TABLES

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Table 1.–Name, size, and location of lakes and impoundments 10 acres or greater in the Tittabawassee River watershed.

Lake name	Size (acres)	County	Latitude	Longitude
Arnold Lake	121.3	Clare	44.069500°	-84.752000°
Atchel Lake	16.3	Roscommon	44.183500°	-84.520333°
Bailey Lake	38.3	Clare	43.891667°	-84.651500°
Barrytown	46.7	Mecosta	43.746333°	-85.146667°
Bass Lake	101.1	Montcalm	43.402500°	-84.927333°
Bass Lake	55.8	Clare	43.867500°	-85.072667°
Beebe Lake	49.7	Clare	43.945500°	-84.759000°
Bentley Marsh	303.3	Gladwin	44.014333°	-84.170500°
Bertha Lake	35.7	Clare	43.932167°	-84.892667°
Big Cranberry Lake	310.5	Clare	43.883000°	-85.038667°
Big Eldred Lake	12.0	Isabella	43.598000°	-85.070667°
Big Mud Lake	230.9	Clare	43.900333°	-85.074333°
Blanchard Millpond	14.9	Isabella	43.523333°	-85.075167°
Blue Lake	24.4	Gladwin	44.122500°	-84.561167°
Bluegill Lake	11.7	Mecosta	43.697000°	-85.226000°
Bluff Lake	41.8	Clare	43.833000°	-84.977333°
Boathouse Lake	50.0	Clare	44.025500°	-84.722000°
Boyles Creek	287.7	Clare	43.847500°	-85.014833°
Brine Pond	868.6	Midland	43.576000°	-84.221333°
Brine ponds	375.9	Midland	43.590167°	-84.237333°
Budd Lake	173.7	Clare	44.020333°	-84.794333°
Bungo Lake	18.7	Clare	43.940333°	-84.910333°
Camelot Lake	55.6	Isabella	43.584333°	-84.610167°
Campbell Lake	14.8	Roscommon	44.191833°	-84.045833°
Cedar Lake	10.2	Gladwin	44.137500°	-84.349500°
Chatman Lake	61.2	Ogemaw	44.167500°	-84.341000°
Chippewa Lake	791.3	Mecosta	43.754500°	-85.298167°
Clear Lake	52.4	Clare	43.894167°	-84.941500°
Clear Lake	65.8	Roscommon	44.230000°	-84.488167°
Coldwater Lake	285.3	Isabella	43.661167°	-84.956000°
Cranberry Lake	162.9	Clare	44.057500°	-84.743667°
Deaner Lake	25.4	Montcalm	43.392167°	-84.875667°
Deer Lake	19.1	Clare	44.020833°	-84.757333°
Diamond Lake	85.7	Mecosta	43.723000°	-85.204500°
Dodge Lake	23.4	Clare	44.021333°	-84.712833°
Dunham Lake	19.1	Roscommon	44.209667°	-84.403667°
East Twin Lake (East)	16.5	Roscommon	44.246667°	-84.451000°
East Twin Lake (West)	52.9	Roscommon	44.246167°	-84.456000°
Eddy Lake	18.7	Roscommon	44.239833°	-84.465167°
Edwards Lake	56.0	Ogemaw	44.193833°	-84.304000°
Eight Point Lake	415.6	Clare	43.840000°	-85.073500°
Elbow Lake	23.7	Clare	44.134167°	-84.662000°
Elk Lake	68.3	Gladwin	44.157833°	-84.359833°
Emerald Lake	13.6	Mecosta	43.800833°	-85.247333°
Lake Enola	17.9	Clare	43.932833°	-84.752333°
Eureka Lake	14.3	Clare	43.926333°	-84.881667°

Table 1.–Continued.

Lake name	Size (acres)	County	Latitude	Longitude
Five Lakes	118.7	Clare	43.872500°	-84.801833°
Lake Four	58.8	Gladwin	44.155000°	-84.445667°
Frost Lake	52.2	Ogemaw	44.181167°	-84.352333°
Gear Lake	31.6	Ogemaw	44.236167°	-84.334500°
Lake George	91.9	Ogemaw	44.209167°	-84.247667°
Glass Lake	24.9	Isabella	43.784167°	-84.857000°
Gorrel Lake	29.9	Mecosta	43.799667°	-85.160333°
Grass Lake	91.5	Gladwin	44.116333°	-84.459000°
Grass Lake	24.8	Gladwin	44.117000°	-84.584833°
Gray Lake	61.9	Clare	43.827833°	-85.015333°
Grewes Lake (East)	11.7	Isabella	43.616833°	-84.729333°
Grewes Lake (West)	41.3	Isabella	43.617167°	-84.734333°
Gut Lake	40.6	Clare	43.881667°	-84.821000°
Half Moon Lake	72.0	Gratiot	43.456167°	-84.823667°
Halfmoon Lake	24.9	Mecosta	43.695333°	-85.200333°
Halls Lake	69.1	Isabella	43.580833°	-85.066500°
Hannah Lake	28.2	Mecosta	43.682500°	-85.126500°
Haven Lake	11.5	Clare	44.024833°	-84.710333°
Hills Lake	13.2	Mecosta	43.752000°	-85.227333°
Hoister Lake	22.9	Gladwin	44.141667°	-84.566833°
Howland Lake	20.3	Clare	43.997000°	-84.650167°
Indian Lake	49.8	Gladwin	44.151667°	-84.352333°
Island Lake	39.4	Gladwin	44.123333°	-84.576000°
Jacks Lake	26.7	Mecosta	43.774500°	-85.223667°
Johnson Pond	13.3	Isabella	43.478000°	-85.035667°
Kerswill Lake	47.9	Gladwin	43.955333°	-84.560667°
Lake Contos	12.3	Gladwin	44.014333°	-84.564333°
Lake Isabella	701.2	Isabella	43.653500°	-84.995667°
Lake of the Hills (central)	13.2	Isabella	43.692833°	-84.969667°
Lake of the Hills (east)	79.7	Isabella	43.692000°	-84.963667°
Lake of the Hills (west)	74.2	Isabella	43.694167°	-84.972667°
Lake Thirteen	91.5	Clare	43.860833°	-84.860333°
Lake Twenty	124.0	Gladwin	43.940500°	-84.578333°
Lake Windaga	26.1	Isabella	43.718667°	-84.997667°
Lake Lancer	853.5	Gladwin	44.111833°	-84.444333°
LaStrange Lake	13.3	Isabella	43.476167°	-84.759833°
Lifter Lake	11.4	Mecosta	43.803833°	-85.216500°
Little Frost Lake	15.7	Ogemaw	44.182833°	-84.363167°
Little Lake George	10.8	Ogemaw	44.200000°	-84.250667°
Little Long Lake	68.2	Clare	44.026333°	-84.785167°
Little Loon Lake	12.1	Clare	43.878667°	-84.883500°
Littlefield Lake	139.8	Isabella	43.772500°	-84.945167°
Lake Lochbrae	85.6	Gladwin	44.103000°	-84.495333°
Long Lake	21.3	Isabella	43.700333°	-85.082833°
Long Lake	62.7	Mecosta	43.780500°	-85.300167°
Loon Lake	71.2	Clare	43.901167°	-84.821167°
Madison Lake	11.4	Gratiot	43.427833°	-84.736167°
Lake Maloy	46.2	Osceola	43.864667°	-85.157667°

Table 1.–Continued.

Lake name	Size (acres)	County	Latitude	Longitude
Marl Lake	19.3	Montcalm	43.406167°	-84.952833°
Marl Lake	11.2	Roscommon	44.164167°	-84.571000°
Martiny Lake	1,663.3	Mecosta	43.717833°	-85.183333°
McGilvery Lake	69.0	Gladwin	44.069167°	-84.601000°
McWatty Lake	23.5	Clare	44.033333°	-84.790167°
Merrill Lake	84.9	Mecosta	43.808667°	-85.155667°
Mill Pond	22.1	Clare	43.833000°	-84.877333°
Moiles Lake	22.3	Mecosta	43.687833°	-85.136833°
Molasses River Flooding #2	46.7	Gladwin	44.074167°	-84.225167°
Molasses River Flooding #3	203.6	Gladwin	43.949500°	-84.187000°
Molasses River Flooding	18.3	Gladwin	44.004167°	-84.188000°
Mud Lake	11.0	Mecosta	43.705833°	-85.207333°
Mud Lake	15.5	Gladwin	44.040000°	-84.552667°
Mud Lake	29.8	Gladwin	44.149500°	-84.363167°
Mud Lake	17.1	Ogemaw	44.193667°	-84.255333°
Mystic Lake	45.5	Clare	43.862833°	-85.042833°
Nestor Lake (East)	13.5	Clare	43.967333°	-84.656833°
Nestor Lake (West)	29.6	Clare	43.960167°	-84.656000°
no name	15.8	Gladwin	44.090000°	-84.257000°
no name	23.6	Gratiot	43.294833°	-84.767833°
no name	11.1	Gratiot	43.381667°	-84.624000°
no name	17.6	Gratiot	43.391167°	-84.615500°
no name	21.7	Saginaw	43.445167°	-84.057833°
no name	18.9	Isabella	43.584667°	-84.942333°
no name	17.3	Midland	43.595167°	-84.224667°
no name	11.8	Isabella	43.623167°	-84.622667°
no name	17.1	Midland	43.638000°	-84.485667°
no name	15.8	Midland	43.705333°	-84.426167°
no name	11.3	Midland	43.706833°	-84.437167°
no name	19.8	Midland	43.708667°	-84.394833°
no name	20.5	Midland	43.720833°	-84.437333°
no name	22.7	Isabella	43.724333°	-85.001000°
no name	32.0	Midland	43.747500°	-84.455167°
no name	37.0	Midland	43.753500°	-84.549833°
no name	10.7	Mecosta	43.756667°	-85.237333°
no name	12.0	Midland	43.762333°	-84.423833°
no name	30.0	Mecosta	43.774333°	-85.267167°
no name	10.5	Isabella	43.776000°	-84.875833°
no name	31.7	Isabella	43.787333°	-84.820000°
no name	18.7	Isabella	43.799167°	-84.719500°
no name	10.2	Isabella	43.804000°	-84.722333°
no name	26.1	Mecosta	43.808833°	-85.222000°
no name	26.2	Clare	43.818833°	-84.690833°
no name	14.2	Midland	43.827333°	-84.329000°
no name	13.6	Clare	43.837833°	-84.752333°
no name	19.6	Osceola	43.842833°	-85.179333°
no name	22.9	Osceola	43.846167°	-85.184167°
no name	12.2	Clare	43.852833°	-84.773167°

Table 1.–Continued.

Lake name	Size (acres)	County	Latitude	Longitude
no name	11.4	Clare	43.866500°	-84.896333°
no name	53.4	Gladwin	43.893833°	-84.235333°
no name	12.2	Clare	43.899333°	-84.631333°
no name	14.0	Clare	43.904667°	-84.828667°
no name	15.6	Gladwin	43.918333°	-84.508500°
no name	22.3	Clare	43.919667°	-84.892500°
no name	22.8	Clare	44.016333°	-84.713167°
no name	12.8	Gladwin	44.122167°	-84.331333°
no name	17.5	Roscommon	44.170333°	-84.375000°
no name	11.9	Ogemaw	44.202000°	-84.296333°
no name	15.6	Ogemaw	44.222667°	-84.301500°
Otter Lake	20.8	Clare	43.859667°	-84.842833°
Peas Lake	13.4	Isabella	43.555500°	-84.846833°
Perch Lake	16.7	Isabella	43.691333°	-84.986500°
Perch Lake	47.7	Clare	43.849167°	-85.001833°
Perch Lake	25.0	Clare	43.921167°	-84.930333°
Pine Lake	19.1	Bay	43.583000°	-85.141167°
Pine Lake	19.8	Mecosta	43.785333°	-85.284833°
Pine River	76.6	Gratiot	43.040167°	-84.668833°
Pine River	136.0	Gratiot	43.413500°	-84.606833°
Pratt Lake	188.1	Gladwin	44.025000°	-84.547000°
Pretty Lake	116.4	Mecosta	43.696167°	-85.234833°
Puro Lake	10.8	Gladwin	44.037000°	-84.563500°
Rattail Lake (Lower)	23.3	Mecosta	43.809333°	-85.196500°
Rattail Lakes	50.7	Osceola	43.816167°	-85.204333°
Robbins Lake	15.3	Montcalm	43.400333°	-84.848667°
Rock Lake	51.2	Montcalm	43.408333°	-84.942833°
Rollway Lake	54.3	Roscommon	44.186333°	-84.553500°
Ross Lake	249.4	Gladwin	43.883833°	-84.484000°
Round Lake	21.3	Isabella	43.697500°	-85.080167°
Round Lake	91.2	Clare	43.898833°	-84.641500°
Round Lake	26.3	Gladwin	44.085833°	-84.485167°
Russell Lake	20.7	Isabella	43.807500°	-85.009000°
Russell Lake	11.8	Clare	43.867000°	-84.953667°
Sand Lake	24.3	Clare	44.020000°	-84.720667°
Sanford Lake	1,401.6	Midland	43.677000°	-84.380167°
Scott Lake	16.2	Isabella	43.717833°	-84.936000°
Secord Lake	399.5	Gladwin	44.041667°	-84.341833°
sewage disposal pond	13.8	Gratiot	43.362500°	-84.668000°
sewage disposal pond	10.3	Isabella	43.532333°	-84.673333°
Shamrock Lake	61.7	Clare	43.831167°	-84.760833°
Smallwood Lake	370.5	Gladwin	43.960333°	-84.336000°
South Lake	18.2	Clare	43.868833°	-84.793500°
Spillway Lake	14.7	Clare	43.873667°	-85.025167°
Spring Lake	16.0	Roscommon	44.236333°	-84.497833°
Spring Lake	11.6	Roscommon	44.262833°	-84.437667°
Springwood Lakes (east)	23.9	Clare	44.006667°	-84.683833°
Springwood Lakes (west)	65.6	Clare	44.008333°	-84.690000°

Table 1.–Continued.

Lake name	Size (acres)	County	Latitude	Longitude
Stevenson Lake	156.6	Isabella	43.762833°	-84.821167°
Streaked Lake	10.4	Gladwin	44.129167°	-84.554500°
Strong Lake	11.9	Mecosta	43.704500°	-85.094833°
Surrey Lake	41.8	Clare	43.850500°	-84.911167°
Sutherland Lake	76.2	Clare	44.024667°	-84.769333°
Tanner Creek Flooding	58.3	Mecosta	43.716000°	-85.110167°
Tee Lake	42.1	Ogemaw	44.208333°	-84.350167°
Three Lake	72.9	Clare	43.886667°	-84.995333°
Tower Lake	15.8	Isabella	43.775333°	-84.958667°
Town Line Lake	12.4	Mecosta	43.791167°	-85.207333°
Townline Lake	31.9	Clare	44.029167°	-84.727667°
Trout Lake	19.8	Clare	44.134500°	-84.630667°
Trout Lake	26.4	Gladwin	44.136167°	-84.565167°
Tubs Lake	35.4	Osceola	43.855833°	-85.114833°
Twin Lake	10.4	Montcalm	43.378333°	-84.871833°
Wahl Lake	12.2	Isabella	43.802500°	-84.872000°
Wallic Lake	21.6	Gladwin	44.118833°	-84.519167°
Waterworks Reservoir	20.9	Midland	43.607833°	-84.195000°
West Twin Lake (East)	139.4	Roscommon	44.248667°	-84.479000°
West Twin Lake (West)	68.6	Roscommon	44.249000°	-84.482833°
Wiggins Lake	293.1	Gladwin	43.996167°	-84.543667°
Willing Lake	16.3	Roscommon	44.187333°	-84.524000°
Wing Lake	11.7	Isabella	43.553667°	-84.864333°
Wixom Lake	1,141.9	Gladwin	43.817000°	-84.384833°
Woodruff Lake	31.2	Isabella	43.558833°	-84.970167°
Woods Lake	33.5	Roscommon	44.234167°	-84.483167°

Table 2.–Archaeological sites within the Tittabawassee River watershed by county and township. Data from B. Mead, Department of State, Office of the State Archaeologist, personal communication.

County	Township	Number of sites
Arenac	19N 06E	1
Bay	14N 03E	1
Clare	17N 03W	1
	17N 04W	2
	17N 05W	3
	17N 06W	3
	18N 04W	1
	19N 03W	3
	19N 04W	14
	20N 03W	1
	20N 04W	5
Gladwin	18N 01E	1
	18N 02E	2
	19N 02E	2
Gratiot	10N 03W	1
	10N 04W	1
	11N 03W	23
	11N 04W	25
	12N 01W	7
	12N 02W	14
	12N 03W	23
	12N 04W	16
Isabella	13N 03W	1
	13N 04W	14
	13N 06W	3
	14N 03W	4
	14N 04W	5
	15N 03W	1
	15N 04W	7
	15N 05W	1
	15N 06W	2
	16N 04W	1
	16N 05W	2
	16N 06W	1
Mecosta	13N 07W	3
Midland	13N 01E	7
	13N 01W	39
	13N 02E	52
	13N 02W	27
	14N 01E	53
	14N 01W	41
	14N 02E	174
	14N 02W	10

Table 2.–Continued.

County	Township	Number of sites
	15N 01E	3
	15N 01W	37
	15N 02E	20
	15N 02W	9
	16N 01E	7
	16N 01W	24
	16N 02E	3
	16N 02W	1
Ogemaw	21N 01E	5
Roscommon	21N 01W	1
	23N 01W	4
	23N 02W	1
Saginaw	11N 03E	8
	11N 04E	16
	12N 02E	1
	12N 03E	73
	12N 04E	81
	13N 02E	1
	13N 03E	31
	13N 04E	1
	14N 03E	1

Table 3.–Prehistoric and historic archeological sites within the Tittabawassee River watershed. Cultural area is Eastern Woodlands. Data from B. Mead, Department of State, Office of the State Archaeologist, personal communication.

Era	Period Phase	Number of sites
Prehistoric	Specified period	
	Paleo-Indian	17
	Archaic	
	Early	9
	Middle	6
	Late	49
	Unspecified	4
	Total	68
	Woodland	
	Early	30
	Middle	29
	Late	78
	Unspecified	94
	Total	231
	Mississippian	2
	Specified period total	318
	Unspecified period	556
Total		874
Historic	Specified period	
	Seventeenth century	2
	Eighteenth century	7
	Nineteenth century	55
	Twentieth century	29
	Specified period total	93
	Unspecified period	34
Total		127

Table 4.–Bedrock layers, period of their formation, and composition within the Tittabawassee River watershed.

Bedrock layer	Period of formation	Area mi^2	Percent of watershed
Red Beds	Late Jurassic	1,025.68	41.51
Grand River Formation	Late Pennsylvanian	1.50	0.06
Saginaw Formation	Early Pennsylvanian	1,379.76	55.83
Bayport Limestone	Late Mississippian	4.36	0.18
Michigan Formation	Late Mississippian	58.04	2.35
Marshall Formation	Early Mississippian	1.67	0.07
Coldwater Shale	Early Mississippian	0.18	0.01

Table 5.–Percent of the Tittabawassee River watershed covered by various surficial materials and permeability rates.

Material	Percent of watershed	Permeability ([ft/day]*1,000)
High permeability		
Ice-contact outwash sand and gravel	4.7	328.08
End moraines of coarse-texture till	38.0	98.43
Dune sand	3.0	65.62
Glacial outwash sand and gravel and postglacial alluvium	14.5	65.62
Medium permeability		
Lacustrine sand and gravel	39.8	32.81

Table 6.–Annual precipitation by weather station within the Tittabawassee River watershed, 1951-80.

	Precipitation (inches)			
Form	Midland	Gladwin	Alma	Mt. Pleasant
Rain	25.8	27.5	26.3	27.4
Snow	37.7	51.6	41.8	36.3
Total	28.7	31.5	29.6	30.2

Table 7.–United States Geological Survey gauging stations within the Tittabawassee River watershed. Station numbers are referenced in Figure 6. Included in this table are period of record for each station, mean discharge, watershed area, and mean yield.

Segment name, map number–river	Location	Latitude Longitude	USGS station no.	Period of record	Mean discharge (ft^3/s)	Watershed area (mi^2)	Mean yield ($ft^3/s\ mi^2$)
Middle							
1–Tobacco	Beaverton	43.879500° -84.473833°	04152500	1948–82	373.8	487	0.77
2–South Branch Tobacco	Beaverton	43.867000° -84.545333	04152238	1987–03	74.2	160	0.46
Mouth							
3–Tittabawassee	Midland	43.595333° -84.235500°	04156000	1936–03	1,702.1	2,400	0.71
4–Tittabawassee	Freeland	43.522000° -84.125333°	04156500	1930–36	1,265.6	2,530	0.50
5–Salt	North Bradley	43.702833° -84.470500°	04153500	1934–71	75.7	138	0.55
6–Chippewa	Mt. Pleasant	43.625500° -84.707833°	04154000	1930–03	322.9	416	0.78
7–Chippewa	Midland	43.594500° -84.369500°	04154500	1947–72	426.5	597	0.71
8–Pine	Alma	43.379500° -84.655500°	04155000	1930–2003	228.2	288	0.79
9–Pine	Midland	43.564500° -84.369167°	04155500	1934–38 1948–97 2000–03	316.0	390	0.81

Table 8.–Communities participating in the National Flood Insurance Program by county and their date (month/day/year) of entry into the program.

County	Community name	Date of entry
Bay	Midland (City)	06/15/1984
	Williams (Township)	02/01/1986
Clare	Clare (City)	02/05/1992
Gladwin	Butman (Township)	07/30/1999
	Hay (Township)	12/31/1997
	Secord (Township)	01/29/1997
Gratiot	Alma (City)	03/01/1982
	St. Louis (City)	01/18/1989
Isabella	Broomfield (Township)	08/05/1991
	Chippewa (Township)	01/07/1998
	Coe (Township)	07/16/1991
	Coldwater (Township) [a]	01/07/1998
	Deerfield (Township)	01/07/1998
	Denver (Township)	07/16/1991
	Fremont (Township)	10/16/1991
	Isabella (Township)	04/16/1991
	Mount Pleasant (City)	08/16/1982
	Nottawa (Township)	05/02/1991
	Rolland (Township)	09/14/1990
	Sherman (Township)	10/16/1991
	Union (Township)	02/15/1991
	Vernon (Township)	02/05/1992
	Wise (Township)	09/18/1991
Mecosta	Fork (Township)	05/25/1984
Midland	Homer (Township)	05/14/1997
Saginaw	James (Township)	09/04/1991
	Saginaw (City)	11/16/1983
	Saginaw (Township)	07/02/1979
	Spaulding (Township)	06/15/1979
	Thomas (Township)	01/19/1983
	Tittabawassee (Township)	02/01/1987

[a] Currently not enrolled in National Flood Insurance Program, but an area where a special flood hazard has been identified.

Table 9.–Year 2001 water withdrawal from the Tittabawassee River watershed, select watersheds, and statewide. Units are in gallons/day/mi^2 (MDEQ 2005b).

	Water source			
Watershed	Great Lakes	Surface water	Groundwater	Total
Au Sable	0	322	1,851	2,173
Cheboygan	0	369	2,764	3,133
Clinton	8,618	4,177	26,505	39,300
Flint	0	1,902	5,840	7,742
Huron	697	29,154	20,089	49,940
Kalamazoo	0	8,242	43,710	51,952
Manistique	0	4,130	53	4,184
Muskegon	109,623	3,104	9,572	122,298
Thunder	93,186	520	1,599	95,306
Tittabawassee	28	2,326	3,798	6,152
Statewide	164,473	7,545	8,727	180,745

Table 10.–Irrigated agriculture 1997, estimated agricultural water withdrawal 2001, and total water withdrawal within the Tittabawassee River watershed (MDEQ 2005c).

	1997		2001			
	No. farms	Irrigated	(gallons/day/mi^2)			
Land use	≥14 acres	acres	Great Lakes	Surface water	Groundwater	Total
Agriculture	31	4,528	0	190	752	942
Nonagriculture			28	2,136	3,046	5,210
Total			28	2,326	3,798	6,152

Table 11.–Presettlement land cover (circa 1800) by percentage of area for the Tittabawassee River watershed and for catchments of the main stem segments and their major tributaries. Catchment summaries for a segment represent the local landscape that contributes water to the segment and do not represent the cumulative upstream landscape.

Cover type	Watershed	Headwaters	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
Aspen–birch forest	0.9	0.8	0.6	0.0	1.9	3.4	0.7	0.5
Beech–sugar maple forest	19.1	0.0	0.0	0.2	20.9	29.7	25.6	46.9
Beech–sugar maple–hemlock forest	25.4	21.6	20.0	48.9	9.2	24.9	33.9	1.5
Black ash swamp	1.0	0.6	1.1	2.0	0.8	1.3	0.8	0.4
Cedar swamp	6.0	19.5	14.1	9.1	0.0	4.4	2.0	0.9
Hemlock–white pine forest	20.8	30.3	38.3	12.1	43.8	24.8	15.4	6.1
Jack pine–red pine forest	0.3	1.2	1.5	0.1	0.0	0.0	0.0	0.0
Lake/river	0.8	1.1	0.5	0.8	0.6	0.1	1.5	0.5
Mixed conifer swamp	8.6	4.1	16.0	9.4	11.5	6.0	7.8	5.0
Mixed hardwood swamp	4.4	0.7	2.9	1.6	10.1	4.3	2.9	9.1
Muskeg/bog	<0.1	0.0	0.0	0.0	0.0	0.0	<0.1	<0.1
Oak/pine barrens	0.2	0.0	0.0	1.1	0.0	0.0	0.0	0.0
Oak–hickory forest	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Pine barrens	0.5	6.4	0.0	0.2	0.0	0.0	0.0	0.0
Shrub swamp/emergent marsh	0.8	0.6	2.1	0.7	0.7	0.2	0.9	0.3
White pine–mixed hardwood forest	5.9	0.0	0.0	0.0	0.0	0.0	7.7	23.9
White pine–red pine forest	4.0	13.2	3.1	11.9	0.4	0.9	0.8	0.0
White pine–white oak forest	1.2	0.0	0.0	1.9	0.0	0.0	0.0	4.8

Table 12.–Current land use by percentage of area for the Tittabawassee River watershed and for catchments of the main stem segments and their major tributaries. Catchment summaries for a segment represent the local landscape that contributes water to the segment and do not represent the cumulative upstream landscape.

Land use	Watershed	Headwaters	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
Agriculture	44.8	12.0	21.2	36.2	38.7	61.0	54.4	67.8
Commercial	0.8	0.5	0.1	0.5	3.4	0.5	0.6	0.4
Developed	1.2	0.0	0.2	0.6	6.5	0.3	0.8	1.0
Grassland	1.3	4.5	3.0	2.4	0.2	0.2	0.1	0.1
Open water	1.7	2.3	3.3	1.5	1.6	0.1	2.0	0.6
Upland	34.8	53.7	37.9	47.7	30.8	24.1	32.3	21.4
Wetland	15.4	26.9	34.3	11.0	18.8	13.8	9.8	8.6

Table 13.–Agricultural use by acres for the Tittabawassee River watershed and for catchments of the main stem segments and their major tributaries. Catchment summaries for a segment represent the local landscape that contributes water to the segment and do not represent the cumulative upstream landscape.

Agricultural use	Watershed	Headwaters	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
Grassland/Herbaceous	18,829	5,400	5,914	7,515				
Pasture/Hay	125,148	7,304	12,438	26,687	5,777	9,440	34,513	28,990
Row crops	583,282	6,728	29,135	85,408	56,228	76,866	175,670	153,246
Total acres	727,258	19,432	47,487	119,611	62,004	86,303	210,183	182,236

Table 14.–Number of oil and natural gas wells and wells per mi^2 for the Tittabawassee River watershed and for catchments of the main stem segments and their major tributaries.

Number of oil & gas wells	Watershed	Upper	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
Wells	398	2	45	34	38	117	96	66
Wells/mi^2	0.16	0.01	0.15	0.07	0.15	0.53	0.16	0.16

Table 15.–Classification of gradient and the channel characteristics associated with each. Data from G. Whelan, MDNR, Fisheries Division, unpublished data.

Gradient class	Value (ft/mi)	Channel characteristics
Low	0.0–2.9	Mostly run habitat with low hydraulic diversity
Fair	3.0–4.9	Some riffles with modest hydraulic diversity
Good	5.0–9.9	Riffle-pool sequences with good hydraulic diversity
Excellent	10.0–69.9	Established, regular riffle-pool sequences with excellent hydraulic diversity
Fair	70.0–149.9	Chute and pool habitats with only fair hydraulic diversity
Poor	>150	Falls and rapids with poor hydraulic diversity

Table 16.–Percent of river miles in each gradient class for the Tittabawassee River watershed. Total miles of river for each segment and tributary in parentheses.

	Percentage							
Gradient (ft/mi)	Upper (20)	Middle (36)	Tobacco (34)	S. Br. Tobacco (38)	Mouth (35)	Salt (18)	Chippewa (89)	Pine (94)
0.0–2.9	5.0	61.1		34.2	100.0	66.7	31.5	47.9
3.0–4.9	20.0	38.9	31.3				43.8	28.1
5.0–9.9	20.0		15.6	39.5		33.3	24.7	18.8
10.0–69.9	45.0		53.1	26.3				5.2
70.0–149.9	10.0							
>150								

Table 17.–United States Geological Survey gauging stations within the Tittabawassee River watershed. Station numbers are referenced in Figure 6. Included in this table are record period for each station, measured bank full widths, expected lower 95% estimated width, expected mean width, and expected upper 95% upper width. Measured bank-full widths outside of the lower and upper 95% widths are noted with "*".

Segment name, map number–river	Location	USGS station no.	Period of record	Width (ft)			
				Measured	Lower 95%	Expected mean	Upper 95%
Middle							
2–Tobacco	Beaverton	04152500	1948–82	92.2	75.2	105.6	148.5
3–South Branch Tobacco	Beaverton	04152238	1987–03	55.1	35.1	47.2	63.5
Mouth							
9–Tittabawassee	Midland	04156000	1936–03	216.8	153.6	224.9	329.3
4–Salt	North Bradley	04153500	1934–71	60.8	35.4	47.7	64.2
5–Chippewa	Mt. Pleasant	04154000	1930–03	84.8	70.1	98.2	137.5
6–Chippewa	Midland	04154500	1947–72	205.5*	80.0	112.8	159.1
7–Pine	Alma	04155000	1930–03	80.3	59.6	82.6	114.6
8–Pine	Midland	04155500	1934–38 1948–97 2000–03	183.0*	69.4	97.2	135.9

Table 18.–Dams and water control structures in the Tittabawassee River watershed. Data from Department of Environmental Quality, Land and Water Management Division, Dams Safety Unit. Hazard ranking: low, significant, high. High hazard = loss of life would occur; significant hazard = large amounts of property damage would occur. Blank indicates no data available. Dam no. corresponds to Figures 46-48. Dam type "other" includes stop logs and rock rip-rap. Sig = significant; hydro = hydroelectric producing.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
	Headwaters											
	Main Stem											
1	Baker	Wheeler Drain	44.082886°	-84.372730°	1962	Private	Earth	19	7	40	Recreation	Low
2	Benmark	West Branch Tittabawassee	44.205928°	-84.428034°	1945	Private	Gravity	12	1	10	Recreation	Low
3	Benmark	West Branch Tittabawassee	44.213272°	-84.428756°	1945	Private	Gravity	6	3	10	Recreation	Low
4	Benmark	West Branch Tittabawassee	44.203607°	-84.427422°	1945	Private	Other	5	2	4	Recreation	Low
5	Benmark	West Branch Tittabawassee	44.214564°	-84.434322°	1945	Private	Gravity	10	4	16	Recreation	Low
6	Benmark	West Branch Tittabawassee	44.212195°	-84.429431°	1945	Private	Other	9	4	14	Recreation	Low
7	Benmark	West Branch Tittabawassee	44.208451°	-84.430189°	1945	Private	Gravity	12	2	30	Recreation	Low
8	Benmark	West Branch Tittabawassee	44.197318°	-84.416622°	1945	Private	Gravity	6	2	5	Recreation	Low
9	Benmark	West Branch Tittabawassee	44.203287°	-84.425817°	1940	Private	Earth	7	1	0	Recreation	Low
10	Blackhurst	West Branch Tittabawassee	44.225007°	-84.418029°	1967	Private	Earth	9	4	18	Recreation	Low
11	Bowsher	West Branch tributary	44.170518°	-84.308542°		Private		3	1	0		Low
12	Bowsher	West Branch tributary	44.169488°	-84.308761°		Private		3	1	0		Low
13	Bowsher	West Branch tributary	44.170843°	-84.307023°		Private		3	1	0		Low
14	Bunting	Cooks Creek	44.238445°	-84.229488°	1970	Private	Earth	7	1	0	Water supply	Low
15	Cahoon	Mansfield tributary	44.207300°	-84.313093°		Private	Earth	8	2	0	Recreation	Low
16	Cushoff	West Branch tributary	44.184044°	-84.448461°	1966	Private	Other	7	2	0	Recreation	Low
17	Dunham	West Branch tributary	44.206356°	-84.406969°	1961	Private	Earth	5	19	100	Recreation	Low
18	Ed Klemac	West Branch tributary	44.133348°	-84.374968°	1961	Private	Earth	11	1	0	Other	Low
19	Elk Lake	Elk Lake Creek	44.151269°	-84.360072°		Private		1	65	0		Low
20	Good News	Wheeler Drain	44.079947°	-84.369127°	1964	Private	Earth	12	2	8	Recreation	Low
21	Hill	East Branch tributary	44.137794°	-84.229657°		Private			5			Low
22	Hoffman	Lake Four	44.151360°	-84.427749°	1964	Private	Earth	19	3	29	Farm Pond	Low
23	Horgewski	East Branch tributary	44.222808°	-84.261811°	1949	Private	Gravity	3	1	2	Recreation	Low
24	Huston	Lake Four Creek	44.148518°	-84.415525°		Private		19	3	0		Low
25	Morris Lake	Parren Creek tributary	44.238745°	-84.339724°	1965	Private	Earth	21	15	181	Recreation	Low
26	Rau Lake	Rau Creek	44.223948°	-84.263605°	1970	Private	Earth	0	0	0	Recreation	
27	Sanislow	West Branch tributary	44.182757°	-84.414830°	1960	Private	Earth	34	4		Recreation	Low

