Michigan Department of Environmental Quality
Water Bureau
August 2005

Total Maximum Daily Load for Biota for York Creek
Kent County, Michigan

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish community and habitat quality targets, specifically a reduction in sediment loadings from sources in the York Creek Watershed that will result in WQS attainment. This TMDL follows the phased approach due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (WLAs) are calculated using the best available data and information recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of York Creek, a coldwater designated water body tributary to the Grand River, is located in Kent County in the vicinity of Grand Rapids (Figure 1). The watershed is entirely located in Alpine Township. The designated use (Rule 100 of the Part 4 rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended) identified as impaired is the support of coldwater fish (trout) populations. The elimination of a self-sustaining trout population served as the original basis for placing York Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about 3.5 miles in length and is identified on the Section 303(d) list (Wolf and Wuycheck, 2004) as follows:

YORK CREEK WBID#: **082805I**
County: KENT HUC: 04050006 Size: 3.5 M
Location: Grand River confluence u/s to Cordes Avenue.
Problem: **Fish community rated poor.**
TMDL YEAR(s): 2006 RF3RchID: 4050006 832

This document represents the basis for the development of a biota TMDL that focuses on the restoration of the coldwater designated use within the impacted perennial reach of York Creek to meet Michigan's WQS designated uses.

Within the approximately 2,119-acre watershed, the flow in the headwater reach of York Creek upstream of a point midway between Alpine Avenue and Cordes Avenue is classified by the United States Geological Survey (USGS) as intermittent (USGS Cedar Springs Southwest

Quad). Flow from that point downstream to the Grand River confluence is classified by the USGS as perennial (Figure 1). Within the 3.5 mile perennial reach, impairment is attributed to degraded water quality, unstable and flashy flow regimes, reduced bank stability (bank erosion), sedimentation, and reduced stream habitat quality. Excessive runoff sources throughout this highly urbanized watershed (from headwaters downstream) results in an impaired biological community associated with habitat loss due to sedimentation.

The determination of impairment within the TMDL reach was based on fish community assessment surveys in 1969, 1987, and 1989 conducted by the Michigan Department of Natural Resources (MDNR) Fisheries Division. The results from these surveys documented the eventual elimination of a self-sustaining brook trout population in York Creek during a 20-year period (MDNR, 1969, 1987, and 1989). The Great Lakes and Environmental Assessment Section (GLEAS) Procedure 51 (MDEQ, 1990) fish community and habitat assessments at Lamoreaux Drive, York View Drive, and Mill Street in 1991 and 1992 (Figure 1) further indicated the total absence of trout among collections of 130, 101, and 296 individual fishes, respectively (Wuycheck, 1993). Procedure 51 requires a minimum collection of 50 to 100 individual fish to serve as an adequate sample number to determine WQS attainment. In the case of an MDNR coldwater designated stream, such as York Creek, the presence of at least one percent or more trout (of total fish collected) is required to indicate designated use support is occurring. Additional fish community assessments conducted in August 2004, indicated the continued absence of trout among collections of only 15 (Lamoreaux Drive) and 94 (West River Drive) fish individuals, respectively (Rockafellow, 2005).

The Procedure 51 habitat assessment protocol used in the September 1991 and June 1992 assessments (MDEQ, 1990) used habitat score ranges of less than 35, 35 to 70, 71 to 106, and 107 to 135 points to represent habitat quality ratings of poor, fair, good, and excellent, respectively. York Creek habitat quality assessed in 1991 and 1992 indicated scores of 65, 67, and 74 that rated fair at Lamoreaux Drive and York View Drive and good at Mill Street, respectively (Wuycheck, 1993). The Procedure 51 habitat assessment protocol was revised in 2002, and uses score ranges of less than 56, 56 to 104, 105 to 154, and 155 to 200 points with ratings of poor, marginal, good, and excellent, respectively. The August 2004 habitat quality assessment at Lamoreaux Drive and West River Drive scored 101 and 132, and rated marginal and good, respectively (Rockafellow, 2005). Scores for the individual metric categories of Sediment Deposition, Flow Stability, and Bank Stability were less than 50 percent of their maximum potential scores. These lesser scores indicate unstable flow and habitat conditions in York Creek that contribute to absence of a trout population.

