Portage & Arcadia Creeks Watershed Management Plan

Transition Grant #2003-0028
USEPA Nine Elements Update

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1.0. Introduction

A Watershed Management Plan (WMP) represents a framework around which a range of approaches have been adopted or identified that are meant to preserve, protect or restore water resources in a selected geographic setting. A Watershed Management Plan for the Portage-Arcadia Creek Watershed was approved by the Michigan Department of Environmental Quality (MDEQ) in June 2003. This particular plan for the 43,723-acre Portage/Arcadia Creek watershed is intended to be a flexible, evolving strategy providing a template of goals and actions based on current conditions and desired water quality objectives. The plan and its objectives can be expanded and adapted as implementation of the framework progresses.

The four primary tributaries encompassed by this plan include Arcadia Creek, Portage Creek, the West Fork of Portage Creek and Axtell Creek, the latter two being major tributaries to Portage Creek. Both Arcadia Creek and Portage Creek discharge to the Kalamazoo River in the heart of the City of Kalamazoo. The hydrologic unit codes (HUC) for these subwatersheds are 4050003- 050020, -0500030, -0500040, -0500050, -0500060, -0500070, -050100 (part of). Although the study area is composed of multiple Hydrologic Unit Codes, it is referred to as one watershed (consisting of four subwatersheds) for the purpose of this WMP. Within these four creek subwatersheds are the Cities of Portage and Kalamazoo, as well as the Townships of Texas, Oshtemo and Kalamazoo. Although each one of these municipalities are separate political entities, they are bound geographically to this shared water resource. Thus, collaborative and overlapping management of these valuable natural features must transcend political boundaries. Cooperative partnerships developed through this planning project, and long-lasting relationships established through mutual development of this plan, will assist in continuing to bridge these political boundaries.

In late 2003, the U.S. Environmental Protection Agency (USEPA) released guidelines for approvable Watershed Management Plans (WMPs), referred to as the Nine Elements. A grant called the "Transition Grant" was awarded to the Forum of Greater Kalamazoo in April 2004 to update the WMP to meet the Nine Elements and allow the watershed to be eligible for Clean Water Act Section 319 Implementation Funding through a grant program administered by the Michigan Department of Environmental Quality. This Transition Grant also funded additional watershed activities, involving monitoring, education and homeowners and implementation projects along Axtell Creek.

Based on the Michigan Department of Environmental Quality's guidelines and requirements for approvable watershed management plans, all necessary elements can be found in a unique electronic format through the dedicated website http://www.kalamazooriver.net/pa319new/index.htm. This innovative electronic format allows for frequent updates and modifications as progress is made on elements of the plan towards water quality goals. The utility of such a web-based approach, accessible to virtually anyone, can be contrasted with a written plan that is very time consuming, costly, and difficult to update and distribute.

This printed and bound document addresses the need for a printable element of the electronic plan for MDEQ review and approval. As such, it is organized with numerous

weblinks and attachments. This printed document is a snapshot of the dynamic watershed management plan as of February 1, 2006.

Numbered attachments (e.g., Attachment 1) to this print correspond to products generated during the course of the Transition Grant after April 2004. Numbered Attachments are located in the middle of this binder. For the sake of reviewing this document for approval, the MDEQ should focus on these numbered Attachments to understand the work products produced during the Transition Grant.

Weblinks and corresponding [bracketed] references inserted into the text of this document refer to text, data, images, tables, and maps generated during the writing of the Watershed Management Plan prior to the Transition Grant. Full documents are available on the dedicated website (http://www.kalamazooriver.net/pa319new/index.htm). [Bracketed] letters refer to full or example documents generated prior to the Transition Grant located at the end of this binder. In some cases, full documents have not been printed given that elements of the plan are lengthy, available online at the weblinks provided, and have already been approved by the MDEQ.

The website provides easy access for all stakeholders and a mechanism for communication with others in the watershed. This represents a key aspect of management plan sustainability. For example, meeting minutes are posted on the website. Furthermore, a wide variety of projects and needs identified in this plan can be more readily integrated into other planning and improvement efforts in surrounding watersheds that might not be directly related to the plan.

This WMP is not a regulation, ordinance or law. Rather, the plan serves as the basis or justification for such regulatory controls. It is also the guide for voluntary improvement efforts. A wealth of information is therefore provided by this plan, ranging from current conditions of these drainage areas to ongoing or future approaches for improvement and protection. The dedicated website for the Portage-Arcadia Watershed serves as a broad-based information source on water resources, while the plan (representing only a portion of the information on the website) serves as a road map for achieving community goals and objectives for sustaining these resources.

All aspects of the WMP can be viewed under the WMP section of the website. Each element of the plan links to other sections of the website with relevant information. Users are encouraged to explore the website through links in the text or by using the "jump to" menu option on the left navigation bar. Feedback on the plan can be provided directly to info@kieser-associates.com.

2.0. The Geographic Scope of the Watershed

The Portage-Arcadia Creek Watershed is composed of four subwatersheds: Arcadia Creek, Axtell Creek, Portage Creek and the West Fork of Portage Creek (http://www.kalamazooriver.net/pa319new/mgplan.htm#1 [A]). Axtell Creek and the West Fork of Portage Creek flow into Portage Creek, which meets the Kalamazoo River in the City of

Kalamazoo. Arcadia Creek also discharges into the Kalamazoo River in Kalamazoo, just north of the Portage Creek outlet. Subwatershed boundaries and boundaries of the contributing areas of each subwatershed were delineated through topography and storm sewer mapping [A]. Storm sewer maps for the City of Kalamazoo and City of Portage are available at (http://www.kalamazooriver.net/pa319new/mgplan.htm#1 [B]).

CAD and GIS programs were utilized to map and evaluate the characteristics of the watershed. Data, such as soil type, topography, land use/land cover, wetlands, and contaminant sites are available on-line (http://www.kalamazooriver.net/pa319new/mgplan.htm#1 [C]). The project website presents this information for the subwatersheds.

The dominant soils are Urban Complex and Oshtemo Sandy Loam. Urban lands are those areas that are so obscured by urban work and structures that identification of the soil is not possible. In the Urban land-Kalamazoo Complex, the urban land and Kalamazoo soils are so mixed that it is not practical to separate them. The Kalamazoo soil is suited to building site development and sanitary facilities. The Oshtemo Sandy Loam (OsB) is hilly, well drained soil on sandy uplands and ridges. The use of this soil for hay and pasture is effective in controlling erosion. Slope and erosion are the major problems. The Oshtemo Sandy Loam is poorly suited to building site development. Care must be taken in establishing septic tank filter fields to prevent hillside seepage. Though the lower reaches of the watershed are largely urban, 44% of the whole watershed is composed of forested land cover.

A Natural Features Inventory was conducted to assess the biological properties of the watershed and to target preservation efforts. The description of those efforts follows.

2.1. Natural Features Inventory

One of the first steps in developing a WMP is to gather information about the nature and health of the watershed. Historical information is gathered from published sources and local agencies, and new information is gathered from field surveys. One form of information retrieval utilized for this project was the Natural Features Inventory (NFI).

A NFI is a collection of information pertaining to the biological, hydrological and social elements of an area. As such, the nature of the inventory is flexible and can take many forms. Information can be collected by field investigations, interviews, questionnaires, a literature search or other methods. Inventories can vary, as they are tailored to suit the particular needs of the intended users.

The purpose of this NFI was to collect information relating to the condition of the riparian (that which adjoins a body of water) areas (or riparian zone) and natural, relatively undisturbed areas in the watershed. Undisturbed, vegetated riparian land can protect surface water bodies from pollutant loading. For example, vegetated stream banks help prevent erosion from contributing sediments and other pollutants, such as phosphorus, to the water and provide shade to the water and aquatic biota. Vegetated riparian lands also provide habitat for wildlife. The types of vegetation growing in the riparian zone, the width of the riparian zone and other features can provide clues about the health of the waterbody. Additionally, the identification of

rare or endangered native plants and animals can help watershed managers prioritize areas for preservation. The identification of natural areas can help managers protect corridors and maintain watershed health.

Information for this NFI was collected both from field surveys and from published sources of data. Many organizations, such as the Kalamazoo Nature Center and the Michigan Department of Natural Resources, have compiled inventories of the plant and animal life in this area. With a large study area and limited time frame, field personnel cannot visit all of the riparian land to conduct new surveys. Therefore, selected areas, such as the locations of storm sewer outfalls or the headwaters of a water body, were chosen for site visits. Field personnel from KIESER & ASSOCIATES conducted field surveys of selected riparian areas in the Fall of 2001. Data collected at each site included:

- Dominant vegetation
- Riparian Width
- Location and Size of Storm Water Outfalls
- Bank Condition, Erosion Determination
- Presence of Litter, General Appearance of Site

In the Spring of 2002, the plant surveys were altered to include green spaces within the watersheds (not just riparian areas). The Natural Features Inventory goal was to identify green spaces which should be targeted for preservation. Those areas that are not preserved (or where the preservation status was unknown) were surveyed. These areas were identified by Kieser & Associates' field work and by public surveys conducted by the Convene the Community project. For some regions of the study area, previous studies have collected information on fauna (bird, mammals, insects, etc.) along with flora (plants) in the area. However, only dominant vegetation was documented during these field visits, due to the large area covered. Vegetational information collected through this study was supplemented by previously documented floral and faunal information. Therefore, all available, obtainable information was integrated to provide an understanding about the nature of the subwatersheds' natural resources.

Information collected from field visits and previous studies was integrated to produce an assessment of the health of the watersheds as a whole and the relative health of various areas within the watersheds. Areas that contain rare or endangered native species or that are relatively undisturbed may be selected for preservation, as they perform significant functions in the protection of the watershed. Areas that are disturbed or that are sources of pollutant loading were targeted for improvements. This information does not stand alone, but was utilized with other data collected during this study, such as water quality data, in the development of the plan. The website for the NFI is divided into five categories:

- biota of the watershed http://www.kalamazooriver.net./pa319new/nat_feat/nfi1.htm [D]
- natural areas in the watershed [D]
- biota of Kalamazoo County http://www.kalamazooriver.net./pa319new/nat_feat/nfi3.htm
- biota of the State of Michigan http://www.kalamazooriver.net./pa319new/nat_feat/nfi4.htm
- ecosystems historically in the watershed [D]

See http://www.kalamazooriver.net/pa319new/nat_feat/nat_feat.htm#top for more information.

2.2. Subwatershed and Lakes Descriptions

The following descriptions provide details about the characteristics of each subwatershed.

2.2.1. Arcadia Creek Subwatershed Description

The Arcadia Creek Subwatershed lies within portions of Oshtemo Township and the City of Kalamazoo (http://www.kalamazooriver.net./pa319new/mgplan.htm#1 [A]). This subwatershed flows mostly in an easterly direction, with the headwaters of Arcadia Creek starting west of 11th Street, in the southeastern portion of Oshtemo Township. The watercourse then flows through the western portion of the City of Kalamazoo, roughly parallel with Stadium Drive and on through to the downtown area before finally discharging to the Kalamazoo River. For much of its length into the city the railroad bed lies beside the creek. Over 6,300 of the approximately 10,971 acres in the Arcadia sub-watershed contribute no flow to the creek under any conditions. These non-contributing areas (areas that do not contribute water to the creek, but do contribute water to lakes and groundwater) are found within the western-most portion of the sub-watershed, in eastern Oshtemo Township and western Kalamazoo. During rainfall events approximately 4,600 acres contribute storm water to the creek from direct surface runoff and storm sewer connections. The drainage area includes land uses of approximately 42% urban, 45% open space and forest, 4% water/wetlands and 9% agriculture. Within the City of Kalamazoo portion of the subwatershed, curb and gutter systems direct storm water from 1,862 acres to storm sewers that collect, transport and discharge approximately 2,362 acre-feet per of storm water into the creek annually. Virtually all 5.5 miles of the creek receive storm water contributions from lightly to heavily urbanized areas within the City of Kalamazoo.

A closer look at the flow path of the creek reveals that it first flows through a vegetated ditch, then is piped underground to emerge east of Drake Road into a small pond prior to discharging into another small channel. From there, the watercourse continues in a narrow channel, parallel to railroad tracks, through scrub vegetation and behind a mobile home community. The creek then flows through a wetland, through a City well field and into another ecologically disjunct area having uplands and wetlands with vegetation of a unique composition. The creek next passes under Stadium Drive, through the Kalamazoo Christian High School property then under Howard Street to Western Michigan University (WMU) property where it follows a series of shallow "S" curves passing back and forth under Stadium Drive (four times). Near WMU's Waldo Stadium additional storm water flow contributions from the WMU Goldsworth Valley Pond and other WMU outlets enter the creek, where it is piped underground until emerging at Lovell Street and the Kalamazoo College campus. It is within this area that a pinch point, which periodically causes flooding, exists. Except for being piped under several roads the creek remains at the surface through this segment, flowing within a constricted narrow, steep-sided channel with stone-lined banks. Piped under South Westnedge Avenue, the Creek emerges into a concrete-lined, open box channel to flow into a storm water detention pond at the Arcadia festival site. Overflow is then directed and conveyed underground to the discharge point at the Kalamazoo River approximately 0.2 miles away.

2.2.2. Axtell Creek Subwatershed Description

The Axtell Creek Subwatershed lies entirely inside of the City of Kalamazoo (http://www.kalamazooriver.net./pa319new/mgplan.htm#1 [A]). There are 1,519 acres in this subwatershed, located within the west-southwest portion of the city. Greater than half of these acres, including the areas surrounding Pikes Pond, Kleinstuck Marsh, Whites Lake and Woods Lake, contribute no surface water flow to the creek. The land uses of the drainage area are approximately 48% urban, 45% open space and forest, 4% water/wetlands and 3% agriculture. The artesian headwaters of Axtell Creek are found within the City of Kalamazoo Well Field #4, at the intersection of Maple Street and Crosstown Parkway. Pressure relief overflow from active wells provides a significant contribution to the base flow of the creek. The stream flows 1.24 miles from the well field through a channel along Crosstown Parkway to a series of large, shallow storm water detention ponds before discharging to Portage Creek. Over portions of its length, small sections of the creek are piped underground, especially under roadways. Much of the watershed is commercial with several mowed parks surrounding the ponds. Storm water drainage units contribute an approximate 815 acre-feet of runoff annually to the creek. Additional contributions to flow are from the fountain at the intersection of Howard Street and Crosstown Parkway, the ponds at Crosstown Apartments and storm sewers outlets. The discharge point is located within Upjohn Park. Portage Creek ultimately discharges to the Kalamazoo River, approximately 1.75 miles beyond its confluence with Axtell Creek.

