City of Jackson

Stormwater Management Manual

Effective Date: February 1, 2012

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SECTION I – Design Requirements

1.0 INTRODUCTION

The intent of this document is to provide information specific to the City of Jackson's design standards to address stormwater quantity and quality. This manual will provide the policy framework, implementation procedures and design standards for stormwater controls.

The Jackson City Council adopted two ordinances on January 11, 2011:

> The first is Ordinance No. 2011.01 known as the Post-Construction Stormwater Management Ordinance. This ordinance requires that a stormwater management permit be obtained prior to commencing any land disturbance activities in connection with new development and redevelopment projects, as defined in the ordinance.
>
> The second is Ordinance No. 2011.02, known as the Stormwater Utility Ordinance. The Design Requirements section of this manual deals with the Post-Construction Stormwater Management Ordinance and the Credit Requirements section deals with the Stormwater Utility Ordinance.

Section I outlines design requirements for stormwater quantity and quality, and flood control. The City of Jackson has adopted the *State's Low Impact Development (LID) Manual for Michigan* to guide the design of proposed Best Management Practices (BMPs) for water quality and quantity so they meet the minimum treatment volume and channel protection standards provided in this document.

Section II is the Storm Water User Fee Credit Manual which defines the user fee, the credits and the credit policies. Forms for applying for credit along with examples of completing the forms are included in this section.

This edition of the rules for the management of stormwater within the City of Jackson reflects a stormwater management philosophy that considers stream channel protection and stormwater quality management in addition to flood control. These revisions are based upon the most current State Permit requirements concerning stormwater management. This manual will be updated periodically as additional BMPs are developed and/or as requirements change.

The following section outlines basic ideas and principals of stormwater management, and provides a conceptual foundation for the design standards contained in this document.

2.0 THE ROLE OF THE DEPARTMENT OF PUBLIC WORKS AND THE MICHIGAN LID MANUAL

The Department of Public Works will review all plans submitted to the standards outlined in this document. Those sites that must submit to this office for review are listed below. The Department exercises authority

over permitted activities of structural facilities that convey and treat stormwater runoff that will be generated from a site as a result of its design. The Department rules will govern the design of such management facilities with the following objectives:

- Incorporate design standards to control both water quantity and quality.
- Encourage innovative stormwater management practices that meet the criteria contained within these rules.
- Ensure future maintenance of facilities by planning for it as a part of system design.
- Make the safety of facilities a priority.
- Strengthen the protection of natural features.
- Encourage more effective soil erosion and sedimentation control measures.

With the change in land surface generated by land development, not only does the peak rate of runoff increase but also the total volume of runoff often dramatically increases. LID focuses on both peak rates and total volumes of runoff. LID application techniques are designed to hold constant peak rates of runoff for larger storms and prevent runoff volume increases for the much more frequent, smaller storms. Thus, the natural flow pattern is kept in better balance, avoiding many of the adverse impacts associated with stormwater runoff. In design, LID is structured to maximize the use of natural features to mimic predevelopment hydrology.

3.0 APPLICABILITY

To prevent an increase in non-point source pollution, these Standards and requirements shall apply to the following:

1) Any new development or redevelopment project that have earth-disturbing activities greater than or equal to 1-acre, or earth disturbing activities less than 1-acre on parcels that are part of a larger plan of development, or include a net increase in impervious area of 1,000 square feet or more, or result in the alteration of existing storm water flow patterns and discharges to a surface water of the state.
2) Any new development or redevelopment project that would change alter or convert the use of land to a stormwater hotspot.

3.1 Sites That Are Hot Spots

Hotspots are defined in the ordinance. They are sites that have a higher potential risk for spills, leaks or illicit discharges and include: any site that handles vehicles for fueling, salvage, service and maintenance, and cleaning; fleet storage areas; industrial sites; outdoor liquid container storage; recycling facilities; etc.

3.2 Stormwater Plan Submittal Requirements

These requirements have been developed in the context of plat submittal under Act 288 of the Public Acts of 1967, as amended, the Michigan Land Division Act. However, they shall also be followed for all other categories of development, including site condominiums and site plans.

The following developments will be submitted to the City for review and approval:

1. Plats submitted under Act 288 of the Public Acts of 1967, as amended, the Michigan Land Division Act
2. Site Condominium plans prepared under Act 59, P.A. 1978, as amended, where local government ordinances require.
3. Mobile home plans prepared under Act 96, PA. 1987.

The developer will describe the mechanism to be established for long-term maintenance and schedule of the development's private stormwater management system (see ordinance for details).

Should the proprietor plan to subdivide or develop a given area but wishes to begin with only a portion of the total area, the original preliminary plan will include the proposed general layout for the entire area. The first phase of the subdivision will be superimposed upon the overall plan in order to illustrate clearly the method of development that the proprietor intends to follow. Each subsequent phase will follow the same procedure until the entire area controlled by the proprietor is developed.

Final acceptance by the City of Jackson of only one portion or phase of the development does not ensure final acceptance of any subsequent phases or the overall general plat for the entire area; nor does it mandate that the overall general plat or plan be followed as originally proposed, if deviations or modifications acceptable to the City of Jackson are proposed.

Preliminary plan approval shall remain in effect for one year. Extensions must be requested in writing.

3.3 Submittal Process

City of Jackson Post-Construction Stormwater Management Permit Application Submission Schedule – City Ordinance Section 27-120

STEP 1: Pre-Application Conference - Before an application for a stormwater permit is submitted, the developer shall meet with the City Engineer to discuss the permit application process.

STEP 2: Preliminary Plan Submittal - The developer may be required to submit a conceptual design based on the pre-application conference. If the preliminary plan is required, approval is required before the City Engineer will proceed with review of a final stormwater management plan.

STEP 3: Permit Application & Plan Submittal: The developer of a proposed covered development project shall be required to submit a stormwater management permit application and plan. The application must be complete before a review can begin.

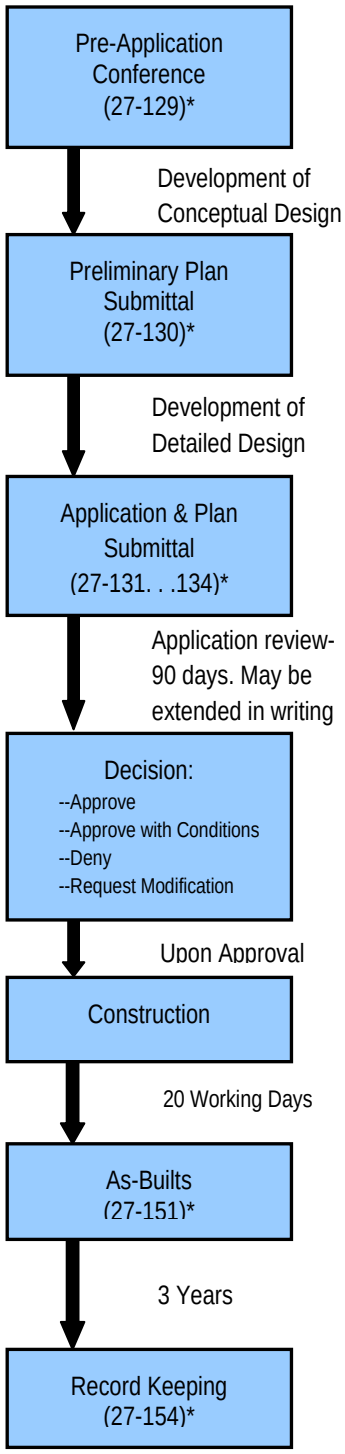
STEP 4: Review Process And Decision- Within 90 days of receipt of a completed application the City Engineer shall reach one of the following decisions: Approve, Approve With Conditions, Deny, or Request a Modification to the Application. The review process may be extended in writing by both city and applicant.

STEP 5: Construction—The Developer constructs the project insuring that soil erosion control measures are used properly and the BMPs are installed.

STEP 6: As Builts – Within 20 working days of the date of completion of a stormwater management system, as-builts shall be submitted to the City Engineer.

STEP 7: Post Construction & Record Keeping – Developer shall retain and preserve for no less than 3 years any and all records, etc., related to stormwater management system.

Figure 1:
Submittal Process Flow Chart



* Ordinance Section Numbers

4.0 DESIGN MANUAL AND STANDARD DETAILS

This document together with the State Low Impact Development (LID) manual will provide information on water quality and quantity standards as well examples of acceptable stormwater treatment practices, including the specific design criteria for each stormwater practice. This document and the LID manual may be updated and expanded from time to time based on federal and state requirements, improvements in engineering, science, monitoring, and local maintenance experience. Stormwater treatment practices that are designed and constructed in accordance with the design and sizing criteria contained in the LID manual should meet the minimum water quality and channel protection performance standards outlined in this document. Calculations to demonstrate that BMP designs will perform to meet required water quality and flood control standards are to be submitted to the City of Jackson. Failure to construct stormwater treatment practices in accordance with these standards may subject the violator to a civil penalty as described in the ordinance.

5.0 REQUIRMENTS

Preliminary Plan Requirements

To maximize the efficiency and effectiveness of the pre-application conference, the City Engineer may require the developer to submit a preliminary stormwater management plan prior to the conference. All preliminary plans will include the following information:

(a) The preliminary plan may be used by the City Engineer to evaluate the type of stormwater management measures that may be necessary and appropriate for the proposed development and to ensure adequate planning for stormwater management on the site consistent with the requirements of this manual.

(b) The preliminary stormwater management plan shall include all of the information and shall meet all of the requirements for final stormwater management plans unless any such information or requirements are determined unnecessary by the City Engineer for the development in question.

(c) All required elements of the preliminary plan, such as maps, plans, easements, details, and calculations may be preliminary rather than final, and detailed construction drawings shall not be required, unless determined necessary by the City Engineer for the development in question.

(d) In all cases, the preliminary plan shall include all information, documents, items, and materials, in the form and at the level of detail, as determined necessary by the City Engineer to adequately evaluate, before the permit application is submitted, the environmental characteristics of the project site, the potential impacts of the proposed development of the site on water resources, and the effectiveness of any measures proposed by the applicant to manage stormwater generated at the project site as required by this manual.

(e) If a preliminary stormwater management plan is required, approval of the preliminary plan by the City Engineer shall be required before the City Engineer will proceed with review of a final stormwater management plan. The City Engineer shall review the submitted preliminary plan and specify any modifications that must be made to the preliminary plan for purposes of preparing a final stormwater management plan that meets requirements. The applicant shall prepare and submit to the City Engineer a final stormwater management plan that incorporates any modifications required to the preliminary plan as specified by the City Engineer and that meets requirements of this manual.

6.0 STORMWATER MASTER PLAN INFORMATION

This section sets forth the requirements that shall apply to final stormwater management plans for proposed development projects.

(a) General.

1. The stormwater management plan shall display and present the information required by this section through the use of maps, illustrations, reports, and calculations.
2. The stormwater management plan shall specify the type, location, and size of stormwater management system to be provided, using final calculations and detailed construction drawings.
3. If the development will be completed in phases, the stormwater management plan shall be prepared and submitted for the total project and for all phases. Further, upon completion of each phase, the stormwater management plan for the project shall be fully functional for the phases already completed and its functionality shall not be reliant in any way upon the completion of future phases. Final approval of one or more phases shall not ensure approval of subsequent phases.

(b) **Plan preparation**. The stormwater management plan shall be prepared, signed, and sealed by a professional civil engineer registered in the State of Michigan.

(c) **Scale for mapping**. The stormwater management plan shall be drawn to a scale not less than 1" = 50', or as otherwise required by the civil engineer.

(d) **Required elements and information**. A stormwater management permit shall not be approved unless the applicant has provided a final stormwater management plan that contains all of the submittals required by this subsection. (The City Engineer may require the same or similar requirements for a preliminary stormwater management plan submitted by an applicant during earlier stages of the stormwater management permit review process, but using preliminary calculations and without requiring detailed construction drawings, as determined appropriate by the City Engineer.) A final stormwater management plan shall include all of the following elements and information:

1. *Location and size*. The location of the development by means of a small location map, drawn to a scale no less than 1" = 2000', and the size of the development in acres.
2. *Zoning.* The zoning classification of the development site and all abutting parcels.
3. *On-site and off-site features*. The location and description of all on-site features and all adjacent off-site features within fifty (50) feet (unless another distance is specified by the City Engineer based on the circumstances at the site), and all other off-site features that may be impacted in determining the overall requirements for the development.

   This shall include:

   (a) Property lines of the development and of adjoining developments.
   (b) Existing site topography with contours at two-foot intervals (one foot preferred) based on the NAVD88 datum.
   (c) On-site public and private streets and street right-of-way lines; and adjoining public and private streets and street right-of-way lines.
   (d) Railroads.
   (e) Power lines or underground transmission lines, gas mains, telephone, monitoring wells.

(f) Cemeteries.
(g) Parks.
(h) Natural and artificial watercourses, wetlands and wetland boundaries, environmental feature boundaries, floodplains, existing stormwater storage facilities, conveyance swales (natural or artificial) with identification of permanent water elevations.
(i) Location of woodlands.
(j) Designated natural areas.
(k) Any proposed environmental mitigation features.
(l) Existing and proposed public and private drains, storm sewers, sanitary sewers, and water mains, and any related easements.
(m) A map, at the U.S.G.S. scale, showing the drainage boundary of the proposed development and its relationship with existing drainage patterns.
(n) Boundaries of any off-site drainage area contributing flow to the development.
(o) All watercourses passing through the development, along with the following:
    (1) Area of upstream watershed and current zoning.
    (2) Final calculations of runoff from the upstream area for both the one hundred-year and two-year 24-hour design storms, for fully developed conditions according to the current land use plan for the area.
(p) Soil borings at the sites of proposed retention/detention and infiltration facilities, and as needed in areas where high groundwater tables or bedrock near the surface exist, and at any other locations as required by the City Engineer.
(q) Proposed development site improvements including lot divisions and building footprints.
(r) Drinking water wells, public wellheads, wellhead protection areas (WHPAs), underground storage tanks, and brownfields.
(s) Any areas of unique geological formations (e.g., karst areas).
(t) Any other on-site or off-site features as determined necessary by the City Engineer.

4. *Stormwater BMP construction plans.* The stormwater management plan shall include final stormwater BMP construction plans. The BMP construction plans shall be drawn to a scale not less than 1" = 50', and on sheets no larger than 24" × 36". The scales used shall be standard engineering scales and shall be consistent throughout the plans. When plans have been completed with computer aided design technology, locations should be geo-referenced and a copy of the electronic file shall also be provided. The construction plans and related documents shall, at a minimum, include:
    (a) Location and specifications of all proposed stormwater management practices, methods, and facilities (plan and profile).
    (b) Proposed storm drains, including rim elevations, invert elevations, pipe sizes, and pipe materials.
    (c) Calculations of runoff from upstream areas for both the one hundred-year and two-year, 24-hour design storms for fully developed conditions according to the current land use plan for the area.
    (d) Identification of stormwater quality and quantity treatment facilities and method of stormwater conveyance.
    (e) Calculation of runoff volume captured by BMPs for treatment facilities.

(f) Proposed open channel facilities including slope, cross-section detail, bottom elevations, and surface material.
(g) Final sizing calculations for stormwater quality and quantity treatment facilities and stormwater conveyance facilities.
(h) Storage provided by one-foot elevation increments.
(i) Tributary area map for the stormwater management system and all components thereof indicating total size and average runoff coefficient for each sub-area.
(j) Analysis of existing soil conditions and groundwater elevation (including submission of soil boring logs) as required for proposed retention and infiltration facilities.
(k) Plans and details of proposed soil erosion and sedimentation control measures, both during construction (as required by Part 91 of the Public Acts of 1994) and permanent measures.
(l) Details of all stormwater BMPs, including but not limited to:
    (1) Outlet structures.
    (2) Overflow structures and spillways.
    (3) Riprap.
    (4) Manufactured treatment systems.
    (5) Underground detention cross-section and product details.
    (6) Cross section of infiltration and/or bio-retention facilities.
(m) Location of proposed stormwater management facility easements.
(n) Final landscaping plans and details.

7.0 PERMIT APPLICATION

The developer of a proposed covered development project shall be required to submit a stormwater management permit application and all required accompanying submittals and shall meet the other requirements provided by the ordinance.

