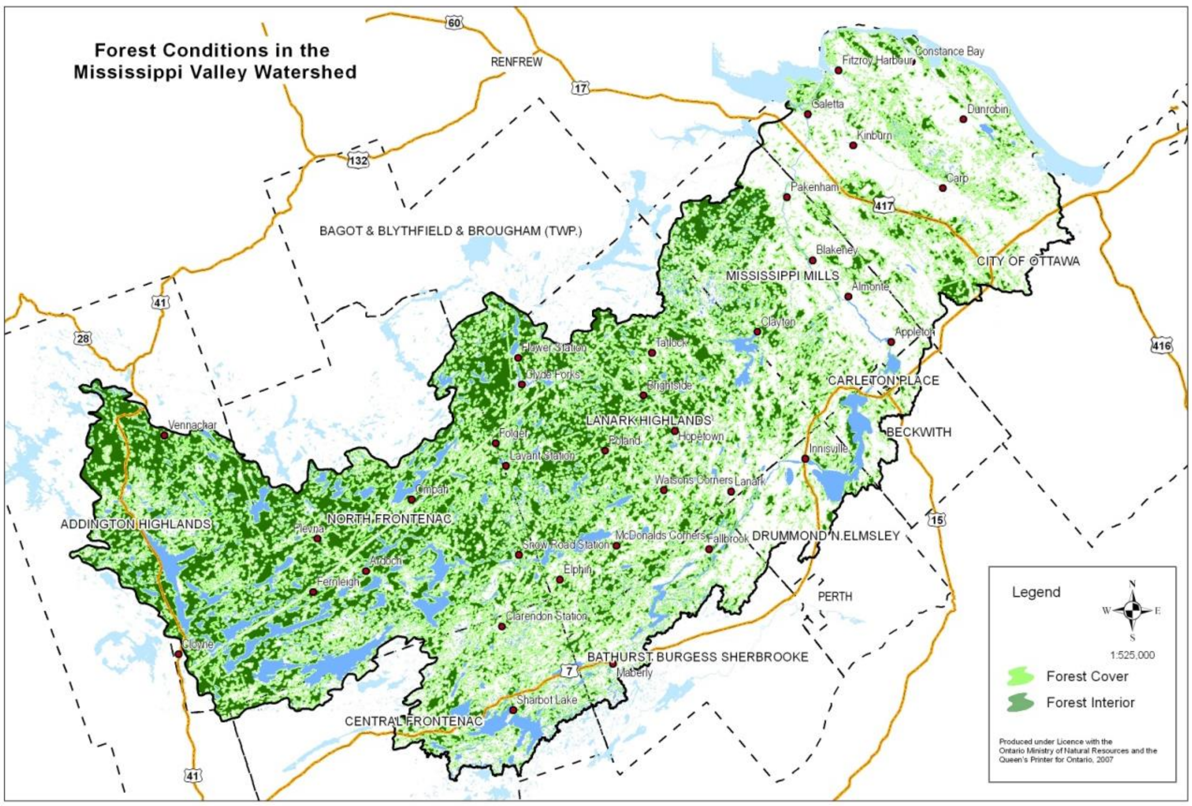


Figure 13: Forest Cover and Forest Interior

Table 4: Subwatershed Forest Cover and Forest Interior, Percentages and Grades

Subwatershed	% Forest Cover	% Forest Interior	Grade
Mazinaw Lake	84%	74%	A
Buckshot Creek	83%	77%	A
Upper Mississippi	71%	59%	A
High Falls	83%	68%	A
Fall River	72%	41%	A

Clyde River	84%	71%	A
Mississippi Lake	42%	39%	A
Lower Mississippi	40%	37%	A
Indian River	76%	58%	A
Carp River	31%	26%	A
Ottawa River	34%	29%	A
Total Watershed	62%	52%	A

3.1.2 Surface Water Quality

Within this section Conservation Ontario has outlined a grading scheme for three different indicators; total phosphorous concentrations, benthic population composition, and E. coli concentrations (Table 5). MVC's sampling efforts have focused upon the first two, providing the results to be discussed in this section.

Total phosphorus has been used as our main indicator of surface water quality. While not a universal quality indicator, total phosphorus concentrations are the best way to describe the nutrient levels of your lake. Phosphorus is the nutrient that controls the growth of algae in most Ontario lakes, because it is the limiting nutrient in most aquatic systems. Meaning that if there is an excess of all the other nutrients needed for growth, and there are low phosphorous levels, growth rates are moderated. High levels can lead to algae blooms, causing a decrease in the dissolved oxygen in the water, as well as decreasing the clarity of the water, which negatively impact the habitat of fish species, with cold water fish such as trout being the most sensitive to these changes.

Phosphorous contamination occurs when pollutants such as detergents, soaps, pesticides, and fertilizers are used near the water and are subsequently washed into the waterway after a rain event. Septic systems can be another source of nutrient contamination of the aquatic environment. Improperly functioning septic systems will not adequately remove nutrients and bacteria due to several different factors. Some of these factors include; improper sizing, broken piping or direct discharge situations. Outdoor showers and greywater sources discharging to the ground surface will carry soaps and detergents directly to nearby watercourses. It is important to always insure that all water using appliances within a household or cottage are connected to the septic system and that it is functioning properly. This, along with a reduction or elimination of pesticide and fertilizer use, will help prevent harmful surface and groundwater contamination.