2.2.3. Main Branch of Portage Creek Subwatershed Description

The Portage Creek Subwatershed lies within the Cities of Portage and Kalamazoo and in Texas Township, with the majority flowing through the City of Portage (http://www.kalamazooriver.net./pa319new/mgplan.htm#1 [A]). This 12.5-mile creek begins to flow west of US-131 in Texas Township to Hampton Lake. After exiting this lake the creek then curves, flowing generally in a northeast direction, through most of the City of Portage before coursing sinuously almost due north through the City of Kalamazoo, and into the Kalamazoo River. Several impoundments exist within this watercourse both in Portage and the City of Kalamazoo. The Schuring and Consolidated Drains contribute flow to Portage Creek in the City of Portage near South Westnedge Avenue. Both the West Branch of Portage Creek and Axtell Creek (each considered as separate sub-watersheds in this project) flow into Portage Creek within the City of Kalamazoo. The portion of the creek from the Bryant Mill Pond to the Kalamazoo River is listed on the USEPA's Superfund National Priorities List for PCB contaminated sediments.

Only 678 acres out of the 16,067 acres in the Portage Creek Subwatershed contribute no surface flow to the creek under any conditions. The non-contributing areas are typically due to municipal and private retention basins in the subwatershed. The drainage area includes land uses of approximately 21.3% urban, 52.4% open space and forest, 3.1% water/wetlands and 23.2% agriculture. In the City of Kalamazoo, storm sewers directly drain 2,215 acres into the creek and contribute 3,346 see Attachment acre-feet of runoff annually.

2.2.4. West Fork of Portage Creek Subwatershed Description

The drainage area for the West Fork of Portage Creek includes portions of Texas Township, Oshtemo Township, the City of Portage and the City of Kalamazoo (http://www.kalamazooriver.net./pa319new/mgplan.htm#1 [A]). The creek flows for approximately 8.1 miles in a general northeast to east direction from its headwaters at Scouters Pond in Texas Township to Portage Creek close to Milham Park in the City of Kalamazoo. Several impoundments and small lakes exist within the watercourse. The West Branch flows through the Rota-Kiwan Boy Scout Reservation, Kalamazoo Valley Community College, the Al Sabo Preserve (well field for the City of Kalamazoo), and suburban residential areas to the southern area of the Parkview Hills Planned Unit Development. Water stemming from the Asylum Lake area also connects to the West Branch through a series of small, linked ponds and wetlands near Parkview Hills. From here the stream flows through more ponds, residential neighborhoods, a small City of Kalamazoo well field, commercial properties in the Cities of Portage and Kalamazoo, to the Blanch Hull Preserve and the confluence with Portage Creek.

Of the 15,170 acres in the West Branch of Portage Creek Subwatershed, 8,778 were determined to contribute direct surface runoff and/or storm sewer flow to the creek. The non-contributing areas include municipal retention basins, private retention areas, Whites Lake in Kalamazoo, Crooked, Eagle, Duck and Pretty Lakes in Texas Township, and approximately 5,800 acres of rural, non-sewered land within this sub-watershed. The drainage area includes land uses of approximately 18.3% urban, 50.7% open space and forest, 7.7% water/wetlands and 23.5% agriculture. Drinking water pumping stations are known to impact the surface water levels and lower them if too much groundwater is pumped.

2.2.5. Lakes

The Portage-Arcadia subwatersheds includes a variety of lakes and surface water features ranging in size from 10-acre ponds to 190-acre recreational lakes. Many of the Portage-Arcadia watershed lakes are hydraulically connected (i.e., they have flowing inlets and outlets) with the surficial receiving waters of the four watershed creeks. As a result, these lakes have been categorically termed “contributing” lakes within the context of this project. The contributing lakes within the watershed deliver both hydraulic and pollutant loads downstream, thus imparting potential influences and impacts on downstream surface waters.

There are also many lakes in the watershed that do not have outlets connected with surficial receiving creeks in the watershed. Such lakes have been characterized as “non-contributing” lakes within the context of this project. Although they may not exhibit a surficial discharge to downstream surface waters, many of these lakes have at least one stormwater inlet (often many) from surrounding drainage areas. Since these water bodies do infiltrate to the underlying groundwater, their observed water quality, possible impairments and lake management goals are still of great importance to the watershed and the environment.

In all, there are thirteen (13) contributing lakes, eight (8) non-contributing lakes and five (5) surface water wetlands/marshes within the Portage-Arcadia watershed. The five major wetlands in the watershed also do not surficially contribute to the four Portage-Arcadia creeks. These wetlands/marshes are not identified as "lakes" within this narrative (despite the name of some of these water bodies). Attachment 1 details extensive information about the lakes in the Portage & Arcadia Creeks Watershed.

3.0. The Designated Uses Being Met and Desired Uses of the Watershed

Members of the Steering Committee were able to participate in any of four subwatershed groups established to better utilize stakeholder knowledge and skills. Among the first actions taken by each subgroup was the identification of the "Designated Uses" being met for each creek, as defined by Part 4, Part 31 of PA 451, 1994, revised 4/2/99. Designated Uses are recognized uses of Waters of the State established by state and federal water quality programs. All Waters of the State are to be designated and protected for all of the uses listed below. However, some uses are not met at all, some are met for only part of a watercourse and some do not apply. Each Subwatershed Committee addressed these issues, as well as identification of those designated uses that were "threatened" or "impaired". Threatened uses are defined as the types of activities that may impact a water body currently meeting a designated use such that it will not meet water quality standards in the future. Impaired uses are defined as verified and perceived concerns resulting in a designated use not being met. The designated uses are:

- Agriculture
- Industrial water supply
- Public water supply at the point of intake
- Navigation
- Warmwater fishery
- Other indigenous aquatic life and wildlife
- Partial body contact, recreation
- Total body contact, recreation between May 1 and October 31

Note: Certain water bodies are also protected as a coldwater fishery.

The Committees also developed additional "desired uses", those additional uses they would like to protect or improve the subwatersheds to meet. The additional desired uses are:

- Native vegetation/naturalization
- Unique habitats/riparian buffers
- Aesthetic and community amenity
- Flood control (capacity)
- Flood capability (transport)
- Flood prevention/control of storm water
- Permitted discharge compliance
- Public water supply, groundwater
- Public access and education

"Watershed/Water Quality Concerns", reason(s) why designated uses may not be met, and "Broadbased Stakeholder Goals" were also identified for each subwatershed. Tables illustrating the results of these efforts were developed for each creek and are available at http://www.kalamazooriver.net/pa319new/mgplan.htm#2 [E].

4.0. The Water Quality Threats or Impairments, Identified Pollutants and Sources

For those uses not being met, known or suspected pollutants and their sources were identified by members of the Subcommittees (http://www.kalamazooriver.net/pa319new/mgplan.htm#3 [F]). Sources were inventoried by reviewing historical and recent reports, water quality monitoring, surveying and scoring the stream corridors, locating and quantifying sediment loading from erosion "hot spots", mapping known sites of contamination along the creek corridors and estimating pollutant loading from the contributing subwatersheds and for storm sewered basin units.

4.1. Subwatershed Sampling Summaries

During 2001-2003, two ISCO Auto-Sampler stations were established within the watershed: at the mouth of Arcadia Creek and just upstream of the mouth of Portage Creek. This equipment records water levels at ten-minute intervals. Stage-discharge relationships have been established in order to calculate flows from the measured levels. A weir was installed at the Arcadia Creek outfall to simplify this calculation. The Auto-Samplers also record rainfall. They have been utilized to collect water samples for 10 wet weather events and to collect 100 baseline dry weather samples, so that annual pollutant loads could be calculated. Total suspended solids (TSS) and total phosphorus (TP) were quantified in the collected samples. Soluble reactive phosphorus was quantified in approximately 25% of the samples. Additionally, 27 grab sample stations were established along the creeks (Arcadia: 6, Axtell: 3, Portage: 13, West Fork: 5). Samples were collected from these stations during one wet weather and one dry weather event each season. Graphs detailing these events and maps illustrating the locations of the sample stations are available on the project website (http://www.kalamazooriver.net/pa319new/mgplan.htm#3 [G]).

Field personnel walked the creek corridors of all four subwatersheds in order to visually assess their conditions during the development of the Watershed Management Plan. The corridors were divided into "stretches" based on similar land use and corridor condition. Each stretch was assigned a score (0-3) for each of 10 physical, observable parameters, for a maximum stretch score of 30. Maps of stretches referred to in the following sections are available at:

- Arcadia http://www.kalamazooriver.net/pa319new/arcadia/arcadia.htm [H]
- Axtell http://www.kalamazooriver.net/pa319new/axtell/axtell.htm [H]
- Portage http://www.kalamazooriver.net/pa319new/portage/portage.htm [H]
- West Fork Portage http://www.kalamazooriver.net/pa319new/wfork/westfork.htm [H]

A synopsis of the sampling results for each subwatershed follows.

4.1.1. Arcadia Creek Sampling Synopsis

- Dry weather Total Phosphorus (TP) loading through downstream City of Kalamazoo areas is notable; especially downstream of Arcadia Creek Festival Site (Stretch #16).
- Wet weather TP concentrations are elevated in upper reaches (Stretch #'s 1-8); these concentrations triple in downstream urban areas (Stretch #'s 9-16). Flows increase in a similar manner.

Summary:

Upstream areas (above the downtown channel): Drainage area requires storm water management including flow reductions and flood plain expansion. Corridor improvements also needed due to severe streambank erosion and poor riparian management.

Downstream areas: Illicit connections, storm water management improvements needed.

4.1.2. Axtell Creek Sampling Synopsis

- Baseline dry weather upstream TP concentrations are elevated compared to other creeks.
- High dry weather TP concentrations are noted immediately above Crosstown Ponds.
- Substantial TP and TSS wet weather loads enter the creeks above Crosstown Ponds.
- Ponds appear to generally serve as 'sinks' of TP and TSS.

Summary:

Upstream (headwater) areas: Illicit connections are a concern; improved riparian management needed.

Downstream areas: Improved riparian and storm water management and capacity of Crosstown Ponds needed.

4.1.3. Portage Creek Sampling Synopsis

- Temperature increases associated with Pharmacia cooling water discharge have generally been mitigated with partial diversion of the discharge away from the creek in Stretch #9.
- Low dissolved oxygen levels are periodically noted in the Oakland Drive area (Stretch #2) associated with stagnant conditions and warmer temperatures.
- Residential, commercial and/or transportation activities at and above Centre Avenue (Stretch #5) contributing higher levels of wet and dry weather TP.
- Schuring Drain, adjacent to the Consolidated Drain, (Stretch #8) is still a large contributor of TP and TSS during wet weather.
- Milham Park (Stretch #10) consistently shows wet weather increase of TP and TSS associated with storm water outfalls, sheet flow runoff and severe bank erosion.
- Storm sewered sections of Portage Creek through the City of Kalamazoo are substantially impacted by storm water contributions.

Summary:

Upstream areas: Riparian area management needs; Schuring Drain discharge impacts.

Midstream areas: Milham Park Best Management Practices (BMP's) needed to address loadings.

Downstream areas: Urban storm water will require long-term management/improvements.

4.1.4. West Fork of Portage Creek Sampling Synopsis

- Good water quality observed through most of the stream reaches (Stretch #'s 1-7) until downstream reaches in commercial areas near S. Westnedge and Kilgore (Stretch #'s 8 & 9) where notable wet weather increases in total phosphorus and total suspended solids are observed.
- Some wet weather increases in total phosphorus noted near Oakland Drive. Wet weather flow increases notable in downstream commercial areas from storm sewer inflows.

Summary:

Upstream areas: Improved riparian management; some localized storm water management needed at road crossings.

Downstream areas: Wet weather flow/load reductions needed through BMPs, structural controls and riparian improvements.

4.2. Subwatershed Monitoring 2003 - 2005

The Portage and Arcadia ISCO automated monitoring devices were operated and collected flow and rain data between 2003 and 2005. Rainfall and flow were graphed and are available in Attachment 2. The raw monitoring data have been added to the project database. Water quality samples were not collected.

Yellow Springs International (YSI), a manufacturer of water quality monitoring devices, had agreed to donate the use of experimental real-time phosphorus monitoring equipment. YSI beta testing of their unit was unsatisfactory. The project team met with YSI technicians, but decided not to use the instrumentation that all had hoped would be available and reliable for deployment in conjunction with the Portage and Arcadia ISCO automated monitoring devices.

Section 5.0. Quantification Efforts to Identify Sources and Prioritize Efforts

Stretches were identified for each subwatershed watercourse. A qualitative, reproducible scoring system was developed and applied to describe stretch characteristics and changes over

time. Various efforts were undertaken to quantify non point sources in the watershed. These efforts are described in the following sections.