(a) An application for a stormwater management permit shall be submitted by the applicant to the City Engineer on the form provided by the City Engineer.
(b) The applicant may be the property owner or the property owner's authorized representative. The permittee, however, shall be the property owner.
(c) The submitted application shall include all information, documents, items, and materials as specified by the application form. In addition to what is required by the application form, the City Engineer may require the applicant to submit any other materials as determined necessary by the City Engineer to fully and adequately review and evaluate the application for purposes of this article.
(d) All of the required application materials shall be submitted in as many copies, and shall be prepared in the form, manner, and level of detail, as specified by the application form or as otherwise required by the City Engineer.
(e) A permit application shall not be deemed complete until the City Engineer has determined that all required information, documents, items and materials have been provided, along with the fully paid stormwater management permit review fee, and, if requested, the fully paid escrow fee and completed escrow fee acknowledgement form.
(f) If the City Engineer determines that an application is not complete, the City Engineer shall specify in writing to the applicant what the applicant must do to complete the application.
(g) Any period for approving, denying, or modifying an application as specified by this article shall not begin to run until the City Engineer has determined that the application is complete as provided by this section.
(h) An application may be considered withdrawn and the application file may be closed by the City Engineer if an applicant fails to respond to any written request from the City Engineer for information, documents, items, or materials regarding the application within thirty (30) days of the request, or within any longer period of time if the City Engineer and the applicant agree in writing that an extension of time is appropriate and the amount of additional time is set forth in the agreement.
(i) At any time during the permit application review and approval process, the City Engineer may forward copies of the application to other city departments and other public bodies for their information, review and input, and to coordinate, to the extent possible, the stormwater management permit review process with other public reviews and approvals that may also be required for the development.
(j) Filing an application for a stormwater management permit grants the city permission to enter the site to verify information in the application and to inspect for compliance with any permit that may be issued.

8.0 PERMIT APPLICATION FEE:

A non-refundable application fee shall be submitted to the City Engineer with the initial submittal of the permit application form. The application fee shall be in an amount sufficient to cover reasonable costs and expenses generally associated with the review by the City Engineer of stormwater management permit applications, including routine administrative and technical reviews and on-site inspections. The amount of the application fee shall be established from time to time by resolution of the City Council.

9.0 ESCROW FEE:

In addition to the application fee, based on the size, complexity, or other aspects of a proposed development, the City Engineer may determine that the applicant must submit to the city as part of the permit application an escrow fee in an amount sufficient, as determined by the City Engineer, to pay for the estimated reasonable costs and expenses of any city personnel and any professional consultants whose services are deemed necessary by the City Engineer to adequately review the application for purposes of compliance with the requirements of the ordinance:

(a) If the City Engineer requires payment of an escrow fee, the applicant must complete and submit an escrow fee acknowledgment form provided by the City Engineer.
(b) The amount of the escrow fee shall be determined at the time of project review based on a specific scope of work, and shall be calculated at the rates determined by the City Engineer.
(c) The services for which an escrow fee may be used may include, but shall not be limited to, hydrologic and drainage analysis, wildlife evaluation, stormwater quality analysis, wetland survey and delineation, site inspections, as-built plan review, analysis of legal issues, and any other city personnel and professional consultant services deemed necessary by the City Engineer.
(d) If the actual total cost of the services of the city personnel and consultants is less than the escrow fee submitted, the city shall refund the balance to the applicant.
(e) If the actual total cost of the services of the city personnel and consultants exceeds the amount of the escrow fee submitted, the applicant shall provide to the city an additional escrow amount equal to no less than one-half (½) the original escrow amount. All review by the city of the stormwater management permit application shall cease until such additional escrow amount is deposited with the city, and the number of days that review of the stormwater management permit application ceases shall be deducted from the period within which the City Engineer may otherwise be required to act upon the application.
(f) Payment of an escrow fee as provided by this section may be required by the City Engineer at any point during the stormwater management permit review process, as determined necessary by the City Engineer.
(g) A denial of an application for a stormwater management permit shall not affect in any way the applicant's obligation to pay the escrow fees required by this section.

All fees required shall be paid by cash, check, or money order. All forms of payment other than cash shall be made payable to the City of Jackson.

10.0 INSPECTION FEES:

Inspection fees may be charged, at the discretion of the City, especially for as-built inspections and if maintenance schedules appears to be not being followed.

11.0 EXPLANATION OF REQUIREMENTS

City Of Jackson Design Criteria

In an effort to standardize design procedures for storm sewers and open channels the City of Jackson has developed these standards. It is intended that these standards will facilitate planning from both the position of the design and reviewing engineer.

It is recognized that design conditions vary and there is no substitute for the professional judgment of an experienced engineer. In all cases this judgment should be applied.

The design engineer should always use the more restrictive requirement/methodology if there is a conflict between the LID standards and the City of Jackson flood control requirements.

Where insufficient data is available to develop basin hydrology by the above method, the developer shall determine flows along the watercourse by the Soil Conservation Service (SCS) based methods, the rational method (for peak flow only), Storm Water Management Model (SWMM), or a combination of these methods. The basin hydrology shall be approved by the City Engineer's office prior to proceeding with the final design of a given project.

The development shall meet the following stormwater design requirements:

- *A* A minimum treatment volume standard *to minimize water quality impacts*
- *B Channel Protection Criteria*
- *C Be compatible/integrate with the City of Jackson's Flood Control requirements*
- *D A requirement for the project developer to write and implement site plans, which shall incorporate the requirements of the City of Jackson ordinances*
- *E Easement for Stormwater Management System*
- *F Implementation Plan*
- *G Enforcement mechanisms with recordkeeping procedures*
- *H Performance Guarantee*
- *I Other information and materials*
- *J Operation and maintenance requirements*

Following is a detailed description for each of the requirements (A-F). There is a table after the *Operation and Maintenance Requirements* section that summarizes the stormwater requirements within the City of Jackson.

Requirement A: "A minimum treatment volume standard to minimize water quality impacts."

The calculated site runoff is from the 90 percent annual non-exceedance storm for the region or locality, according to (a) or (b) below, respectively:

To address water quality impacts of storm runoff, all stormwater management plans shall comply with the minimum treatment volume standard provided by this section.

(a) The minimum treatment volume standard shall be one (1) inch of runoff from the entire site.
(b) Treatment methods shall be designed on a site-specific basis to achieve either of the following:
    (1) A minimum of eighty (80) percent removal of total suspended solids (TSS), as compared with uncontrolled runoff; or
    (2) Discharge concentrations of TSS not to exceed eighty (80) milligrams per liter (mg/l).
(c) A minimum treatment volume standard is not required where site conditions are such that TSS concentrations in stormwater discharges will not exceed eighty (80) mg/l.

Sites are in compliance with this permit requirement if the minimum treatment volume from the site is treated by properly designed BMPs that achieve either 80% removal of total suspended solids, or discharge 80 mg/l or less of total suspended solids according to accepted literature. It is also important to note that new development will often be in compliance with this permit requirement if the volume control specified in the channel protection requirement of this permit is achieved.

Compliance may be shown through calculation or through direct measurement. Calculations or measurements must show reductions to the calculated TSS concentration in uncontrolled runoff using the data provided here or another acceptable literature source. The State LID Manual summarizes the potential application and the quantity and quality function for most BMPs, when designed correctly, either individually or as a suite of BMPs.

Requirement B: "Channel Protection Criteria."

All stormwater management plans shall comply with the channel protection criteria provided by this section to address post-development site runoff volume and peak flow rates.

(a) A stormwater management plan shall require such stormwater management practices, methods, and facilities as necessary to maintain post-development site runoff volume and peak flow rates at or below existing levels for all storms up to the two-year, twenty-four-hour event, as determined adequate by the City Engineer. "Existing levels" means the runoff flow volume and rate for the last land use prior to the proposed development. The City Engineer may specify more restrictive criteria if determined necessary by the City Engineer to meet the goals of reducing runoff volume and peak flows to less than existing levels on the property to be developed.
(b) To ensure that the required channel protection criteria are met, the City Engineer shall use the procedures, methods, techniques, formulas, and data sources as contained in the city's stormwater management manual or as otherwise determined appropriate by the City Engineer.

Requirement C: **"**Be compatible/integrate with the City of Jackson's Flood Control requirements.**"**

Structures are to be sized to accommodate a twenty-four hour, 100-year storm. The maximum allowable discharge is based a thirty-minute, ten-year storm. Furthermore, See Chapter 11 of the City of Jackson code of ordinances for further details regarding permissible uses in the floodplain.

Requirement D: **"**A requirement for the project developer to write and implement site plans, which shall incorporate the requirements of the City of Jackson ordinances." This includes:

<u>Soil Erosion Control</u>

(a) All development and other land disturbance activities shall be designed, constructed, and completed in such a manner that the exposed area of any disturbed land is limited to the shortest practical period of time.
(b) Proposed erosion control measures shall be submitted to Jackson County for determination that such measures comply with the county's soil erosion and sedimentation control requirements. The project developer must obtain part 91 permit from the County.
(c) Approved soil erosion control measures shall be installed and maintained between the disturbed area and any down-gradient watercourses (including rivers, streams, creeks, lakes, ponds, and other watercourses), wetlands, roadways, and property lines.
(d) Sediment resulting from accelerated soil erosion shall be removed from runoff water before it leaves the site of the development.
(e) Temporary and permanent soil measures designed and constructed for the conveyance of water around, through, or away from the development or land disturbance activity area shall be designed to limit the water flow to a non-erosive velocity.
(f) Temporary soil measures shall be removed after permanent soil measures have been implemented and stabilized. All developments and land disturbance activity areas shall be stabilized with permanent soil measures.
(g) If inland lakes, ponds, rivers, creeks, streams, or other watercourses and wetlands are located on or near the site, measures that trap sediment shall be provided. The use of temporary sediment basins, sediment traps, filter fabric, and rock filters shall be employed as required by the City Engineer. Other measures may be required if reasonably determined to be necessary by the City Engineer to protect a watercourse or wetland.
(h) If it is not possible to permanently stabilize a disturbed area after an earth change has been completed or where significant land disturbance activity ceases, temporary soil erosion control measures shall be implemented within two (2) calendar days.
(i) Permanent soil measures for all slopes, channels, ditches, or any disturbed land area shall be completed within fifteen (15) calendar days after final grading or the final land disturbance activity has been completed. All temporary soil measures shall be maintained until permanent soil measures are implemented and stabilized.
(j) Vegetated filter strips, twenty-five (25) feet in width, preferably vegetated with native plant species, shall be created or retained along the edges of all lakes, creeks, streams, wetlands, and other watercourses. The width of a particular filter strip may be reduced to the extent it is demonstrated to the City Engineer's satisfaction that a portion of the width will serve no useful

function, e.g., to the extent the grade is such that water flow will be away from the watercourse and the filter strip does not serve to protect wildlife habitat or other useful function.

Discharge of Stormwater to Wetlands

(a) Wetlands shall be protected from damaging modification and adverse changes in runoff quality and quantity associated with land disturbance activities. Before approval of a final plat or site plan, all necessary wetland permits from the MDNRE and/or the city must first be obtained.
(b) Wetlands shall be protected during development by appropriate soil erosion and sedimentation control measures that are continuously maintained throughout the construction phase.

Requirement E: Easements for stormwater management system. The applicant shall provide all stormwater management easements as determined necessary by the City Engineer to implement the approved final stormwater management plan and to otherwise comply with the ordinance.

(a) Stormwater management easements may be required for any of the following purposes:
    (1) To provide access for stormwater management facility inspections and maintenance.
    (2) To preserve stormwater runoff conveyance, infiltration, and detention areas and facilities, including flood routes for storm events.
    (3) To preserve primary and secondary drainage ways that are needed to serve stormwater management needs of other properties.
    (4) To accomplish purposes such as those listed above for all areas used for off-site stormwater control, including undeveloped or undisturbed lands, as applicable.
    (5) To serve other purposes and objectives as necessary to achieve the purposes of this article as determined by the City Engineer.
(b) All stormwater management easements shall meet the following requirements:
    (1) The purpose of each easement shall be specified in writing.
    (2) The easements shall be acceptable to the city attorney in form and substance and shall be recorded with the county register of deeds.

Requirement F: Implementation Plans. The applicant shall provide an implementation plan for construction and inspection during and after construction of all stormwater management system components required by the final stormwater management plan, including a schedule of the estimated dates of completing construction of the stormwater management system shown on the plan; identification of the proposed inspection procedures to ensure that the stormwater management system components are constructed and operating in accordance with the final stormwater management plan; and recordkeeping requirements. The implementation plan will include arrangements acceptable to the City Engineer for notification by the applicant to the City Engineer before the commencement of construction of the stormwater management system (and before construction of critical components of the system) and for final verification of construction by a registered professional engineer.

Requirement G: "Enforcement mechanisms with record keeping procedures."

Enforcement of the requirements will be achieved through the stormwater ordinance that supports the City of Jackson stormwater program. In particular, maintenance agreements shall implement and track maintenance activities to ensure long-term O&M plans for the **water quality treatment** controls.

The BMP owner-operator must track and record, and if required by the City, report all field inspection findings to ensure proper O&M occurs for the life of the BMP. As per the ordinance, the BMP/owner operator must maintain inspection and maintenance information for the life of the BMP and make this information available to City staff during inspections.

Requirement H: Performance guarantee. The applicant shall provide a performance guarantee in a form and amount satisfactory to the City Engineer and the city attorney as provided by this section.

(a) The applicant shall submit a performance bond (or other financial guarantee acceptable to the city) for the timely and satisfactory construction of all stormwater management system components in accordance with the final stormwater management plan. The performance bond or other financial guarantee shall be accompanied by a detailed cost estimate provided by the applicant. Upon written certification by a registered professional engineer that all components of the required stormwater management system have been completed in accordance with the final stormwater management plan, including, but not limited to, the provisions contained in the implementation plan and as-built certification and final inspection, and subject to final acceptance and approval by the City Engineer, the city may release the performance bond or other financial guarantee.

(b) Except as provided in item c below, the amount of the financial guarantee shall be in the amount of the cost estimate for the work provided by the applicant, unless the City Engineer determines that a greater amount is appropriate, in which case the basis for such determination shall be provided to the applicant in writing. In determining whether a greater amount is appropriate, the City Engineer shall consider the size and type of the development, the size and type of the on-site stormwater system, and the nature of the off-site stormwater management system the development will use.

(c) The City Engineer may, but shall not be required to, waive or reduce the amount of the financial guarantee for a development that will not increase the impervious surface of the development site by more than two thousand (2,000) square feet.

(d) Nothing in this section or this article shall be construed or interpreted as relieving any person of their obligation to pay all costs associated with on-site private stormwater management systems, as well as those costs arising from the need to make other drainage improvements to reduce a development's impact on a drain consistent with adopted design standards.

Requirement I: Other information and material. The stormwater management plan shall include any other information, documents, items, and materials determined necessary by the City Engineer to verify that the stormwater management plan complies with the city's design and performance standards for drains and stormwater management systems, and that the plan otherwise complies with the requirements of the ordinance and other applicable laws and regulations.

Requirement J: "Operation and Maintenance Requirements."

All structural and vegetative BMPs installed as a requirement of the permit shall include a plan for maintaining maximum design performance through long-term operation and maintenance (O&M). The O&M plans will ensure that the BMP continues to meet the **water quality treatment** controls outlined in this manual. The maintenance plan shall be subject to approval by the City and enforceable. The applicant shall provide a stormwater O&M plan and agreement.

(a) The O&M plan and agreement shall be provided by the applicant in such form and substance as required by the city attorney.
(b) The O&M plan and agreement shall contain provisions to ensure that the maximum design performance of stormwater BMPs is maintained on a long-term basis and that the city's standards for stormwater quality and quantity are met.
(c) At a minimum, the O&M plans and agreements shall include all of the following information and contents:
    (1) The names and addresses of the property owners, and, the owners of all components of the stormwater system.
    (2) The names and addresses of the persons responsible for operation and maintenance.
    (3) The names and addresses of the persons responsible for financing operation and maintenance and emergency repairs.
    (4) The signatures of the owners and any other persons to be bound by the agreement.
    (5) A detailed annual estimated budget for the expected life of the BMPs; and a demonstrated means of financing operation and maintenance and emergency repairs.
    (6) A map showing the location of the stormwater systems and facilities, including catch basins, manholes/access lids, main, and stormwater devices.
    (7) A schedule for routine, non-routine, emergency, and long-term inspection and maintenance of all structural and vegetative stormwater BMPs, with detailed tasks to be performed, and detailed inspection and maintenance checklists.
    (8) Operating instructions for stormwater outlet components.
    (9) Vegetation maintenance schedule.
    (10) Recordkeeping, tracking, inspection, and notice checklists and requirements.
    (11) A statement recognizing the city's right to enter the property for the purpose of inspections.
    (12) Provisions regarding the city's right to perform, or cause to be performed, any required operation and maintenance if the responsible persons fail or refuse to do so, and the obligation of property owner to fully reimburse the city for the costs and expenses incurred by the city in connection with such activity.

