

Rules of the Ingham County Drain Commissioner *2005 Edition*

Supplemented November 30, 2015

**Standards for Stormwater Management:
*Systems, Procedures and Design Criteria***



Patrick E. Lindemann

Ingham County Drain Commissioner

Effective October 21, 2005

Supplements found at the end of this document alter the effective rules. Please review supplements prior to submission of work to the Drain Office.

Supplemented March 18, 2008

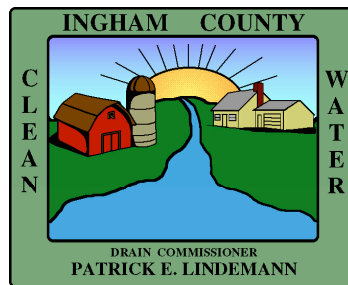
Supplemented July 30, 2009

Supplemented November 30, 2015

Rules of the Ingham County Drain Commissioner

Pursuant to the Land Division Act, Act 288 of the Public Acts of Michigan of 1967, as amended, and the Michigan Drain Code, Act 40 of the Public Acts of 1956, as amended, and other applicable statutes.

Patrick E. Lindemann
Ingham County Drain Commissioner



*Front cover photograph of Mud Lake Outlet Drain
By Patrick E. Lindemann*

*Copies of these standards are available at the Ingham County Drain Commissioner's Office or on line
at www.ingham.org*

ORDER OF ADOPTION OF RULES

WHEREAS, Section 105c of the Land Division Act, Act 288 of the Public Acts of Michigan of 1967, as amended, provides for the promulgation and publication of Rules by the Ingham County Drain Commissioner to govern stormwater drainage facilities of new subdivisions; and,

WHEREAS, the Ingham County Drain Commissioner conducted a review of previously adopted Rules, entitled Supplementary Design Standards and Procedures for Plat Development, dated September 28, 1990; and,

WHEREAS, the Ingham County Drain Commissioner has revised the Rules pursuant to applicable statutory amendments and published draft Rules entitled Design Standards and Procedures for Plat and Commercial Development.

NOW, THEREFORE, IT IS HEREBY ORDERED, that the "Rules of the Ingham County Drain Commissioner," pursuant to Section 105c of Act 288 of the Public Acts of Michigan of 1967, as amended, and other applicable statutes shall be hereby adopted, and are also referred to as Stormwater Standards and shall be followed in the processing of all subdivision plats and other developments that come under the jurisdiction of the Ingham County Drain Commissioner, including, but not limited to, site condominiums, developments on lands discharging directly to County Drains, and any other reviews required by local government ordinances.

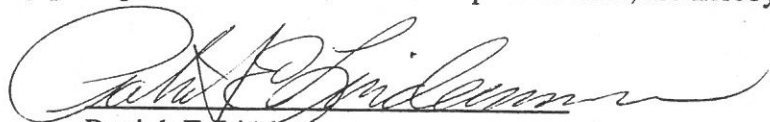
IT IS FURTHER ORDERED, that Appendices illustrating the application of these Rules are also adopted, but are not part of these published Rules, and may be modified, added to, or deleted in the future without prior notice.

IT IS FURTHER ORDERED, that notice of the availability of these published Rules shall be placed in a newspaper of general circulation in the County of Ingham within two weeks of this order.

IT IS FURTHER ORDERED, that the Rules be published in a booklet form and be made available to all interested parties for the cost of reproduction from the Office of the Ingham County Drain Commissioner.

IT IS FURTHER ORDERED, that these Rules shall take immediate effect.

IT IS FURTHER ORDERED, that any prior published Rules, either adopted or draft, are hereby repealed.



Patrick E. Lindemann
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Dated this 21st day of Oct., 2005

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PART 1: INTRODUCTION

This edition of the Rules of the Ingham County Drain Commissioner continues a stormwater management philosophy that considers stream channel protection and stormwater quality management in addition to stormwater quantity management. These revisions are based upon the most current body of knowledge concerning stormwater management from across the state and country, modified as appropriate for application in Ingham County.

These Rules are promulgated by the authority granted the Ingham County Drain Commissioner to “have jurisdiction over all drains within [the] county”(Sections 10 and 23 of The Drain Code of 1956, Public Act No. 40 of the Public Acts of 1956). Additional authority comes from local, state and federal laws governing programs administered by the Ingham County Drain Commissioner. Almost equally as important, is the authority obtained from over a century of experience in stormwater management by the public servants in this office. In all cases, these Rules shall be interpreted and applied to protect the public health, safety and welfare.

The following rules of language shall apply to the text of this document. The word “shall” is mandatory. The word “may” is permissive. When not inconsistent with the context, words in the present tense shall include the future and words designating singular numbers shall include the plural. Definitions of italicized terms printed herein may be found in the Glossary of Terms. Any portion of this document found invalid by a court of competent jurisdiction shall be held severable from, and independent of, the remaining document, and shall be fully enforceable.

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

Copies of this document may be downloaded at: <http://www.ingham.org>.

