Michigan Department of Environmental Quality
Water Bureau
August 2005

Total Maximum Daily Load for Biota for the Sand Creek Watershed Ottawa County/Kent County

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 loads of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states with 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 foster the use of appropriate, sustained actions to achieve the fish community target that will result in attainment of the stream's coldwater designated use. This TMDL follows the phased approach due to inherent uncertainties in deriving numeric targets and estimating total suspended solids (TSS) loads from NPS that in excess can impair biological communities. Under the phased approach, TSS 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 will 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 Sand Creek is a designated trout stream as classified by the Michigan Department of Natural Resources (MDNR, 1997) and, therefore, protected by Michigan's WQS (Rule 100(7) 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 [Act 451]) as a coldwater water body capable of supporting trout. The stream is tributary to the Grand River within the townships of Chester, Wright, and Tallmadge in Ottawa County and Alpine Township in Kent County (Figure 1). The designated use identified as impaired is the support of coldwater fish (trout and/or salmon) populations. The elimination of a trout population served as the original basis for placing Sand Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL is identified on the Section 303(d) list (Wolf and Wuycheck, 2004) as follows:

SAND CREEK WBID#: 082801G
County: Ottawa Size: 16 M
Location: Chester Twp. (T9N, R13W, Sec. 34) Wilson Road d/s to confluence with Grand River, Tallmadge Twp. (T7N, R13W, Sec. 33). Just west of Kent County Line.
HUC: 4050006 RF3RchID: 4050006 35
Problem: Fish community rated poor.
TMDL Year(s): 2006

This biota TMDL focuses on the restoration of the coldwater designated use within the impacted TMDL reach of Sand Creek.

The Sand Creek watershed is approximately 55 square miles (35,000 acres) containing about

64 miles of stream channel comprised of 30 miles of perennial and 34 miles of intermittent stream channel as classified by the United States Geological Survey (USGS Marne and Grandville Quads) as depicted in Figure 1. Impairment of Sand Creek is attributed to excessive sedimentation and flashy flow conditions that degrade stream habitat quality and associated biological integrity. Moderately flashy stream flows, bank erosion, excessive sedimentation, and illegal water diversion and withdrawals are historically considered responsible for the impaired fish community and habitat loss. Flashy flows are characterized herein as rapid increases and decreases in response to wet-weather runoff events.

The determination of the coldwater designation impairment within the TMDL reach was based on the Great Lakes and Environmental Assessment Section (GLEAS) Procedure 51 (MDEQ, 1990) fish community assessment surveys of August 1993 and September 1996 (Goodwin, 2000). The results from the 1993 survey documented the absence of a trout population at Arthur Street and less than 1% trout at both the Lincoln Street (3 out of 132 individual fish collected) and M-45 (9 out of 126 individual fish collected) survey sites. The September 1996 stream surveys demonstrated the absence of trout in the headwater reach of Sand Creek at both the Cleveland Street and Arthur Street survey sites. A July 2004 survey further demonstrated the absence of trout at the Arthur Street site and less than 1% trout (1 brown trout out of 139 individual fish collected) at the Luce Street site (Rockafellow, 2005). Salmonids were absent in the East Fork Sand Creek at 4 Mile Road. The 1991 version of Procedure 51 (MDEQ, 1990) used in the September 1993 and September 1996 assessments and the updated 2002 Procedure 51 used for the 2004 surveys both recommend a collection goal of at least 100 individual fish to be examined from each survey station. When less than 50 fish individuals are collected, the reach is rated “poor” (WQS not met). For coldwater designated use streams, if the percentage of trout individuals relative to the total number of fish individuals collected exceeds 1%, the stream reach is considered to be supporting its coldwater designated use.