Table 18.–Continued.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
28	Soloskey	West Branch Tittabawassee	44.166684°	-84.386685°	1951	Private	Gravity	6	2	0		Low
29	Stillwagon	Mansfield tributary	44.191685°	-84.323334°		Private	Earth	6	1	0	Recreation	Low
30	Timmeck	West Branch tributary	44.166301°	-84.409405°	1969	Private	Gravity	15	2	0	Recreation	Low
31	Toutant	Elk Lake Creek	44.108335°	-84.353410°		Private		3	3	0		Low
32	Winter	Perry's Creek	44.235010°	-84.314208°		Private		3	1	0		Low
33	Winter	Perry's Creek	44.235474°	-84.313204°		Private		3	1	0		Low
34		West Branch Tittabawassee tributary	44.168877°	-84.386145°								
	Middle											
	Main Stem											
35	Edenville	Tittabawassee	43.816298°	-84.384026°	1924	Private	Earth, gravity	54	2250	66200	Hydro	High
36	Frayer	Sugar River tributary	44.071162°	-84.397029°	1972	Private	Earth	26	4	90	Farm Pond	Low
37	Heil	Black Creek	43.971529°	-84.323234°	1970	Private	Earth	23	10	140	Recreation	Low
38	Lake Lancer	Sugar River	44.106394°	-84.435254°	1976	Private	Earth	36	977	17500	Recreation	High
39	Lake Lancelot	Sugar River tributary	44.110302°	-84.465114°	1976	Private	Earth	17	250	2100	Recreation	Low
40	Lake Lochbrae	Long Lake Creek	44.103548°	-84.487378°	1968	Private	Earth	14	82	700	Recreation	Sig
41		Sugar River tributary	44.163425°	-84.486906°		Private	Earth	7	1	30		Low
42	Molasses	Molasses	44.085164°	-84.205473°	1949	State	Earth	5	83	276	Recreation	Low
43	Molasses	Little Molasses	43.948641°	-84.186840°	1955	State	Earth	12	590	4100	Recreation	Low
44	Molasses	Molasses	44.074126°	-84.224654°	1959	State	Earth	12	228	2000	Recreation	Low
45	Molasses	Molasses tributary	44.005288°	-84.211966°	1962	State	Earth	9	195	1240	Other	Low
46	Morey	Sugar River	44.143719°	-84.500011°	1912	Private	Earth	6	2		Recreation	Low
47	Priddy Lake	Sugar River tributary	44.196946°	-84.495490°	1968	Private	Earth	16	9	80	Recreation	Sig
48	Russell	Sugar River tributary	44.136948°	-84.483488°	1950	Private	Earth	17	4	50	Recreation	Low
49	Sanford	Tittabawassee	43.676807°	-84.380246°	1925	Private	Earth, gravity	36	1528	34500	Hydro	High
50	Secord	Tittabawassee	44.041171°	-84.341817°	1925	Private	Earth, gravity	57	894	51000	Hydro	High
51	Smallwood	Tittabawassee	43.960012°	-84.335796°	1925	Private	Earth, gravity	36	402	9000	Hydro	High
	Tobacco River											
52	Arnold Lake	Cranberry Creek	44.065277°	-84.746942°	1966	Private	Earth	4	118	190	Recreation	Low
53	Beaverton	Tobacco	43.883272°	-84.483444°	1919	Local gov	Gravity	30	270	2390	Hydro	High

Table 18.–Continued.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
54	Bebee Lake	Clear Creek	43.947315°	-84.752160°	1938	Private	Earth	22	51	800	Recreation	Low
55	Bertha Lake	South Branch Tobacco tributary	43.935419°	-84.898715°	1967							
56	Blue Lake	North Branch Cedar tributary	44.120892°	-84.560200°	1961	Private	Earth	17	33	0	Other	Low
57	Chappel	Cedar	44.003353°	-84.530054°	1910	Private	Earth, gravity	32	435	4650	Hydro (ret.)	High
58	Cranberry	Cranberry Creek	44.060498°	-84.740487°		Local gov	Other	4	106		Other	Low
59	Dodge Lake	Mostellar Creek Drainage	44.021731°	-84.716354°			Other		24		Recreation	
60	Farwell Mill Pond	South Branch Tobacco	43.831944°	-84.874714°	1909	Private	Earth	18	32	350	Hydro (ret.)	Low
61	Ferrel	North Branch Tobacco	43.962476°	-84.710343°	1927	Private	Earth	6	1	3	Recreation	Low
62	Five Lake	Five Lake Creek	43.868704°	-84.805622°	1958	Private	Gravity	8	117	0	Other	Low
63	Haines	Tobacco River tributary	43.959322°	-84.588003°		Private	Earth	18	2		Recreation	Low
64	Hamlin	South Branch Tobacco tributary	43.791032°	84.828820°	1967	Private	Earth	25	4	29	Farm Pond	Low
65	Hayward	Cedar River tributary	44.051462°	-84.534209°		Private	Earth, gravity	5	5	0	Recreation	Low
66	Hoister Lake	North Branch Cedar tributary	44.140136°	-84.567635°	1955	State	Earth	15	22	620	Recreation	Low
67	James B.	South Branch Tobacco tributary	43.837390°	-84.752506°	1971	Private	Earth	12	14	155	Recreation	Low
68	Kerswill	Kerswill Drain	43.956338°	-84.564645°	1967	Private	Earth	12	52	315	Recreation	Low
69	Klienhart	Middle Branch Tobacco tributary	43.931195°	-84.750933°	1963	Private	Earth	20	5	36	Farm Pond	Low
70	Krahner	Silver Creek	44.005872°	-84.522330°	1958	Private	Earth, gravity	6	3	0	Recreation	Low
71	Lake Contos	North Branch Cedar tributary	44.013987°	-84.565180°	1950	Private	Earth	12	15	150	Recreation	Low
72	Lake Pond	Duncan Drain	43.787050°	-84.818646°	1967	Private	Earth	27	36	472	Recreation	Low
73	Lake Thirteen	Runyon Creek	43.861594°	-84.854701°	1948	Private	Earth	19	88	1100	Recreation	High
74	Lang	Tobacco River tributary	43.898675°	-84.485473°		Private	Earth, gravity	13	3	0	Recreation	Low
75	Little Long Lake	North Branch Tobacco River	44.021997°	-84.776255°	1968	Local gov	Earth, gravity	5	43	85	Recreation	Low
76	McKays	Loon Lake Creek	43.906388°	-84.829167°	1940	Private	Earth	13	96	600	Recreation	Low
77	No. Two	Middle Branch Tobacco tributary	43.929877°	-84.772791°	1953	Private	Earth	14	2	11	Recreation	Low
78	Otter Lake	South Branch Newton Creek	43.858058°	-84.846371°	1976			4				Low
79	Pratt Lake	Foran Drain	44.029467°	-84.540457°	1989	Local gov	Earth	5	180	350	Recreation	Low
80	Presspitc	Middle Branch Cedar River	44.085883°	-84.610121°	1947	Private	Gravity	9	4	0	Recreation	Low
81	Sand Lake	Mostellar Creek	44.017592°	-84.723858°		Private	Earth	7	118	300	Recreation	Low
82	Scottish	Lake Twenty Creek	43.938408°	-84.578550°	1974	Private	Earth	14	128	2100	Recreation	Low

Table 18.–Continued.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
83	Shamrock	South Branch Tobacco	43.830474°	-84.753006°	1962	Local gov	Earth	20	120	882	Recreation	High
84	Sikkema	Elm Creek	43.860165°	-84.916564°	1963	Private	Earth	10	4	0	Other	Low
85	Spring Valley	Newton Creek	43.892007°	-84.859915°	1956	Private	Earth	6	4	0	Other	Low
86	Springwood	North Branch Cedar tributary	44.007158°	-84.688047°	1959	Private	Earth	18	70	230	Recreation	Low
87	Springwood	North Branch Cedar tributary	44.007776°	-84.680241°	1959	Private	Earth	11	32	320	Recreation	Low
88	Surrey Lake	Elm Creek	43.850045°	-84.910654°	1965	Private	Earth	16	234	1800	Recreation	High
89	Sutherland Lake	North Branch Tobacco	44.019772°	-84.774311°	1968	Private	Earth	9	78	230	Recreation	Low
90	Trout Lake	North Branch Cedar tributary	44.135562°	-84.562775°	1961	State	Earth	19	25	240	Recreation	Low
91	Valdaloch	Overton Creek	43.874386°	-84.920109°	1963	Private	Earth	14	10	0	Other	Low
92	Walter W.	Middle Branch Tobacco tributary	43.904077°	-84.738873°		Private	Earth	5			Other	Low
93	Warner	Cranberry Creek	44.047212°	-84.707772°	1966	Private	Earth	9	9	0	Recreation	Low
	Mouth											
94	Cole	Tittabawassee tributary	43.535175°	-84.134103°	1949	Private	Earth	16	3	15	Recreation	Low
95	Dow	Tittabawassee	43.599994°	-84.238957°	1939	Private	Gravity	7	0		Other	Low
96	Lincoln's	Tittabawassee tributary	43.543183°	-84.135329°	1951	Private	Earth	7	11	0	Recreation	Low
	Salt River											
97	Coleman B.	Bluff Creek tributary	43.749096°	-84.546788°		State						Low
98	Gregor	Bluff Creek tributary	43.712976°	-84.478252°		Private	Earth	6	1	0		Low
99	Marcus	Bluff Creek tributary	43.707920°	-84.468949°	1975	Private	Earth	20	3	0	Recreation	Low
	Chippewa River											
100	Barryton	West Branch Chippewa	43.746479°	-85.140520°	1920	Local gov	Earth, gravity	15	46	260	Hydro (ret.)	Sig
101	Big Cranberry	North Branch Chippewa	43.879550°	-85.048447°	1961	Private	Earth	6	293		Other	Low
102	Birch Lake	Long Lake Creek tributary	43.772556°	-85.291243°	1985	Private	Earth		11		Recreation	Low
103	Chippewa	Chippewa Creek	43.743591°	-85.302234°		Private		3	770	0		Low
104	Crooked Lake	North Branch Chippewa tributary	43.856404°	-85.020257°	1976							Low
105	Deerfield	Chippewa River tributary	43.591099°	-84.899263°	1960	State	Earth	14	3	11	Other	Low
106	Dragonfly	West Branch Chippewa	43.593198°	-84.284958°	1992	Private	Earth	6	17		Other	Low
107	Eight Point	Eight Point Creek	43.831388°	-85.072008°	1966	Private	Gravity	4	388	615	Recreation	Low
108	Forbes	Delaney Creek	43.780893°	-85.047783°		Private	Earth, gravity	2	3	0	Recreation	Low
109	Georgia J.	Tanner Creek	43.716082°	-85.108542°	1972	Private	Earth	15	45	348	Recreation	Low
110	Gray Lake	North Branch Chippewa tributary	43.832313°	-85.021895°			Other		61		Recreation	Low

Table 18.–Continued.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
111	Grey's	Walker Creek tributary	43.730217°	-85.020220°	1959	Private	Earth, gravity	5	1	8	Irrigation	Low
112	Harris (removed)	Chippewa	43.600887°	84.784778°	1870	Private	Earth	16	2	150	Recreation	Low
113	Heron	West Branch Chippewa	43.595793°	-84.284353°	1992	Private	Earth	8	10		Other	Low
114	Lake Camelot	Black Creek	43.583594°	-84.609733°	1971	Private	Earth	19	85	855	Irrigation	Low
115	Lake Isabella	Chippewa	43.653379°	-84.992598°	1967	Private	Earth	45	730	13500	Recreation	High
116	Long Lake	Long Lake Creek tributary	43.775826°	-85.295036°	1993	Local gov	Other	6	75		Other	Low
117	Maloy Lake	North Branch Chippewa tributary	43.861566°	-85.157209°	1962	Private	Earth	5	40	180	Recreation	Low
118	Maple Lake	Long Lake Creek tributary	43.771307°	-85.288793°	1985	Private	Earth	11	4		Recreation	Low
119	Mission Creek	Mission Creek	43.621645°	-84.792591°	1950	Private	Earth	12	0	95	Recreation	Low
120	Muskrat	West Branch Chippewa	43.593514°	-84.289127°	1992	Private	Earth	6	10		Other	Low
121	Peas Lake	Johnson Creek	43.555666°	-84.846607°	1961	Private	Earth	18	10	165	Recreation	Low
122	Phillips	Bamber Creek tributary	43.723629°	-85.136969°		Private	Earth	5	4	0		Low
123	Pretty Lake	West Branch Chippewa tributary	43.698321°	-85.231744°	1992	Local gov	Other	6	116		Recreation	Low
124	Siebecker	Rattail Creek	43.808976°	-85.195823°	1978	Private	Earth	21	28	315	Recreation	Low
125	Stevenson	North Branch Chippewa tributary	43.757368°	-84.826924°	1975	Private	Earth, gravity	5	113	340	Recreation	Low
126	Thompson	North Branch Chippewa	43.760225°	-84.864314°		Private	Earth, gravity	13	22	160	Recreation	Low
127	Walker Creek	Walker Creek	43.717681°	-84.997996°	1965	Private	Earth	17	41	850	Recreation	Low
128	Walker Creek	Walker Creek	43.724872°	-85.000228°	1968	Private	Earth	18	42	900	Recreation	Sig
129	Weidman Mill	Coldwater	43.688715°	-84.964217°	1900	Private	Earth	12	65	300	Recreation	Sig
130	Wiedman Pond	Walker Creek	43.693673°	-84.971438°	1968	Private	Earth	14	50	420	Recreation	Sig
131	Winchester	West Branch Chippewa	43.718365°	-85.182989°	1954	State	Earth	13	1420	7500	Recreation	Sig
	Pine River											
132	Archer	South Branch Pine tributary	43.410060°	-84.992325°		Private		11	2	0		Low
133	Babcocks	South Branch Pine tributary	43.518238°	-85.069934°	1973	Private	Earth	18	9	66	Recreation	Low
134	Blanchard	North Branch Pine tributary	43.523086°	-85.072599°	1978	Private	Earth	12	13	300	Recreation	Low
135	Fitzgeral	Pony Creek	43.540912°	-84.994606°	1965	Private	Earth, gravity	5	3	0	Recreation	Low
136	Johnson Pond	Skunk Creek tributary	43.477118°	-85.037000°		Private		6	1	0		Low
137	Mason	Decker Creek tributary	43.522415°	-85.123100°	1977	Private	Earth	14	2	12	Recreation	Low
138	Millbrook	Pine Creek	43.556086°	-85.119337°	1915	Private	Other	7	1	25		Low

Table 18.–Continued.

Dam no.	Segment Tributary Dam name	River	Latitude	Longitude	Built	Owner	Type	Height	Acres	Surface acres	Purpose	Hazard
139	Peterson	Skunk Creek tributary	43.478762°	-85.034651°	1948	Private	Earth	12	10	0	Irrigation	Low
140	Schafer	Thatcher Creek	43.533550°	-84.862915°	1969	Private	Earth	10	3	60	Recreation	Low
141	St Louis	Pine	43.412628°	-84.607385°	1887	Local gov	Gravity	21	71	1000	Hydro	Sig
142	State Street	Pine	43.375107°	-84.662165°	1938	Local gov	Gravity	18	140	1500	Water supply	Sig
143	Stevens Lake	Carpenter Creek tributary	43.313097°	-84.887808°		Private	Gravity	4	7	0	Recreation	Low

Table 19.–Designated trout streams (as of 2006) in the Tittabawassee River watershed. Streams are designated upstream of the town, range, and section number unless specified otherwise. Data are from MDNR (2005).

Segment County Stream	Location
Headwaters	
Ogemaw	
East Br. Tittabawassee River	from T21N, R2E, S32 upstream
Spring Creek	(T21N, R2E, S32)
Cooks Creek	(T21N, R2E, S20)
Rau Creek	(T21N, R1E, S13)
Brick Creek	(T21N, R1E, S13)
Middle Br. Tittabawssee tributaries.	
Mansfield Creek	(T21N, R1E, S22)
Parren Creek	(T21N, R1E, S10)
Perrys Creek	(T21N, R1E, S10)
Gladwin, Roscommon	
W. Br. Tittabawassee and tributaries	From T20N, R1W, S23 upstream and tributaries Except: Lake Four Outlet (Gladwin County)
Roscommon	
Muma Creek	(T21N, R1W, S35)
W. Br. Tittabawassee River	(T21N, R1W, S22)
Roscommon, Ogemaw	
Unnamed tributary	(T21N, R1W, S24)
Middle	
Gladwin, Roscommon	
Sugar Creek	(T21N, R1W, S24)
Gladwin	
Sugar River and tributaries	upstream from T20N, R1W, S19
Sugar River	(T20N, R1W, S22 and 27)
Gladwin, Clare	
Cedar River	T19N, R2W, S20 upstream
N. Br. Tobacco and tributaries	(T17N, R2W, S1)
Middle Br. Tobacco	(T17N, R2W, S11)
Clare	
Middle Br. Cedar and tributaries	(T19N, R3W, S14)
West Branch Cedar River	(T19N, R3W, S15)
Cranberry Creek	(T19N, R3W, S15)
Popple Creek	Creek (T20N, R3W, S34)
Mostellar Creek	downstream (T18N, R4W, S1), upstream (T19N, R4W, S25)
Jose Creek	(T18N, R4W, S12)
Spike Horn Creek	(T19N, R4W, S35)
Unnamed tributary	(T18N, R3W, S32)
Clear Creek	(T18N, R3W, S30)
S. Br. Tobacco River	T17N, R4W, S27)

Table 19.–Continued.

Segment County Stream	Location
Clare–continued	
Sanford Creek	(Tl7N, R4W, S13)
Five Lakes Creek	(T17N, R4W, S33)
Loon Lake Creek	(T17N, R4W, S6)
Newton Creek	(Tl7N, R4W, S30)
Runyon	Creek (T17N, R5W, S13)
Overton Creek	(T17N, R5W, S26)
Elm Creek	(T17N, R5W, S16)
Two unnamed tributaries	(T17N, R5W, S28)
Mouth	
Mecosta, Osceola	
North Branch Chippewa River	(T16N, R7W, S27)
Butts Creek (Devil Creek)	(T16N, R7W, S11)
Benjamin Creek	Creek (T16N, R7W, S2)
Mecosta	
Rattail Creek	(T16N, R7W, S22)
Brown Creek	(T16N, R7W, S28)
Roundybranch Creek	(T16N, R8W, S35)
Isabella	
Jewell Creek	(T13N, R6W, S18)
Squaw Creek	(T14N, R6W, S3)
Indian Creek	(T14N, R6W, S3)
Jewell Creek S18)	(T14N, R6W, S3)
Johnson Creek	(T14N, R4W, S30)
Colley Creek	(T16N, R6W, S34)
Delaney Creek	(T16N, R6W, S34)
Walker Creek and tributaries	above T16N, R6W, S35
Cedar Creek	(T14N, R5W, S27)
Sucker Creek	(T16N, R5W, S18)
Gratiot, Montcalm, Isabella, Mecosta	
Pine River mainstream	mainstream from Lumberjack Road (T12N, R4W, S18) upstream to 10th Avenue (T14N, R7W, S26)
Gratiot, Montcalm, Isabella	
North Branch Pine River	from confluence with mainstream of Pine to Coe Road (T13N, R5W, S34)
Isabella, Mecosta	
Skunk Creek	(T13N, R6W, S25)
Mecosta	
Miller Creek	(T14N, R7W, S36)
Isabella	
Pony Creek	from confluence with Pine River upstream to S2, T13N, R6W
Decker Creek	(T13N, R6W, S18)

Table 20.–Monthly maximum river temperatures (°F) allowed in selected streams. These standards are applied to all permitted stream discharges and are given a 2–5 °F variance as shown in Table 8b. Data from Michigan Department of Environmental Quality, Water Bureau.

Stream type	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	Temperature (°F)											
Coldwater	38	38	43	54	65	68	68	68	63	56	48	40
Warmwater	41	40	50	63	76	84	85	85	79	68	55	43

Table 21.–Dissolved oxygen (mg/l) and temperature (°F) standards for designated uses of the Tittabawassee River and tributaries. Temperatures represent allowable degrees of increase from the monthly river maximum. Data from Michigan Department of Environmental Quality, Water Bureau.

Designated use	Minimum dissolved oxygen (mg/l)	Temperature (°F)
Warmwater fish	5.0	5
Coldwater fish		
Designated trout	7.0	2
Designated migratory route	5.0	5

Table 22.–Areas not attaining designated uses (303d listings as of 2004) in the Tittabawassee River by segment. u/s = upstream; d/s = downstream.

Segment and stream	Category [a]	Problem	Location
Headwaters			
E. Br. Tittabawassee River	2	Sedimentation	Herner Road crossing SW of Greenwood Road
Middle Branch Tittabawassee River	2	Sedimentation	Boensch Road crossing, W. of Greenwood Road
W. Br. Tittabawassee River	2	Sedimentation	Fitzwater Road crossing, NE of Sugar Rapids
Middle			
Black Creek	2		E. of Woodenshoe at M61 upstream
Larabee Creek	2		At Weiman Road crossing, W. of Highwood
Sugar River	2	Suspended Solids	At M30 upstream
Little Sugar River	2		Sugar River confluence u/s to M18
Little Tobacco River	2	Habitat and bank erosion	At drain crossing NW of Wooden Shoe
Molasses River	2	Habitat and bank erosion	At M61 crossing, E of Wooden Shoe
Tittabawassee River	2	Sedimentation	Fitzwater Crossing, NE of Sugar Rapids
Sanford Lake	5	FCA-PCBs and fish tissue mercury	NW of Midland at Sanford
Little Cedar River	2		At Dale Road SE of Beaverton
Middle Branch Cedar River	2		Confluence with Cedar River u/s
N. Br. Cedar River	2		Confluence with Cedar River u/s
W. Br. Cedar River	2		Cranberry Creek confluence u/s
Budd Lake	3		Vicinity of Harrison
Cranberry Lake	3		NE of Harrison
N. Br. Tobacco River	2		Grout Road u/s to Clarwin Road
Middle Branch Tobacco River	2		McCullough Road u/s to Hoover Avenue
Black Creek	3		Sanford Lake Confluence, West River Road
S. Br. Tobacco River	2		Grout Road u/s to Rodgers Road
S. Br. Tobacco River	2		Grant Road u/s of Clare
N. Br. Tobacco River	3	Erosion	Ross Lake Confluence u/s
Middle Branch Tobacco River	3		Ross Lake Confluence u/s
Tobacco River			Shock Road u/s to Ross Lake Outlet
Cedar River	5	CSO and pathogens	Vicinity of Gladwin (M61) u/s to Howard Oil Field Road
Mouth			
Viscar Drain	2		TWP 17, 18
Black Creek	3		Sanford Lake Confluence, West River Road
Carrol Creek Dr.	2	Habitat	At Meridian Rd, NW of Midland
Sturgeon Creek	3	Habitat	Tittabawassee confluence
Tittabawassee River	5	Untreated sewage discharge, pathogens	1 mile d/s of Dow Dam
Tittabawassee River	5	FCA-PCBs, TCDD (Dioxins), fish tissue-mercury, WQS exceedances for hg	Dow Dam to confluence with Saginaw River

Table 22.–Continued.

Segment and stream	Category [a]	Problem	Location
Bluff Creek	2	Habitat	Poseyville Road crossing
Salt River	2		Big Salt River at North Bradley to Rosebush Road
Cedar Creek	2		Chippewa River confluence u/s to Millbrook Road
Chippewa River	2		At S. Meridian Road crossing, SW of Mt. Pleasant
Chippewa River	2		At Meridian Road crossing, W. of Midland, E. of Little Salt Creek
Chippewa River	2		At Coldwater Road crossing, SW of Weidman
Chippewa River	2		M-20 u/s to Barryton (excluding Lake Isabella)
Chippewa River	2		Lincoln Road u/s of Mt. Pleasant, Jerome Twp, Sec. 24
Chippewa River, N. Br.	2		Coleman Road crossing u/s to Grass Lake outlet
Coldwater River	2	Temperature	At Baseline Road crossing, S. of Weidman
Hogg Creek	2		Hogg Creek is a tributary to N. Br. Chippewa River in Deerfield Twp.
Jewel Creek	2		Blanchard Millpod confluence u/s
Little Salt Creek	2		From confluence with Chippewa River W. of 8 Mile Road (T14N, R1W) u/s to Redstone Road
Hogg Creek	2		Hogg Creek is a tributary to N. Br. Chippewa River in Deerfield Twp.
N. Br. Chippewa River	2		Chippewa River at Barryton u/s
Walker Creek			Lake of the Hills inlet u/s (Section 11 Sherman Twp).
Chippewa River	3		At Mt. Pleasant
Chippewa River, S. Br.	3		SW of Barryton. 35th Avenue u/s to Winchester Dam (19th Avenue)
Crooked Lake	3		Vicinity of Lake Station S. of U.S. Rt. 10 West of Clare
Martiny Lake	3		SW of Barryton. u/s of Winchester Dam on the W. Br. Chippewa River
Potter Creek	3	Poor macroinvertebrates	Onion Creek confluence u/s
Salt Creek	3	Ammonia WQS exceedance (one grab sample)	Chippewa River confluence u/s
Coldwater River	4a	Biological community threatened	Vernon Road Crossing u/s to Outlet Lake (Littlefield Lake area).
Pine River	2		Harrison Road, SW of Alma, u/s to Pine Lake, S. of Remus
Pony Creek	2		Pine River confluence u/s
Halls Lake	3		3.5 miles SE of Remus. D/s of Wheatland Twp. WWSL and Pony Creek
Pine River, S. Br.	3		E. of Blanchard. Pine River confluence u/s

Table 22.–Continued.

Segment and stream	Category [a]	Problem	Location
Pony Creek	3		Wheatland Twp., E. of Remus on M-20
Rock Lake	3		NW of Vestaburg. E. of Pine Grove; E. of Pine Grove Road and N. of M-46
Sugar Creek	3	Poor macroinvertebrates	Pine River confluence u/s from the vicinity of Begole Road
Wolf Creek	3	Assess fish for mercury concentrations due to historical discharges of mercury	d/s of Hitachi Magnetics in Edmore. Pine River confluence u/s to Cedar
Pine River and St. Louis Impoundment	4b	FCA-PBBs, DDT	

[a] Water quality assessment and water quality attainment categories:

1 All designated uses met.
2 Some uses are met but there is insufficient data to determine if remaining uses are met.
3 Insufficient data to determine whether any uses are met.
4a WQS Nonattained (USEPA approved TMDL but unverified WQS restoration).
4b WQS Nonattained (Other corrective action used but unverified WQS restoration).
4c WQS Nonattained (Highly modified water body).
5 Water is impaired or threatened and a TMDL is needed.

Table 23.–National Pollution Discharge Elimination System permits issued in the Tittabawassee River watershed by Michigan Department of Environmental Quality, Surface Water Quality Division. Acronyms: WWTP = wastewater treatment plant, WWSL = wastewater sewage lagoon, WW = wastewater, * = major discharges.

Segment River Tributary	Facility name	City
Middle		
Main Stem		
Unnamed	Billings Township WWTP	Beaverton
Sugar River	Butman Township WWTP	Gladwin
Unnamed	Eggers Exc-Lakewood Estates	Freeland
Unnamed	Stockholm Forest Vil MHP	Bay City
Tobacco River		
Tobacco River	Brown Machine-Beaverton	Beaverton
Tobacco River	Brown Machine-Beaverton	Beaverton
South Branch Tobacco River	Clare PRP Committee	Clare
South Branch Tobacco River	Clare WWTP	Clare
Unnamed	Clare-Water Filtration Plant	Clare
Not listed	Farwell WWSL	Farwell
Cedar River	Gladwin WWTP	Gladwin
Bailey Creek	Packard Farms-CAFO	Clare
Mouth		
Main Stem		
Unnamed	Bullock Creek High School WWSL	Midland
Tittabawassee River*	Dow Chemical-Midland	Midland
Lingle Drain	Dow Corning Corp-Midland	Midland
Lingle Drain	Dow Corning Corp-Midland	Midland
Unnamed	Fisher Cont Co-Pardel Pit	Midland
Unnamed	Freeland MHP	Freeland
Tittabawassee River*	Midland Cogeneration Venture	Midland
Tittabawassee River*	Midland WWTP	Midland
Tittabawassee River	Old Oak Trails Est MHP	Sanford
Sturgeon Creek	Pats Gradall Stark Pit	Hope
Tittabawassee River*	Saginaw Township WWTP	Saginaw
Tittabawassee River	Saginaw Township-Center Road LF	Saginaw
Carrol Creek Drain	Sterling Manor MHP	Midland
Tittabawassee River	Tittabawassee Township WWTP	Freeland
Not listed	James Township MS4-Saginaw	Saginaw
Not listed	Saginaw Township MS4-Saginaw	Saginaw
Not listed	Tittabawassee Township MS4-Saginaw	Freeland
Not listed	Thomas Township MS4-Saginaw	Saginaw
Salt River		
Jordon Creek	Country Place Park MHP	Mt. Pleasant
Unnamed	Rosebush WWSL	Rosebush
Bluff Creek	Coleman WWSL	Coleman
Bluff Creek, Mud Creek	Robinson Industries Inc	Coleman
Bluff Creek	Huhtamaki Plastics Inc	Coleman

Table 23.–Continued.

Segment River Tributary	Facility name	City
Mouth–continued		
Chippewa River		
Upton Drain	CMU-Central Energy Facility	Mt. Pleasant
Chippewa River	Isabella Co Landfill	Mt. Pleasant
Onion Creek	Isabella Reservation WWTP	Mt. Pleasant
Not listed	MDOT-Mt Pleasant-Dobias ROW	Mt. Pleasant
Chippewa River	Mi Reutilization	Mt. Pleasant
Chippewa River	Mt Pleasant WWTP	Mt. Pleasant
Chippewa River	Nartker-Wyman Apts	Mt. Pleasant
Salt Creek	Shepherd WWSL	Shepherd
Not listed	TPI-Mt Pleasant	Mt. Pleasant
Pine River		
Pine River*	Alma Products I Inc	Alma
Pine River	Alma WWTP	Alma
Sucker Creek	Breckenridge WWSL	Breckenridge
Not listed	Edmore WWSL	Edmore
Not listed	Great Lakes Adventist Academy	Cedar Lake
Wolf Creek	Hitachi Magnetics Corp	Edmore
Wolf Creek	Hitachi Magnetics Corp	Edmore
Little Salt Creek*	Mibelloon Dairy-CAFO	St. Louis
Pine River	St. Louis WWTP	St. Louis
Pine River	TPI Petroleum Inc-Alma	Alma
Thatcher Creek	Morey Foundation	Shepherd

Table 24.–Industrial storm water permits issued (as of 2006) by Michigan Department of Environmental Quality, Surface Water Quality Division, in the Tittabawassee River watershed.

Segment River Tributary	Facility name	Location
Headwaters		
Main Stem		
Cooks Creek	Bunting Sand Gravel Products, Incorporated	West Branch
Rau Creek	Flash Wood Products	West Branch
Unnamed tributary to Rau Creek	West Branch Concrete Products	West Branch
Rau Creek	Woodstock Incorporated	West Branch
Middle		
Main Stem		
Lorrabee Creek	Frito-Lay	Gladwin
Tittabawassee River	International Engineering & Manufacturing Incorporated	Edenville
Lorrabee Creek	JVS Auto Salvage, Incorporated	Gladwin
Round Lake	Pine Tech, Incorporated	Gladwin
Tobacco River		
Little Tobacco Drain	Campbell Printing, Incorporated	Clare
Conham Drain	Dura Automotive Sys-Gladwin	Gladwin
Doone Creek	Elmer's Concrete of Beaverton	Beaverton
Cedar River	Frank's Auto Salvage	Gladwin
Conham Drain	Gladwin Tank Manufacturing Incorporated	Gladwin
Not listed	JD Metalworks, Incorporated	Clare
Not listed	JD Metalworks, Incorporated	Clare
Little Tobacco Drain	Johnson Auto Parts-Clare	Clare
Little Tobacco Jt. Drain	Letherer Truss, Incorporated	Clare
Little Tobacco Drain	Pilot Industries	Clare
Overton Creek	Renosol Corporation/Renosol Seating LLC	Farwell
Tobacco River	Rockcrete Transit Mix, Incorporated	Clare
Unnamed Ditch to Tobacco River	Stage Right Corporation	Clare
Tobacco River	Spartech Plastics-Mideast	Clare
Wetlands	Waste Management of Michigan Incorporated	Harrison
Mouth		
Main Stem		
Tittabawassee River	Airgas Great Lakes, Incorporated	Midland
Sarle Drain	Anthony Gushow & Sons, Incorporated	Freeland
Harris Drain	B & B Pick Up Salvage	Hope
Lingle Drain	Cabot Corporation	Midland
Yates Drain	Carroll Excavating Incorporated	Sanford
Tittabawassee River	Case Systems Incorporated	Midland
Tittabawassee River	Dendritech Incorporated	Midland
Tittabawassee River	Dow Chemical Sludge Dewatering Facility	Midland
Tittabawassee River	Dow Chemical	Midland
Martinus Drain	FedEx Freight East	Midland
Sturgeon Creek	Fisher Property Account	Midland
Tittabawassee River	J Pomranky Incorporated	Midland
Jacobs Drain	Jack Barstow Airport	Midland
Unnamed tributary to Ashby Drain	Lake Painting, Incorporated	Midland
Jacobs Drain	Midland Armory-OMS22	Midland
Tittabawassee River	Midland-Municipal Service Ctr	Midland
Sturgeon Creek	Pats Gradall Stark Road Pit	Midland

Table 24.–Continued.

Segment River Tributary	Facility name	Location
Mouth–continued		
Tittabawassee River	Quebecor World Midland	Midland
Newell Drain	Sova Auto Sales and Parts	Midland
Tittabawassee River	Specialty Manufacturing, Incorporated	Saginaw
Jacobs Drain	Three Rivers Construction Company	Midland
Lingle Drain	Transport Service Company	Midland
Unnamed tributary to Tittabwawassee River	Willsie Lumber Company	Freeland
Salt River		
Howard Drain #11	C & M Rubber Technologies Incorporated	Coleman
Curtis Drain	G & D Auto Sales	Coleman
Curtis Drain	Homestead Tool & Machine, Incorporated	Coleman
Curtis Drain	Homestead Tool & Machine, Incorporated	Coleman
Unnamed tributary of Howard Creek	Mark-1 Flooring, Incorporated	Coleman
Bluff Creek	Robinson Industries	Coleman
Chippewa River		
Chippewa River	4-D an Oldcastle Co-Midland	Midland
Duncan Drain	Fair Salvage Company	Clare
Chippewa River	Fisher-Whitman Dr Sand & Clay	Midland
North Branch Chippewa River	Bandit Industries Inc-Remus	Remus
Chippewa River	Central Asphalt Incorporated	Mt. Pleasant
Unnamed Ditch	Central Concrete Products	Mt. Pleasant
Potter Creek	CME Corporation	Mt. Pleasant
Chippewa River	Delfield Company	Mt. Pleasant
Salt Creek	Dice’s Auto Scrap-Plus	Shepherd
Graves Lake	EaglePicher Automotive	Mt. Pleasant
Graves Lake	EaglePicher Automotive	Mt. Pleasant
Chippewa River	Elmer’s Concrete of Mount Pleasant	Mt. Pleasant
Chippewa River	Frito-Lay	Mt. Pleasant
Salt Creek	Highland Plastics Incorporated	Shepherd
Chippewa River	ITW Foil	Mt. Pleasant
Coldwater River	Maeder Brothers, Incorporated	Weidman
Unnamed tributary to Chippewa River	McGuirk Sand and Gravel, Incorporated	Mt. Pleasant
Chippewa River	Mt. Pleasant Central Concrete, Inc.	Mt. Pleasant
Chippewa River	Mt. Pleasant Minicipal Airport	Mt. Pleasant
Halstead Drain	Oil City Auto Salvage Incorporated	Shepherd
Chippewa River	Randell Manufacturing	Weidman
Chippewa River	Snowmobile-Motorcycle Salvage	Mt. Pleasant
Chippewa River	TB Woods Incorporated	Mt. Pleasant
Chippewa River	United Parcel Service	Mt. Pleasant
Chippewa River	W. Wing Auto Parts & Recycling	Mt. Pleasant
Chippewa River	Waste Management of Michigan	Mt. Pleasant
Wagner Drain	Weber Brothers Sawmill Incorporated	Mt. Pleasant
Pine River		
Pine River	Alma Concrete Products	Alma
Pine River	Alma Iron & Metal Co Inc	Alma
Pine River	Alma Products I Inc	Alma
Pine River	Alpha Plastics-St Louis	St. Louis
Riggle Marsh Drain	Apex Marine	St. Louis
Pine River	Bear Truss & Components Co	St. Louis
Horse Creek	Brinks Machine Co Inc-Alma	Alma

Table 24.–Continued.

