
POST CONSTRUCTION CONTROL

STORMWATER MANAGEMENT DESIGN

Village of Lexington

GENERAL COMPLIANCE STANDARDS AND NPDES PHASE II REQUIREMENTS
FOR POST CONSTRUCTION CONTROL DESIGN
FOR DEVELOPMENT AND REDEVELOPMENT PROJECTS
WITHIN THE VILLAGE OF LEXINGTON
UNDER GENERAL PERMIT No. MISO40087

Prepared By:



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I. INTRODUCTION

A. Objective of the Post Construction Controls (Storm Water Management Plan)

The purpose of developing this plan is to aid developers and Village in the design of their storm water runoff collection and detention systems. The Post Construction Controls are developed for compliance with the National Pollutant Discharge Elimination System (NPDES) storm water discharge permit held by the Village of Lexington, ACO 000174.

This Storm Water Management Plan establishes the framework for site development which disturb one or more acres, including projects less than an acre that are part of a larger common plan of development or sale and discharge into the Village's MS4. This includes detention measures and the design of storm water collection systems which will be implemented and details the process that must be followed to gain approval for new developments or redevelopment projects. The plan requires storm water management design practices, which will help to minimize the impacts of proposed development or redevelopment projects on the existing drainage system. In addition, these guidelines will help to insure adequate drainage systems are being constructed for future development in the Village.

The Post Construction Controls provide detailed information about the Village's storm drainage system and explains the Village's approach to managing storm water.

The Post Construction Control Plan includes:

1. A summary of the administrative procedures to be followed to comply with the plan, including meeting requirements, review procedures, inspection requirements, fee schedule, issuance of the storm water discharge permit, penalties and enforcement, and other agency requirements.
2. A summary of existing drainage conditions within the Village.
3. A description of design calculations.
4. A description of design standards and guidelines.
5. The Village's Storm Water Management Procedure.

B. Administration of the Post Construction Controls

The Post Construction Control Plan will be implemented and operated by the Village of Lexington. The Village will be responsible for the review of new development and redevelopment plans and for the installation and maintenance of measures within the Village to accomplish the plan. The Department will work in conjunction with Village Administration, Planning Commission, architectural and engineering consultants, landowners, and developers within the Village. Additionally, as needed or necessary, the Village will coordinate with the Sanilac County Drain Commissioner and the Sanilac County Road Commission.

C. Review/Design Criteria for Existing and Proposed Storm Water Collection

Proper sizing of storm sewers and open drains is accomplished by examining past rainfall data and projecting the amount of surface water runoff that can be expected from a rain storm. In this study, the design rainstorm was chosen with a recurrence frequency of 10 years (10% recurrence interval). The amount of surface water runoff to be collected in storm sewers and open drains will be estimated using the Modified Rational Method.

The plan also requires there will best management practices (BMPs) implemented to address water quality for any storm water discharges that will enter into the Village's storm water system or the small drainage streams or other storm water systems within the jurisdictional boundary of the Village of Lexington that ultimately discharge to Lake Huron. Examples of BMPs are capture and slow discharge of the "First Flush" volume on site projects or retrofitting existing sites to address first flush. It should be noted that discharges directly to a storm sewer (pipe system only), or Lake Huron, will not be required to deal with "Bankfull" discharge conditions. However, if stormwater discharge is into an existing stream that has bank and stream bed erosion situations then this discharge criteria may have to be used to achieve water quality standards.

D. NPDES Phase II Requirements for Storm Water

The Village of Lexington has a jurisdictional stormwater discharge permit (MIS040087) and must attain compliance with the National Pollutant Discharge Elimination System (NPDES) Phase II requirements as they relate to storm water discharge in the Village's jurisdictional area. With the implementation of the Post Construction Controls there will be specific best management practices (BMPs) that developers may be required to implement to assure the storm water discharged from a site is clean to the maximum extent practicable.

To accomplish this goal of clean storm water discharges, BMPs such as bio-swales, rain gardens, bio-infiltration, sediment forebays, catch basin inserts and other BMPs may be required on specific sites. The design engineers must make every attempt to use appropriate BMPs to clean the storm water runoff as it is collected by the storm sewer system, properly detained, and ultimately discharged into an established village storm drain, county drain, road commission drain, or natural waterway within the jurisdictional area of Lexington.

Furthermore, it is the responsibility of the owners of private storm sewer systems to maintain these systems properly to assure they are discharging storm water runoff as clean and pollutant free as possible and only storm water or other authorized discharges are discharged by the private on-site storm sewer system. Storm sewer outfalls into public systems are subject to inspection and if pollutants are being discharged from a private site into a public system or waters of the state of Michigan it is the responsibility of the owner of the private system to clean up any spill or discharge from their site into a public system.

E. Tampering or Removal of Storm Water Controls or Best Management Practices

No property owner or other party shall remove or modify any storm water device or best management practice designed to restrict the flow of storm water into a storm water conveyance system or waters of the State. The removal or modification of a device or best management practice to restrict flows of storm water can only be performed if the party responsible for the removal has had a detailed hydrology & hydraulic study done that provides proof of no significant impact on neighboring properties upstream or downstream of the site. The Village Engineer must approve this study. The party removing such a restrictor will be held liable for any water damage incurred on neighboring properties.

No property owner or other party shall remove or modify a best management practice that protects, preserves, or improves storm water quality. The owner or their designee must obtain permission from the Village to remove or modify a best management practice. If permission is not received in writing from the Village, the owner or other party must replace the best management practice at their expense. It is the responsibility of every parcel owner to discharge the cleanest possible storm water from their site as this water drains to the Great Lakes, and we all must take care to protect this water resource to the maximum extent possible.

II. DEFINITIONS

For the purpose of this Storm Water Management Plan, the following definitions are adopted:

1. *Allowable Discharge*: The maximum flow rate that can be discharged from a site, as calculated for design criteria in accordance with this Storm Water Management Plan.
2. *Base Flood Elevation*: The 100-year flood elevation as determined from Flood Insurance Rate Maps (FIRMs) or the best available information.
3. *Best Management Practices (BMPs)*: Structural, vegetative or managerial practices used to protect and improve the quality of surface water and groundwater.
4. *Bio-filtration*: A system comprised of native plants and amended soils with an underdrain that goes to a detention area. The system is designed to receive storm water runoff and clean it via a filtration process and slow the runoff by letting it percolate through the amended soils to reach an underdrain, which then conveys it to a detention area. The system is designed to remove sediment and pollutants from storm water before discharge.
5. *Bio-swales*: Vegetated swales with specified native species and amended soils that is sloped and graded to provide conveyance of storm water runoff on a site. The system is designed to remove sediment and pollutants from storm water before discharge.
6. *Channel Protection (bankfull)* – see Section V. Design Calculations for this criteria. This is not needed if discharge is into a MS4 or directly to the Great Lake.
7. *Conduit*: Any channel, pipe, sewer or culvert used for the conveyance or movement of water, whether open or closed.
8. *Control Elevation*: Contour lines and points of predetermined elevation used to denote a detention storm area on a plat or site drawing.
9. *Detention Facility*: A facility constructed to provide detention storage.
10. *Detention Storage*: The temporary detaining or storage of storm water in a storage basin, on rooftops, in streets, parking lots, school yards, parks, open space, or other areas under predetermined and controlled conditions, with the rate of drainage regulated to the allowable discharge by appropriately installed devices. These detention storage areas shall not be considered regulated wetlands.
11. *Developer/Owner Engineer*: The engineering company formally designated by the Developer/Owner to act as their Engineer.
12. *Development*: The construction of a building, parking lot, structure, etc. on a piece of land or otherwise changing the use of a piece of land.
13. *Discharge*: The release or outflow of water from any source.
14. *Drainage Area*: The area from which storm water runoff is conveyed to a single outlet (i.e. a watershed or catchment area).
15. *Easement*: A parcel of land on which the owner has granted rights-of-way to make surveys, construct, maintain, operate, alter, replace, repair, and remove at any time that part of the storm

drainage system located within the easement. The landowner will not be allowed to construct buildings or other structures on said easement without the written consent of the easement grantee.