The 1991 Procedure 51 habitat assessment protocol used during the August 1993 and September 1996 assessments involved habitat score ranges of less than 35, 35 to 70, 71 to 106, and 107 to a maximum of 135 points with corresponding habitat quality ratings of poor, fair, good, and excellent, respectively. Sand Creek habitat quality assessed in August 1993 at Arthur Street, Lincoln Street, and M-45 had habitat quality scores of 28, 106, and 104 with ratings of poor, good, and good, respectively (Goodwin, 2000). The September 1996 habitat quality assessment scores at Cleveland Street and Arthur Street were 52 and 51, respectively, with ratings of fair. The 2002 updated habitat quality assessment portion of Procedure 51 was used for the July 2004 habitat quality assessment scoring and rating. The total point score ranges of the 2002 habitat quality assessment protocol are: less than 56, 56 to 104, 105 to 154, and greater than 154 to a maximum of 200 points with corresponding score range ratings of poor, marginal, good, and excellent, respectively. The July 2004 habitat quality assessment score at Arthur Street and Luce Street were 98 and 93, respectively, with both rated as marginal. Also, the scores for the individual metric categories of Sediment Deposition, Flow Stability, and Bank Stability of the July 2004 assessment were far less than 50% of their respective maximum potential scores of 20 points. Such scores indicate unstable flow and habitat conditions in Sand Creek that contribute to the stream not supporting its designated trout stream use. Observations just upstream of the Luce Street crossing indicated sand deposition depths of 3 to 4 feet across the entire 30-foot wide stream channel that extended upstream for a distance of at least 300 yards.

Wet weather event monitoring of TSS and stream flow in the Sand Creek watershed was conducted for the Michigan Department of Environmental Quality (MDEQ) during the months of June through November 2004 by staff from the Grand Valley State University’s Water Research Institute as funded by USEPA Contract No. 68-C8-0010 (Cadmus Group, 2005). The project, designed by the MDEQ, involved assessment of stream TSS concentrations at 8 locations during 3 dry weather, non-runoff events when stream flow conditions were stable (Figure 2).

The project also involved monitoring to characterize stream conditions for a minimum of 3 wet weather runoff events at each site to assess responses in in-stream TSS concentrations and flow during wet weather precipitation runoff events of 0.1 inch or greater. Attention was directed towards sampling TSS and flow during the rise and fall of the Sand Creek hydrograph to characterize TSS in response to increases and subsidence in resulting runoff flow regimes.

Results from the study indicated a background TSS concentration range of 1 to 8 milligrams per liter (mg/l) during stable, base flow conditions of June 28, July 15, and July 29, 2004 (Cadmus Group, 2005). The TSS concentration measured at the furthest downstream station at Luce Street (SC-1), during the dry weather sampling dates, were 8, 5, and 1 mg/l, respectively. These concentrations are quite low and characterize stable, instantaneous stream flow conditions of 37.4, 21.5, and 14.5 cubic feet per second (cfs), respectively.

Wet weather event monitoring at the most downstream station at Luce Street, in response to the 0.1, 1.1, and 1.3-inch precipitation events of August 25, August 2, and November 1, 2004, respectively, indicated the following: in-stream flows increased from 15.2 to 16.6 cfs (an increase of 1.1 cfs over a 3-hour period) in response to the 0.1-inch rainfall event, 15.5 to 41 cfs (a 25.5 cfs response increase over a 4-hour period) in response to a 1.1 inch rainfall event, and 20.8 to 50.8 cfs (a 30 cfs response increase over a 5-hour period) in response to a 1.3-inch precipitation. The results indicate moderately flashy stream flow responses to precipitation events of 1.1 inches or greater. The wet weather event monitoring showed TSS maximum, response concentrations of 8, 67, and 110 mg/l with event average TSS concentrations of 4, 55, and 77 mg/l at Luce Street, respectively. The average runoff event TSS concentrations observed during the 3 wet weather runoff events indicate a moderate increase in TSS concentrations during the precipitation events monitored. The study results indicate that precipitation events greater than 1.1 inches produce moderate increases in stream TSS levels and flows.