Segment River Tributary	Facility name	Location
Mouth–continued		
Brady Creek	C & S Steel Service Co Inc	Ithaca
Brady Creek	Craig Frames Incorporated	Ithaca
St. Louis Storm Drain	Crippen Manufacturing Co Inc	St. Louis
Brady Creek	Davis Machine & Manufacturing	Ithaca
Pine River	Lear Corp-Alma	Alma
Horse Creek	Liquid Transport Trucking Inc	Alma
Pine River	Mich Chloride Sales-St Louis	St. Louis
Pine River	Oxford Automotive-Alma	Alma
Pine River	Plasti-Paint Incorporated	St. Louis
Pine River	Playbuoy Pontoon Mfg-Alma	Alma
Pine River	Powell Fabrication & Mfg Inc	St. Louis
Pine River	SPX Contech-Alma	Alma
Pine River	Terry Materials of Mich-Alma	Alma
Pine River	US EPA-Velsicol	St. Louis

Table 25.–Michigan Department of Environmental Quality 319 Grants to address nonpoint source issues. CL-project closed OP–project is open.

Project	Status	Goals of project/Cost
Dundas Road Reconstruction	CL	As a result of this road stabilization project, 269 tons of sediment per year were eliminated from entering Wixom Lake. 7100 cubic yards of gravel and 2654 tons of asphalt pavement were installed to reduce erosion and sedimentation into the Tittabawassee River watershed. $437,671.70
Cedar River Road Crossings	CL	This project resulted in the stabilization of 5 eroding road-stream crossings. $116,563.00
Cedar River Watershed Project	CL	The goal of the project is to complete a comprehensive nonpoint source watershed management plan, which will identify, document, quantify, and prioritize nonpoint pollution sources within the watershed. $101,995.00
North Branch Salt River	CL	This project resulted in the installation of 5.5 miles of exclusionary fencing, 15 grade stabilization structures, 10 livestock crossings/watering practices, 5.5 acres of critical area treatment and 1 diversion. During this project, EQIP practices were installed, including manure management and upland wildlife habitat improvement. Also installed during this project were Conservation Reserve Enchancement Program (CREP) practices, including filter strips, shallow water wildlife ponds, and animal exclusionary fencing/crossings. EQIP and CREP practices were not eligible nor counted as match. Advisory Committee meetings were held throughout this project to update partners. $390,559.20
Sturgeon Creek Watershed Plan (Midland County)	CL	The goal of this project is to develop a comprehensive watershed management plan. $170,801.00
Cedar River Implementation	OP	The goal of the Cedar River project is to restore the environmental integrity and the state's designated uses of warmwater fishery, coldwater fishery and partial body contact recreation of the Cedar River watershed. $394,502.97
Saginaw Bay Watershed Livestock Exclusion	OP	The goal of this project is to improve water quality by reducing nutrient and sediment input into the small creeks and flood plains, excluding livestock, providing stable crossings, restoring critical areas and providing stable watering facilities. $633,338.00
Sturgeon Creek Transition/Implementation I	OP	To upgrade watershed plan to meet EPA's 9 elements and begin implementation of priority BMPs to address priority pollutants of concern. $121,234.50
Sturgeon Creek Watershed Implementation	OP	Contract is to stabilize 7 stream banks, 5 storm drain outlets and restore a 5-acre wetland. $374,212.16
Cedar River Watershed Permanent Easement Acquisition Program	OP	The goals of this project include improving water quality and wildlife habitat, and protecting key natural features, by obtaining permanent conservation easements. $563,145.80
North Branch Chippewa River	CL	–Workshop seminar, Kellogg Center, MSU –Bi-weekly monitoring of selected physical and chemical parameters $38,000.00

Table 25.–Continued.

Project	Status	Goals of project/Cost	
North Branch Chippewa River	CL	–Streambank=2,470.14 ft –Fencing=12,380 ft –Filter strips=8 acres –Diversions=833 ft –Critical Area seeding=7.2 acres	$200,000.00
North Branch Chippewa River	CL	–Grade stabilization structures==14 units –Diversions==50 feet –Streambank stabilization==1626.63 feet –Filter strips==2.71 units –Agricultural waste storage==1 unit –Critical area planting==1.37 acres	$130,842.00
South Branch Salt River	CL	–erosion control structures –filters strips –animal exclusionary fencing –grassed waterways –critical area seeding –diversions –stream bank stabilization –agricultural waste management	$43,012.00
South Branch Salt River	CL	Planning only.	$47,500.00
South Branch Salt River	CL	BMP's implemented as a result of this project include: 39 erosion control stuctures, 5,962 feet of animal exlusionary fencing, two demonstration farms, and 3.18 acres of filter strips. In addition, information and education activities included a "Twilight Tour" of the demonstration farms for local interested parties, and the development of a newsletter and a photo journal.	$130,738.00
South Branch Big Salt River	CL	As a result of this project, thirteen erosion control structures, 7,900 feet of fencing, five animal crossings, 20, 746 feet of animal exclusionary fencing, and eleven grade stabilization structures were installed. In addition, three animal crossings were repaired.	$261,476.00
Coldwater River TMDL Project	OP	The project goal is to achieve a habitat rating of "acceptable" by reducing sediment inflows. Achievement of project objectives should result in removal from the TMDL list.	$150,429.94

Table 26.–Natural Resources Environmental Protection Act Part 201 Contamination sites in the Michigan portion of the Tittabawassee River watershed, by segment. Acronyms: BTEX = benzene, toluene, ethylbenzene, and xylene; DCA = dichloroethane; DCE = dichloroethylene; DDE = dichlorodiphenyldichloroethylene; MTBE = methyl tertiary butyl ether; DDT = Dechlorodiphenyltrichloroethane; PCB = polychlorinated biphenyl; PCE or PERC = perchloroethylene; PNAs = polynuclear aromatic hydrocarbons; TCA = trichloroethane; TCE = trichloroethylene; TPH = total petroleum hydrocarbons; LF = landfill.

Segment Tributary Site	Location	Pollutant
Headwaters		
Main Stem		
Zettel Drive	West Branch	Fuel oil , heating oil
Middle		
Main Stem		
Buckeye Oil Field		Brine/chloride, crude oil
Elm Street Spill	Gladwin	Ethylbenzene, xylenes, home heating oil
Rabb, Mary 12		Condensate-BTEX, crude oil, brine, chloride
D and G Laundromat	Sanford	PCE, dichloroethane, bromodichlorometha
Tobacco River		
Buckeye Twp Dump Closed	Gladwin	Trace pesticides, landfil
D and B Disposal Closed	Beaverton	Domestic Comm
Elliot Gas and Oil Co	Gladwin	Fuel oil
Gladwin Bulk Oil Plant State St	Gladwin	BTEX
Gladwin City of LF Closed	Gladwin	Arsenic, cadmium chromium, lead
Gladwin Co Road Comm	Gladwin	salt
Ruby Dr Residential Leaking Pipeline	Gladwin	Fuel oil
Sage Twp Dump Closed	Gladwin	Domestic Comm
Tobacco Twp Refuse Closed	Beaverton	Landfill
Chovich #1	Gladwin	brine/chloride
Maier J 1	Gladwin Co.	Condensate BTEX, crude oil
Buckeye Oil Field T&E Investment	Gladwin Co.	Condensate BTEX, crude oil, brine/chloride
American Dry Cleaners	Clare	Xylene, Tetrachloroethylene, carbontetrachloride
Arthur Twp Dump	Gladwin	Domestic Comm
Clare Co MDOT Bulk Storage Site	Clare	Benzene xylene, ethylbenzene, toluene
Clare Co Rd Comm Mansiding Rd	Harrison	Salt
Clare LF Closed City of	Clare	Domestic Comm
Clare Municipal Wells City of	Clare	PCE TCE 1,2 DCE, 1,1,1 TCA
Clare Sanitary LF City of	Clare	Chloroform, trichloroethylene, cadmium
Dodge Lake Dump	Harrison	Landfill
GW Contamination Meredith	Gladwin	PERC, BTX
Harrison Lagoon System City of	Harrison	Ammonia nitrate
Harrison LF City of	Harrison	Domestic Comm
Hoover Universal Funnell Prop	Farwell	Cr, Mn, Ni, Cu, As, beta-BHC
Renosol Plant	Farwell	Ethylhexylphthalate
Residential Well Farwell	Farwell	Nitrates
Surrey Twp LF	Farwell	PERC, Cis 1,2-DCE
Tuscola Saginaw Bay RR Derail	Farwell	Diesel fuel
Valcast Inc	Clare	Manufacturing waste
Crichton Property	Harrison	DDE, DDD, DDT, copper
Hamilton Compressor Station	Clare Co.	Condensate BTEXs
Mid Michigan Recyclers	Clare	PCB Lead, toluene
Gleason, Agnes J. 1	Clare Co.	Natural gas, chloride

Table 26.–Continued.

Segment Tributary Site	Location	Pollutant
Middle–continued		
McDonald Property	Clare	benzene, xylenes, ethylbenzene
Residential Contam Curtis Road	Edenville	BTEX
Mouth		
Main Stem		
Dow Chemical Rockwell Landfill	Midland	Benzene, ethylbenzene, chlorophenol phenol
SCA Saginaw Twp LF	Saginaw	C-66 endrin aldehyde, cadmium chromium
Shields Ziebart	Midland	Mineral spirits
Saginaw Community Hospital	Saginaw	Fuel oil
Dow Chem Brine Pipeline Spills	Several	Brine
Dow Corning	Midland	Toluene
Mostly Mopars	Midland	Toluene, methylene chloride
Oil Field Area Andreason Residential	Midland	Chlorides
Dow Poseyville Land Fill	Midland	Benzene, pentachlorophenol, PCE
Residential Contam W Isabella Road	Midland	BTEX
Tittabawassee River	Midland	2,3,7,8 Tetrachloro-, dibenzo-p-dioxin
Tridge Area	Midland	Domestic Comm
Dow Chemical Midland Plant	Midland	2,3,7,8 Tetrachloro-, dibenzo-p-dioxin
Dalton Pesticide Spill-Midland	Midland	2,4-D, gasoline
Transport Services	Midland	BTEX 1,1 DCE PERC, DCB 1,1,1 TCE, trichlorobenzene
Dow Corning Benzene	Midland	Benzene
Midland Co Bldg LUST	Midland	Fuel oil
Midland Co Bldg PCE	Midland	Tetrachloroethylene
Midland Painting	Midland	MEK Xylene, ethylbenzene toluene, dichlorobenzene
Hary Herron Domestic Well	Midland	Brine/chloride
State B 2 Flowline Johnson Site	Midland	Crude oil, brine/chloride
Howland 3 and TB	Midland	Condensate-BTEX, crude oil, brine/chloride
Tittabawassee River	Midland	Not listed
Salt River		
Michigan Ohio Pipeline Co	Mt. Pleasant	Petroleum products
Residential Well Loomis	Loomis	Benzene, ethylbenzene, toluene, xylenes
Wise Twp LF	Rose Bush	Hg As Cd Cr PERC TCA, 1,2-DCE
Harry Tope No 3	Beaverton	Brine
Warren Township Dump	Midland Co.	Nickel , arsenic, Mn, BEHP
Chippewa River		
Dana Corp	Mt. Pleasant	PCE TCE, methylene chloride
Fussman Race Track	Mt. Pleasant	Brine
Gilmore Twp Sanitary LF	Gilmore	Phthalates chrysene, Chromium Arsenic, Aluminum
Isabella Co Sanitary LF	Mt. Pleasant	Phthalates
Mich Wisconsin Pipeline Co	Weidman	Hydrocarbons
Mt Pleasant, City of	Mt. Pleasant	Benzene, ethylbenzene, toluene xylenes
Mt Pleasant Tar Pit	Mt. Pleasant	Chromium, lead, phenol, benzene, cyanide, As, PNAs
Residential Well Nottawa	Coldwater Lake	Gasoline, lubricating oil
Residential Well Schutt	Mt. Pleasant	Gasoline
Stanley Oil Co	Shepherd	Gasoline
Total Petroleum Inc Roosevelt	Mt Pleasant	Lead, oils
Dalton 24D Spill Isabella Co	Isabella Co.	2,4-D
Shepherd Village DPW	Shepherd	Salt
Rodgers, John 2	Isabella Co.	Crude oil BEXT, chloride

Table 26.–Continued.

Segment Tributary Site	Location	Pollutant
Mouth–continued		
Watkins, Andrew 1	Isabella Co.	Crude oil BEXT, chloride
Sides, Russell 2	Isabella Co.	Crude oil BEXT, chloride
Dague, Robert 0 1	Isabella Co.	Crude oil BEXT, chloride
Hoffman, Fred L. 1	Isabella Co.	Crude oil BEXT, chloride
Rodgers, J W 1	Isabella Co.	Crude oil BEXT, chloride
Dague, Robert O 2	Isabella Co.	Crude oil BEXT, chloride
Cummings, John 5	Isabella Co.	Crude oil BEXT, chloride
Cummings John 4	Isabella Co.	Crude oil BEXT, chloride
CMU/MDOT	Mt. Pleasant	Crude oil BEXT, chloride
Gordonville Road	Midland	Benzo(a)pyrene, Cr, Cu, chrysene Pb PNAs
Midland Iron Works	Midland	Heavy mfg
Residential Well Bradford Road	Midland Co.	Sodium chloride
Shepard Road Dump	St Louis	PCB, Cr, Cd, pyrene chrysene
St Jasper and Baker 1-2	Midland Co.	Brine/chloride
Conley and St Jasper 1-3	Midland Co.	Brine/chloride
Reed, Emma O C-1	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Bond Root 12, 18, 19 and TB	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Rayner D2, B3,B4 and Bond B RaynerTB	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Bond Root 7	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Rayner, John B D-7	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Rayner, J B 1	Midland Co.	Condensate-BTEX, crude oil, brine/chloride
Jasin Property	Garden City	BTEX
Ullom Residence	Mecosta	BTEX
Pine River		
Wickes Agriculture	Blanchard	Nitrate (Nitrogen), urea
Alma City of	Alma	Phenol
Alma Iron Metal Smith Property	Alma	Lead, chromium, PCB, Nickel, PBB
Alma Products	Alma	Cyanide, toluene, TCE
Total Petroleum Alma	Alma	Methylene, chloride, phenols
Lobdell-Emery	Alma	Lead, benzene, tetrachloroethene
Total Petroleum Present Refinery	Alma	BTEX
Admiral Petroleum	Alma	PNA’S, cyanide, BTEX, Pb, Cd, As, Ni
Midwest Refinery	Alma	BTEX, Chloroform, PCE, PNA’s, Acetone, Pb,Cd As, Cr
Total Petro Lansing Product Line	Alma	Gasoline
Vining Welding	Riverdale	Hydrocarbons
Gratiot County LF	St Louis	PBB
City of St. Louis, Electric Dept	St. Louis	PNAs, PCE, benzene, pesticides 1,4-DCB
Pat’s Service	Sumner	Benzene, toluene, lead
Velsicol Chemical Corporation	St. Louis	Benzene, DDT, DDD, chromium, PBB
Crystal Oil Field	Montcalm Co.	Brine/chloride
Hitachi Magnetics	Edmore	Trichloroethene(TCE), mercury, PCBs
Residential Wells Vestaburg	Vestaburg	Salt, brine
Gallaher Tank Battery	Home Twp	Oil, brine
Staffen, Glen Et Al 1	Montcalm Co.	BTEX Brine/Chloride, crude oil
Sackett, Raymond 2	Montcalm Co.	BTEX Brine/Chloride, crude oil
Graham, Harold 2	Montcalm Co.	BTEX Brine/Chloride, crude oil
Graham, Harold 1	Montcalm Co.	BTEX Brine/Chloride, crude oil
Lamphier Frank 2	Montcalm Co.	BTEX Brine/Chloride, crude oil

Table 26.–Continued.

Segment Tributary Site	Location	Pollutant
Middle–continued		
Marzig, Max C 1	Montcalm Co.	BTEX Brine/Chloride, crude oil
North 10 Mile	Montcalm Co.	Chloride
Campbell Lease	Midland Co.	Crude oil
Howard 7, 6, 2 and Howard TB	Midland Co.	Condensate-BTEX, brine/chloride
Root C-4, C-7, C-10 and Root C TB	Midland Co.	Condensate-BTEX, brine/chloride
TMT Petroleum Porter Field	Midland Co.	Condensate-BTEX, brine/chloride
Kleinhans TB and Kleinhans 1,2,3,4	Midland Co.	Condensate-BTEX, brine/chloride
Wager #2-12 DRLG 85-12-10	Midland Co.	Brine/chloride

Table 27.–July average stream temperature (°F) for the Tittabawassee River and tributaries. Blanks indicate missing information (MDNR, Fisheries Division, unpublished data).

Stream	County	Site	Year	Temperature(°F) Minimum	Maximum	Mean
Main Stem Headwaters						
Mid. Br. Tittabawassee	Gladwin	M30/BoenschRd	2004	62.4	79.4	69.2
W. Br. Tittabawassee	Roscommon	Dunham Road	2004	52.8	68.2	58.8
E. Br. Tittabawassee	Ogemaw	Cook Road	2005	60.6	83.7	73.6
Mid. Br. Tittabawassee	Ogemaw	Beardslee Road	2004	63.9	80.1	70.7
Brick Creek	Ogemaw	Lehman Road	2004	53.5	67.5	59.4
Cooks Creek	Ogemaw	Lehman Road	2004	54.6	68.4	60.2
Main Stem Middle						
Little Molasses	Gladwin	Grim Road	2005	54.0	80.9	68.1
Molasses Flooding 3	Gladwin	Grim Road	2005	55.1	77.6	67.5
Fish Creek	Gladwin	Wildwood Road	2005	44.8	78.1	66.7
Sugar River	Gladwin	Above L. Lancer	2002	57.0	74.2	65.8
Sugar River	Gladwin	Below L. Lancer	2002	67.6	79.1	72.6
Bailey Creek	Clare	Surrey Road	2005	57.3	74.4	67.2
N. Br. Tobacco	Clare	Rodgers Road	2004	53.3	68.7	59.7
Sanford Creek	Clare	Elderhart Road	2004	53.9	68.4	60.0
Cedar River**	Gladwin	Above Wiggins L	2002	74.6	86.1	80.2
Cedar River	Gladwin	Below Wiggins L	2002	59.8	78.1	68.8
Main Stem Mouth						
Carroll Creek	Midland	Meridian Road	2005	57.3	75.6	75.6
Sturgeon Creek	Midland	Letts Road	2005	49.0	84.8	70.3
McDonald Drain	Isabella	Battle Road	2004	64.0	81.2	71.6
N. Br. Salt River	Isabella	Vernon Road	2005	59.2	79.4	70.5
S. Br. Salt River	Isabella	Leaton Road	2005	60.6	77.2	69.3
Big Salt River	Midland	Castor Road-Down	2004	60.8	80.9	70.4
Big Salt River	Midland	Castor Road-Up	2005	63.5	84.3	74.1
Big Salt River	Midland	Coleman Road	2004	57.3	75.6	67.8
Big Salt River	Midland	Coleman Road	2005	62.8	79.2	71.1
Cedar Creek	Isabella	Tyler Road	2004	54.9	69.9	61.8
Coldwater River	Isabella	Baseline Road	2005	67.9	86.4	77.2
Delaney Creek	Isabella	Rolland Road	2004	53.4	70.5	61.2
Indian Creek	Isabella	Wyman Road	2004	51.5	67.6	58.6
Johnson Creek	Isabella	Bluegrass Road	2004	53.2	66.6	59.0
N. Br. Chippewa River	Isabella	Glass Lake Road	2004	64.0	81.2	71.6
Walker Creek	Isabella	Vernon Road	2004	54.9	72.8	63.6
Brown Creek	Mecosta	20 Mile/40th	2005	58.3	67.2	63.0
Butts Creek	Mecosta	10th Avenue	2004	49.5	62.6	55.8
Jewell Creek	Mecosta	Harrison Road	2004	53.2	67.4	60.2
N. Br. Chippewa River	Mecosta	Hoover Road	2004	56.6	76.4	66.0
Rattail Creek	Mecosta	40th Avenue	2004	55.0	79.4	66.2
Roundybranch Creek	Mecosta	20 Mile	2004	57.3	73.0	64.8
South Branch Chippewa	Mecosta	19 Mile	2004	63.9	83.0	72.0
Benjamin Creek	Osceola	10th Avenue	2005	54.7	73.7	65.3
Honeyoey Creek	Gratiot	Madison Road	2004	55.8	73.7	65.0

Table 27.–Continued.

Stream	County	Site	Year	Temperature(°F) Minimum	Maximum	Mean
Main Stem Mouth–continued						
Pine River	Gratiot	Bridge Road	2004	66.2	83.5	74.5
Pine River	Gratiot	Lumberjack Road	2005	60.5	78.7	71.2
Pine River	Gratiot	Tyler Road	2004	55.6	104.1	71.5
Pine River	Midland	Redstone Road	2004	66.2	83.5	74.5
Pine River	Midland	Redstone Road	2005	68.4	85.8	78.5
N. Br. Pine River	Isabella	Coe Road	2004	53.9	73.0	63.8
Pine River	Isabella	Rolland Road	2004	55.1	74.9	65.2
S. Br. Pine River	Isabella	Pleasant Valley Rd	2005	46.8	93.9	69.4
Pony Creek	Isabella	Bridge	2004	56.2	74.3	65.2
Skunk Creek	Isabella	Brinton Road	2004	53.8	72.8	62.9
Decker Creek	Mecosta	10th Avenue	2004	52.7	67.3	59.8

Table 28.–Trigger levels for nine chemicals used by the Michigan Department of Community Health in the establishment of fish consumption advisories (ppm = parts per million; ppt = parts per trillion). Information from Wesley (2005).

Chemical	Advisory triggers
Total chlordane	0.3 ppm
Total DDT	5.0 ppm
Dieldrin	0.3 ppm
Toxic dioxin equivalents	10.0 ppt
Heptachlor	0.3 ppm
Mercury	0.5 ppm
Mirex	0.1 ppm
Total PCB	2.0 ppm
Toxaphene	5.0 ppm

Table 29.–Length (mi) and establishment date (Est.) of Tittabawassee River watershed designated county drains by subwatershed, county, and township. Information provided by county drain offices. Some drains are in more than one township and county. If so, this information is listed in parentheses following the drain name. N/A = not available.

Drain	Length (mi)	Est.
Headwaters		
Gladwin County		
• *Sherman Township*		
Busch Drain (Butman)	1.00	1922
Butman Township		
Busch Drain (Sherman)	1.00	1922
Hunt Drain	2.00	1918
Middle		
Gladwin County		
• *Sherman Township*		
Foote Drain (Butman)	1.00	1922
Round Lake Drain (Sherman, Sage, Gladwin)	4.00	1902
• *Sage Township*		
Foran Drain	3.00	1923
Long Drain (Gladwin)	2.00	1909
Mud Lake Drain	2.00	1913
Round Lake Drain (Sherman, Butman, Gladwin)	4.00	1902
• *Butman Township*		
Foote Drain (Sherman)	1.00	1922
Round Lake Drain(Sherman, Sage, Gladwin)	4.00	1902
Shell Drain	3.00	1915
• *Gladwin Township*		
Bennington Drain	2.50	1912
Canham Drain (Buckeye)	4.00	1895
Humason Drain	1.00	1901
Johnson Drain	1.00	1917
Long Drain (Sage)	2.00	1909
Little Sugar Drain	3.00	1894
Round Lake Drain(Sherman, Sage, Butman)	4.00	1902
Weir Drain	2.00	1899
• *Buckeye Township*		
Arkwright Drain	2.00	1920
Canham Drain (Gladwin)	4.00	1895
Dam Drain	2.00	1918
Heth Drain	2.50	1911
Larabee Creek Drain (Hay)	7.00	1916
Oard Drain (Hay)	2.00	1914
Van Horn Drain	3.00	1911
• *Secord Township*		
Sheridan Drain (Grim)	4.00	1917
• *Hay Township*		
Babcock Drain	1.00	1919
Emmott Drain	2.00	1919
Larabee Creek Drain (Buckeye)	7.00	1916
• *Sherman Township* – continued		
Jadle Drain	1.50	1925
Wheeler Drain	5.00	1907
• *Clement Township*		
Elk Creek Drain	1.25	1909
Fornier Drain	1.25	1960
• *Hay Township* – continued		
LeClear Drain (Billings)	2.00	1911
McMahon Drain	1.50	1917
Oard Drain (Buckeye)	2.00	1914
Robbins Drain	1.00	1914
Thompson Drain	0.50	1918
• *Billings Township*		
LeClear Drain (Hay)	2.00	1911
Leuenberger Drain	4.00	1922
Abbott & Ware Drain (Jerome)	6.99	1901
Edd Drain	0.63	1916
Ervin Drain	2.04	1897
Lee Drain	0.96	1908
Mason Drain (Hope)	1.26	1892
Meridian Drain (Hope)	2.48	1890
Raymond Drain (Hope)	4.01	1906
Snyder Drain	0.45	1929
Stone Drain	0.45	1916
• *Hope Township*		
Davids Drain	3.60	1903
Fowley Drain	2.90	1914
Hess Drain	1.78	1909
Meridian Drain (Edenville)	2.48	1890
Raymond Drain (Edenville)	4.01	1906
• *Jerome Township*		
Abbott & Ware Drain (Edenville)	6.99	1901
Crosby Drain	3.85	1995
Flanders Beach Tile	0.21	1965
Francis Drain	1.45	1919
Francis Grove Sub. Tile	0.08	1965
Perry Drain (Lincoln, Jerome)	1.20	1914
Midland County		
• *Geneva Township*		
Carroll Creek (Jerome, Homer)	15.50	1912
Custer Drain	1.50	1914
Russ Drain	2.50	1917

Table 29.–Continued.

Drain	Length (mi)	Est.
Mouth		
Midland County		
• *Greendale Township*		
South Br. Carroll Creek (Jerome)	9.00	1915
Prairie Creek Drain (Homer, City)	5.50	1908
• *Jerome Township*		
Black Creek	4.00	1902
Carroll Creek (Geneva, Homer)	15.50	1912
Falk Tile	0.50	1915
Irish Reed Drain (Homer)	3.25	1915
Knapp Drain (Lee, Homer)	4.20	1904
Sanford Tile	0.75	1966
South Br. Carroll Creek (Greendale)	9.00	1915
Zilski Drain	0.75	1915
• *Lee Township*		
Grace & Waltz Drain	3.00	1903
Knapp Drain (Homer, Jerome)	4.20	1904
Knapp Drain Cutoff	6.25	1917
Prairie Creek Drain (Homer, City, Greendale)	5.50	1908
• *Porter Township*		
Bullock Creek (Gratiot Cty, Mt. Haley, Homer)	11.20	1925
Corbat Drain	3.00	1905
Dowd Drain	1.70	1898
Hood Drain	2.00	1947
Howley Drain	1.00	1897
Kneeland Drain (Mt. Haley)	8.00	1913
Oliver Drain	2.00	1908
Ryan Drain	2.50	1895
• *Hope Township*		
Boyle Drain (Mills, Larkin, Lincoln)	7.50	1913
Clark Drain	1.00	1913
Harris Drain(Lincoln)	1.34	1906
Kelly Drain	2.50	1989
McCoy Drain	2.22	1908
Schoolhouse Drain (Lincoln)	2.30	1913
Weaver Br. 1	3.62	1906
Weaver Drain	1.95	1907
• *Lincoln Township*		
Averill Drain	2.00	1901
Beck Drain	0.39	1905
Bensch Drain (City)	4.28	1900
Boyle Drain (Mills, Hope, Larkin)	7.50	1913
Ditmar Drain	9.53	1905
Harris Drain (Hope)	1.34	1906
Inman Drain	3.85	1896
Lincoln Estates Drain	0.20	1984
• *Lincoln Township* – continued		
State Drain (Homer, City)	2.52	1902
Stearns Drain	4.00	1894
Weaves Cutoff	1.30	1891
• *Mt. Haley Township*		
Bullock Creek (Gratiot County, Porter, Homer)	11.20	1925
Duncan Brooks Drain (Homeer)	7.00	1891
Kneeland Drain (Porter)	8.00	1913
Mt. Haley 16	0.70	1956
Valler & Rose Drain	3.40	1966
• *Homer Township*		
State Drain (Lincoln, City)	2.52	1902
Bullock Creek (Gratiot Cty, Porter, Mt. Haley)	11.20	1925
Carroll Creek (Jerome, Homer)	15.50	1912
Colon Drain	1.50	1910
Draves Drain	1.00	1918
Duncan Brooks Drain (Mt. Haley)	7.00	1891
Feaster Drain	1.00	1915
Gleason Tile	0.50	1946
Haywood Drain	1.25	1913
Irish Reed Drain(Jerome)	3.25	1915
Knapp Drain (Lee, Jerome)	4.20	1904
Prairie CreekDrain (Greendale, Lee, City)	5.50	1908
Rose Drain	5.00	1914
Schrade Drain	0.25	1961
Youngs Drain	1.50	1937
State Drain (Lincoln, City)	2.52	1902
• *Mills Township*		
Boyle Drain (Larkin, Hope, Lincoln)	7.50	1913
Morris Drain	3.50	1905
Whitmer Drain (Larkin)	5.00	1950
• *Larkin Township*		
Balcirak Drain	0.63	1917
Boyle Drain (Mills, Hope, Lincoln)	7.50	1913
Demski Drain	2.73	1908
Hahn Drain (City)	2.00	1902
Jacobs Drain (City)	6.13	1899
Jebert Drain (City)	3.50	1903
Kohtz Drain (City)	0.79	1946
Kruse Drain	0.71	1923
Lathrope Drain	1.73	1906
Miller Drain	2.33	1901
Newell Drain (City)	11.90	1895
Pluss Drain	6.33	1898

Table 29.–Continued.

Drain	Length (mi)	Est.
Mouth, *Midland County*–continued		
• *Larkin Township* – continued		
Venner Drain	2.41	1904
Whitmer Drain (Mills)	5.00	1950
Wisgar Drain	3.09	1896
• *Ingersoll Township*		
Cane Drain (City)	2.50	1998
Haley Drain (City)	3.50	1884
DeBolt Drain (City)	3.70	1882
• *City Township*		
Ames Drain (Saginaw & Bay cnties; Ingersoll)	2.00	1922
Ashby Main	0.75	1914
Beck Drain (Lincoln)	0.39	1903
Bensch Drain (Lincoln)	4.28	1900
Cane Drain (Ingersoll)	2.50	1998
Carter Drain	1.50	1941
DeBolt Drain (Ingersoll)	3.70	1882
Hahn Drain (Larkin)	2.00	1902
Haley Drain (Ingersoll)	3.50	1884
Irelan Drain	0.50	1938
Jacobs Drain (Larkin)	6.13	1899
Jebert Drain (Larkin)	3.50	1903
Kohtz Drain (Larkin)	0.79	1946
Lalk Drain	0.13	1951
Lingle Drain	1.50	1903
Martinus Drain	1.00	1914
Miller Relief	0.50	1962
Moore Drain	0.25	1954
Newell Drain (Larkin)	11.93	1895
Prairie Drain (Homer, Lee)	5.5	1908
Rockwell Drain	0.50	1897
State Drain (Lincoln, Homer)	2.52	1902
Bay County		
• *Williams Township*		
Ames Drain (Saginaw & Midland cnties)	1.14	1923
Saginaw County		
• *Tittabawassee Township*		
Ames Drain (Bay County)	2.10	1919
Brown & Mills Drain (Midland County)	2.86	1900
Freeland Tile	0.80	1926
Hackett Drain	1.20	1928
Lentz Drain	1.00	1946
• *Tittabawassee Township* – continued		
Macomber Drain (Thomas)	3.14	1895
New Freeland Tile	0.80	1956
Ostrander Drain	1.14	1915
Parker Swamp Drain	4.29	1912
Ralph Drain	1.14	1968
Sarle Drain	2.40	1920
Trickey Drain	2.86	1917
• *Thomas Township*		
Dutch Garey Drain (Saginaw)	1.71	1916
Hager 1	1.00	1927
Hoffman Drain	2.86	1903
Hunters Ridge Drain	2.14	1992
Kastorf Drain	3.86	1916
Macomber Drain (Tittabawassee)	3.14	1895
Metzler Drain (Saginaw)	1.00	1960
Monk Tile (Saginaw)	2.50	1916
Reineke Drain (Saginaw)	3.71	1899
TKS Drain (Saginaw, Kochville)	6.14	1899
Wagner Drain (Saginaw)	0.80	1964
• *Kochville Township*		
TKS Drain (Saginaw, Thomas)	6.14	1899
• *James Township*		
Thompson 2 Drain	1.71	1915
• *Saginaw Township*		
Allenhurst Drain	1.20	1969
Amanda Drain	0.71	1970
Center Road Drain	3.71	1957
Companion Tile	0.50	1998
Dutch Garey Drain (Thomas)	1.71	1916
Gemple Drain	0.50	1921
Metzler Drain (Thomas)	1.00	1960
Monk Tile (Thomas)	2.50	1916
Otto Tile	1.57	1972
Reineke Drain (Saginaw)	3.71	1899
Seidel Drain	2.86	1946
Stroeble Drain	2.29	1931
TKS Drain (Thomas, Kochville)	6.14	1899
Wagner Drain (Thomas)	0.80	1964
Winterstein Drain	3.14	1900
Tobacco River		
Clare County		
• *Lincoln Township*		
Bertha Lake Drain	N/A	1997
Ross Drain	N/A	N/A
• *Surrey Township*		
Allen Drain (Grant)	1.69	1915
Cut-off Drain	N/A	1992
Farwell Drain (Village of Farwell)	0.54	1920

Table 29.–Continued.