Provincial Water Quality Objectives (PWQO) "are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycle during indefinite exposure to the water." They are "established when a defined minimum information base representing the following effects is available: aquatic toxicity; bioaccumulation; and mutagenicity" (Ministry of the Environment and Energy, (MOEE) 1994)

There is no firm PWQO for phosphorus, as "current scientific evidence is not sufficient to develop a firm Objective at this time." However there are interim values, which are used as general guidelines, "expected to be supplemented by site-specific studies". Table 6 shows how the "A" grades were further broken down using the interim PWQO's which influence the standard MVC currently uses for its Watershed Watch program (Section 3.1.5).

Table 5: Water Quality Grading Index (Conservation Ontario, 2003)

Benthos Case 1 (RCA)	Benthos Case 2 (biotic index)	E.Coli 5 yr geometric mean (#/100mL)	Total Phosphorus (5 yr pooled sample) (mg/L)	Point score	Grade
P interval > 0.95	< 5.00	0 – 10	< 0.03	5	A
	5.01 – 5.75	11 – 100	0.03 – 0.10	4	B
0.05 < P interval < 0.95	5.76 – 6.50	101 – 1000	0.11 – 0.17	3	C
	6.51 – 7.25	1001 – 10000	0.18 – 0.24	2	D
P interval < 0.05	> 7.25	10 000 +	> 0.24	1	F

Table 6: Enhanced Scoring for Total Phosphorus

Range of values (mg/L)	Grade	Notes
0 - 0.01	A+	Oligotrophic: "A high level of protection against aesthetic deterioration will be provided for the ice-free period. This should apply to all lakes naturally below this value."
0.011 - 0.02	A	Mesotrophic: "avoid nuisance concentrations of algae in lakes" during the ice-free period.
0.021 - 0.03	A-	Eutrophic: "excessive plant growth in rivers and streams should be eliminated" below this level.

*used to break down the "A" grade into more detail based on PWQO standards.

Table 7 presents the phosphorus scoring results showing the 75th percentile of total phosphorus concentrations over 5 years, and 288 samples from 1996 to 2000, and 243 samples from 2001 to 2005. Grades assigned based on PWQO standards for total phosphorus concentrations.

Table 7: Detailed Phosphorus Scoring

Subwatershed	Total Phosphorus (mg/L) 1996-2000	Grade 1996-2000	Total Phosphorus (mg/L) 2001-2005	Grade 2001-2005	Change in quality?
Mazinaw Lake	0.004	A+	0.006	A+	None
Buckshot Creek	N/A		N/A		
Upper Mississippi	N/A		N/A		
High Falls*	0.006	A+	0.011	A	Down
Fall River	0.008	A+	0.011	A	Down
Clyde River	0.01	A+	0.013	A	Down
Indian River	N/A		N/A		

Mississippi Lake*	0.012	A	0.014	A	None
Lower Mississippi	0.016	A	0.02	A	None
Carp River	0.034	B	0.04	B	None
Average for the Watershed	0.013	A	0.016	A	None

*Samples stations are actually located in next subwatershed downstream, however they are so close to the inflow that their values were used to grade the upstream subwatershed.

Phosphorus levels in the Mississippi Valley watershed are measured as a part of the Provincial Water Quality Monitoring Network (PWQMN). There are 16 regular sampling sites throughout the watershed 13 of which are sponsored by the MOE while MVCA sponsors the other 3 samples, all of which are collected monthly during the ice free season of April to November. Due to budget changes over the years certain sites have data going back to 1966 with some gaps in data years, and 10 sites were added in 1968 and then removed by 1972. Seven currently monitored sites have been selected as being representative of their respective subwatersheds because they are located at the most downstream location within the subwatershed. Thus showing what that subwatershed contributes to the larger system.

It can be seen in Table 7 that 3 of our subwatershed's phosphorus levels are not currently monitored throughout the year, and it is proposed that future efforts aim to even out the sampling effort by reinstating historic sampling stations within those subwatersheds.

When analyzing the data, the 75th percentile was used over a 5-year period in order to "reflect the tendency for PWQMN data to be dry-weather based", meaning that over 5 years the variations caused by seasonal droughts, or extremely wet conditions, do not bias the phosphorus concentration trends.

The City of Ottawa conducts its own water sampling within the Ottawa River subwatershed, thus their results, although displayed differently (Table 8), have been used to provide the area with a surface water grade. Due to the variety of stream basins within this watershed, phosphorous results are shown for 5 of the major creeks instead of averaging them.