Increasing development and associated storm water runoff from the watershed is expected to increase runoff impacts to the stream quality. Storm water runoff to Sand Creek from the various land uses in the watershed, during greater precipitation/runoff events, appears to be a primary cause of the impaired fish community due to excessive solids loadings from runoff, resuspension, stream bank erosion, and sedimentation of stream habitat. Storm water drainage areas are typically designed to efficiently divert and direct precipitation to nearby water bodies to facilitate rapid drainage, often without consideration of impacts to surface waters. Substantial degradation in biological communities has been demonstrated to occur in watersheds containing 10% to 20% impervious surface areas that directly discharge to a water body by creating unstable, flashy flow conditions (WPT, 1994).

Reductions in storm sewer 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 Sand Creek relates to degraded coldwater fish population(s). Michigan's WQS require the protection of designated trout streams as coldwater fisheries characterized by the presence and support of trout or other salmonid populations [Rule 100(7)]. 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 upon Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 2002). The biota TMDL target is to establish, maintain, and protect a trout population where the fish community contains a minimum of 1% trout in a collection of greater than 50 individuals. Fish communities will be evaluated following the

implementation of best management practices (BMPs) to stabilize runoff/washoff discharges and extremes in stream flow conditions that will minimize bank erosion and sediment loads to the TMDL reach.

A secondary numeric target based on TSS will be used to further assess improvements in Sand Creek. The secondary target goal is a mean annual, in-stream TSS concentration of 80 mg/l for wet weather runoff/washoff events. This secondary numeric target may be overridden by achievement of the biological numeric 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 reported 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 fish and macroinvertebrate communities in river reaches continuously receiving suspended solids loadings of less than 40 mg/l. The European Inland Fisheries Advisory Commission (EIFAC) 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 Sand Creek as a secondary target.

Overall, the secondary target of 80 mg/l TSS is intended to evaluate solids load affects and assist in orienting and focusing corrective actions for source reductions. A TSS target, based on flow-related considerations, may be developed as additional data on Sand Creek become available. At this time, sufficient, site-specific data are unavailable regarding the flow and TSS concentration relationship associated with storm water sources during wet weather precipitation runoff events of greater than 1.1 inches to allow establishment of numeric targets for individual sources. Therefore, to allow for additional data collection, this TMDL is established as a phased TMDL.

SOURCE ASSESSMENT

Stream flow conditions of Sand Creek can best be described as moderately flashy in response to assessed wet weather precipitation events of 1.1 and 1.3 inches as characterized by the flow extremes observed during the August 25, August 2, and November 1, 2004, wet weather precipitation event surveys (Cadmus Group, 2005). Precipitation events greater than 1.3 inches are expected to further elevate TSS resuspension and sedimentation.

From the Grand River confluence upstream, land use in the Sand Creek watershed is dominated by developed land use areas that involve agricultural-, residential-, and transportation-related uses (Table 2). Increased residential and urban development within a watershed alters its hydrologic characteristics because increased areas of impervious surface

result in increased runoff and washoff 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 Sand Creek watershed 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.

The MDEQ, Water Bureau's National Pollutant Discharge Elimination System (NPDES) permit tracking database (NMS, 2005) indicates the presence of 1 general wastewater stabilization lagoon (WWSL) NPDES-permitted point source discharge, 5 construction site permits-by-rule, 3 industrial storm water discharges, and 8 municipal separate stormsewer system Phase II (MS4) storm water certificates of coverage under the MS4 general watershed permit No. MIG619000 (Table 1). Phase II of the federal regulation, along with Michigan's Phase II rules, requires a public entity (e.g., county, township, city, village, or institution) to obtain a certificate of coverage if it is located in a federally defined urbanized area and has the power and authority to control storm water discharges to an MS4. The Cadmus Group (2005) identified storm water outfalls in the vicinity of Leonard Street Dam and upstream and downstream of M-45 (SW-4 and SW-5 of Figure 2).