Feldpausch (1995) conducted wet-weather event monitoring surveys for the York Creek Watershed in 1994. Feldpausch concluded that wet-weather, urban runoff-related peak flows were approximately 50 percent greater than the nonurban runoff-related peak flows in the upper reaches of the watershed (upstream of Alpine Avenue). In addition, the urban runoff resulted in a six-fold increase in the storm event loads of in-stream total suspended solids (TSS) as compared to the nonurban upper reaches of the watershed.

Follow-up wet-weather event monitoring of TSS and stream flow in the York Creek Watershed was conducted at five locations (Figure 2) during the months of June through October 2004, by staff from the Grand Valley State University's Water Research Institute (Cadmus, 2005). This study was requested by the Michigan Department of Environmental Quality (MDEQ) and funded by the USEPA (contract #68-C8-0010). The MDEQ-approved contract required monitoring a minimum of three times to characterize dry-weather, background TSS concentrations during stable flow conditions. In addition, the contract specified monitoring a minimum of three wet-weather runoff events to assess responses to wet-weather precipitation events of 0.1 inches or greater in in-stream TSS concentrations and flow. Attention was directed towards sampling TSS and flow during the rise and fall of the hydrograph to characterize TSS in response to increases and subsidence in resulting runoff flow regimes.

The dry weather monitoring results from all five sites showed a TSS concentration range throughout the 3.5 mile TMDL reach of 1 to 6 milligrams per liter (mg/l) during stable, base flow conditions assessed on June 29, July 14, and July 28, 2004, respectively (Cadmus, 2005). The TSS concentrations measured at the most downstream site (North Park Street) during the above dry weather sampling dates were 3, 1, and 3 mg/l, respectively. These concentrations are quite low and characterize low volume, stable, stream-flow conditions of 2.12, 1.8, and 1.8 cubic feet per second (cfs), respectively.

The maximum flows measured at the most upstream sampling station (Cordes Road) during the three wet-weather event monitoring dates were 0, 1.06, and 1.8 cfs, respectively. This reach of stream was often dry. Wet-weather event monitoring at the West River Drive site in response to the 0.1, 1.1, and 1.3 inch precipitation events of August 25, August 2, and October 23, 2004, respectively, showed event TSS maximum concentrations of 25, 1262, and 1580 mg/l, respectively. In-stream flows measured at West River Drive demonstrate flow extremes measured during the three wet-weather event monitoring dates. Sampling results showed flow increases from 2.1 to 3.8 cfs (a 1.7 cfs increase), 3.9 to 43.4 cfs (a 40 cfs increase) and 3.88 to 46.96 cfs (a 43 cfs increase) over a two-hour period. The flow response to the 1.1 and 1.3 inch wet-weather events demonstrate substantial flashy flow responses to wet-weather, precipitation events. This information indicates that wet-weather runoff events in the watershed substantially increase the amount of TSS in transport in York Creek, thereby, increasing potential for impaired habitat quality.

Excessive storm water runoff to York Creek from the residential-, commercial-, and transportation-related land uses in the watershed (from Alpine Avenue downstream) appears to be the primary cause of the impaired biological community due to flashy stream flow conditions, stream bank erosion, and sedimentation. There are no individual National Pollutant Discharge Elimination System (NPDES) permits for discharges to York Creek. However, Alpine Township (MIG610121), the Kent County Drain Commission (MIG610130), and the Kent County Road Commission (MIG610129) have certificates of coverage under the watershed general storm water permit for discharges to York Creek, based on the NMS (2005) database (Table 1). The Michigan Department of Transportation is permitted under a statewide MS4 (MI0057364). Storm water discharges throughout the York Creek Watershed contribute to existing unstable, sedimented habitat conditions. Cadmus (2005) reported the presence of a storm water retention pond in the vicinity of Yorkland Drive and 4-Mile Road that discharges to the main stem of the stream (Figure 2).