16. Engineer: A civil engineer that is licensed to work in the state of Michigan or a person who is working under the direct supervision of a civil engineer licensed to work in Michigan.
17. *Excess Storm Water Runoff*: The volume and rate of flow of storm water discharged from a drainage area, which is in excess of the allowable discharge.
18. *Floodplain*: The special flood hazard lands adjoining a watercourse, the surface elevation of which is lower than the Base Flood Elevation and is subject to periodic inundations determined from Flood Insurance Rate Maps (FIRMs) or the best available information. A parcel of land can be located within a floodplain without being shown on a FIRM map.
19. *First Flush*: Is the runoff from 1 inch of rain over the entire contributing area of a site. The first flush of a rain event typically carries the most pollutants to our storm sewer system and ultimately to our rivers, lakes and streams. The first flush volume must be discharged over a 24-hour period of time to settle out pollutant loads. Recommended by MDEQ before discharge into any waters of the State.
20. *Impervious Factor (IF)*: The percentage of impervious surface specific to a site that the existing storm drain outlet has been historically designed to convey. The **IF** is used to calculate the allowable discharge from a site. Proposed developments or redevelopments will not be allowed to discharge storm water at a rate, which is greater than the runoff that would occur from the site with the percentage of impervious surfaces defined by the impervious factor. **IFs** have been established for the existing drains and storm sewer systems located within the Village (See Table I, Page 22).
21. *Impervious Surface*: A surface that does not easily allow the infiltration or penetration of water. During rainstorm events, a large percentage of water will runoff. (Typically considered as rooftops, paved walks, roadways, driveways, sidewalks, parking lots, etc.)
22. *Low Impact Development*: Implementation of developmental strategies or best management practices in a manner that maintains predevelopment hydrology, or decreases runoff quantity, and improves runoff quality. It is recommended that the *Low Impact Development Manual of Michigan* be used as a design standard. This document is available for download from the following website: <http://www.semcog.org/LowImpactDevelopment.aspx>
23. *NPDES*: National Pollutant Discharge Elimination System. In 1987 the Clean Water Act was amended and required to implement a program that would address pollutants being discharged to the nation's waters. This now includes storm water discharges into waters of the nation/state.
24. *Peak Flow*: The maximum rate of flow of storm water runoff at a given location.
25. *Percent Imperviousness (IMP)*: The actual proposed percentage of impervious surface for a proposed development or redevelopment. The **IMP** is used to calculate the design discharge (**Q_a**). The design discharge is used to determine storm sewer sizes and required detention volumes. Minimum impervious factors have been established for various zoned land uses (See Table I, Page 22).
26. *Pervious Surface*: A surface that allows infiltration or penetration of water. During rainstorm events, a percentage of water will infiltrate into the surface with the remaining storm water running off. The percentage of runoff is dependent on the type, slope, percent saturation, etc. of

the surface. (i.e. lawns, farm fields, parks, wooded areas, golf courses, etc.). Design personnel should attempt to maximize these surfaces as much as possible.

27. *Rain Gardens*: A depressed area of a size that is determined by specified engineering guidelines with amended soils and specific plants, shrubs, and trees that have a specific volume to store storm water runoff. The site can be underdrained to increase performance.
28. *Rear lot drainage*: A storm water system designed to provide drainage in rear lot areas to prevent water from ponding for extended periods of time. It must be noted that these systems are not designed to convey storm water in a rapid manner. It is a deliberately designed system that can provide additional detention capabilities during severe runoff conditions. It is a system that in condos or subdivisions is the responsibility of the owner to maintain. It is not the Villages responsibility. The Village may repair the system if necessary to prevent damage to neighboring properties, but all associated repair costs, plus a 20% administrative fee, will be passed on to the owner.
29. *Redevelopment*: Altering, improving, reconstructing or otherwise changing the use of an existing developed property. A site will be considered a redevelopment for this Storm Water Management Plan when an area greater than or equal to 5% of the existing developed portion of the site (i.e. roof, gravel, & paved surfaces), or an area greater than 20,000 square feet, is increased or reconstructed with roof, pavement, or any other impervious surface. **NOTE:** this percentage is cumulative. If redevelopment is 2% one year and 3% at another time, this will meet the 5% rule. Also, at times, less than 5% can create drainage problems, and the Village Engineer may require additional detention or storage based on historical or anecdotal problems on a site.
30. *Retention Storage*: The permanent retaining or storage of storm water in a storage basin, on rooftops, in streets, parking lots, schoolyards, parks, open space, or other areas under predetermined and controlled conditions. The only discharge of storm water from the retention storage area is by ground infiltration, evaporation, etc. An emergency overflow must be provided in the event the capacity of the retention facility is exceeded. These retention storage areas shall not be considered regulated wetlands.
31. *Storm Water Management Plan (SWMP)*: Also known as post construction controls, this is a site specific storm water runoff drainage plan developed specifically for individual sites. The plan includes calculation of allowable and restricted discharge rates, detention/retention volume, restrictor sizing, size of pipes, or conveyance devices. A train of best management practices to provide for discharge of clean storm water runoff from a site.
32. *Storm Water Runoff*: The water from a rainstorm or snowmelt, which flows over the surface of the ground or is collected in a drainage system.
33. *Ten-Year Design Storm*: A precipitation event with a duration equal to the time of concentration, having a ten percent probability of occurring in any given year, or occurring once every 10 years on average. This amounts to approximately 3.05 inches of rain in 24 hours. But, brief, intense storms of 10-year design can range from 1.5 inches in 1 hour to 2.87 inches in 18 hours. (Source: Bulletin 71, Rainfall Frequency Atlas of the Midwest, F.A. Huff & J.R. Angel, 1992).
34. *Time of Concentration (T_c)*: The elapsed time for storm water runoff to flow from the most hydraulically distant point in a drainage area to the outlet or other predetermined point.
35. *Village Engineer*: The civil engineer or civil engineering firm formally designated by the Village of Lexington to act as their Engineer. This person or firm must have qualifications

suitable for review of stormwater management plans and knowledgeable with NPDES Phase II regulations in the State of Michigan.

36. *Upland Area:* Land located in the upper portion of a watershed whose surface drainage flows toward the area being considered for development.
37. *Urbanization:* The development, change, or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, institutional, recreational, or public utility purposes.
38. *Urbanized Area:* An area designated by the US Census Bureau, which has specific rules and regulations concerning storm water under the NPDES Phase II regulations. This regulated area may require adherence to specific water quality standards.
39. *Watercourse:* Any natural or artificial stream, river, creek, channel, ditch, canal, conduit, culvert, drain, waterway, gully, ravine, street, roadway, swale, or wash in which water flows in a definite direction, either continuously or intermittently.
40. *Waters of the State:* Means any of the following: The Great Lakes bordering the State and their connecting waters, all inland lakes, rivers, streams, impoundments, open drains, and other surface bodies of water within the jurisdiction of the state, including wetlands as defined by Part 303 of PA 451 of 1994. In Lexington, that would include streams that have a defined bed and bank, and established flow and Lake Huron.

III. REVIEW PROCESS AND PROCEDURES

A. Review Procedures

Lexington shall review all plans for development of subdivisions, multiple family projects, commercial, and industrial sites which disturb one or more acres, including projects less than an acre that are part of a larger common plan of development or sale and discharge into the Village's MS4 for compliance with the Village's regulations for storm water management, as recommended in the Storm Water Management Plan and required by adoption of the Storm Water Runoff Regulation and Control Ordinance.

The Planning Commission shall designate a review Engineer who will provide the services required to assure the Village that all the requirements of the plan and the ordinance are being met. The Engineer shall review the Developer's plan and submit a report to the Village showing the acceptance or rejection of the proposed site drainage plans, calculations and best management practices for discharge of clean storm water.

A site will be considered in compliance with the Storm Water Regulations and guidelines when an approval of the site's Storm Water Management Plan has been completed. The Village will not accept runoff into drainage systems located within the Village from newly developed or redeveloped sites without compliance with the Post Construction Controls guidelines.

To comply with the Storm Water Management Plan and Storm Water Runoff Regulation and Control Ordinance, complete the following process and deliver or mail all submittals to the Village of LEXINGTON, Planning Commission.

A complete submittal package for a storm water review consists of:

- A completed Drainage Checklist
- 3 sets of Site Plans
- 2 sets of calculations

1. Pre-design Meeting/ Conceptual Review

This meeting, at a minimum, shall consist of the Developer's Engineer and the Village's Engineer. The purpose of the meeting is to address the various storm water management proposals of the developer. Conceptual storm water management alternatives can be discussed and potential problems addressed prior to the design phase of the project. The goal of the meeting is to eliminate potential problems up front and reduce the time and costs needed for the design and review of the project.

This meeting will be required for all platted developments, condominium projects, and site developments larger than five (5) acres. It is recommended other site development projects have this meeting or at a minimum correspond with the Village's Engineer by phone, e-mail, and/or facsimile regarding conceptual design alternatives prior to submitting for formal review.

The Developer's Engineer and/or Village's Engineers should have in his/her possession or have an understanding of the following information prior to attending the pre-design meeting.

- a. The drainage district or area in which the proposed development is located and the outlet condition for the proposed development. This information can be obtained from the Village Engineer or public works staff.
- b. Small location map showing where the site is situated.

- c. Location and description of activities that may impact or be impacted by the proposed development or redevelopment both on and off the site.
- d. Acreage of the total site and an estimate of the area tributary to the proposed storm drainage system, including offsite runoff.
- e. The size and location of the proposed storm drainage outlet and information on contributing area.
- f. If known, a conceptual layout of the proposed storm drainage system for the development or redevelopment.