Determination of the annual TSS loads to the Sand Creek watershed from the various land use categories involved estimates of the acres of each land use category (Cadmus Group, 2005), a mean annual rainfall of 32 inches, and USEPA's PLOAD Simple Method model approach (USEPA, 2001). These aspects were used in conjunction with TSS export coefficients derived from the Rouge River Storm Water Demonstration Project (Cave et al., 1994).

The estimated total current annual TSS load from all sources in the Sand Creek watershed is 3,465,704 pounds (Table 2). The annual total represents a summation of NPDES-permitted point source and storm water TSS source loads (WLA) of 2,106,349 pounds plus the NPS land use category (LA) TSS loads of 1,359,355 pounds, respectively (Table 2). The total estimated annual TSS load to the Sand Creek from NPDES non-storm water point sources (WLA), NPDES storm water sources (WLA), and NPS (LA) is approximately 3,465,704 pounds, representing <1%, 61%, and 39% of current estimated contributions, respectively. The use of annual load estimates for TSS is used to better define the most probable sources and their relative contribution to TSS loads to Sand Creek and allows for a comparison when the annual average 80 mg/l TSS concentration target is used to estimate recommended annual TSS load reductions.

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 (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. 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 and macroinvertebrate communities 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 Sand Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation as affected by excessive runoff and resulting in-stream moderately flashy flow conditions. 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 numeric score of 1% trout representation in the assessed fish community 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 R 323.1082 (Mixing zones) and R 323.1090 (Applicability of water quality standards) of Michigan's WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the excessive flows to Sand 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/washoff events.

A secondary target of 80 mg/l TSS is used to develop a TMDL TSS load goal during wet weather runoff/washoff events, especially from agricultural and industrial discharge areas because of TSS typical runoff concentrations greater than 80 mg/l.

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 3 TMDL components: WLA for point sources, LA for NPS and background loads, and the MOS.

WLA

The estimated total annual TSS load from the seasonal, non-storm water NPDES permitted point source, e.g., the Indian Trails Children's Camp WWSL, is 385 pounds (Table 2). The TSS load was estimated based on summing the products of half the facility design flow (annual average design flow is 0.84 million gallons per year) times the monthly maximum average TSS effluent limit of 70 mg/l for the spring discharge period and the other half of the design flow discharge times a monthly maximum average value of 40 mg/l TSS that applies during the fall discharge period. The TSS limits are defined in the general permit (MIG580000).

Based on acres of land use categories listed under "Urban/Industrial/Built-Up" and TSS export coefficients derived from the Rouge River Storm Water Demonstration Project (Cave et al., 1994), a current total annual TSS load estimate of approximately 2,105,964 pounds is attributable to NPDES permitted industrial and MS4 municipal permitted storm water runoff/washoff discharges to the Sand Creek watershed. Most of the categories listed are

predicted to be meeting the 80 mg/l target secondary target, with the exception of the industrial category, which is projected to be contributing an average of 149 mg/l TSS to Sand Creek based on estimates from the Rouge River Storm Water Demonstration Project (Cave et al., 1994). To achieve the goal of 80 mg/l as an annual average during wet weather runoff events from all point sources, a reduction of 46% (269,453 pounds/year) from industrial sources will result in a projected annual WLA target load of 1,836,896 pounds of TSS, a 13% reduction in TSS loads from all NPDES regulated point sources (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 that are considered controllable through the existing NPDES permit requirements and the Phase II MS4 programs. It will be necessary to employ "maximum extent practicable" treatment for storm water point sources. The permittee shall design storm water treatment 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 the Bass River watershed in order 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 that is nonpoint in origin that includes the following land use categories: agricultural, forested/shrub/open land, and/or water bodies (Table 2). An estimated annual TSS load of 1,359,355 pounds (LA) is currently 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 (Cave et al., 1994). 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% annual reduction (from 1,164,254 to 642,346 pounds) from agricultural areas in the watershed is recommended resulting in a TSS total load LA target of 837,447 pounds, based on achieving a runoff mean annual average concentration of 80 mg/l TSS, the target concentration during wet weather runoff/washoff events.