Drain	Length (mi)	Est.
Tobacco River, *Clare County*–continued		
• *Hatton Township*		
Lower Drain(Grant, Arthur)	0.48	1916
• *Grant Township*		
Allen Drain (Surrey)	1.69	1915
Gilmore Jt. Drain (City of Clare)	2.00	1898
Herring Drain (Isabella County)	0.56	1901
Jordan Drain (Sheridan))	1.47	1914
Little Tobacco Dr (Isabella Cnty, City of Clare)	2.27	1897
Lloyd Drain	1.02	1921
Lower Drain(Hatton, Arthur)	0.48	1916
Ness Drain	0.91	1913
State Trunkline Drain (City of Clare)	1.50	1922
Tobacco Drain	3.00	N/A
Whitbeck Drain (City of Clare)	N/A	1989
• *Franklin Township*		
Nash Drain (Gladwin County)	0.75	N/A
• *Arthur Township*		
Ackney Drain	1.74	1914
Coates Drain	0.89	1918
Cook Drain (Sheridan)	2.13	1915
Cornwell Drain	0.38	N/A
Hutchinson Drain (Arthur)	0.61	N/A
Leitner Drain	0.88	N/A
Lower Drain(Hatton, Grant)	0.48	1916
Mark & Brand Drain	0.41	1909
Tonkin Drain	0.62	N/A
Tonkin Jt. Drain	3.50	N/A
• *Sheridan Township*		
Bailey Drain	2.03	N/A
Carrow Drain	0.92	N/A
Cook Drain (Arthur)	2.13	1915
Harvey Drain	0.90	1921
Howe Dr (Isabella, Gladwin, & Midland cnties)	N/A	1910
Hutchinson Drain (Arthur)	0.61	N/A
Jordan Drain (Grant)	1.47	1914
Larson-Elliot Drain	0.16	1918
Loomis Jt. Drain	0.05	N/A
McGivern Drain	1.70	1901
Rilette Jr. Drain (Gladwin County)	3.00	1920
Warner Drain	0.97	N/A
Gladwin County		
• *Sherman Township*		
Nash IC Drain (Clare County)	1.00	1916
• *Sage Township*		
Bendle Drain	2.50	1914
Foran Drain	3.00	1923
Grams Drain	1.00	1914
• *Sage Township* – continued		
Van Drain	6.00	1895
• *Grout Township*		
Carr Drain	2.50	1916
Dickens Drain(Beaverton)	2.00	1918
Doane Creek Drain (Beaverton)	3.50	1903
Flynn Drain	1.00	1900
Grams Drain	1.00	1914
Huber Drain (Beaverton)	1.50	1913
Lee Farm Creek Drain	2.00	1894
Longstretch Drain (Buckeye)	2.00	1923
Lucas Drain	2.50	1916
Mills Drain	1.00	1901
Stroman Drain (Beaverton)	1.00	1909
Tobacco Drain	1.25	1895
Tubbs Drain	0.50	1919
Walker I. C. Drain (Clare County)	1.00	1998
Whitman Drain	1.00	1899
Carr Drain	2.50	1916
Dickens Drain(Beaverton)	2.00	1918
Doane Creek Drain (Beaverton)	3.50	1903
Flynn Drain	1.00	1900
Grams Drain	1.00	1914
Huber Drain (Beaverton)	1.50	1913
Lee Farm Creek Drain	2.00	1894
Longstretch Drain (Buckeye)	2.00	1923
Lucas Drain	2.50	1916
Mills Drain	1.00	1901
Stroman Drain (Beaverton)	1.00	1909
Tobacco Drain	1.25	1895
Tubbs Drain	0.50	1919
Walker I. C. Drain (Clare County)	1.00	1998
Whitman Drain	1.00	1899
• *Beaverton Township*		
Baker Drain	0.50	1921
Bear Creek Drain (Tobacco)	5.00	1902
Bell Drain	0.50	1921
Burleson Drain	3.00	1915
Davidson Creek Drain	3.00	1913
Dickens Drain (Grout)	2.00	1918
Doane Creek Drain (Grout)	3.50	1903
Dopp Drain	2.50	1901
Dopp Drain Ext.	1.00	1910
Dow Drain (Tobacco)	8.00	1903
Dunbar I.C. Drain (Midland County)	3.00	1916
Huber Drain (Grout)	1.50	1913
Long/Scott Drain (Tobacco)	4.50	1908

Table 29.–Continued.

Drain	Length (mi)	Est.
Tobacco River, *Clare County*–continued		
• *Beaverton Township*–continued		
Lyle Drain	7.00	1912
McKimmy Drain (Tobacco)	1.50	1913
Nestor Creek Drain (Beaverton)	6.00	1915
Quillet Drain (Tobacco)	2.50	1919
Spencer Drain	3.50	1918
Stroman Drain (Grout)	1.00	1909
Taylor Drain	1.00	1917
• *Gladwin Township*		
Little Tobacco Drain	3.50	1908
Ogg Drain	4.00	1903
Sampson Drain	3.00	1912
Van Drain	6.00	1895
Warner Drain	1.00	1918
• *Buckeye Township*		
Bennett Drain	3.00	1917
Canham Drain (City of Gladwin)	4.00	1895
Dow Drain (Tobacco)	8.00	1903
Duby DRAIN	1.50	1902
Flynn/Nash Drain	0.75	1917
Graham Drain	7.75	1914
Hoy Drain (Tobacco, Billings, Hay)	3.00	1907
Longstretch Drain (Grout)	2.00	1923
Martin Drain	2.50	1900
Pete Drain	4.00	1918
Venison Creek Drain	4.50	1913
• *Hay Township*		
Hoy Drain (Tobacco, Billings, Tobacco)	3.00	1907
• *Billings Township*		
Brushaber Drain (Tobacco)	1.00	1921
Hoy Drain (Buckeye, Tobacco, Hay)	3.00	1907
• *Tobacco Township*		
Bear Creek Drain (Beaverton)	5.00	1902
Brooks Drain	0.50	1898
Brushaber Drain (Billings)	1.00	1921
Coolidge Drain	2.00	1914
Crockett Drain	1.00	1910
Dow Drain (Buckeye)	8.00	1903
Hay Drain (Buckeye, Billings, Hay)	3.00	1907
Hoover Drain	2.00	1917
Hoy Drain (Buckeye, Billings, Hay)	3.00	1907
Kaake Drain	1.25	1908
Long/Scott Drain (Beaverton)	4.50	1908
McKimmy Drain (Beaverton)	1.50	1913
Nestor Creek Drain (Beaverton)	6.00	1915
Ottgen Drain	2.00	1908
Quillet Drain (Beaverton)	2.50	1919
Ray Drain	1.00	1920
Rich Drain	2.00	1905
Smith/Chris Drain	1.50	1917
Snyder Drain	2.00	1912
Tremaine Drain	1.50	1904
Wagner Drain	1.00	1929
Woodby Drain	1.00	1917
Salt River		
Gladwin County		
• *Beaverton Township*		
Bliss 1 Drain (Midland County)	2.00	1901
Bliss 2 Drain (Midland County)	0.50	1901
Sage IC Drain (Midland County)	2.00	1918
• *Tobacco Township*		
Curtice IC Drain (Midland County)	2.00	1920
Isabella County		
• *Nottawa Township*		
Garvin Drain (Union, Isabella)	1.22	1894
John Neff Drain (Union, Isabella, Deerfield)	7.96	1904
Jordan Creek Drain (Isabella)	12.6	1903
• *Vernon Township*		
Crowley Drain	1.19	1919
Dixon Drain	4.65	1901
Gilmore Drain (Clare County)	0.54	1898
Howland Drain	1.90	1906
• *Vernon Township* – continued		
Jennings Drain (Wise)	3.95	1916
Killenbeck Drain (Isabella, Wise, Denver)	6.68	1914
Lamphere Drain (Wise)	8.08	1967
Loomis Drain (Clare Cnty, Vernon, Wise)	8.30	1904
McConnell Drain (Isabella)	0.89	1819
Ouderkirk Drain	0.61	1907
Seeley Drain	1.91	1899
Seiter Drain (Isabella)	0.77	1915
Sharp Drain	2.56	1968
Spring Creek Drain (Denver, Isabella)	8.20	1951
Wager Drain (Isabella)	2.43	1915
Wing Drain (Isabella)	3.03	1897
• *Isabella Township*		
Bloom Drain	0.77	1914
Bradley Drain	0.52	1921
Bullard Drain	1.79	1926

Table 29.–Continued.

Drain	Length (mi)	Est.
Salt River, *Isabella County*–continued		
• *Isabella Township* – continued		
Burr & Thompson Drain	0.79	1916
Calkins Drain	3.96	1900
Cameron Drain	1.16	1918
Carpenter Drain	0.72	1906
Clare Drain	0.63	1913
Conway Drain	2.14	1907
Dimond Drain (Denver, Union, Chippewa)	3.64	1918
Dock Bryant Drain	1.01	1911
Ege Drain (Union)	1.83	1921
Elliot Drain	0.53	1907
Fall Drain	0.78	1916
Fitzpatrick Drain	0.51	1911
Garvin Drain (Union, Nottawa)	1.22	1894
Harrison Drain (Denver)	2.25	1916
House Drain	3.88	1918
John Neff Drain (Nottawa, Union, Deerfield)	7.96	1918
Johnson Drain	2.35	1915
Jordan Creek Drain (Nottawa)	12.58	1903
Killenbeck Drain (Wise, Vernon, Denver)	6.68	1914
Lewis Drain (Denver)	8.52	1904
McConnell Drain (Vernon)	0.89	1819
McDonald Drain (Union)	0.78	1919
McKay Drain (Denver)	6.65	1916
Pelcher Drain	0.27	1943
Phillips Drain	0.23	1920
Seiter Drain (Vernon)	0.77	1915
Spring Creek Drain (Vernon, Denver)	8.20	1951
Vincent Drain	3.44	1894
Wager Drain (Vernon)	2.43	1915
Walton Drain	1.15	1915
West Drain (Denver)	2.82	1916
Wing Drain (Vernon)	3.03	1897
• *Union Township*		
Dimond Drain (Denver, Isabella, Chippewa)	3.64	1918
Ege Drain (Isabella)	1.83	1921
Garvin Drain (Isabella, Nottawa)	1.22	1894
McDonald Drain (Isabella)	0.78	1919
• *Wise Township*		
Bagley Drain	1.07	1917
Bickerton Drain (Midland County)	2.74	1903
Brock Drain (Denver)	0.28	1944
Burns Drain	2.33	1911
Butler Drain	1.08	1917
Curtiss Drain	2.96	1905
Gibson Drain	0.80	1930
High Drain (Midland County)	3.40	1915
Howe Jt. Drain (Mecosta County)	2.50	1910
• *Wise Township* – continued		
Jennings Drain (Vernon)	3.95	1916
Killenbeck Drain (Isabella, Vernon, Denver)	6.68	1914
King Drain	2.31	1915
Klashak Drain	1.92	1915
Knipe Drain	2.19	1951
Lamphere Drain (Vernon)	8.08	1967
Lennox Drain (Denver)	0.60	1917
Loomis Drain (Clare County, Vernon)	8.30	1904
Lowe Drain (Midland County, Denver)	3.18	1915
Menery DRAIN	1.60	1911
Methner Drain	2.05	1913
Morrison Drain	0.80	1913
Sealey Drain	1.91	1899
Sharp Drain (Vernon)	2.50	1968
Wise Drain (Midland County, Denver)	3.26	1900
• *Denver Township*		
Bender Drain	0.38	1946
Boone Drain	2.85	1913
Brock Drain (Wise)	0.28	1944
Cluley Drain	1.95	1918
Dimond Drain (Isabella, Union, Chippewa)	3.64	1918
Epple Drain	1.49	1932
Harrison Drain (Isabella)	2.25	1916
Killenbeck Drain (Isabella, Vernon, Wise)	6.68	1914
Kirkey Drain	0.99	1918
Kreiner Drain	1.99	1918
Leaton Drain	0.74	1945
Lennox Drain (Wise)	0.60	1917
Lewis Drain (Isabella)	8.52	1904
Lowe Drain (Midland County, Wise)	3.18	1915
McKay Drain (Isabella)	6.65	1916
Raymond Drain	0.70	1915
Spring Creek Drain (Vernon, Isabella)	8.20	1951
Stuber Drain	1.67	1916
Welnack Drain (Chippewa)	5.62	1916
West Drain (Isabella)	2.82	1916
Wise Drain (Midland County, Wise)	3.26	1900
• *Chippewa Township*		
Dimond Drain (Isabella, Union, Denver)	3.64	1918
Welnack Drain (Denver)	5.62	1916
Midland County		
• *Warren Township*		
Babcock Drain (Edenville, Jerome)	1.50	1912
Bickerton Drain	5.00	1903
Bliss 1 Drain (Gladwin County)	10.00	1900
Bliss 2 Drain (Gladwin County)	3.00	1901
Bluff Creek	4.00	N/A

Table 29.–Continued.

Drain	Length (mi)	Est.
Salt River, *Midland County*–continued		
• *Warren Township* – continued		
Childs Drain (Geneva)	3.40	1900
Coleman Drain	3.30	1902
High Drain (Isabella County)	3.20	1900
Home Drain (Isabella County)	6.50	1900
Howard Drain(Geneva)	5.50	1886
Johnson Drain	0.70	1915
McCumber Drain	0.75	1921
Nelson Drain	2.20	1916
Russell Drain	1.00	1917
Sage Drain (Gladwin County)	0.70	1918
Stemple Drain (Geneva)	3.40	1904
Tripp Drain (Edenville)	4.30	1912
• *Geneva Township*		
Childs Drain (Warren)	3.40	1900
Dawe Drain	0.25	1916
Green Drain	1.00	1916
Haller Drain	1.50	1915
Haulk Jt. Drain (Isabella County)	2.50	1962
Housholder Drain	1.70	1921
Howard Drain (Warren)	5.50	1886
• *Geneva Township* – continued		
Lamping Drain	1.00	1914
Lowe Drain (Isabella County)	0.50	1915
Macnelly Drain	0.20	N/A
May Drain	1.50	1923
Middleton Drain	0.30	N/A
Roth Drain	0.50	1973
Smith Drain	1.00	1915
Stemple Drain (Warren)	3.40	1904
Teed Drain (Jerome)	12.00	1904
Tigner Drain	2.00	1909
Vanderveen Drain	1.00	1918
• *Edenville Township*		
Curtis Drain (Gladwin County)	8.50	1898
Babcock Drain (Jerome, Warren)	1.50	1912
Tripp Drain (Warren)	4.30	1912
• *Jerome Township*		
Babcock Drain (Edenville, Warren)	1.50	1912
Durbin Drain	9.00	1919
Teed Drain (Geneva)	12.00	1904
Vane Drain	2.00	1911
Chippewa River		
Osceola County		
• *Orient Township*		
Orient Drain #4 and #5	2.27	1906
Orient Fork Jt. Drain (Mecosta County)	0.97	1929
Mecosta County		
• *Martiny Township*		
Martiny and Br.1 Drain	1.70	1916
• *Fork Township*		
Orient Fork Drain (Osceola County)	0.60	1928
Barryton Drain	3.10	1920
• *Sheridan Township*		
Mark/Meeker Drain	2.83	1907
Green Drain	1.53	1916
Sheridan Drain	3.23	1917
Moyer Drain	1.60	1907
Isabella County		
• *Coldwater Township*		
Buger Drain	2.21	1912
Conley Drain	0.20	1925
Reynolds Drain	1.48	1917
• *Sherman Township*		
Denslow Drain	1.88	1919
• *Gilmore Township*		
Blesch Drain (Nottawa)	3.15	1920
Burgess Drain(Nottawa)	3.44	1915
• *Gilmore Township* – continued		
Larrance Drain (Vernon Nottawa, Isabella)	1.43	1916
Love Drain(Nottawa)	9.90	1915
Scholfield Creek	4.60	1898
Scutt Lake Drain (Nottawa)	6.60	1913
Seymour Drain	1.50	1907
Willow Lake Drain (Vernon)	3.13	1896
• *Nottawa Township*		
Blesch Drain (Gilmore)	3.15	1920
Burgess Drain(Gilmore)	3.44	1915
Foerst Drain	3.90	1903
Fox Drain	1.26	1921
Garrett Drain	2.38	1947
Hagerman Drain (Deerfield)	0.38	1913
Kennedy Drain	0.93	1918
Larrance Drain(Vernon, Gilmore Isabella)	1.43	1916
Lawens Drain	0.57	1917
Love Drain(Gilmore)	9.90	1915
Martin Drain (Deerfield)	5.10	1912
Pitts Drain	0.23	1905
Schafer Drain	0.95	1917
Scutt Lake Drain (Gilmore)	6.60	1913
Simmer Drain	3.37	1917
Smith Drain (Deerfield)	1.03	1896
Tilman Drain	1.51	1919

Table 29.–Continued.

Drain	Length (mi)	Est.
Chippewa River, *Isabella County*–continued		
• *Nottawa Township* – continued		
Wagner Drain	2.83	1906
Weber/Mill Drain	0.29	1917
Weidman Drain	1.03	1884
White Imp. Drain	2.51	1901
Wichenhiser Drain	1.40	1922
Yonker Drain	3.97	1912
Zucker Drain (Deerfield)	1.00	1925
• *Deerfield Township*		
Barnard Drain (Union)	1.82	1915
Boettner Drain	0.48	1915
Bunker Drain	0.68	1929
Davis Drain	2.76	1917
Fowler Drain	2.34	1915
Gordon/Meyers Drain (Union)	0.50	1912
Hagerman Drain (Nottawa)	0.38	1913
Hein Drain	1.60	1913
Martin Drain (Nottawa)	5.10	1912
McCarthy Drain	1.16	1913
Murphy Drain	0.63	1908
Page Drain	1.02	1911
Rhodes Drain (Union)	0.67	1915
Smith Drain (Nottawa)	1.03	1896
Starkweather Drain(Fremont)	4.02	1922
Urie Drain	0.95	1914
Walker Drain (Union)	1.96	1919
Young Drain	3.03	1913
Zucker Drain (Nottawa)	1.00	1925
• *Vernon Township*		
Bogan Drain	0.94	1915
Duncan Drain	6.88	1897
Flood Drain	0.28	1904
Gilbert Drain	1.53	1903
Gorr Drain	0.79	1900
Larrance Drain (Gilmore, Nottawa, Isabella)	1.43	1916
McKinnen Drain	2.27	1899
McMillan Drain	0.28	1916
Nevills Drain	2.39	1900
Snear Drain	1.42	1950
Willow Lake Drain (Gilmore)	3.13	1896
• *Isabella Township*		
Larrance Drain (Gilmore, Nottawa, Vernon)	1.43	1916
• *Union Township*		
Beckett Drain	0.59	1936
Bellinger/Schooley Drain (Lincoln)	1.69	1917
Beltnick Drain	0.48	1919
Bollman Drain	0.94	1946
Brody Drain (Lincoln)	4.20	N/A

Drain	Length (mi)	Est.
• *Union Township* – continued		
Bufford Drain	0.38	1918
Cahoon Drain (Lincoln)	2.30	1915
Carroll Drain	1.58	1924
Cole Drain	1.29	1920
Dorris Drain	1.25	1917
Dumas Drain	0.28	1952
Fitzgerald Drain	2.37	1919
Gordon/Meyers Drain (Deerfield)	0.50	1912
Hance Drain (Chippewa)	4.60	1909
Hunter Drain (Chippewa)	2.10	1910
Jefford Drain	0.70	1906
LaPoe Drain (Chippewa)	1.10	1941
Log Cabin Drain	0.40	1935
Mead Creek	1.11	1916
Miser Drain (Chippewa)	6.17	1905
Mission Creek	5.47	1904
Oberlin Drain (Chippewa)	0.85	1888
Onion Creek Drain (Chippewa, Lincoln)	6.15	1907
Paisley Drain	0.99	1909
Peterson Drain	0.56	1923
Pope Drain	0.50	1918
Potter Brodie Drain (Coe, Lincoln, Chippewa)	8.63	1908
Quarterline Drain (Chippewa)	2.27	1973
Reserve Drain (Chippewa)	N/A	N/A
Sponsteller Drain	0.2	1938
Sterling Drain	0.89	1910
Stillwell (Lincoln)1.71	0.89	1895
Theirs Drain	1.00	1918
Tice Drain	2.28	1904
Travis Drain	0.49	1922
Turney Drain	0.10	1929
Upton Drain (City)	2.47	1964
Welsch Drain (Lincoln)	1.25	1911
Wheeler Drain (Lincoln)	3.60	1918
Woodin Drain (Lincoln)	1.33	1921
• *Lincoln Township*		
Bass Lake Drain (Gratiot County)	3.00	1910
Bellinger/Schooley Drain (Union)	1.69	1917
Bowman Drain	0.23	1925
Brenner Drain	0.85	1921
Brody Drain (Union)	4.20	N/A
Bronson Drain (Coe)	0.67	1914
Burdick Drain	0.58	1901
Cahoon Drain (Union)	2.30	1915
Campbell Drain (Coe)	2.10	1906
Childs Drain (Coe)	2.10	1906
Coe & Lincoln Drain (Coe)	2.06	1894

Table 29.–Continued.

Drain	Length (mi)	Est.
Chippewa River, *Isabella County*–continued		
• *Lincoln Township* – continued		
Crim Drain	0.56	1905
Dubois Drain	2.68	1908
Ervans Drain	1.17	1913
Figg Drain	11.77	1903
Fisher Drain	0.95	1911
Garber Drain	0.61	1912
Irishtown Drain (Gratiot County)	0.60	1956
Jerseyville Drain	N/A	N/A
Kenny Drain	0.34	1944
Key Drain (Coe)	2.37	1918
Keys Drain (Lincoln)	2.37	1918
Kirconnell Drain	0.50	1915
Krick Drain (Midland County, Fremont, Coe)	0.52	1916
Kyser Drain	0.2	1927
Little Salt Dr (Midland & Gratiot cnties; Coe)	1.40	1906
Mead Drain	1.16	1925
Millett Drain (Gratiot County)	0.69	1919
Mud Lake Drain	4.22	1916
Onion Creek Drain (Union, Lincoln)	6.15	1907
Parcher Drain	2.45	1907
Piatt Drain	0.48	1919
Potter Brodie Drain (Coe Union Chippewa)	8.63	1908
Roberts Drain (Gratiot County)	0.71	1917
Root Drain	1.61	1914
Rowlader Drain	0.54	1919
Salt River Drain (Coe)	6.00	1900
Saunders Drain	3.80	1906
Stillwell (Union)	1.71	1895
Tomlinson Drain	0.54	1913
Tripp Drain (Coe)	2.11	1916
Van Lieu Drain	2.36	1923
Welsch Drain (Union)	1.25	1911
Wheeler Drain (Union)	3.60	1918
Wilberding Drain	0.77	1930
Woodin Drain (Union)	1.33	1921
Wyant Drain	2.80	1899
• *Denver Township*		
Mitchell Drain (Chippewa)	4.03	1903
• *Chippewa Township*		
Chamberlain Drain	6.04	1912
Church Drain (Coe)	3.69	1906
Deputy Drain	2.43	1903
Durfee Drain	2.28	1908
Froggett & Fitzgerald Drain (Coe)	0.21	1922
Gillspie Drain	1.43	1911
Granger Drain	3.78	18.99
Halstead Drain (Midland County)	3.00	1906
• *Chippewa Township* – continued		
Hammond Drain	0.61	1914
Hance Drain (Union)	4.60	1909
Hentz Drain	0.12	1924
Hickson Drain	2.12	1973
Hill Drain (Midland County)	1.26	1903
Hunter Drain (Chippewa)	2.10	1910
John Dibble Drain	0.68	1914
Kempter Drain	1.31	1901
Kern Drain (Coe)	1.67	1915
Landon Drain	1.52	1910
Maurice Drain	1.55	1953
Miles Drain	1.24	1910
Miley Drain (Coe)	0.61	1915
Miser Drain (Union)	6.17	1905
Mitchell Drain (Denver)	4.03	1903
Neff Drain	5.90	1910
Oberlin Drain (Union)	0.85	1888
Onion Creek Drain (Union, Lincoln)	6.15	1907
Potter Brodie Drain (Coe, Lincoln, Union)	8.63	1908
Powers Drain	1.23	1912
Quarterline Drain(Union)	2.27	1973
Richmond Drain	1.16	1914
Ripley Drain	0.50	1918
Salisbury Drain	1.93	1911
Servoss Drain	0.33	1914
Stacey Drain	0.76	1912
• *Coe Township*		
Adams Drain	0.54	1961
Adgate Drain	1.3	1909
Alexander Drain	0.54	1914
Atwater Drain (Midland County)	3.90	1956
Barden & Ross Drain	2.78	1905
Bell Drain	1.12	1928
Best Drain	2.69	1902
Bronson Drain (Lincoln)	0.67	1914
Campbell Drain (Lincoln)	2.10	1906
Childs Drain (Lincoln)	2.10	1906
Church Drain (Chippewa))	3.69	1906
Cline Drain	1.03	1916
Coe & Lincoln Drain (Lincoln)	2.06	1894
Conley Jt. Drain (Gratiot)	0.59	1914
Countyline Drain(Gratiot)	1.04	1912
Dubois Drain (Lincoln)	2.68	1908
Dutt & Hart Drain(Midland County)	1.64	1906
Ewing Drain (Midland County)	1.00	1900
Feltman Drain	0.50	1937
Froggett & Fitzgerald Drain (Chippewa)	0.21	1922

Table 29.–Continued.

Drain	Length (mi)	Est.
Chippewa River, *Isabella County*—continued		
• *Coe Township* – continued		
Frost Drain (Midland County)	1.76	1905
Gallagher Drain (Midland County)	0.76	1950
Girvin Drain	1.25	1916
Hall Drain (Midland County)	0.05	1914
Hannett Jt. Drain (Midland County)	0.75	1904
Kent & Northrup Drain	2.40	1927
Kern Drain (Chippewa)	1.67	1915
Keys Drain (Lincoln)	2.37	1918
Kinter Hannett Drain	2.57	1912
Krick Drain (Midland County)	0.52	1916
Leonard Drain	3.43	1912
Little Salt Dr (Midland & Gratiot cnties; Lincoln)	1.40	1906
McClintic Drain	0.51	1916
McFarren Drain (Midland County)	0.70	1906
Mellville Drain	1.18	1920
Miley Drain (Chippewa)	0.61	1915
Miller & Occonner Drain	1.13	1924
Myers Drain	1.65	1916
Nilson Drain	0.27	1918
Petoskey Drain	2.80	1929
Potter Brodie Drain (Lincoln, Union, Chippewa)	8.63	1908
Salt River Drain (Lincoln)	6.00	1900
Stahlman Drain	1.21	1911
Stuble Drain	0.63	1914
Swain Jt. Drain (Midland County)	0.38	1930
Taylor Drain	1.02	1897
Throop Drain	0.47	1905
Tripp Drain (Lincoln)	2.11	1916
Turner Jt. Drain (Midland County)	0.88	1911
Turnwald Drain	1.29	1954
VanVraken Drain	0.16	1915
Walling Drain	0.40	1912
Way & Childs Drain	2.18	1913
Midland County		
• *Greendale Township*		
Caywood Drain (Jasper, Porter, Lee)	2.00	1961
Dickensen Drain (Isabella County)	0.50	N/A
Emma Drain (Lee)	1.00	2000
Halstead Drain (Isabella County)	1.00	N/A
Hill Drain (Isabella County)	1.50	1900
Krick Drain (Isabella County, Jasper)	0.52	1916
Lawson Drain (Lee)	4.00	1917
Prairie Drain (Lee)	9.00	1908
Purtell Drain	2.50	1956
Unnamed Drain (Isabella County)	1.00	N/A

Drain	Length (mi)	Est.
• *Jasper Township*		
Alspaugh Drain	5.00	1913
Atwater Drain (Isabella County)	1.10	1907
Barnes Drain	0.50	1914
Caywood Drain(Greendale Porter, Lee)	2.00	1961
Cronk Drain (Gratiot County)	7.00	1895
Davison Drain	1.00	1909
Dolan Drain	1.30	1911
Dutt & Hart Drain (Isabella County)	2.00	1906
Ewing Drain (Isabella County)	2.60	1904
Frost Drain (Isabella County)	2.00	1905
Hall Drain (Isabella County)	3.00	1894
Hanlet Drain	2.50	1912
Hannett Drain (Isabella County)	2.50	1903
Harlon Drain	0.10	1917
Hevel Drain	2.50	1912
Holton Drain	0.30	1953
Jasper Coe 1 Drain (Isabella County)	0.60	1913
Jasper Coe 2 Drain	0.50	1893
Krick Drain (Isabella County, Jasper)	0.52	1916
Little Salt Creek (Isaballa County)	7.00	1882
Martin Drain	1.00	1911
McFarren Drain (Isabella County)	3.00	1900
Murry Drain	0.60	N/A
Old Cronk Drain	3.00	1895
Sehler Drain	0.50	1945
Sinif Drain	2.80	1913
Sparks Drain	1.50	1914
Swain Drain (Isabella County)	3.00	1894
Turner Drain (Isabella County)	2.00	1911
• *Lee Township*		
Baker Drain(Homer)	3.60	1902
Caywood Drain(Greendale Jasper, Porter)	2.00	1961
Emma Drain (Greendale)	1.00	2000
Frank Drain (Porter)	1.00	1919
Herrill Drain	3.00	1915
Hoxie Drain (Porter)	4.80	1902
Huber Drain (Porter, Homer)	5.50	1913
Lawson Drain (Greendale)	4.00	1917
Prairie Drain (Greendale)	9.00	1908
Turkey Creek (Porter)	14.00	1914
Unnamed Drain	3.00	N/A
Wilson Drain 2 (Homer)	3.00	1899
• *Porter Township*		
Caywood Drain(Greendale Jasper, Lee)	2.00	1961
Frank Drain (Lee)	1.00	1919

Table 29.–Continued.

Drain	Length (mi)	Est.
Chippewa River, *Midland County*–continued		
• *Porter Township* – continued		
Hoxie Drain (Lee)	4.80	1902
Huber Drain (Lee, Homer)	5.50	1913
Turkey Creek (Lee)	14.00	1914
Wilson Drain	2.50	1889
• *Homer Township*		
Baker Drain(Lee)	3.60	1902
Burgoon Drain (Mills, City)	2.00	1909
Pine River		
Mecosta County		
• *Wheatland Township*		
Pine Lake Drain	1.90	1911
Martin Drain	3.05	1917
Cummins Drain	0.54	1921
Millbrook Jt. Drain(Isabella County)	1.47	1918
Gingrich Drain	0.79	1912
• *Millbrook Township*		
Blanchard Jt. Drain (Isabella)	1.26	1916
Isabella County		
• *Broomfield Township*		
Millbrook Jt. Drain (Mecosta County)	3.05	1919
Riggle Marsh Drain (Rolland, Fremont)	4.00	1904
• *Rolland Township*		
Blanchard Drain (Mecosta County)	3.70	1915
Delo Drain	1.04	1915
Foster Drain (Fremont)	1.28	1916
Guy Drain	0.10	1916
Howard Drain (Fremont)	1.50	1905
Masters Drain (Fremont)	1.49	1916
Moody Drain	1.70	1917
Riggle Marsh Drain (Broomfield)	4.00	1904
Stanley Drain (Fremont)	5.10	1900
• *Fremont Township*		
Bundy Drain	1.24	1883
Delo Drain(Rolland)	1.04	1915
Demlow Drain	1.41	1907
Foster Drain (Rolland)	1.28	1916
Masters (Rolland)	1.49	1906
Howard Drain (Rolland)	1.50	1905
Bundy Drain	1.24	1883
Delo Drain(Rolland)	1.04	1915
Demlow Drain	1.41	1907
Foster Drain (Rolland)	1.28	1916
Masters (Rolland)	1.49	1906
Howard Drain (Rolland)	1.50	1905
Richardson Drain	0.95	1898
Riggle Marsh Drain(Broomfield, Fremont)	4.00	1904
• *Homer Township* – continued		
Dice Drain	4.00	1903
Huber Drain (Porter, Lee)	5.50	1913
Wilson Drain 2 (Lee)	3.00	1899
• *CityTownship*		
Burgoon Drain (Homer, City)	2.00	1909
Hepner Drain	0.50	1913
O'Conner Drain	1.00	1951
• *Fremont Township* – continued		
Russell Drain	2.11	1923
Stanley	5.10	1900
Montcalm County		
• *Home Township*		
100 (Richland, Ferris)	3.78	1901
Dallavo Drain	0.64	1898
Edmore Sewer	0.63	1940
Parmeter Drain	N/A	N/A
Wilson Drain	1.62	1898
100 (Richland, Ferris)	3.78	1901
Dallavo Drain	0.64	1898
• *Richland Township*		
Erskin Drain	0.95	1916
Fisk and Johnson Drain	0.66	1898
Galvin Drain	2.79	1952
Lacey and Hall Drain	1.11	1904
Montc/Isabella Drain (Isabella County)	0.75	N/A
Richland Drain	0.80	1944
100 (Home, Ferris)	3.78	1901
• *Ferris Township*		
Corbin Creek	11.9	1893
Ext. 131 (Gratiot County, Crystal)	5.29	1916
Ferris Creek and Brs.	5.27	1900
Howe Drain	2.12	1923
Kneer/Robinson (Gratiot County, Crystal)	3.00	1893
Whetsone (Crystal)	3.02	1952
Gratiot County		
• *Seville Township*		
96 (Sumner, Pine River, Arcada)	8.32	1894
105 (Pine River, Bethany)	5.25	1998
174	6.60	1900
176	5.20	1901
177	0.80	1902
178 (Montalm County)	0.26	1903
226	1.80	1902
243 (Pine River, Arcada, Seville, Bethany)	0.60	1909
290 (Sumner, Arcada)	5.80	1912

Table 29.–Continued.

Drain	Length (mi)	Est.
Pine River, *Gratiot County*–continued		
• Seville Township – continued		
321	1.60	1914
507	0.25	1954
553 (Isabella County)	1.00	1943
556 (Isabella County)	1.10	1918
• *Sumner Township*		
36 (Newhaven)	1.83	1890
70	5.40	1902
96 (Seville, Pine River, Arcada)	8.32	1894
97	2.00	1904
111 (Newhaven, Arcada)	17.40	1887
112	4.76	1898
113	6.60	1898
126 (Newhaven)	1.15	1889
147	0.63	1890
166	5.50	1901
167	3.90	1901
189	0.26	1905
243 (Arcada, Seville, Bethany, PineR)	1.50	1909
263	1.40	1910
290 (Seville, Arcada)	5.80	1912
291	4.00	1912
303 (Newhaven)	1.50	1912
318	1.50	1914
337	3.00	1915
366	3.15	1916
367	0.70	1915
388	0.50	1883
420	1.00	1920
443	0.46	1928
557 (Montcalm County, Newhaven)	1.13	1950
263	1.40	1910
290 (Seville, Arcada)	5.80	1912
291	4.00	1912
303 (Newhaven)	1.50	1912
318	1.50	1914
337	3.00	1915
366	3.15	1916
367	0.70	1915
388	0.50	1883
420	1.00	1920
443	0.46	1928
557 (Montcalm County, Newhaven)	1.13	1950
• *Newhaven Township*		
36 (Sumner)	1.83	1890
110 (Arcada, Sumner, Newark)	7.73	1915
111 (Newhaven, Arcada)	17.40	1887
126 (Sumner)	1.15	1889
• Newhaven Township – continued		
303 (Sumner)	1.50	1912
557 (Montcalm County, Sumner)	1.13	1950
• *Pine River Township*		
21 (Emerson, Arcada)	2.00	1882
52 (Emerson, Arcada)	6.20	1898
73 (Arcada)	11.60	1906
96 (Seville, Sumner, Arcada)	8.32	1894
104 (Bethany)	4.18	1898
105 (Pine Rr, Seville, Sumner)	5.25	1998
160 (Arcada)	5.50	1888
180	0.50	1996
218 (Bethany, Emerson)	7.78	1880
199	2.29	1906
231(Midland County, Bethany)	5.00	1884
232 (Bethany)	1.64	1892
243 (Arcada,Sumner,Bethany, Seville)	1.50	1909
251 (Midland County, Bethany)	1.75	1894
254	2.25	1911
283 (Bethany)	9.00	1911
319	2.47	1913
335 (Arcada)	1.80	1915
339	4.96	1915
343 (Bethany)	0.60	1909
374	1.01	1917
384 (Midland)	1.00	1914
398	1.60	1918
418 (Arcada)	4.48	1920
424 (Bethany)	0.65	1923
432 (Arcada)	0.28	1925
441	0.57	1927
445	0.88	1928
463	0.40	1930
464	1.40	1930
470	0.56	1926
486	0.52	1969
491	0.62	1948
497	2.15	N/A
501	0.44	1952
539 (Midland County)	1.14	1913
• *Arcada Township*		
1	4.30	1894
8	1.20	1879
21 (Emerson, Pine River)	2.00	1882
24	3.29	1888
52 (Emerson, Pine River)	6.20	1908
73 (Pine River)	11.60	1906
96 (Seville, Sumner, Pine River)	8.32	1894

Table 29.–Continued.