5.1 Stretch Identification and Scoring

Field personnel walked the creek corridors of all four subwatersheds in order to visually assess their conditions during the development of the Watershed Management Plan. Photographs were taken for the website's "Tour Your Watershed" component. The corridors were divided into "stretches" based on similar land use and corridor condition. Each stretch was assigned a score (0-3) for each of 10 physical, observable parameters, for a maximum stretch score of 30. These scores were utilized to identify priority areas. The site selection process started with a review of the scoring results for the stream corridors of each creek. High scores were reflective of "good" conditions. Discussions focused not only upon these stream corridor conditions, but also on any upland opportunities that would reduce direct storm water contributions to the creek. Consideration of suitable BMP options for conditions at sites of concern included consideration of the greatest community benefit and a "maximum return" on any investment in improvements. Stretch numbers run sequentially from the source of the watercourse to the mouth of the creek. Numbers in the following summaries correspond to the same stream segment numbers found in the website's tables. Members of the Steering Committee aided in the evaluation of these stretches and the development of the methodology. Please refer to the website for additional supportive information on flow path and locations described in the following text. The following parameters were scored:

- shading
- sinuosity
- connection to floodplain
- erosion
- litter
- riparian width and quality
- water clarity
- development pressure
- substrate
- number of discharge points

Maps of stretches referred to in the following sections are available at:

- Arcadia http://www.kalamazooriver.net/pa319new/arcadia/arcadia.htm [H]
- Axtell http://www.kalamazooriver.net/pa319new/axtell/axtell.htm [H]
- Portage http://www.kalamazooriver.net/pa319new/portage/portage.htm [H]
- West Fork Portage http://www.kalamazooriver.net/pa319new/wfork/westfork.htm [H]

5.2 Runoff from the Subwatersheds and Storm Sewer Drainage Units

The WMP relies on empirical nonpoint source loading estimates of the contributing areas [A] (areas defined by topography and surface water connections) of the subwatersheds (Arcadia, Axtell, Portage and the West Fork) to predict annual runoff volume and loads of pollutants to the creeks. Pollutant loading was estimated based on subwatershed area, land cover and soil types,

for each subwatershed. Runoff volume estimates from the contributing subwatersheds were generated using the USDA Technical Release-55 Method (USDA, 1993). Pollutant loads were quantified using event mean concentrations (MI-ORR, 2002).

Storm sewer drainage units in the City of Kalamazoo were delineated based on available maps of the storm sewer infrastructure before 2002. The City of Kalamazoo completed its most recent storm sewer asset inventory in 2002. In 2004, updated maps were generated (Attachment 3) using the new infrastructure maps and used to calculate stormwater volume contribution to the creeks. Runoff volume estimates from these storm sewer drainage units generated using the USDA Technical Release-55 Method (USDA, 1993). Pollutant loads were quantified using event mean concentrations (MI-ORR, 2002). This effort was intended to identify areas having high pollutant loads to the creeks, so that BMPs could be directed toward reducing those loads. Modeled runoff volume estimates from subwatershed contributing areas and storm sewer drainage units are shown in the following table. The Storm Sewer Drainage Unit column in the table identifies the runoff directly piped to the creeks by storm sewers. The percent of this volume or load in relation to the total Contributing Area is also reported.

Table 5.2.1. Stormwater Runoff Volume Estimates from Contributing Areas of the Subwatersheds and from Defined Storm Sewer Drainage Units.

Subwatershed	Contributing Area Volume (acre-feet/year)	Storm Sewer Drainage Unit Volume (subset of Contributing Area loading (acre-feet/year)
Arcadia Creek	5,842	2,362 40% of contributing area volume
Axtell Creek	914	815 89% of contributing area volume
Portage Creek	14,943	3,346 22% of contributing area volume
West Fork of Portage Creek	8,535	552 6% of contributing area volume

The comparisons of runoff volumes from the storm sewer drainage units to the contributing watersheds indicate that the Axtell Creek Watershed is heavily storm sewered. Ninety percent of the modeled storm water runoff in this watershed is generated from storm sewered areas. In contrast, only 40% of the Arcadia Creek Watershed is estimated to be piped directly to the creek. The remaining areas discharge to other off-line ponds or are not storm sewered. In the Portage Creek Watershed, much of the drainage falls in the City of Portage, where storm water retention/detention is required for new developments. The majority of the watershed in the City of Kalamazoo is directly piped to the creek. Some areas were identified as not sewered, or as discharging to disconnected areas, such as the former Bryant Mill Pond.

5.3 Streambank Erosion

Sediment and phosphorus loading from streambank erosion was also quantified and included in the total loading estimates for each stretch, where available. Previously identified high- and medium-priority sites of erosion were revisited by field staff (Attachment 4). Measurements of the site geometry, an estimation of erosion severity and an analysis of the soil texture were recorded for each site. The MDEQ Lateral Recession Rate (MDEQ, 1999) was used to calculate the annual loading of sediments from each site. This method relies on measurements of the height and length of the site of erosion and a visual observation of the erosion severity. The severity is determined by the appearance of the streambank and the presence of rills, overhanging vegetation and exposed tree roots. The erosion severity is translated into an estimated lateral recession rate (the distance the streambank is expected to recede on an annual basis). An average TP concentration for soils in the Kalamazoo River Watershed (1.028 lb TP/ton soil, based on a streambank project funded by the Clean Michigan Initiative, 2002) was applied to each calculated sediment load to produce a TP load from each steambank.

5.4. Estimations of Pollutant Load Reductions from Completed Projects

Pollutant loading for an earlier Version of the WMP was based on a 2002 baseline condition in the watershed assessed during the original phase of the planning project. New implementation projects have been conducted since that time, especially in the Axtell Creek Watershed. These new projects were identified based on fieldwork and Steering Committee input. Attachment 5 lists each new project, the associated benefits, the annual load reduction and the new stretch score, if applicable. Of the 13 new projects, quantification tools cited above were used to document a total of 208 pounds of annual phosphorus reduction and 153 tons of annual sediment reduction in the Portage-Arcadia Creek Watershed. Approximately 1.6 acre-feet of runoff (0.2% of the total annual average runoff) is now retained annually by a BMP (a rain garden) installed in the Axtell Creek Subwatershed. Stream stretch scores improved in three stretches of Arcadia Creek, three stretches in Axtell Creek and two stretches in Portage Creek.

5.5. Summary of Loading from Contributing Watersheds, Storm Sewer Areas, Streambank Loading and New Projects

The Stretch Loading Tables in Attachment 6 detail loading results in each stretch of each subwatershed. Identified storm sewer drainage loading, streambank loads and load reductions from new projects (that occurred between 2002 and 2004) are identified. However, the reported total TSS load reductions from new projects do not reflect those reductions because they are based on a 2002 baseline. The new projects have occurred since 2002 and demonstrate load reductions that can be achieved through additional implementation projects.

The following tables summarize TSS and TP loading from the whole contributing subwatershed as well as loading from storm sewer drainage units and streambanks. These calculated loads are also compared to previous loading estimated with the ISCO auto-samplers.

Table 5.5.1. Total Suspended Solids Loads from Storm Water Runoff and Streambank Loads (tons/year)

Subwatershed	Storm Sewer Drainage Unit Loads (subset of contributing watershed load) (tons/year)	Modeled Contributing Watershed Runoff Loads (tons/year)	Eroding Streambank Loads (tons/year)	Total Current Load (Contributing Watershed Runoff + Streambanks) (tons/year) Columns 3 + 4.
Arcadia	267 40% of contributing load	660	268	928 ISCO wet weather: 700, dry weather: 12.6
Axtell	83 90% of contributing load	92	48	140
Portage	365 (lower) 22% of contributing load	1,673	204	1,877
West Fork	40 (lower) 4% of contributing load	936	8.5	945
Total Portage Creek (Axtell, Portage, West Fork)		2,701	258	sum of above: 2,962 ISCO wet weather: 1610 dry weather: 475

Table 5.5.2. Total Phosphorus Loads from Storm Water Runoff and Streambank Loads (pounds/year)

Subwatershed	Storm Sewer Drainage Unit Loads (subset of contributing watershed	Modeled Contributing Watershed	Eroding Streambank Loads	Total Current Load (Contributing Watershed Runoff + Streambanks)
Arcadia	1,817 44% of contributing load	4,117	273	4,390 ISCO wet weather: 2,387 dry weather: 380
Axtell	538 90% of contributing load	598	50	648
Portage	2,512 (lower) 29% of contributing load	8,771	210	8,981
West Fork	256 (lower) 5% of contributing load	5,432	9	5,441
Total Portage Creek (Axtell, Portage, West Fork)	3306 (lower) 22% of contributing load	14,751	2687	sum of above: 15,000 ISCO wet weather: 8,473 dry weather: 3,940

The comparisons of total modeled loads (contributing area runoff plus streambank loads) with annual loads measured with the ISCO auto-samplers indicate that 60-80% (depending on watershed and pollutant) of the estimated monitored loading was realized at the mouth of the creek. This is expected because each creek contains in-line ponds, which slow flows and retain sediments. The modeling does not account for in-stream dynamics. An additional factor is seasonality, which can affect loading for the year sampled (2002). Streambank erosion was found to constitute a major source of TSS and TP loading to stretches in Portage and Arcadia Creeks.

5.6 Total Stretch Loading Charts

In order to illustrate the relative storm water loading to each stretch, pie charts were created. Those stretches receiving the greatest storm water loads were identified. A corresponding pie chart for each of those stretches illustrates the distribution of runoff from each urban land use type. This information aids in targeting suitable BMPs to treat storm water runoff. Similar charts illustrate relative TSS and TP loading to the stretches. These charts also include loading values from streambank erosion. When these eroding streambank data are considered, loading in areas with severe erosion, such as Milham Park along Portage Creek and Kalamazoo Christian High School (KCHS) along Arcadia Creek, becomes a much larger percentage of the total load then when storm water runoff alone is considered. See Attachment 7 for pie charts.

Table 5.6.1, below, lists the stretches from each creek receiving the greatest amount of storm water runoff, TSS loading and TP loading and the associated source of loading. These estimates were only calculated for Arcadia Creek, Axtell Creek, the lower portions (Stretches 10-18) of Portage Creek and the middle/lower portions of the West Fork in the City of Kalamazoo (Stretches 3, 4 and 8) because these areas are storm sewered with no municipal requirements for retention. Many portions of the West Fork lie in the City of Portage and Texas Township, where stormwater retention is required. Three drainage units were delineated for the City of Kalamazoo portion of the West Fork. Water withdrawals in the lower section (Stretch 7) of the creek also greatly impact the creek by diminishing baseflows in dry weather periods.

Table 5.6.1. Storm sewered creek stretches with greatest runoff and pollutant loading.

Subwatershed	Stretch with Greatest Storm Water Runoff Volume	Stretch with Greatest TSS Loading	Stretch with Greatest TP Loading
Arcadia	16 (Downtown, 22% of sewered runoff, 83% of runoff is from commercial areas)	8 (KCHS, due to 151 tons/year from streambanks)	16 (22% of sewered load)
Axtell	5 (Crosstown Ponds, 47% of sewered runoff, 61% of runoff is from commercial areas)	5 (due to streambank erosion, some of which has been repaired since 2002 baseline)	5
Portage (lower)	16-18 (Downtown commercial areas, 29% of sewered runoff) 11 (Monarch Mill Pond, 24% of sewered runoff)	10 (over half from streambank erosion and overland flow from parking lot across grass)	16-18 (32% of sewered load)
West Fork Portage Creek (middle/lower)	3 (Parkview Hills, 74% of sewered runoff, greatest runoff due to largest drainage area)	3 (49% of sewered load)	3 (57% of sewered load)

5.7 Additional Quantifications Completed

Additional quantifications were conducted between 2004 and 2006. Complete details of investigations already mentioned are available in the following attachments:

- BMP monitoring (Attachment 8)
- Rain Barrel Demonstration Project (Attachment 9)
- Neighborhood Rooftop Runoff Survey (Attachment 10)
- Major Landholders Survey (Attachment 11)

Each additional quantification investigation is introduced briefly in the following sections.

5.7.1 BMP Monitoring

Limited wet weather sampling of stormwater runoff was conducted at existing and future Best Management Practice (BMP) sites within the Portage-Arcadia Creek Watershed. The Portage-Arcadia Steering Committee recommended these sampling locations during regular meetings held in 2004 and 2005 to evaluate current BMP treatment effectiveness (and/or opportunity for future treatment) of stormwater runoff for parameters of interest (Attachment 8).

The Kalamazoo Water Reclamation Plant (KWRP) agreed to process samples in their laboratory as an in-kind contribution to the project qualifying as local match. All sample collection, sample handling and data analysis has been performed in accordance with the Quality

Assurance Project Plan (QAPP) approved by the Michigan Department of Environmental Quality (MDEQ) on November 1, 2005 (Attachment 8).

Multiple locations were sampled during wet weather events including: 1) Milham Park Runoff; 2) AquaSwirl-in; 3) AquaSwirl-out; 4) Loy Norrix Outfall; 5) Maple St. Rain Garden; and 6) Pfizer Curb Cut. Composite samples were collected from locations 2, 3 and 4 given their relative likelihood of prolonged runoff flows during rain events. Discrete grab samples were collected from locations 1, 5 and 6 to characterize the more infrequent, excess runoff generated from each of these sites. Stormwater runoff from each site was sampled on at lease one occasion. Event Mean Concentrations of TP and TSS were calculated and are presented below:

Location	**TP EMC mg/L**	**TSS EMC mg/L**
Site #1 Milham Park Runoff	0.47	300
Site #2 AquaSwirl-In	0.01	155
Site #4 Loy Norrix Outfall	0.3	66
Site #5 Maple St. Rain Garden	0.02	4.4
Site #6 Pfizer Curb Cut	0.04	2

Attachment 8 contains full details of the BMP sampling exercise. While initial data are helpful for targeting problem loading areas, the data collected during these BMP sampling efforts are limited to three storm events (all below 0.35 inches) and should be considered initial findings. Additional sampling is recommended if more detailed evaluation of loading is desired for a particular site.

Seasonal influences (i.e., spring, summer, fall) should also be identified to obtain more accurate EMCs related to each sampling site. Other considerations such as use of automated sampling equipment, first flush characterization, quantification of peak flows, rainfall intensity and storm duration should be are fully contemplated if more detailed monitoring data is desired. Overall, it was determined that proposed BMPs for Milham Park and Loy Norrix High School will be beneficial given measured EMCs at or above national averages.

5.7.2 Rain Barrel Demonstration Project

As part of the Portage and Arcadia Creeks 319 - Transition Grant Project, reduction of downspout rainwater flowing onto the hard surface collection system in the neighborhood and then into Axtell Creek, was identified as an educational deliverable. Geum Services Inc. was contracted to contact likely residents in this neighborhood and assess interest and willingness to participate in such a demonstration project. The second step in the process was to assemble

necessary materials. The third step was to assist willing participants to prepare their barrel(s), (when requested), and provide follow-up to document placement and evaluate participation in this pilot project, with a goal of providing additional information to assist in any follow up rain barrel/downspout disconnect program.