The O&M plan and agreement shall be binding on all current and subsequent owners of land served by the stormwater BMPs and shall be recorded in the county register of deeds as directed by the city attorney.

Any person responsible for the operation and maintenance of a stormwater management facility shall provide records of all maintenance and repairs to the City Engineer upon request.

An example of a stormwater maintenance agreement can be found in the LID Manual for Michigan.

The City of Jackson stormwater program requirements should be designed to be compatible/integrate the with the flood damage requirements as outlines in Chapter 11.

Table 1 summarizes City of Jackson water quality requirements.

Table 1: Stormwater Requirements

Treatment Category	Design Requirement
Minimum Treatment Volume*	One (1) inch of runoff from the entire site.
Total Suspended Solids (TSS)*	Minimum of 80% removal of (TSS), compared with uncontrolled runoff – or – Discharge concentrations of TSS not to exceed 80 (mg/l).
Channel Protection Criteria	Maintain post-development site runoff volume and peak flow rates at or below existing levels for all storms up to the two-year, twenty-four-hour event
Maintenance*	All required structural and vegetative BMPs installed will include a plan for maintaining maximum design performance through long-term operation and maintenance (O&M)
Flood Control	Structures are to be sized to accommodate a twenty-four hour, 100-year storm. The maximum allowable discharge is based a thirty-minute, ten-year storm.

12.0 APPEAL PROCEDURES

Any person aggrieved by a notice of violation, order, or other action taken by the City Engineer under the ordinance may request review and reconsideration by the City Engineer and/or may appeal to the stormwater board of appeals. If review and reconsideration or appeal is not properly and timely requested in connection with an action as provided, the action shall be deemed final. The person requesting the appeal shall pay an appeal fee in the amount determined from time to time by the City Council. The appeal fee shall be paid at the time that the appeal is requested.

A request for a review and reconsideration by the City Engineer must be made in writing within seven (7) days from the date of the City Engineer's action in question. The request must state the reasons for the review and shall include all supporting documents and dates. A hearing on the request shall be scheduled at the earliest practicable date as determined by the City Engineer. The hearing shall be conducted on an informal basis at the City Engineer's offices or at another location designated by the City Engineer. The City Engineer shall conduct the hearing. Following the informal hearing, the City Engineer may affirm or reverse, in whole or in part, the action appealed from, or may make any order, requirement, decision, or determination as, in the City Engineer's opinion, ought to be made in the case under consideration. The City Engineer shall notify the aggrieved person of the decision on the request in writing within fourteen (14) days of the hearing. The City Engineer may request additional information and extend the time for his/her decision by an additional seven (7) days in writing following the submission of the additional information. The decision of the City Engineer may be appealed to the Stormwater Board of Appeals. All supporting documentation and information shall be provided by the person requesting the appeal at no cost to the city.

The building code board of examiners and appeals of the city shall serve as a Stormwater Board of Appeals ("SWBA"). The SWBA shall consider appeals from final decisions of the City Engineer. The SWBA shall adopt its own rules of procedure, and keep a record of its proceedings, showing findings of fact, the action of the board, and the vote of each member upon each question considered. The presence of five (5) members of the SWBA shall be necessary to constitute a quorum.

The following provisions shall govern appeals of final decision of the City Engineer made to the SWBA:

(a) An appeal from any final action of the City Engineer must be made to the SWBA within seven (7) days from the date of the action appealed. The appeal may be taken by any person aggrieved by the action. The appellant shall file a written notice of appeal with the City Engineer and with the SWBA. The notice of appeal shall specify the grounds for the appeal and shall be accompanied by a non-refundable appeal fee. Failure to file a timely notice of appeal shall be deemed to be a waiver of the right to appeal.

(b) Prior to a hearing before the SWBA regarding an appeal, the City Engineer shall transmit to the SWBA a written summary of all previous action taken in connection with the action being appealed. The SWBA may, at the SWBA's discretion, request the City Engineer to provide further information regarding the action that is the subject of the appeal.

(c) The SWBA shall fix a reasonable time for the hearing of the appeal. Notice of the hearing shall be provided at least ten (10) days in advance of the hearing to require the attendance and testimony of witnesses and the production of evidence relevant to any matter involved in the hearing. The appellant must submit an exhibit and witness list to the SWBA at least five (5) days before the hearing or as directed by the SWBA.

(d) The SWBA shall conduct the hearing. At the hearing, attorneys may represent the parties and they may file briefs, present evidence, and call, examine and cross-examine witnesses. Any testimony taken at the hearing shall be under oath and recorded. A copy of the transcript of the hearing shall be made available at cost to any person upon payment of applicable charges for the transcript.

(e) The SWBA shall admit all testimony having reasonable probative value and shall exclude irrelevant or unduly repetitious testimony, as determined by the SWBA. The SWBA shall not be bound by common law or statutory rules of evidence. The appellant shall have the burden of proof and persuasion for showing that the City Engineer's decision was clearly erroneous.

(f) If the action of the City Engineer subject to the appeal involves the City Engineer's grant or denial of a waiver, the SWBA's decision to grant or deny the appeal shall be based on the standards and conditions provided in the ordinance.

(g) Within thirty (30) days after the completion of the hearing, the SWBA shall mail or otherwise deliver to all of the parties a written decision g ranting, denying or modifying the decision appealed and/or relief being sought.

(h) The decision of the SWBA on the matter shall be final, and shall be a final determination for purposes of judicial review.

(i) If the City Engineer or his or her designee sits on the building code board of examiners and appeals because of additional responsibilities as the director of public works, the City Engineer shall abstain from any decision before the SWBA.

All charges, penalties, fines, fees, surcharges, costs, or expenses outstanding during any appeal process shall be due and payable to the city. Upon resolution of any appeal, the amounts due and payable shall be adjusted accordingly. The city may suspend discharges to the MS4 if a corrective course of action is not taken or if service charges, penalties, fines, fees, surcharges, costs, or expenses are not timely paid in full.

If an appeal is not demanded as provided by this division within the periods specified, the City Engineer's action shall be deemed final.

If an appeal is properly demanded, the action appealed shall be suspended until a final determination has been made by the SWBA, except for emergency orders or actions where a suspension or delay might endanger human health, safety, welfare, the environment, or the MS4; and as otherwise expressly provided by this section regarding permit appeals.

If an appeal involves a final decision made by the City Engineer in connection with issuing or implementing a stormwater management permit, the following provisions shall apply:

(a) The person appealing the decision must specify in its notice of appeal the action of the City Engineer being appealed and the grounds for the appeal. If a particular permit provision is objected to, the notice of appeal must specify in detail the reasons for the objection, and the specific alternative provision, if any, sought to be placed in the permit.

(b) If, after considering the record on appeal including any statements provided by the City Engineer in response to the appeal, the SWBA determines that a permit or any provision of a permit should be reconsidered, the SWBA shall remand the matter to the City Engineer for further action as determined appropriate by the SWBA. Only the specific provisions of a permit that are remanded by the SWBA for reconsideration by the City Engineer shall be stayed pending further final action taken by the City Engineer as required by the decision of the SWBA.

(c) A decision of the SWBA not to remand any matter shall be considered final administrative action for purposes of judicial review.
(d) Except as otherwise expressly provided above, no action taken or request filed by any permittee shall operate to stay the effect of any permit or of any provision, term or condition of any permit.

Appeals from a final determination of the SWBA may be made to the county circuit court as provided by law. All findings of fact made by the SWBA, if supported by the evidence, shall be deemed conclusive.

SECTION II - STORM WATER USER FEE CREDIT MANUAL

CITY OF JACKSON, MICHIGAN

1.0 INTRODUCTION

The Jackson City Council adopted Ordinance No. 2011.02, known as the Storm Water Utility Ordinance, on January 11, 2011. This ordinance provides the City with the authorization to establish and collect storm water user fees calculated proportionate to the necessary cost of providing storm water system management services to the users of the City's storm water system. The City is further authorized by Michigan statutes to construct, reconstruct, improve, and extend the storm water system.

The City of Jackson storm water management program addresses flooding, erosion and water quality problems throughout the City. Managing storm water flows is critical for several reasons:

- Excessive storm water overwhelms storm drainage systems including streams, culverts and storm drain pipes and can cause flooding.
- Storm water erodes the land, damaging roads, bridges and other infrastructure, and increases the amount of pollutants added to local waterways.

The City of Jackson's storm water system is a public system, similar to a water or sanitary wastewater system, which provides a public benefit and is maintained by the City.

2.0 WHAT IS A STORM WATER USER FEE?

When subdivisions, roads and commercial developments are built or improved in the City of Jackson the City must pay for managing the resulting storm runoff. The City must install catch basins to capture storm water and storm sewers to convey the storm water to streams or rivers, ensuring it does not drain into the sanitary wastewater system and create sewer overflows. Furthermore the City must maintain the entire storm water collection system. In the past the City performed this work without a dedicated revenue source. The City used money from the general fund or the road budget, thus taking funds away from other critical programs. The storm water system is an expensive piece of the City's municipal infrastructure. The City's water and sanitary wastewater systems each have their own dedicated revenue sources derived from water and sanitary wastewater user fees. Water and sanitary wastewater users pay user fees that are partially calculated based on water consumption. However, this has not been the case with storm water management, which has had no user fees attached to it. Municipalities across the country are changing this. They now view their storm water systems as utilities similar to their water and sanitary wastewater systems. They are developing storm water user fee structures to pay for storm water planning, administration, construction and operation and maintenance.

The sole funding source for the implementation and administration of the storm water utility is the storm water user fee which is a fee charged to properties located within the City of Jackson. This fee is proportional to the storm water leaving each property and the impervious and pervious surface areas of each property are used to estimate the amount of stormwater leaving each property. The impervious area, in square feet, is multiplied by a factor of 0.95 and the pervious area by a factor of 0.15. The sum of these calculations is defined as the Equivalent Hydraulic Area (EHA) of the property.

Based on the impervious and pervious area measurements of a sample of properties, the EHA of a typical detached single family residential property in the City of Jackson has been determined to be 2,125 square

feet and has an associated fee that is established by resolution by the City of Jackson. This is defined as one EHA unit.
Detached single family homes (up to and including four units) pay a flat storm water user fee based on the fee charged to a property having one EHA unit.

For all other non-residential properties their impervious and pervious areas are individually measured and their individual EHA units are calculated. These properties are billed individually calculated storm water user fees based on their EHA units. These properties are billed based on an associated fee that is established by resolution by the City of Jackson. The number of EHA units assigned to a property will remain constant unless physical changes are made that alter the calculation of the number of EHAs assigned to that property. These non-residential properties are billed a minimum storm water user fee equivalent to the lowest category flat storm water user fee charged to detached single family homes regardless of any credits that may be applicable to them.

3.0 WHAT IS A STORM WATER USER FEE CREDIT?

All property types are eligible for a reduction in their storm water user fees through storm water user fee credits.

The storm water fee user fee credit is a conditional reduction in the storm water user fee if a property owner voluntarily takes measures to reduce the storm water rate or volume flowing from the property to the City of Jackson's storm water system. The credit can be obtained through:

- Installation and continuing use, operation, and maintenance of an approved physical storm water best management practice (BMP) that the City of Jackson does not own, maintain, or operate.
- BMP activities that reduce or alleviate the City of Jackson's cost of providing the City's storm water management program.

This Storm Water User Fee Credit Manual details the policies and procedures applicable to the storm water user fee credit program.

4.0 CREDIT POLICIES

4.1 General Policies

(a) Credit is given to eligible customers only. An eligible customer shall be the legal owner of a property which has the primary legal responsibility for operation and maintenance of a qualifying storm water BMP located on the same property.

(b) Multiple credits can be given to eligible properties by adding approved credit percentages. The total credit given to any property cannot exceed 75% of the storm water user fee for that property. The minimum storm water user fee for individually measured non-residential properties, regardless of credits, is the storm water user fee equivalent to the lowest category flat storm water user fee charged to detached single family homes.

(c) It is the responsibility of the storm water customer to apply for storm water user fee credits, and to provide the necessary information with the credit application, as described herein. Questions relating to credits and credit applications should be directed to the Administrator. City staff is not responsible for initiating, performing engineering calculations, or otherwise assisting with the preparation of credit applications. Any engineering calculations, drawings and inspection reports required by the credit application must be prepared and stamped by a professional engineer,

architect or landscape architect licensed in the State of Michigan for this area of expertise as described in the credit application. This application shall include a recent inspection report by an engineer certifying that the system is properly designed and is being maintained.

(d) Credit applications will only be reviewed if they are filled-out completely. If the credit application is not administratively complete or been approved, the credit applicant will receive notice either by email (if provided) or by U.S. mail.

(e) Any approved credit application received within one (1) year from when the applicant received their initial storm water user fee bill will apply retroactively to the date of the initial user fee bill. After July 1, 2012, if credit applications are approved at least thirty (30) days before an applicant's next regularly scheduled bill, the credit will appear on the next bill.

(f) Applications for a storm water user fee credit for new construction may be submitted after the storm water BMP is in place.

(g) The City will, at its discretion, undertake periodic visual inspections of the storm water BMPs being utilized to obtain a credit. Consequently, an access easement must be granted to the City for credits to be approved. If the storm water BMP is found to be functional and being properly maintained, the credit will remain in effect. If the BMP facility is not functional or is not being adequately maintained, the credit will be voided on subsequent billing cycles. The Administrator may revoke a credit at any time for non-compliance by providing thirty (30) days written notice of a non-complying condition and intent to revoke the credit to the property owner. If the non-compliance is not cured within the thirty (30) day period, the Administrator shall eliminate the credit. Before a credit is re-instated, the property owner will have to reapply for the credit.

(h) Properties that have been issued storm water credits will be required to submit compliance statements every three (3) years from the date of credit approval. This statement can be filled out and signed by the property owner or the owner's designee. The Administrator may revoke a credit for failure to submit this compliance statement by providing thirty (30) days written notice of a non-complying condition and intent to revoke the credit to the property owner. If the non-compliance is not cured within the thirty (30) day period, the Administrator shall eliminate the credit. Before a credit is re-instated, the property owner will have to reapply for the credit.

(i) Storm water user fee credits are available for:
    a. Residential Property: Flat Rate 50%
    b. Non-Residential Storm Water Quantity: 37.5 to 75%
    c. Education: 25%
    d. Direct Discharge: Maximum of 75%

Each practice is described in more detail below.

4.2 Credit Descriptions

4.2A Residential Property Credit: Flat Reduction of 50%

A Residential Flat Rate Water Quantity Reduction Credit of 50% is available to owners of a property that contains a detached single family home or up to four units. The applicant must show that a City of Jackson-approved storm water BMP has been effectively implemented on the property. City of Jackson approved residential property storm water BMPs include:

- Rain Gardens
- On-site Storm Water Storage
- Vegetated Filter Strips

4.2A1 Rain Gardens: Rain gardens are landscaped areas built in a depression that are designed to capture and filter storm water runoff from a roof or other impervious surface. The plants and soil of the rain garden provide an easy, natural way of reducing the amount of storm water runoff from individual residential properties. To obtain the Residential Property Credit, the rain garden must meet the following criteria:

- At least 25% of a property's roof area or an equivalent impervious surface area on the property must drain to the rain garden.
- Storm water overflows from the rain garden must be directed to appropriate outlets to the storm water system and away from neighboring properties, sidewalks, steep slopes, or retaining walls.
- The rain garden must be sized and constructed in accordance with the City of Jackson Storm Water Management Manual.

Maintenance Guidelines – Rain Gardens

- Maintenance guidelines for rain gardens can be found in the City of Jackson Storm Water Management Manual.

4.2A2 On-site Storm Water Storage: On-site residential storm water storage structures can include rain barrels, cisterns or other storage devices. These structures collect and capture storm water from roofs that would otherwise be drained directly to the storm water system or streams. On-site storm water storage structures can be used to water plants, trees, or lawns during dryer periods. To obtain the Residential Property Credit the following criteria must be met:

- 75% of the property's roof area is properly connected to rain barrels or other approved storage devices that provide at least 50 gallons of storage per downspout, or storage devices must be sized to hold the runoff from 50% of the property's roof area during a 1-inch rainfall event.
- The minimum amount of on site water storage required must be completely drained in no less than 24 hours, and no longer than 4 days, after each rainfall event. Longer drainage periods may be acceptable if the storage device is larger than the minimum required storage.
- Storm water overflows from on site storm water storage or the draining of on-site storage devices must be directed to appropriate outlets to the storm drainage system or to vegetated areas, and away from neighboring properties, sidewalks, steep slopes, or retaining walls.
- On-site storm water storage must be completed in such a way that does not provide mosquito breeding grounds, such as making sure rain barrels are covered with a lid or screen that prevents mosquitoes from entering the storage structure.
- Storm water from the onsite storm water storage structures must be applied to on-site vegetation and should not discharge from the property. Longer drainage periods may be acceptable if the storage structure is larger than the minimum size required for credit.
- All on-site storm water storage structures must meet the requirements of the City of Jackson Storm Water Management Manual.