In summary, the proposed accumulative annual TSS load estimate to Sand Creek (WLA + LA) is 2,674,343 pounds/year representing an overall 23% (791,361 pounds) annual reduction from an existing estimated total annual load of 3,465,704 pounds. Therefore, the general NPDES non-storm water permitted point source discharge in the Sand Creek watershed of approximately 1% of the annual load is allocated to the Indian Trails Children's Camp WWSL, 68% (1,836,511 pounds/year) is allocated to the NPDES permitted industrial storm water construction site permits-by-rule and municipal storm water outfalls covered under the Phase II MS4 Storm Water Programs, and 31% (837,447 pounds/year) is attributed to the LA.

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.

Follow-up biological and habitat quality assessments to determine progress in attaining the TMDL goals will be conducted during stable flow conditions over the months of June through September and compared to prior surveys conducted during the same time period. The results will reflect an MOS that is implicit by expressing integration of the effects of the variability in sediment loads in the aquatic environment and minimizing seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable, low flow conditions. For assessing TSS loads to Sand Creek, seasonal event monitoring will be conducted once source control measures are in place, if necessary, to better define and characterize both hydraulic and TSS loads from the Sand Creek watershed that influences the biota 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. For comparative purposes with previous surveys, follow-up biological 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 as previously sampled.

If the biological monitoring indicates that WQS are not being attained, in-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet weather events may be necessary to refine the TSS loading estimates for the Sand Creek watershed and measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet weather runoff events. This information will further define the level of TSS load reduction necessary.

REASONABLE ASSURANCE

The focus of the actions to protect Sand Creek is directed towards installing BMPs and other control measures to reduce solids loads from upland sources and reduce runoff peak flows that result in increased 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.

R 323.2161a(8), adopted pursuant to Part 31 of Act 451, states that “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, R 323.2161a(10) states 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.” Also, R 323.2161a(3e), for sites of new construction, specifically requires development of a program to evaluate the postconstruction 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 Sand 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 (Phase I and Phase II) are required to collectively develop a watershed management plan that includes the detailing of 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 Sand Creek watershed) of their individual storm water prevention plans. The Ottawa County, Wright Township, Chester Township, Tallmadge Township, Alpine Township, and the city of Walker master plans need to acknowledge that proposed actions for the Sand Creek watershed are needed to manage both quality and quantity issues to be consistent with Phase I and II water practices for construction and postconstruction activities.

A Lower Grand River Watershed (LGRW) Planning Project watershed management plan outlines strategies and recommendations to effectively reduce nonpoint source pollution (Grand Valley Metropolitan Council, 2004). Several interactive tools and two guidebooks were created in addition to the management plans to assist subwatersheds in their individual watershed planning efforts. A strategy was also developed for a LGRW provisional organization that will provide basin-wide oversight, implement regional and watershed-wide initiatives, and prioritize water quality concerns.

The MDEQ district staff will continue to work with and assist interest groups in the Sand Creek watershed in defining and designing 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 Sand Creek watershed.

Recommended actions include:

- Monitor NPDES permitted outfalls, as necessary, to identify and regulate sources of excessive wet weather TSS loadings and runoff flow volumes to Sand Creek through NPDES permit conditions.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to Sand 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/washoff, thereby minimizing habitat impairment of Sand Creek.

- Implement BMPs in the storm water permits program to reduce sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Sand Creek watershed. These actions are expected to improve and protect designated uses throughout the watershed. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; and Schueler and Holland, 2000.