A Pilot Project to disconnect downspouts from direct access into Axtell Creek in the Hillcrest Neighborhood was conducted in August, September, and October of 2005. Sixteen (55 gallon) Rain Barrels were prepared and delivered to willing volunteer participants in this neighborhood. A total of twenty-three area residents were contacted and eleven accepted those sixteen barrels. The barrels will capture run-off from an estimated 7550 square feet of roof area. At the end of October 2005, seven barrels had been installed. The remainder did not want to make downspout modifications prior to the winter season and postponed hook-up of their barrel until 2006.

Materials cost $600.87, which included seven donated barrels. When taking into account all project costs, per barrel expense (for sixteen installed barrels) was $140.05. Actual materials expense was on a per barrel basis $37.55.

Attachment 9 contains a full account of the rain barrel/downspout disconnect program effort. In addition, based on the estimate provided in the November 2005 report (Geum Services Inc., 2005), runoff from 7,550 square feet of roof area would be captured with the installation of rain barrels. Using an annual rainfall for the Kalamazoo area, this would equate to approximately 0.5 ac-ft of runoff. The Hillcrest neighborhood is located in storm sewer drainage unit 3 of the Axtell Creek watershed. K&A calculated the annual runoff from this storm sewer drainage to be 139.3 ac-ft/yr. The downspout pilot program will remove approximately 0.4% of the annual stormwater runoff from storm sewer drainage unit 3 (See Table in Attachment 9).

5.7.3 Neighborhood Rooftop Runoff Survey

Source reduction of storm water runoff is necessary to reduce pollutant loading and storm water volumes in urban watersheds. Many cities faced with impacts from combined sewer overflows, including Dearborn, MI; Washington, DC and Toronto, Ontario, have turned to residential rain barrels as a method to reduce runoff to the sewer system (DFP, 2003, DCWASA, 2001). The Detroit Water and Sewerage Department estimates an average-size roof connected to a rain barrel can collect 4,000 gallons of rainwater from April through August (DFP, 2003). In order to determine the degree to which a similar downspout disconnection program could reduce storm water loads in the Portage-Arcadia Creek Watershed, six test neighborhoods were surveyed from the street. The percentages of downspouts draining to underground pipes, driveways and lawns were estimated. (Downspouts were observed from the street with the assumption that downspouts in the rear of each residence drain to lawn areas.)

These percentages were then applied to the total number of residences in that drainage unit which was determined using the City of Kalamazoo online mapping system. It was estimated from field observations that the observed downspouts on the street side of the residences captured runoff from one-third of the roof top area. An average roof top area was also estimated, based on literature (DCWASA, 2001). The annual rainfall that could be captured or

diverted from the storm sewer system by redirecting/disconnecting those downspouts draining to driveways or underground pipes was estimated and compared to the total runoff for that drainage unit. The greatest percent diversion realized was 15.2 percent of the storm water volume. The smallest was 0.05% in a neighborhood in which few houses had eave troughs. These data are included in Attachment 10 and illustrate the potential effectiveness of downspout disconnection programs in reducing storm water flows to the creeks.

5.7.4 Major Landholders Survey

One element that was pursued under this task related to opportunities related to downtown Kalamazoo areas to incorporate stormwater BMPs. Attachment 11 contains summary work products focused on ongoing efforts to identify City of Kalamazoo (vacant) properties where future use might include options for stormwater detention, infiltration or treatment. Attachment 11 also includes a list of such properties derived through interactions with the City of Kalamazoo.

This attachment also includes a synopsis of Pfizer properties (a major downtown landholder) in Kalamazoo that focuses on the amount of impervious surfaces, and the related hydraulic and pollutant loads from this one landholder. The long-term interest is to identify these in relation to other stormwater loads and have the information available to Pfizer and the community for future site-specific stormwater improvements. Additionally, it is to help illustrate the general need to pursue source reduction, infiltration and treatment policies beyond the city's current requirements for "stormceptor" types of installations for new or reconstructed parking lots.

K&A identified all Pfizer-owned properties located in the City of Kalamazoo. Twelve properties, totaling 33.75 acres, were identified within the City limits. All the parcels are located in Portage Creek subwatershed Stretch #18. The parcels ranged in size from 0.02 acres to 10.84 acres. Using the City of Kalamazoo on-line GIS mapping tools, each Pfizer-owned parcel was divided into pervious and impervious areas. Annual stormwater runoff volumes were calculated for each parcel along with annual total suspended solids (TSS) and total phosphorus (TP) loads. On those parcels where stormwater best management practices (BMPs) were deemed feasible, additional calculations were completed showing stormwater treatment volumes at various excavation depths.

The 12 Pfizer properties contribute 70.6 ac-ft of runoff to Portage Creek annually, which constitutes 23% of the Portage Creek subwatershed Stretch #18 annual runoff. The TSS load from these same properties is 6,166 lb/yr and the TP load is 25 lb/yr.

5.8 Additional Quantifications Desired

The Steering Committee continues to look for opportunities to tie construction load quantification and land use changes into the Watershed Management Plan with partners such as Kalamazoo Area Homebuilder's Association, the Kalamazoo Conservation District. Desired efforts will focus on quantification of TSS and TP contributions from typical, temporary

construction operations, as a baseline. Tracking, inspection and educational programs to reduce off-site impacts of construction sites were not pursued.

Urban waterfowl populations have been noted in the watershed at nuisance levels. Specifically, significant populations exist at the Crosstown Ponds in the Axtell Creek Subwatershed and at Milham Park in the Portage Creek Subwatershed. It has been estimated that one Canada goose can deposit 0.5 pounds of phosphorus annually in its feces (PACD, 2004). (A range of 0.36 to 0.77 pounds/goose/year was found in the literature.) This can represent a significant localized phosphorus load. Waterfowl can also contribute pathogens to the watershed. However, estimates of waterfowl populations were not readily available for past or the present. Therefore loading reductions associated with waterfowl reductions were not calculated. Future work to this end might utilize Kalamazoo Nature Center Bird Counts, Milham Park Bird Rescue Counts, or site specific surveys.

5.9 Quantification Tools

Web resources for quantifying pollutant loading and for mapping watersheds were compiled and made available for reference on the project website at http://www.kalamazooriver.net/pa319new/quant_toools.htm. Those quantification tools and mapping resources used in the Transition Grant include:

- Michigan Trading Rules
- MDEQ Pollutants Controlled Manual
- City of Kalamazoo and City of Portage Parcel Mappers
- U.S. Geological Survey GIS Data
- Michigan Center for Geographic Information GIS Data

5.10. Stretch Scoring and Narratives

Attachment 12 contains a lengthy, detailed narrative covering each stretch in each subwatershed. Elements of the narrative include:

- Description of the stretch
- Scoring of the stretch and any changes in scoring resulting from rehabilitation efforts
- Impacts of any issues identified in the stretch
- Recommendations resulting from Steering Committee discussions
- Updates of any work that is ongoing or has been completed at locations within the stretch

5.11. Conceptual Projects

In preparation for potential grant opportunities with the State of Michigan in April 2004, K&A began to prepare several conceptual stormwater BMP scenarios for seven different sites within the Portage and Arcadia watershed for discussion and consideration by the Steering Committee. These potential implementation sites included the following locations: Axtell Creek headwaters (City-owned property), Axtell Creek headwaters (Maple School KPS property), Axtell Creek (National City property), Milham Park (City-owned property), Loy Norrix High School (KPS property), Milham Golf Course (City-owned property), Portage Creek headwaters

(Oakland Drive private property), Arcadia Creek (Kalamazoo Christian property). During a 2½-month period, K&A prepared conceptual design sketches, stormwater BMP load reduction estimates, construction cost estimates and a series of conceptual before and after photos for each of these sites in accordance with the Portage-Arcadia Watershed Management Plan. Detailed text, figures and images are available in Attachment 13.

Axtell Creek Headwaters (Stretch #1)

- Off-line stormwater detention opportunities were identified for multiple outfalls near the headwaters of Axtell Creek.
- The City of Kalamazoo owns approximately 9.5 acres of property at the Axtell Creek headwaters (municipal well field #4 located between Maple Street, Hudson Street, Peeler Street and Bronson Blvd). Refer to Figure 2, Attachment 13.
- If the Bronson Blvd (drainage area #1) and Hudson Street (drainage area #2) storm sewer outfalls were to be rerouted within the municipal well field property, the 100-year storm volume to Axtell Creek from these two drainage areas could be reduced by approximately 31.7% (that's 31.7% of the 100-year storm volume from both drainage areas). This combination would amount to 6.8% of the 100-year storm volume of runoff from the entire 663 acres of the contributing areas of the Axtell Creek subwatershed.
- The South Maple Street Magnet School for the Arts (Kalamazoo Public Schools) has expressed interest in continued participation with environmental related projects to enhance and protect Axtell Creek along Crosstown Parkway.
- If the Maple Street storm sewer outfall (drainage area #3) is rerouted within the southeastern portion of the school's riparian property, the 100-year storm volume to Axtell Creek from this drainage area could be reduced by approximately 31.6% (that's 31.6% of the 100-year storm volume from this drainage area). This 5.2 ac-ft capture volume would amount to 2.5% of the 100-year storm volume of runoff from the entire 663 acres of the contributing areas of the entire Axtell Creek subwatershed.

Axtell Creek (Stretch #4)

- K&A provided limited technical recommendations to the Kalamazoo Area Chapter of the Wild Ones regarding streambank toe protection and native plant installation along the southern streambank of Axtell Creek, Stretch #4.
- The Wild Ones Chapter was preparing to install native vegetation along approximately 20-30 feet of this riparian corridor adjacent to Paris Cleaners (approximately 300-400 ft2).
- K&A prepared general recommendations for soil stabilization of the streambank toe utilizing vegetated coconut fiber rolls (a.k.a., wrapped plant rolls).
- This BMP method of streambank bioengineering can be accomplished within a very reasonable budget and volunteer labor (no professional landscaping expertise is required).

Axtell Creek (Stretch #5)

- K&A prepared three scenarios for discussion and consideration for feasibility of implementation along Axtell Creek within the portion of open channel between Westnedge Avenue and Burdick Street (behind the National City Bank).

- The basic themes of these scenarios are the same which include: streambank stabilization through dense vegetative planting, parking lot infiltration trenches and small bioinfiltration rain gardens to accommodate direct runoff from impervious surfaces.
- Based on the existing conditions and projected needs along the initial portion of open channel at the underground outfall location, different options (for cost purposes) are presented to accommodate the heavy scouring that currently takes place along streambanks of the National City asphalt parking area.

Arcadia Creek (Stretch #8)

- This highly manicured and high pedestrian traffic riparian area is subject to on-site and off-site storm sewer and sheet flow runoff contributing to highly eroded and steeply incised creek banks.
- The annual contribution of sediment loading to Arcadia Creek (152 tons) is similar to the amount of sediment removed annually or semi-annually from the downstream "Arcadia Creek Festival Site" pond.
- Implementation of WMP BMPs will result in substantial downstream water quality benefits.
- Installation of 1,243 feet of riparian buffer protection with native plants.
- Permanent educational signage to describe these BMP approaches and benefits.
- Reduction of 156 lbs TP/yr.

Portage Creek (Stretch # 1)

- In communicating with another local engineering firm, K&A identified an opportunity to suggest concepts and ideas to a developer for a buffer enhancement project along a portion of Portage Creek west of Oakland Drive.
- This large private parcel, which is now being converted into a multi-unit housing development, will generate stormwater runoff.
- This site presents opportunities for the implementation of innovative stormwater BMPs.
- Riparian wetlands exist on this property and should also be considered for enhancement and long-term preservation within site development plans.

Portage Creek (Stretch #10)

- This is a highly used public park area with severely eroding streambanks associated with poor riparian management, overland and storm sewered runoff, and human foot-traffic as well as nuisance waterfowl traffic.
- With the exception of bioengineering streambank restoration, WMP recommended BMPs could be installed with implementation funds at this site.
- These BMPs include: a continuous riparian buffer of native vegetation along upland streambanks of Portage Creek; bioinfiltration planters/rain gardens to capture on-site surface runoff; parking lot subsurface infiltration trenches; diversion of existing stormwater outfalls into a new wetland/rain garden area; installation of vegetative plugs in highly visible rain garden areas; photodegradable erosion control blankets; temporary fencing to protect new vegetation, and; permanent educational signage to describe these BMP approaches and benefits.

- In addition, approximately thirteen acres of impervious surfaces for the adjacent Loy Norrix High School can be redirected from a storm sewer and creek discharge into two on-site infiltration rain garden areas, also constructed with implementation funds.
- Implementation 6,900 feet of riparian buffer protection with native plants.
- Up to 0.35 acres of bioinfiltration areas with decorative native plantings.
- 1.4 acres and 0.9 acres created wetlands/rain gardens to filter pre-treated roadway/parking lot runoff.
- Waterfowl exclusion/decreases in resident populations through riparian management.
- Reduction of 13.3 lbs TP/yr; reduction of 2.2 tons sediment/yr.

6.0 Water Quality Protection Goals

Water Quality Protection Goals were identified by Subwatershed Committee members (http://www.kalamazooriver.net/pa319new/mgplan.htm#6 [I]). For the Transition Grant, a Water Quality Protection Potential score was developed with the Technical Subcommittee (Attachment 14). A score of 0-3 was assigned. The highest score calculated (2.2) was noted in three stretches: the West Fork and Axtell Creek headwaters (WF1 and AX1, respectively) and wetland areas along Oakland Drive (PC3).

7.0 Tasks to Address Impairments and the Associated Costs

Impairments are to be addressed through a combination of Best Management Practices (BMPs), ordinance recommendations and educational efforts. An Education Subcommittee was established for this project. The Committee developed and updated an education plan, which can be reviewed on the project website in Section 8.0. The website also includes links to educational resources and educational presentations created by KIESER & ASSOCIATES staff. One component of the site overlays the watershed boundaries on City of Kalamazoo neighborhoods, aiding residents in locating themselves within the watershed. The Links page of the project website also includes information on storm water technologies, ordinances and practices residents can do to protect watershed health. The current municipal ordinances (of the four municipalities within the watershed) were evaluated for their applications to watershed management. Discussions of Best Management Practices, local ordinances and the education plan follow below.