Rain Barrel: A rain barrel is composed of a 30 gallon, minimum volume, barrel or drum, a spigot, a vinyl hose, downspout diverter, and an overflow mechanism. A screen opening or downspout diverter can be used to keep debris and insects out. Overflow mechanisms allow the storm water to either be diverted to the

storm water system or landscaping features when the barrel is full. These overflow mechanisms may include diverters that allow water to flow back into the downspout or flexible pipe that allows overflows to be diverted to landscaped areas.

Saving water not only helps protect the environment it saves money and energy because of the decreased demand for treated tap water.

Rain barrels can be purchased from the Jackson County Conservation District

211 West Ganson Street
Suite 200
Phone 784-2800
http://www.jacksoncd.org/wp-content/uploads/2009/09/rain-barrels1.pdf.

Cistern: Cisterns are similar to rain barrels in function but hold larger quantities of water. They can be installed underground, at ground level, or elevated depending on the site and space constraints of the property. A cistern should be constructed out of reinforced concrete, galvanized steel, or plastic, and should have a smooth interior surfaces, be watertight, have enclosed lids and be sized according to the installation standards below to manage the proper amount of runoff.

Installation Standards: To obtain a Residential Property Credit for on-site storm water storage the following standards and requirements must be met:

- 75% of the property's roof area is properly connected to rain barrels or other approved storage devices that provide at least 50 gallons of storage per downspout, OR
- Storage structures must be sized to hold the runoff from at least 50% of the property's roof area during a 1-inch rainfall event.

$V = ½ \times A \times 0.6225 \text{ gallons/feet}^2$

Where:
V = volume of storage structure in gallons
A = surface area of roof in square feet
0.6225 = conversion factor (gallons per cubic foot per inch of rain)

Example
A 500 gallon cistern would provide runoff storage from a 1,600 square foot rooftop for a 1 inch rainfall.

A = 1,600 square feet

½ x 1,600 x 0.6225 = 498 gallons

Maintenance Guidelines – Rain Barrel or Cistern

- Clean your gutters regularly to reduce debris.
- Clear off any screens as necessary.
- Periodically check any hoses associated with the storage structure to clear any debris.

- To winterize, disconnect the downspout and return the downspout to its original configuration. Remove the hoses, mesh screen and store them. Make sure to drain the container, to prevent it from freezing and cracking. If possible, store it upside down, so no water or materials will be able to enter.
- For cisterns, leave the outflow spigot fully open during frost/freezing periods and unhook the drain hose about twice a year to clean out any compacted sediment.

4.2A3 Vegetated Filter Strips: Vegetated filter strips are uniform strips of dense turf, meadow grasses, trees or other vegetation with a maximum slope to treat the water quality of small sheet flows from impervious surfaces. In certain circumstances a large lawn may meet the criteria for a vegetated filter strip. To obtain the Residential Property Credit the following criteria must be met:

- 50% of the property's roof area drains to the vegetated filter strip.
- Runoff from downspouts must be dispersed using splash block prior to reaching filter strip.
- The slope of a vegetated filter strip must be less than 5%.
- Filter strips must be fully vegetated and vegetation must be kept healthy.
- Vegetated filter strips must have a minimum length of 50 feet.

Maintenance Guidelines – Vegetated Filter Strips

- Maintain healthy vegetation along the filter strip. If planted with grass, the height should be at least 3 inches.
- If erosion occurs causing rills and gullies, repair and stabilize.
- Check splash blocks twice a year and make sure they are not broken or deteriorating. Replace as needed.

4.2A4 Maintenance Requirements: Storm water BMPs installed on a property must be maintained to ensure their continued function. The applicant has the legal responsibility to maintain the storm water BMP. The recertification process will require documentation that the storm water BMP is continuing to function as originally intended.

4.2A5 Restrictions:

- The Residential Property Credit applies only to the applicant.
- Credits do not transfer if ownership changes. A new application must be submitted for new owners to continue receiving the Residential Property Credit.
- Residential storm water BMPs cannot be combined on a property for a credit larger than 25%.
- The storm water BMPs must comply with the requirements of the City of Jackson Storm Water Management Manual.

4.2A6 Application and Documentation:

To receive the Residential Property Credit, the applicant must submit the documentation listed below. A complete application must be submitted for the City of Jackson to begin the review process.

- General Application (Appendix A).
- Residential Property Credit Application (Appendix B).

4.2A7 Recertification:

The Residential Property Credit is valid for five (5) years. The applicant must submit the recertification application every five years to continue to receive credits towards their storm water user fee.

Failure to submit recertification information by the required deadline will result in elimination of the credit.

4.2B Non-Residential Storm Water Quantity Credit

A Storm Water Quantity Credit is available for non-residential applicants who implement storm water BMPs designed to control storm water peak flows from to properties whose peak storm water runoff rate is restricted and/or controlled through on-site structural control facilities such as detention and retention ponds designed, constructed, and maintained according to the City of Jackson Storm Water Management Manual. This will reduce the burden on storm water infrastructure, including streams, storm sewers, combined sewers and other receiving waters, and can reduce flooding frequency and magnitude.

4.2B1 Non-Residential Storm Water Quantity Credit Amounts

The City of Jackson will provide up to a 75% credit for surfaces that drain through a storm water BMP that controls the peak discharge rates at which flow of post-development peak runoff is released with respect to the pre-development peak flow:

- Post-development is equal to or less than pre-development peak flow for the1year storm flow design: Credit Amount 37.5%.
- Post-development is equal to or less than pre-development peak flow for the 2, 10, and 25-year storm flow design: Credit Amount 52.5%.
- Post-development is equal to or less than pre-development peak flow for the 2, 10, 25, 50, 100 year storm flow design: Credit Amount 67.5%.
- Post-development is equal to or less than pre-development peak flow for the 2, 10, 25, 50, 100 year storm flow design: Storm water facilities that provide 20% more storage volume than required for the 100-year design storm. This does not include required freeboard above the emergency spillway. Credit Amount 75%.

4.2B2 Application and Documentation:

To receive the Non-Residential Storm Water Quantity Credit, the applicant must submit the documentation listed below. A complete application must be submitted for the City of Jackson to begin the review process.

- General Application (Appendix A).
- Non-Residential Storm Water Quantity Credit Application (Appendix C).

4.2B3 Recertification:

The Non-Residential Storm Water Quantity Credit is valid for three (3) years. The applicant must submit the recertification application every three years to continue to receive credits towards their storm water user fee.

Failure to submit recertification information by the required deadline will result in elimination of the credit.

4.2C Education Credit

The education credit of 25% is available to schools recognized by the State of Michigan that provide to its students a regular and continuing program of education concentrating on stewardship of our water resources and minimization of demand on the City of Jackson's storm water system. This education must be provided annually to at least 25% of the grade levels across the school or school district. An individual school may apply for the credit, or a school district may apply on behalf of all its schools. The rationale behind this credit is that the information provided by the school will translate into appreciation and stewardship of local water resources and thereby reduce negative impacts (such as pollutant impacts) on local streams, ponds and lakes that can result from uninformed citizens.

4.2C1 Education Credit Requirements:

The Education Credit is available to elementary, middle and high schools (both public and private) located in the City of Jackson. Suggested education topics include:

- The natural water cycle as well as the urban water cycle, including water and wastewater treatment.
- The watershed concept, stream formation, and causes of erosion and flooding.
- Effects of storm water and surface water pollution on Michigan rivers, streams, and the Great Lakes.
- Storm water runoff pollution prevention.
- Water conservation and its relevance in water-rich Michigan.
- Watershed management, topography and the geologic history of Michigan.
- The function and ecosystem services provided by streams, wetlands, and floodplains for flood control and erosion control.

1. Approval of the Education Credit application will result in a 25% credit to the assessed storm water user fee. The Education Credit will be applied only to the school property(s) where the curriculum is taught. Approved Education Credits can be applied in addition to any other approved credits.

2. Schools that are interested in obtaining the Education Credit must submit a completed application form to the Administrator. The form will require a description of the educational program, list of educational tools used, estimated number of students that will/have receive the education, the length of the educational program and the schedule for providing refresher teacher training courses.

4.2C2 Restrictions:

- Separate non-educational properties owned by the school or school district, such as administrative, transportation or maintenance facilities are not eligible for the Education Credit, but may apply for any Storm Water Quantity Credit.
- Education Credits may be taken in combination with other Storm Water Quantity Credit.

4.2C3 Application and Documentation:

To receive the Education Credit, applicants must submit the documentation listed below:

- General Application (Appendix A).

- Education Credit Application (Appendix D).
- Description of educational program, curricula or program materials. This should be 3 pages in length, maximum.
- Grade levels using the curricula (must be at least 25% of all grades at school or school district).
- Estimated number of students reached each school year.

4.2C4 Recertification:

The Education Credit is valid for five (5) years. The school must submit recertification information every five years to continue to receive the credit.

- The applicant must use the recertification application provided by the City of Jackson.
- Failure to submit the required documentation by June 30th of the fifth year will result in elimination of the credit.

4.2C5 Examples:

- The North School District has implemented three different curricula that have been integrated across all the school district's 3rd, 7th, and 9th grades. The school district can apply for a 25% Education Credit for providing this curriculum for 25% of the school district's grade levels. The credit would apply to all school buildings in the district that are used for educational purposes.
- St. Catherine's High School, is a private 4-year high school that has integrated a clean water program into the 9th grade curriculum that is taught to all 9th graders. The school can apply for a 25% Education Credit for providing this curriculum to 25% of the grade levels. The school also has a storm water detention pond on the school's property, designed to the City of Jackson's detention pond standards, to manage the storm water runoff from the school parking lot. The school can also apply for a Non-Residential Storm Water Quantity Credit for the impervious surface that drains to the storm water detention pond as long as it provides the required documentation. However, the maximum storm water user fee credit is limited to 75% of the school's storm water user fee for the high school property. Regardless of the applicable storm water user fee credits, the school's storm water user fee cannot fall below the equivalent storm water user fee of the lowest category flat storm water user fee charged to a detached single family home.

4.2D Direct Discharge Credit

This credit of a maximum of 75% of the storm water user fee shall be available to eligible customers. An eligible customer shall be the legal owner of a property which is contiguous to the Grand River.

- It is the responsibility of the storm water customer to apply for a Direct Discharge credit and to provide the necessary information with the credit application, as described herein. Questions relating to this credit and the credit application should be directed to the Administrator. City staff is not responsible for initiating, performing engineering calculations, or otherwise assisting with the preparation of the Direct Discharge credit application.
- A Discharge Discharge credit application will only be reviewed if it is filled-out completely. If the Direct Discharge credit application is not administratively complete or been approved, the applicant will receive notice either by email (if provided) or by U.S. mail.
- Any approved Direct discharge credit application received within one (1) year from when the applicant received their initial storm water user fee bill will apply retroactively to the date of the initial user fee bill. After July 1, 2012, if a Direct Discharge credit application is approved

at least thirty (30) days before an applicant's next regularly scheduled bill, the credit will appear on the next bill.

- The Direct Discharge credit need only be applied for once, but will be reviewed if the property is redeveloped or regraded

4.2D1 Examples

(a) The Miller Printing Company property is contiguous with the Grand River. The company can demonstrate that 100% of its EHA property area runs off to the Grand River. Therefore, the company would receive a Direct Discharge credit of 100% of 75% of its storm water user fee (75%). Therefore, the company's storm water user fee would be reduced by 75%.

(b) The Acme Storage Company's property is contiguous with the Grand River. The company can demonstrate that 70% of its EHA property runs off to the Grand River. Therefore, the company would receive a Direct Discharge credit of 70% of 75% of its storm water user fee (52.5%). Therefore, the company's storm water user fee would be reduced by 52.5%.

(c) The Acme Storage Company's property is contiguous to the Grand River and previously qualified for a Direct discharge credit of 70% of 75% of its storm water user fee. The company regarded the site so that 100% of its EHA property runs off to the Grand River. Therefore, its Direct Discharge credit would be revised to receive a credit of 100% of 75% of its storm water user fee (75%). Therefore, the company's storm water user fee would be reduced by 75%.

5.0 GENERAL CREDIT APPLICATION PROCEDURES

Applications must be submitted with all required documentation to the City of Jackson as described on each application.

When an application is received, the Administrator will conduct an administrative completeness review of all submitted materials. If the application is not complete, the applicant will be contacted and requested to provide any additional information necessary to complete the application.

Following the receipt of a complete application, the Administrator will provide a complete review and the applicant will be notified in writing when an application is approved or denied.

If a credit application is approved at least thirty (30) days before an applicant's next regularly scheduled bill, the credit will be applied to that upcoming bill, otherwise, the credit will appear on the next bill.

In cases of denial, the reasons for denial will be included.

The Administrator's determination to grant, deny, or revoke storm water user fee credits may be appealed in accordance with the City of Jackson Storm Water Utility Ordinance, Ordinance Number 2011.02, as amended.

6.0 GLOSSARY

The following definitions shall apply in the use of this Storm Water User Fee Credit Manual. All definitions used in the City of Jackson, Michigan Storm Water Utility Ordinance, Ordinance No. 2011.02 ,as amended, are applicable as well to this Storm Water User Fee Credit Manual. Words used in the singular shall include the plural, and the plural, the singular; words used in the present tense shall include the future tense. The word "shall" is mandatory and not discretionary. The word "may" is permissive. Words not defined herein shall be construed to have the meaning given by common and ordinary use as defined in the latest edition of Webster's Dictionary.

Administrator is the City Engineer or such other person as the City Manager may designate.

Appeal is the process of filing a dispute with the user fee determination, adjustment or credit as recognized by the City.

Applicant is any person, or a duly designated representative applying for a storm water user fee credit, storm water discharge permit or storm water connection.

Best Management Practices, or BMPs shall mean a schedule of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to the waters of the State.

City shall mean the City of Jackson, Michigan and its authorized agents.

Council shall mean the City Council of the City of Jackson, Michigan.

Credit shall mean a conditional reduction in the amount of a storm water user fee charge to a property based on the provision and continuing presence of, use, operation, and maintenance of practices that the City of Jackson does not own, maintain or operate; or based on the continuing provision of activities that may reasonably reduce or mitigate the City's cost of providing for the City's storm water management program.

Customer shall mean the owner of any property that is receiving a storm water utility service from the City of Jackson, Michigan.

Detention shall mean the prevention of, or to prevent, the discharge, directly or indirectly, of a given volume of storm water runoff into the storm water system by providing temporary on-site storage.

Discharge shall mean the flow of water from a project, site, aquifer, drainage basin, or other drainage facility.

Easement shall mean a grant by a property owner for a specified use of all or a specified portion of land to a person or the public at large.

Erosion shall mean the wearing or washing away of soil by the action of water.

Equivalent Hydraulic Area (EHA) of a property shall mean the sum of the impervious surface area of the property multiplied by a factor of 0.95 plus the pervious surface area multiplied by a factor of 0.15.

Equivalent Hydraulic Area Unit (EHA Unit) shall mean the EHA of a typical detached single family residential property in the City of Jackson determined by an engineering analysis to be 2,125 square feet.

The EHA Unit may be modified from time to time, if necessary, based on future engineering analyses. Detached single family homes (up to and including four units) pay a flat storm water user fee based on the fee charged to a property having one EHA unit.

Freeboard shall mean the space from the top of an embankment to the highest water elevation expected for the largest design storm stored. The space is often required as a safety margin in a pond or detention basin.

Frequency Year Storm shall mean a rainfall event expressed as an exceedance probability with a specified chance of being equaled or exceeded in any given year, as follows:

One Year……..100 percent
Two Year…….. 50 percent
Ten Year……10 percent
Twenty-Five Year…. 4 percent
Fifty Year…….. 2 percent
One-Hundred Year… 1 percent

Impervious area or *surface* shall mean any surface that is compacted or covered with material that resists or impedes permeation by water, including but not limited to, most conventionally graded streets, rooftops, parking lots, sidewalks, patios and driveways, and any other oiled, graveled, graded, or compacted surfaces.

MDNRE shall mean the Michigan Department of Natural Resources and Environment (formerly known as the Michigan Department of Environmental Quality)

Operation and Maintenance shall mean any component of a storm water system requiring expenditure for materials, labor, utilities and other items for the management and uninterrupted operation of the storm water system in a manner for which the storm water system was designed and constructed.