Feldpausch (1995) reported that 19 percent (about 400 acres) of the York Creek Watershed is impervious (e.g., roads, parking lots, and roof tops). Some of the subwatersheds, making up the entire York Creek Watershed, contained 29 percent impervious surfaces. Such areas are commonly designed to divert and direct precipitation directly to nearby water bodies to facilitate rapid drainage. Substantial degradation in biological communities has been demonstrated to occur in watersheds containing 10 to 20 percent impervious surface areas that directly discharge to a water body by creating unstable, flashy flow conditions (WPT, 1994).

The primary contributor to poor stream quality is excessive runoff volumes resulting in flashy, destabilizing extremes in stream flow conditions in the highly urbanized/commercialized portion of the watershed from M-37 (Alpine Avenue) downstream. This condition results in substantial stream bank erosion and erosive impacts to both habitat and colonizing organisms, and sedimentation impacts on biologically important habitat. Reductions in storm water runoff rates, resulting flashy stream conditions, and reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life and meet WQS.

NUMERIC TARGETS

The impaired designated use for York Creek relates to coldwater fish. Michigan's WQS (Rule 323.1100(7)) requires the protection of designated trout streams as coldwater fisheries. Attainment of WQS for the coldwater fisheries designated use will be demonstrated based on further assessments of the fish community.

The primary numeric target is based on the Procedure 51 biological community assessment (MDEQ, 1990). The biota TMDL target is to establish a fish community that, when monitored, contains a minimum of 50 fish species of which one percent are trout. Fish communities will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in successive years, following the implementation of Best Management Practices (BMPs) to stabilize runoff discharges and extremes in stream flow conditions, minimize bank erosion, and sediment loadings to the subject TMDL reach.

A secondary numeric target based on TSS will be used to further assess improvements in York Creek. The secondary target is a mean annual, in-stream TSS concentration of 80 mg/l for wet-weather runoff events. This secondary numeric target may be overridden by achievement of the biological target. However, if the TSS numeric target is achieved but the biota target is not achieved, then the TSS target may have to be reevaluated. The secondary numeric target is intended to help guide proper control over NPS of excessive suspended solids loads from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 80 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS to aquatic life. Vohs indicated that a chemically inert suspended solids concentration of 100 mg/l appears to separate those streams with a fish population from those without (Vohs et al., 1993). Gammon (1970) demonstrated decreases in the standing crop of both fishes and macroinvertebrates in river reaches continuously receiving suspended solids loadings of less than 40 mg/l. The European Inland Fisheries Advisory Commission stated that in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l (EIFAC, 1980).

Alabaster (1972) provided the following water quality goals for suspended solids (finely divided solids) for the protection of fish communities:

Optimum	= ≤ 25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than Moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet-weather events was chosen for York Creek as a secondary target.

Overall, the secondary target of 80 mg/l TSS is intended to evaluate solids load effects and assist in orienting and focusing corrective actions for source reductions. A revised TSS target, based on flow-related considerations, may be developed as additional data on York Creek becomes available. To allow for additional data collection, if necessary, this TMDL is established as a phased TMDL.

SOURCE ASSESSMENT

Stream flow conditions of York Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded during the August 2 and October 23, 2004 wet-weather precipitation event surveys (Cadmus, 2005).

From the Grand River confluence upstream, land use in the York Creek Watershed is dominated by residential, commercial, and transportation uses (Table 2). Such development within a watershed alters its hydrologic characteristics because increased areas of impervious surface result in increased runoff of solids and pollutant loads being discharged to stream reaches within the watershed (Fongers and Fulcher, 2001; and Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of York Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the urbanized landscape and contribute to rapid precipitation runoff rates to the stream.

Cadmus (2005) identified one storm water retention pond outfall to York Creek. Alpine Township (MIG610121), has a certificate of coverage under the watershed NPDES Municipal Separate Storm Sewer System (MS4) general permit. The MS4 permitted outfalls require a plan development to achieve any applicable TMDL by minimizing pollutant and volume loads to the "maximum extent practicable." There are three facilities covered by general storm water permits and one site covered by a construction permit under Permit-By-Rule (Table 1).