Table 8: Ottawa River - Average Phosphorus, up to 2004

Subwatershed	Number of samples	Average Total Phosphorus (mg/L)	Grade
Constance Creek	95	0.046	B
Shirley's Brook	111	0.045	B
Watts Creek	87	0.068	B
Casey Creek	87	0.105	C
Harwood Creek	79	0.062	B
Average	459	0.065	B

3.1.3 Benthic Macro Invertebrates

"Benthic organisms are the aquatic invertebrates that live in stream sediments and are a good indicator of water quality and stream health." Their limited mobility makes them a better indicator than fish, since they can't simply swim away from contamination, or the sampling procedure. Different species can have radically different tolerances to pollution, sedimentation, temperature, dissolved oxygen, and so on; making it possible to create a grading scale for water quality based on the composition of organisms found. For example a Stonefly (Plecoptera) requires fast water and high oxygen to thrive, whereas a Scud (Isopoda) can be found in slower more turbid waters (Hilsenhoff, 1988). To assist in determining the quality of the stream other indicators such as, pH level, water temperature, dissolved oxygen (mg/L) and conductivity (µS/cm) are measured and recorded.

MVC samples aquatic invertebrates as part of the Ontario Benthos Biomonitoring Network (OBBN). It is a standardized provincial program co-operatively developed by Environment Canada's Environmental Monitoring and Assessment Network (EMAN) and the National Water Research Institute (NWRI), as well as the Ontario Ministry of the Environment (MOE). The program was adopted by MVC in 2003 and now has 17 sites that have been sampled at least once. Preliminary results seem to support the subwatershed grades obtained from the phosphorus analysis (Table 7), though there's not enough data at this point to draw any formal/reliable conclusions. An increase in sites and repetitions of current sites will result in more specific subwatershed conclusions for future reports.

To be consistent across the province future samples will be scored using the Family Biotic Index (FBI), which assigns a value to each species based on its tolerance to contamination, and use that to calculate a score. This score will then be compared to the grading scale as defined by Conservation Ontario.

3.1.4 Groundwater

Groundwater is an integral part of our ecosystem as a storage basin of water that has been filtered through many layers of soil and rock. This water then flows underground to outlets known as springs where it becomes part of the surface water system of creeks, ponds, and rivers. This balance of water flow can be disrupted in two major ways, either from drought reducing the amount of water filtering through the soil, or by increased withdrawal of groundwater for anthropogenic uses.

Over three million Ontario residents rely on groundwater as their source of drinking water and so the monitoring of the amount of water available to these people is of importance. With this understanding the Provincial Groundwater Monitoring Network (PGMN) was initiated in partnership with the MOE after the spring and summer of 1999, when low water conditions in many parts of southern Ontario prompted the formation of an inter-ministerial task force to assess drought conditions, determine trigger levels and develop a response strategy. The intent of the network upon its creation is to enable an accurate assessment of current groundwater conditions, provide for an early warning system for changes in water levels (caused by climatic conditions or in response to human activities such as water takings), as well as, provide an early warning system for changes in water quality from natural or manmade causes. It is important to keep in mind that the results that we receive from this testing does not reflect a private well's supply of drinking water. This is because the sampling wells were intentionally located in areas of isolation from potential pollutants to provide data on background water levels, and background concentrations of naturally occurring organic and inorganic substances.

Nine monitoring wells have been established in the Mississippi Valley watershed, and in the near future we are looking at adding another well to the network. The first round of water samples were taken in the fall of 2006; however it will take many more years of sampling to collect enough data to make a meaningful conclusion on the status of the groundwater. In the meantime variables such as water level and temperature are constantly being monitored and entered into a provincial wide data base to track the changes in groundwater level as an indicator of the supply of groundwater to our ecosystem. It is our intention that in five years, there will be enough data to provide the public with some groundwater information in the next report card, using the Conservation Ontario scoring index shown in Table 9.

The water is sampled for 30 variables, however Nitrogen in the form of Nitrate plus Nitrite, and Chloride levels are of most concern to monitoring because of their potential effect on human health, and because they are easily identifiable indicators that can be linked to other harmful sources of pollution.

Table 9: Groundwater Quality Scoring Index (Conservation Ontario, 2003)

Nitrate + Nitrite (mg/L)	Chloride (mg/L)	Point Score	Grade
0-3.0	0-50	5	A
3.1-7.0	51-100	4	B
7.1-10.0	101-150	3	C
10.1-20.0	151-200	2	D
>20.0	>200	1	F

Although nitrogen does occur naturally in the environment at safe levels and is very useful to plants, too much nitrogen in drinking water can be an indicator of contamination. "Elevated nitrate levels may suggest the possible presence of other contaminants such as disease-causing organisms, pesticides, or other inorganic and organic compounds that could cause health problems." (PWQO) The drinking water standard set by the Ontario Provincial Water Quality Objectives (PWQO) says that when nitrogen levels are consistently above 10mg/L the risk of blue baby syndrome is increased. Blue baby syndrome is caused when excess nitrogen in the body inhibits the blood from carrying an adequate amount of oxygen to the organs causing the skin to appear bluish, and in extreme cases can be fatal in infants younger than 6 months old.

Similar to nitrogen, almost all natural water contains chlorides in low to moderate concentrations. A maximum concentration of 250mg/L in drinking water has been set by the PWQO, because it is at this concentration or higher the water has a noticeably salty taste. But according to the World Health Organization (WHO) there has been no health based value assigned to chloride concentrations in drinking water (WHO, 2003). Although high levels of salt intake in our diet have been linked to high blood pressure which can increase the risk of heart attack and stroke, or dehydration; the main source of chlorides in a human's diet comes from the addition of salt to food and not from their drinking water (WHO, 2003). High levels of chlorides in the water can originate from natural sources, or it can be an indicator of leaching from sewage, industrial effluents, or urban run-off from de-icing activities (WHO, 2003).