Operation and Maintenance Costs shall mean all costs, direct and indirect, of operation and maintenance of a storm water system.

Owner shall mean any person, firm, partnership, association, joint venture, corporation or other entity or combination of entities who alone, jointly, or severally with others hold(s) legal or equitable title to any real property. The term “owner” shall also include heirs, successors, and assigns.

Parcel shall mean a tract, or contiguous tracts, of land in the possession of, owned by, or recorded as property of the same claimant person.

Person shall mean any individual, association, organization, partnership, firm, public or private corporation or public agency.

Pervious area or *surface* is all land area that is not impervious.

Professional Engineer shall mean a professional engineer who is licensed by the State of Michigan and skilled in the practice of civil engineering and the engineer of record for the project under consideration.

Property shall mean any land within the boundary of the city of Jackson, both publicly and privately owned, including public and private rights of way.

Retention shall mean the prevention of, or to prevent, the discharge, directly or indirectly, of any storm

water volume into the storm water system.

Storm event shall mean a storm of specific duration, intensity, and frequency.

Storm water means storm water runoff, snowmelt runoff, footing drain discharges, surface runoff and drainage.

Storm water design standards shall mean those standards included within the City's Storm Water Management Manual, and such other standards that may be adopted by the City from time to time.

Storm water management shall mean one or more of the following:
The quantitative control achieved by the storm water system of the increased volume and rate of surface runoff caused by alterations to the land.
The qualitative control achieved by the storm water system, pollution prevention activities, and ordinances to reduce, eliminate or treat pollutants that might otherwise be carried by storm water.
Public education, information, and outreach programs designed to educate and inform the public on the potential impacts of storm water.

Storm water management plan shall mean the written documents and plans that contain the following elements which shall be used to guide the storm water management program:

- September, 2010 City of Jackson, Michigan Storm Water Utility Feasibility Study prepared by Tetra Tech.
- December, 2003 Upper Grand River Watershed Management Plan prepared by Tetra Tech and the June 2006 Update.
- Geographic limits of the City of Jackson.
- Storm water management services to be provided.
- The planning period covered by the storm water management plan.
- Projected operation and maintenance and capital expenses for each year of the storm water management plan planning period including steps taken to reduce expenses.
- Documentation of an analysis undertaken to evaluate the comparative cost-effectiveness of storm water management alternatives.
- Projected impervious and pervious areas of each class of property.
- The method of calculating any storm water user fees and storm water development charges, if used, proportionate to the necessary cost of providing the necessary level of service of storm water management services.
- The process and method by which the City of Jackson will determine which properties will be subject to any storm water user fee for use of the storm water system owned and operated by the City of Jackson.
- A description of the components of the storm water system owned and operated by the City of Jackson.
- A description of how credits to reduce storm water user fees will be applied and calculated.

Storm water management program shall mean one or more aspects of storm water management undertaken for the purpose of complying with applicable federal and state law and regulation or the protection of the

public health, safety, and welfare related to storm water runoff.

Storm water runoff shall mean flow on the surface of the ground, resulting from precipitation and snowmelt that does not infiltrate into the soil, including material dissolved or suspended in it.

Storm water system shall mean the roads, streets, catch basins, curbs, gutters, ditches, storm sewers and appurtenant features, lakes, ponds, channels, swales, storm drains, canals, creeks, catch basins, streams, gulches, gullies, flumes, culverts, siphons, retention or detention basins, dams, floodwalls, levees, pumping stations, and other like facilities, and natural watercourses and features located within the geographic limits of the City which are designed or used for collecting, storing, treating or conveying storm water or through which storm water is collected, stored, treated or conveyed, or any other physical means by which storm water management is achieved.

Storm water user fee shall mean the fee charged to properties within the City of Jackson calculated proportionate to the necessary cost of providing storm water system management services to the users of the City's storm water system.

Structure shall mean anything constructed or installed with a fixed location on or in the ground.

Surface Waters shall mean any receiving waters existing on the surface of the ground, including but not limited to; brooks, streams, rivers, wetlands, ponds, or lakes.

Undeveloped shall mean the condition of a property unaltered by construction or the addition of impervious surface.

User shall mean a firm, person or property that directly or indirectly contributes storm water to the storm water system.

Water quality shall mean those characteristics that relate to the physical, chemical, biological or radiological integrity of water.

Water quantity shall mean those characteristics that relate to the rate and volume of the storm water runoff to downstream areas.

Watershed shall mean an extent of land where storm water runoff drains downhill into a body of water, such as a river, lake, reservoir, estuary, or wetland. The watershed includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent watersheds by a topographic divide.

APPENDIX A

Storm Water User Fee General Application

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE CREDIT
GENERAL APPLICATION

Applicant Name:
Contact Name (if different than applicant):
Parcel Identification Number (if known):
Water/Sewer/Storm Water Account Number (if known):
Property Address: Street Number: Zip code:
Mailing Address (if different than property address): Street Number: City: Zip code:
Phone Number:
FAX Number:
Email Address:
Credits Applying For: Residential Property Credit (50% Flat Rate) Storm Water Quantity Credit (37.5 to 75%) Education Credit (25% - Schools Only) Direct Discharge Credit (Maximum 75%)
Applicant/Contact Signature: I hereby request that the City of Jackson review this application for a storm water user fee credit. I further authorize City staff to inspect the property identified in this application, if necessary, for the purpose of assessment for a possible credit. I certify that I have authority to make such a request and grant such authority for this property. The attached information is true and correct to the best of my knowledge and belief. I agree to provide corrected information to the City of Jackson should there be any change in the information provided herein. Applicant Signature:_____ Applicant Name:_____ Title: Date:

Email form to: Stormwater@cityofjackson.org OR
Mail to: City of Jackson, Public Works – Storm Water, 521 Water Street, Jackson, MI 49203
OR FAX to: 517-788-4639

For Questions Regarding the Credit Application, Contact: Phone: 517-788-4082 (Main line for calls)

APPENDIX B

Storm Water User Fee
Residential Property Credit Application

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
RESIDENTIAL PROPERTY CREDIT APPLICATION

Applicant Name:
Credit Applying For: Rain Garden # of downspouts draining to rain garden _____ (if applicable) Jackson Storm Water Management Manual worksheet, attached. On-Site Storm Water Storage: Rain Barrels Cistern # of downspouts draining to on-site storage _____ Volume of on-site storage _____ gallons For cistern, calculations from Jackson Storm Water Management Manual worksheet, attached. Vegetated Filter Strips # of downspouts draining to vegetated filter strip Slope of yard _____% Length of vegetated strip_____ feet
Photograph or sketch of Rain Garden, Rain Barrels, Cistern or Vegetated Filter Strip as installed is attached.

APPENDIX C

Storm Water User Fee
Non-Residential Quantity Credit Application

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
NON-RESIDENTIAL QUANTITY CREDIT APPLICATION

Applicant Name:
Storm Water Structure Description:
Credit Applying for: Post-development is equal to or less than pre-development peak flow for the1year storm flow design: Credit Amount 37.5%. Post-development is equal to or less than pre-development peak flow for the 2, 10, and 25-year storm flow design: Credit Amount 52.5%. Post-development is equal to or less than pre-development peak flow for the 2, 10, 25, 50, 100 year storm flow design: Credit Amount 67.5%. Post-development is equal to or less than pre-development peak flow for the 2, 10, 25, 50, 100 year storm flow design: Storm water facilities that provide 20% more storage volume than required for the 100-year design storm. This does not include required freeboard above the emergency spillway. Credit Amount 75%.
Required Documents Attached: _____ Submitted topographic map(s) or site plan(s) showing project location, scale, contours, north arrow, impervious and pervious areas and constructed storm water system(s) including the components for which a credit is requested. _____ Drainage area map, including off-site areas draining through components for which a credit is requested. _____ Size, location and labeling of all storm water structures. _____ Construction details of storm water components. _____ Final recorded document (deed description or plat) dedicating storm drainage and access easements (if applicable). _____ Inspection and Operation, Maintenance and Repair Plan ____ Legal agreement(s) for operation and maintenance for applications that include multiple account holders (if necessary). _____ A recent inspection report (less than one year from application date) by an engineer, architect or landscape architect certifying that the system is properly designed and is being maintained. _____ Calculations using industry-standard hydrologic/hydraulic software for pre-and post-development conditions, including input and output data.

Signature: I hereby certify that to the best of my knowledge the storm water system for which a storm water user fee quantity credit is requested has been constructed in a manner to potentially meet one or more of the storm water user fee quantity credit criteria, is operating as designed and is being properly maintained. I further certify that to the best of my knowledge the calculations, technical details and information provided accurately reflect the condition of this storm water system at the time of my inspection.

Engineer, Architect or Landscape Architect Signature:_____
Name:_____

Michigan License Number:_____

Company:_____

Address:_____

Company Phone:_____ Company FAX:_____
Date:_____

APPENDIX D

Storm Water User Fee
Education Credit Application

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
EDUCATION CREDIT APPLICATION

School or School District Name:
List Schools That Apply:
Program Information: Grade Levels Offered at School/School District:_____ Grade Levels Using Curriculum: _____ Estimated Number of Students Reached Each Year: _____
Description of educational program, curricula and/or program materials attached.
Proof of coursework:
Principal Signature: I hereby certify that to the best of my knowledge the storm water education program for which a storm water user fee education credit is requested meets the storm water user fee education Principal Signature:_____ Name:_____ School:_____ Address:_____ Phone:_____ FAX:_____ Date:_____

APPENDIX E

Storm Water User Fee
Direct Discharge Credit Application

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
DIRECT DISCHARGE CREDIT APPLICATION

Applicant Name:
A maximum credit of 75% of the storm water user fee is available to properties that are contiguous to the Grand River. Runoff that passes through a public or private drainageway prior to outfalling to the Grand River is not eligible.
The EHA area of the property that discharges to the Grand River shall determine the percentage reduction applied to the storm water user fee
Required Documents Attached: _____ Submitted topographic map(s) or site plan(s) showing property location, scale, contours, north arrow, and impervious and pervious areas. _____ Drainage map showing those impervious and pervious areas that drain to the Grand River. _____ Watershed breaks across the property. _____ Construction details of storm water components, including location and elevations of natural and man-made features. _____ Sufficient topographic data or elevations to verify general drainage patterns across the property.
Signature: I hereby certify that to the best of my knowledge the property for which a Direct Discharge credit for the storm water user fee is requested is contiguous to the Grand River. I further certify that to the best of my knowledge the calculations, technical details and information provided accurately reflect the drainage patterns of this property. Engineer, Architect or Landscape Architect Signature:_____ Name:_____ Michigan License Number:_____ Company:_____ Address:_____ Company Phone:_____ Company FAX:_____ Date:_____

APPENDIX F

Storm Water User Fee
Credit Examples

RESIDENTIAL STORM WATER USER FEE CREDIT

EXAMPLES

Residential homeowners can take advantage the Storm Water User Fee Credit by taking small measures to reduce their properties' runoff. The City will allow for a 25% reduction in the storm water user fee if homeowners are willing to construct one of the following BMP's on their property:

- Rain Garden
- On-site Water Storage, such as a rain barrel or cistern
- Vegetated Filter Strips

In order to qualify for the storm water user fee credit, the residential homeowner must fill out an application with the City. The application has two sheets that need to be filled out. The first sheet is the general application which records information such as the name and address of the applicant, as well as the credit they are applying for, The second sheet records the type of BMP to be constructed on the property to qualify the applicant for the credit. The applicant is required to include a sketch of the property with the location of the BMP, or a photograph of the installed BMP so the City may easily review and verify the credit application through an on-site inspection. Attached are two separate example applications that display a typical completed application.

If the application is accepted and the property is eligible for a storm water user fee credit, the City will issue a letter of verification for the property owner's records. The credit will be applied to that property's storm water user fee for a period of three years, after which the property owner will be required to re-apply for the credit.

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE CREDIT
GENERAL APPLICATION - EXAMPLE RAIN GARDEN

1.	Applicant Name: Ann Smith
2.	Contact Name (if different than applicant):
3.	Parcel Identification Number (if known): 4-102300000
4.	Water/Sewer/Storm Water Account Number (if known):
5.	Property Address: Street Number: 238 Rosedale Place Zip Code: 48951
6.	Mailing Address (if different than property address): Street Number: City: Zip Code:
7.	Phone Number: (517) 555-1234
8.	Fax Number:
9.	Email Address: annsmith@email.com
10.	Credits Applying For: ● Residential Property Credit (25% Flat Rate) ○ Storm Water Quantity Credit (25 to 50%) ○ Education Credit (25% - Schools Only)
11.	Applicant/Contact Signature: *I hereby request that the City of Jackson review this application for a storm water user fee credit. I further authorize City staff to inspect the property identified in this application, if necessary, for the purpose of assessment for a possible credit. I certify that I have authority to make such a request and grant such authority for this property. The attached information is true and correct to the best of my knowledge and belief. I agree to provide corrected information to the City of Jackson should there be any change in the information provided herein.* Applicant Signature: _____ Applicant Name: Ann Smith Title: _____ Date: 10/18/2011

Email form to: Stormwater@cityofjackson.org OR
Mail to: City of Jackson, Public Works - Storm Water, 521 Water Street, Jackson, MI 49203 OR
FAX to: 517-788-4639

For Questions Regarding the Credit Application, Contact: Phone: 517-788-4082 (Main line for calls)

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
RESIDENTIAL PROPERTY CREDIT APPLICATION - EXAMPLE RAIN GARDEN

1. Applicant Name: Ann Smith

2. Credit Applying For:

- ● **Rain Garden**
  - ○ # of downspouts draining to rain garden 2 (if applicable)
  - ○ Jackson Storm Water Management Manual Worksheet, attached.

- ○ **On-Site Storm Water Storage**
  - ○ Rain Barrels _____
  - ○ Cistern _____

  # of downspouts draining to on-site storage _____

  Volume of on-site storage _____ gallons
  - ○ For cistern, calculations from Jackson Storm Water Management Manual worksheet, attached.

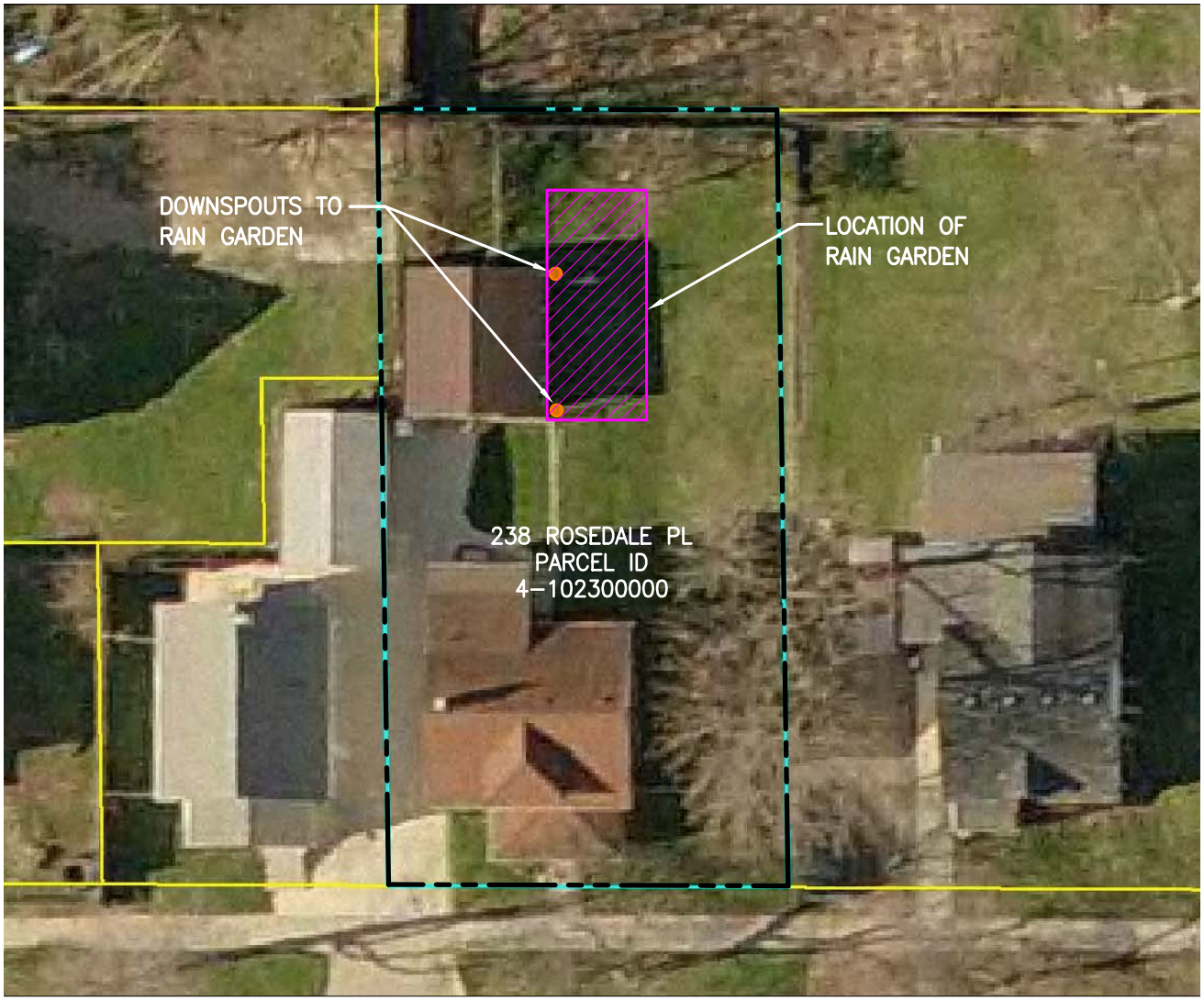
- ○ **Vegetated Filter Strips**

  # of downspouts draining to vegetated filter strip _____

  Slope of yard _____ %

  Length of vegetated strip _____ feet

3. Photograph or sketch of Rain Garden, Rain Barrels, Cistern or Vegetated Strip as installed is to be attached to the application. Applicant may use online aerial maps (i.e. Google) of the property for the sketch.