Drain	Length (mi)	Est.
Pine River, *Gratiot County*–continued		
• *Arcada Township* – continued		
108	0.75	1898
110 (Newhaven, Newark)	7.73	1915
144 (Emerson)	7.40	1988
160 (Pine River)	5.50	1888
235	1.60	1905
243 (Pine River, Sumner, Bethany, Seville)	1.50	1909
264	1.40	1910
285	2.26	1910
290 (Sumner, Seville)	5.80	1912
291 (Sumner)	4.00	1912
320	0.64	1914
335 (Pine River)	1.80	1915
418 (Pine River)	4.48	1920
432 (Pine River)	0.28	1925
437	1.26	1927
450	1.20	1928
504	0.94	1954
519	0.30	1960
• *Newark Township*		
110 (Newhaven, Arcada)	7.73	1915
• *Emerson Township*		
3 (Midland County, Bethany)	11.65	1881
21 (Arcada, Pine River)	2.00	1882
22 (Bethany)	4.14	1889
29 (Bethany)	2.85	1891
52 (Arcada, Pine River)	6.20	1908
128 (Emerson)	3.96	1898
144 (Arcada)	7.40	1988
218 (Pine River)	7.78	1880
320	0.65	1914
338	1.39	1915
• *Bethany Township*		
3 (Midland County, Emerson)	11.65	1881
22 (Emerson)	4.14	1889
29 (Emerson)	2.85	1891
3 (Midland County, Bethany)	11.65	1881
21 (Arcada, Pine River)	2.00	1882
22 (Bethany)	4.14	1889
29 (Bethany)	2.85	1891
52 (Arcada, Pine River)	6.20	1908
128 (Emerson)	3.96	1898
144 (Arcada)	7.40	1988
218 (Pine River)	7.78	1880
320	0.65	1914
338	1.39	1915
41	4.60	1925
78	0.83	1908
• *Bethany Township* – continued		
86 (Midland County)	2.16	1889
89 (Midland County)	5.10	1903
93 (Midland County)	0.89	1903
94	1.48	1903
104 (Pine River)	4.18	1898
105 (Pine River, Seville, Sumner)	5.25	1998
116	6.03	1898
128 (Emerson)	3.96	1898
148	0.80	1900
170 (Wheeler)	2.39	1888
202 (Midland County)	1.93	1905
218	7.78	1880
231(Midland County, Pine River)	5.00	1884
232 (Pine River)	1.64	1892
246 (Midland County)	0.42	1892
251 (Midland County, Pine River)	1.75	1894
265	2.52	1910
283 (Pine River)	9.00	1911
329	2.44	1902
371	1.00	1915
372 (Wheeler)	1.05	1917
373	0.70	1916
384	0.54	1916
415	0.50	1921
424 (Pine River)	0.65	1923
568	1.89	1929
595	0.75	1890
• *Wheeler Township*		
31 (Midland County)	10.00	1887
42	7.68	1889
208 (Midland County)	3.70	1905
372 (Bethany)	1.05	1917
381	2.40	1885
478 (Midland County)	1.70	1941
522	1.00	1965
554 (Midland County)	1.00	1930
575	1.80	1957
580 (Midland County)	2.50	1957
Midland County		
• *JasperTownship*		
Bear Head Drain (Gratiot County)	2.00	1902
Bush Drain (Gratiot County, Porter)	4.50	1914
Davis Drain	5.00	1912
Forest Drain	0.25	1966
Hagen Drain	1.50	1907
Irvin Drain	1.00	1912
Laning Drain	0.75	1911

Table 29.–Continued.

Drain	Length (mi)	Est.
Pine River, Midland *County*–continued		
• *JasperTownship* – continued		
Nevins Drain	1.00	1903
Townline Drain (*Gratiot County*)	2.00	1905
Wells Drain (*Gratiot County*)	0.50	1925
• *Lee Township*		
Wilson Drain#2	2.50	1889
• *Porter Township*		
Brue Drain	3.50	1915
Bush Drain	4.50	1914
Bush Drain (Gratiot County)	2.80	1901
Centerline Drain	4.80	1897
Davis Drain(Jasper)	5.00	1912
Hastings Drain	2.00	1912
Jackson Drain	2.00	1910
King Drain (Homer, Mt. Haley)	9.00	1901
McNeill Drain	1.00	1904
Redstone Drain	2.00	1896
• *Porter Township* – continued		
Stoneman Drain (Gratiot County)	0.50	1968
Sucker Drain (Gratiot County)	7.00	1888
Townline Drain (Gratiot County, Jasper)	2.00	1905
Wayne Drain	1.50	1911
Whitney Drain	1.50	1906
• *Homer Township*		
Brewer Drain .	2.00	1893
Frost Drain	2.00	1899
King Drain(Porter, Mt. Haley)	9.00	1901
Rose Glenn	0.50	1993
Unknown Drain	1.50	N/A
Woodcock Drain	0.50	N/A
• *Mt. Haley Township*		
King Drain(Porter, Homer)	9.00	1901
Mt. Haley Drain	8.50	1902

Table 30.–State and Federal land areas (acres) within the Tittabawassee River watershed for catchments of the main stem segments and their major tributaries. Catchment summaries for a segment represent the local landscape that contributes water to the segment and do not represent the cumulative upstream landscape.

Owner Type	Headwaters	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
Michigan							
State forest	27,199	68,915	12,551	15,498	12,849	8,291	52
Public - general	423	612	3,954	2,024	609	3,563	1,537
State game areas						4,126	3,340
State park			36				
Federal							
Nat. wildlife refuge				145			
Total public lands	27,622	69,527	16,540	17,667	13,458	15,980	4,929

Table 31.–List of fishes in the Tittabawassee River watershed. Origin: N = native, C = colonized, I = introduced. Status: O = extirpated, P = recent observations, U = historic record-current status unknown. Data from: University of Michigan records; Michigan Department of Natural Resources, Fisheries Division records; Michigan Department of Environmental Quality, Surface Water Quality Division records, Environmental Science & Engineering Consultants (1983); and United States Fish and Wildlife Service records.

Common name	Scientific name	Origin	Status
Lampreys			
northern brook lamprey	*Ichthyomyzon fossor*	N	P
American brook lamprey	*Lampetra appendix*	N	P
sea lamprey	*Petromyzon marinus*	C	P
Sturgeons			
lake sturgeon **(threatened)**	*Acipenser fulvescens*	N	P
Gars			
longnose gar	*Lepisosteus osseus*	N	P
Bowfins			
bowfin	*Amia calva*	N	P
Herrings			
alewife	*Alosa pseudoharengus*	C	P
gizzard shad	*Dorosoma cepedianum*	N	P
Carps and minnows			
central stoneroller	*Campostoma anomalum*	N	P
goldfish	*Carassius auratus*	I	P
spotfin shiner	*Cyprinella spiloptera*	N	P
common carp	*Cyprinus carpio*	I	P
brassy minnow	*Hybognathus hankinsoni*	N	P
common shiner	*Luxilus cornutus*	N	P
redfin shiner	*Lythrurus umbratilis*	N	U
pearl dace	*Margariscus nachtriebi*	N	P
hornyhead chub	*Nocomis biguttatus*	N	P
river chub	*Nocomis micropogon*	N	P
golden shiner	*Notemigonus crysoleucas*	N	P
pugnose shiner (**special concern**)	*Notropis anogenus*	N	U
emerald shiner	*Notropis atherinoides*	N	P
blackchin shiner	*Notropis heterodon*	N	P
blacknose shiner	*Notropis heterolepis*	N	P
spottail shiner	*Notropis hudsonius*	N	P
rosyface shiner	*Notropis rubellus*	N	P
sand shiner	*Notropis stramineus*	N	P
mimic shiner	*Notropis volucellus*	N	P
northern redbelly dace	*Phoxinus eos*	N	P
finescale dace	*Phoxinus neogaeus*	N	P
bluntnose minnow	*Pimephales notatus*	N	P
fathead minnow	*Pimephales promelas*	N	P
longnose dace	*Rhinichthys cataractae*	N	P
blacknose dace	*Rhinichthys obtusus*	N	P

Table 31.–Continued.

Common name	Scientific name	Origin	Status
Carps and minnows–continued			
creek chub	*Semotilus atromaculatus*	N	P
Suckers			
quillback	*Carpiodes cyprinus*	N	P
longnose sucker	*Catostomus catostomus*	N	P
white sucker	*Catostomus commersonii*	N	P
lake chubsucker	*Erimyzon sucetta*	N	P
northern hog sucker	*Hypentelium nigricans*	N	P
silver redhorse	*Moxostoma anisurum*	N	U
black redhorse	*Moxostoma carinatum*	N	P
golden redhorse	*Moxostoma erythrurum*	N	P
shorthead redhorse	*Moxostoma macrolepidotum*	N	P
greater redhorse	*Moxostoma valenciennesi*	N	U
Bullhead catfishes			
black bullhead	*Ameiurus melas*	N	P
yellow bullhead	*Ameiurus natalis*	N	P
brown bullhead	*Ameiurus nebulosus*	N	P
channel catfish	*Ictalurus punctatus*	N	P
stonecat	*Noturus flavus*	N	P
tadpole madtom	*Noturus gyrinus*	N	P
flathead catfish	*Pylodictis olivaris*	C	P
Pikes			
grass pickerel	*Esox americanus*	N	P
northern pike	*Esox lucius*	N	P
muskellunge	*Esox masquinongy*	N	P
Mudminnows			
central mudminnow	*Umbra limi*	N	P
Trouts			
lake herring **(threatened)**	*Coregonus artedi*	N	O
lake whitefish	*Coregonus clupeaformis*	N	U
rainbow trout	*Oncorhynchus mykiss*	I	P
coho salmon	*Oncorhynchus kisutch*	I	P
Chinook salmon	*Oncorhynchus tshawytscha*	I	P
brown trout	*Salmo trutta*	I	P
brook trout	*Salvelinus fontinalis*	I	P
lake trout	*Salvelinus namaycush*	N	P
Trout-perches			
trout-perch	*Percopsis omiscomaycus*	N	P
Pirate perches			
pirate perch	*Aphredoderus sayanus*	N	P
Killifishes			
banded killifish	*Fundulus diaphanus*	N	P

Table 31.–Continued.

Common name	Scientific name	Origin	Status
Silversides			
brook silverside	*Labidesthes sicculus*	N	P
Sticklebacks			
brook stickleback	*Culaea inconstans*	N	P
Sculpin			
mottled sculpin	*Cottus bairdi*	N	P
Smelt			
rainbow smelt	*Osmerus mordax*	C	P
Temperate basses			
white perch	*Morone americana*	C	P
white bass	*Morone chrysops*	N	P
Sunfishes			
rock bass	*Ambloplites rupestris*	N	P
green sunfish	*Lepomis cyanellus*	N	P
pumpkinseed	*Lepomis gibbosus*	N	P
bluegill	*Lepomis macrochirus*	N	P
longear sunfish	*Lepomis peltastes*	N	P
redear sunfish	*Lepomis microlophus*	I	P
smallmouth bass	*Micropterus dolomieu*	N	P
largemouth bass	*Micropterus salmoides*	N	P
white crappie	*Pomoxis annularis*	N	P
black crappie	*Pomoxis nigromaculatus*	N	P
Perches			
rainbow darter	*Etheostoma caeruleum*	N	P
Iowa darter	*Etheostoma exile*	N	P
least darter	*Etheostoma microperca*	N	P
fantail darter	*Etheostoma flabellare*	N	P
johnny darter	*Etheostoma nigrum*	N	P
yellow perch	*Perca flavescens*	N	P
logperch	*Percina caprodes*	N	P
blackside darter	*Percina maculata*	N	P
walleye	*Sander vitreus*	N	P
Drums			
freshwater drum	*Aplodinotus grunniens*	N	P
Gobies			
round goby	*Neogobius melanostomus*	I	P

Table 32.–Aquatic macroinvertebrates of the headwaters Tittabawassee River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

Taxa	Tittabawassee River sites (Road crossing)		
	Middle Branch (Bensch)	East Branch (Hemer)	West Branch (Fitzwater)
Porifera (sponges)	X		
Bryozoa (moss animals)		X	
Platyhelminthes (flatworms)			
Turbellaria	X		
Annelida (segmented worms)			
Hirudinea (leeches)		X	X
Oligochaeta (worms)	X	X	X
Arthropoda			
Crustacea			
Amphipoda (scuds)	X	X	X
Decapoda (crayfish)	X	X	X
Isopoda (sowbugs)			
Arachnoidea			
Hydracarina (mites)	X		X
Insecta			
Ephemeroptera (mayflies)			
Baeticidae		X	
Baetidae	X	X	X
Caenidae			
Ephemerellidae			
Ephemeridae	X	X	
Heptageniidae	X	X	X
Isonychiidae	X	X	X
Syphlomuridae			X
Potamanthidae			
Tricorythidae			
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	X	X	
Cordulegastridae	X		
Gomphidae	X	X	X
Libellulidae	X		
Zygoptera (damselflies)			
Calopterygidae	X	X	X
Coenagrionidae			
Lestidae			
Perlodidae			
Plecoptera (stone flies)			
Perlidae	X	X	X
Pteronarcyidae			X

Table 32.–Continued.

Taxa	Tittabawassee River sites (Road crossing)		
	Middle Branch (Bensch)	East Branch (Hemer)	West Branch (Fitzwater)
Insecta–continued			
Hemiptera (true bugs)			
Belastomatidae	X		
Corixidae	X	X	
Gerridae	X	X	X
Nepidae			
Notonectidae			
Pleidae			
Veliidae			
Saldidae			
Megaloptera			
Corydalidae (dobson flies)	X	X	X
Sialidae (alder flies)	X	X	
Trichoptera (caddisflies)			
Brachycentridae	X	X	X
Glossosmatidae	X		X
Helicopsychidae	X		X
Hydropsychidae		X	
Hydroptilidae	X		
Lepidostomatidae	X		
Leptoceridae		X	X
Limnephilidae	X	X	X
Molannidae			
Philopotamidae		X	
Phryganeidae	X	X	
Uenoidae		X	
Lepidoptera (moths)			
Nornidae			
Coleoptera (beetles)			
Amphizoidea			
Dryopidae			
Dyticsidae			
Elmidae			
Gyrinidae			
Haliplidae	X	X	
Psephenidae			
Scirtidae (adults)	X		X
Diptera (flies)			
Athericidae	X	X	X
Ceratopogonidae			
Culicidae		X	X
Chironomidae	X	X	X
Ephydridae			
Muscidae			
Sciomyzidae			
Simuliidae	X	X	
Statiomyidae			
Tabanidae		X	
Tipulidae			

Table 32.–Continued.

Taxa	Tittabawassee River sites (Road crossing)		
	Middle Branch (Bensch)	East Branch (Hemer)	West Branch (Fitzwater)
Mollusca			
Gastropoda (snails and limpets)			
Ancylidae	X		
Lymnaeidae	X	X	
Physidae		X	
Planorbidae	X	X	
Bithyniidae			
Pleuroceridae			
Pomatiopsidae			
Vivaparidae			
Bivalvia (bivalves)			
Sphaeriidae	X		X
Unionidae		X	
Pisididae			

Table 33.–Aquatic macroinvertebrates of the tributaries to the middle segment Tittabawassee River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

	River or Creek sites (Road crossing)				
Taxa	Larrabee (Creel survey) (Weiman)	Molasses (M-61)	Black (M-61)	Sugar (M-30)	Little Tobacco (Drain)
Porifera (sponges)					
Bryozoa (moss animals)				X	
Platyhelminthes (flatworms)					
Turbellaria				X	
Annelida (segmented worms)					
Hirudinea (leeches)		X	X	X	X
Oligochaeta (worms)				X	
Arthropoda					
Crustacea					
Amphipoda (scuds)	X	X	X	X	X
Decapoda (crayfish)	X	X	X	X	X
Isopoda (sowbugs)					
Arachnoidea					
Hydracarina (mites)					
Insecta					
Ephemeroptera (mayflies)					
Baeticidae				X	
Baetidae	X	X	X	X	X
Caenidae		X		X	X
Ephemerellidae					
Ephemeridae				X	
Heptageniidae	X	X	X	X	X
Isonychiidae				X	
Syphlomuridae					
Potamanthidae					
Tricorythidae					
Odonata					
Anisoptera (dragonflies)					
Aeshnidae	X		X	X	
Cordulegastridae					
Gomphidae				X	
Libellulidae					
Zygoptera (damselflies)					
Calopterygidae	X	X	X	X	X
Coenagrionidae					
Lestidae					
Perlodidae					
Plecoptera (stone flies)					
Perlidae	X		X	X	
Pteronarcyidae				X	

Table 33.–Continued.

Taxa	River or Creek sites (Road crossing)				
	Larrabee (Creel survey) (Weiman)	Molasses (M-61)	Black (M-61)	Sugar (M-30)	Little Tobacco (Drain)
Insecta–continued					
Hemiptera (true bugs)					
Belastomatidae		X	X		X
Corixidae	X	X		X	X
Gerridae	X	X	X		X
Nepidae					
Notonectidae					
Pleidae					
Veliidae	X				
Saldidae					
Megaloptera					
Corydalidae (dobson flies)	X			X	X
Sialidae (alder flies)	X	X	X	X	
Trichoptera (caddisflies)					
Brachycentridae				X	
Glossosmatidae					
Helicopsychidae	X			X	X
Hydropsychidae		X		X	
Hydroptilidae				X	
Lepidostomatidae					
Leptoceridae	X		X	X	X
Limnephilidae	X	X		X	
Molannidae					
Philopotamidae			X		
Phryganeidae				X	
Uenoidae					
Lepidoptera (moths)					
Nornidae		X			X
Coleoptera (beetles)					
Amphizoidea					
Dryopidae					
Dyticsidae					
Elmidae	X	X		X	
Gyrinidae					
Haliplidae	X		X		
Psephenidae				X	X
Scirtidae (adults)		X	X		X
Diptera (flies)					
Athericidae			X	X	
Ceratopogonidae					
Culicidae		X			X
Chironomidae	X	X		X	X
Ephydridae					
Muscidae					
Sciomyzidae					

Table 33.–Continued.

Taxa	River or Creek sites (Road crossing)				
	Larrabee (Creel survey) (Weiman)	Molasses (M-61)	Black (M-61)	Sugar (M-30)	Little Tobacco (Drain)
Insecta–continued					
Simuliidae		X			X
Statiomyidae					
Tabanidae	X	X		X	X
Tipulidae	X	X		X	
Mollusca					
Gastropoda (snails and limpets)					
Ancylidae					
Lymnaeidae					
Physidae	X	X	X	X	X
Planorbidae	X				
Bithyniidae					
Pleuroceridae					
Pomatiopsidae					
Vivaparidae					
Bivalvia (bivalves)					
Sphaeriidae	X	X	X	X	X
Unionidae				X	
Pisididae					

Table 34.–Aquatic macroinvertebrates of the Tobacco River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

	River or creek sites (Road crossing)					
Taxa	Little Cedar (Dale)	Cedar (Campbell)	N. Br. Tobacco (Grout)	Mid. Br. Tobacco (McCollouch)	S. Br. Tobacco (Grout)	S. Br. Tobacco (Grant)
Porifera (sponges)	X					
Bryozoa (moss animals)		X				
Platyhelminthes (flatworms)						
Turbellaria		X				
Annelida (segmented worms)						
Hirudinea (leeches)					X	X
Oligochaeta (worms)	X		X	X		
Arthropoda						
Crustacea						
Amphipoda (scuds)	X	X	X	X	X	X
Decapoda (crayfish)	X	X	X	X	X	X
Isopoda (sowbugs)	X				X	
Arachnoidea						
Hydracarina (mites)			X	X		X
Insecta						
Ephemeroptera (mayflies)						
Baeticidae						
Baetidae	X	X	X		X	X
Caenidae		X	X		X	
Ephemerellidae					X	
Ephemeridae			X			
Heptageniidae	X	X	X	X	X	X
Isonychiidae		X	X	X	X	X
Leptophlebiidae						
Potamanthidae						
Tricorythidae						
Odonata						
Anisoptera (dragonflies)						
Aeshnidae	X	X		X	X	X
Corduliidae						
Gomphidae			X			
Libellulidae						
Zygoptera (damselflies)						
Calopterygidae	X	X	X	X	X	X
Coenagrionidae						
Lestidae						
Perlodidae						
Plecoptera (stone flies)						
Perlidae	X	X	X	X	X	X
Pteronarcyidae		X	X	X	X	

Table 34.–Continued.

Taxa	River or creek sites (Road crossing)					
	Little Cedar (Dale)	Cedar (Campbell)	N. Br. Tobacco (Grout)	Mid. Br. Tobacco (McCollouch)	S. Br. Tobacco (Grout)	S. Br. Tobacco (Grant)
Insecta–continued						
Hemiptera (true bugs)						
Belastomatidae						
Corixidae			X			
Gerridae	X	X	X	X	X	X
Mesoveliidae				X	X	X
Notonectidae						
Pleidae						X
Veliidae			X			
Saldidae						
Megaloptera						
Corydalidae (dobson flies)		X	X	X	X	X
Sialidae (alder flies)						
Trichoptera (caddisflies)						
Brachycentridae		X	X	X	X	X
Glossosmatidae						X
Helicopsychidae	X	X	X	X		X
Hydropsychidae		X	X	X	X	X
Hydroptilidae						
Lepidostomatidae		X				
Leptoceridae						X
Limnephilidae	X	X	X	X	X	X
Molannidae						
Philopotamidae		X	X			
Polycentropodidae						
Uenoidae		X	X	X		X
Coleoptera (beetles)						
Amphizoidea						
Dryopidae						
Dyticsidae		X				
Elmidae	X	X	X	X		
Gyrinidae		X			X	X
Haliplidae						
Psephenidae		X				X
Scirtidae (adults)						
Diptera (flies)						
Athericidae		X	X	X	X	
Ceratopogonidae						
Culicidae						
Chironomidae	X	X	X	X	X	X
Ephydridae						
Muscidae						
Sciomyzidae						
Simuliidae		X	X	X		
Statiomyidae						

Table 34.–Continued.

Taxa	River or creek sites (Road crossing)					
	Little Cedar (Dale)	Cedar (Campbell)	N. Br. Tobacco (Grout)	Mid. Br. Tobacco (McCollouch)	S. Br. Tobacco (Grout)	S. Br. Tobacco (Grant)
Insecta–continued						
Tabanidae		X				
Tipulidae			X	X		X
Mollusca						
Gastropoda (snails and limpets)						
Ancylidae	X	X	X			
Lymnaeidae						
Physidae					X	X
Planorbidae						
Bithyniidae						
Pleuroceridae						
Pomatiopsidae						
Vivaparidae	X	X	X			
Bivalvia (bivalves)						
Sphaeriidae	X	X		X	X	X
Unionidae			X			
Pisididae						

Table 35.–Aquatic macroinvertebrates of the tributaries to the mouth segment Tittabawassee River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

Taxa	River or Creek sites (Road crossing)	
	Carrol (Meridian)	Bullock (Poseyville)
Porifera (sponges)	X	
Bryozoa (moss animals)	X	
Platyhelminthes (flatworms)		
Turbellaria		X
Annelida (segmented worms)		
Hirudinea (leeches)		
Oligochaeta (worms)	X	
Arthropoda		
Crustacea		
Amphipoda (scuds)	X	X
Decapoda (crayfish)	X	X
Isopoda (sowbugs)		X
Arachnoidea		
Hydracarina (mites)		
Insecta		
Ephemeroptera (mayflies)		
Baeticidae	X	
Baetidae	X	X
Caenidae		
Ephemerellidae		
Ephemeridae		
Heptageniidae	X	X
Isonychiidae		
Syphlomuridae		
Potamanthidae		
Tricorythidae		
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	X	X
Cordulegastridae		
Gomphidae	X	
Libellulidae		
Zygoptera (damselflies)		
Calopterygidae	X	X
Coenagrionidae		
Lestidae		
Perlodidae		
Plecoptera (stone flies)		
Perlidae		
Pteronarcyidae		
Hemiptera (true bugs)		
Belastomatidae		
Corixidae		X
Gerridae	X	X
Nepidae		X

Table 35.–Continued.

Taxa	River or Creek sites (Road crossing) Carrol (Meridian)	Bullock (Poseyville)
Insecta–continued		
Notonectidae		
Pleidae		
Veliidae		
Saldidae		
Megaloptera		
Corydalidae (dobson flies)	X	X
Sialidae (alder flies)		
Trichoptera (caddisflies)		
Brachycentridae		
Glossosmatidae		
Helicopsychidae		
Hydropsychidae	X	
Hydroptilidae		
Lepidostomatidae		
Leptoceridae	X	
Limnephilidae	X	X
Molannidae		
Philopotamidae		
Phryganeidae	X	X
Uenoidae		X
Lepidoptera (moths)		
Nornidae	X	
Coleoptera (beetles)		
Amphizoidea		
Dryopidae		
Dyticsidae		
Elmidae	X	X
Gyrinidae		
Haliplidae		X
Psephenidae		
Scirtidae (adults)		
Diptera (flies)		
Athericidae		
Ceratopogonidae		
Culicidae		X
Chironomidae	X	X
Ephydridae		
Muscidae		
Sciomyzidae		
Simuliidae		
Statiomyidae		
Tabanidae	X	
Tipulidae	X	X
Mollusca		
Gastropoda (snails and limpets)		
Ancylidae		
Lymnaeidae		
Physidae	X	X
Planorbidae		

Table 35.–Continued.

Taxa	River or Creek sites (Road crossing)	
	Carrol (Meridian)	Bullock (Poseyville)
Mollusca–continued		
Bithyniidae		
Pleuroceridae		
Pomatiopsidae		
Vivaparidae		
Bivalvia (bivalves)		
Sphaeriidae	X	X
Unionidae		
Pisididae		

Table 36.–Aquatic macroinvertebrates of the Salt River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

Taxa	River or Creek sites (Road crossing)	
	Bluff (Weinert)	Salt (Coleman)
Porifera (sponges)		
Bryozoa (moss animals)	X	X
Platyhelminthes (flatworms)		
Turbellaria		X
Annelida (segmented worms)		
Hirudinea (leeches)		
Oligochaeta (worms)		X
Arthropoda		
Crustacea		
Amphipoda (scuds)	X	X
Decapoda (crayfish)	X	X
Isopoda (sowbugs)		X
Arachnoidea		
Hydracarina (mites)	X	X
Insecta		
Ephemeroptera (mayflies)		
Baeticidae	X	
Baetidae	X	X
Caenidae		
Ephemerellidae		
Ephemeridae		
Heptageniidae	X	X
Isonychiidae		
Leptophlebiidae		
Potamanthidae		
Siphlonuridae		X
Tricorythidae	X	X
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	X	X
Corduliidae		
Gomphidae	X	X
Libellulidae		
Zygoptera (damselflies)		
Calopterygidae	X	X
Perlodidae		
Plecoptera (stone flies)		
Perlidae		X
Pteronarcyidae		
Hemiptera (true bugs)		
Belastomatidae		X
Corixidae	X	X
Galastocoridae		X
Gerridae	X	X
Mesoveliidae		

Table 36.–Continued.

Taxa	River or Creek sites (Road crossing)	
	Bluff (Weinert)	Salt (Coleman)
Notonectidae		
Pleidae		
Veliidae		
Saldidae		
Megaloptera		
Corydalidae (dobson flies)	X	X
Sialidae (alder flies)	X	X
Trichoptera (caddisflies)		
Brachycentridae		
Glossosmatidae		
Helicopsychidae		X
Hydropsychidae	X	X
Hydroptilidae		
Lepidostomatidae		
Leptoceridae	X	X
Limnephilidae	X	X
Pharyganeidae		X
Philopotamidae		
Polycentropodidae		
Uenoidae	X	X
Coleoptera (beetles)		
Amphizoidea		
Dryopidae		
Dyticsidae		
Elmidae	X	X
Gyrinidae		
Haliplidae	X	X
Psephenidae	X	X
Scirtidae (adults)		
Diptera (flies)		
Athericidae	X	
Ceratopogonidae		
Culicidae		
Chironomidae	X	X
Dixidae		X
Muscidae		
Sciomyzidae		
Simuliidae	X	X
Statiomyidae		
Tabanidae	X	X
Tipulidae	X	X
Mollusca		
Gastropoda (snails and limpets)		
Ancylidae		
Lymnaeidae		X
Physidae	X	X
Planorbidae	X	

Table 36.–Continued.

Taxa	River or Creek sites (Road crossing)	
	Bluff (Weinert)	Salt (Coleman)
Bithyniidae		
Pleuroceridae		X
Pomatiopsidae		
Vivaparidae		
Bivalvia (bivalves)		
Sphaeriidae	X	X
Unionidae		X
Pisididae		

Table 37.–Aquatic macroinvertebrates of the Chippewa River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

Taxa	River or Creek sites (Road crossing)											
	Chippewa (Meridian)	Chippewa (M-20)	Chippewa (S.Meridian)	Chippewa (Coldwater)	L. Salt (McGruder)	L. Salt (9-Mile)	Salt (Alamondo)	N. Br. Chippewa east (S.Nottawa)	N. Br. Chippewa east (Rosebush)	N. Br. Chippewa east (Stevenson Lake)	Coldwater (Baseline)	Coldwater (Vernon)
Porifera (sponges)				X			X					
Bryozoa (moss animals)	X		X	X				X		X		
Platyhelminthes (flatworms)												
Turbellaria	X	X	X	X	X	X		X				
Annelida (segmented worms)												
Hirudinea (leeches)		X	X	X	X	X	X	X		X	X	X
Oligochaeta (worms)					X				X			
Arthropoda												
Crustacea												
Amphipoda (scuds)	X	X	X	X	X	X	X	X	X	X	X	
Decapoda (crayfish)	X	X	X	X	X		X	X	X	X	X	
Isopoda (sowbugs)	X				X			X	X	X	X	
Arachnoidea												
Hydracarina (mites)	X				X							
Insecta												
Ephemeroptera (mayflies)												
Baeticidae								X		X		
Baetidae	X	X	X		X	X	X	X	X	X	X	
Caenidae	X			X	X	X	X			X	X	
Ephemerellidae	X		X	X			X				X	
Ephemeridae		X		X			X					
Heptageniidae	X	X	X		X	X		X	X	X	X	
Isonychiidae	X	X	X									
Leptophlebiidae												

Table 37.–Continued.

Taxa	River or Creek sites (Road crossing)											
	Chippewa (Meridian)	Chippewa (M-20)	Chippewa (S.Meridian)	Chippewa (Coldwater)	L. Salt (McGruder)	L. Salt (9-Mile)	Salt (Alamondo)	N. Br. Chippewa east (S.Nottawa)	N. Br. Chippewa east (Rosebush)	N. Br. Chippewa east (Stevenson Lake)	Coldwater (Baseline)	Coldwater (Vernon)
Insecta–continued				X			X					
Potamanthidae			X									
Tricorythidae			X									
Odonata												
Anisoptera (dragonflies)												
Aeshnidae					X							
Corduliidae												
Gomphidae	X		X		X	X	X	X	X	X	X	
Libellulidae												
Zygoptera (damselflies)												
Calopterygidae	X	X	X		X	X	X	X	X	X	X	X
Coenagrionidae		X		X							X	X
Lestidae				X								
Perlodidae	X				X	X						
Plecoptera (stone flies)												
Perlidae	X	X	X		X	X	X	X		X	X	
Pteronarcyidae		X	X					X				
Hemiptera (true bugs)												
Belastomatidae												
Corixidae	X				X		X			X		
Gerridae	X	X	X		X		X		X	X	X	
Mesoveliidae												
Notonectidae												
Veliidae												
Saldidae												

Table 37.–Continued.

Taxa	River or Creek sites (Road crossing)											
	Chippewa (Meridian)	Chippewa (M-20)	Chippewa (S.Meridian)	Chippewa (Coldwater)	L. Salt (McGruder)	L. Salt (9-Mile)	Salt (Alamondo)	N. Br. Chippewa east (S.Nottawa)	N. Br. Chippewa east (Rosebush)	N. Br. Chippewa east (Stevenson Lake)	Coldwater (Baseline)	Coldwater (Vernon)
Insecta–continued				X			X					
Megaloptera												
Corydalidae (dobson flies)	X		X	X		X	X			X		
Sialidae (alder flies)												
Trichoptera (caddisflies)												
Brachycentridae	X		X									
Glossosmatidae	X											
Helicopsychidae	X	X	X	X	X	X	X			X	X	
Hydropsychidae	X	X	X	X	X	X	X	X	X	X	X	
Hydroptilidae			X									
Lepidostomatidae	X	X	X	X								
Leptoceridae							X					
Limnephilidae					X	X	X			X	X	X
Molannidae											X	
Philopotamidae			X									
Polycentropodidae							X	X				
Uenoidae	X	X	X		X		X			X	X	
Coleoptera (beetles)												
Amphizoidea						X						
Dryopidae												
Dyticsidae								X	X			
Elmidae		X	X	X	X	X	X	X	X	X	X	X
Gyrinidae	X	X	X	X		X			X	X	X	
Haliplidae	X				X							X
Psephenidae			X				X			X	X	
Scirtidae (adults)												

Table 37.–Continued.

Taxa	River or Creek sites (Road crossing)											
	Chippewa (Meridian)	Chippewa (M-20)	Chippewa (S.Meridian)	Chippewa (Coldwater)	L. Salt (McGruder)	L. Salt (9-Mile)	Salt (Alamondo)	N. Br. Chippewa east (S.Nottawa)	N. Br. Chippewa east (Rosebush)	N. Br. Chippewa east (Stevenson Lake)	Coldwater (Baseline)	Coldwater (Vernon)
Insecta–continued				X			X					
Diptera (flies)												
Athericidae												
Ceratopogonidae												
Chaoboridae												
Chironomidae	X	X	X	X	X	X	X	X	X	X	X	X
Ephydridae												
Muscidae												
Sciomyzidae												
Simuliidae	X	X	X	X	X	X	X	X	X	X		
Statiomyidae											X	
Tabanidae												
Tipulidae	X					X						X
Mollusca												
Gastropoda (snails and limpets)												
Ancylidae							X	X				
Lymnaeidae			X								X	
Physidae		X	X	X		X	X	X	X	X	X	X
Planorbidae	X		X									
Bithyniidae												
Pleuroceridae			X				X					
Pomatiopsidae												
Vivaparidae												
Bivalvia (bivalves)												
Sphaeriidae	X	X	X	X	X	X	X	X	X	X	X	X
Unionidae	X		X	X			X				X	
Pisididae				X								

Table 38.–Aquatic macroinvertebrates of the Pine River. Data code: X = present, blank indicates not collected. Data from Cooper (2002).

Taxa	River or Creek sites {County} (Road crossing or approximate location)													
	Pine {Midland} (lower)	Pine {Midland} (middle)	Pine {Gratiot} (middle)	Pine {Gratiot} (upper)	Honey {Gratiot}	Unnamed {Gratiot} (Ely)	Pine {Montcalm}	N. Br. Pine {Montcalm}	Pony {Isabella}	Pine {Isabella}	Pony {Isabella}	S. Br. Pine {Isabella}	Jewell {Mecosta}	Wolf {Montcalm}
Porifera (sponges)				X							X			X
Bryozoa (moss animals)														
Platyhelminthes (flatworms)														
Turbellaria		X												
Annelida (segmented worms)														
Hirudinea (leeches)	X			X	X	X					X			
Oligochaeta (worms)	X	X	X		X	X		X			X	X	X	X
Arthropoda														
Crustacea														
Amphipoda (scuds)	X	X	X	X	X	X		X	X	X	X	X	X	X
Decapoda (crayfish)	X	X	X	X	X	X		X	X	X	X	X	X	X
Isopoda (sowbugs)					X									
Arachnoidea														
Hydracarina (mites)					X						X			
Insecta														
Ephemeroptera (mayflies)														
Baetidae	X	X	X	X	X			X	X	X	X	X	X	X
Caenidae	X	X	X	X	X	X				X	X			X
Ephemerellidae					X								X	X
Ephemeridae	X	X		X	X							X	X	X
Heptageniidae	X	X	X	X				X	X	X		X	X	X
Isonychiidae	X			X										
Leptophlebiidae										X				
Potamanthidae	X	X												
Tricorythidae	X	X	X					X	X	X			X	X

Table 38.–Continued.