7.1 Best Management Practices

Based on the Stretch Scoring Summary component, BMP's were proposed and priced for each stretch. They included structural, vegetational, preservation, policy and education. Tables of the suitable BMP's and their costs are available on the web site and in Attachment 15. In 2004 the tables were updated to include a water quality improvement potential, loading from stormwater runoff, streambank loading, load reductions estimated from new projects, and riparian landowner information (Attachment 15). Where upland infiltration structures are recommended for the stretch, but not at a specific locale, the entire annual stormwater runoff volume and nonpoint source loads calculated for that stretch are reported in the BMP Tables. Completed projects are also noted in the BMP Tables.

A schedule for each practice identified was included in the original BMP tables. No changes to the schedules were made based on an October 25, 2004 Steering Committee meeting. Items in the BMP Tables were identified as having a short-term (0-3 years) or long-term priority (4-15 years). Prioritized milestones were given target dates ranging from 2006 up to 2010.

The Steering Committee reviewed these tables and selected priority stretches. Additional BMP details and cost information were generated for those stretches where structural or vegetational implementation work will be targeted. The discussion of specific recommendations for each stretch as well as ongoing, completed and planned projects was included above in the Stretch Scoring Summary (Attachment 12).

7.2 Estimations of Pollutant Load Reductions from Potential Projects and Demonstration Projects

The BMP Tables developed in the Version I WMP were updated to include columns listing the potential runoff volume reductions and TSS and TP load reductions for proposed projects. Load reductions are listed for streambank restoration projects, based on the identified loading from those streambank sites and the assumption that an improvement project would eliminate that loading. For infiltration projects listed in the BMP tables in which a specific locale is not determined, the runoff volumes and storm water TSS and TP loadings from the appropriate stretches were listed as maximum potential reductions. Where a specific site is listed, such as the Loy Norrix High School parking lot in Portage Creek Stretch 10, the annual runoff volume and pollutant loading values calculated for just that site are listed.

Load reductions that could be realized from building wet and dry detention ponds to capture urban storm water runoff were also calculated for the stretches with identified storm sewer drainage units (Arcadia, Axtell, lower Portage Creek and lower West Fork). Specific locations were not identified because the objective of this exercise was to illustrate the land needed to provide sufficient pond volumes and the associated costs. The results portray the significant investment needed for retrofitting the urban environment to treat storm water. Estimates of pond efficiency from the Michigan Trading Rules (MI-ORR, 2002) were used to calculate annual TSS and TP pollutant reductions for capturing fifty-percent of the runoff from a 2-year, 24-hour storm (or smaller) from urban land uses in each stretch. Attachment 16 includes these estimates. The most downstream portions of Arcadia and Portage Creeks had the most potential to reduce TP loading with wet ponds. This is due to the highly urbanized nature of these areas. In the Axtell Creek Watershed, Stretch 5 had the most potential to reduce TP, due to the size of the drainage units in that stretch and the urbanized nature of those units. In the West Fork, Stretch 8, which captures runoff from South Westnedge Avenue, could reduce the most TP loading with wet ponds. Although, the drainage in Stretch 3 (Parkview Hills) was much larger (386 vs. 77 acres), it does not have as much potential for TP load reductions as Stretch 8 because the area is not as urbanized. Storm water in Stretch 3 also discharges to lakes and wetland areas, which may reduce the pollutants reaching the downstream creek corridor; although these surface water resources should also be protected.

The Version I BMP Tables listed responsible parties for each recommended BMP. They also listed associated cost ranges. For the update, costs for installing wet and dry detention ponds to capture and infiltrate fifty-percent of the urban runoff from each stretch were calculated for those storm sewered stretches with no municipal retention requirements, i.e., those targeted in the Attachment 16 materials. Costs were annualized over a 30-year period and include both capital and operation/maintenance expenditures (Rouge, 2001). Wet pond costs were also included in the updated BMP Tables. Thirty-year costs (for capital expenses and operation/maintenance) ranged from $1,000 in a small drainage unit in the West Fork to $63,000 in Stretch 11 (Monarch Mill Pond area) of Portage Creek. All stretches realized a treatment cost of approximately $300/pound of TP reduction, with the exception of the smallest area (the unit which only cost $1,000 total to treat), which reached the greatest per pound cost ($400).

7.3 Milestones

A list of interim milestones to gauge effective progress was developed and organized by BMP type (i.e., structural/vegetative, habitat, education/public participation, policy). The list was presented to the Steering Committee as a worksheet, and feedback was sought. Information regarding method of measurement was also included (Attachment 17). The list was prioritized for general watershed improvements and for subwatershed-specific objectives by the Steering Committee and includes:

7.3.1 General Milestones

- Reduce sediment loading from streambank erosion sites by 50% (230 tons) by 2010. (Metric is sediment reduction calculated by lateral recession rate.)
- Two neighborhoods adopt rain barrel/downspout disconnection by 2010.
- Treat all runoff from new developments with on-site retention and infiltration of 2-year or smaller storms and of at least the first 2.37 inches of larger storms to capture first flush of storm water. Release rates for retention of larger storms should be equal to 0.05 cubic feet per second for each acre captured to prevent streambank erosion and flooding.
- Routine reporting of sediments removed from private storm water treatment devices by 50% of owners.
- No loss of prioritized preservation areas.
- Involvement of two new schools in volunteer work-days, such as removal of exotics, riparian plantings, stream cleanups, by 2007.
- Development of elementary school curricula and adoption by one school by 2007.
- Improve/protect riparian buffers along all creek stretches.
- Reduce annual phosphorus loading by 5,000 pounds by 2013. (Current annual load is 15,200 pounds based on monitoring at creek mouths.) [Metrics used will include streambank recession estimations, waterfowl counts (one half pound per goose per year) and estimations from BMPs completed.]

7.3.2 Creek Specific Milestones

Arcadia Creek

- Increase flood storage capacity in pond east of Drake Road (Stretch 2) by 20 acre-feet/year. Runoff from Stretch 2 is 373 acre-feet/year.
- Eliminate streambank erosion at Kalamazoo Christian High School (Stretch 8) for an annual load reduction of 151 tons of sediment and 155 pounds of phosphorus.
- Create 10 acre-feet of storage for on-site and upstream wet weather flow volumes at Stretch 8.
- Retain and infiltrate 50% of annual volume of storm water with redevelopment in downtown areas and 75% of storm water with new developments. Infiltrate 2-year or smaller storms and first 2.37 inches or larger storms to capture first flush of pollutants (Stretch 16).

Axtell Creek

- Reduce annual runoff volume to creek in Stretch 2 by 2 acre-feet through residential downspout disconnection programs by 2007.
- Reduce waterfowl population in Crosstown Ponds by 50% by 2006 to reduce phosphorus loading by 0.5 pounds/goose/year.
- Reduce flooding frequency to 4-year event through residential (Vine Neighborhood, Stretch 5) storm water infiltration by 2008.

Portage Creek

- Eliminate streambank loads for an annual reduction of 57 tons of sediment and 61 pounds of phosphorus and reduce storm water inputs through on-site retention/detention by 10 acre-feet/year at Milham Park (Stretch 10) by 2010.
- Reduce waterfowl population at Milham Park (Stretch 10) by 50% by 2010. (Kalamazoo Nature Center studies can be used as baseline.)
- Retain and infiltrate 50% of annual volume of storm water with redevelopment in downtown areas and 75% of storm water with new developments. Infiltrate 2-year or smaller storms and first 2.37 inches or larger storms to capture first flush of pollutants (proposed Pfizer campus, Stretches 16 and 17).

West Fork

- Maintain creek buffers at new developments along Interstate-94, preferably at a depth greater than ten feet (Stretch 7).
- Infiltration of 50% of storm water from commercial areas (60 acre-feet/year) (Stretch 8).
- Eliminate streambank loads at Burdick Street culvert and edge of Big Lots parking lot (Stretch 9) for an annual reduction of 2.3 tons of sediment and 2.4 pounds of phosphorus by 2008.

It was noted that phosphorus reductions were important to track due to the Kalamazoo River TMDL. However, it was also understood that several factors affect phosphorus levels in the creeks, and that statistically valid sampling and data analysis can be costly. Milestones that can be related to phosphorus reductions, such as decreases in waterfowl populations, were favored. Priorities relating to education, new ordinance adoption and habitat improvement were

also favored. Priorities in these lists may change as new watershed opportunities emerge. Additional education milestones relating to newsletter articles, signage and workshops are the responsibility of the Education Subcommittee.

7.4 Analysis of Ordinances, Rules and Policies

In an effort to evaluate the consistency of existing local governmental ordinances applicable to this WMP, research was conducted to identify and compare specific the municipalities and Kalamazoo County. Ordinances referenced for the City of Portage, City of Kalamazoo and Texas Township are available on-line through the Municode system. Links can be found at the home website of each municipality (www.portagemi.com, www.ci.kalamazoo.mi.us, www.texastownship.org). Oshtemo Township does not yet have their codes available on the internet. Sanitary codes (septic systems) and the Storm water Management Rules for Kalamazoo County are available on-line at www.kalcounty.com. From the home page, navigate to Departments/Human Services/Health Department for the sanitary codes. Navigate to Departments/Administration/Drain Commissioner for the storm water rules.

A table of ordinances, available at http://www.kalamazooriver.net/pa319new/ordinance_text.htm [J], includes citations for ordinances pertaining to watershed management for each municipality, organized by topic. The Kalamazoo Metropolitan County Planning Commission adopted Policy Statements on February 4, 1999, the most pertinent of which address Land Use Planning Policy, Land Development Control Policy and Community Facilities Policy. Many of the elements addressed in the table are referenced within these Policy Statements, available from the county.

It is worth noting those areas where intergovernmental coordination currently exists:

- utilities
- mutual aid agreements
- transit, roads
- solid waste
- environmental protection
- economic development
- recreation
- stormwater planning/permitting

Included among discussed topics of intergovernmental cooperation have been:

- water and wastewater/utilities
- well head protection/planning
- land use/zoning
- environmental quality concerning the Kalamazoo River
- recreation/river trailways

No coordination currently exists for land use zoning. A locally developed project, formerly Convening the Community and now Convening for Action at www.kzoo.edu/convene, is lead by Dr. Kiran Cunningham and Dr. Hannah McKinney. This project is directed toward

smart land use and growth issues. Maps of existing land uses and proposed land uses for each municipality in Kalamazoo County have been integrated in a set of GIS formatted maps. Meetings have been held with participation from a wide diversity of stakeholders. Identification of what participants believe to be areas worthy of preservation, unique character or distinction have been located and mapped. One goal is to have a unified, county-wide land-use mapping program to allow visualization of land use impacts (positive and negative). The intrinsic link between land use and water quality should be exploited as a means for furthering intergovernmental coordination.

This watershed management planning process has illustrated the willingness of multi-jurisdictional partners to share information and seek solutions of mutual benefit. The following key categories are addressed by each municipalities' ordinances:

- storm water management
- erosion control
- illicit connections
- groundwater protection
- discharges to storm sewers
- land development regulations
- Site Plan Review
- littering on land and water
- landscape issues

Groundwater pumping is allowable only by a permit from the county. The county has oversight of private sanitary and sewage disposal systems. The county also operates a hazardous waste collection program, which helps to keep those types of materials from impacting the watershed. The Cities of Portage and Kalamazoo have their own designated Part 91 Soil Erosion and Sedimentation compliance personnel, while the townships rely upon the Drain Commissioner, as the County Agent designated to fulfill these obligations for them. Wetlands issues are the purveyance of the Michigan Department of Environmental Quality and/or the US Army Corps of Engineers.

Comprehensive Plans for each of the four municipalities are quite current. Oshtemo's Comprehensive Plan was adopted in 1993 and has been frequently amended. The City of Kalamazoo's Comprehensive Plan was adopted in 1998 and their Zoning Ordinances are currently undergoing updating and rewriting. Texas Township adopted their Comprehensive Plan in late 1999, and the City of Portage is in the final stages (September 2002) of adopting a revised Plan. Portage is also revising their Zoning Ordinances to reflect alterations within the Comprehensive Plan. All four jurisdictions incorporate the use of Site Plan Review Committees to ensure compliance with necessary ordinances for residential projects of greater than three units on the same parcel and for all commercial/industrial proposals. The City of Kalamazoo has perhaps the most comprehensive landscaping ordinance in the area, which could serve as a model for others.

In conclusion, while a noteworthy effort has already been made within each of these jurisdictions for many of the key elements related to the success of a watershed management

plan, there remains need for additional progress. It is both beneficial and desirable for each to understand the ordinances of the others and their cumulative implications in relation to land use and watershed planning. Recommendations include:

- Steering Committee formation of a sub-committee to consider overlay zoning,
- Evaluation by other units of government of the recent City of Kalamazoo TMDL Ordinance and the Kalamazoo County Soil Erosion Program and Storm Water Management Rules for their own adoption,
- Consideration of the TMDL Implementation Plan elements as found at http://www.kalamazooriver.net/tmdl/implement/Implementation_text.PDF,
- Development criteria for shoreline protection that address shoreline, shoreline buffers, shoreline protection areas and watershed concerns where applicable through:
    - vegetation targets for each zone (e.g., maintain as natural - undisturbed, forest/natives, view corridors, limits to clearing, buffer guidelines),
    - allowable uses (e.g., bioengineering, 1 dock/lot, 1 stairway/lot, walkways, boathouses, view corridors, residences, septic systems),
    - restricted uses (e.g., docks, boathouses, structures, rip rap, bulkheads),
    - on-site wastewater treatment options (e.g., not allowed, setback distances),
    - storm water (e.g., no new outfalls or contributions, on-site design criteria, sediment and phosphorus reduction guidelines),
    - lot requirements (e.g., minimum size, frontage, impervious cover, roof runoff, open space % for developments),
    - zoning (e.g., limited residential, resource protected, stream protection, limited commercial, general development),
    - enforcement (e.g., local or state permit, local development review process),
    - education (e.g., local groups, public, resource agency, watershed organization),
    - see related links at http://www.kalamazooriver.net/pa319new/link.htm.
- Review of Phase II permit consistencies,
- Consideration of the use of two-stage storm water retention systems,
- Efficacy and costs of upland treatment options,
- A future comprehensive water resources protection ordinance that will address many of the related issues currently isolated, scattered or not recognized,
- A policy or ordinance that establishes phosphorus limits on or outright bans the use of phosphorus in residential and commercial fertilizers (non-agricultural), and
- Provide presentations to local units of government to obtain their buy-in to these overall recommendations and observations.