It is due to these factors and many more that we encourage private well owners to regularly test their drinking water and be "Well Aware". More information is availed in our library as well as from your local health unit who can supply free water testing kits.

3.1.5 Watershed Watch: Lake Monitoring

MVC's major sampling program revolves around our watershed's abundance of lakes. Watershed Watch (WW) samples the deepest point of 42 lakes, as well as sampling other deep basins within the larger lakes bringing total sampling stations to 59 sites. The majority of the lakes have been divided into a once in 5 year sampling rotations. Variables such as pH, water temperature, dissolved oxygen, water clarity, and phosphorous concentrations are monitored 3 times within the sample year to show seasonal transitions in the chemistry of the lake. The data that is gathered during sampling is turned into a summary report and posted on our website, as well as made available for cottage association meetings. Certain lakes have been fortunate enough to have been adopted by Waste Management Canada, and Omya Canada Inc., who donate the money required to increase our sampling effort to 8 times within a given year, as well as increasing the number of times a lake is sampled within the 5 year cycle. Since this program was started in 1998 the second round of sampling will be completed this summer providing for some loose comparison of years, however 2 sampling years of data per lake is not enough to draw any statically significant conclusions. More repetitions of the sampling protocol are required to rule out seasonal variations affecting the results, so MVC will continue to collect and monitor these lakes and watch for signs of change.

The objectives of the program are to accumulate reliable environmental data, both historic and current, and to determine the limits of which lakes can assimilate nutrient input. The data will be used to encourage shoreline property owners to undertake restoration projects and to adopt sound stewardship practices. The lakes will be monitored over five years to identify and document long-term trends in water quality. The key parameters (total phosphorus, dissolved oxygen, temperature and water clarity) will provide a simple, cost-effective means to quantify the extent of aging of the lakes.

Phosphorus is the nutrient that controls the growth of algae in most Ontario lakes because it is the limiting nutrient in most aquatic systems. Meaning that if there is an excess of all the other nutrients needed for growth, and there are low phosphorous levels, growth rates are moderated. High levels can lead to algae blooms, causing a decrease in the dissolved oxygen in the water, as well as decreasing the clarity of the water, which negatively impact the habitat of fish species, with cold water fish such as trout being the most sensitive to these changes.

Phosphorous contamination occurs when pollutants such as detergents, soaps, pesticides, and fertilizers are used near the water and are subsequently washed into the waterway after a rain event. Septic systems can be another source of nutrient contamination of the aquatic environment. Improperly functioning septic systems will not adequately remove nutrients and bacteria due to several different factors. Some of these factors include; improper sizing, broken piping or direct discharge situations. Outdoor showers and greywater sources discharging to the ground surface will carry soaps and detergents directly to nearby watercourses. It is important to always insure that all water using appliances within a household or cottage are connected to the septic system and that it is functioning properly. This, along with a reduction or elimination of pesticide and fertilizer use, will help prevent harmful surface and groundwater contamination.

Clarity is not only important for the aesthetic quality of enjoying a lake; it can be an indicator of algae concentrations, as well as the turbidity of the waterbody. It is an indicator of how deep in the water the sun's rays can penetrate, which is good for oxygen production by algae and other aquatic plants, which then benefits the lakes food chain and the fish population. Fish species survival can be affected by clarity because some of them, like the Northern Pike, are visual hunters and need clear water to be able to see their prey to be successful, where as other fish such as the Brown Bullhead have other methods of gathering food and may not be affected by the waters clarity. Clarity is monitored by lowering a Secchi Disk into the water at the deepest point and recording the depth when the disk is no longer visible. Doubling this value defines the euphotic zone, which is the area of light penetration and thus greatest activity; it is also the area where the total phosphorous sample is taken from to assess the concentration of nutrients affecting the lakes productivity.

By combining the clarity and euphotic phosphorous values for the deepest point in each lake a standardized trophic characterization can be given and status can be assigned. Trophic characterizations are broken down into 3 groups ranging from low concentrations of nutrients with a high clarity value to very high concentrations of nutrients with a low clarity value, oligotrophic, mesotrophic, and lastly eutrophic. Table 10 presents the index recommended by the Ontario Ministry of the Environment for the Lake Partner Program to determine a waterbodies trophic status based on its total phosphorous and water clarity (Secchi transparency) readings (Ministry of the Environment , 2005). It should be recognized that some lakes naturally occur in these ranges; however the red flag is raised when a lake known to exist at one state either becomes enriched with nutrients (eutrophic), or ends up void of nutrients (oligotrophic), thus changing its status and prompting further investigation. Another red flag is sometimes raised when a lake is found to be hypereutrophic, meaning the lake is super enriched with nutrients, generally due to human activity, and makes the waterbody nearly uninhabitable due to lowered oxygen concentrations.