Determination of the annual TSS loads to the York Creek Watershed from the various land use categories involved estimates of the acres of each land use category (Cadmus, 2005), a mean annual rainfall of 34 inches, and the USEPA's PLOAD simple method model approach (USEPA, 2001). This model was used in conjunction with TSS export coefficients derived from the Rouge River Project (Cave et al., 1994).

The estimated current annual TSS load from the NPDES permitted point sources (WLA) versus the NPS land use categories (LA) in the York Creek Watershed is about 308,826 pounds and 32,070 pounds, respectively (Table 2). The percentage of the total estimated annual TSS load to York Creek from NPDES non-storm water point sources (WLA), NPDES storm water sources (WLA), and nonpoint sources (LA) is approximately 340,896 pounds, representing 0, 91, and 9 percent of current contributions, respectively. The use of annual load estimates for TSS is used for comparative purposes to better express the potential sources and relative magnitude of the TSS loads to York Creek.

LINKAGE ANALYSIS

A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive bank erosion and sedimentation has been demonstrated to impair the biological integrity of rivers by obscuring or reducing the suitability of colonizable or useable substrate by stream biota (Waters, 1995). With improved habitat through the reduction in sedimentation, both fish and macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish community and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by a water body while still achieving WQS. The York Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation as affected by excessive runoff. Therefore, the TMDL is based on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a minimum of one percent trout representation in a collection of 50 fish or greater will serve as the primary target for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 (mixing zones) and 323.1090 (applicability of WQS) of Michigan's WQS. In general, the lowest monthly 95 percent exceedance flow for a stream is used to establish effluent limits for point sources. However, the excessive flows to York Creek are attributable to wet-weather driven discharges. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet-weather runoff events.

The secondary target of 80 mg/l TSS is used to develop a TMDL goal for TSS during wet-weather runoff events, primarily from storm water discharges in the watershed (represented by 1,918 total acres) of urban/industrial/built-up land use category that represents about 66 percent of the land use area in the York Creek Watershed.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for permitted point sources and LAs for NPS and natural background levels. A margin of safety (MOS), either implicit or explicit, accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving waters. Conceptually, this relationship is defined by the equation:

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for point sources, LA for NPS and background loads, and the MOS.

WLA

The estimated total annual TSS load from all non-storm water NPDES permitted point sources is zero (Table 1) since there are none in the watershed.

Based on acres of land use categories listed under "Urban/Industrial/Built-Up" of Table 2 and TSS export coefficients derived from the Rouge River project (Cave et al., 1994), a total annual TSS load estimate of approximately 308,826 pounds is attributable to NPDES MS4 municipal permitted storm water runoff discharges to the York Creek Watershed. All the categories listed are predicted to be meeting the 80 mg/l secondary target, with the exception of the industrial category, which is predicted to be contributing an average of 149 mg/l TSS to York Creek (Cave et al., 1994). To achieve the goal of 80 mg/l as an annual average during wet-weather events

from all point sources, a reduction of 46 percent from industrial land use areas or 2 percent overall in TSS loads would be necessary from all permitted point sources, resulting in a projected annual WLA of 303,206 pounds of TSS (Table 2).

Any necessary TSS limits will be established with an effluent limit based on available treatment technology that applies to the discharge type. Such an approach makes it unnecessary to consider mixing zone scenarios and would include permitted storm water point source contributions to the WLA, which are considered controllable through the existing NPDES permit requirements. It will be necessary to employ "maximum extent practicable" treatment for MS4 discharges. The industrial storm water and MS4 permittees shall implement BMPs for attainment of the secondary in-stream target of 80 mg/l TSS as a mean annual average concentration during wet-weather runoff events. The intent is to attenuate the runoff delivery rates and volume inputs to York Creek to reduce flashiness, better stabilize and normalize flow conditions, and minimize stream bank erosion, TSS resuspension, and sedimentation impacts on habitat and biological communities.