The likely outcome will be a more coordinated, comprehensive effort at evaluating and using limited resources while providing maximum oversight for the interface of riparian biotic and human communities.

8.0 Public Education Component

There are two primary objectives for public education as a component of this watershed management plan. The first is to create broad community awareness of the word and concept "watershed." It is important that all community members understand that we live, learn and

work in a watershed and that we rely on its water as a basic resource. Our watershed is an important element of "place" and efforts will be made to encourage people to identify with their own watershed just as they identify with their local municipality or school district. The second educational objective is to promote stewardship of water resources as a common-sense civic responsibility of good citizenship. What we do on land can have a direct impact on the present and future quality of surface and ground water in our watershed. Our goal is to elevate public understanding of these connections and to encourage actions that maintain the highest water quality and a healthy watershed ecosystem.

The four sub-watersheds in this WMP are comprised of mixed land uses. What all four have in common is that they flow through highly urbanized areas as they approach the Kalamazoo River. In this urban core area all four streams have historically been, and continue to be, heavily impacted by human activities and land development. Portage Creek and the West Branch of Portage Creek, the two larger watersheds, have headwaters (the area from which a stream or creek begins) in rural and agricultural areas and then flow into the urban core. Axtell and Arcadia Creeks, the two smaller subwatersheds, are located entirely in the urbanized core. In all four watersheds there are high-quality stretches worthy of protection and preservation as well as problem areas where improvements and corrective action are needed. Watershed education efforts are intended to address both ends of the spectrum to ensure that what is good stays good and what is bad gets attention and improvement efforts.

Significant to this WMP is its website format. It is a "living document", in which updates can easily be communicated to the community. Access to specific education and data resources for these watersheds, as well as information relevant to the many facets of watersheds and water quality in general, is provided. Updates are a part of any good planning process, but they can be cost prohibitive when printed documents must be revised/replaced and recirculated. The electronic structure of this document allows alterations to be made relatively easily with instant accessibility to any user logging onto the site.

Framing educational messages

Identification with one's own watershed should involve:

- a basic understanding of the term and concept "watershed",
- an understanding of the watershed's characteristics including its merits, challenges and problems and a recognition of oneself as potential part of those problems, and
- a realization of how one can become part of the solutions to problems and a protector of what is good.

Such understanding and realization should lead to action. Watershed education is best directed to three different age groups: young students (K-8), adolescents and adults. Educational efforts stemming from this Watershed Management Plan would attempt to engage audiences in the following three areas of inquiry:

What is my watershed and how am I connected to it? Where does water from my property and neighborhood flow to when it rains or when I water my lawn and garden? Where does waste

liquid go when poured in the street or on the land? What does all this flowing water take with it? A common misconception is that water goes from the streets to a wastewater treatment facility. For most this is not the case. Instead, it travels from the street untreated to a stream via storm drains and eventually to the Kalamazoo River. A property owner at the water's edge is termed a riparian. For this WMP, we have coined the term "storm water riparian" for anyone whose property drains to a storm drain . While the stream or lake may not be visible, a storm water riparian and the pollutants and storm water generated from their property nevertheless have a direct connection to area water bodies. Thus, storm water riparians can play an active and essential role as water quality stewards.

What is good and what is not so good in my watershed? What activities contribute to watershed problems? In what ways do urban and suburban homes, neighborhoods and businesses impair water quality in streams, lakes, wetlands and groundwater that provides our drinking water? How do residents, business institutions and others contribute, sometimes knowingly and sometimes not, to the problems of water pollution and watershed degradation?

What Can I Do? What are the ways I can help to protect and improve water quality? How can I change my daily activities to advance watershed stewardship? Are their small, inexpensive steps I can take? What are some of the innovative ways I can become more deeply involved in protecting water quality and my watershed? Informational links to materials that address these questions and other components of the educational plan, relevant to residential, business, government, industrial and institutional members of these watershed communities are included on the website.

Education Strategies, Tools & Tasks*

Watershed Identification Signage

Roadside and pedestrian signage identifying local waterways will help us to recognize what we ordinarily pass by without noticing, thus acting as a first step toward encouraging knowledge of and interest in our local watersheds. Along with the name of the waterway, watershed identification signs at key points of road crossings and waterways will include the regionally used "Clean Water" logo. This water drop logo with its message, "We all live in a watershed. You make the difference.", was first used by The City of Battle Creek. The logo and message have since been adopted by the Kalamazoo River Total Maximum Daily Load (TMDL) Committee for use throughout the Kalamazoo River Watershed and, most recently, adopted by the Steering Committee for this WMP. Common use of this logo will help unify educational efforts from various projects and will build "watershed" awareness, a primary objective of this Watershed Management Plan. Signage including the water drop logo was designed and placed along the Axtell Creek corridor in 2003. Signs included identification of the water body with the text, "Axtell Creek: Ours to Protect". Walking tour signage, as discussed below, was also installed at key points along the creek. The signs included information on well head protection, native plants and storm water.

Point of Interest Educational Signs – Walking Tours

A series of six educational signs have been installed for the Axtell Creek corridor so that it can serve as a destination for urban watershed education. These signs point out features of the creek corridor and encourage visitors to look and explore the sights and sounds around them and to take a walking tour of the Axtell Creek corridor. Positive attributes as well as problem areas are addressed with suggestions for how individuals can make positive contributions to water quality in an urban watershed. The signs are situated in the most accessible areas along the creek from its headwaters to where it joins Portage Creek at Upjohn Park. The first organized walking tour of the creek was held in June 2003. Sponsored by the local Wild Ones chapter and featuring members of this planning project, it attracted about twenty people for a well-received Saturday morning educational tour. Signs are being maintained by the City of Kalamazoo.

Western Michigan University installed an educational sign on campus which contains the water drop logo and a map illustrating the Arcadia Creek Watershed major features.

Large Informational Signs

Signs at public gathering places could be sized up to 4'x 8' and should include a:

- Map of the stream and its entire watershed with a "You are Here" point of reference;
- Brief explanation of where the water comes from and where it goes,
- Educational message(s) with suggestions for ways to help protect and restore waterways and water quality, and
- Prominent display of the web address for more information.

At least one sign is desired for each of the four subwatersheds with possible locations to include:

- Crosstown Ponds,
- Kalamazoo Christian High School,
- The Arcadia Creek "Festival" Site,
- Milham Park,
- Upjohn Park,
- Parkview Hills,
- Al Sabo Preserve,
- Rota-Kiwan Reservation,
- City of Portage Bicentennial Park,
- City of Portage Police Station and Band Shell.

Storm Water System Markers

Developing awareness of direct storm water connections to creeks and other surface waters is viewed as a critical point of public education. Many people are wholly unaware that they are "storm water riparians" who can directly impact water quality. An education campaign is envisioned using semi-permanent, multi-color, plastic markers placed at many of the more visible *inflow* (points where storm water enters a storm water system) storm drains and manholes

and *outflows* (points where storm water exits from one location and enters into another) within each of the four subwatersheds. Markers will include a universal "logo" or "signature" and a consistently adopted message (e.g., “Flows to River”, “Flows to Water Body”, etc.). Partnership projects with member communities/agencies of the Kalamazoo River/Lake Allegan TMDL Implementation Plan Committee, and local institutions (Western Michigan University, Kalamazoo College, Kalamazoo Valley Community College) will help to insure thorough coverage within each of these watersheds. Effort will be made to involve other interested communities within the Kalamazoo River Watershed to place one large order for storm system markers, thereby lowering per unit costs. Local environmental organizations and "Adopt-A-Stream" groups (see below, section III) could be enlisted in the project for placement assistance. In most cases, installation is likely to be performed by a combination of staff and volunteers, making this an excellent community event for in-service education of most participants. Local schools may be able to compliment this educational effort through the distribution of door hangers or take home materials for families.

Educational Brochures and/or Door Hangers

Three educational “electronic brochures,” targeted for each of the three age levels, are proposed to carry basic information on our three focus questions, "What is my Watershed?" "Am I Contributing to Problems?" and "What Can I Do to Help?" Concepts such as non-point source pollution (nonpoint source pollution includes runoff from land surfaces, such as golf courses, construction sites, agricultural operations and impervious surfaces, to a water body), sedimentation and habitat degradation would be addressed in age-appropriate fashion. Brochure text should be easily adapted for short articles and illustrations in neighborhood and civic newsletters, local government publications, newspapers, business publications and other media. Brochures would be easily available for downloading and photocopying from the project website. As an electronic resource, they can be easily updated without excessive printing costs. Some brochures may be printed for targeted distribution and placement in locations such as libraries, municipal offices, neighborhood offices, the Chamber of Commerce and the Kalamazoo Conservation District. Additionally, some door hangers may also be produced as part of school projects in which students go door to door to deliver watershed messages. This is seen as a promising strategy for “storm water riparian” neighborhood education campaigns. Unused printed materials are not a desired outcome of this planning effort and can be avoided by encouraging use of the website or by providing the information on a CD. Efforts will also be made to coordinate messages with other regional water education efforts to avoid duplication. Several relevant educational brochures, produced by previous efforts of the TMDL committee and the Davis Creek 319 project, are currently available through website links.

School Curricula and Other Educational Materials and Programs

Schools are being encouraged to supplement existing school curricula by using our information rich website to learn specifics about local watersheds. There is willingness on the part of Education Committee volunteers to develop additional curricula for all three K-12 levels—elementary, middle school and high school—relating to the four subwatersheds included in the WMP. Specific information on the following may be included when available:

- Pre-settlement ecosystems,
- Native American communities and their impact on the watershed,
- Changes over time, with perhaps "snapshots" and maps for each half century,
- Historical problems and solutions for different time periods,
- Plant and animal species specific to each watershed, with losses and gains over time,
- Stream data and how to use it to assess watershed health, and
- How students, their families and their schools can help restore each subwatershed, with suggestions and outlines for guided activities, both generic and in specific locations.

A school engagement project organized by the Axtell Creek Committee with the Maple Street Magnet School for the Arts (Kalamazoo Public Schools) in May 2003 will serve as a model for replication. On a project rally day, Axtell Creek Committee volunteers provided historical information about Axtell Creek, current state-of-the-creek information, and a native plant slide show to set the stage for creek clean-up and native plant restoration along the schools Axtell creek frontage. Then over the course of two days, community volunteers, led by a local chapter of Wild Ones Native Landscapers, provided planting guidance to engage nine seventh-grade science classes (170 +/- students) in planting about 2000 native plants to restore creek-side habitat. This site can now serve as an ongoing learning laboratory for future school efforts and as a local learning destination for other Kalamazoo Public Schools. A rain garden which captures 23,000 square feet of roof top runoff was constructed at the Maple School in 2003. It was planted with native vegetation and serves as an additional learning laboratory for students and an attractive alternative to mowed grass.

This strategy of engaging area schools in hands-on watershed education and improvement is viewed as quite promising for developing community awareness and buy-in for watershed stewardship. While the KPS Maple Street School has Axtell creek frontage, The Montessori School and Kazoo School are just a short walk away. Arcadia Creek flows through the properties of Kalamazoo Christian High School, Western Michigan University and Kalamazoo College and is right next to St. Augustine Catholic Elementary and the Kalamazoo Valley Community College downtown campus. Loy Norrix High School is just across the street from Portage Creek and the confluence of the West Branch of Portage Creek. In Texas Township, the West Branch flows through the Rota-Kiwan Boy Scout Reservation and next to the Kalamazoo Valley Community College main campus before entering Portage where it is an easy walk from St. Monica's Catholic Elementary and Hackett Catholic Central High School. Several Portage Schools are in easy walking distance to stretches of Portage Creek. There is no shortage of opportunities for schools to "adopt" stretches of all four creeks for outdoor education and hands-on improvement efforts.

There is also a desire to either make or adapt a video to show the effects of phosphorus on water quality. The Education Committee realizes that this would be a significant project and is looking for an existing video to adapt to these watersheds. Ideally this would show above and below water views so that the effects of water degradation could be clearly seen. The video will ask and answer the following questions:

- "What does a healthy stream look like and what lives in this ecosystem?",
- "Where do algal blooms come from and what is their effect on the environment?",

- " What is oxygen depletion and how does it happen?",
- " What could and could not live in an oxygen depleted environment?", and
- " What is eutrophication and what causes it?".

Permission has been granted through the University of Wisconsin Extension for the WMP to adapt their Youth Program for Watershed Action called "Give Water A Hand". In this program, students map their school grounds, home, farm and community and locate the borders and features of their watershed. They develop and work through an action checklist for improving water conservation, water quality and other watershed concerns. This program, best suited for middle school students, is recommended to be adapted for use in the WMP. (Investigation is now under way to evaluate the possible collaboration of retired professors directing an undergraduate student enrolled in an independent study class to accomplish this task.).

The Steering Committee is finalizing an Axtell Creek brochure targeted toward adults and adult chaperones leading tours of students. The current draft text is included in Attachment 18. The Forum is incorporating Steering Committee feedback and the final brochure will be posted on the project website for download and printing.

Website

The Watershed Management Plan website http://www.kalamazooriver.net/pa319new/index.htm as a whole is intended as a community education resource that can provide detailed information on many aspects of each of the four watersheds. It offers general information for the public-at-large along with detailed research and analysis that can serve academic and institutional purposes. Additionally, the Education page provides access to other features including a "New Lakescaping Guide" for riparian property owners, a presentation titled "Best Management Practices (BMP's) in your Backyard"; a feature that will help City of Kalamazoo residents determine in which subwatershed they live and if they are a storm water riparian; and an educational piece directed toward storm sewer riparians. The Links page provides access to numerous websites. Among the groupings are Links to State and Federal Resources, a Glossary, Data Sources and Web Resources for:

- Educators and Students,
- Residents, and
- Planners/Municipalities/Consultants.