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August 16, 2005

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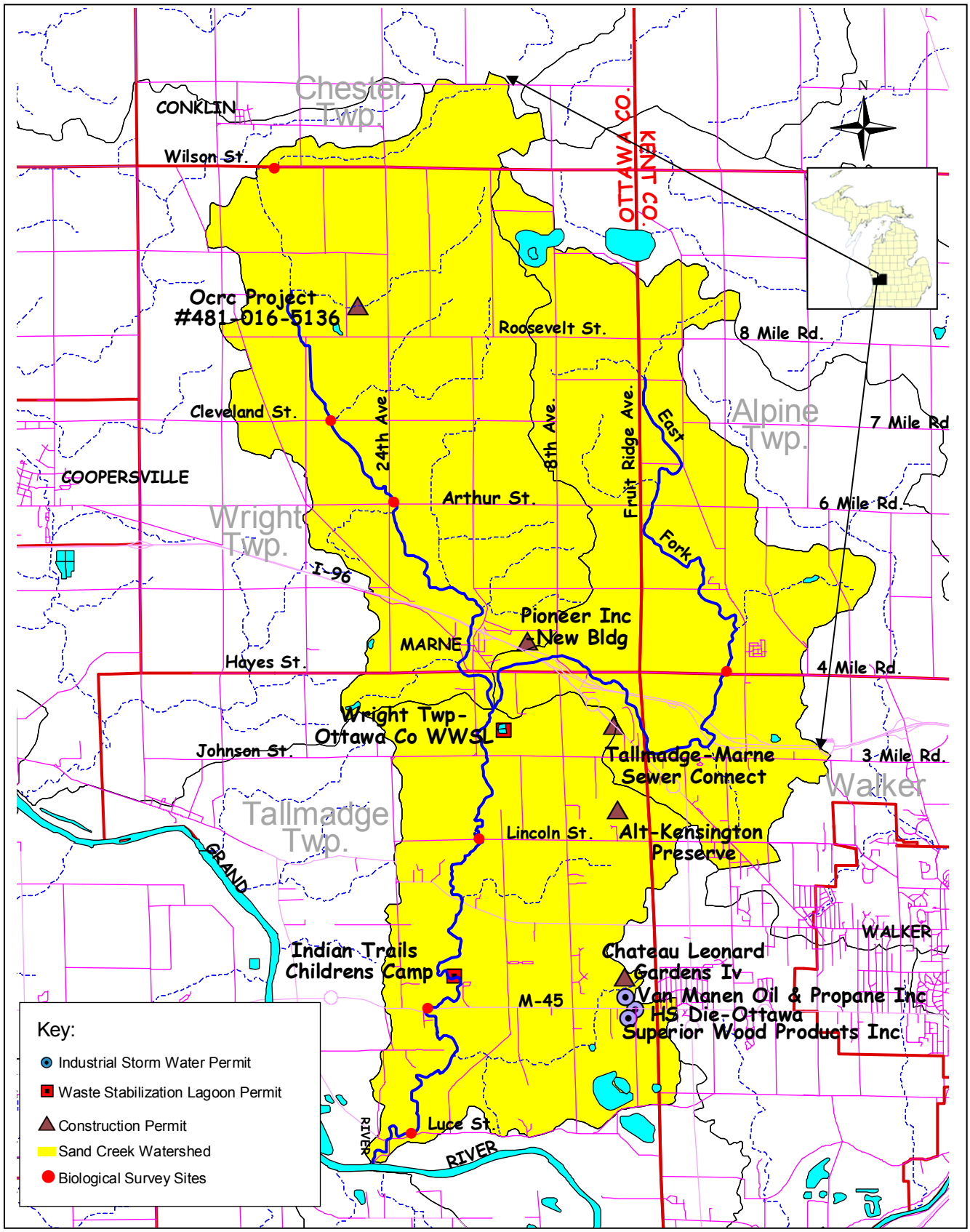

Figure 1. NPDES permitted sites and biological survey sites in the Sand Creek watershed.