LA

The LA component of the TMDL defines the load capacity for a pollutant from nonpoint sources including the following land use categories: agricultural, forested/shrub/open land, and/or water bodies (Table 2). An estimated annual TSS load of 32,070 pounds (LA) is attributed to these categories of NPS in the watershed. All but the agricultural land uses are treated as background load sources because runoff concentrations of TSS are typically less than 80 mg/l. Therefore, the only targeted load reduction source is from agricultural sources, which has a runoff average TSS concentration of 145 mg/l (Cave et al., 1994). A 45 percent annual reduction (from 22,271 to 12,287 pounds) from agricultural areas in the watershed is recommended resulting in an LA TSS target of 22,086 pounds, based on achieving a runoff mean annual average concentration of 80 mg/l TSS, which is the target concentration during wet-weather runoff events.

In summary, the proposed total annual TSS load estimate to York Creek (WLA + LA) is 325,292 pounds/year, an overall 5 percent reduction from existing estimated loads. With the absence of any individual or general NPDES non-storm water permitted point source discharges in the York Creek Watershed, 0 percent of the annual load is allocated to these sources, 91 percent (303,206 pounds/year) is allocated to the NPDES permitted storm water sources, and 9 percent (22,086 pounds/year) is attributed to the LA.

Suspended solids data from the Cadmus (2005) stream study of 2004 indicates there are sources either unaccounted for, and/or underestimated, in terms of suspended solids contributions to York Creek. Land use data used to develop the LA and WLA projections for suspended solids do not predict the elevated TSS concentrations observed during the 2004 wet-weather events; e.g., up to 1580 mg/l TSS. Possibilities for the inconsistency between the modeled WLA/LA TSS contributions and the observed TSS concentrations are underestimated contributions from land use practices and/or sources of TSS originating in-stream (e.g., resuspension and/or stream bank erosion during wet-weather events). The latter is considered a most probable cause for the elevated TSS concentrations observed as evidenced by the increases in both TSS concentrations and flow during wet-weather events.

To achieve the primary and secondary TMDL targets, a reduction in the wet-weather runoff of TSS load through controls in the runoff rates and volume discharges are necessary. It will require employing BMPs that attenuate the runoff delivery rates and volume inputs to York Creek in order to reduce flashiness, better stabilize and normalize stream flow conditions, and minimize stream bank erosion, TSS resuspension, and excessive sedimentation that impacts habitat quality and biological integrity of the stream.

MOS

The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loads to the aquatic environment.

To determine progress in meeting the fish community score, follow-up biological assessments will be conducted during stable flow conditions during the months of June through September. The results will best reflect an MOS that is implicit and express integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for the fish community. To minimize temporal variability in the biological community, sampling will be conducted during June through September during stable, low flow conditions. For assessing TSS loads to York Creek, seasonal event monitoring will be conducted as necessary to define and characterize both hydraulic and TSS loads from the York Creek Watershed that influence the TMDL reach.

MONITORING PLAN

Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota TMDL target following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the biological community and habitat quality, at the Lamoreaux Drive and West River Drive locations, will be conducted until assessment results from two consecutive years demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted during the June to September time frame and stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations during each sampling effort.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in York Creek, stream flow and TSS sampling can be implemented to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet-weather runoff events in the event that the biota target is not achieved. In-stream monitoring of TSS, stream flow, and representative land use runoff characteristics for a variety of stable flow and wet-weather events may be necessary to refine the TSS loadings estimates for the York Creek Watershed. This information will further define the level of TSS load reduction necessary. Multiple samplings during critical high flow events, as well as low flow events, will be conducted to determine TSS loads in York Creek subsequent to BMP implementation.

REASONABLE ASSURANCE

The focus of the actions to protect York Creek is primarily directed towards installing BMPs and other control measures to reduce and minimize solids loads with primary emphasis on reducing runoff peak flows that substantially increases TSS concentrations resulting from resuspension and bank erosion. Control measures potentially include limits on industrial and municipal storm water discharge volume, chemical-specific permit limits, and approved BMPs for areas currently not under any permit.