Mini-Grant Program

A discretionary fund of $10,000 is recommended to be established for school projects in surface water quality improvement. Grant awards would vary from $100 up to a maximum of $1,000, depending on the scope and innovation of the project. Matching funds from such programs as the "Seeds for Education", sponsored by the Wild Ones, Kalamazoo Conservation District (KCD), Kalamazoo Community Foundation and others, could also be sought by applicants. A watershed panel would be established to review grant proposals.

Funding was awarded during the Transition Grant to support a trial mini-grant program but interest was low. The money was instead utilized to conduct the Lakes research and summary write up at MDEQs request.

Demonstration and "Model" Sites

Demonstration sites for stream bank or wetland restoration within the stream corridor are desired in each of the subwatersheds. Possible locations include:

- Axtell Creek Park,
- Kalamazoo Christian High School,
- Western Michigan University,
- Crosstown Parkway Ponds,
- UpJohn Park,
- Milham Park, and
- City of Portage Bicentennial Park, including the trailway.

In all subwatersheds where opportunities exist, upland sites will also be selected as demonstration or “model” sites to diminish the volumes of storm water reaching the tributaries. Techniques such as pervious paving, vegetated swales, rain gardens and rain barrels will be considered where best applicable to decrease volumes of runoff and increase infiltration, transpiration and retention. A two-tiered approach is under consideration:

- Employing professionals for design and construction, and
- Utilizing voluntary efforts.

Photos of the site before and after restoration, along with information about methods and plants used, could be included in an educational pamphlet featured on the website and available for educational tours, either self-guided or led by a docent (a voluntary “educator”).

Several “model” sites worthy of preservation will be included, as well. Efforts to ensure that such sites are maintained and managed for the long term will become a feature of the plan as well. Locally, the Southwest Michigan Land Conservancy is dedicated to land acquisition to ensure preservation, while the local Wild Ones organization promotes native landscaping of private and public properties, including residential yards.

During this planning project, two native plant demonstration sites have been established along Axtell Creek with the help of Wild Ones Natural Landscapers. The first area, west of the creek just north of Howard Street, is being showcased with one of the Point of Interest Education Signs along Axtell Creek. The second area includes multiple planting sites along both sides of Axtell Creek on the Maple Street Magnet School for the Arts property. A third site, demonstrating storm water diversion into a Rain Garden was completed in the fall of 2003 on an upland portion of the Maple Street School property. A public workshop on Rain Garden Design for Homeowners and educational signage was a part of this separately funded project. The Kalamazoo Nature Center was the lead organizer working through a 319 grant administered by

the City of Kalamazoo. This rain garden project was being done in coordination with the Axtell Creek Committee that was formed during this planning effort.

Recognition and Awards for Watershed Stewardship

As part of a family and group participation program, an environmental stewardship award program will be developed. The awards will be given for employing BMP's in residential yards, schoolyards, businesses, churches and institutional properties. As with the "Backyard Habitat" and "Schoolyard Habitat" awards given by the National Wildlife Federation, applicants will receive a certificate showing that they have completed the steps necessary to be designated as a "Watershed Guardian". They will each also receive a storm water drain marker for their community, and a decal they can display in a home or office window. If appropriate sponsors can be found to defray costs, a yard plaque or a wall plaque might also be presented.

Occasional workshops will be planned to demonstrate how to qualify for a "Guardian" certificate. Applicants will simply fill out a form specifying which elements from among a "menu" of BMP's they have successfully implemented on their property.

Names of "Guardians" will be posted on the website and made available to the media through public service announcements. Special recognition could be given annually for the most innovative and effective stewardship projects, with photographs and stories in the local news media.

Some of these "Guardian" sites could, with the property owner's permission, be designated as "demonstration" or "model" sites within the neighborhood or watershed and listed on the project website. Tours and/or on-site workshops may also be arranged to view these sites if agreed to by the owners.

The Steering Committee considered developing such a program during the Transition Grant but instead focused its energies on other tasks.

"Adopt-A-Creek" Program

Groups of citizens, neighborhood associations, clubs, service organizations, schools, environmental organizations, businesses, scout troops or colleges will be able to "adopt" a stretch of one of the four creeks in the WMP. The program will be developed along the lines of the current West Michigan Environmental Action Council (WMEAC) program and, if possible, with their cooperation. There would be several levels of participation, perhaps similar to those utilized by the WMEAC program. See the School Curricula section above for details relating to involving schools in "adopting" stretches of creeks for educational purposes.

A resource group of expert or trained volunteers would manage the "Adopt-A-Creek" program and help to provide or train docents for group tours and leaders for workshops on BMP's and watershed stewardship.

Business Sector Specific Approaches

The agricultural component of the WMP will approach several sectors of the agricultural community not previously covered under other programs. Beginning with the Farm-A-Syst program, developed by the Groundwater Guardianship Team, equine owners will identify potential environmental risks posed by their farmstead operations. This initiative includes the first of its kind equine manure management program. Most equestrians and equine-related business operators and owners do not typically treat manure as a valuable nutrient, but a waste product that can degrade water quality. The large surface area of horse manure increases the likelihood of nutrients impacting surface waters. Hooves can destroy stream bank vegetation and stability, resulting in sediment runoff and nutrient loading into the surface water. Pretty Lake Camp has volunteered to participate in this program with the Kalamazoo Conservation District. Participation is also anticipated from the U.S. Department of Agriculture Natural Resource and Conservation Service and the Michigan Groundwater Stewardship Program. There are a number of stables and horse owners within the western reaches of three of these sub-basins.

One greenhouse grower in the watershed has agreed to use the new Greenhouse-A-Syst Program developed by MSU Extension and implemented by the Groundwater Stewardship Program. This program runs an environmental risk potential through fact sheets completed by the bedding plant industry owner.

Participation of Environmental and Other Organizations

As should be evident from the above approaches, no educational program for water quality improvements/watershed stewardship is likely to succeed without involvement of organizations such as service clubs and environmental Non Government Organizations. Organizations dedicated to promoting the use of native plants on both private and public property, such as the Kalamazoo Area Chapter of Wild Ones Natural Landscapers, Kalamazoo Greenspaces, Kalamazoo Nature Center and garden clubs, will be essential in:

- Establishing and maintaining demonstration sites,
- Providing educational workshops and programs, and
- Publicizing the need for better watershed management.

School clubs, science classes and scouting troops could provide the labor and the knowledge for many of the projects listed above. Service clubs, such as local chapters of Rotary International, Optimists International and Ambucs, could provide valuable educational, hands-on and, potentially, financial assistance by matching small ($100-300) grants. Cooperation of organizations with a conservation focus, such as the Southwest Michigan Land Conservancy or the Audubon Society of Kalamazoo, could be invaluable in these educational efforts.

Every effort will be made to integrate educational opportunities for cooperation with other groups in the Kalamazoo River watershed having similar needs and requirements. Other Section 319 funded programs may wish to cooperate on any number of the proposals recommended here. The local Storm Water Management Group has developed a significant list of Educational Tasks and Timelines. The Total Maximum Daily Load (TMDL) Implementation

Committee included educational elements within the Implementation Plan for the TMDL program as well. Several members of this planning project also serve as participants in these other efforts and have been able to share information between them. While coordination among groups with diverse goals and interests is never easy, it will nevertheless be worthwhile in this endeavor due to potential cost savings and dissemination of their respective messages to a broader audience achieved by such cooperation.

Grant Funding and Volunteer Efforts for Community Projects

Education and riparian corridor improvement projects in the watershed are primarily supported by volunteer efforts and local grant contributions. The Kalamazoo Area WildOnes (Native Landscapers) have organized several activities in the Axtell Creek Watershed. Up to October 16, 2004, they have reported 506 volunteer hours worked in 2004. Activities include exotic vegetation removal, native plantings, weeding, educational presentations and meetings with community groups. Additionally, they were awarded $2,650 from local organizations for work from 2002-2005. An estimated $1,200 in plant materials have also been donated for their efforts. Additionally, the Friends of Axtell Creek have donated time and materials to landscaping efforts around Crosstown Ponds. The Transition Grant efforts developed methods of communication for these and other efforts (and progress toward goals) beginning with individual web pages to either project sites or community groups.

Sustaining Watershed Education Efforts

Watershed-based education is viewed as an integral part of all ongoing and future efforts to preserve and improve the four creeks in this Watershed Management Plan, each of which impacts water quality in the Kalamazoo River. Stakeholders in all four watersheds plan to continue meeting in subwatershed groups, and periodically as a whole, after this planning grant has ended. Their focus will be on preservation and implementation of improvements along with education to compliment these efforts. As mentioned in the previous section, every effort will be made to coordinate education efforts with the larger regional activities of the TMDL Implementation Committee, the Storm Water Management Group, The Kalamazoo River Watershed Council and any other effort that can drive water quality and watershed improvements. Finally, it is anticipated that the ongoing maintenance of this WMP as a "living document" on the website will serve as a valuable educational resource for the community. Future watershed efforts can be acknowledged and documented in hopes that they will stimulate higher levels of watershed stewardship with additional improvement and preservation activities.

RECOMMENDATIONS	RESPONSIBLE PARTNERS	TIMELINE	ESTIMATED COSTS	FUNDING SOURCES
Signage (Watershed ID, Education, Information)				
Arcadia Creek	WMU, K College, City of Kalamazoo	2004	$2,500-$3,500	Grants, private
Axtell Creek	City of Kalamazoo, Greenspaces, Axtell Creek subcommittee	June 2003	$3,000 - $4,000	Grants, private
Portage Creek	City of Portage, City of Kalamazoo	On-going	$1,500 - $3,500	Grants, private
West Branch Portage Creek	Partnership, City of Kalamazoo, City of Portage		$2,500 - $4,000	Grants, private
Storm System Markers				
Arcadia Creek	WMU, K College City of Kalamazoo TMDL Partners	On-going	NA	Grants, City of Kalamazoo
Axtell Creek	City of Kalamazoo Volunteers TMDL Partners	On-going	NA	Grants
Portage Creek	Volunteers TMDL Partners	On-going	NA	Grants
West Branch Portage Creek	Volunteers, KVCC TMDL Partners	On-going	NA	Grants
Educational Brochures: Audience				
Students	Partners, Schools	On-going	NA	Grants, private
Soil Test for Fertilizer application	TMDL Partners	In Print	$500 reprint	Grants, private

Riparian Owners: Davis Creek Riparian brochure	TMDL Partners, Kal. Conservation District	In Print	$500 reprint	Grants, private
Local School Involvement & Curriculum				
Partner with schools for local watershed education, creek clean-up and restoration efforts	Portage-Arcadia Educ. Committee & partners	Pilot in 2003	$1500 - $5000 per watershed	Grants, private
Schools, Students: "Give Water A Hand" Adaptation from existing youth program	Portage-Arcadia Educ. Committee, Kalamazoo Conservation District	2004	NA	Grants
Website				
Riparian Owners, Storm water Riparians, Targeted Audience	TMDL Partners	On-going	NA	Kieser & Assoc., Grants, private
Planners/Ordinances/Consultants * See Ordinances in WMP	City of Kalamazoo, MDEQ	On-going	NA	City of Kalamazoo MDEQ, State & local regulatory agencies.
Mini-Grant Program				
School projects: water quality study & improvements.	Watershed Panel	Pilot in 2003	$10,000	Kal. Community Foundation, grants, private
Storm Water Treatment-innovative design	Watershed Panel	On-going		Mini-grant
Demonstration Sites for wetland or stream bank restoration	Watershed Panel, SWMLC, Wild Ones	On-going		Mini-grant
Stewardship Awards "Watershed Guardian"				

Schools, private sector, homeowners, churches, homebuilders.	Watershed Panel	On-going	Minimal	Watershed Team
"Adopt-A-Creek" Program				
Citizens adopt a stretch of creek	Watershed Panel and volunteers	On-going	Minimal	Local Government Hazardous Waste Team (Disposal) Watershed Team
Business Sector				
Farm-A-Syst	Groundwater Stewardship Program-Conservation District	On-going	Funded	Existing Funding: check-off on Pesticide Sales
Greenhouse-A-Syst	Groundwater Stewardship Program-MSU Extension, Conservation District	On-going	Funded	Existing Funding: check-off on Pesticide Sales
Participation of Environmental & Other Organizations				
Establish and maintain demonstration sites	Watershed Team	O & M agreement	NA	Private Sector Grant recipients
Provide Workshops & Demonstration Sites	Watershed Team	2004	$40,000	Grant recipients, City of Kalamazoo, schools, WMU
Publicize need for better watershed management	City and Townships, all partners	On-going	NA	Township newsletters, environmental groups, media

Sustaining Education Efforts				
Sustainability and Perpetuation	Watershed Advisory Teams, Other volunteer or mandated watershed efforts	On-going	NA	Grants, private

9.0 The Estimated Period of Time Needed to Complete Each Task and the Proposed Sequence of Task Completion

During the preparation and prioritization of actions for specific stream segments, participants in all subwatershed groups and the Steering Committee evaluated each activity to determine a subjective, potential time of implementation. The results of these deliberations are found in the BMP Tables under the column headings of Priority and Sequence. Priority rankings of low, medium and high were used as a measure of the importance of an element in terms of the need for it to implemented. Further prioritization efforts resulted in the color-coded rows illustrated in the referenced BMP tables. Low priorities are expected to come later in the overall implementation process unless they can be "tag-along" elements of projects with greater need. High priority projects are viewed as those with the greatest need and benefits, deserving more rapid consideration. Sequence refers to the implementation timeline of short- and long-term, defined as 0-3 years and 4-15 years respectively. No other specific time designations are provided.

Other elements shown in the BMP tables were also important to deliberations on the timeline for implementation, including Method Category, Property Ownership, Responsible Parties and Funding Sources. Participants were made aware of ongoing projects and activities as well as known actions envisioned or scheduled for the short-term. Given the status of local funds (public and private) and the uncertainty on most state and many federal implementation funds, many of the timelines projected are likely to be aggressive in nature. Portions of some proposed actions, such as education components, will move ahead as part of USEPA Phase II storm water requirements for municipalities and institutions. Other projects, such as in the Axtell Creek area, may well be stimulated by voluntary efforts, small local grant sources and, in some cases, private sector needs. Many of the projected actions in the BMP tables were aspirations based on the premise of available grant funds. Efforts will continue into the foreseeable future to solicit project-specific funding wherever possible. It is conceivable that actions related to the TMDL for phosphorus for the Kalamazoo River Watershed could play an assisting role in implementing these local projects.