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CITY OF JACKSON
DEPARTMENT OF
ENGINEERING

RESIDENTIAL STORM WATER FEE CREDIT RAIN GARDEN EXAMPLE SKETCH USING INTERNET AERIAL MAPPING (I.E. GOOGLE MAPS)

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE CREDIT
GENERAL APPLICATION - EXAMPLE RAIN BARREL

1.	Applicant Name:	Tom Richards
2.	Contact Name (if different than applicant):	Lisa Jones
3.	Parcel Identification Number (if known):	3-256500000
4.	Water/Sewer/Storm Water Account Number (if known):	
5.	Property Address:	
	Street Number:	1411 Mound Avenue
	Zip Code:	48951
6.	Mailing Address (if different than property address):	
	Street Number:	1234 Michigan Avenue
	City:	Lansing
	Zip Code:	48910
7.	Phone Number:	(517) 555-4321
8.	Fax Number:	(517) 555-1122
9.	Email Address:	trichards@email.com
10.	Credits Applying For:	
	● Residential Property Credit (25% Flat Rate)	
	○ Storm Water Quantity Credit (25 to 50%)	
	○ Education Credit (25% - Schools Only)	
11.	Applicant/Contact Signature: *I hereby request that the City of Jackson review this application for a storm water user fee credit. I further authorize City staff to inspect the property identified in this application, if necessary, for the purpose of assessment for a possible credit. I certify that I have authority to make such a request and grant such authority for this property. The attached information is true and correct to the best of my knowledge and belief. I agree to provide corrected information to the City of Jackson should there be any change in the information provided herein.*	
	Applicant Signature:	_____
	Applicant Name:	Tom Richards
	Title:	Landlord
	Date:	10/18/2011

Email form to: Stormwater@cityofjackson.org OR
Mail to: City of Jackson, Public Works - Storm Water, 521 Water Street, Jackson, MI 49203 OR
FAX to: 517-788-4639

For Questions Regarding the Credit Application, Contact: Phone: 517-788-4082 (Main line for calls)

CITY OF JACKSON, MICHIGAN
STORM WATER USER FEE
RESIDENTIAL PROPERTY CREDIT APPLICATION - EXAMPLE RAIN BARREL

1. Applicant Name: Tom Richards

2. Credit Applying For:

- ○ **Rain Garden**
  - ○ # of downspouts draining to rain garden _____ (if applicable)
  - ○ Jackson Storm Water Management Manual Worksheet, attached.
- ● **On-Site Storm Water Storage**
  - ● Rain Barrels 5 gallon barrels at down spouts
  - ○ Cistern _____

  # of downspouts draining to on-site storage 2

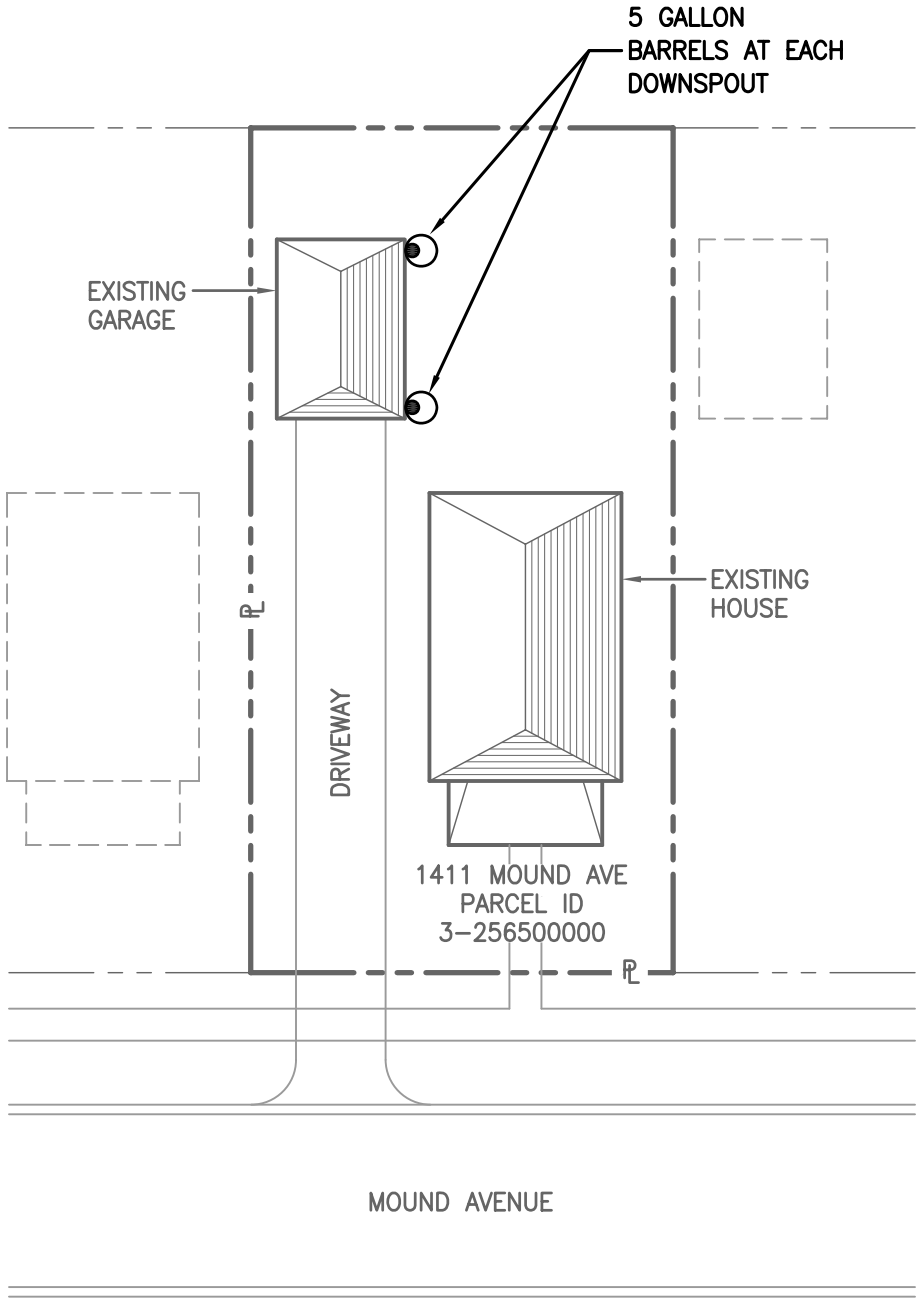
  Volume of on-site storage 10 gallons
  - ○ For cistern, calculations from Jackson Storm Water Management Manual worksheet, attached.
- ○ **Vegetated Filter Strips**

  # of downspouts draining to vegetated filter strip _____

  Slope of yard _____ %

  Length of vegetated strip _____ feet

3. Photograph or sketch of Rain Garden, Rain Barrels, Cistern or Vegetated Strip as installed is to be attached to the application. Applicant may use online aerial maps (i.e. Google) of the property for the sketch.



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CITY OF JACKSON
DEPARTMENT OF
ENGINEERING

RESIDENTIAL STORM WATER FEE CREDIT
RAIN BARREL EXAMPLE SKETCH

APPENDIX G

Blank Worksheets

Worksheet 1. General Watershed/ Site Information

NOTE: If the project extends over more than 1 Watershed, fill out Worksheet 1 for each Watershed

Date: _____

Project Name: _____

Municipality: _____

County: _____

Total Area (acres): _____

Major Watershed: _____

http://cfpub.epa.gov/surf/state.cfm?statepostal=MI

Subwatershed: _____

Nearest Surface Water(s) to Receive Runoff: _____

Part 4 - Designated Water Use: _____

http://www.michigan.gov/deq/0,4561,7-135-3313_3682_3714-237821--,00.html

Michigan Natural Rivers watershed? Yes ☐ No ☐

http://www.michigan.gov/dnr/0,1607,7-153-30301_31431_31442-95823--,00.html

Impaired according to Chapter 303(d) List? Yes ☐ No ☐

http://www.deq.state.mi.us/documents/deq-wb-intreport-appendixj.pdf

List Causes of Impairment:

Areas of impairment not local to project

Is project subject to, or part of:

Phase I or Phase II Municipal Separate Storm Sewer System (MS4) Requirements? (Is the site greater than 1 acre?) Yes ☐ No ☐

http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-24366--,00.html

Existing or planned drinking water supply? Yes ☐ No ☐

If yes, distance from proposed discharge (miles): _____

Approved Watershed Management Plan? Yes ☐ No ☐

http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714_4012-95955--,00.html

Worksheet 2. Sensitive Natural Resources

Project: _____

INSTRUCTIONS:

1. Provide Sensitive Resources Map for the site. This map should identify waterbodies, floodplains, riparian areas, wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural features.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres).

Small wooded area identified on the site to be protected.

3. Summarize total proposed Protected/Undisturbed Area. Use the following BMPs to define Protected/Undisturbed Area; protect sensitive areas, protect riparian buffers, protect natural flow pathways, cluster development, and minimize disturbed area.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once (include as either floodplain or wetland, not both).

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? (yes, no, n/a)	TOTAL AREA (Ac.)	PROTECTED/ UNDISTURBED AREA (Ac.)
Waterbodies			
Floodplains			
Riparian Areas			
Wetlands			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15% - 25%			
Steep Slopes, over 25%			
Special Habitat Areas			
Other:			
TOTAL EXISTING:			

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WORKSHEET 4A. Calculations for Channel Protection Volume

PROJECT NAME: _____

2-Year, 24-Hour Rainfall): _____ **in**

Total Site Area: _____ **acres**

Disturbed Area to be managed: _____ **acres** (From WS 3)

Pre-Development Conditions

Cover Type	Soil Type	Area (sf)	Area (ac)	CN (from TR-55)	S^3	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woods / Meadow	A	**0**		30			
Woods	B	**0**		55			
Meadow	B	**0**		58			
Woods	C	**0**		70			
Meadow	C	**0**		71			
Woods	D	**0**		77			
Meadow	D	**0**		78			
Impervious	N/A	**0**		98			
Other:		**0**					
TOTAL:	**N/A**	**-**	**0.00**	**N/A**	**N/A**		

Post-Development Conditions**

Cover Type	Soil Type	Area (sf)	Area (ac)	CN*	S	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
		-					
		-					
		-					
		-					
		-					
TOTAL:	**N/A**	**-**	**0.00**	**N/A**	**N/A**		

Runoff Volume Increase (ft^3): _____ ***Transfer to WS 5***

Runoff Volume Increase = (Post-Dev. Runoff Volume) MINUS (Pre-Dev. Runoff Volume)

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where:

P = 2-Year, 24-Hour Rainfall (in)

3. S = 1000/ CN - 10

CN = Curve Number

Q = Runoff (in)

2. Runoff Volume (ft^3) = Q x 1/12 x Area

Area = Area of specific land cover (ft^2)

* Runoff Volume must be calculated separately for pervious and impervious areas (without using a weighted CN), unless Non-Structural BMP Rooftop/Downspout Disconnection is applied.

** Pre- and Post-development areas shall match. Post development conditions shall reflect non-structural BMPs applied on WS 3

City of Jackson
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WORKSHEET 4B. Calculations for Channel Protection Peak Flow Rate

PROJECT NAME: _____

1-Year, 24-Hour Rainfall): _____ **in**

Pre-Development Conditions

Cover Type	Soil Type	Area (sf)	Area (ac)	CN (from TR-55)	S	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woods / Meadow	A	**0**		30	23.3		
Woods	B	**0**		55	8.2		
Meadow	B	**0**		58	7.2		
Woods	C	**0**		70	4.3		
Meadow	C	**0**		71	4.1		
Woods	D	**0**		77	3.0		
Meadow	D	**0**		78	2.8		
Impervious	N/A	**0**		98	0.20		
Other:		**0**					
TOTAL:	**N/A**	**-**		**N/A**	**N/A**		

Post-Development Conditions

Cover Type	Soil Type	Area (sf)	Area (ac)	CN*	S	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
		0					
		0					
		0					
		0					
		0					
TOTAL:	**N/A**	**-**		**N/A**	**N/A**		

Runoff Volume Increase (ft^3): 0

PEAK FLOW RATE ANALYSIS

(Use detailed information to complete Worksheets 4C & 4D, or use simplified Graphical Method below)

Storm Event	Duration (Hr)	Pre-Settlement Peak Discharge[A]	Post-Settlement Peak Discharge Rate	Difference (Post - Pre)	Are the criteria met? (Y/N)**
1-year	24				
2-year	24				

[A] Graphical Peak Discharge method = Qp = Qu*A*Q Where: Qp = Peak Discharge (cfs)
Qu = Unit Peak Discharge (csm/in)
A = Drainage Area (mi) Q = Runoff

*To determine Qu through graphical methods see Worksheets 4C & D, and attached figure assuming a minimum Time of Concentration of 6 minutes to fill out the table below for the peak flow table above.