If required, the Owner/Developer and his/her technical consultant shall attend a land development advisory committee meeting. The intention of this meeting is to obtain uniform direction and communication to minimize misdirection of early construction and minimize financial losses to proprietors, developers, and consultants.

If the conceptual layout of the storm drainage system is agreed upon by the Village's Engineer and the Developer's Engineer, the Owner/Developer shall begin completing plans and calculations for formal review by the Village.

2. Formal Review

- a. The Owner/Developer or representative shall submit three sets of plans, three sets of calculations, a copy of the completed checklist (Appendix A), and any other supporting information for the site to the Village Engineer. The plans and calculations shall comply with the requirements of this Storm Water Management Plan. The checklist, design calculations, and design standards that will be used during the formal review process are established by this Storm Water Management Plan.
- b. Submit deposit/fee for storm water management plan review and inspection to the Planning Commission in accordance with the current fee schedule established by the Village.
- c. Formal review and approval will not begin until all items required for application have been received. The proposed drainage system will be either approved or rejected with reason and returned to the owner/ developer.
- d. The Village Engineer will review all plans, calculations, and other information for compliance with the Village's design guidelines. All materials will be reviewed for completeness. Calculations will be checked. The minimum design calculations and design standards outlined in this document will be used for review. The drainage plan checklist will be reviewed.
- e. A typical review will take approximately two (2) weeks to complete from the date the plan is submitted in complete form.
- f. If the proposed drainage system is rejected, three (3) sets of plans and calculations will need to be resubmitted with the appropriate revisions. A completed checklist will also have to be resubmitted.

B. Plan Approval

Once the storm water management plan has been recommended for approval by the Village Engineer a recommendation for approval letter will be sent to the Village. A copy of the letter will be forwarded to the Developer. Three sets of plans will be stamped approved: one set will be forwarded each to the Village and the applicant, and one set will be kept on file with the Village Engineer. The approval letter will include, if necessary, inspection and compliance requirements. **A copy of a soil erosion and sediment control permit may also be required before construction commences.**

C. Changes to Plan after Approval

1. Any changes made to the approved plan after issuance of the storm water permit shall require three sets of plans are submitted to the Village for review and approval.
2. Upon receipt of this information, it will be determined if additional information, such as calculations, revised checklist, etc. will be required.
3. The fee for review of any changes to the plan after approval will be billed on an hourly basis. An occupancy permit will not be issued until all changes have been approved and the Village has received all review fees.

D. Inspection/Letter of Certification Requirements

Inspection of storm sewer systems and/or detention facilities will be required on all development and redevelopment projects. The extent of the inspection will depend on the size and type of the development or redevelopment. Descriptions of these inspection requirements are outlined below. Specific inspection requirements, including the frequency of inspections, will be outlined on the approval letter. The fees associated with this inspection are included in the original deposit.

1. Small Developments/ Redevelopments (Less than 3 acres) – A general site inspection of the restrictor and the detention storage areas by the Village Engineer will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist. The fees for subsequent inspections will be based on an hourly basis.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until a letter of certification has been received by the Village and the final approved inspection of the site has been completed by the Village Engineer or designee.

2. Large Developments/ Redevelopments (3 acres and greater) - Periodic Site inspections of the storm sewer, outlet, restrictors, and detention storage areas may be required by the Village Engineer. Specific items needing inspection prior to the completion of the project will be identified in the approval letter (i.e. installation of restrictors, restricting pipes, etc.). The Village Engineer or designee shall be informed 24 hours in advance of the placement of items requiring inspection as outlined on the storm water management permit.

A final inspection of the restrictor and the detention storage areas by the Village Engineer or designee will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been inspected during construction and the drainage system was constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until the Village has received a letter of certification and the Village Engineer or designee has completed the final approved inspection of the site.

3. Any Single Family, Two Family, or Multi-family Development Projects -Daily inspections of the storm sewer and drainage system construction will be required. This inspection shall be performed by the Owner/Developers Engineer or by the Village Engineer or designee. Daily Inspection reports shall be completed for all days on which construction of the storm drainage system occurs. At a minimum, the daily inspection reports shall include the information shown on the sample daily inspection report included in Appendix A. These daily inspection reports do not have to be submitted to the Village. However, they should be on file with the design engineer and made available upon request.

A final inspection of the restrictor and the detention storage areas by the Village Engineer or designee will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until the Village has received a letter of certification and the Village Engineer or designee has completed the final approved inspection of the site.

E. Fee Schedule

The fee schedule for reviewing storm drainage submittals and performing inspections of drainage system construction shall conform to the current Lexington Resolution Regarding Fees. This resolution will be reviewed on an annual basis and fees may be adjusted if determined necessary.

IV. STORM DRAINAGE SYSTEMS WITHIN LEXINGTON

Within the Village, there are drains that fall under several different agencies' jurisdictions. These include the following:

- A. Established County Drains - Work done directly on or connected to these drains falls under the jurisdiction of the Sanilac County Drain Commissioner. Preliminary and final plat approval requires a signature and review from the Drain Commissioner. However, many site plan developments, condominiums, etc. that impact established county drains are not submitted for review to the Drain Commissioner. There are no established county drains within the jurisdiction of the Village of Lexington.
- B. County Roadside Drains - There are many drains that fall under the jurisdiction of the Sanilac County Road Commission. When a crossing is installed over a county roadside drain, a permit or permission must be obtained from the County Road Commission.
- C. Michigan Department of Transportation (MDOT) - There are several drains that are located along M-25 and M-90 that fall under the jurisdiction of MDOT. Any development that proposes to use these drains for a storm water outlet must get a permit from MDOT. As part of this permit, storm water detention may be required. A copy of this permit application is available at the website address located in Appendix B of this document.
- D. Michigan Department of Natural Resources & Environment (MDEQ) - The MDEQ regulates any work done within the 100-year floodplain and/or any inland lakes or streams. There are several wetland areas within the Village that are regulated by the MDEQ. A copy of the Joint Permit application for a site to discharge to Lake Huron, or within 500 feet of inland lakes or streams, as well as wetlands, is provided from a website address that can be found in Appendix B.
- E. Lexington Drains - There are several areas within the Village that have drainage swales, open channel drains and/or tile drains that are not regulated by any of the above referenced agencies. In these areas, it is the sole responsibility of the Village to manage the storm water. This storm water management plan will provide for the management of those areas. Proposed storm water management in these areas is explained in more detail later in this section.

Each of the agencies listed previously have their own design criteria for reviewing proposed developments and drainage improvements. These criteria are not always consistent with the storm water requirements of the Village as a whole. For example, the MDOT is concerned about the proper drainage of the roadway and sub-base of the road; a permit may be obtained to discharge a large quantity of water to a road side drain not causing a problem now but may not leave any additional storm water outlet capacity for future development upstream. For these reasons, it is very important that the Village review all proposed developments/ improvements to assure that the proposed storm water management is consistent with the future plans of the Village.

V. DESIGN CALCULATIONS

A. Allowable Discharge Rate (**Qa**) and 10-Year Design Discharge (**Qd₁₀**)

The storm water discharge rate from any proposed development or redevelopment site shall be restricted to an allowable discharge (**Qa**). This allowable discharge shall be the most restrictive discharge (smallest discharge) from the site as determined by one of the following three (3) design approaches. The 10 Year design discharge (**Qd₁₀**) for the proposed site development or redevelopment to be used for storm sewer sizing shall include the discharge from all development upstream of the proposed site fully developed to current zoning requirements.

1. Rational Method using predetermined Impervious Factors (**IF**) and actual percent imperviousness (**IMP**).

The allowable discharge rate and 10 Year design discharge for a site is calculated using the Rational Method.

$$Q = (C)(I)(A)$$

Q is the runoff rate in cubic feet per second (cfs).

C is the coefficient of runoff.

I is the intensity of rainfall in inches per hour (in./hr.).

A is the area of the site in acres (ac.).

The rational method will be used to calculate allowable discharge (**Qa**) and 10-year design discharge (**Qd₁₀**). The allowable discharge (**Qa**) is calculated using the impervious factor (**IF**) for the site. The **IF** for the proposed site development or redevelopment can be obtained from the Village Engineer or from within this document.

The 10-year design discharge (**Qd₁₀**) is calculated using the actual percentage of imperviousness (**IMP**) for the entire drainage district when fully developed to the zoned land usage. The **IMP** for the Villages' zoned land uses can be obtained from the Village Engineer or from within this document. The actual proposed and/or existing amount of impervious surface shall be used when designing the storm sewer system. The minimum **IMP** shall not be less than the values defined in Table I of this document. If an **IMP** lower than the minimum values is used, the basis for determining the proposed and/or existing amount of impervious surface shall be submitted with calculations.

All of the contributing area to the site shall be considered when determining the 10 Year design discharge (**Qd₁₀**), including any existing offsite drainage coming onto the site. Sizing the proposed drainage system based on the entire contributing drainage area will minimize potential impacts to upstream property owners.