10.0 Summary of the Public Participation Process

This initial watershed management planning effort has been fortunate to have consistent commitment and input from a diverse group, ranging from professionals to laypersons, both as community participants and as members of the Steering Committee. Their dedication and perseverance provided the focus of this plan. From pre-planning stages, the intention has been to create an electronic, web-based plan; one that would provide greater accessibility and flexibility for all users than a "paper" document. Savings have been achieved through all phases of this planning project in paper, postage, printing and energy.

Daytime meetings have been the rule in this project. The electronic nature of this WMP also allows anyone to participate on a timeframe suited best to the individual. Meeting summaries have been electronically provided to all who have attended Steering Committee meetings. These summaries are posted to the website and available to any interested party. KIESER & ASSOCIATES, the compilers of the plan and the website, has maintained open and available communication channels for anyone wishing to comment or provide feedback.

Operational Guidelines for the Steering Committee were adopted early in the process (e.g., frequency of meetings, selection of a Chairperson, openness to broad opinions, no one person could speak for the SC without approval of the SC on the materials, every person has one vote). Periodically a Steering Committee meeting would be eliminated in favor of more intensive meetings and work sessions at the subcommittee and subwatershed work group levels.

The Education Subcommittee, Technical Subcommittee, and four Subwatershed Subcommittees met consistently during 2001-2003, though often at different locations offered by participants throughout the four subwatersheds. The Transition Grant to update the plan to meet the USEPA Nine Elements began in September 2003. Efforts for the grant tied in with requirements for Municipal Separate Storm Sewer Systems (MS4s) to submit permit applications and develop Public Education Plans. Early meetings were held with the MS4s in attempts to coordinate efforts. Representation from the Kalamazoo River TMDL Implementation Committee was also included in this grant process to assure data sharing and consistency across the larger Kalamazoo River Watershed. All meetings have typically been well attended, focused and productive in terms of moving project elements forward. Not enough can be said about the contributions prepared and provided by individuals within these groups. Their efforts are responsible for shaping this into a balanced community plan.

The number of meetings held over the course of this effort since July 2001 illustrates the scope of such commitment.

- 24 Steering Committee Meetings
- 6 Technical Subcommittee Meetings
- 9 Education Subcommittee Meetings
- 14 Axtell Creek Subcommittee Meetings
- 9 Arcadia Creek Subcommittee Meetings
- 4 Portage Creek Subcommittee Meetings
- 5 West Fork of Portage Creek Subcommittee Meetings

In summary, community interests of these subwatersheds have been well served by those individual participants concerned with water quality and related issues. An expressed desire to continue on with the steps initiated in this WMP via scheduled meetings and stakeholders commitments will bolster future citizen involvement, participation and follow through on improvements. Such actions will continue to positively impact both physical surroundings and water quality.

11.0 Process that Will be Used to Evaluate the Effectiveness of Implementing the Plan and Achieving its Goals

11.1 Criteria to Determine whether Loading Reductions are being Achieved

11.1.1 In-stream Metrics

Water quality based metrics were reviewed by the Steering Committee. They were evaluated based on their ability to be measured by volunteers, as development of a volunteer monitoring program was called for in the Transition Grant. It was noted that phosphorus reductions, as related to the Kalamazoo River TMDL, should be measured. Metrics, such as waterfowl populations, streambank stabilization/revegetation, and number of BMPs, can be used as an indicator of phosphorus reductions. In-stream metrics that are inexpensive to measure were favored by the Steering Committee. These included macroinvertebrate sampling, in-stream and riparian habitat surveys, turbidity measurements and sediment and litter accumulation observations.

11.1.2 Volunteer Monitoring

In the workplan, we indicated that a volunteer monitoring QAPP would be finalized if implementation funding was received for a volunteer monitoring program. Implementation funds were not received and therefore a QAPP has not been prepared.

The volunteer monitoring framework document (Attachment 19) was created prior to application for implementation funding to stimulate discussion on how the Steering Committee might organize to support a volunteer monitoring program. In that paper, several examples were listed for how the SC could build a program. The paper was shared with the Steering Committee. At that time, the Michigan Clean Water Corps was in formation and it was expected that the Steering Committee could simply adopt MCWC QAPP materials and apply for support from the program. Since that time, the Steering Committee has discussed the belief that the MCWC rigorous standards may preclude participation given that a point person is not available to reliably receive training, coordinate and train volunteers, and handle data.

The Portage/Arcadia Steering Committee under the leadership of The Forum of Greater Kalamazoo operates on an as needed, voluntary basis, in response to the need for community planning supported by competitive grants. Successful volunteer monitoring programs generally are built on organizations with a more formalized structure and dedicated funding sources that make both the organizations and programs more sustainable. In short, no clear coordinator associated with the Steering Committee has yet come forward to run a volunteer monitoring program and no clear funding mechanism exists to support a coordinator. The support of a volunteer monitoring program (and the need for a QAPP) seem to hinge on the establishment of sustainable strategies for the Steering Committee that are more formalized. In addition, lacking a point person, the Steering Committee has identified a broad range of parameters that volunteers might monitor, but to proceed with a QAPP, the selection of parameters must be narrowed down. To date, the Steering Committee has discussed continuing to work as a voluntary group through the current and future implementation grants.

Various groups working on various watershed scales face similar sustainability challenges. This is evident in ongoing discussions involving various watershed partners interested in sustaining the TMDL efforts and incorporating them into a larger, sustainable watershed organization.

New watershed wide volunteer monitoring developments include MSUE efforts to formalize a turbidity tube volunteer monitoring program and continued growth of a teacher training program in Calhoun County. The Steering Committee might best proceed by inviting local participants to join up with these watershed wide programs.

11.1.3 Methods to Track Progress

Communication of watershed progress is key to building momentum toward achieving goals. Various methods, some of which are linked to on-line tools, were presented to the Steering Committee. For example, new project information may be added as a GIS layer to each city's on-line parcel mapping system (Attachment 20). It was seen as advantageous to link watershed tracking to existing tools, which are widely used. Table 8-3 lists the methods being considered and Attachment 21 illustrates ideas considered by the Steering Committee for the development of a Community Scoreboard. Attachment 22 includes a webpage of links to similar programs available online for individuals to research available watershed tools.

Evaluating the effectiveness of this WMP will be determined through a long-term commitment. Steady implementation of selected projects over time, consistent with achieving goals established through this planning process, will serve as a comprehensive evaluation guide. A desire to provide for sustainability of the WMP has been a consistent point expressed by multiple participants in Steering Committee meetings. Sustainability will lead to effective prioritization, implementation and evaluation of the proposed plan elements.

Before and after photos of implementation projects are available on the project website. Attachment 23 shows thumbnail shots of various implementation projects. Additional webpages show ongoing restoration projects.

One of the most fundamental aspects to achieving sustainability of efforts in natural resource protection is education. Successful education relies on several key factors: quality of information, ease of access to information, motivation on the part of the message deliverer, and incentives for responding to the message delivered. Efforts have been made to incorporate all of these considerations into the educational aspects of this plan.

Without commitment on the part of local citizens or leaders to acknowledge the plan's goals and objectives, the WMP will not yield continuing success. Presently, there is a strong commitment among Steering Committee members to continue participation and maintain some type of a Steering or Oversight Committee. This group will convene periodic meetings, encourage new participants, evaluate actions taken and consider the overall status of the WMP.

Continuity, maintenance and updating of the existing website are targets for sustaining the plan. Other key efforts are:

- Report/document accomplishments through the website,
- Periodic digital photo documentation and rescoring of the current stream stretches using the same physical characteristics,
- Verification of phosphorus reductions via monitoring on a yet-to-be-determined schedule.
- Update specifically targeted BMP's for post-implementation load reduction estimates to determine efficacy and promote results,
- Maintain the existing database; incorporate and interpolate new data as available.
- Reprioritize "Projects to be Completed" lists for each subwatershed, once every three to five years or more frequently if needed,
- Continue to involve local governments and citizens in all facets of the plan,
- Seek synergistic partner cooperation wherever feasible to strengthen projects,
- Implement elements of the Education Plan wherever and whenever opportunities, especially partnering possibilities, appear (e.g., Phase II entities, TMDL actions, other watershed management plans),
- Maintain the existing capability of the website and expand it for the process for public feedback,
- Seek public evaluation (website use of a Microsoft Access questionnaire) for each project element implemented and maintain results as part of an overall database for the watershed,
- Determine and record the number of relevant projects undertaken each year that will have an impact on water quality in the subwatersheds,
- Promote the timely implementation of prioritized projects whether large or small,
- Provide publicity for noteworthy voluntary implementation efforts in the hope of stimulating others into similar actions,
- Obtain sustainable funding from Steering Committee members,
- Have the Steering Committee identify, direct and/or write proposals for new grants (Section 319, Clean Michigan Initiative, USEPA, Kalamazoo Community Foundation, etc.) to maintain these efforts, and
- Have the Forum of Greater Kalamazoo continue to facilitate WMP implementation efforts.

Over time, the effectiveness of this WMP will be determined by answers to these key questions:

- What measurable improvements in water quality have been accomplished and maintained?,
- Have projects been implemented by willing partners/participants?,
- Has the plan remained viable (updated and reflective of altering conditions) over 5 to 10 years?,
- Does the community reflect positively on the plan and its outcomes?, and
- Has the plan achieved a sustainable status?

A summary schematic included in Attachment 24 details overall goals of the Steering Committee through all past, current, and future projects. Many educational goals are being met, and lessons are being learned. The Education Subcommittee and The Forum attempted several

meetings in the past year with school leaders, teachers, and classes and met with variable success. It seems that much remains to be done in order to truly develop useable, adoptable curriculm. Teacher standards and limitations on teachers' time make this a much more difficult venture than originally anticipated. On the other hand, opportunities seem to be expanding for local volunteers and experts to lead or assist school and children's groups with "sampling" projects. In addition, local Creeks have also been the target of sampling and analysis by local colleges.

Periodic press releases will be developed to promote the WMP and the efforts completed during the year. Biennially, notice of the public response/survey to the above questions through the website will be made in these releases. Cross-postings of the press releases will be made electronically to list serves including: Great Lakes Information Network, and other local and municipal web sites.

11.2 Sustainability

11.2.1 Sustainability Elements for the Portage-Arcadia Creek Subwatersheds

The following sustainability elements have been identified as evidence that momentum is building for sustained watershed planning in and around the Portage and Arcadia Creeks Watersheds.

- Phase II Stormwater Permits overlap with all areas of the Portage & Arcadia Creeks subwatersheds providing the regulatory mechanism for select WMP activities, implementation, education, reporting and updates. Where there is inactivity, there will be enforcement.
- The Steering Committee will remain active and engaged, at least through 2007 with a CMI grant.
- Local integration of implementation efforts by various organizations is occurring (e.g., Vine Neighborhood/Partners Building Community; upper Axtell Creek volunteer groups and Girl Scouts).
- Leveraging other non-WMP funds continues to occur (i.e., DEQ restoration of Portage Creek channel below Alcott Street).
- Local PA 319 participants remain active on TMDL efforts and the Kalamazoo River Watershed Council.
- The Steering Committee continues to identify new funding and overlapping projects to implement WMP efforts.
- On-line quantification and tracking systems are being developed the larger Kalamazoo River Watershed (MSU phosphorus activities database) through the TMDL new on-line tools in development (e.g., NutrientNet) for the larger Kalamazoo River Watershed.
- Local watershed steward anchors are developing with current partners (e.g., Girl Scouts and Axtell Creek Attachment 25).
- Local schools have used the website and repeatedly approached the Steering Committee (Kalamazoo College, Portage Northern High School).
- Major new LID projects and principles are being considered, discussed, adopted and infused into policy (WMU, Portage, Kalamazoo stormwater projects).

- The Kalamazoo Water Reclamation Plant Laboratory participated with voluntary monitoring program at the Kalamazoo River Watershed level and provided lab services for Portage & Arcadia Creeks BMP sample analysis.
- A local commitment by consultant (K&A) to seek funding continues.
- TMDL point sources maintain a financial commitment to maintain the www.kalamazooriver.net website.
- Organizations provide materials for posting their related activities on websites.
- Volunteer monitoring programs are developing at the watershed scale through other efforts with PA input and many overlapping participants. The MDEQ is also exploring ways to encourage these types of efforts through workshops and training.
- Vested homeowners participated in a downspout disconnect and rain barrel program.
- Local High Schools have been active Participants (PNHS, Loy Norrix, Kalamazoo Christian).
- Adoption of local creek segments by active volunteer groups (Axtell Creek) has occurred without a formal program of promotion and recognition resulting in regular trash pickups.
- Ongoing implementation efforts are occurring (downspouts, Axtell Creek plantings, etc.).
- Successful funding for implementation projects has been aquired with anticipated water quality benefits (Milham Park, Loy Norrix, Axtell Creek, Kalamazoo Christian, Girl Scouts, etc.).

11.2.2 Sustainability Successes

The TMDL Implementation Committee is moving towards a formal watershed organization to manage the TMDL via an umbrella group that could compliment many smaller subwatershed efforts. These smaller efforts each have several common goals, one primary goal of phosphorus loading reduction that is integrally tied to the TMDL. A recent strategy outline for an upcoming meeting organized by Michigan State University Extension in association with an ongoing project is provided in Attachment 26. Several members of the Portage & Arcadia Creeks Steering Committee are taking part as this new organization is defined or created.

The Portage & Arcadia Creeks Steering Committee will continue to meet during the course of the current CMI implementation grant which funds work at the Milham Park/Loy Norrix site on Portage Creek and the Kalamazoo Christian High School Site on Arcadia Creek. The website will be maintained and periodically updated during the course of the project by Kieser & Associates. New text included in this printed WMP will be used to update various webpages on the current website following MDEQ approval.

The Steering Committee, under the continued leadership of The Forum and with technical assistance from Kieser & Associates, continues to look for additional implementation funding opportunities. The Committee has expressed interest in conducting projects at additional sites and in redesigning the website for specific target audiences.

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