Ia = 0.2*(1000/CN-10) Where : CN = weighted curve number P = Rainfall

	Weighted CN	I_a	I_a/P 1-yr, 24Hr	I_a/P 2-yr, 24Hr	Qu 1-yr	Qu 2-yr
Pre						
Post						

** If the peak flow rate increases after development, then BMPs must be designed to address the increase.

WORKSHEET 4C. Time of Concentration

PROJECT NAME: _____

2-Year, 24-Hour Rainfall): _____ **in**

Pre-Development Conditions

Sheet Flow	Surface Description	Manning	Flow length (ft)	Slope (ft/ft)	Tc (hr)
					0.00
	2				0.00
	3				0.00
				Sheet Flow Subtotal	*0.00*
Shallow Concentrated Flow	Surface Description		Flow length (ft)	Slope (ft/ft)	
	Unpaved				0.00
	Paved				0.00
				Shallow Concentrated Subtotal	*0.00*
Channel Flow	Surface Description	Velocity (fps)	Flow length (ft)		
	1				0.00
	2				0.00
	3				0.00
				Channel Flow Subtotal	*0.00*
				Time of Concentration (hr)	
				Adjusted Time of Concentration (hr)**	

Post-Development Conditions

Sheet Flow	Surface Description	Manning	Flow length (ft)	Slope (ft/ft)	Tc (hr)
	1				
	2				
	3				
				Sheet Flow Subtotal	
Shallow Concentrated Flow	Surface Description		Flow length (ft)	Slope (ft/ft)	
	Unpaved				
	Paved				
				Shallow Concentrated Subtotal	
Channel Flow	Surface Description	Velocity (fps)	Flow length (ft)		
	1				
	2				
	3				
				Channel Flow Subtotal	
				Total Time of Concentration (hr)	
				Adjusted Time of Concentration (hr)**	

*** minimum allowed Tc is 0.1hr; maximum allowable is 10 hrs*

Roughness Coefficient (Manning's n) for sheet flow

Surface Description	**n**
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover <= 20%	0.06
Residue cover > 20%	0.17
Grass	
Short grass prairie	0.15
Dense grassess	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods	
Light underbrush	0.4
Dense underbrush	0.8

WORKSHEET 4D. Calculations for Channel Protection Peak Flow Rate

PROJECT NAME: _____

PEAK FLOW RATE ANALYSIS

Storm Event	P (in)	Develop-ment	Tc[1] (hr)	Weighted Avg CN[2]	Ia/P[3]	Peak Unit qu (csm/in)[4]	Peak Runoff (cfs)[5]	Peak Runoff (cfs/ac)[6]
1-year 24-hour		Pre-						
		Post-						
2-year 24-hour		Pre-						
		Post-						

1. From Worksheet 4C
2. From Worksheet 4B
3. From Worksheet 4B

4. Peak Unit qu (csm/in) =

10^((-2.744*(Ia/P)^3)+(0.312*(Ia/P)^2-(0.212*(Ia/P))+2.574)

Where:
Ia/P = From Table above

5. Peak Runoff (cfs) =

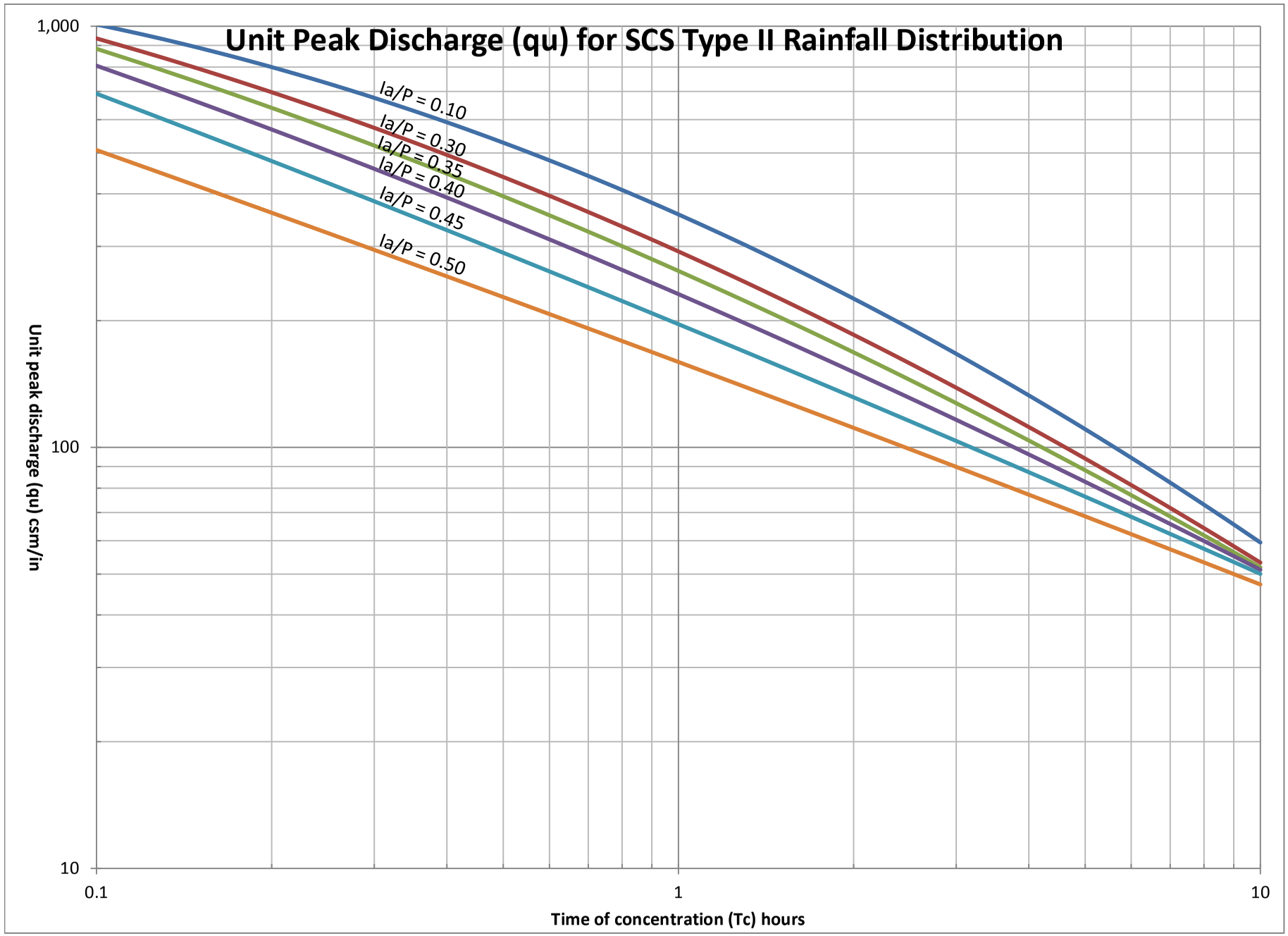
$$\frac{(qu*A)}{640} * Q$$

Where:
qu = From Table above
A = Total site area, pre/post
Q = Total site runoff pre/post
(A & Q from Worksheet 4B)

6. Peak Runoff (cfs/ac) =

$$\frac{\text{Peak Runoff}}{A}$$

Where:
A = Total site area, pre/post
(A from Worksheet 4B)


Unit Peak Discharge (qu) for SCS Type II Rainfall Distribution
1,000
100
10
0.1
1
10
Unit peak discharge (qu) csm/in
Time of concentration (Tc) hours
Ia/P = 0.10
Ia/P = 0.30
Ia/P = 0.35
Ia/P = 0.40
Ia/P = 0.45
Ia/P = 0.50

WORKSHEET 5. STRUCTURAL BMP VOLUME REDUCTION**

PROJECT: _____

This worksheet is to be used to tabulate the volume reduction as a result of the installation of structural BMPs. To meet Channel Protection Criteria for volume reduction, the Permanently Removed Storage Volume will be considered as sufficient support documentation. The Infiltration Volume During Storm calculations may be provided in addition at the developer's discretion.

Runoff Volume Increase (cubic feet) *from Worksheet 4A* : _____

Proposed BMP[A]	**Area (ft^2)**	**Permanently Removed Storage Volume[B] (ft^3)**	***Ave. Design Infiltration Rate (in./hr.)**	***Infiltration Volume During Storm[C] (ft^3)**	**Total Volume Reduction[D] (ft^3)**
Porous Pavement					
Infiltration Basin					
Subsurface Infiltration Bed					
Infiltration Trench					
Bioretention					
Dry Well					
Vegetated Swale					
Retentive Grading					
Vegetated Roof			N/A	N/A	
Capture and Re-use			N/A	N/A	

Total Volume Reduction Credit by Proposed Structural BMPs (ft^3): -

Runoff Volume Increase (cubic feet): _____

* Optional information

**** FOR PERMANENTLY REMOVED VOLUME ONLY, TEMPORARY DETENTION VOLUMES ARE NOT INCLUDED HERE. PERMANENTLY REMOVED STORAGE NOT TO BE INCLUDED IN PEAK DISCHARGE DETENTION CALCULATIONS**

[A] Follow design guidance and Protocols from Manual for each Structural BMP type

[B] Storage volume as defined in individual BMP writeups found in the Low Impact Development for Michigan- this represents permanently removed volume, not detention storage

[C] Can be approximated as the average design infiltration rate over 6 hours multiplied by the BMP area:
Design Infiltration Rate x 6 hours x BMP Area x Unit Conversions = Infiltration Volume (ft^3)

[D] Total Volume Reduction is sum of Storage Volume and Infiltration Volume During Storm.

Other Proposed BMPs *Not Volume Reducing*	**Area (ft^2)**
Constructed Filter	
Constructed Wetlands	
Wet Detention Pond	
Dry Extended Detention Basin	
Water Quality Devices	
Level Spreader	

WORKSHEET 6. WATER QUALITY WORKSHEET

PROJECT: _____

This worksheet calculates water quality volume based on the criteria of 1 inch of runoff from the entire site pervious and impervious.

A	B		C	D	E	F
BMP Tributary Area[A]	**Total Disturbed Area (ft^2)**	**Impervious Area (ft^2)**	**Disturbed Pervious Area (ft^2)**	**Water Quality Volume for Impervious Area (ft^3)**	**Water Quality Volume for Pervious (ft^3)[B]**	**Total Water Quality Volume to BMPs (ft^3)[C]**
				Col B x 1 inch/12	**Col C x 1 inch/12**	**Col D + Col E**
A						
B						
C						
D						
E						
F						
G						
Totals:						

Total area: _____ acres Total Site: _____ acres (From WS 3)

A - Only indicate the areas tributary to a particular BMP. The sum of all areas shall equal the total site area used to calculate channel protection and flood control criteria.

If only 1 water quality BMP is proposed for a given area, then it must be rated "High" for TSS Removal **. A TSS removal of "High" indicates a minimum of 80% TSS removal.

Indicate below which areas are treated by

Through BMP	BMP	TSS Removal Rating[B]
	Bioretention	High
	Capture/Reuse	Medium
	Constructed Wetlands	High
	Wet Ponds	High
	Dry Ponds	Medium
	Constructed Filters	High
	Porous Pavement*	High
	Infiltration Systems*	High

Fill in other if not listed

If 2 or more water quality BMPs are proposed in series, any that are rated "Low/Medium" or better for TSS Removal are acceptable. List proposed BMPs here:

* Requires appropriate pretreatment to prevent clogging

** Proprietary, manufactured water quality devices are not acceptable unless they have been field tested by a third-party according to approved testing protocols.

WORKSHEET 7. Maximum Allowable Discharge and Detention Calculations

The Runoff Detention calculation is required for non-residential construction that results in an increase of impervious area greater than 1000 square feet

Purpose: Development typically includes impervious parking lots and roofs. Rain water that used to soak into the ground immediately runs off into storm sewers that were originally designed and installed to accommodate storm runoff from residential property. To assure that storm sewers are not overloaded, runoff from new development is limited.

PROJECT NAME: _____

SITE LOCATION: _____

Maximum Allowable Discharge[B]: _____ **ft^3**

Post-Development Conditions

Total Site Drainage Area[A]: _____ **acres** **Impervious :** _____ **acres**

Existing "C": _____ **Pervious :** _____ **acres**

DURATION (min)	Rainfall Intensity 100-year Storm[C] t(hr)	I(in/hr)	R(in)	Average Coefficient[D]	100-year Runoff[E] (ft^3)	Permitted Outflow[F] (ft^3)	Required Storage[G] (ft^3)
20	0.33	4.9 =	1.62				
30	0.5	3.85 =	1.93				
40	0.67	3.33 =	2.23				
50	0.83	2.83 =	2.35				
60	1	2.52 =	2.52				
90	1.5	1.92 =	2.88				
120	2	1.58 =	3.16				
24 hrs	24	0.23 =	5.52				

Pond Size Required (ft^3): _____

INSTRUCTIONS

A) SITE DRAINAGE AREAS shall be calculated in acres and divided into impervious and pervious areas.

B) MAXIMUM ALLOWABLE DISCHARGE (Q) (ft^3) shall be for a 2 yr, 24-hr storm

Q = C*I*A — C = 0.40 for Previously Develped areas

I=2.60 inches/hr — C = 0.15 for Previously Unevelped areas

A = Site Area in acres — or C = Design Value for storm system

C) Inches of rainfall, given for a 100 year storm, source: Rainfall Frequency Atlas of the Midwest by Floyd A. Huff and James R. Angel. Bulletin 71 (MCC Research Report 92-03). Midwestern Climate Center and Illinois State Water Survey. 1992.

D) AVERAGE COEFFICIENT for runoff, used for all durations, is calculated by the weighted average of pervious and impervious areas, using a pervious coefficient of 0.15 and an impervious coefficient of 0.90.

(ie: AVE COEF = (Impervious*0.90)+(Pervious*0.15)/Total Site Area)

E) Runoff: multiply the total site drainage area by the average coefficient then by inches of rainfall converted into feet, then by 43,560 to convert acres into square feet, result will be in cubic feet.

(ie: RUNOFF = DRAIN AREA*AVE COEF*(RAINFALL/12)*43560)

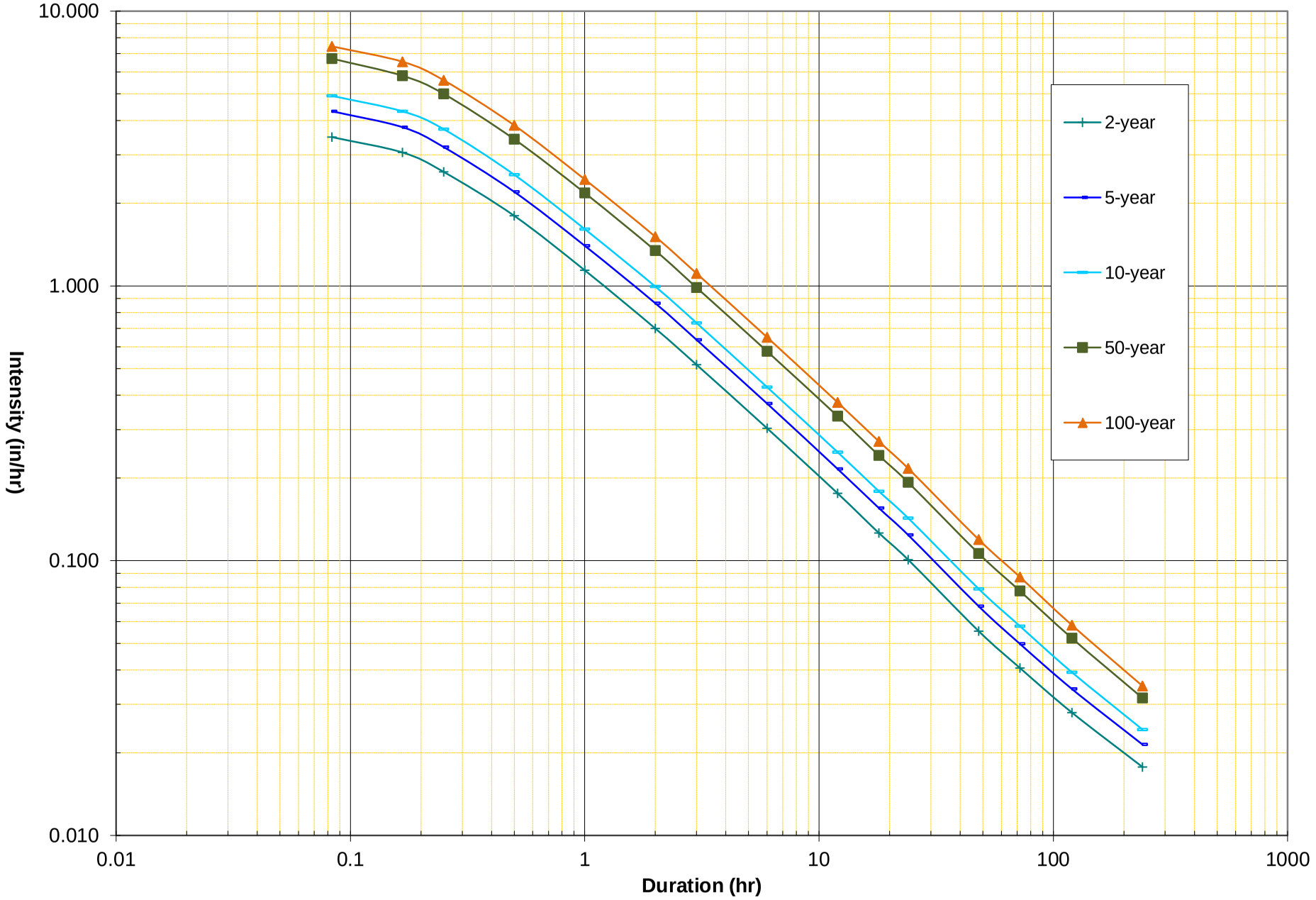
F) Permitted Outflow: Multiply maximum allowable outflow by time in hours, then by 3600

(ie: PERMITTED OUTFLOW = MAX ALLOWABLE DISCHARGE (FT^3/SEC)*TIME(HR)*3600(SEC/HR))

G) REQUIRED STORAGE: Subtract Permitted Outflow from 100-Year Runoff. Storage volume will increase to a peak and then decrease.

H) The Pond Size Required is the peak volume from the Required Storage column.

Rainfall IDF Curves
based on Huff and Angel Section 9



IDF Huff-Angel Data Huff-Angel Sec 9 Chart 1/24/2012

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WORKSHEET 8. Criteria Summary Sheet

PROJECT:

Total Site Area	_____	acres	
Impervious	_____	acres	Pre-Development
	_____	acres	Post-Development
Pervious	_____	acres	Pre-Development
	_____	acres	Post-Development

Channel Protection Criteria

Criteria Satisfied?

Maintain post-development site runoff volume and peak flow rates at or below existing levels for all storms up to the two-year, twenty-four-hour event.