Table 10: Trophic Status Index used in Watershed Watch Analysis

Parameter	Oligotrophic	Mesotrophic	Eutrophic
Total Phosphorous (μg/L)	≤10	11-20	≥21
Secchi transparency (m)	≥5	3.0-4.9	≤2.9

Source: Ontario Ministry of the Environment (MOE). 2005. Interpretation of TP and Secchi Results. Guideline Prepared for Lake Partner Program

In Partnership with the Ontario Federation of Anglers and Hunters (OFAH), MVC implements an invasive species monitoring program which includes but isn't limited to, sampling our Watershed Watch lakes for Zebra Mussel veligers (larva), and Spiny Waterflea, doing educational talks with shoreline residents, and distributing educational material. The invasive species monitoring has been expanded beyond the yearly set of lakes chosen for WW to include lakes from other years as well as other lakes in our watershed to insure that our invasive species data is as up to date as possible. This allows for more accurate information sharing on the prevention of transferring these species to lakes where they have not become established.

Table 11 presents a summary of Watershed Watch lakes invasive species status, and trophic status as determined according to the index shown in Table 10. Lakes without a 5 year value are currently being sampled.

Table 11: Summary of Watershed Watch Lakes

Lake Name	Subwatershed	Number of sampling stations	Zebra Mussel Veligers Present	Spiny Waterflea Present	Clarity (m) first sample	Clarity (m) after 5 years	Phosphorus (ave. yearly value - euphotic zone mg/L) first sample	Phosphorus (ave. yearly value - euphotic zone mg/L) after 5 years
Ardoch	Upper Mississippi	1	No	No	Mesotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Bennett	Fall River	2	**Yes**	No	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Big Gull	Upper Mississippi	3	No	**Yes**	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Black	Fall River	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Blue	Buckshot Creek	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Buckshot	Buckshot Creek	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Canonto	Clyde River	2	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Clayton	Indian River	1	No	No	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Clear	Fall River	1	**Yes**	No	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Clyde	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
Crotch	Upper Mississippi	2	No	**Yes**	Mesotrophic	Mesotrophic	Oligotrophic	Mesotrophic
Dalhousie	Mississippi Lake	1	**Yes**	No	Mesotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Fawn	Upper Mississippi	1	No	No	Mesotrophic	Mesotrophic	Mesotrophic	Eutrophic
Flower Round	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
Grindstone	Buckshot Creek	2	No	No	Oligotrophic	Oligotrophic	Mesotrophic	Mesotrophic
Horne	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
Joe’s	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
Kashwakamak	Upper Mississippi	2	**Yes**	**Yes**	Mesotrophic	Oligotrophic	Mesotrophic	Oligotrophic
Kishkebus	Mazinaw	1	No	No	Mesotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Macavoy Lake	Mazinaw	1	No	**Yes**	Mesotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Malcolm	Upper Mississippi	1	No	No	Mesotrophic	Mesotrophic	Mesotrophic	Oligotrophic
Marble	Mazinaw	1	No	No	Mesotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Mazinaw	Mazinaw	2	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
McCausland	Mazinaw	1	**Yes**	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Mississagagon	Buckshot Creek	2	**Yes**	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic

Lake Name	**Subwatershed**	**Number of sampling stations**	**Zebra Mussel Veligers Present**	**Spiny Waterflea Present**	**Clarity (m) first sample**	**Clarity (m) after 5 years**	**Phosphorus (ave. yearly value - euphotic zone mg/L) first sample**	**Phosphorus (ave. yearly value - euphotic zone mg/L) after 5 years**
Mississippi	Mississippi Lake	2	**Yes**	No	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Mosque	Upper Mississippi	3	**Yes**	No	Mesotrophic	Oligotrophic	Eutrophic	Oligotrophic
Paddy's	Clyde River	1	No	No	Eutrophic		Eutrophic	
Palmerston	Clyde River	2	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Patterson	Mississippi Lake	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Mesotrophic
Pine	Upper Mississippi	1	No	No	Oligotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Roberston	Clyde River	1	No	No	Oligotrophic		Oligotrophic	
Sand	Buckshot Creek	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Shabomeka	Mazinaw	1	No	No	Oligotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Sharbot west basin*	Fall River	3	No	No	Mesotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Sharbot east basin*	Fall River	1	**Yes**	No	Mesotrophic	Oligotrophic	Oligotrophic	Oligotrophic
Shawenagog	Buckshot Creek	2	**Yes**	No	Mesotrophic	Mesotrophic	Mesotrophic	Oligotrophic
Silver	Fall River	1	**Yes**	No	Oligotrophic	Oligotrophic	Mesotrophic	Oligotrophic
Sunday	Clyde River	1	No	No	Mesotrophic	Oligotrophic	Mesotrophic	Oligotrophic
Taylor	Indian River	1	No	No	Eutrophic		Mesotrophic	
Upper Park	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
White	Fall River	1	No	No	Mesotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Widow	Clyde River	1	No	No	Mesotrophic		Mesotrophic	
Total		**59**	**11 lakes**	**4 lakes**				

3.2 Scoring of Subwatersheds

A summary of grades for each subwatershed in each category as defined above is presented in Table 12.