Rule 323.2161a(8) pertains to wastewater discharge permits. The rule states, “A permittee shall comply with any more stringent effluent limitations in the national permit, including permit requirements that modify or are in addition to, the minimum measure based on a total maximum daily load (TMDL) or equivalent analysis.” In addition, Rule 323.2161a(10) allows that the

"department may establish monitoring requirements in accordance with state or watershed specific monitoring plans as needed for a permittee to demonstrate the pollution reduction achieved by implementing best management practices." For sites of new construction, the rules specifically require development of a program to evaluate the post-construction storm water runoff from projects, including an ordinance designed to prevent or minimize water quality impacts, including extreme flow volumes and conditions.

The regulatory mechanisms are available to reduce the storm water impacts of the urban/industrial/built-up sources on York Creek. Where the necessary data are available, permit requirements will be established in the NPDES permits. Where necessary, additional data to determine specific loadings and flow volumes associated with these sources will be collected through the NPDES permit requirements.

In addition to the establishment of permit requirements, the NPDES storm water MS4 permittees in the watershed are required to develop a watershed management plan that includes short- and long-term goals and attainment actions, public education plans, illicit discharge elimination plans, and the development (by each local unit of government within the York Creek Watershed) of their individual storm water prevention plans. The AlpineTownship master plan needs to acknowledge that proposed actions for the York Creek Watershed are needed to manage both water quality and quantity issues to be consistent with Phase I and Phase II water practices for construction and post-construction activities.

The MDEQ district staff will continue to work with and assist interest groups in the York Creek Watershed to define and design approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the York Creek Watershed.

Recommended actions include:

- Monitoring of the NPDES permitted discharges, if necessary, to identify and regulate sources of excessive wet-weather TSS loadings and runoff flow volumes to York Creek through NPDES permit conditions. Establish permit conditions as necessary.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to York Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff, thereby minimizing habitat impairment of York Creek.

- Implementation of BMPs in the storm water permits, to reduce sediment loadings and moderate runoff release rates and excessive runoff to the York Creek Watershed, are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected.

- Develop a watershed plan through the Alpine Township MS4 program to reduce solids and flow loadings to minimize flashy flow, bank erosion, and excessive sedimenation.

Prepared By: John Wuycheck
Surface Water Assessment Section
Water Bureau
Michigan Department of Environmental Quality
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Figure 1. York Creek Watershed and Fish Community Survey Locations (MIRIS, 2005).