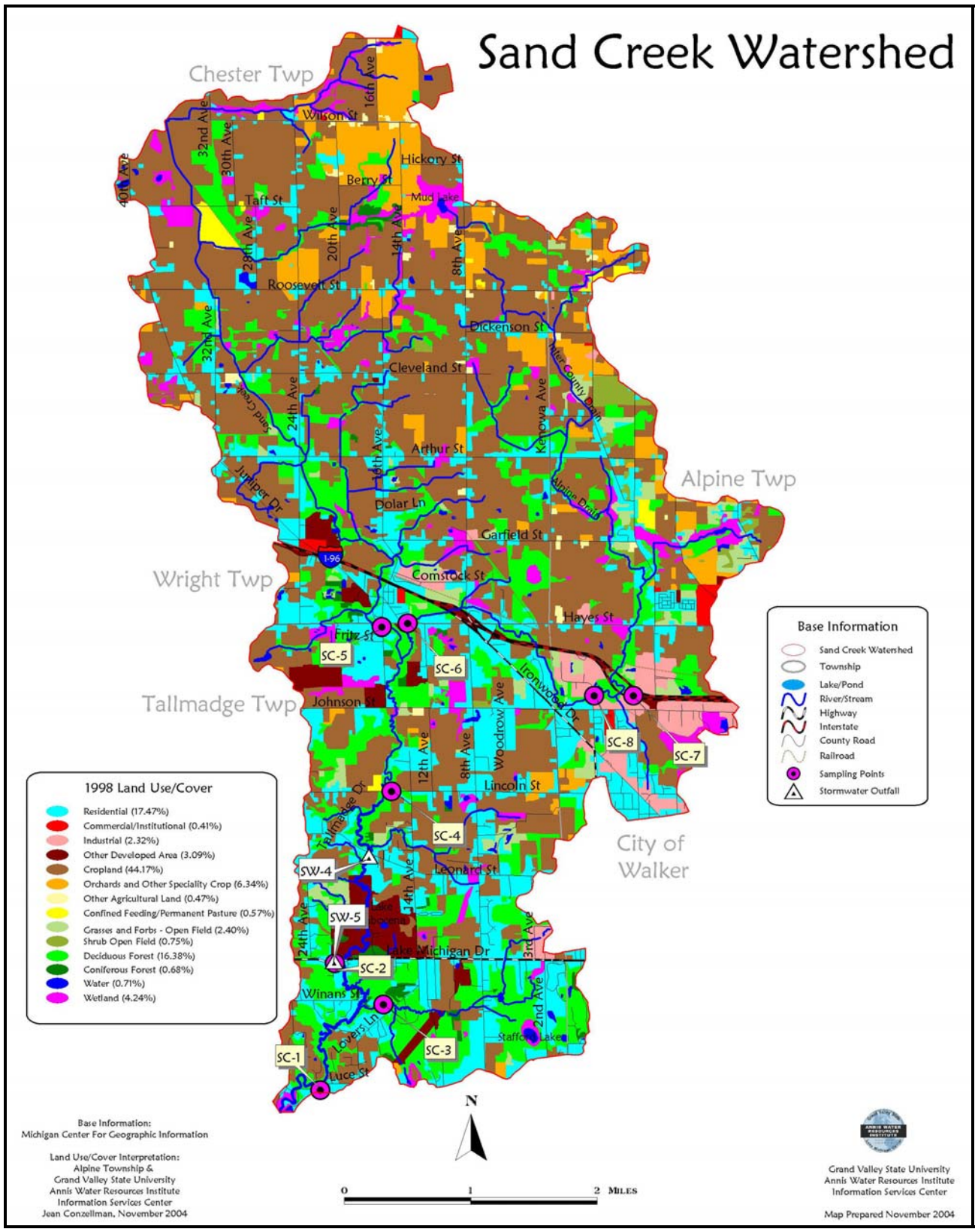

Figure 2. Sand Creek watershed detailing land use categories (1998 coverage) provided by the Cadmus Group (2005), TSS and flow sampling sites in 2004 and storm water outfalls.