The actual area of the site development, excluding runoff from surrounding lands, shall be used when determining the allowable discharge from the site (**Qa**). Using only the runoff from within the proposed site development to determine the allowable discharge minimizes impacts to the existing downstream outlet.

The allowable discharge or 10 year design discharge will be determined by summing the calculated runoff from impervious surfaces and pervious surfaces based on the required **IF**. **Qi** is the runoff rate from the impervious surfaces of a site and **Qp** is the runoff rate from the pervious surfaces of a site. The total runoff rate for a site is the sum of **Qi** and **Qp**.

$$\begin{aligned}
 Q &= Q_i + Q_p = (C_i)(A_i)(I) + (C_p)(A_p)(I) \\
 Q_a &= (C_i)(I)[(IF)/100](A) + (C_p)(I)[(100-IF)/100](A) \\
 Q_d &= (C_i)(I)[(IMP)/100](A) + (C_p)(I)[(100-IMP)/100](A)
 \end{aligned}$$

To calculate **Qa** or **Qd** the values for **Ci**, **Cp**, **I**, **IMP**, **IF**, and **A** must be determined. The percent impervious (**IMP**) are obtained from the Village, Village Engineer, from within this document, or measured from the site plan. The impervious factor (**IF**) is a design value obtained from the Village Engineer or from within this document. The Area (**A**) is determined based on measurements of the entire area contributing to the storm sewer or detention area. The impervious area runoff coefficient (**Ci**), the pervious area runoff coefficient (**Cp**), and the rainfall intensity (**I**) are calculated values based on the time of concentration (**tc**).

Time of concentration (**tc**) is the time it will take for runoff from the most hydraulically distance point (i.e. high elevation) to reach the design point (i.e. low elevation such as a catch basin or an outlet sewer). The following can be used to calculate time of concentration:

$$t_c \text{ (min)} = \text{length (ft.) of runoff} / \text{avg. vel. (fps)} * 60 \text{ (sec./min.)} + \text{lag time (min.)}$$

The average velocity for overland drainage in Lexington will range between 1.0 fps and 2.5 fps based on overland slope and land use. Lag time will range between 15 and 20 minutes. When calculating time of concentration (**tc**), include all assumptions with calculations.

When the time of concentration (**tc**) is found to be greater than 30 minutes calculate the runoff coefficients (**Ci**, **Cp**) and rainfall intensities (**I**) according to the following equations:

$$\begin{aligned}
 \text{impervious area (Ci)} &= 0.80 \\
 \text{pervious area (Cp)} &= 0.20 \\
 I_{10} &= 175 / (25 + t_c)
 \end{aligned}
 \qquad
 \text{NOTE: } I_{100} = 275 / (25 + t_c)$$

When the time of concentration (t_c) is found to be less than 30 minutes calculate the runoff coefficients (C_i , C_p) and rainfall intensities (I) according to the following equations. If t_c is calculated to be less than 15 minutes, use t_c equal to 15 minutes.

$$\text{impervious area } (C_i) = t_c / (8 + t_c)$$

$$\text{pervious area } (C_p) = t_c / (80 + 4 t_c)$$

$$I = 175 / (25 + t_c)$$

- The allowable discharge may need to be restricted further based on the capacity of the downstream storm sewer or drainage system. To minimize impacts downstream, the maximum capacity of the existing storm sewer or drain without surcharging or flooding shall be determined at the controlling downstream restriction. The drainage area contributing at this restriction shall be determined. Based on the area of the proposed development, the area upstream of the restriction, and the outlet capacity at the restriction, an allowable discharge shall be determined by the following method.

$$Q_a = Q_r(A_d/A_c)$$

Q_a = Allowable discharge from proposed development or redevelopment.

Q_r = Maximum capacity of downstream storm sewer/drain at the controlling restriction.

A_d = Area of the proposed site development or redevelopment.

A_c = Total area of watershed contributing upstream of the restriction.

- If it is determined the existing runoff from the drainage district is at or exceeding the capacity of the downstream storm sewer or drain the proposed development or redevelopment will, at a minimum, have to be restricted to existing conditions. The allowable discharge from the site shall not exceed the runoff from the site during the 10-year storm event under existing conditions. This discharge can be determined using the rational method previously identified and the existing percentage of impervious surface on the site.

B. Storm Water Detention Requirements

The storm water detention storage required for a site is calculated as follows:

Calculate the maximum flow rate per acre of impervious surfaces, Q_o .

$$Q_o = Q_a / C_w A$$

A = Area of the site in acres.

C_w = Weighted Coefficient for runoff for the proposed development.

Calculate the storage time (T) in minutes at which the maximum volume of storage will occur on site for the 10-year design storm.

$$T = (4080/Q_o)^{1/2} - 20$$

Calculate the maximum volume of storage per acre of impervious surfaces, V_s . The units of V_s are cubic feet per acre of impervious surface (cu. ft / acre).

$$V_s = [(8160)(T) / (T + 20)] - (40)(Q_o)(T)$$

Finally, calculate the **total volume of storage required** for the site, **V_t**. The units of **V_t** are cubic feet.

$$V_t = (V_s) (A * C_w)$$

Discharge Restrictor Requirements

Restrictors are required to regulate the discharge of storm water to the allowable discharge rate established for a site. The circular in-line restrictor is sized based on the orifice formula.

$$a = Qa / [0.62 (64.4(\Delta h))^{1/2}]$$

a = area of orifice (sq. ft.)

Δh = head differential from center of orifice to Hydraulic Grade Line of detention pond at maximum capacity, (ft.).

First Flush requirements

All construction projects are required to detain the first flush volume, which is defined as 1.0 inch of runoff over the entire contributing parcel being developed or re-developed. This volume will be calculated as:

$$3630 \times A \times Cw = \text{FF volume}$$

This volume must be held for more than 18 hours but not more than 24 hours.

This volume can also be filtered through use of a sand filtration system or a vortex system.

The average allowable release rate for runoff resulting from 1-inch of rain in 24 hours is calculated as follows:

$$Q_{\text{ff}} = \frac{\text{Volume}}{(24\text{hr}) * \left(\frac{3600\text{sec}}{1\text{hour}}\right)} = \frac{V}{86,400\text{sec}}$$

Determine Area of Orifice

The first flush discharge controls the required total area of orifice (number of holes needed).

$$A_{\text{ff}} = \frac{Q_{\text{ff}}}{(0.62) * \sqrt{2gh_{\text{ave}}}}$$

Where h_{ave} is defined as, $h_{\text{ave}} = (2/3) \times (\text{elev.}_{\text{first flush}} - \text{elev.}_{\text{bottom}})$

The number of holes needed is calculated as follows:

$$\text{Number of holes} = \frac{A_{\text{ff}}}{\text{Area of orifice}}$$

Detention Time for Given Orifice Area (Calculated above)

$$Q_{\text{ff New}} = A_{\text{ff New}} * 0.62 * \sqrt{2gh_{\text{ave}}}$$

New Holding Time ($T_{\text{ff New}}$)

$$T_{\text{ff New}} = \frac{V_{\text{ff}}}{Q_{\text{ff New}}}$$

The new holding time must be within the time frame listed above (18 to 24 hours).

Channel Protection or Bank full (bf) requirements

All construction projects are required to detain the channel protection (CP) or bank full (bf) volume, which is defined as the 24 hour, 2-year storm event (~2.14 inches). This volume will be calculated as:

$$V_{bf} = (2.14") * \left(\frac{1'}{12"}\right) * \left(\frac{43560 ft^2}{1ac}\right) * (Area) * C_w$$

Or

$$7768 \times A \times C_w = CP \text{ volume}$$

This volume must be held for more than 36 hours but not more than 48 hours. The average allowable release rate for this rain event is calculated as follows:

Determine Area of Orifice

Check the discharge through the first flush orifice to see if additional holes are necessary.

$$h_{ave} = (2/3) \times (\text{elev. bank full} - \text{elev. bottom})$$

$$Q = A_{bf} * (\# \text{ orifices}) * 0.62 * \sqrt{2gh_{ave}}$$

$$T_{bf} = \frac{V_{bf}}{Q}$$

If T_{bf} is greater than 48 hours, more orifice area will be needed.

Choose a target detention time (T_{total}) to find the remaining volume which needs to be released so that detention time is between 36 to 48 hours.

$$V_{rem} = V_{bf} - V_{ff}$$

$$T_{rem} = T_{total} - T_{ff \text{ New}}$$

Find Q_1 , which is defined as the discharge through the First Flush orifice when both the FF and the bank full volumes are contributing.

$$Q_1 = A_{ff} * (\#orifices) * \sqrt{2gh_{ave}}$$

$$V_1 = T_{rem} * Q_1$$

Leftover volume will be released by the Bank Full orifice. V_2 will be defined as the amount of water to be discharged

$$V_2 = V_{rem} - V_1$$

$$Q_2 = \frac{V_2}{T_{rem}}$$

$$A_2 = \frac{Q_2}{0.62 * \sqrt{2gh_{ave, bf}}}$$

The number of holes needed is calculated as follows:

$$\text{Number of holes} = \frac{A_{ff}}{\text{Area of orifice}}$$

C. Future Land Uses/Percent Imperviousness (IMP)

The percent of imperviousness is based on the proposed land usage as required by the Villages' zoning ordinance. The future land use and their estimated percent imperviousness (IMP) are summarized in Table I. The IMP will be used for the design of storm drainage systems that will be maintained by the Village after construction of the storm drainage system is complete.