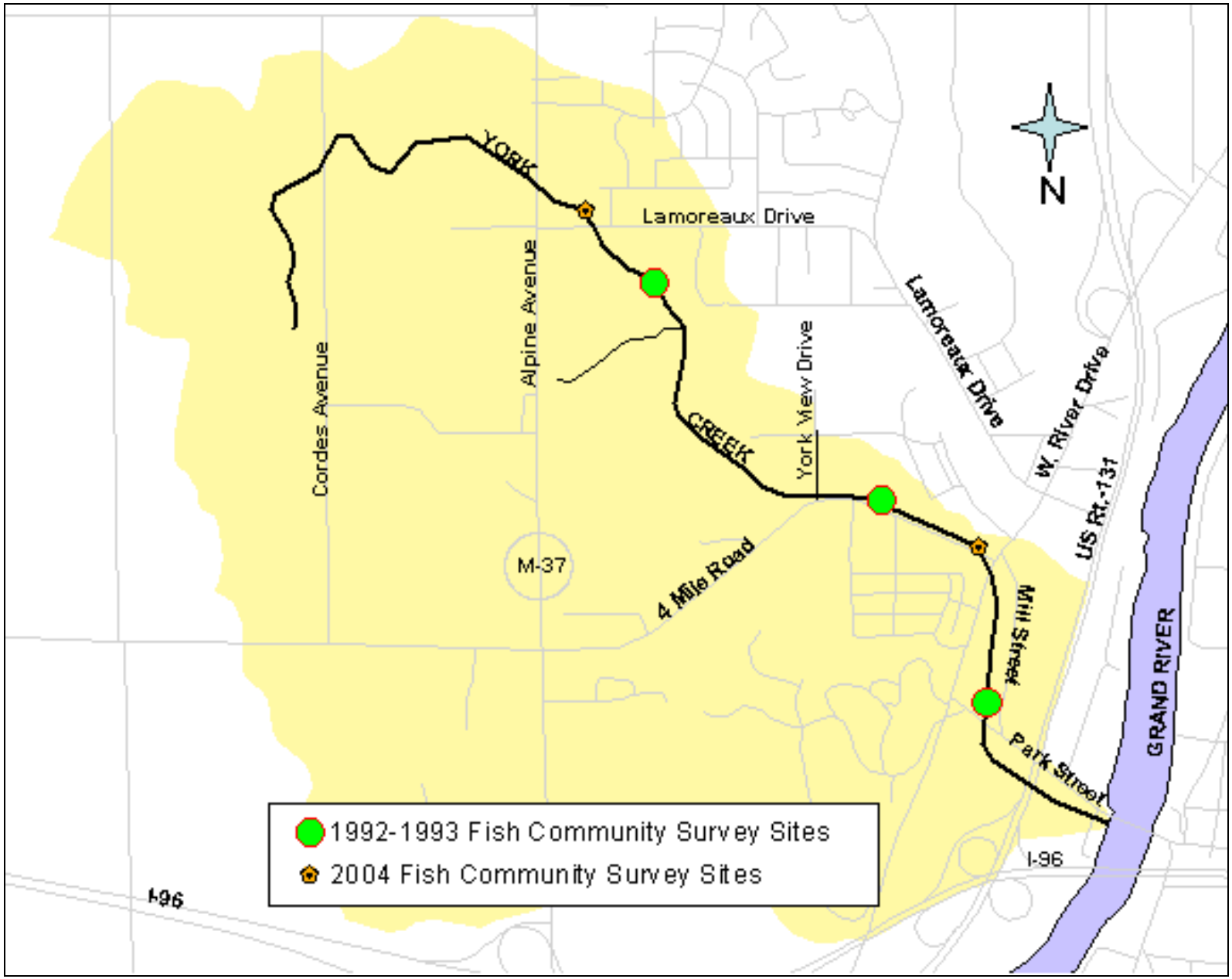

Figure 2. York Creek Watershed TSS and Flow Monitoring Sites in 2004 and Land Use Delineations.