Taxa	River or Creek sites {County} (Road crossing or approximate location)													
	Pine {Midland} (lower)	Pine {Midland} (middle)	Pine {Gratiot} (middle)	Pine {Gratiot} (upper)	Honey {Gratiot}	Unnamed {Gratiot} (Ely)	Pine {Montcalm}	N. Br. Pine {Montcalm}	Pony {Isabella}	Pine {Isabella}	Pony {Isabella}	S. Br. Pine {Isabella}	Jewell {Mecosta}	Wolf {Montcalm}
Insecta–continued														
Odonata														
Anisoptera (dragonflies)														
Aeshnidae			X		X			X	X	X	X	X	X	
Corduliidae													X	
Gomphidae	X			X					X	X				X
Libellulidae											X		X	
Zygoptera (damselflies)														
Calopterygidae	X	X		X		X			X	X		X	X	X
Coenagrionidae	X	X	X		X									
Perlodidae	X												X	
Plecoptera (stone flies)														
Perlidae	X	X	X	X	X			X	X	X		X	X	X
Pteronarcyidae		X		X										
Hemiptera (true bugs)														
Belastomatidae				X										
Corixidae	X	X	X	X	X	X	X					X		X
Gerridae		X	X	X	X	X	X	X	X	X	X	X	X	X
Mesoveliidae			X						X				X	
Notonectidae					X									
Veliidae	X	X		X										
Saldidae										X				
Megaloptera														
Corydalidae (dobson flies)		X					X			X			X	X
Sialidae (alder flies)				X						X			X	
Trichoptera (caddisflies)														
Brachycentridae					X		X	X	X	X	X	X		X
Glossosmatidae							X	X	X			X		X

Table 38.–Continued.

Taxa	River or Creek sites {County} (Road crossing or approximate location)													
	Pine {Midland} (lower)	Pine {Midland} (middle)	Pine {Gratiot} (middle)	Pine {Gratiot} (upper)	Honey {Gratiot}	Unnamed {Gratiot} (Ely)	Pine {Montcalm}	N. Br. Pine {Montcalm}	Pony {Isabella}	Pine {Isabella}	Pony {Isabella}	S. Br. Pine {Isabella}	Jewell {Mecosta}	Wolf {Montcalm}
Insecta–continued														
Helicopsychidae		X	X	X				X	X	X		X		X
Hydropsychidae	X	X	X				X		X	X	X	X	X	X
Hydroptilidae														
Lepidostomatidae												X		
Leptoceridae	X	X	X	X			X							X
Limnephilidae			X	X	X	X	X	X	X	X	X	X	X	X
Molannidae										X	X			
Philopotamidae														X
Polycentropodidae				X									X	
Uenoidae	X	X	X	X			X	X	X			X		X
Coleoptera (beetles)														
Dryopidae														
Dyticsidae	X	X	X	X							X		X	X
Elmidae	X	X	X	X	X		X	X	X					X
Gyrinidae	X	X	X		X	X				X				
Haliplidae				X	X			X						
Psephenidae	X		X											X
Scirtidae (adults)				X						X				X
Diptera (flies)														
Athericidae		X												
Ceratopogonidae	X	X	X	X	X		X						X	
Chaoboridae														
Chironomidae	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ephydridae	X	X	X											
Muscidae					X		X							
Sciomyzidae														
Simuliidae		X			X			X		X	X	X	X	X

Table 38.–Continued.

Taxa	River or Creek sites {County} (Road crossing or approximate location)													
	Pine {Midland} (lower)	Pine {Midland} (middle)	Pine {Gratiot} (middle)	Pine {Gratiot} (upper)	Honey {Gratiot}	Unnamed {Gratiot} (Ely)	Pine {Montcalm}	N. Br. Pine {Montcalm}	Pony {Isabella}	Pine {Isabella}	Pony {Isabella}	S. Br. Pine {Isabella}	Jewell {Mecosta}	Wolf {Montcalm}
Insecta–continued														
Statiomyidae	X								X					
Tabanidae							X							
Tipulidae	X										X		X	X
Mollusca														
Gastropoda (snails and limpets)														
Ancylidae				X			X	X	X					X
Lymnaeidae		X	X	X							X		X	
Physidae		X	X	X	X	X	X	X	X		X	X	X	X
Planorbidae			X	X			X	X						
Bithyniidae										X		X		
Pleuroceridae														X
Pomatiopsidae														
Vivaparidae				X										X
Bivalvia (bivalves)														
Sphaeriidae					X	X	X	X		X	X	X		X
Unionidae							X	X				X		
Pisididae	X	X	X						X					

Table 39.–Occurrence of natural features within the Tittabawassee River watershed. Data from Michigan Department of Natural Resources, Wildlife Division, Natural Features Inventory, May 2006. State status codes: E=endangered, T=threatened, SC=special concern (rare, may become E or T in the future), X=extirpated. Federal status codes: LT=listed threatened, PDL=proposed for de-listing, C=candidate to be listed.

Common name or feature	Scientific name	Status		Upper	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
		Federal	State							
Vertebrate										
Bald eagle	*Haliaeetus leucocephalus*		SC	X	X	X	X		X	
Blanding's turtle	*Emys blandingii*		SC	X		X			X	X
Common loon	*Gavia immer*		T	X	X	X			X	
Common tern	*Sterna hirundo*		T				X			
eastern box turtle	*Terrapene carolina carolina*		SC						X	
eastern fox snake	*Elaphe vulpina gloydi*		T				X			
eastern massasauga	*Sistrurus catenatus catenatus*	C	SC			X				
Grasshopper sparrow	*Ammodramus savannarum*		SC							X
King rail	*Rallus elegans*		E						X	
lake sturgeon	*Acipenser fluvescens*		T				X			
Northern goshawk	*Accipiter gentilis*		SC		X					
Osprey	*Pandion haliaetus*		T			X			X	
pugnose shiner	*Notropis anogenus*		SC			X			X	
Red-shouldered hawk	*Buteo lineatus*		T		X	X	X		X	
spotted turtle	*Clemmys guttata*		T			X				
wood turtle	*Clemmys insculpta*		SC	X	X	X		X	X	X
woodland vole	*Microtus pinetorum*		SC			X				X
Invertebrate										
ebony boghaunter	*Williamsonia fletcheri*		SC						X	
elktoe	*Alasmidonta marginata*		SC	X	X	X	X			X
ellipse	*Venustaconcha ellipsiformis*		SC	X	X	X		X		
hickorynut	*Obovaria olivaria*		SC				X			
laura's snaketail	*Stylurus laurae*		SC	X						
rainbow	*Villosa iris*		SC							X
rapids clubtail	*Gomphus quadricolor*		SC						X	
riverine snaketail	*Stylurus amnicola*		SC						X	
round pigtoe	*Pleurobema coccineum*		SC							X
slippershell mussel	*Alasmidonta viridis*		SC	X	X	X		X		X
snuffbox	*Epioblasma triquetra*		E				X	X	X	
splendid clubtail	*Gomphus lineatifrons*		SC						X	

Table 39.–Continued.

Common name or feature	Scientific name	Status		Upper	Middle	Tobacco	Mouth	Salt	Chippewa	Pine
		Federal	State							
Vascular plant										
alleghany or sloe plum	*Prunus alleghaniensis var. davisii*		SC							X
beak grass	*Diarrhena americana*		T						X	X
blue-eyed-grass	*Sisyrinchium strictum*		SC							X
broad-leaved puccoon	*Lithospermum latifolium*		SC						X	X
calypso or fairy-slipper	*Calypso bulbosa*		T						X	
Cooper's milk-vetch	*Astragalus neglectus*		SC							X
Engelmann's spike-rush	*Eleocharis engelmannii*		SC		X					
false hop sedge	*Carex lupuliformis*		T							X
ginseng	*Panax quinquefolius*		T							X
Hayden's sedge	*Carex haydenii*		X					X		
lake cress	*Armoracia lacustris*		T							X
pale beard tongue	*Penstemon pallidus*		SC			X				
prairie fringed orchid	*Platanthera leucophaea*	LT	E							X
ram's head lady's-slipper	*Cypripedium arietinum*		SC						X	X
sedge	*Carex seorsa*		T				X		X	
showy orchis	*Galearis spectabilis*		T							X
slough grass	*Beckmannia syzigachne*		T							X
small love grass	*Eragrostis pilosa*		SC				X			
three-awned grass	*Aristida longespica*		T					X		
twinleaf	*Jeffersonia diphylla*		SC						X	
Virginia spiderwort	*Tradescantia virginiana*		SC						X	
whorled pogonia	*Isotria verticillata*		T							X
Plant community										
mesic southern forest							X			
dry-mesic northern forest								X		
rich conifer swamp										X
bog										X
Rookery										
Great Blue Heron	*Ardea herodias*			X	X			X	X	X

Table 40.–Mammals of the Tittabawassee River watershed. SC denotes mammals of special concern, mammals extirpated from the Tittabawassee River watershed are denoted * and extinct species **. Data from Burt (1957) and Evers (1994).

Common name	Scientific name
Pouched mammals	Marsupiala
opossum	*Didelphis virginiana*
Shrews, moles, and allies	Insectivora
eastern mole	*Scalopus aquaticus*
starnose mole	*Condylura cristata*
masked shrew	*Sorex cinereus*
shorttail shrew	*Blarina brevicauda*
Bats and flying mammals	Chiroptera
little brown myotis	*Myotis lucifugus*
keen myotis	*Myotis keeni*
silver-haired bat	*Lasionycteris noctivagans*
big brown bat	*Eptesicus fuscus*
red bat	*Lasiurus borealis*
hoary bat	*Lasiurus cinereus*
Rabbits, hares and picas	Lagamorpha
snowshoe hare	*Lepus americanus*
eastern cottontail	*Sylvilagus floridanus*
Rodents	Rodentia
eastern chipmunk	*Tamias striatus*
woodchuck	*Marmota monax*
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
eastern gray squirrel	*Sciurus carolinensis*
eastern fox squirrel	*Sciurus niger*
red squirrel	*Tamiasciurus hudsonicus*
southern flying squirrel	*Glaucomys volans*
beaver	*Castor canadensis*
white-footed mouse	*Peromyscus leucopus*
deer mouse	*Peromyscus maniculatus*
meadow vole	*Microtus pennsylvanicus*
woodland vole **(SC)**	*Microtus pinetorum*
muskrat	*Ondatra zibethicus*
southern bog lemming	*Synaptomys cooperi*
Norway rat	*Rattus norvegicus*
house mouse	*Mus musculus*
meadow jumping mouse	*Zapus hudsonius*
porcupine	*Erethizon dorsatum*
Flesh eaters	Carnivora
gray wolf*	*Canis lupus*
coyote	*Canis latrans*
red fox	*Vulpes vulpes*
gray fox	*Urocyon cinereoargenteus*
black bear	*Ursus americanus*
raccoon	*Procyon lotor*
marten*	*Martes americana*
long-tailed weasel	*Mustela frenata*
least weasel	*Mustela nivalis*
mink	*Mustela vison*

Table 40.–Continued.

Common name	Scientific name
American badger	*Taxidea taxus*
striped skunk	*Mephitis mephitis*
river otter	*Lutra canadensis*
cougar*	*Felis concolor*
lynx*	*Lynx canadensis*
bobcat	*Lynx rufus*
Even-toed ungulates	Artiodactyla
eastern elk**	*Cervus elaphus canadensis*
whitetail deer	*Odocoileus virginianus*
woodland caribou*	*Rangifer tarandus caribou*

Table 41.–Breeding bird observations in the Tittabawassee River watershed. Status codes in parentheses and bold (Brewer et. al. 1991).

Common name	Scientific name
Loon	Gaviidae
Common Loon **(threatened)**	*Gavia immer*
Grebe	Colymbidae
Pied-billed Grebe	*Podilymbus podiceps*
Herons	Ardeidae
Great Blue Heron	*Ardea herodias*
Green-backed Heron	*Butorides striatus*
American Bittern	*Botaurus lentiginosus*
Least Bittern (**threatened**)	*Ixobrychus exilis*
Swans, Geese, and Ducks	Anatidae
Mute Swan	*Cygnus olor*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
American Black Duck	*Anas rubripes*
Blue Winged Teal	*Anas discors*
Wood Duck	*Aix sponsa*
Hooded Merganser	*Lophodytes cucullatus*
American Vultures	Cathartidae
Turkey Vulture	*Cathartes aura*
Hawks	Accipitridae
Northern Goshawk	*Accipiter gentilis*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-tailed Hawk	*Buteo jamaicensis*
Red-shouldered Hawk (**threatened**)	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Bald Eagle **(special concern)**	*Haliaeetus Ieucicephalus*
Grouse	Tetraonidae
Ruffed Grouse	*Bonasa umbellus*
Pheasants and Quail	Phasianidae
Northern Bobwhite	*Colinus virginianus*
Ring-necked Pheasant	*Phasianus colchicus*
Turkeys	Meleagrididae
Wild Turkey	*Meleagris gallopavo*
Cranes	Gruidae
Sandhill Crane	*Grus canadensis*
Rails	Rallidae
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
American Coot	*Fulica americana*
Plovers	Charadriidae
Killdeer	*Charadrius vociferus*

Table 41.–Continued.

Common name	Scientific name
Sandpipers	Scolopacidae
American Woodcock	*Scolopax minor*
Common Snipe	*Gallinago gallinago*
Spotted Sandpiper	*Actitis macularia*
Upland Sandpiper	*Bartramia longicauda*
Pigeons and Doves	Columbidae
Mourning Dove	*Zenaida macroura*
Rock Dove	*Columba livia*
Cuckoos	Cuculidae
Yellow-billed Cuckoo	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Barn Owls	Tytonidae
Eastern Screech-owl	*Otus asio*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Short-eared Owl (**endangered**)	*Asio flammeus*
Whip-poor-will	*Caprimulgus vociferus*
Common Nighthawk	*Chordeiles minor*
Swifts	Apodidae
Chimney Swift	*Chaetura pelagica*
Hummingbirds	Trochilidae
Ruby-throated Hummingbird	*Archilochus colubris*
Kingfishers	Alcedinidae
Belted Kingfisher	*Ceryle alcyon*
Woodpeckers	Picidae
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Flycatchers	Tyrannidae
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Wood-pewee	*Contopus virens*
Larks	Alaudidae
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Hirundo pyrrhonota*
Barn Swallow	*Hirundo rustica*

Table 41.–Continued.

Common name	Scientific name
Purple Martin	*Progne subis*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Jays and Crows	Corvidae
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Titmice	Paridae
Black-capped Chickadee	*Parus atricapillus*
Tuffed Titmouse	*Parus bicolor*
Nuthatches	Sittidae
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Creepers	Certhiidae
Brown Creeper	*Certhia americana*
Wrens	Troglodytidae
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Mockingbirds and Thrashers	Mimidae
Northern Mockingbird	*Minnus polyglottos*
Brown Thrasher	*Toxostoma rufum*
Gray Catbird	*Dumetella carolinensis*
Thrushes	Turdidae
American Robin	*Turdus migratorius*
Wood Thrush	*Hylocichla mustelina*
Veery	*Catharus fuscescens*
Eastern Bluebird	*Sialia sialis*
Gnatcatchers and Kinglets	Sylviidae
Blue-gray Gnatcatcher	*Polioptila caerulea*
Golden-crowned Kinglet	*Regulus satrapa*
Waxwings	Bombycillidae
Northern Harrier	*Circus cyaneus*
American Kestrel	*Falco sparverius*
Common Moorhen	*Gallinula chloropus*
Cedar Waxwing	*Bombycilla cedrorum*
European Starling	*Sturnus vulgaris*
Solitary Vireo	*Vireo solitarius*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Blue-winged Warbler	*Vermivora pinus*
Golden-winged Warbler	*Vermivora chrysoptera*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Black-throated Blue Warbler	*Dendroica caerulescens*

Table 41.–Continued.

Common name	Scientific name
Black-throated Green Warbler	*Dendroica virens*
Blackburnian Warbler	*Dendroica fusca*
Pine Warbler	*Dendroica pinus*
Prairie Warbler (**endangered**)	*Dendroica discolor*
Cerulean Warbler	*Dendroica cerulea*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapillus*
Northern Waterthrush	*Seiurus noveboracensis*
Louisiana Waterthrush	*Seiurus motacilla*
Mourning Warbler	*Oporornis philadelphia*
Common Yellowthroat	*Geothlypis trichas*
Hooded Warbler	*Wilsonia citrina*
Canada Warbler	*Wilsonia canadensis*
Yellow-breasted Chat	*Icteria virens*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Dickcissel	*Spiza americana*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Field Sparrow	*Spizella pusilla*
Vesper Sparrow	*Pooecetes gramineus*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow (**threatened**)	*Ammodramus henslowii*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird	*Agelaius phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Orchard Oriole	*Icterus spurius*
Northern Oriole	*Icterus galbula*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Pine Siskin	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*

Table 42.–Amphibians and reptiles in the Tittabawassee River watershed. Data are from Harding and Holman (1990, 1992), Harding (1997) and Michigan Department of Natural Resources, Fisheries Division.

Common name	Scientific name
Salamanders	
mudpuppy	*Necturus maculosus maculosus*
eastern newt	*Notophthalmus viridescens*
spotted salamander	*Ambystoma maculatum*
blue-spotted salamander	*Ambystoma laterale*
eastern tiger salamander	*Ambystoma tigrinum tigrinum*
red-backed salamander	*Plethodon cinereus*
four-toed salamander	*Hemidactylium scutatum*
Frogs and toads	
eastern American toad	*Bufo americanus americanus*
Blanchard's cricket frog	*Acris crepitans blanchardi*
striped chorus frog	*Pseudacris triseriata*
northern spring peeper	*Pseudacris crucifer crucifer*
eastern gray tree frog	*Hyla versicolor*
Cope's gray tree frog	*Hyla chrysoscelis*
bullfrog	*Rana catesbeiana*
green frog	*Rana clamitans melanota*
wood frog	*Rana sylvatica*
northern leopard frog	*Rana pipiens*
pickerel frog	*Rana palustris*
Turtles and lizards	
common snapping turtle	*Chelydra serpentina serpentina*
common musk turtle	*Sternotherus odoratus*
spotted turtle	*Clemmys guttata*
eastern box turtle	*Terrapene carolina carolina*
Blanding's turtle	*Emydoidea blandingii*
common map turtle	*Graptemys geographica*
painted turtle	*Chrysemys picta*
red-eared slider	*Trachemys scripta elegans*
eastern spiny softshell turtle	*Apalone spinifera spinifera*
five-lined skink	*Eumeces fasciatus*
Snakes	
northern water snake	*Nerodia sipedon*
queen snake	*Regina septemvittata*
common garter snake	*Thamnophis sirtalis*
Butler's garter snake	*Thamnophis butleri*
northern ribbon snake	*Thamnophis sauritus septentrionalis*
brown snake	*Storeria dekayi*
northern red-bellied snake	*Storeria occipitomaculata*
smooth green snake	*Opheodrys vernalis*
blue racer	*Coluber constrictor foxi*
black rat snake	*Elaphe obsoleta obsoleta*
eastern fox snake	*Elaphe gloydi*
eastern milk snake	*Lampropeltis triangulum triangulum*
northern ring-necked snake	*Diadophis nunctatus edwardsii*
eastern hog-nosed snake	*Heterodon platirhinos*
eastern massasauga	*Sistrurus catenatus catenatus*

Table 43.–Fish stocking in the Tittabawassee River watershed, 1995–2005. Data from Michigan Department of Natural Resources, Fisheries Division.

County Location	Species	Years	Numbers	Comments
Clare				
Bertha Lake	bluegill	2001	400	private stocking
	hybrid sunfish	2005	200	private stocking
	largemouth bass	2001, 2004	610	private stocking
Budd Lake	northern muskellunge	1995, 1997, 2000, 2003	4,321	management stocking
	redear sunfish	2003, 2004	1,500	private stocking
	walleye	1995, 1996, 2004	52,694	management and private stocking
	yellow perch	2004	2,600	private stocking
Eightpoint Lake	black crappie	2005	900	private stocking
	largemouth bass	1989, 1992	700	private stocking
	walleye	2004	10,965	private stocking
	yellow perch	2003	20,000	private stocking
Lake Thirteen	bluegill	2004	800	private stocking
	hybrid sunfish	2003	1,000	private stocking
	walleye	1998, 2001, 2002, 2005	3,300	private stocking
	yellow perch	2003, 2004	1,800	private stocking
Little Long Lake	black crappie	2001	2,500	private stocking
	bluegill	2001	2,500	private stocking
	brown trout	1995–2004	10,991	discontinued 2005
	hybrid sunfish	2000	2,000	private stocking
	rainbow trout	2000–04	14,691	discontinued 2005
Newton Creek	brown trout	1995–2005	12,664	management stocking
S. Br. Tobacco River	brown trout	1995–2005	48,050	management stocking
Shamrock Lake	walleye	1996	53,433	management stocking, discontinued
Sutherland Lake	largemouth bass	1999	357	private stocking

Table 43.–Continued.

County Location	Species	Years	Numbers	Comments
Gladwin				
Blue Lake	rainbow trout	2004	500	private stocking
Lake Four	walleye	1998	522	private stocking
Lake Lancer	walleye	1995, 1996, 1998, 2000, 2002, 2004	357,480	ongoing management
N. Br. Cedar River	brown trout	1995–2005	22,945	management stocking
Pratt Lake	walleye	1996, 1998, 2000, 2002, 2004	119,237	management stocking
	yellow perch	1996	1,000	private stocking
Ross Lake	northern muskellunge	1997, 2000, 2003, 2000	5,828	management stocking
	walleye	2000, 2002, 2004	82,281	management stocking
Secord Lake	northern muskellunge	1995, 1996, 1997, 2000, 2001, 2004	101,977	management stocking
	walleye	1995, 1998, 2000, 2002, 2004	244,067	management stocking
Smallwood Lake	northern muskellunge	1995–1997, 2001, 2004	5,046	management stocking
	northern pike	2001	44	management stocking
	walleye	1995, 1996, 1998, 2000, 2003, 2005	244,440	management stocking
Trout Lake	rainbow trout	2000–02	2,480	management stocking
Wiggins Lake	bluegill	1999	1,300	private stocking
	largemouth bass	1995, 1996	1,840	private stocking
	northern pike	1996, 1999	3,600	management stocking
	walleye	1995, 1996, 1998, 2000, 2002, 2004	111,581	management stocking
	yellow perch	1999	2,231	private stocking
Wixom Lake	northern muskellunge	1996, 1998, 2004	7,202	management stocking
	walleye	1995, 1996, 1997, 2000, 2001, 2004	494,212	management stocking
Isabella				
Chippewa River	Chinook salmon	1998, 1999	87	private stocking
	rainbow trout (steelhead)	1995–2005	145,882	management stocking
	walleye	1995	2,964	rearing pond release
Coldwater Lake	northern pike	1995	3,000	management stocking
	walleye	1996, 1999, 2002	29,328	management stocking
Herrick Pond North	bluegill	1997	84	restocking
	largemouth bass	1995	37	restocking

Table 43.–Continued.

County Location	Species	Years	Numbers	Comments
Isabella–continued				
Herrick Pond South	northern pike	1999–2000	635	restocking
	rainbow trout	1995–98	4,230	interim fishery
	yellow perch	1996, 1997	128	restocking
Herrick Swimming Pond	largemouth bass	1997	163	restocking
Littlefield Lake	walleye	2002	9,317	management stocking
Pine River	brown trout	1995–2005	51,153	management stocking
Mecosta				
Chippewa Lake	walleye	1995, 1997, 1998, 2000, 2003	286,765	management stocking
Pretty Lake	redear sunfish	1999	1,800	management stocking
	walleye	1995, 2001, 2005	3,070	private stocking

Table 44.–Public boat launch sites in the Tittabawassee River watershed by county and water body (MDNR 1996).

County	Name of water body	Location	Ownership
Clare	Arnold Lake	T20N, R4W, SEC. 35	State
	Budd Lake	T19W, R4W, SEC. 21	State
	Cranberry Lake	T19N, R4W, SEC. 1	State
	Crooked Lake	T17N, R6W, SEC. 22	State
	Five Lakes	T17N, R4W,SEC. 9	State
	Little Long Lake	T19N, R4W, SEC. 22	State
	Big Mudd Lake	T18N, R6W, SEC. 31	State
	Nester Lake	T18N, R3W, SEC. 10	State
	Perch Lake	T17N, R6W, SEC. 23	State
	Shamrock Lake	T17N, R4W, SEC. 26	City
Gladwin	House Lake	T20N, R2W, SEC. 8	State
	Lake Four	T20N, R1W, SEC. 4	State
	Lake Lancer	T20N, R1W, SEC 21	Township
	Hoister Lake	T20N, R2W, SEC. 9	State
	Pratt Lake	T19N, R2W, SEC. 21	State
	Ross Lake	T17N, R2W, SEC. 12	Township
	Secord Lake	T19N, R1E, SEC. 9	State
	E. Branch Tittabawassee River	T20N, R2E, SEC. 29	State
	Trout Lake	T20N, R2W, SEC. 9	State
	Wiggins Lake	T19N, R2W, SEC. 34	State
	Wixom Lake	T17N, R1W, SEC. 36	State
Gratiot	Alma Impoundment	T11N, R1W, SEC. 3	City
	St. Louis Impoundment	T12N, R2W, SEC. 25	City
Isabella	Coldwater Lake	T15N, R5W, SEC. 30	County
	Halls Lake	T14N, R6W, SEC. 19	Township
	Littlefield Lake	T16N, R5W, SEC. 17	State
	Stevenson Lake	T16N, R4W, SEC. 19	State
Mecosta	Chippewa Lake	T16N, R8W, SEC. 20	State
	Big Evans (2)	T16N, R8W, SEC.35	State
	Lost Lake	T15N, R8W, SEC. 1	State
	Lower Evans	T15N, R8W, SEC. 3	State
	Pretty Lake	T15N, R8W, SEC. 14	State
	Tubbs Lake	T15N, R7W, SEC. 7	State
	Tubbs Lake	T15N, R7W, SEC. 5	State
Midland	Sanford Lake	T15N, R1W, SEC. 24	County
	Tittabawassee River	T14N, R2E, SEC. 17	City
	Tittabawassee River	T14N, R5E, SEC. 35	City
Montcalm	Rock Lake	T12N, R5W, SEC.29	Township
Saginaw	Tittabawassee River	T12N, R3E, SEC. 11	County
	Tittabawassee River	T12N, R4E, SEC. 32	County

Table 45.–Organizations with interests in the Tittabawassee River watershed.

Organization name
Ducks Unlimited
Gladwin County Walleye Association
Izaak Walton League
Little Forks and Chippewa Nature Conservancy
Lone Tree Council
Michigan B.A.S.S. Chapter Federation
Michigan Chapter of American Fisheries Society
Michigan Duck Hunters Association
Michigan Muskie Alliance
Michigan Trappers Association
Michigan United Conservation Clubs District #10
Midland County Sportfishing Association
Mt. Pleasant League of Women Voters
Natural Resource Conservation Service
Nature Conservancy
Pheasants Forever
Pikemasters
Saginaw Bay Walleye Club
Saginaw Field and Stream Club
Saginaw Bay Watershed Initiative Network
Sanford Lake Improvement Board
Sierra Club
Sugar Springs Property Owners Association
Trout Unlimited
Wixom Lake Association
Wixom Lake Improvement Board

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APPENDICES

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Appendix A.1

Federal Energy Regulatory Commission license covering Secord, Smallwood, Edenville, and Sanford hydroelectric dams. Dams are located in the middle segment of the main stem. The license was issued October 16, 1998.

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85 FERC ¶ 61,064

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: James J. Hoecker, Chairman;
Vicky A. Bailey, William L. Massey,
Linda Breathitt, and Curt Hébert, Jr.

Wolverine Power Corporation) Project No. 10809-000

ORDER ISSUING MINOR LICENSE

(Issued October 16, 1998)

BACKGROUND

Wolverine Power Corporation (Wolverine) filed applications under Part I of the Federal Power Act (FPA) for original licenses for the continued operation and maintenance of four unlicensed hydroelectric projects located on the Tittabawassee River in Gladwin and Midland Counties, Michigan. Beginning furthest downstream, the projects are: the 3.3-megawatt (MW) Sanford Hydroelectric Project No. 2785, the 4.8-MW Edenville Project No. 10808, the 1.2-MW Smallwood Project No. 10810, and the 1.2-MW Secord Project No. 10809.

We issued a license for the Sanford Project No. 2785 in 1987. 1/ Rehearing requests of the license order have been held in abeyance while we analyzed all four projects together. 2/ We stayed parts of the license order for the same reason. In 1989, Wolverine filed license applications for its Edenville, Smallwood, and Secord Projects.

Notice of the applications was issued, and the State of Michigan Department of Natural Resources (Michigan DNR), the U.S. Department of the Interior (Interior), Donald J. Maladecki, and Terry Whittington filed timely motions to intervene in the three licensing proceedings. Maladecki and Whittington, local residents and recreational users of the project reservoirs, state that large fluctuations of reservoir levels adversely affect boaters and lake-front residences, and ask that any license issued limit such fluctuations.

The Commission staff prepared an Environmental Assessment (EA) that evaluates the impacts of all four projects on the

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1/ 41 FERC ¶ 62,192.

2/ The four projects comprise a single unit of development. See Section 3(11) of the FPA, 16 U.S.C. § 796(11).

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environmental resources of the area. 3/ We are concurrently issuing an order on rehearing of the Sanford Project license, and orders issuing licenses for the other three projects. This order issues the license for the Secord Project No. 10809.

The license order for the Edenville Project No. 10808 addresses, among other matters, issues of pertinence to all four projects, notably including mode of operation, fluctuation of reservoir levels, and fish entrainment. The discussion in the Edenville license order is incorporated by reference herein.

PROJECT DESCRIPTION

The Secord Project is the most upstream of the four projects. The Secord Dam, which has three sections totaling about 2,085 feet in length and has a maximum height of 55 feet, creates Secord Lake, a 1,100-acre reservoir with a 69-mile shoreline at full pool. There is a 47-foot-long intake leading to the powerhouse, which is located at the dam and has an installed capacity of 1.2 MW. The license application does not propose any new construction or redevelopment.

WATER QUALITY CERTIFICATION

The State of Michigan waived water quality certification for this project by its failure to act on Wolverine's certification request within one year. 4/

SECTION 18 FISHWAY PRESCRIPTION

As requested by Interior, we are including a condition in this license (Article 405) that reserves our authority to require such fishways as Interior may prescribe pursuant to Section 18 of the FPA. 5/

ENDANGERED SPECIES

Bald eagles (federally listed as threatened) are known to forage along the Tittabawassee River, Sanford Lake, and probably

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3/ A draft EA was issued March 31, 1994; the final EA was issued August 14, 1998.

4/ See Order Issuing Original License for Project No. 10808.

5/ Id.

Smallwood Lake. As requested by FWS, Article 406 of the license requires Wolverine to prepare a bald eagle protection plan. 6/

RECOMMENDATIONS OF FEDERAL AND STATE FISH AND WILDLIFE AGENCIES

A. Section 10(j) Recommendations

Section 10(j)(1) of the FPA 7/ requires the Commission, when issuing a license, to include license conditions, based on recommendations of federal and state fish and wildlife agencies submitted pursuant to the Fish and Wildlife Coordination Act, for the protection of, mitigation of adverse impacts to, and enhancement of fish and wildlife resources (including related spawning grounds and habitat) affected by the project. 8/

Michigan DNR and Interior submitted ten recommendations that we have considered under Section 10(j): (1) run-of-river operation of the projects; (2) continued flow releases through the project during project shut-downs; (3) a gaging plan to monitor project operation; (4) establishment of target reservoir elevations and limitation on reservoir fluctuations to +/-0.2 feet; (5) maintenance of state water quality standards for temperature and dissolved oxygen (DO), and development of a monitoring plan; (6) a bald eagle protection plan; (7) a habitat protection plan for state-listed threatened or endangered species; (8) a nuisance flora monitoring and control plan; (9) a wildlife management and land use plan; and (10) an erosion control plan. 9/

6/ Id.

7/ 16 U.S.C. § 803(j)(1).

8/ If the Commission believes that any such recommendation may be inconsistent with the purposes and requirements of Part I of the FPA or applicable law, Section 10(j)(2) requires the Commission and the agencies to attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agencies. If the Commission then does not adopt a recommendation, it must explain how the recommendation is inconsistent with applicable law and how the conditions selected by the Commission adequately and equitably protect, mitigate damages to, and enhance fish and wildlife.

9/ The agencies submitted five other recommendations that we do not consider under Section 10(j), because they are not specific measures to protect, mitigate damages to, or enhance fish and wildlife. See, e.g., Mead Corp., 72 FERC (continued...)

We have included conditions in the Secord license consistent with five of the recommendations and portions of two others: (1) a gaging plan to monitor project operation (Article 405); (2) establishment of target reservoir elevations (Article 403); (3) maintenance of state water quality standards for dissolved oxygen (DO) and temperature downstream of the project, and development of a related monitoring plan (Article 402); (4) a bald eagle protection plan (Article 406); (5) a nuisance flora monitoring and control plan (Article 407); (6) an erosion control plan (Article 401); and (7) a wildlife management and land use plan (Articles 403 and 406). 10/

As explained in the license order for Project No. 10808, we decline to adopt the Section 10(j) recommendations for (1) run-of-river operation, (2) continuous flows from the project during project shutdowns, (3) a temperature change standard, and (4) a habitat protection plan for listed species.

B. Other Recommendations and Resource Issues

As discussed in the Project No. 10808 license order, we decline to include in the Secord license conditions requiring the licensee: (1) to study the costs of project retirement; (2) to perform additional entrainment and mortality studies, evaluate potential protection devices, and provide compensation for fish losses at the project; and (3) to modify project operations or facilities or to install fish passage facilities when so ordered by Michigan DNR.

As proposed by both Wolverine and Michigan DNR, the license requires recreation facility improvements. 11/

In response to comments received, we are including a condition in the Secord Project license that requires Wolverine

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9/ (...continued)
¶ 61,027. These recommendations are: (1) a turbine entrainment and mortality study; (2) a reservation of authority to Michigan DNR to order changes in project operations and facilities; (3) a reservation of authority to Michigan DNR to order preparation of an upstream fish passage plan; (4) a plan for recreation facilities; and (5) a plan for studying the costs of decommissioning and partial or complete project removal. We instead consider these recommendations under Section 10(a) of the FPA.

10/ See Order Issuing Original License for Project No. 10808.

11/ Id.; and EA at 60-70.

to draw down the projects' reservoirs in early-winter to no more than three feet below the target elevations. 12/

COMPREHENSIVE PLANS

Pursuant to Section 10(a)(2)(A) of the FPA 13/ we reviewed the comprehensive plans relevant to this project and found no conflicts. 14/

COMPREHENSIVE DEVELOPMENT

Sections 4(e) and 10(a)(1) of the FPA require the Commission, in acting on applications for license, to give equal consideration to the power and development purposes and to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality. Any license issued shall be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. The decision to license this project, and the terms and conditions included herein, reflect such consideration.