TABLE I

PERCENT OF IMPERVIOUSNESS BASED ON FUTURE LAND USAGE

Zoned Land Usage	Percent Imperviousness (IMP)*
Agricultural	10
Low Density Residential	20
Medium Density Residential	30
High Density Residential	40
Office	50
Neighborhood Business	50
Corridor Business	50
Area-Wide Business	50
Exclusive Business	50
Manufacturing	50
Floodplain	N/A
Parks	N/A
Public	Dependent on Use

* These percentages of Imperviousness are assumed minimum values. The actual proposed and/or existing amount of impervious surface shall be used when designing the storm sewer system. The basis for determining the proposed and/or existing amount of impervious surface shall be submitted with calculations. A more detailed description of these land usages follows.

DESIGN STANDARDS

A. Requirements

1. General Requirements
 - a. Storm water detention requirements for any new construction development, redevelopment, or land use change occurring within Lexington will be determined according to this storm water management plan.
 - b. The peak runoff rate during a 10-year storm event from a developed or improved site shall not exceed the allowable discharge rate (**Qa**). This rate is determined as outlined in the design calculations section of this plan.
 - c. There shall be no detrimental effect on the floodway or the floodplain elevation during a 10-year design storm upstream or downstream of the proposed development area as a result of the proposed development.
 - d. Engineering calculations must be submitted with the proposed storm drainage system plans. The calculations shall follow the procedures outlined in this document.
 - e. Roof drains may be connected to a storm sewer system if the flow through the outlet to the Village system is properly restricted. Unrestricted runoff from a roof drain will not be accepted, there are no exemptions.
 - f. The developer, Village Engineer and/or Village DPW staff shall make a determination as to whether any or all of the facilities proposed are to become private or part of the Village Drainage system or part of any other regulating agencies storm sewer system.
 - g. The Village Engineer shall in the case of a proposed subdivision, make a determination as to those control elevations that shall be entered on the final plat or make a determination as to the necessity for deed restrictions on any particular lot in said subdivision requiring the preservation of mandatory drainage facilities. Where a non-subdivided parcel of land is proposed for development, the Village Engineer shall make a determination as to the need for covenants to maintain responsibility for mandatory drainage facilities. All the said facilities shall be located in easements dedicated to the public, and shall be subject to continual inspection during the construction period.
 - h. Best Management Practices (BMPs) for water quality must be designed to reduce post-development total suspended solid loadings by 80% or achieve a discharge concentration not to exceed 80 mg/L. Any sampling done will be at the expense of the property owner.

- i. Proposed storm sewer enclosures must be designed so they will not adversely impact any adjacent properties, upstream or downstream, and must be designed to the impervious factors of the lands based upon zoning, not necessarily existing conditions.
- j. Soil erosion and sedimentation control measures must be implemented per Part 91 of Public Act 451 of 1994 (NREPA).

2. Storm Sewer Piping Requirements

- a. Proposed storm sewer shall be designed to have capacity to pass 10-year design storm runoff rate (**Qd**) Refer to Design Calculations section of this document.
- b. Class III or IV concrete pipe must be used for the following:
 - i. Combined sewers (Combined sewers must have premium joints)
 - ii. Storm Sewers within Village, county, and state right-of-way
- c. Provide 2' Minimum cover with minimum 5' cover in M.D.O.T. R.O.W.
- d. Provide 18" Vertical separation between all other utilities including, sanitary sewers and water mains. Provide 10' Horizontal separation from other utilities.
- e. A minimum of four inches of sand bedding is required beneath the pipe and a minimum of 6 inches of sand backfill is required above the pipe.
- f. Manhole/catch basins shall be placed at a maximum distance of 300' from any other manhole/catch basin for access/maintenance purposes.
- g. Provide a sump discharge outlet for each individual property/lot in all developments. Sump leads shall not be connected to rear lot drainage systems. This outlet shall be a catch basin (minimum 3' diameter) or a storm sewer lead extended to the Right-of-Way/Property line of each lot (minimum 6").
- h. Place a catch basin (minimum 3' diameter) between each pair of driveways, if curb and gutter, driveway culverts, and/or valley shaped ditches are not proposed.
- i. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 ft./sec. when pipe is flowing full without surcharging.
- j. Concrete pipe (C-76-III, IV) shall have fabric wrapped joints.
- k. For private storm sewer systems Plastic pipe may be used. This plastic pipe shall be either smooth walled HDPE or SDR 35 P.V.C. Pipe. If pipe is perforated a manufacturers "Sock" shall be used over the pipe.
- l. Minimum pipe diameter for catch basin leads is 10".
- m. Minimum pipe size for sewer main is 12".
- n. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible.
- o. Catch basins should have a minimum sump depth of 18". It should be noted that some new systems using "end of pipe" BMPs may require systems with no sumps. This type

of system requires less maintenance of each individual catch basin, but requires routine maintenance of the BMP.

3. Detention Requirements

- a. If a separate lot or parcel is used for detention or retention the outer limits shall be delineated on the Exhibit B drawings of a Condominium Development or on the Final Plat.
 - i. Condominium Developments - Detention or Retention areas shall be designated as general common areas.
 - ii. Platted Developments - Detention or Retention areas shall be designated as a storm water detention/retention area. **(See State Requirements)**
- b. Requirements for all Detention/ Retention Areas
 - i. Proposed storm water detention facilities shall be designed to detain the 10-year design storm runoff volume from the entire contributing area in excess of the allowable discharge from the site. **(See Design Calculations, Section V)**
 - ii. The maximum design storage elevation in a detention area must be a minimum of one (1) foot below the lowest ground elevation adjacent to the detention area.
 - iii. The design maximum storage elevation in a detention area must not exceed a depth of nine (9) inches above any paved surfaced in non-residential developments. In residential developments the maximum ponding elevation in the detention pond shall not exceed the lowest rim elevation in the development.
 - iv. If parking lot detention is used the owner or lessee must be aware of this detention and sign a letter of understanding that the parking lot will flood during design storms and be flooded for periods of time.
 - v. The design maximum storage elevation in a detention area must not be closer than one (1) foot below the minimum finish floor elevation of the proposed structure(s) or existing facilities.
 - vi. An emergency overflow shall be provided at the detention basin to insure the maximum ponding elevation does not exceed the depths outlined in items iii. and iv. above. This overflow shall be able to allow drainage from the site in the event the 10-year storm is exceeded or the restricted outlet is obstructed.

- vii. Designs of detention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, and at any attractive nuisances. These features may include, but not be limited to, landscaping, fencing, handrails, lighting, steps, grills, signs, and other protective or warning devices so as to restrict access as required by the Village.
- viii. Side slopes and the bottom of detention basins shall be top soiled, to a minimum of 3 inches, and seeded.
- ix. The side slopes and bottom of the basins shall be shaped with maximum slopes of 1 vertical to 4 horizontal to allow mowing of these surfaces.
- x. Detention basins with bottom slopes less than 1% shall be underdrained.
- xi. Detention basins shall be constructed with the top of banks a minimum of 5 feet from any pedestrian walkway (i.e. public and private sidewalks/ bike paths).
- xii. If a “Wet” detention pond is proposed the bottom of the pond shall be a minimum of 5 feet below the proposed ponds' outlet elevation. Item ix. shall not apply to “Wet” detention facilities.

4. Rear Lot Drainage Requirements

- a. Minimum rear lot tile drain sizes and slopes have been determined assuming ponding will occur in rear yards for a duration 4 times the duration of a given 10-year design storm event. This time may range from 4 to 24 hours depending on drainage conditions. The following minimum pipe sizes and slopes apply:
 - i. Rear lot tile drains with contributing drainage areas up to 2 acres will have a minimum diameter of 6 inches and a minimum slope of 0.5 %.
 - ii. Rear lot tile drains with contributing drainage areas greater than 2 and less than 3 acres shall have a minimum diameter of 8 inches and a minimum slope of 0.4%.
 - iii. Rear lot tile drains with contributing drainage areas greater than 3 and less than 4 acres shall have a minimum diameter of 10 inches and a minimum slope of 0.32%.