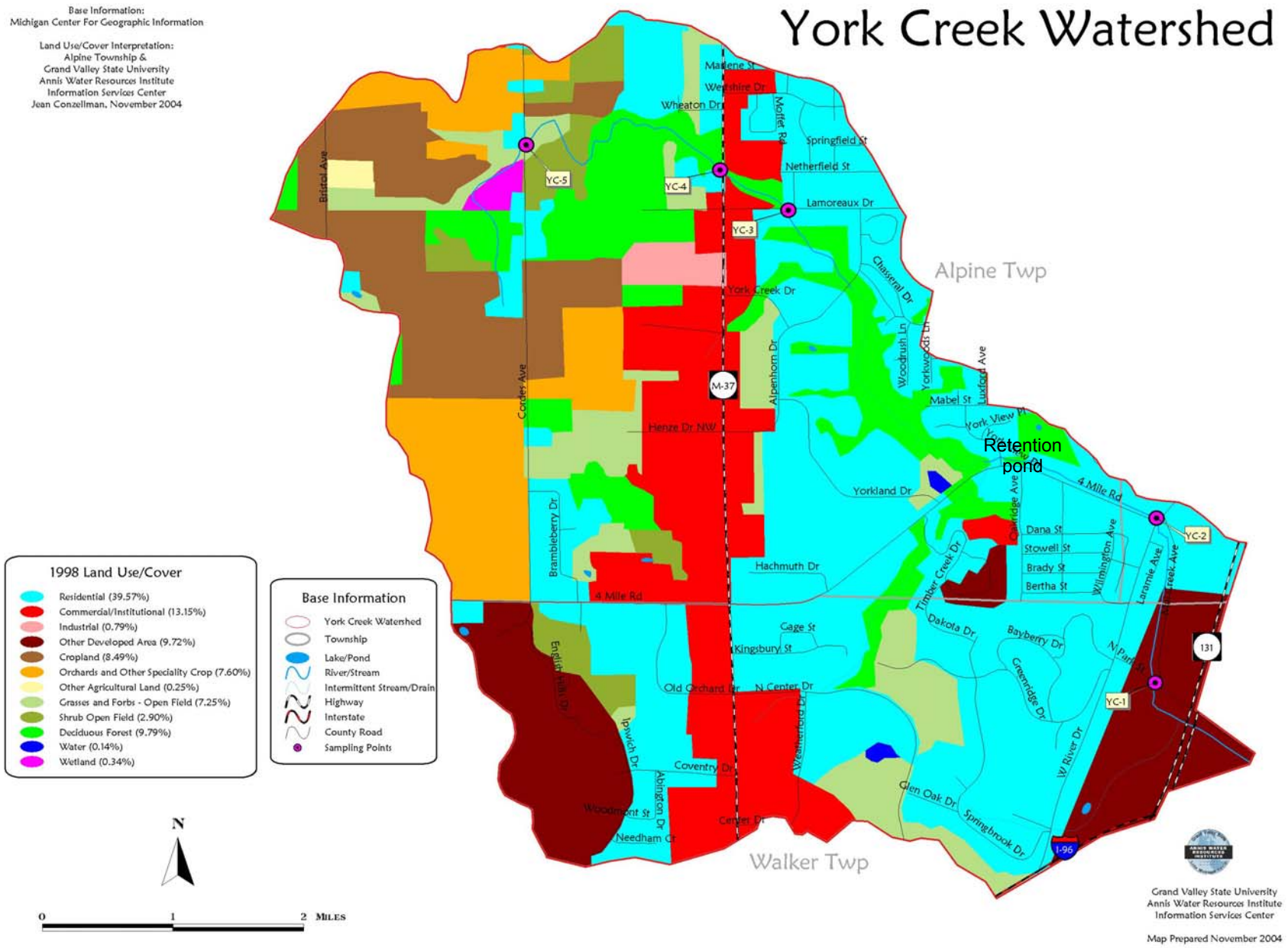

Table 1. NPDES permitted discharges in the York Creek Watershed (NMS, 2005).

MS4 Watershed General Storm Water NPDES Permits (MIG619000)

Alpine Township MS4 – MIG610121
Kent County Drain Commission MS4 – MIG610130
Kent County Road Commission MS4 – MIG610129
Michigan Department of Transportation Statewide MS4 – MI0057364

Industrial Storm Water General Permit (MIS119000)

Dry-Mix Crete & Supply Company (MIS110832)
Dubois Production Services (MIS111005)
Pitsch-Concrete Crushing (MIS110819)

Constructions Permits-By-Rule

Kent Co-4 Mile Road Reconstruction (MIR108376)

Table 2. Land Use Categories and TSS Loads in the York Creek Watershed, Kent County, Michigan.

Source Category	Acres	Estimate Current TSS (pounds/year)*	TMDL TSS Target Load TSS (pounds/year)
WLA Components:			
NPDES Non-Storm Water TSS Load		None	None
Urban/Industrial/Built-Up			
Residential	838	161,630	161,630
Commercial and Service	279	77,694	77,694
Industrial	17	12,137	6,517 (46% reduction)
Transportation/Comm/Util.	206	57,365	57,365
Subtotal:	1340	308,826	303,206 (2% reduction)
WLA Total:	1340	308,826	303,206 **(WLA)**
LA Components:			
Agricultural Land			
Cropland	180	11,586	6,392 (45% reduction)
Orchards and Other Specialty Crops	161	10,363	5,717 (45% reduction)
Other Agricultural Land	5	322	178 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Open Land/Shrub/Range Land	216	4,890	4,890
Deciduous Forest	208	4,709	4,709
Water Body			
Streams	3	60	60
Wetlands	7	140	140
LA Subtotal:	780	32,070	22,086 **(LA)**
Overall Totals:	2,020	340,896	325,292 (overall 5% reduction)

**TSS load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derives from 1998 land use coverage for Alpine Township, and a mean annual rainfall value of 32 inches. Land use coverages provided by Cadmus (2005).*