Table 1. NPDES permitted facilities located in the Sand Creek Watershed, Ottawa and Kent Counties, Michigan.

NPDES PERMIT	PERMIT NO.	COUNTY	TOWNSHIP	LATITUDE_DD	LONGITUDE_DD
WWSL General Permits (MIG589000)					
Indian Trails Childrens Camp (0.84 MGY)	MIG580134	Ottawa	Tallmadge	42.97833	-85.83278
Construction Permits-by-Rule					
Chateau Leonard Gardens Iv	MIR104987	Ottawa	Tallmadge	42.97795	-85.79241
Pioneer Inc-New Bldg	MIR105763	Ottawa	Wright	43.03640	-85.81536
Tallmadge-Marne Sewer Connect	MIR106159	Ottawa	Tallmadge	43.02159	-85.79496
Ocrc Project #481-016-5136	MIR107588	Ottawa	Wright	43.09457	-85.85532
Alt-Kensington Preserve	MIR107835	Ottawa	Tallmadge	43.00706	-85.79396
Industrial Storm Water General Permits					
HS Die-Ottawa	MIS110784	Ottawa	Tallmadge	42.97222	-85.79000
Superior Wood Products Inc	MIS111024	Ottawa	Tallmadge	42.97083	-85.79167
Van Manen Oil & Propane Inc	MIS110838	Ottawa	Tallmadge	42.97444	-85.79222
Municipal Storm Water MS4 General Permits					
Alpine Township MS4	MIG610121	Kent	Alpine		
Tallmadge Township MS4	MIG610204	Ottawa	Tallmadge		
Wright Township MS4	MIG610205	Ottawa	Wright		
City of Walker MS4	MIG610137	Kent			
Ottawa CDC MS4	MIG610203	Ottawa			
Ottawa CRC MS4	MIG610117	Ottawa			
Kent CDC MS4	MIG610130	Kent			
Kent CRC MS4	MIG610129	Kent			

Table 2. Land use categories and estimated current TSS loads and TSS load reductions in the Sand Creek watershed, Ottawa 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			
Indian Trails Children's Camp		385	385
Subtotal:		**385**	**385**
Urban/Industrial/Built-Up			
Residential	6,129	1,182,139	1,182,139
Commercial and Service	145	40,378	40,378
Industrial	815	581,862	312,409 (46% reduction)
Transportation/Comm/Util.	1,083	301,585	301,585
Subtotal:	**8,172**	**2,105,964**	**1,836,511**
WLA Total:	**8,172**	**2,106,349**	**1,836,896 (WLA)** (13% reduction)
LA Components:			
Agricultural Land			
Cropland	15,497	997,481	550,334 (45% reduction)
Orchards and Other Specialty Crops	2,225	143,215	79,015 (45% reduction)
Confined Feeding/Pasture	202	13,002	7,173 (45% reduction)
Other Agricultural Land	164	10,556	5,824 (45% reduction)
Subtotal:	**18,088**	**1,164,254**	**642,346** (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Open Land/Shrub/Range Land	1,106	25,039	25,039
Deciduous Forest	5,747	130,107	130,107
Coniferous Forest	237	5,365	5,365
Water Body			
Water (Streams/Lakes/Ponds)	248	4,944	4,944
Wetlands	1,487	29,646	29,646
Subtotal:	**8,825**	**195,101**	**195,101**
LA Total:	**26,913**	**1,359,355**	**837,447 (LA)** (38% reduction)
Overall Totals:	**35,085**	**3,465,704**	**2,674,343** (23% reduction)

**TSS load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derived from 1998 land use database coverage (Cadmus Group, 2005) and a mean annual rainfall value of 32 inche.*