- b. Rear lot tile drains with a contributing area greater than 4 acres shall be considered main line storm sewer and shall be designed according to corresponding storm sewer requirements (See design calculations section of this report). Calculations shall be submitted to verify that rear lot drains have the capacity to pass the 10-year design storm event. Plastic pipe is acceptable for rear lot drainage systems draining more than 4 acres provided it is installed in landscaped/ lawn areas.
- c. Rear lot tile drains cannot connect to road underdrains.
- d. Rear lot drainage tiles shall have a minimum cover of 2 feet. A minimum of four inches of sand bedding is required beneath the pipe and a minimum of 6 inches of sand backfill is required above the pipe.
- e. Rear lot catch basins shall have a minimum diameter of 2 feet. Plastic structures may be used for rear lot drainage systems. Concrete structures are required for storm sewer systems. The catch basins shall not be placed at spacing greater than 300 feet. Any bends, turns, or dead ends shall require a structure.
- f. If pipe is perforated, a manufacturers “Sock” may be used over the pipe, but is not required.
- g. A 20-foot easement will be required for all rear lot drainage systems. This easement should be centered along lot lines to allow for a 10-foot easement along adjacent lots and to provide access to the rear lot drainage system from either adjacent property owners. Said easements shall be written as to permit neighboring property and/or condominium owners to maintain the rear lot drainage system as it may affect their property.
- h. Rear lot drainage shall be large enough to convey all contributing area to the rear lot system, including off site drainage if it is not diverted around the development.
- i. Existing rear lot drainage systems abutting a proposed development may be used for the following new development provided:
 - i. The existing rear lot drainage system has the capacity to convey storm water runoff from the proposed rear lot drainage areas.
 - ii. A signed agreement is obtained from property owners located within the existing subdivision allowing the proposed subdivisions' rear lot storm water runoff to pass through their existing system.

- j. Phased developments owned by the same proprietor may utilize proposed rear lot drainage for a current development phase on future phases of the following development provided:
 - i. Covenants shall be recorded into the deeds of the property owners affected in the current phase allowing for future phases of the development to drain into the current phases' rear lot drainage system.
 - ii. If covenants are not made as outlined above, future phases will require separate rear lot drainage systems or agreements from the current land owners allowing for the use of their rear lot drainage system.
 - iii. The rear lot drainage system shall be constructed to convey rear lot drainage from both the existing and proposed rear lot drainage areas.
 - iv. Easements shall be provided allowing for maintenance by both abutting landowners in current and proposed phases of development.
- k. Rear lot drainage shall be shown on the preliminary plat (subdivisions) or site plan (condominiums).
- l. All rear lot drains shall connect to an approved storm water drainage system.

B. General Compliance Guidelines

The following guidelines are recommended, but are not a requirement of this plan. These guidelines are provided for reference.

- 1. The minimum surface slopes for overland drainage are as follows:
 - a. For bituminous paved surfaces, 1%.
 - b. For concrete paved surfaces, 0.5%.
 - c. For concrete curb and gutter, 0.32%.
 - d. For drainage swales and valley shaped ditches, 0.5%.
 - e. For rear lot drainage swales and valley shaped ditches, 0.5%.
 - f. Landscape grading, 2%.
- 2. The maximum surface slopes for overland drainage are as follows:
 - a. For bituminous, concrete paved surfaces, 5%.
 - b. For concrete curb and gutter, 5%.
 - c. For drainage swales and valley shaped ditches, 5%.
 - d. For rear lot drainage swales and valley shaped ditches, 5%.

- e. Drainage swales and valley shaped ditches shall have maximum side slopes of 3 horizontal to 1 vertical.
- f. Landscape grading, 4 horizontal to 1 vertical.

C. Variances from Requirements

The Village may waive allowable discharge requirements and or detention requirements. All variances will be reviewed under the appeal procedures established in the current storm water management ordinance. Variances from these requirements shall require the approval of Lexington whose actions shall be conditioned upon the following:

1. A petition shall be submitted describing in detail the rationale for the proposed design changes including hydraulic and/or hydrologic computations.
2. Special circumstances or conditions exist which will affect the property under consideration such that strict compliance with the provisions of the storm water discharge permit would deprive the applicant of the reasonable use of their land.
3. A variance is necessary for the preservation and enjoyment of a substantial property right of the proprietor.
4. Granting of the variance will not be detrimental to the public health, safety or welfare, or injurious to other property in the territory in which said property is located.
5. An affirmative recommendation must be received from the Village Engineer supporting such variance. In the event that the Village Engineer does not submit an affirmative recommendation, a recommendation shall be received from Lexington.

APPENDIX A

1. LEXINGTON DRAINAGE PLAN APPLICATION & CHECKLIST
2. LEXINGTON STORM WATER MANAGEMENT SITE REVIEW AGREEMENT PROCEDURE & FORM
3. TYPICAL DAILY INSPECTION REPORT FORM
4. SOIL EROSION AND SEDIMENT CONTROL FOR CONSTRUCTION SITES PROCEDURE
5. VILLAGE ENGINEER FINAL INSPECTION FORM
6. SITE VISIT AND INSPECTION REPORT PROCEDURE
7. STORM WATER MANAGEMENT SITE REVIEW AGREEMENT

VILLAGE of LEXINGTON

STORM WATER DISCHARGE PERMIT APPLICATION

PROJECT NAME:	
Property Tax Identification #:	
Site Plan Review Date:	
Date Applied:	
Deposit Amount Submitted:	
NAME OF DEVELOPER/OWNER:	ENGINEER/ARCHITECT:
Contact Person:	Contact Person:
Street Address:	Street Address:
City, State, Zip:	City, State, Zip:
Telephone:	Telephone:
Email:	Email:
PROJECT LOCATION:	
Street Address:	
Name of Subdivision/Plat:	
Drainage District:	
STORM WATER DESIGN INFORMATION (*Calculation must be submitted for verification. Calculations must have clearly labeled headings, clearly labeled formulas, and clearly labeled units.)	
Type of Development (Circle): <i>COMMERCIAL SITE, INDUSTRIAL SITE, RESIDENTIAL PLATTED, RESIDENTIAL CONDOMINIUM, OTHER</i>	
*AREA OF DEVELOPMENT (acres):	
*AREA OF CONTRIBUTING DRAINAGE DISTRICT (acres):	
*AREA OF EXISTING IMPERVIOUS SURFACE (acres):	
*AREA OF PROPOSED IMPERVIOUS SURFACE (acres):	
*ALLOWABLE DISCHARGE RATE (Q _a) (cfs):	
*TOTAL VOLUME OF STORAGE REQUIRED (cu. ft.)	
*TOTAL VOLUME OF STORAGE DESIGNED (cu. ft.)	
10 YR DESIGN STORM WATER DETENTION STORAGE ELEVATION:	
EMERGENCY OVERFLOW/MAXIMUM STORAGE ELEVATION:	
LOWEST FINISHED FLOOR ELEVATION:	
OUTLET DRAIN SIZE AND DESIGN FLOW CAPACITY:	
OUTLET DRAIN INVERT ELEVATION:	
DESIGN IMPERVIOUS FACTOR (IF):	
*10 YEAR DESIGN DISCHARGE (cfs):	
*HEAD DIFFERENTIAL THROUGH RESTRICTOR (ft.):	
*DIAMETER OF PROPOSED RESTRICTOR (in.):	
*ACTUAL RESTRICTED DISCHARGE (cfs):	
AUTHORIZED SIGNATURE _____ DATE _____	PLEASE DRAINAGE PLAN CHECKLIST TO ASSURE ALL INFORMATION IS PRESENT FOR REVIEW

DRAINAGE PLAN CHECKLIST

In order for the Owner, Developer, or Builder to be in compliance with these guidelines he/she shall for review by the Village Engineer, three complete sets of the site drainage and grading plan, and one copy of the calculations for allowable discharge and on-site storage requirements, as prepared by a Registered Professional Engineer or Architect. A copy of the completed checklist will be sent with all submittals.

Each of the following items shall be included on the plan:

- _____ Total acres of site.
- _____ Total acres of watershed draining through the site outlet.
- _____ Drainage district lines including sub-district lines contributing to individual storm sewers and rear lot drainage systems.
- _____ Location of site including dimension to nearest intersection road or section line.
- _____ Existing ground elevations at maximum 50' centers, including shots on perimeter of site and 50' beyond or contour lines at 1 foot intervals extending 50 feet beyond the site limits.
- _____ Elevations of ground, edge of pavement, and buildings within 50' of site.
- _____ Top of curb, gutter, ditch line, and centerline of road elevation at maximum 50' intervals.
- _____ Existing storm catch basins, manholes, sewers, and culverts showing rim and invert elevation(s).
- _____ Proposed elevations showing parking lot grades and control and building elevations.
- _____ Lawn/landscape areas.
- _____ Location, size, length, slope, and type of proposed storm sewer and rear lot drains.
- _____ Rim and invert elevation(s) of proposed manholes and catch basins, including rear lot drainage.
- _____ Location of on-site storage showing contour line for the top of storage elevation.
- _____ Provide sufficient dimensions, cross-sections, profiles, tie downs, etc. to determine the location and size of proposed storm sewers and detention areas. This information will be used for verifying proposed detention volume calculations in grassed and paved areas.
- _____ Location of restrictor and proposed restrictor detail(s).
- _____ Location and elevation of the Emergency Overflow.