Table 12: Summary of Subwatershed Grades

Subwatershed	Forest	Groundwater	Surface Water
Mazinaw	A	N/A	A+
Buckshot	A	N/A	N/A
Upper Mississippi	A	N/A	N/A
Clyde River	A	N/A	A
Indian River	A	N/A	N/A
High Falls	A	N/A	A
Fall River	A	N/A	A
Mississippi Lake	A	N/A	A
Lower Mississippi	A	N/A	A
Carp River	A	N/A	B
Ottawa River	A	N/A	B

4.0 Summary/Conclusions

The data used in this report is not a representation of ideal or pristine conditions however it creates a baseline of values to gauge the changes in our watershed. Unlike other watersheds in more developed areas, we are very fortunate that many of our values are nearly ideal, and we should show pride in this status and a dedication to continue to receive high grades for future report cards.

Forest cover and forest interior is essential for the health of the whole watershed. Due to the importance of large tracks of connected forest, maintaining these high percentages of coverage is very important to the wildlife and to the humans who use these areas. The appeal of cottage country wouldn't be what it is, without the atmosphere that living in or near a forest can give. Forests help clean our air, shade and cool our streams, hold our soil, and thus assist in purifying our water and reducing the siltation that reaches our waterways. Forest interior levels need to be maintained or enhance to allow interior forest birds and animals to survive. They can be highly sensitive to crowding, light levels, temperature, and wind, all of which can cause a reduction in territory size or quality which could mean their capability to reproduce and be here in years to come is reduced. The opportunity for a species to safely migrate is also essential to its ability to forage and find a mate. Without a good network of connected forests and forest interiors these survival skills are inhibited while increasing the potential for encounters with edge predators.

Surface water quality is generally good, with only one subwatershed not receiving an A grade. Three of the subwatersheds measured fell in quality from an A+ to an A from the previous five years' measurements, but are still well within accepted levels and so are not a cause for concern. Only the Ottawa subwatershed showed a grade less than an A, but this can be attributed to the area being the most developed of the subwatersheds.

The quality of our lakes is astounding with 40 lakes in the watershed being cold water lakes (14 of which are sampled by Watershed Watch), and out of 42 sampled lakes only 13 are affected by invasive species. The quality of the water is also generally good with most lake's status occurring within the mesotrophic range. The lakes that do not occur in this middle range are not too far in the extremes of nutrient poor, or nutrient rich. However in an effort to control algae blooms it is important to ensure that the lakes are not receiving the anthropogenic excess of nutrients that puts the lake into the eutrophic category by reducing or eliminating the surface run off of fertilizers, soaps, grey water, or septic leaching.

Although many areas have received high grades it is not a sign that we can relax our environmental protection and best management efforts. On the contrary it is a sign that we should maintain if not enhance our protection efforts in order to preserve our environment in the best condition possible for the benefits to our generation, and for generations to come. We only have good areas once, and after they have been altered it takes a lot more time and money to restore them than it did to harm them, so with the aid of good stewardship and best management practices we can continue to use and live on the land while protecting it. As for the areas that have received lower grades, there is a lot that can be done on the local level to restore and protect those areas in order to prevent them from sliding further down the grading scale.

4.1 Future Actions

In the future, we will continue monitoring of existing surface water sampling sites, and all other measures currently underway. There will also be several additional measures undertaken, as follows:

- Sample site distribution will be adjusted to better represent all the subwatersheds. 3 currently sampled PWQMN sites are being discontinued because their results have been determined to be redundant, and 2 new sites will be picked up in 2007, 1 on the Indian River, and 1 on Buckshot Creek to represent those subwatersheds contribution to the Mississippi River.

- Some of the PWQMN variables are also being changed in 2007 and for following years to better focus our efforts and sampling budget on results that will be relevant and useful.

- We also aid in monitoring a few areas beyond our borders because we are the closest trained body to take these samples. Watershed Watch has been expanded to sample White Lake, near Arnprior, and the PWQMN has been expanded to include the outlet of the Bonnechere River in addition to our current sampling site in Arnprior at the mouth of the Madawaska River to supply data to the MOE.

- Benthic sampling will be increased to better represent all the subwatersheds, as well as a sampling cycle will be created to track changes in previously sampled areas.

- Inspection of waterfront alteration activities and enforcement of our regulations has increased and will continue to increase to ensure that our waterways are not continuing to be negatively impacted by human actions.

Most of the land that lies within the Mississippi River's watershed is privately owned and so it is up to these land owners to act as the front line of defence to help prevent a decrease in the quality of the streams, rivers, lakes, and forests that create the environment that currently exists and is receiving such high grades. MVC enjoys working closely with individual land owners and organized groups such as lake associations, naturalists, and stewardship comities to assist with this task. We can provide expert guidance on site specific issues, supply educational materials, and help bring groups together so that they are all using the same best management practices to balance their needs on the land and the need to preserve the quality of the ecosystem. MVC's 2 main programs that relate to stewardship outreach are the Landowner Advisory Service (LAS), and our Lake Association/Lake Steward relations.

The LAS is a land management-based initiative that allows landowners to access professional advice through the conservation authority on a variety of topics such as, forest, wetland, and habitat management for commercial, agricultural and recreational land uses. This is done through outreach programs such as public speaking within the community, seminars, workshops, providing literature at the office, in office or onsite meetings with land owners, and MVC can also provide referrals to other organizations that can best meet the needs of the situation.