The EA analyzed the effects associated with the issuance of an original license for the existing Secord Project. It recommends a number of measures to protect and mitigate environmental resources, which we adopt, as discussed herein and in the companion order issuing license for the Edenville Project No. 10808. These measures will establish target reservoir levels, limit reservoir fluctuations, and enhance recreational resources in the project area.

The electricity generated from renewable water power resources will be beneficial, because it will continue to offset the use of fossil-fueled, steam-electric generating plants, thereby conserving nonrenewable resources and reducing atmospheric pollution.

One of the public interest factors the Commission considers is the economic benefits of project power. Under our approach to evaluating the economics of hydropower projects, as articulated

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12/ See Order Issuing Original License for Project No. 10808; and EA at 35-36, 48-51, 69-70, and 75.

13/ 16 U.S.C. § 803(a)(2)(A).

14/ See Order Issuing Original License for Project No. 10808.

in Mead Corp., 15/ we employ an analysis that uses current costs to compare the costs of the project and likely alternative power, with no forecasts beyond the license issuance date concerning potential future inflation, escalation, or deflation. The basic purpose of the analysis is to provide a general estimate of the potential power benefits and the costs of a project, and reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

In making our decision, we consider the project power benefits both with the applicant's proposed mitigation measures and with the Commission's proposed recommendations to the applicant's proposal. In addition, certain economic factors related to project decommissioning impinge on the decision to issue original licenses for existing projects that are not present in the licensing of unconstructed projects. If an existing project is not issued a license, or if its licensee declines to accept the license, the project generally will have to be retired in one form or another. This could range from simply removing the generator at the powerhouse to major environmental restoration varying from minor measures to dam removal.

As licensed by the Commission, the Secord Project will produce an average of about 4.0 GWh of energy, at an annual cost of about $104,000 (26.0 mills/kWh). The current annual value of the project's power would be $176,000 (44.0 mills/kWh). 16/ To determine whether the project is currently economically beneficial, we subtract the project's cost from the value of the project's power. Thus, the project, as licensed by the Commission would have a net benefit of about $72,000 (about 18.0 mills/kWh).

As explained in Mead, the economic analysis is by necessity inexact, and project economics is only one of many public interest factors considered in determining whether or not, and under what conditions, to issue a license. Wolverine is ultimately responsible and best able to determine whether continued operation of the existing project, with the conditions adopted herein, is a reasonable decision in these circumstances.

15/ 72 FERC ¶ 61,027 (1995).

16/ We base this value on the cost of alternative resources, which in this case is the cost of a new combined cycle and simple cycle combustion turbine plants, the regional cost of natural gas, and peak and off-peak energy values. The estimate of the value of project power is more completely described in the EA.

Based on our review of the comments on this project filed by agencies and the public, our review of the staff's evaluation of the environmental and economic effects of the project and its alternatives, and our analysis pursuant to Sections 4(e) and 10(a)(1), we find that the Secord Project, with our mitigative measures, will be best adapted to the comprehensive development of the Tittabawassee River for beneficial public uses.

LICENSE TERM AND ANNUAL CHARGES

The license for the Secord Project will be issued for a prospective 30-year term. 17/ In addition, the license will be conditioned upon payment of an additional amount equivalent to the charges that would have been collected, had Wolverine obtained a license for this project in a timely manner, to when it first was required, i.e., from April 1, 1962. 18/

The Commission orders:

(A) This license is issued to Wolverine Power Corporation (Licensee) for a period of 30 years, effective the first day of the month in which this order is issued, to operate and maintain the Secord Project. This license is subject to the terms and conditions of the Federal Power Act (FPA), which is incorporated by reference as part of this license, and subject to the regulations the Commission issues under the provisions of the FPA.

(B) The Secord Project consists of:

(1) All lands, to the extent of the Licensee's interest in those lands shown by exhibit G:

Exhibit G-	FERC No. 10809-	Showing
1	6	Secord Project Map

(2) Project works consisting of: (a) Secord Lake, an 1,100-acre reservoir with a gross storage of approximately 15,000 acre-feet at the normal pool elevation of 750.8 feet National Geodetic Vertical Datum; (b) a 1,400-foot-long earth embankment

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17/ See Order Issuing Original License for Project No. 10808.

18/ Id. As of October 1, 1994, the Commission is not assessing annual charges for projects, like the Secord, with less than 1.5-MW authorized installed capacity. Therefore, the Secord Project will be assessed annual charges for the period April 1, 1962, through September 30, 1994.

section of the dam (maximum height of 55.0 feet) between the left abutment and the powerhouse; (c) a 600-foot-long earth embankment section of the dam between the spillway and the right abutment; (d) a reinforced concrete multiple arch spillway with an ogee crest and two Tainter gates; (e) a powerhouse integral with the dam, equipped with one Francis vertical-axis turbine-generator unit rated at 1.2 MW; (f) a 47-foot-long intake structure; and (g) appurtenant facilities.

The project works generally described above are more specifically shown and described by those portions of Exhibit A and F that also form a part of the application for license and that are designed and described as:

Exhibit A: The turbines and generators as described on page A-1 of the Exhibit A filed July 24, 1989.

Exhibit F Drawing	FERC No.	Description
F-1	10809-1	Record Survey Plan
F-2	10809-2	Record Plan View
F-3	10809-3	Record Spillway Section
F-4	10809-4	Record Powerhouse Section
F-5	10809-5	Record Embankment Section

(3) All of the structures, fixtures, equipment, or facilities used to operate or maintain the project, all portable property that may be employed in connection with the project, and all riparian or other rights that are necessary or appropriate in the operation or maintenance of the project.

(C) The Exhibits A, F, and G as designated in ordering paragraph (B) above are approved and made part of the license.

(D) The following sections of the FPA are waived and excluded from the license for this minor project:

4(b), except the second sentence; 4(e), insofar as it relates to approval of plans by the Chief of Engineers and the Secretary of the Army; 6, insofar as it relates to public notice and to the acceptance and expression in the license of terms and conditions of the Act that are waived here; 10(c), insofar as it relates to depreciation reserves; 10(d); 10(f); 14, except insofar as the power of condemnation is reserved; 15; 16; 19; 20; and 22.

(E) This license is subject to the articles set forth in Form L-9 (October 1975), entitled, "Terms and Conditions of License for Constructed Minor Project Affecting Navigable Waters of the United States," and the following additional articles.

Article 201. The Licensee shall pay the United States the following annual charges:

(1) From April 1, 1962, through September 30, 1994, for the purpose of reimbursing the United States for the cost of administration of Part I of the Federal Power Act (FPA), a reasonable amount as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for that purpose is 1,200 kilowatts (kW).

(2) From October 1, 1998, through August 31, 2028, for the purpose of reimbursing the United States for the cost of administration of Part I of the FPA, as determined by the Commission, a reasonable amount as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for that purpose is 1,200 kW. Under the regulations currently in effect, projects with authorized installed capacity of less than or equal to 1,500 kW will not be assessed an annual charge.

Article 401. Within six months of license issuance, the Licensee shall file for Commission approval a plan for erosion control in order to minimize shoreline erosion and bank instability occurring in the project reservoir and the river area downstream from the project dam and tailrace. Erosion control measures in the plan shall adhere to the most recent version of the Michigan Department of Transportation standards, and shall be designed to allow pedestrian access while providing long-term stability.

The plan shall include at a minimum:

(1) a summary description of the existing erosion control program;

(2) a description of measures to monitor shoreline erosion and bank instability caused by project operations;

(3) descriptions, functional design drawings, and topographic map locations of proposed new and enhanced control measures;

(4) a description of how the control measures will allow pedestrian access while providing long-term stability;

(5) identification of the Michigan Department of Transportation standards used, and description of how the pertinent standards would be adhered to;

(6) an implementation schedule;

(7) provisions for the Licensee's periodic review and revision of the plan; and

(8) provisions for provide the results of its monitoring program to the Michigan Department of Natural Resources, other agencies, and property owners upon request.

The Licensee shall prepare the plan after consultation with the Michigan Department of Natural Resources and the Natural Resources Conservation Service. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan, and specific description of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 402. The Licensee must implement all reasonable and prudent measures to ensure that the following water quality standards are met whenever inflows to the projects are greater than or equal to the 95-percent-exceedance inflow:

(1) Dissolved oxygen (DO) concentrations in the project's tailwaters of not less than 5 milligrams per liter (mg/l) at all times; and

(2) monthly average temperatures downstream from the project of no greater than:

January ------	42°F
February -----	41°F
March --------	53°F
April --------	67°F
May ----------	78°F
June ---------	85°F
July, August -	86°F
September ----	80°F
October ------	69°F
November -----	56°F
December -----	44°F

These monthly average temperatures may be exceeded for short periods when natural water temperatures measured upstream of the project exceed the 90th percentile occurrence of water temperatures (i.e., the monthly average temperatures cited in item No. 2 minus 5°F).

Within six months of license issuance, the Licensee shall file for Commission approval a plan to monitor, and mitigate if necessary, DO and temperature levels of the Tittabawassee River downstream from the Secord Project. The plan shall include provisions for: (1) monitoring of DO and temperature above the Secord impoundment and downstream from Secord Dam with the sensor locations and monitoring frequency determined in consultation with the Michigan Department of Natural Resources (Michigan DNR) and the U.S. Fish and Wildlife Service (FWS); and (2) a description of operating procedures developed in consultation with Michigan DNR and FWS to alleviate water quality conditions which deviate from the above limits.

The Licensee shall prepare the plan after consultation with Michigan DNR and FWS. The monitoring plan shall include schedules for: (1) implementing the plan within 24 months of license issuance; (2) consulting with Michigan DNR and FWS on the results of monitoring; and (3) filing the results, agency comments, and Licensee's response to agency comments with the Commission.

The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of thirty days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 403. Within sixty days of the installation of reservoir level gages required by Article 405, the Licensee shall operate the Secord Project so that the project reservoir elevation does not fluctuate more than 0.4 foot below or 0.3 foot above the normal pool elevation of 750.8 feet National Geodetic Vertical Datum (NGVD) except during the winter drawdown. The Licensee shall begin the winter drawdown after December 15, and shall complete the winter drawdown by January 15 of each year. The Licensee shall complete the refill of the reservoir, thus ending the winter drawdown period, prior to the surface water

temperature of the reservoir reaching 39°F. During the winter drawdown, the Licensee shall operate the Secord Project so that the reservoir level does not fall below 747.8 feet NGVD, and so that the daily fluctuation in reservoir elevation does not exceed 0.7 foot.

The required reservoir elevations may be temporarily modified if required by operating emergencies beyond the control of the Licensee, and for short periods for project maintenance purposes, upon mutual agreement between the Licensee and the Michigan Department of Natural Resources. If the reservoir level fluctuation is so modified, the Licensee shall notify the Commission as soon as possible, but no later than ten days after each such incident.

Article 404. The Commission reserves the authority to require the Licensee to construct, maintain, and operate or to provide for the construction, maintenance, and operation of such fishways as may be prescribed by the Secretary of the U.S. Department of the Interior.

Article 405. To ensure compliance with the reservoir elevation requirements of Article 403, the Licensee, within 180 days of license issuance, shall file for Commission approval a reservoir level gaging plan to monitor water surface elevations in Secord Lake at intervals of no greater than 15 minutes.

The plan shall include, but not be limited to, (1) details on the location, design, and calibration of the monitoring equipment; (2) the method of data collection; (3) provisions for compiling and storing the data; and (3) provisions for supplying the data to the U.S. Fish and Wildlife Service (FWS), the U.S. Geological Survey (USGS), and the Michigan Department of Natural Resources (Michigan DNR) within thirty days of the agency's request.

The monitoring plan shall also include a schedule for: (1) implementation of the program; (2) consultation with the appropriate federal and state agencies concerning the data from the monitoring; and (3) filing the data, agency comments, and the Licensee's response to agency comments with the Commission.

The Licensee shall prepare the plan after consultation with Michigan DNR, FWS, and USGS. The Licensee shall include with the plan, documentation of consultation, copies of comments and recommendations on the completed plan, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of thirty days for the agencies to comment and to make recommendations prior to filing the plan with the Commission. If the Licensee does not adopt a recommendation,

the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 405. Within one year of license issuance, the Licensee shall file for Commission approval a Bald Eagle Management Plan to protect the federally listed as threatened bald eagle (Haliaeetus leucocephalus) and its habitat. The Commission reserves the right to require changes to the plan.

The plan shall be developed in consultation with the U.S. Fish and Wildlife Service (FWS) and the Michigan Department of Natural Resources (Michigan DNR), and include, but not be limited to the following:

(1) The results of a winter and breeding season survey of bald eagles and a bald eagle habitat assessment of project lands and waters, including descriptive and mapped identification of any existing and potential future eagle perching, roosting, nesting, and foraging habitat areas;

(2) A proposed protocol and an implementation schedule for an ongoing bald eagle monitoring program;

(3) Specific measures to maintain and protect any existing and potential eagle habitat areas on project lands and waters, including an implementation schedule;

(4) Specific measures to maintain and protect bald eagle perch and roost trees on project lands, including an implementation schedule; and

(5) Procedures for notifying the Commission if potential adverse impacts to eagles or their habitats arise as a result of project operation or activities on project lands or waters.

The Licensee shall include in the plan documentation of consultation, copies of agency comments and recommendations on the completed plan, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of thirty days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

Article 407. Within six months of license issuance, the Licensee shall, in consultation with the Michigan Department of Natural Resources (Michigan DNR), file for Commission approval a plan to monitor purple loosestrife and Eurasian watermilfoil in project waters. The Commission reserves the right to require changes to the plan.

The plan shall include, but not be limited to: (1) a description of the monitoring method; (2) a monitoring schedule; and (3) a schedule for providing the monitoring results to Michigan DNR; (4) documentation of agency consultation, including copies of comments and recommendations on the completed plan; and (5) specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of thirty days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

If at any time during the period of license, Michigan DNR demonstrates that purple loosestrife or Eurasian watermilfoil is significantly affecting fish and wildlife populations at the project and that control measures are needed, and the Commission agrees with those determinations, the Commission may require the Licensee to cooperate with Michigan DNR and to undertake reasonable measures to control or eliminate the weeds in project waters.

Article 408. The Licensee, before starting any land-clearing or land-disturbing activities within the project boundary, including recreation developments at the project, shall consult with the State Historic Preservation Officer.

If the Licensee discovers previously unidentified archeological or historic properties during the course of constructing or developing project works or other facilities at the project, the Licensee shall stop all land-clearing and land-disturbing activities in the vicinity of the properties and consult with the State Historic Preservation Officer.

In these instances, the Licensee shall file for Commission approval a cultural resource management plan prepared by a qualified cultural resource specialist after having consulted with the State Historic Preservation Officer. The plan shall include the following items: (1) a description of each discovered property indicating whether it is listed, or eligible to be listed, on the National Register of Historic Places; (2) a description of the potential effect on each discovered property; (3) proposed measures for avoiding or mitigating effects; (4) documentation of the nature and extent of consultation; and

(5) a schedule for mitigating effects and conducting additional studies.

The Licensee shall include with the plan documentation of agency consultation, copies of agency comments and recommendations on the completed plan, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of thirty days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 409. Within one year of license issuance, the Licensee shall file for Commission approval a recreation plan for the Secord Project. The Commission reserves the right to make changes to the plan.

The plan shall be prepared in consultation with the Michigan Department of Natural Resources (Michigan DNR) and shall include the following:

(1) A fishing access site at the Secord Project dam that shall include (a) directional signs; (b) a barrier-free restroom; (c) access paths to the tailwater and dike areas, restrooms, canoe portage, and parking areas; (d) parking for 15 vehicles with designated barrier-free parking spaces; (e) improved railed shoreline fishing pier at the tailwater; and (f) improved railed barrier-free fishing pier located on the dike shoreline near the dam;

(2) A canoe portage;

(3) Installation of signs that identify the project's recreational facilities;

(4) functional design drawings, costs for the improvements to, or construction of, the required facilities; and

(5) A schedule for completing construction of the required facilities within three years of license issuance.

The Licensee shall include with the plan documentation of agency consultation, copies of comments and recommendations on the completed plan, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee

shall allow a minimum of thirty days for the agencies to comment before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

No land clearing or land-disturbing activities shall begin until the Licensee is notified by the Commission that the plan is approved.

Article 410. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the projects. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interest that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 watercraft at a time and where said facility is intended to serve single-family type dwellings; and (3) embankments, bulkheads, retaining walls or similar structures for erosion control to protect the existing shoreline.

To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to projects lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply

with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction; (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site; and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline.

To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir.

No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases or project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been

obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for the project development are conveyed under this clause (d)(7) in any calendar year.

At least forty-five days before conveying any interest in project lands under this paragraph (d), the Licensee must submit a letter to the Director, Office of Hydropower Licensing, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked exhibit G or K map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within forty-five days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved exhibit R or approved report on recreational resources of an exhibit E; or, if the project does not have an approved exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the land conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to insure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will

occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised exhibit G or K drawings would be filed for approval for other purposes.

(g) The authority granted to the Licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.

(E) The Licensee shall serve copies of any Commission filing required by this order on any entity specified in this order to be consulted on matters related to that filing. Proof of service on these entities must accompany the filing with the Commission.

(F) This order is final unless a request for rehearing is filed within thirty days of the date of its issuance pursuant to Section 313 of the Federal Power Act. The filing of a request for rehearing does not operate as a stay of the effective date of this order or of any other date specified in this order, except

as specifically ordered by the Commission. The Licensee's failure to file a request for rehearing shall constitute acceptance of this order.

By the Commission.

(S E A L)

David P. Boergers

David P. Boergers,
Secretary.

Appendix A.2

Federal Energy Regulatory Commission license covering the St. Louis Dam, Tributaries – Pine River. The license was issued November 29, 2001.

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97 FERC ¶ 62, 184
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

City of St. Louis, Michigan — Project No. 11428-000
Michigan

ORDER ISSUING ORIGINAL LICENSE
(Minor Project)
(November 29, 2001)

INTRODUCTION

Pursuant to Part I of the Federal Power Act (FPA)[1], the City of St. Louis, Michigan (City) filed an application for a minor license for operating the existing unlicensed 425-kilowatt Municipal Dam Hydroelectric Project No. 11428-000. The project is located on the Pine River[2] in the City of St. Louis, Gratiot County, Michigan.

BACKGROUND

On December 4, 1987, the Commission issued an order[3] determining that the St. Louis Municipal Dam Project was located on a stretch of the Pine River which was deemed to be navigable under Section 3(8) of the Federal Power Act, and was therefore subject to the Commission's licensing jurisdiction pursuant to Section 23(b) of the FPA. Accordingly, the Commission ordered the City to file a license or exemption application. The City filed its application for a minor license on August 5, 1993.[4]

The Commission issued a public notice accepting the application for filing on June 30, 1994. No motions to intervene were filed. The Commission then issued a public notice on December 31, 1996, indicating the project was ready for environmental

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[1]16 U.S.C. §§ 791a - 825r.

[2]The Pine River is a navigable waterway of the United States. See 41 FERC ¶ 62,211 (1987). Therefore, Section 23 (b) (1) of the FPA. 16 U.S.C. § 817 (1), requires the project to be licensed.

[3]41 FERC ¶62,211.

[4]A minor water power project means any licensed or unlicensed, existing or proposed water power project that would have a total installed generation capacity of 1.5 MW or less. 18 CFR § 4.30(b)(17).

analysis and soliciting comments, recommendations, prescriptions, and terms and conditions. The Commission received comments from the Michigan Department of Natural Resources (MDNR) and the U.S. Department of the Interior (Interior).

On July 13, 2001, the Commission's staff made available for public comment a draft environmental assessment (DEA). The DEA recommended that the project be licensed with certain additional environmental measures, and found that licensing the project would not constitute a major federal action significantly affecting the quality of the human environment. Comments on the DEA were filed by the MDNR, and the Commission's staff considered these comments in preparing the final environmental assessment (FEA), which is attached to this license. The comments filed by MDNR have been fully considered and addressed in this order in determining whether, and under what conditions, to issue this license.

PROJECT DESCRIPTION

The existing project consists of the following: (1) a 21-foot-high, 126-foot-long reinforced concrete dam surmounted by six 19-foot-wide, 8-foot-high radial gates; (2) a 60-foot-long left embankment, 55-foot-long center embankment, and 250-foot-long right embankment; (3) a 1,575-acre-foot reservoir at a normal water surface elevation of 719 feet; (4) a gated 18-foot-wide, 12-foot-deep intake flume; (5) a powerhouse containing two generating units for a total installed capacity of 425-kW; (6) a tailrace; (7) a short 2,400-volt transmission line; and (8) appurtenant electric and mechanical facilities. The project is described in greater detail in ordering paragraph (B)(2).

SUPERFUND SITE

The project area is part of the Velsicol Chemical Superfund Site. The St. Louis reservoir is currently under cleanup by the U.S. Environmental Protection Agency (EPA) and the Michigan Department of Environmental Quality (MDEQ).

Historically, heavy contamination from industrial sources led to severe degradation of water quality in the Pine River. Wastes discharged into the Pine River from Velsicol Chemical Plant (operated from 1936 to 1978), located on the St. Louis reservoir, include: polybrominated biphenyl (PBB), dichlorodiphenyl-trichloroethane (DDT), hexabromobenzene (HBB), and chlorobenzene. In 1982, the 56-acre Velsicol Chemical site was added to the EPA National Priorities List of sites eligible for cleanup under Superfund.

In general, the contaminants are concentrated in bottom sediments of the St. Louis reservoir and immediately downstream, with surface and ground water samples in these areas showing little or no evidence of contamination. Additionally, reservoir sediments are heavily polluted with polycyclic aromatic hydrocarbons (PAHs) from abandoned petroleum refineries upstream of the reservoir. Bottom sediments have been reported to contain large amounts of oil as far back as 1967. Michigan Department of Health has continued to issue advisories for no consumption of fish in the Pine River at St. Louis and a 10-mile segment downstream from the reservoir since 1974 due to the DDT and PBB contamination.

The cleanup of the St. Louis reservoir is scheduled to be completed by 2002. From a site visit conducted on August 29, 2001, Scott Cornelius from the MDEQ stated that they were behind schedule because of a late start this season. Mr. Cornelius also stated that EPA and MDEQ have learned that the Velsicol Chemical land-site adjacent to the St. Louis reservoir may be leaking contaminants into the reservoir. This issue needs to be addressed before cleanup of the reservoir continues. Mr. Cornelius further added that they are in the process of receiving grants to assist with the cleanup of PAHs the Pine River upstream of the St. Louis reservoir (below Alma dam).

The City is currently restricting operations and has modified reservoir water level elevations at the request of the EPA and MDEQ. Accordingly, included in this license is a condition (Article 402) to modify project operations to assist in the cleanup and monitoring of contaminants, if so requested by EPA or MDEQ.

WATER QUALITY CERTIFICATION

Under Section 401(a)(1) of the Clean Water Act (CWA), the Commission may not issue a license for a hydroelectric project unless either the licensee obtains a water quality certificate (WQC) from the certifying agency of the state in which the project discharge will originate, or the certifying agency waives certification. Section 401(a)(1) states that certification is deemed waived if the certifying agency fails to act on a water quality certification request within a reasonable period of time, not to exceed one year.[1] Section 401(d) of the CWA provides that state certification shall set forth conditions

[1] Section 401(a)(1) requires an applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters to obtain from the state in which the discharge originates certification that any such discharge will comply with applicable water quality standards.

necessary to ensure that licensees comply with specific portions of the CWA and with appropriate requirements of state law.[6]

The City initially requested a WQC from MDNR on July 21, 1993. The MDNR reviewed and denied the request without prejudice on July 14, 1994 due to deficient data. The City reapplied for a WQC from MDNR on September 21, 1994. Since MDNR neither granted nor denied the applicant's certification request within one year of receiving that application, the WQC is deemed waived for the project.[7] Michigan Department of Environmental Quality (MDEQ)[8] issued a WQC on March 4, 1998 pursuant to a further request from the City on March 13, 1997. This later certification will not be considered valid because more than one year had elapsed since the September 21, 1994 request. Measures to protect water quality are included in this license (Articles 402, 403, 404, 405, 407, 408).

THREATENED AND ENDANGERED SPECIES

Section 7(a) of the Endangered Species Act of 1973 (ESA)[9] requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat. Interior determined that there are no federally listed threatened and endangered species. Therefore, we determined that the Municipal Dam Project would have no effect on federally listed species and further consultation per the ESA, as amended, is not needed.

FISHWAY PRESCRIPTIONS

Section 18 of the FPA[10] provides that the Commission shall require the construction, maintenance, and operation by a licensee of such fishways as the

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[6] 33 U.S.C. Section 1341(d).

[7] 18 CFR § 4.38 (f)(7)(ii).

[8] By Executive Order No. 1995-18, the Governor of the state of Michigan created the Michigan Department of Environment Quality, which was to take responsibility for WQC issuance as of October 1, 1995.

[9] 16 U.S.C. § 1536(a).

[10] 16 U.S.C. § 811.

Secretaries of the U.S. Departments of Commerce and of the Interior may prescribe. By letter filed February 27, 1997, Interior requested the Commission to reserve Interior's authority to prescribe fish passage facilities for the project. Consistent with the Commission's policy, Article 401 of this license reserves the Commission's authority to require fishways that may be prescribed by Interior for the Municipal Dam Project.

RECOMMENDATIONS OF FEDERAL AND STATE FISH AND WILDLIFE AGENCIES

Section 10(j)(1) of the FPA[11] requires the Commission, when issuing a license, to include conditions based upon recommendations of federal and state fish and wildlife agencies submitted pursuant to the Fish and Wildlife Coordination Act,[12] to "adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including related spawning grounds and habitat)" affected by the project. If the Commission believes that any such recommendations may be inconsistent with the purpose and requirements of Part I of the FPA, or other applicable law, Section 10(j)(2) of the FPA requires the Commission and the agencies to attempt to resolve such inconsistencies, giving due weight to the recommendations, expertise, and statutory responsibilities of such agencies. If the Commission still does not adopt a recommendation, it must explain how the recommendation is inconsistent with Part I of the FPA or other applicable law and how the conditions imposed by the Commission adequately and equitably protect, mitigate damages to, and enhance fish and wildlife resources.

Interior and MDNR filed recommendations for license conditions that were considered in the Section 10(j) process in this proceeding.[13] Included in this license are conditions based on the agencies' recommendations, including requirements relating to maintaining state water quality standards (Article 403), a water quality monitoring plan (Article 404), run-of-river operation (Article 405), an operation and compliance plan (Article 406), a planned drawdown plan (Article 407), an erosion monitoring and control plan (Article 408), passing woody debris (Article 409), a wildlife management plan (Article 410), and a nuisance plant monitoring plan (Article 411).

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[11]16 U.S.C. § 803(j)(1).

[12]16 U.S.C. § 661 *et seq.*

[13]See letter filed February 27, 1997, for Interior recommendations submitted under Section 10(j) of the FPA. See letter filed March 3, 1997, for MDNR recommendations submitted under Section 10(j) of the FPA.

In the DEA, the Commission staff made an initial determination that the following recommendations made by Interior and MDNR may be inconsistent with the requirements of the FPA: (1) maintain state water quality standards; (2) develop and implement a water quality monitoring program; (3) periodically monitor contaminant concentrations in the reservoir and downstream of the dam; (4) maintain discharges within 10% of expected river flow during maintenance drawdown and refill; (5) provide funds to operate, maintain, and upgrade the upstream Alma USGS gage with telemetry; (6) install a continuous reservoir level recording device, equipped with telemetry; (7) maintain record of operation on a 30-minute basis and provide data to resource agencies upon request; (8) install a USGS gage downstream of the dam; (9) develop and implement an erosion monitoring and control plan; (10) improve downstream fish habitat by using large woody debris and restoring woody debris transport; and (11) develop and implement a wildlife management plan.

In letters dated July 23, 2001, the Commission staff sought to resolve the apparent inconsistency regarding Interior's and MDNR's recommendations by requesting a Section 10(j) meeting. In a letter commenting on the DEA from the MDNR filed August 6, 2001, MDNR disagreed with some of the Commission staff's recommendations. No comments were filed by Interior.

On August 30, 2001, the Commission staff convened a 10(j) meeting with a representative from MDNR (a representative from the U.S. Fish and Wildlife Service (FWS), representing Interior, did not attend the meeting). Resolution was achieved on most issues. Two issues (recommended by Interior) remain unresolved. Due to the EPA Superfund cleanup of the reservoir and the resultant increase in reservoir depth of 8 feet, Staff agreed to maintaining state water quality standards and 1 year of seasonal temperature and dissolved oxygen monitoring (with the possibility of a second year of seasonal monitoring due to extreme flow or temperature conditions, if requested by MDNR), to be conducted after the cleanup is completed (results of the monitoring would determine if further action was needed). The MDNR agreed that contaminant monitoring was not necessary, since contaminant monitoring is taking place through the EPA Superfund cleanup. The MDNR agreed that discharges during maintenance drawdowns and refills should be determined on a case by case basis, and not predetermined at 10% of expected river flow. The City agreed to add telemetry to the continuous reservoir level sensor and MDNR therefore withdrew USGS gaging recommendations. The MDNR agreed to records of operation maintained on an hourly basis (instead of every 30 minutes). The City stated it already conducts erosion surveys annually and repairs any erosional sites and therefore the Staff agreed to developing an erosion plan. The MDNR agreed to passing large woody debris over the dam, and clarified that they were not looking for additional habitat structures downstream (as

stated in the original recommendation). The MDNR agreed to the wildlife management plan as modified by the Staff, without nesting structures for bluebirds and owls.

Commission staff were unable to resolve the Interior's recommendation to periodically monitor contaminant concentrations in the reservoir and downstream of the dam. As discussed in the FEA, there is no information that indicates project operations would alter the level of contaminants in the impoundment or downstream. Additionally, sufficient monitoring is taking place through the EPA Superfund Cleanup.

Commission staff were unable to resolve the Interior's recommendation to install a USGS gage downstream of the dam. As discussed in the FEA, installing a USGS gaging station is not necessary for compliance determination. Compliance will be based on reservoir elevation and demonstrated by powerplant recording data. As a result of Section 10(j) meeting with MDNR, telemetry will be added to the reservoir water level sensor and the turbine rating curves will be made available.

OTHER ISSUES

A. Administrative Conditions

Section 10(e) of the FPA[14] provides that the Commission shall assess licensees annual charges to reimburse the United States for the costs of administering Part I of the FPA. However, the Commission does not assess administrative annual charges for projects less than 1,500 kW authorized installed capacity[15]; accordingly, since the installed capacity for this project is 425 kW, no annual administrative charge will be assessed.

B. Cultural Resources

The Michigan State Historic Preservation Officer concludes that no cultural resources are listed or eligible for inclusion in the National Register of Historic Places are known to exist in the project area and that the project would have no effect on such resources. However, Article 413 of this license order provides guidance and protection if archeological or historic sites are discovered during: (1) upgrading recreation facilities; and (2) the future operation and maintenance of the project.

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[14] 16 U.S.C. § 803(e).

[15] 18 CFR § 11.(b)(1).

C. Project Boundary Map

Minor license applicants are not required to file a project boundary map delineating the project works such as the dam, powerhouse, and reservoir. Therefore, no project boundary map is required for this project.

CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA[16] requires the Commission to consider the extent to which a hydroelectric project is consistent with federal and state comprehensive plans for improving, developing, or conserving waterways affected by the project.[17] Under Section 10(a)(2)(A), federal and state agencies filed 64 comprehensive plans that address various resources in Michigan. Of these, the Commission staff identified and reviewed three plans relevant to this project.[18] No conflicts were found.

COMPREHENSIVE DEVELOPMENT

In determining whether a proposed hydroelectric power project will be best adapted to a comprehensive plan for developing a waterway for beneficial public uses, pursuant to Section 10(a)(1), the Commission considers a number of public interest factors, including the projected economic benefits of project power.

Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[19] the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power, with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of the Commission's economic analysis is to provide a general estimate of the potential power benefits and the costs of a project, and of reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. In making its decision, the Commission considers the project power benefits both with the

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[16]16 U.S.C. § 803(a)(2)(A).

[17]Comprehensive plans for this purpose are defined at 18 C.F.R. § 2.19 (1997).

[18]See Section IX of the FEA.

[19]72 FERC ¶ 61,027 (1995).

applicant's proposed measures and with the Commission's modifications and additions to the applicant's proposal.

Staff has analyzed the applicant's proposal. We find that the levelized annual cost of developing and operating the Municipal Dam Project would be about $54,000 or 34 mills per kilowatt-hour (kWh). The project would produce about 1,590,000 kWh annually, having a total value of about $51,000 or 32 mills per kWh in 2001 dollars, based on the average cost of alternative capacity and energy in the region.[20] Therefore in the first year of licensing, we estimate the project power would annually cost about $3,000 or 2 mills per kWh more than alternative power in the regional market.

Staff has also evaluated the applicant's proposal with staff-recommended enhancements that are valued at a total annual cost of $5,200 (see section VI of the FEA). The levelized annual cost of operating the project would be about $59,200 or 37 mills per kWh based on the average annual generation of 1,590,000 kWh. The project would produce generation valued at about $51,000 or 32 mills per kWh in 2001 dollars as stated above. Therefore in the first year of licensing, we estimate the project power would annually cost about $8,200 or 5 mills per kWh more than alternative power in the regional market. Thus, a comparison of the two proposals indicate that our recommended enhancements for the Municipal Dam Project would decrease annual benefits by about $5,200 when compared to the City's proposal. Both proposals would have no effect on project generation.

Our evaluation of the economics of the proposed action and the proposed action with additional staff-recommended measures shows that project energy would cost more

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[20]Our estimate of the cost of alternative power is based on the projected cost of energy generation in fossil-fueled electric generating plants in the East Central Area Reliability Coordination Agreement Region of the North American Electric Reliability Council plus a value of $114 per kilowatt year for the project's average annual capacity of 425 kW. We compute the regional energy value to be 24.8 mills/kWh and the capacity value to be 7.17 mills/kWh, for a total power value of 31.97 mills/kWh. Our estimate of the energy value is based on the cost of fuel that would be displaced by the hydroelectric generation in a combined-cycle combustion turbine plant fueled by natural gas, operating at a heat rate of 6,200 Btu/kWh. We estimate the cost of fuel based on the Energy Information Administration's reference-case estimate of average real natural gas costs for electric utilities, as published by the Energy Information Administration (EIA) in their Annual Energy Outlook for 2001 and its supplemental data on the EIA Internet Homepage.

than alternative energy. However, project economics is only one of the many public interest factors that is considered in determining whether or not to issue a license, and operation may be desirable for other reasons. For example, other public interest factors are to: (1) diversify the mix of energy sources in the area; (2) promote local employment; and (3) provide a fixed-cost source of power and reduce contract needs.

In analyzing public interest factors, the Commission takes into account that hydropower projects offer unique operational benefits to the electric utility system (ancillary benefits). These benefits include their value as almost instantaneous load-following response to dampen voltage and frequency instability on the transmission system, system-power-factor-correction through condensing operations, and a source of power available to help in quickly putting fossil-fuel based generating stations back on line following a major utility system or regional blackout.

Ancillary benefits are now mostly priced at rates that recover only the cost of providing the electric service at issue, which do not resemble the prices that would occur in competitive markets. As competitive markets for ancillary benefits begin to develop, the ability of hydropower projects to provide ancillary services to the system will increase the benefits of the projects.