Volume:

Pre-Development Volume	_____	ft^3	(From Worksheet 4A)
Post-Development Volume	_____	ft^3	(From Worksheet 4A)
Difference	_____	ft^4	
BMP Storage	_____	ft^3	(From Worksheet 5)

***Criteria for channel protection volume may be satisfied if the site provides adequate BMP storage to handle the increase in runoff from pre- to post-development conditions.** _____

Peak Flow Rate:

Pre-Development Peak Flow Rate	_____	ft^3	(From Worksheet 4B)
Post-Development Peak Flow Rate	_____	ft^3	(From Worksheet 4B)

*** Criteria for channel protection peak rate analysis may be satisfied if the post-development rate is less than the pre-development rate. If not, the criteria can be achieved if the development has included BMPs in the site plan.** _____

Flood Control Criteria

Structures are to be sized to accommodate a twenty-four-hour, fifty-year storm. Maximum allowable discharge is based on a thirty-minute, ten-year storm

Maximum Allowable Discharge	_____	ft^3/sec	(From Worksheet 7)
Required Storage - Flood Control	_____	ft^3	(From Worksheet 7)
Excess BMP Storage	_____	ft^3	(BMP Storage-Ch. Pro. Vol)
On-Site Detention/Retention	_____	ft^3	Provide separate calculations.**
Volume Provided - Volume Required	_____	ft^3	(Excess BMP Storage+On-site storage-Flood Control volume requirements)

***Criteria for flood control may be satisfied if the site provides for enough storage to retain the post development runoff and to detain/retain the volume of water required to maintain the maximum allowable discharge. This may be completed through utilization of available BMP storage , including storage provided by any on-site re-/detention ponds.** _____

(Detention and discharge calculations should be submitted based upon selected detention method.

** Volume provided in sewer system through oversized piping, or non-BMP storage. Cannot apply towards channel protection.

Water Quality Criteria

Minimum of 80% removal of Total Suspended Solids (TSS), compared with uncontrolled runoff - or - Discharge concentrations of TSS not to exceed 80 (mg/l).

Water Quality Volume _____ ft^3 (From Worksheet 6) _____

Maintenance Criteria

All BMPs installed require a plan for maintaining maximum design performance through long-term operation and maintenance (O&M). An easment is necessary to perform periodic assessment of BMP condition.

O&M Plans Provided? Y / N

Easement Agreement? (Attach Signed Agreement) Y / N

Soil Erosion Control

Has a soil erosion control plan been developed and submitted? Y / N

Wetland Protection

Have acceptable wetland protection measures been taken? Y / N

APPENDIX H

Site Plan Examples

EXAMPLE #1 – Small Commercial Site (Total area < 1 acre)

DESCRIPTION:

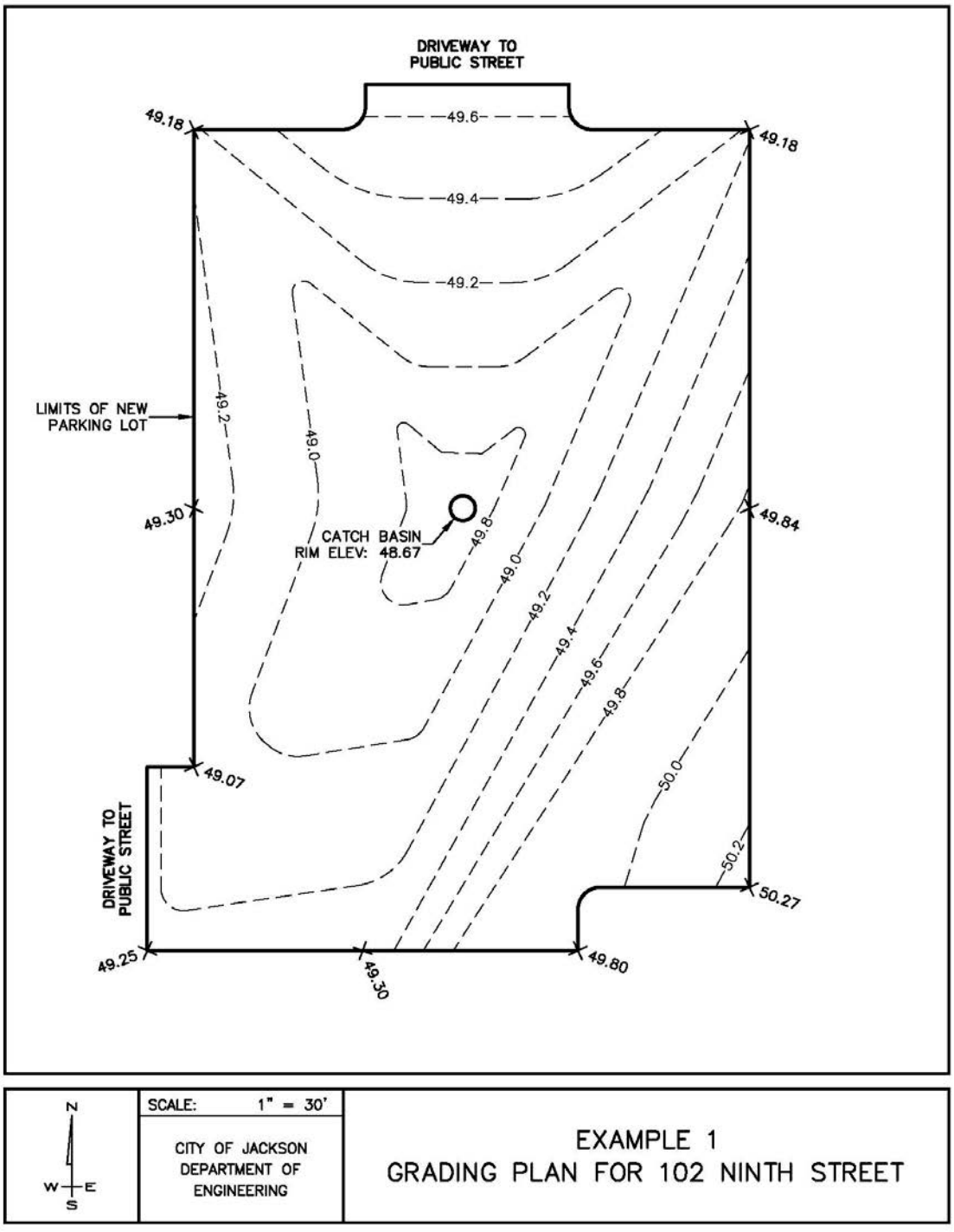
The owner of an office building at 102 Ninth Street needs additional parking. To this end, she has purchased an adjacent vacant lot for the purpose of building a parking lot. The 66 foot x 103 foot, approximately 0.156 acre lot was previously a house and garage which have since been demolished and left to seed. The new parking lot will be constructed to collect storm water runoff in a centrally located catch basin that will outlet to the City's storm sewer main under the adjacent street. The parking lot will be graded to retain the runoff on its surface. The outlet to the City storm sewer main will need to be restricted in the new catch basin to ensure that discharge to the sewer main does not exceed the allowable rate.

Around the perimeter of the new parking lot, a small band of grass and shrubs will be installed to meet the landscaping and screening requirements of the Zoning Ordinance. The remainder of the site will be hard surfaced with either asphalt or concrete. The grassed area of the developed site will be 1393 sft (0.032 acres). The hard surfaced area will be 5400 sft (0.124 acres).

Using this information in the City of Jackson's Runoff Detention Worksheet as shown below, it is determined that the required storage volume is 557 cft and the allowable discharge rate is 0.16 cfs.

STEPS REQUIRED:

1. For sites less than 1 acre, determine the increase in impervious area, if greater than 1000 sft, fill out Worksheet 7, for determining Runoff Detention. This will provide both the maximum allowable discharge rate for this site and the required on-site storage volume required for flood protection.
2. Use the site plan to determine the available on site storage volume.
3. Determine the high water elevation based on stored runoff.
4. Calculate the recommended outlet orifice size to maintain the maximum allowable discharge rate as stated on Worksheet 7.



Use the proposed grading plan to determine the post-development pervious and impervious areas. For this example, the areas were given in the narrative; however actual areas may be calculated directly from a scaled drawing or done using computerized methods. Use these areas to fill out Worksheet 7, Runoff Detention as shown in the following example:

Worksheet 7 provides us with the following values:

Maximum Allowable Discharge = 0.16 cfs Required Storage = 557 cft

To determine if the site grading plan satisfies these requirements the applicant shall check if there is adequate storage available, and if any measures need to be taken to restrict the rate of flow from the site to the City storm sewer system.

With no on-site detention facilities, all runoff generated that is greater than the permitted outflow must be maintained on site. In this example, the applicant verifies the on-site storage capacity through using the contour lines as shown on the site grading plan. The amount of water that will pond and stay within the property limits can be found by starting at the catch basin rim and calculating the area at each contour up to the last one which lies completely within the site boundary, as shown in the table below.

Sample Calculation Table:

Elevation	Area (sft)	Δ H (ft)	Average Area (sft)	Volume (cft)	∑ Volume (cft)
49.2	3125	0.20	2125.5	425.1	565.9
49.0	1126	0.20	648.5	129.7	140.8
48.8	171	0.13	85.5	11.1	11.1
48.67	0				

Provided Storage Volume > Required Storage Volume

569.5 cft > 557 cft

-> Sufficient Storage Provided

To determine the high water elevation on the site during the event, interpolate using the provided and required volumes in the numerator and the provided elevations in the denominator to solve for the actual high water level:

$$\frac{(565.9 - 140.8)}{(49.2 - 49.0)} = \frac{(565.9 - 557)}{(49.2 - X)}$$

X = High water elevation = 49.2

In this example, there is no on-site detention so an orifice will be required on the catch basin discharge pipe to regulate the amount of flow discharging to the storm sewer system. The allowable area of an orifice can be calculated using the maximum allowable flow and high water elevation found above. Alternatively, on-site storm water control could be implemented, should the developer choose to do so, that will reduce the discharge rate to the desired level.

Example orifice calculation:

$A = Q/((0.62)*\sqrt{(2*g*h)})$

A = Area of outlet orifice, sft

Q = Maximum allowable discharge = 0.16 cfs

g = Gravity = 32.2

h = average head = (2/3) *(49.2-45.12) = 2.72

$A = 0.16/((0.62)*\sqrt{(2*32.2*2.72)})$

A = 0.019 sft -> A 1.75-inch diameter opening has an area of 0.017 sft

-> Place a cap over the outlet pipe with a 1.75-inch diameter hole at the invert

EXAMPLE #2 – Large Commercial Site, Total area > 1 acre

DESCRIPTION:

A national tire retailer is redeveloping a 1.38 acre parcel that was previously the site of a car dealership. The 272 foot x 220.5 foot lot currently has an impervious area of approximately 0.5 acres consisting of a paved area with the remaining 0.88 acres of pervious surfaces evenly split between wooded and meadow areas. Upon completion of the development, the total impervious area of the proposed building, parking lot and pedestrian facilities will be increased to 0.825 acres.

Three variations of this site plan have been developed to display varying levels of Low Impact Development (LID) in order to meet the requirements of this ordinance, including:

- No LID elements applied – This site plan is of a typical storm sewer system that utilizes oversized 48" piping in order to satisfy maximum discharge limits and achieve detention requirements as established under previous standards.
- Some LID elements applied – This site plan incorporates some LID measures, but falls short of satisfying all ordinance requirements.
- LID design – This site plan contains a comprehensive LID design that will meet, and exceed the current ordinance requirements.

These examples have been attached at the end of this document. The following is a step by step walk through the process of successfully completing these worksheets.

<u>Worksheet #1 - General Watershed / Site Information</u>

Worksheet #1 is for general information about the site including owner identification and site location. Specific watershed information requested can be found for any site by utilizing the reference links embedded in the sheet. The information provided on this worksheet will be unique for any given site, and will change based on the type of development (LID or not).

<u>Worksheet #2 – Sensitive Natural Resources</u>

Worksheet #2 is used to collect information on the presence of any sensitive natural resources found within the limits of the site and a table to summarize if any of these areas are to be disturbed or not. This information is used in conjunction with Worksheet #3 to determine the actual area of the project to be managed for storm water control. Once the area to be protected or undisturbed has been identified, it is deducted from the total area to be used for determining site runoff calculations. This area will not change based on the type of development.

Worksheet #3 – Runoff Reduction Credits

Worksheet #3 is used to determine if any non-structural Better Management Practices (BMPs) have been incorporated into the site plan. For calculation purposes, a non-structural BMP is one that alters the site hydrology to reduce runoff, rather than manage generated runoff. An example of a non-structural BMP would be to minimize soil compaction on the site. By doing this, the applicant can use an improved "credited" CN for use on Worksheet 4 for calculating the volume of runoff generated on the site.

Worksheet #4 – Calculations for Channel Protection Volume and Peak Flow Rate

Worksheet #4 is used to calculate the pre- and post-development runoff volumes based on areas of given surface types, and consists of worksheets 4A through D. On worksheet 4A, the applicant will complete the upper table for pre-development site conditions, and the lower table based on the proposed post-development conditions, and utilizing the areas with improved "CN" factors from Worksheet 3. If the difference between the pre- and post-development runoff volumes is positive, then that volume from Worksheet 4A is transferred to Worksheet 5 for use in determining whether the Channel Protection Criteria is satisfied. If the post-development runoff is less than the pre-development volume, then this criteria is satisfied. Worksheet 4B is for calculating the pre- and post-development peak flow rate. The peak flow rate analysis is based on a 1 year, 24-hour rainfall event, while the volume analysis is based on a 2 year, 24-hour event. Worksheets 4C and 4D must be completed in order for the calculations in worksheet 4B to work successfully. In cases where the site hydrology is too complicated, the applicant may submit a hydraulic model generated using a program such as EPA SWMM, or similar.

Worksheet #5 - Structural BMP Volume Reduction (Channel Protection)

When site development results in an increase of runoff generated, this runoff must be managed on-site to satisfy Channel Protection Criteria. A table is given on this worksheet with a listing of potential BMPs to be utilized on the site. The applicant will fill in only the areas applicable to BMPs incorporated into their site development, and perform the calculations showing that the BMPs to be implemented can provide enough volume reduction to match or exceed the increase in runoff generated by the site. A table is included on the bottom of the sheet for inclusion of BMPs that do not treat volume, BMPs that actively decrease the volume of runoff through infiltration into the soils, capture and reuse or evaporation will not contribute to meeting the criteria for channel protection. If the post-development runoff is less than the pre-development volume, this worksheet may still be completed to demonstrate that the amount of on-site storage available in the proposed structural BMPs can be used for the Flood Control Criteria.

Worksheet #6 – Water Quality Worksheet

For a site to meet the criteria for water quality, the first 1-inch of runoff from all pervious and impervious areas on the site shall be treated to achieve 80% removal of total suspended solids (TSS). In order to ensure that all runoff on the site is treated, the site must be designed so that all tributary areas are directed

through the appropriate BMPs needed to meet the criteria. The table at the top of the sheet is used to calculate individual tributary areas and the volume of water generated by each. The table at the bottom of the sheet lists the various BMPs and assigns each a TSS removal rating, where a rating of "High" indicates a removal of a minimum of 80% TSS removal. In order to satisfy the criteria for water quality, all on site generated runoff from the first 1-inch of rainfall must pass through one BMP rated High, or two BMPs rated Low or Medium in series.

Worksheet #7 – Runoff Detention Calculation Worksheet (Flood Control)

The runoff detention calculation is required for any non-residential construction that results in an increase of impervious area greater than 1000 square feet. Using the instructions on the worksheet, the applicant will enter the site area and divide that into pervious and impervious segments. This will calculate the maximum allowable discharge rate from the site, in addition to the required volume of storage that needs to be available on the site in order to maintain that rate of discharge. The volume of storage required is based on the peak difference calculated between the 100-year runoff and the permitted outflow. Once this volume has been determined, the developer can use this figure to determine if enough on site storage capacity has been provided in the proposed structural BMPs, and/or on site detention. This will be summarized on Worksheet 8.

Worksheet #8 – Criteria Summary Sheet

This worksheet is used to summarize the calculations and results from Worksheets #1-7 to ensure that the site developer has submitted a plan that meets all three storm water criteria: channel protection (worksheets 4 & 5), flood control (worksheets 5 & 7), and water quality (worksheet 6). At the bottom of the worksheet is a section for Maintenance Criteria. This has been included to show that the applicant acknowledges that in order for BMPs to maintain long term operational effectiveness, a plan for operating and maintaining these facilities needs to be in place. Also, an easement is granted to the City for inspection of on-site BMPs to ensure that the site owner does maintain all on site BMPs in satisfactory operating condition.