The other major stewardship communication initiative is with the lake associations within our watershed. Most associations are made up of concerned waterside landowners headed by a lake steward. MVC's monitoring department works closely with them to monitor the quality of the lake for all recreational uses such as swimming and fishing. This can include dock side community talks on best management strategies, our sampling protocols, and how the association can assist us in maintaining or expanding the monitoring efforts, which provides the data so that landowners can be well educated on the status of their waterbody. There are many areas where lake associations due not exist, if you are in one of these areas do not let that stop you from becoming a lake steward; please contact our office and we can provide you with useful information, and connect you with lake associations within your area so that you can learn from their experiences as well as ours.

4.2 How You Can Help

Whether or not you're a rural land owner, cottager, or solely an urban dweller, there is a lot that you can do to help protect our watershed and maintain or restore its status as a clean and healthy environment.

Take part in Citizen Science, they have a variety of volunteer sampling programs that you can participate in on your own property. Check out www.naturewatch.ca for a list of current programs offered by the Canadian Nature Federation. These efforts helps supplement our sampling because you are the ones most familiar with the site, thus you are the ones who can best tell if something has changed over time. Citizen science and other volunteer programs help monitor these changes and put them on a standardized comparable scale making your observations useful and important to the watershed and the province.

Other ways that you can be involved are listed below:

- Lake Partner program
- Stewardship program
- Get involved with the naturalists or cottage associations

- Read documents such as the Shoreline Primer and Dock Primer that are published by the DFO.
- Tree and shrub planting
- Litter picking
- Water conservation activities
- Maintain/enhance buffer zones
- Nutrient management
- Maintain septic systems and wells

MVC is a great source of information for these activities as well as an aid to get them done. For example our planning department is responsible for giving out advice and permits to insure that any work done in or near the water is handled in a way that will minimize the impact on the system. We also have a land owner advisory program that promotes best management strategies by allowing landowners access to professional site specific advice on forest and wetland management, for commercial, agricultural or recreational uses. We are also a contact point for the Ottawa Rural Clean Water Program which provides financial assistance to rural landowners within the city's boundaries with the goal of protecting our surface and groundwater by replacing or upgrading wells, septic systems, chemical storage facilities, nutrient management plans, and educational initiatives; to name a few of the activities that are covered.

If you're not sure how or if we can lend a hand check out our website, or give us a call.

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6.0 Glossary

Agriculture: Includes areas of cropland, and pasture.

AREA OF NATURAL OR SCIENTIFIC INTEREST (ANSI): Area of Natural or Scientific Interest, are areas containing natural landscapes or features that have been identified by the MNR as having life science of earth science values related to protection, scientific study, education and natural heritage appreciation. This designation is used to help protect special and representative areas, plants and animals.

Anstruther soils: Are a thin granular well drained acidic soil occurring over Precambrian granite.

Blue Baby Syndrome: Is an illness that begins when large amounts of nitrates in water are ingested by an infant and converted to nitrite by the digestive system. The nitrite then reacts with oxyhemoglobin (the oxygen-carrying blood protein) to form metheglobin, which cannot carry oxygen. If a large enough amount of metheglobin is formed in the blood, body tissues may be deprived of oxygen, causing the infant to develop a blue coloration of their mucous membranes and possibly digestive and respiratory problems. The majority of cases have occurred when nitrate levels have been over 100 mg/litre.

Built up: A land classification defined by combining GIS categories of settlement and infrastructure with built up areas that are pervious and impervious and are required to have a density of 4 buildings/hectare or 10 or more buildings along a 500 m stretch of road. They include areas with buildings, pavement and many other anthropogenic features, and generally represent developed areas. Features were attributed as “Impervious” based on a higher presence of impermeable (to water) surface (e.g., pavement). Built-up Areas that comprised recreational areas (e.g., golf courses, baseball diamonds, soccer fields and football fields) and that were adjacent to or surrounded by Impervious Built-up Area were attributed as “Pervious”. Farm complexes were not included in these density calculations.

Chloride: Inorganic element that is found in water. High chlorides can make water taste salty.

E. coli: E. coli is a bacterium that is found in human and animal waste. Its presence in water indicates fecal contamination. Ontario Recreational Water Quality Guidelines suggest that waters with less than 100 CFUs/100 ml are safe for swimming.

Euphotic zone: The upper layer of a lake which is penetrated by sunlight allowing photosynthesis to occur, and can be determined by multiplying the Secchi depth by 2. This value can fluxgate due to changes in turbidity affecting the clarity and productivity of the waterbody.

Eutrophic: Are lakes that are enriched with nutrients, resulting in good plant growth and possible algae blooms.

FBI: Family Biotic Index, used to categorize benthic invertebrates by their tolerance to organic and nutrient pollutants, providing an estimate of local water quality.

Forested or **Forest Cover:** Forest Cover is the percentage of the watershed that is forested. Environment Canada suggests that 30% forest cover is the minimum needed to support healthy wildlife habitat, but more coverage is beneficial.