Based on our independent review and evaluation of the Municipal Dam Project, recommendations from the resource agencies and other stakeholders, and the no-action alternative, as documented in the FEA, the Municipal Dam Project, with the staff-recommended measures, is the preferred alternative.

This alternative was selected because: (1) issuance of an original license would serve to maintain a beneficial, dependable, and an inexpensive source of electric energy; and (2) the required environmental measures would protect and enhance fish and wildlife, water quality, recreational, and cultural resources.

The preferred alternative includes the following measures:

(1) reserve the Commission's authority to require fishways as may be prescribed by Interior under Section 18 of the FPA (Article 401);

(2) cooperate with the EPA cleanup and monitoring efforts in the Pine River (Article 402);

(3) maintain state water quality standards for temperature and dissolved oxygen (Article 403);

(4) develop and implement a water quality monitoring plan (Article 404);

(5) operate the project in a run-of-river mode (Article 405);

(6) develop and implement an operation and compliance plan (Article 406);

(7) prepare drawdown plans, in consultation with MDNR, Interior, and EPA, for any protracted drawdowns (Article 407);

(8) develop and implement an erosion monitoring and control plan (Article 408);

(9) pass woody debris downstream of the project (Article 409);

(10) develop and implement a wildlife management plan (Article 410);

(11) develop and implement a plan to monitor nuisance plants (411);

(12) develop and implement a recreation and land use plan (412); and

(13) consult with the SHPO in the event that archeological or historic sites are discovered (Article 413).

LICENSE TERM

Section 6 of the FPA[21] provides that original licenses for hydropower projects shall be issued for a term not exceeding 50 years. The Commission's license term policy when issuing original licenses for existing projects that should have been licensed earlier is set forth in *City of Danville*.[22] A 30-year license is issued for projects with little or no redevelopment, new construction, or new environmental mitigation and enhancement measures; a 40-year license is issued for projects with a moderate amount of such activities; and a 50-year license is issued for projects with extensive measures.

This license authorizes a moderate amount of new environmental mitigation measures relative to the size of the project. Accordingly, this license will be issued for a term of 40 years, effective the first day of the month in which the license is issued.

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[21] 16 U.S.C. § 799.

[22] 58 FERC ¶ 61,318 at pp. 62,020-21 (1992).

SUMMARY OF FINDINGS

Background information, analysis of impacts upon the environment, and support for related license articles are contained in the FEA and in the record of this proceeding. Issuance of this license is not a major federal action significantly affecting the quality of the human environment.

The design of this project is consistent with the engineering standards governing dam safety. The project will be safe if operated and maintained in accordance with the requirements of this license.[23]

The Director orders:

(A) This license is issued to the City of St. Louis, Michigan (licensee) for a period of 40 years, effective the first day of the month in which this order is issued, to operate and maintain the Municipal Dam Hydroelectric Project. This license is subject to the terms and conditions of the Federal Power Act (FPA), which is incorporated by reference as part of this license, and subject to the regulations the Commission issues under the provisions of the FPA.

(B) The project consists of:

(1) All lands, to the extent of the licensee's interests in those lands, shown by Exhibit G filed March 11, 1994:

Exhibit G Drawing	FERC No.	Description
G - 1	11428-7	Project Location Map
G - 2	11428-8	Project Location Map

(2) Project works consisting of:

The project's principal features are three earthen embankments, a gated concrete gravity dam structure, an intake area leading to an integral powerhouse with a small tailrace area, a reservoir, a primary transmission line, and appurtenant facilities.

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[23]See Safety and Design Assessment issued for the St. Louis Municipal Dam Hydroelectric Project.

In detail, from left to right, looking upstream, the existing unlicensed project consists of:

1. a left sandy silt earthen embankment, about 250 feet long by 7.5 feet high, with a top elevation of 723.5 feet national geodetic vertical datum (NGVD)[24];

2. an intake area leading to the powerhouse, which consists of (a) a reinforced concrete headrace, about 19 feet wide by 70 feet long; and (b) a concrete headgate flume, about 17 feet wide by 12 feet deep by 30 feet long, equipped with steel trashracks with 1 ½-inch spacings;

3. a center sandy silt earthen embankment, about 55 feet long by 10.5 feet high, with a top elevation of 723.5 feet, protected upstream by a steel sheet piling wall and downstream by a concrete retaining wall;

4. a concrete gravity dam, about 126 feet long by 10 feet high, with a sill elevation of 714.0 feet, topped with six radial gates, each measuring about 19 feet wide by 8 feet high, with a top of pier elevation of about 725.0 feet;

5. a right sandy silt earthen embankment, about 60 feet long by 4.0 feet high, with a top elevation of 723.5 feet, protected upstream by rip rap and downstream by a steel sheet piling wall;

6. a powerhouse, integral with the dam, equipped with 2 vertical Francis hydroelectric generating units, having (a) rated horsepower of 317 hp at 225kW and 290 hp at 200 kW for total installed capacity of 425 kW; (b) hydraulic capacity of 95 to 240 cfs; (c) average annual head of 12 feet; (d) power factor of 1.00 kW/kVA; and (e) tailrace channel about 35 feet long by 32 feet wide at the downstream face of the powerhouse, with a normal tailwater elevation of 706.5 feet;

7. a reservoir, with (a) normal pool elevation of 719.0 feet; (b) surface area of about 205 acres; (c) gross storage capacity of about 1,575 acre-feet; (d) useable storage capacity of 45 acre-feet, with a proposed 0.2-foot fluctuation; and (e) net storage capacity of 690 acre-feet, maintained

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[24] All elevations are stated as NGVD, unless otherwise noted.

between the maximum pool elevation of about 722.0 feet and the normal pool elevation of about 719.0 feet;

8. a 2.4-kilovolt (kV), 80-foot-long overhead transmission line; and

9. appurtenant facilities.

The project works generally described above are more specifically described in Exhibit A of the application and shown by Exhibit F filed August 5, 1993:

Exhibit F Drawing	FERC No.	Showing
Sheet F-1	11428-1	Site Plan Sections
Sheet F-2	11428-2	Dam and Powerhouse Plans and Elevations
Sheet F-3	11428-3	Powerhouse Profiles
Sheet F-4	11428-4	Gated Spillway Cross Sections
Sheet F-5	11428-5	Earth Embankment Sections
Sheet F-6	11428-6	Powerhouse Plan View

(3) All of the structures, fixtures, equipment, or facilities used to operate or maintain the project, all portable property that may be employed in connection with the project, and all riparian or other rights that are necessary or appropriate in the operation or maintenance of the project.

(C) The Exhibits A, F, and G designated above are approved and made part of this license.

(D) The following sections of the FPA are waived and excluded from the license for this minor project:

4(b), except the second sentence; 4(e), insofar as it relates to approval of plans by the Chief of Engineers and the Secretary of the Army; 6, insofar as it relates to public notice and to the acceptance and expression in the license of terms and conditions of the FPA that are waived here; 10(c), insofar as it relates to

depreciation reserves; 10(d); 10(f); 14, except insofar as the power of condemnation is reserved; 15; 16; 19; 20; and 22.

(E) This license is subject to the articles set forth in Form L-9 (October 1975), entitled "Terms and Conditions of License for Constructed Minor Project Affecting Navigable Waters of the United States," and the following additional articles:

Article 201. The licensee shall pay the United States the following annual charges effective the first day of the month in which this license is issued:

For the purposes of reimbursing the United States for the Commission's administrative costs, pursuant to Part I of the Federal Power Act, a reasonable amount as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for that purpose is 425 kilowatts (kW). Under the regulations currently in effect, projects with authorized installed capacity of less than or equal to 1,500 kW will not be assessed an annual charge.

Article 202. The licensee shall file, within 45 days of the license issuance, three sets of aperture cards of the approved exhibit drawings. The sets must be reproduced on silver or gelatin microfilm and mounted on type D (3 1/4" X 7 3/8") aperture cards.

Prior to microfilming, the FERC Drawing Numbers (11428-1 through 11428-8) shall be shown in the margin below the title block of the approved drawing. After mounting, the FERC Drawing Number must be typed on the upper right corner of each aperture card. Additionally the Project Number, FERC exhibits (e.g., F-1, G-1, etc.), Drawing title, and date of this order must be typed on the upper left corner of each aperture card. See Figure 1.

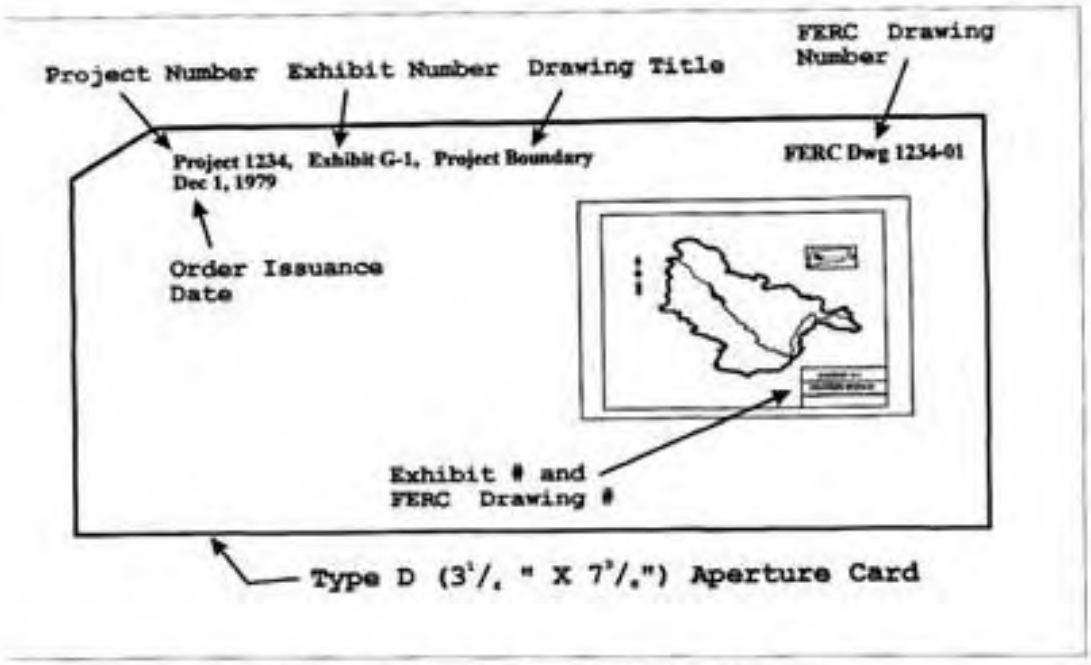

Figure 1. Sample Aperture Card Format

The original and one duplicate set of aperture cards shall be filed with the Secretary of the Commission, ATTN: OEP/DHAC. The remaining duplicate set of aperture cards shall be filed with the Commission's Chicago Regional Office.

Article 203. The licensee shall clear and keep clear to an adequate width all lands along open conduits and shall dispose of all temporary structures, unused timber, brush, refuse, or other material unnecessary for the purposes of the project which result from maintenance, operation, or alteration of the project works. All clearing of lands and disposal of unnecessary material shall be done with due diligence to the satisfaction of the authorized representative of the Commission and in accordance with appropriate federal, state, and local statutes and regulations.

Article 204. If the licensee's project was directly benefitted by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement during the term of the original license (including extensions of that term by annual licenses), and if those headwater benefits were not previously assessed and reimbursed to the owner of the headwater improvement, the licensee shall reimburse the owner of the headwater improvement for those benefits, at such time as

they are assessed, in the same manner as for benefits received during the term of this license.

Article 401. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of, such fishways as may be prescribed by the Secretary of the Interior under Section 18 of the Federal Power Act.

Article 402. The licensee shall cooperate, to the extent appropriate, with the U.S. Environmental Protection Agency (EPA) and Michigan Department of Environmental Quality (MDEQ) for the cleanup and monitoring efforts of the Velsicol Chemical Superfund Site. The licensee shall file, for Commission approval and after consultation with Michigan Department of Natural Resources (MDNR), U.S. Fish and Wildlife Service (FWS), MDEQ, and EPA, any proposed changes in project operation requested by EPA or MDEQ. Documentation of the request from EPA or MDEQ as well as proof of consultation with the agencies shall be provided.

The Commission reserves the right to require changes to the proposed changes in project operations. Upon Commission approval, the licensee shall implement the changes in project operations, including any changes required by the Commission.

Article 403. The licensee shall maintain the following state water quality standards for water temperature and dissolved oxygen (DO) at the Municipal Dam Hydroelectric Project when river discharges are greater than or equal to the 95 percent exceedence flow as follows:

(a) the average monthly temperatures downstream of the project shall not exceed the following temperatures (°F):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
41	40	50	63	76	84	85	85	79	68	55	43

(b) the DO concentrations in the project tailwaters shall not be less than 5.0 milligrams per liter (mg/l) at any time;

(c) these condition shall not apply when the natural temperatures or DO of the Pine River upstream of the project exceed the standards listed.

Article 404. The licensee shall file, within 1 year after the completion of all river contaminant cleanup activity in the Pine River between the Alma and St. Louis dams, for Commission approval, a plan to sample water quality in the project area for one season. The plan shall include a description of the methods that will be used to collect dissolved oxygen (DO) and water temperature data upstream (upstream of the St. Louis reservoir) and downstream (tailrace) of the project from January 1 through December 31. The plan shall also contain provisions to measure the DO and water temperature profile in the deepest part of the reservoir every two weeks from May through October. Measurements shall be made at 0.5 meter increments or less.

Further, the plan shall include provisions for filing a summary of the monitoring data to the Commission, Michigan Department of Environmental Quality (MDEQ), U.S. Fish and Wildlife Service (FWS), Michigan Department of Natural Resources (MDNR), and the U.S. Environmental Protection Agency (EPA) within 60 days after the end of the water quality monitoring year.

The licensee shall prepare the plan after consultation with the MDEQ, FWS, MDNR, and EPA. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

If the study year consists of higher than normal river flows or lower than average temperature conditions, MDNR may request the Commission to require the licensee to conduct a second year of water quality sampling. MDNR must provide the Commission with a written request within 60 days of receiving the summary report from the licensee, detailing the unusual river flows or temperatures that warrant another season of water quality sampling.

If results from the water quality sampling indicate that there are potential water quality problems in the St. Louis reservoir or in the tailrace, as determined by the Commission, the licensee shall consult with MDEQ, FWS, MDNR, and EPA on an action plan to continue monitoring water quality and implement changes in project

operations to rectify the problems. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the action plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the action plan. Upon Commission approval, the licensee shall implement the action plan, including any changes required by the Commission.

Article 405. The licensee shall operate the Municipal Dam Project in a run-of-river (R-O-R) mode for the protection of water quality, and aquatic and recreational resources, such that the St. Louis reservoir elevation is within plus or minus 0.2 feet of 719.0 feet National Geodetic Vertical Datum (NGVD).

The licensee shall at all times act to minimize the fluctuation of the reservoir surface elevation by maintaining a discharge from the project so that, at any point in time, flows, downstream of the project tailrace, approximate the sum of the inflows to the project reservoir. The licensee shall not use the operating band width for peaking purposes.

The R-O-R mode of operation may be temporarily modified if required by operating emergencies beyond the control of the licensee and for short periods (less than three weeks) upon mutual agreement between the licensee, the U.S. Fish and Wildlife Service and the Michigan Department of Natural Resources. If project operations are so modified, the licensee shall notify the Commission as soon as possible, but no later than 10 days after each incident.

Article 406. The licensee shall file, within one year of license issuance, for Commission approval, an operation and compliance plan to monitor the run-of-river (R-O-R) operating mode required by Article 405. The plan shall include, at a minimum, measures to implement the following:

(a) maintain a calibrated staff gage in the St. Louis reservoir at a location clearly visible to the public to show the minimum and maximum reservoir water surface elevations to the National Geodetic Vertical Datum;

(b) install, operate, and maintain an automated water surface elevation sensor in the St. Louis reservoir, record the reservoir water surface elevation on an hourly basis, and connect with telemetry;

(c) record operations data, including turbine start-up and shutdown times, and flows associated with project features.

The operation and compliance plan shall also include protocols for recording monitoring data, such as pond elevations and turbine flows, and provisions for maintaining and filing a log of naturally-occurring high flows and ice jams that may hinder compliance with R-O-R operations. The plan shall include a timetable for: (1) installing an automated headpond sensor and a staff-type gage that is clearly visible to the public on the St. Louis reservoir and (2) filing with the Commission summaries of monitoring data including, headwater water surface elevations, and project operations data to show compliance with R-O-R operations.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service and the Michigan Department of Natural Resources. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 407. At least 90 days before undertaking any planned drawdowns, for a time period greater than 3 weeks, of the St. Louis reservoir for construction or operations and maintenance purposes, the licensee shall file, for Commission approval, notification of the planned drawdown.

The licensee shall consult with the U.S. Fish and Wildlife Service (FWS), the Michigan Department of Natural Resources (MDNR), and the U.S. Environmental Protection Agency (EPA). The licensee shall provide a minimum of 30 days for the FWS, MDNR, and EPA to comment on any planned reservoir drawdown. The licensee shall file with the notification, a summary of resource agency comments, including how comments were addressed. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information. The Commission reserves the right to modify procedures for, and the execution of, any planned reservoir drawdowns.

Article 408. The licensee shall file a plan, for Commission approval, to monitor and control erosion every 10 years in the St. Louis reservoir and downstream of the St. Louis dam for a distance of 200 yards within 5 years after the contaminant cleanup of the St. Louis reservoir.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the U.S. Environmental Protection Agency. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 409. The licensee shall pass all natural organic material over the St. Louis dam. The licensee shall remove and properly dispose of all other materials collected on the trashracks. The downstream passage of all natural organic material shall focus on material accumulating on project trashracks and other project structures, as safety and flow conditions allow.

The licensee shall file, within one year of license issuance, for Commission approval, the summary of consultation with the Michigan Department of Natural Resources (MDNR) regarding procedures for the disposition of woody debris not immediately passed downstream of the project, including the disposition of any large woody material requiring cutting or substantive non-manual efforts to pass downstream.

The licensee shall allow a minimum of 30 days for the MDNR to comment and to make recommendations before filing the summary with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information. The Commission reserves the right to modify methods of woody debris disposition.

Article 410. The licensee shall file, within 3 years of license issuance, for Commission approval, a wildlife management plan. The plan shall include, but not be limited to the following:

(a) protection and enhancement of wildlife habitat, to the extent appropriate;

(b) protection of environmentally sensitive areas, to the extent appropriate;

(c) waterfowl enhancements consisting of wood duck boxes and mallard nesting structures;

(d) kestrel nest structures on project lands and rights of way;

(e) the protection and enhancement of habitat for any federal or state listed threatened or endangered species on project lands; and

(f) annual consultation with the resource agencies on the status of wildlife populations and measures to protect and enhance wildlife populations.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service (FWS) and the Michigan Department of Natural Resources (MDNR). The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

If any of the measures prove unsuccessful, the plan shall provide for the inclusion of alternative measures or modifications to measures that are developed in consultation with the FWS and MDNR.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 411. The licensee shall file, within 3 years of license issuance, for Commission approval, a plan to monitor purple loosestrife (*Lythrum salicaria*) and Eurasian water-milfoil (*Myriophyllum spicatum*) in project lands and waters and to

develop a public outreach program aimed at controlling the spread of these species. The plan shall include, but not be limited to the following:

(a) a description of the monitoring method and public outreach program;

(b) a monitoring schedule;

(c) a schedule for providing the monitoring results to the MDNR and FWS;

(d) an implementation schedule for the public outreach program; and

(e) documentation of agency consultation, including copies of comments and recommendations on the completed plan.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service (FWS) and the Michigan Department of Natural Resources (MDNR). The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

If at any time during the term of the license, the FWS or the MDNR demonstrate that purple loosestrife or Eurasian water-milfoil is significantly affecting fish and wildlife populations at the project and that control measures are needed, and the Commission agrees with those determinations, the Commission may require the licensee to cooperate with the FWS and MDNR to undertake reasonable measures to control or eliminate these weeds in project lands and waters.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 412. Within one year of the date of issuance of this license, the licensee, in consultation with the Michigan Department of Natural Resources (MDNR), shall file for the Commission's approval a recreation and land use plan for the project.

The plan shall include the final details of upgrades and enhancements to be made, maintenance schedule of facilities, a map of the existing and proposed facilities and City-owned lands, and a construction and implementation schedule. Further, the plan shall also include provisions for consultation with the Environmental Protection Agency for any construction that may disturb contaminated river sediments. Specifically, the licensee shall include measures for: (1) improvements for all project recreational facilities to be fully accessible to persons with disabilities, including improvements at Westgate Park to meet accessibility standards: the pier at the boat ramp, portable toilet, and walkway to the accessible picnic table; (2) improvements in the tailwater fishing area, including parking, toilet, picnic tables and grills; (3) signed, safe canoe portage around the dam at Mill Street within 5 years of license issuance; (4) signage improvements throughout the project area, including directional signage improvements in parking areas at Westgate, Prospect, and Michigan Avenue Parks with basic information such as: hours for recreation, nearest toilet facilities, nearest hospital, and a 911 emergency posting; and (6) "fish consumption" warning signs and "no swimming signs" posted in all areas where users have access to project waters.

The licensee shall prepare the plan after consultation with MDNR. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to MDNR, and specific descriptions of how MDNR's comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for MDNR to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 413. If archeological or historic sites are discovered during any future project modifications or construction that require land-disturbing activities, or during project operation or maintenance, or if the licensee plans any future modifications, other than routine maintenance, the licensee shall: (1) consult with the Michigan State Historic Preservation Officer (SHPO) about the discovered sites; (2) prepare a site-specific plan, including a schedule, to evaluate the significance of the sites and to avoid or mitigate any impacts to sites found eligible for inclusion in the National Register of Historic Places; (3) base the site-specific plan on recommendations of the SHPO and the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; (4) file the site-specific plan for Commission approval, together with the written comments of the

SHPO; and (5) take the necessary steps to protect the discovered archeological or historic sites from further impact until notified by the Commission that all of these requirements have been satisfied.

The Commission may require cultural resources surveys and changes to the site-specific plans based on the filings. The licensee shall not implement a cultural resources management plan, begin any land-clearing or land-disturbing activities in the vicinity of any discovered sites, or modify previously discovered sites until informed by the Commission that the requirements of this article have been fulfilled.

Article 414. (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy are consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed under this article.

If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 watercraft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancements.

To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The licensee shall also

ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile (measured over project waters) from any other private or

public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year.

At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Energy Projects, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal or state agency official consulted, and any Federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee shall consult with Federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved exhibit R or approved report on recreational resources of an exhibit E; or, if the project does not have an approved exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee shall take all reasonable precautions to insure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee shall not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the

protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised exhibit G or K drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.

(F) The licensee shall serve copies of any Commission filing required by this order on any entity specified in this order to be consulted on matters related to that filing. Proof of service on these entities must accompany the filing with the Commission.

(G) This order is issued under authority delegated to the Director and is final unless a request for a rehearing is filed within 30 days from the date of its issuance, pursuant to 18 CFR § 385.713. The filing of a request for a rehearing does not operate as a stay of the effective date of this license or of any other date specified in this order, except as specifically ordered by the Commission. The licensee's failure to file a request for rehearing of this order shall constitute acceptance of the license.

J. Mark Robinson
Director
Office of Energy Projects

Appendix A.3

Federal Energy Regulatory Commission exemptions and requirements of the Beaverton hydro-electric dam, Tributaries – Tobacco River. This Commission grant was issued December 31, 1981.

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17 FERC ¶62,522

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

City of Beaverton, Michigan) Project No. 5308-000

ORDER GRANTING EXEMPTION FROM LICENSING OF A SMALL HYDROELECTRIC PROJECT OF 5 MEGAWATTS OR LESS

(Issued December 31, 1981)

The Applicant 1/ filed an application for exemption from all or part of Part I of the Federal Power Act pursuant to 18 C.F.R. Part 4 SUBPART K (1980) implementing in part Section 408 of the Energy Security Act (Act) of 1980 for a project as described in the attached public notice. 2/ 3/

Notice of the application was published in accordance with Section 408 of the Act and the Commission's regulations and comments were requested from interested Federal and State agencies including the U. S. Fish and Wildlife Service and the State Fish and Wildlife Agency. All comments, protests and petitions to intervene that were filed have been considered. No agency has any objection relevant to issuance of this exemption.

Standard Article 2 included in this exemption, requires compliance with any terms and conditions that Federal or State fish and wildlife agencies have determined appropriate to prevent loss of, or damage to, fish and wildlife resources. The terms and conditions referred to in Article 2 are contained in any letters of comment by these agencies which have been forwarded to the Applicant in conjunction with this exemption.

1/ City of Beaverton, Michigan, Project No. 5308, filed on August 28, 1981.

2/ Pub. Law 96-294, 94 Stat. 611. Section 408 of the ESA amends inter alia, Sections 405 and 408 of the Public Utility Regulatory Policies Act of 1978 (16 U.S.C. §§2705 and 2708).

3/ Authority to act on this matter is delegated to the Deputy Director, Office of Electric Power Regulation under §375.308 of the Commission's regulations 45 Fed. Reg. 21216 (1980), as amended by Order No. 112 in Docket No. RM81-5, issued November 21, 1980, (45 Fed. Reg. 79024).

DC-A-21

Should the Applicant contest any terms or conditions that were proposed by Federal or State agencies in their letters of comment as being outside the scope of Article 2, the Commission shall determine whether the disputed terms or conditions are outside the scope of Article 2.

The Beaverton Hydroelectric Project is classified as a high hazard dam. Therefore, pursuant to the Commission's regulations, Article 6 included in this exemption requires that an Emergency Action Plan for the project be filed, and that inspection of the project be performed by an independent Engineering Consultant. In addition, Article 6 reserves to the Commission the right to make periodic project inspections.

It is ordered that:

(A) The Beaverton Hydroelectric Project No. 5308 as described and designated in the City of Beaverton, Michigan's application filed on August 21, 1981, is exempted from all of the requirements of Part I of the Federal Power Act, including licensing, subject to the standard articles in §4.106 of the Commission's regulations attached hereto as Form E-2, 18 C.F.R. §4.106 45 Fed. Reg. 76115 (November 18, 1980), and the following Special Article.

Article 6. This exemption is subject to the following provisions of 18 C.F.R., Part 12: (1) Section 12.4(b)(2)(i), (ii), (iii)(B), (iv), and (v); (2) Section 12.4(c); and (3) Subparts C and D.

(B) This order is final unless a petition appealing it to the Commission is filed within 30 days from the date of its issuance, as provided in Section 1.7(d) of the Commission's regulations, 18 C.F.R. 1.7(d)(1981), as amended, 44 Fed. Reg. 46449 (1981). The filing of a petition appealing this order to the Commission or an application for rehearing as provided in Section 313(a) of the Act does not operate as a stay of the effective date of this order, except as specifically ordered by the Commission.

Robert E. Cackowski
Deputy Director, Office of
Electric Power Regulation

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

City of Beaverton, Michigan) Project No. 5308-000

NOTICE OF APPLICATION FOR EXEMPTION FOR SMALL HYDROELECTRIC POWER PROJECT UNDER 5 MW CAPACITY

(October 23, 1981)

Take notice that on August 21, 1981, City of Beaverton, Michigan, (Applicant) filed an application under Section 408 of the Energy Security Act of 1980 (Act) (16 U.S.C. §§2705 and 2708 as amended), for exemption of a proposed hydroelectric project from licensing under Part I of the Federal Power Act. The proposed small hydroelectric project (Project No. 5308) would be located on the Tabacco River in Gladwin County, Beaverton, Michigan. Correspondence with the Applicant should be directed to: Mr. H. James Wesley, City Manager, City of Beaverton, 124 West Brown Street, P.O. Box 477, Beaverton, Michigan 48612.

Project Description - The proposed Beaverton Hydroelectric Project would consist of: (1) an existing concrete dam approximately 40 feet long and 25 feet high, an adjacent concrete spillway approximately 113 feet long and 25 feet high with seven bays; (2) an existing reservoir with a maximum storage capacity of 2390 acre-feet at elevation 712.7 feet m.s.l.; (3) two separate existing powerhouses located adjacent to the spillway in which the east powerhouse would have a capacity of 650 kW and the west powerhouse would have a capacity of 308 kW for a combined proposed total capacity of 958 kW; and (4) appurtenant facilities. The project would be operated on a run-of-river basis. The average annual energy generation is estimated to be 3,300,000 kWh

Purpose of Project - Energy produced at the proposed project would be either sold to the Michigan Public Power Association and Consumers Power Company.

Agency Comments - The U.S. Fish and Wildlife Service, The National Marine Fisheries Service, and the Michigan Department of Natural Resources are requested, for the purposes set forth in Section 408 of the Act, to submit within 60 days from the date of issuance of this notice appropriate terms and conditions to protect any fish and wildlife resources or to otherwise carry out the provisions of the Fish and Wildlife Coordination Act. General comments concerning the project and its resources are requested; however, specific terms and conditions to be included as a condition of exemption must be clearly identified in the agency letter. If an agency does not file terms and conditions within this time period, that agency will be presumed to have none. Other Federal, State, and local agencies are requested to provide any comments they may have in accordance with their duties and responsibilities. No other formal requests for comments will be made. Comments should be confined to substantive

DC-6-33

issues relevant to the granting of an exemption. If an agency does not file comments within 60 days from the date of issuance of this notice, it will be presumed to have no comments. One copy of an agency's comments must also be sent to the Applicant's representatives.

Competing Application - Any qualified license applicant desiring to file a competing application must submit to the Commission, on or before DEC 3 1981, either the competing license application that proposes to develop at least 7.5 megawatts in that project, or notice of intent to file such a license application. Submission of a timely notice of intent allows an interested person to file the competing license application no later than 120 days from the date that comments, protests, etc. are due. Applications for preliminary permit will not be accepted.

A notice of intent must conform with the requirements of 18 C.F.R. §4.33(b) and (c) (1980). A competing license application must conform with the requirements of 18 C.F.R. §4.33(a) and (d) (1980).

Comments, Protests, or Petitions to Intervene - Anyone may submit comments, a protest, or a petition to intervene in accordance with the requirements of its Rules of Practice and Procedure, 18 C.F.R. §1.8 or §1.10 (1980). In determining the appropriate action to take, the Commission will consider all protests or other comments filed, but only those who file a petition to intervene in accordance with the Commission's Rules may become a party to the proceeding. Any comments, protests, or petitions to intervene must be received on or before DEC 3 1981.

Filing and Service of Responsive Documents - Any filings, must bear in all capital letters the title "COMMENTS", "NOTICE OF INTENT TO FILE COMPETING APPLICATION", "COMPETING APPLICATION", "PROTEST", or "PETITION TO INTERVENE", as applicable, and the Project Number of this notice. Any of the above named documents must be filed by providing the original and those copies required by the Commission's regulations to: Kenneth F. Plumb, Secretary, Federal Energy Regulatory Commission, 825 North Capitol Street, N.E., Washington, D.C. 20426. An additional copy must be sent to: Fred E. Springer, Chief, Applications Branch, Division of Hydropower Licensing, Federal Energy Regulatory Commission, Room 208 RB, 825 North Capitol Street, N.E., Washington, D.C. 20426. A copy of any notice of intent, competing application, or petition to intervene must also be served upon each representative of the Applicant specified in the first paragraph of this notice.

Kenneth F. Plumb
Secretary

Attachment
E-2 Form

§ 4.106 Standard terms and conditions of exemption from licensing.

Any exemption from licensing granted under this subpart for a small hydroelectric power project is subject to the following standard terms and conditions:

(a) Article 1. The Commission reserves the right to conduct investigations under sections 4(g), 306, 307, and 311 of the Federal Power Act with respect to any acts, complaints, facts, conditions, practices, or other matters related to the construction, operation, or maintenance of the exempt project. If any term or condition of the exemption is violated, the Commission may revoke the exemption, issue a suitable order under section 4(g) of the Federal Power Act, or take appropriate action for enforcement, forfeiture, or penalties under Part III of the Federal Power Act.

(b) Article 2. The construction, operation, and maintenance of the exempt project must comply with any terms and conditions that any Federal or state fish and wildlife agencies have determined are appropriate to prevent loss of, or damage to, fish or wildlife resources or otherwise to carry out the purposes of the Fish and Wildlife Coordination Act, as specified in Exhibit E of the application for exemption from licensing or in the comments submitted in response to the notice of the exemption application.

(c) Article 3. The Commission may accept a license application by any qualified license applicant and revoke this exemption if actual construction or development of any proposed generating facilities has not begun within 18 months, or been completed within four years, from the date on which this exemption was granted. If an exemption is revoked, the Commission will not accept a subsequent application for exemption within two years of the revocation.

(d) Article 4. This exemption is subject to the navigation servitude of the United States if the project is located on navigable waters of the United States.

(e) Article 5. This exemption does not confer any right to use or occupy any Federal lands that may be necessary for the development or operation of the project. Any right to use or or occupy any Federal lands for those purposes must be obtained from the administering Federal land agencies. The Commission may accept a license application by any qualified license applicant and revoke this exemption, if any necessary right to use or occupy Federal lands for those purposes has not been obtained within one year from the date on which this exemption was granted.

Appendix A.4

Federal Energy Regulatory Commission order approving minimum flow release structure at the Edenville hydro-electric dam. This Commission grant was issued November 15, 2000.

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93 FERC ¶ 62,119

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Wolverine Power Corporation — Project No. 10808-012

ORDER APPROVING MINIMUM FLOW RELEASE STRUCTURE[1]

(Issued November 15, 2000)

On June 6, 2000, Wolverine Power Corporation (licensee) filed a plan for a minimum flow release structure at the Tobacco spillway of the Edenville Project. The filing was made pursuant to paragraph (B) of the Order Modifying and Approving Reservoir Level Gaging Plan and Extension of Time to Design Minimum Flow Release Structure and Gaging System, issued June 22, 1999[2]. The project is located on the Tittabawassee River in Midland and Gladwin Counties, Michigan.

Paragraph (B) requires the licensee to file a minimum flow release design and gaging plan to provide the minimum flow releases required by article 403 of the project license. The plan shall be prepared in consultation with the U.S. Fish and Wildlife Service, U.S. Geological Survey, and the Michigan Department of Natural Resources.

In the filed plan the licensee states that the spillway gate will be opened 2.5 inches to provide 66 cfs during the summer, and 1.75 inches to provide 40 cfs during the winter. Two metal blocks were fabricated to hold the gate in the appropriate positions so that the lifting/lowering mechanism could not accidentally change the opening. The filed plan included the calculations for providing the required releases. The gate opening is small enough so that ice buildup on the gates is not expected to be a problem. The consulted agencies made no comments on the minimum flow release structure.

The filed minimum flow release design plan should ensure the required minimum flow releases are achieved. The filed plan satisfies the requirements of paragraph (B); this plan should be approved.

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[1]Paragraph (B) of the Order Modifying and Approving Reservoir Level Gaging Plan, issued June 22, 1999; Article 403.

[2]87 FERC ¶ 62,333.

001116-0134-3

The Director orders:

(A) The minimum flow release structure design plan filed on June 6, 2000, for providing minimum flows at the Edenville Project, as required by the Order Modifying and Approving Reservoir Level Gaging Plan and Extension of Time to Design Minimum Flow Release Structure and Gaging System, is approved.

(B) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 CFR § 385.713.

Rebecca M. Martin
Team Leader
Division of Hydropower Administration
and Compliance

Appendix B

Water quality reports available from the Michigan Department of Environmental Quality.

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