DRAINAGE PLAN - CHECKLIST (Continued)

Each of the following items shall be included in the submitted calculations:

- _____ Drainage District and impervious factor.
- _____ Calculation of maximum allowable discharge (Obtain impervious factor from the Village Engineer).
- _____ Calculation of on-site storage required.
- _____ Calculation of storage volume provided.
- _____ Calculation of restrictor size.
- _____ Hydrologic & Hydraulic Calculations for sizing storm sewer systems, which will be maintained by a public agency.
- _____ Hydrologic and Hydraulic calculations showing there will be no adverse impacts upstream or downstream of the proposed development.

Beyond the Village of Lexington requirements, the Developer must submit applications for permit with all agencies that regulate storm water within the area of development. These may include Michigan Department of Transportation, Michigan Department of Natural Resources & Environment, Sanilac County Drain Commissioner, or the Sanilac County Road Commission.

Developed June, 2009

DAILY INSPECTION REPORT FORM

PROJECT NAME:	WORK ORDER NO.:			
CONTRACTOR:	REPORT NO.:			
SUPERINTENDENT:	DATE:			
WEATHER (CLEAR, CLOUDY, RAIN, SNOW):	TEMPERATURE:	INSPECTOR:		
WORK FORCE ON SITE:	NUMBER:	TRADE:	NUMBER:	TRADE:
EQUIPMENT IN USE (Number and Type):				
WORK DONE (Location, Amount, and Type): (Be Specific)				
TYPE OF UTILITY INSTALLED (Water, Sewer, Pavement, size, Class, Description, Source):				
GROUND CONDITIONS ENCOUNTERED (Clay, Sand, Wet, Dry, Good Poor, or Other & Detail Further):				
BACKFILL INSTALLED:				
EXISTING UTILITIES ENCOUNTERED:				
RELOCATION OF PROPOSED UTILITIES AND REASON NECESSARY:				
MATERIAL DELIVERED TO SITE (Size, Class, Description, Source):				
VISITORS TO WORK SITE (Name, Affiliation):				
REMARKS:				

NOTE: Complete in ink each day. Use reverse side if necessary.
 By: _____ Date: _____

A general procedure for Soil Erosion and Sediment Control (SESC) and NPDES permits to discharge storm water from construction sites:

There have been changes in the permitting for construction sites for contractors, developers, municipalities, and other public agencies. These rules took effect at the date listed below; everyone must adhere to these changes and be aware of them.

EFFECTIVE DATE – MARCH 10, 2003

General procedure to follow:

Site has a soil disturbance of 1 to <5 acres:

Apply for Soil Erosion Sediment Control permit from either the county enforcement agency (CEA) or municipal enforcement agency (MEA).

The NPDES discharge permit for this site is covered by the “permit by rule”; no permit or application needs to be filled out for the state.

Note: If client is an APA (authorized public agency for soil erosion and sediment control) they still must follow the permit by rule, they do not need a SESC Permit as they have procedures approved by MDEQ. The rules are at the following site:

<http://www.deq.state.mi.us/documents/deq-swq-stormwater-nocrules.doc>

Site has a soil disturbance of 5 or more acres:

Apply for Soil Erosion Sediment Control permit from either the county enforcement agency (CEA) or municipal agency (MEA) first.

Then fill out the NPDES Notice of Coverage form for discharges from the construction site, attached the proper fee, and send it to the State at the address listed on the form.

Once the state receives the form, the site is covered.

Note: If client is an APA (authorized public agency for soil erosion and sediment control) they still must obtain and fill out the NPDES Notice of Coverage to discharge storm water from a construction site; they do not need SESC Permit as they have procedures approved by MDEQ.

<http://www.deq.state.mi.us/documents/deq-swq-nocform.doc>

Once the project site is stabilized and has good vegetative cover, remember to fill out a project termination form, this can be found at:

<http://www.deq.state.mi.us/documents/deq-swq-notform.doc>

Determine inspection responsibilities:

Make sure that SESC issues are an agenda item at the pre-bid meeting and at the pre-construction meeting. Do not just put a note on the plans that SESC is the contractors responsibility; make sure they are fully aware of their site responsibilities. Remember that the owner of the project is ultimately the responsible party, the MDEQ or enforcing agency will be fining them. If the owner is a municipality that we are doing a service for, we must protect them as best we can.

**LEXINGTON
DETENTION AND RESTRICTION
FINAL INSPECTION REPORT FORM**

Name of Site Development:	
Planning Commission Approval Number:	
Location:	
Type of Development:*	
Size of Restrictor:	
Type of Restrictor:**	
Location of Restrictor:	
Required Detention (ft ³):	
Type of Detention:***	
Location of Detention:	
Do As-builts Conform To Present Site Conditions?	
Inspection Comments:	
Date of Inspection:	
Inspector's Name and Affiliation:	

* - Residential, Commercial, Subdivision, Etc.

** - Orifice in Outlet Pipe, Metering Outlet Pipe, Square Orifice, Etc.

*** - Parking Lot Ponding, Detention Basin, Etc.

Lexington Storm Water Management Plan Site Report Visits Procedure & Deposit

All site development projects are subject to a storm water management plan site visits after construction has been completed. There are two distinct types of Site Visits:

1. Commercial / Business sites.
2. Subdivision, Condominium, Manufactured home sites.

COMMERCIAL & BUSINESS SITES

For **Commercial / Business sites** the following inspection procedure will be in place to assure compliance with the approved storm water management plan for the site and to assure that all best management practices for water quality related to storm water are in place and functioning properly.

One visit will take place as soon as site construction is completed. The storm sewer system will be inspected for pipe sizes, structure layout, detention basin / area, and flow restrictor as it relates to the approved storm water management plan. A letter report will be generated to document the visit and sent to the owner and the Village.

Second visit will take place no sooner than 6-12 months after occupancy to assure that any best management practices are functioning and are being maintained properly. A letter report will be generated to document the visit and sent to the owner and the Village.

A cash deposit for these site visits will be required and established by the Village. Any costs incurred by the Village associated with inspections or administrative efforts for repair, replacement, or deficiency reconciliation will be deducted from this deposit. Any remaining deposit balance after successful completion of the site visit and report process will be refunded to the owner/developer who paid the deposit.

SUBDIVISIONS, CONDOMINIUMS & MANUFACTURED HOME SITES

For **Subdivision, Condominium, & Manufactured Home sites** the following procedure will be in place for inspections and deposit. The site must conform to the original reviewed plans that have been stamped "Approved" by the Village engineer. Any changes that are necessary based on field conditions during construction that change the approved plan must be documented in a letter and a copy provided to the Village and the Village's engineer. This will assure that the site visits are as efficient as possible.

A review deposit will be in a suitable or acceptable deposit payable to the Village of Lexington. The developer will be responsible for any additional fees above and beyond the deposited fee.

The deposit will be returned to the proprietor provided that all storm water facilities and best management practices are clean, unobstructed and in good working order and that the Village's Planning Commission as received all required documents, certificates, copies of covenants, maintenance plans, and as-built drawings. It is the proprietor's responsibility to request final site visit.

The site will be inspected to assure compliance with the approved storm water management plan. Any costs incurred by the Village associated with subsequent visits or Village of Lexington administrative efforts for repair, replacement, or deficiency reconciliation will be deducted from this deposit. Any remaining balance after successful completion of the site visit process will be refunded to the owner/developer who paid the deposit.

To assure compliance there will be **two site visits**:

One visit will take place as soon as site construction is completed. The storm sewer system will be inspected for pipe sizes, structure layout, detention basin / area, and flow restrictor as it relates to the approved storm water management plan.

Second visit will take place after 50% of the lots or units have been sold or built upon to assure the storm sewer system and any best management practices are functioning and are being maintained properly.

Storm water and rear lot drainage can be problematical in many developments in Saginaw County. To alleviate some of these problems the following will occur:

- Developer will meet with the Village and complete a Storm Water Management Site Review Agreement that:
 1. reflects the amount of the fees placed in an account for site visits of the developments storm sewer system
 2. has a responsibility statement
 3. has a checklist of items to be covered
- The site must have a storm water system maintenance plan. This plan must have a plat/site layout (11" x 17"), a list of homeowner/association responsibilities for the storm sewer, rear lot drainage and detention area.
- Developer must provide proof to the Village that each homeowner or lot owner will get copies of the aforementioned information (e.g., make part of Master Deed or covenants on deeds).
- Developer must provide proof that they have communicated information to the homeowners association or condo association about their responsibility for storm water quality, quantity, and drainage issues that develop.