Forest Interior: Area of forest left after a 100m buffer zone is removed from all forest edges. It is significant because it provides a home to species of plants and animals that require large, undisturbed areas of long-lived, shade-loving tree species and cannot compete with aggressive edge species for survival, such as Brown-headed cowbirds and raccoons. It is shown as a percentage of the total subwatershed area. Environment Canada suggests that 10% forest interior cover is the minimum needed to support a range of species.

Geometric mean: A type of average (measure of central tendency), which is defined as the "n-th" root of the product of all the values in a set of numerical data (where n = # of values in the data set).

Groundwater: The water found below the earth’s surface, and can only be accessed for use by drilling a well.

Mesotrophic: Are lakes that have good clarity and an average level of nutrients.

MNR: Ontario Ministry of Natural Resources

MOE: Ontario Ministry of the Environment

Monteagle soils: Are usually derived from granites and lack the limestone content of the Tweed soils, and therefore are more vulnerable to nutrient loading and acidification. The Monteagle soils differ because they were developed from granite which makes these soils more acidic, it is low in fertility and moisture retention and high in rocks and boulders. Can have a rock complex.

MVC: Mississippi Valley Conservation Authority

Nitrate: Chemically speaking, it is the molecule NO3, which contains a nitrogen atom, three oxygen atoms and a lone pair of electrons. It is the last stage of the aquarium nitrogen cycle and is converted from nitrites. It is harmful to aquatic animals in high concentrations. It can be formed when ammonia is degraded by microorganisms in soil or groundwater. This compound is usually associated with fertilizers. Ontario drinking water standards are set at 10mg/L of nitrites + nitrates = total nitrogen concentration.

Nitrite: Intermediate nitrogen compound in the biological conversion of Ammonia (NH4) to Nitrate (NO3) in the Nitrogen Cycle. Nitrite is toxic to fish, but less so than Ammonia, and can be harmful to infants when consumed orally. (See Blue Baby Syndrome)

OBBN: Ontario Benthic Biomonitoring Network, is a system designed to study and track the current status of our streams and waterways based on their invertebrate communities.

OFAH: Ontario Federation of Anglers and Hunters

Oligotrophic: Nutrient-poor lakes, are generally clear, and have a low concentration of plant life.

PGMN: Provincial Groundwater Monitoring Network, a sampling protocol conducted to determine ground water concentrations of 30 variables including chloride, aluminium, fluoride, nitrogen, sulphates and phosphorus, for the MOE.

PROVINCIALLY SIGNIFICANT WETLAND: Provincially Significant Wetland classification was designed by the MNR in response to an increasing concern for the need to conserve and protect wetland habitats in Ontario.

PWQMN: Provincial Water Quality Monitoring Network is funded and designed by the MOE as a sampling protocol to be conducted in the ice free months of April to November to test surface water for 36 variables including nitrogen, phosphorus, chloride, calcium, magnesium, sodium, iron and lead.

PWQO: Provincial Water Quality Objectives as set out by the MOE, to protect human health, aquatic life, and recreation uses. Policy direction is provided about how to deal with situations where water quality is better or worse than the Objectives. They are numerical and narrative criteria which serve as chemical and physical indicators representing a satisfactory level for surface waters. The PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water. The Objectives for protection of recreational water uses are based on public health and aesthetic considerations.

Rock complex: Is a soil characteristic when 50% of the area is exposed rock and or rock with a thin covering of organic matter, the other 50% of the area is made up of a mixture of soil types to create the defined Tweed or Monteagle soil types.

Sandy Loam soils: Loams are gritty, plastic when moist, and retain water easily. They generally contain more nutrients than sandy soils. In addition to the term *loam*, different names are given to soils with slightly different proportions of sand, silt, and clay: sandy loam, silty loam, clay loam, sandy clay loam, silty clay loam. Due to the presence of increased sand it drains better than a balanced loam that has a composition of 40% sand, 40% silt and 20% clay.

Settlement and Infrastructure: Clearing for human settlement and economic activity; major transportation routes. It serves to separate major areas of human activity from other land cover types.

Stewardship: The wise management and use of personal resources, such as natural resources, for the benefit of all.

Subwatershed: Is a watershed in its own right, but contributes to the larger scale watershed that is being monitored. See Watershed.

Surface water: All waters on the earth's surface such as in streams, lakes, and wetlands.

Total phosphorus: A nutrient essential to the growth of organisms, and is commonly the limiting factor in the primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies. Measured in milligrams per litre (mg/L).

Tweed soils: Are when the soil is less than 3 feet deep to bedrock; it has large amounts of calcite from the limestone origins, and is a well drained soil. It can have a rocky complex.

Watershed: The land area from which surface runoff drains into a stream, channel, lake, reservoir, or other body of water; also called a drainage basin. They are often made up of many smaller distinct drainage areas or subwatersheds.

Wetlands: A combination of all bogs, fens, swamps, and marsh lands within each subwatershed, and shown as a percentage of the total subwatershed area.

WW: Watershed Watch, a program that monitors the chemistry and temperature of the waters within 42 of our lakes.

75th percentile: A percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it. Therefore the 75th percentile represents the half-way point between average (50%) and extremely high (100%).