Maintenance:

- A. All stormwater runoff control structures, measures, systems and facilities shall be maintained by the property owner or homeowners association. (For example, property owners will be individually responsible for rear lot drainage structures or best management practices (BMPs) on their parcels. Associations will be responsible for common use facilities, measures, systems and structures.)
- B. The person or association responsible for maintenance of storm water systems shall be designated in the Stormwater Maintenance Plan for a subdivision, condominium, commercial property, et cetera must be communicated to the Village's Planning Commission or their designee. Options include:
 - Name of property owner.
 - Property owners association or other nonprofit organization provided that provisions for financing necessary maintenance are included in deed restrictions or other contractual agreements.
 - Sanilac County Drain Commissioner in accordance with provisions of the Michigan Drain Code (Public Act 40 of 1956, as amended).
- C. Maintenance agreements shall specify responsibilities for financing maintenance and emergency repairs, including but not limited to the maintenance and repair of:
 - Detention / Retention basins (wet or dry).

- Best Management Practices implemented on the site to address water quality.
 - Flow restriction structures.
 - Rear Lot drainage systems.
 - Storm sewer structures, pipes as required by type of system and ownership of such a system. (For example if the system is under control of the MDOT, they will maintain the system, if a private owner or association, then they have responsibility.)
- D. If necessary to protect public health, safety, welfare, or water resources, including lakes, rivers, streams, protected wetlands, county drains or other receiving bodies of water, the Village may initiate emergency action to abate imminent and substantial danger and risk. Any costs incurred will be the responsibility of the owner or association responsible for maintenance of the storm water system.

**LEXINGTON
STORM WATER MANAGEMENT SITE REVIEW
AGREEMENT**

**DEVELOPER'S/CONTRACTOR'S SITE REVIEW AGREEMENT for
STORM WATER MANAGEMENT**

PROJECT NAME: _____

SITE ADDRESS / LOCATION: _____

CONTACT PERSON: _____

COMPANY: _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP CODE:** _____

For **Subdivision, Condominium, & Manufactured Home Sites** the following procedure will be in place for site inspections and deposit. The site must conform to the original plans reviewed and stamped "Approved" by the Village engineer. Any changes that are necessary based on field conditions during construction that change the approved plan must be documented in a letter and a copy provided to the Village and the Village's engineer.

The site will be inspected to assure compliance with the approved storm water management plan. All costs associated with re-inspections or repair, replacement, deficiency reconciliation above the fee paid will be invoiced to the owner/developer and must be paid by them. No refunds will be given from unused fees paid.

A unit is defined as a dwelling or residential apartment, condo or site for mobile/manufactured home. For example a parcel may contain a condominium that can house 4 individual families, which will be construed as 4 units, a duplex will be two units, et cetera.

To assure compliance with design guidelines there will be **two inspections**.

**LEXINGTON
STORM WATER MANAGEMENT SITE REVIEW
AGREEMENT**

I hereby certify that to the best of my knowledge, information and belief, the storm water system will be constructed in general conformance to the approved plans and specifications delivered to me by the design engineer. I accept the responsibility that the storm water system will be in compliance with the design guidelines of Lexington’s Storm Water Management Plan. I understand that if deficiencies are discovered during inspections that I am responsible for correction of those deficiencies within a prescribed time frame.

_____ Printed Name _____ Signature

_____ Date

Items to cover:

_____ Review of SWMP inspection procedure and copy to developer / contractor

_____ Deposit of funds for inspections of storm water system

_____ Developer / Contractor to notify Village Planner (or Engineer) for first inspection

_____ Developer / Contractor to notify Village Planner (or Engineer) for second inspection

_____ Developer / Contractor has a set of plans marked “Approved” by the Village engineer from the storm water review process

_____ Storm Water System maintenance plan submitted

_____ Developer / Contractor provides documentation that homeowners association, condo association, or property owners have a copy of maintenance plan, easements, plat layout, and property owner’s responsibility for rear lot drainage.

_____ Developer / Owner advised to obtain and provide a copy of the Part 91 Soil Erosion and Sediment Control Permit from Sanilac County **810-648-4664**

APPENDIX B

To assure that all agency forms are as up to date as possible Lexington has provided the following web site addresses that various forms may be attained at for use by developers and design engineers.

1. MICHIGAN DEPARTMENT OF TRANSPORTATION PERMIT APPLICATION FOR USE OF RIGHT-OF-WAY, is available at:

http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS_FormNumber=2205

2. MICHIGAN DEPARTMENT OF TRANSPORTATION STORM WATER DISCHARGE PERMIT APPLICATION, is available at:

http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS_FormNumber=2484

3. MICHIGAN DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT - USACE JOINT PERMIT APPLICATION is available at:

http://www.michigan.gov/deq/0,1607,7-135-3307_29692_24403---,00.html

MDEQ Notice of Coverage and Notice of Termination forms for Construction sites of 5 acres or more in size.

<http://www.deq.state.mi.us/documents/deq-swq-nocform.doc>

<http://www.deq.state.mi.us/documents/deq-swq-notform.doc>

Appendix C

Village of Lexington Post Construction Control Review Procedure Revised 2018

Purpose:

To provide a review process in the Village of Lexington for stormwater management and water quality for new development or redevelopment within the Village of Lexington which disturb one or more acres, including projects less than an acre that are part of a larger common plan of development or sale and discharge into the Village's MS4, and maintain compliance with regulations as they relate to the federal Clean Water Act as administered by the State of Michigan.

Procedure:

The Village of Lexington has a National Pollutant Discharge Elimination System (NPDES) Discharge Permit number MIS040087 to discharge stormwater from outlets within the jurisdictional boundaries of the Village to Waters of the State. **Waters of the State** are defined as: Groundwater, Lakes, Including the Great Lakes bordering the state, Rivers, Streams, all other watercourses and bodies of water within the jurisdiction of the state including wetlands.

The purpose of developing this procedure is to aid developers in the design of their storm water runoff collection and detention systems. Current storm water quality requirements are in the form of Village's Storm Water Management Plan developed as part of their NPDES Discharge Permit.

The Village has adopted a Post Construction Control Plan that establishes the framework through which detention measures and the design of storm water collection systems will be implemented and details the process that must be followed to gain approval for new developments or redevelopment projects that disturb one (1) acre or more. It also includes projects less than one (1) acre that are part of a larger common plan of development or sale that would disturb one (1) acre or more. The plan requires storm water management design practices, which will help to minimize the impacts of proposed development or redevelopment projects on the existing storm drainage system and water quality. In addition, these guidelines will help to insure adequate drainage systems are being constructed for future development in the Village.

The Post Construction Control Plan provides information about the Village's storm drainage system and explains the Village's proactive approach to managing storm water within its jurisdiction.

The Post Construction Controls design guidelines include:

1. A summary of the administrative procedures to be followed to comply with the plan, including meeting requirements, review procedures, inspection requirements, fee schedule, issuance of the permit, penalties and enforcement, and other agency requirements.
2. A description of design calculations.
3. A description of design standards and guidelines.
4. Enforcement mechanisms with record keeping procedures.

5. Operation and maintenance requirements.

This procedure is only for commercial, non residential development, or platted subdivisions or condominium complex development or re-development. It is not to be applied to single family or duplex residential developments.

The developer or their representative shall submit to the village three sets of plans and one set of calculations that have been completed for the proposed development or re-development and follow the Villages Post Construction Control Design Guidelines. The submittal packet will be reviewed by the planning commission and their technical designee to assure that design standards are followed. Additionally, no building permit will be issued for the proposed site until the plans and calculations related to storm water have been approved and a valid soil erosion and sediment control permit is obtained.

The Village will retain records of all Post Construction Control reviews done under this procedure. The adopted Post Construction Controls must be reviewed and updated every NPDES permit period (5 years) to assure compliance with the regulations as administered by the State of Michigan.

Appendix D

Runoff Coefficients

Table 1

TABLE 1. Runoff Coefficients

Urban areas The use of average coefficients for various surface types, which are assumed not to vary through the duration of the storm, is common. The range of coefficients, classified with respect to the general character of the tributary reported in use is:

Description of area	Runoff coefficients
Business	
Downtown areas	0.70 to 0.95
Neighborhood areas	0.50 to 0.70
Residential	
Single-family areas	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard areas	0.20 to 0.35
Unimproved areas	0.10 to 0.30

Note: It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure is often applied to typical 'sample' blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of surface	Runoff coefficients
Streets	
Asphaltic and concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns, sandy soil	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, heavy soil	

Flat, 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

Note: The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Rural areas

Topography and Vegetation	Soil texture		
	Open sandy loam	Clay and silt loam	Tight clay
Woodland			
Flat 0-5% slope	0.10	0.30	0.40
Rolling 5-10% slope	0.25	0.35	0.50
Hilly 10-30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

Source: C.T. Haan, B.J. Barfield, J.C. Hayes, *Design Hydrology and Sedimentology for Small Catchments*, Academic Press, Inc. (1994).