SECTION 1: Impacts of Development on Water Quantity

The hydrology of a watershed changes immediately in response to site clearing and development of the natural landscape. A site’s existing stormwater storage capacity is quickly altered or lost as vegetation is removed, natural depressions are graded, and both topsoil and wetlands are eliminated. As the soil is compacted and resurfaced with impervious materials, rainfall can no longer penetrate into the ground and, as a result, so runs off of the land. These modifications, along with the installation of "efficient" drainage facilities, such as catch basins and pipes, greatly alter natural drainage patterns. Hydrological changes will eventually cause changes in stream morphology.

A. Changes in Watershed Hydrology

- Increases of impervious cover and reductions of pervious cover increase the volume of runoff within the watershed. This raises the magnitude and frequency of severe flood events.
- Frequency of bankfull floods increases. These floods fill the stream channel to the top of its banks, but do not spill over into the floodplain. Increased bankfull flooding subjects the stream channel to continual disturbance and scour.

- Flow velocities increase. This is due to the combined effect of greater discharge, rapid time of concentration, and smoother hydraulic surfaces.
- Stream flow fluctuations increase dramatically. As runoff is concentrated into sharper, faster and higher peaks, equally abrupt returns to pre-storm level discharges will follow. Increased flow fluctuations disrupt habitats and reduce the diversity of aquatic species regardless of water quality.
- Infiltration into the underlying water table is reduced. This in turn lowers the level of surface water bodies that are dependent on groundwater to maintain base flows during dry periods.

B. Changes in Stream Morphology

Channel widening and down-cutting are the primary consequences of increased runoff and flow fluctuations. Stream bank erosion is accelerated, as channels are severely disturbed by undercutting, tree-falls and bank slumping. Sediment loads increase sharply due to stream bank erosion and construction site runoff. These sediments settle out and form shifting bars that often accelerate the erosion process by deflecting runoff into sensitive bank areas. Increased sedimentation and channel widening modify aquatic habitats. Pools and riffles are eliminated as the gradient of the stream adjusts to accommodate frequent floods. Sediment deposition destroys insect and benthic organism habitat as well as fish spawning areas.

SECTION 2: Impacts of Development On Water Quality

As development occurs, changes in land use contribute new or additional pollutants to stormwater runoff. In addition, the accompanying impervious surfaces provide efficient delivery of pollutants into receiving waterways. Leaves, litter, animal droppings, exposed soil from construction sites; fertilizer and pesticides are all washed off of the land. Vehicles and deteriorating urban surfaces deposit trace metals, oil, and grease onto streets and parking lots. Loss of vegetation along watercourses results in an increase in temperatures of receiving waters as well as hindering habitat and species diversity. Pollutants are carried by stormwater and conveyed through creeks, ditches and storm drains into rivers and lakes.

In short, the ecology of urban streams may be completely re-shaped by the extreme shifts in hydrology, morphology and water quality that can accompany the development process. The stresses that these changes place on the aquatic community, although gradual and frequently not immediately visible, are often profound unless mitigated. That is why the United States Environmental Protection Agency (EPA) has issued regulations governing stormwater runoff, known as Phase II regulations. Briefly, Phase II makes use of a “best management practice” (BMP) approach. Each of the covered local governments is required to take six minimum steps as a part of its Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit. These include:

- Public education and outreach on stormwater impacts;
- Public involvement/participation;
- Illicit discharge detection and elimination;
- Construction site stormwater runoff control;
- Post construction stormwater management in new development and redevelopment;
- Pollution prevention/good housekeeping for municipal operations.

The EPA recommends that states develop general permits for the municipalities affected by the new rule. A general permit requires municipalities to minimally meet the six best BMPs listed above.

The Michigan Department of Environmental Quality (MDEQ) administers Michigan's general permit program for Phase II. The Ingham County Drain Commissioner has received a "Certificate of Coverage" from the MDEQ requiring compliance with the six BMPs, as a condition for continued discharge of Ingham County storm drains into the Grand River, Red Cedar River, and Looking Glass River. The Rules of the Ingham County Drain Commissioner will be interpreted and enforced so as to promote compliance with the Phase II Program including, but not limited to, provision of environmental impact studies throughout the County where needed.

To mitigate stream impacts, it is necessary to reevaluate the way that stormwater and land development are managed. The following discussion provides a framework for this reevaluation, which must encompass the entire development process from land use planning and zoning to site design and construction.

SECTION 3: Framework for the Design of Stormwater Management Systems

Thoughtful site planning can substantially reduce environmental impacts associated with development. To facilitate this result, communities, regulatory agencies, and designers must begin to evaluate the impact of each individual development project over the long term, and on a watershed scale. Such an approach requires consideration of BMPs that function together as a system to ensure that the volume, rate, timing and pollutant load of runoff remains similar to that, which occurred under natural conditions. This can be achieved through a coordinated network of structural and nonstructural methods, designed to provide both source and site control. In such a system, each BMP by itself may not provide major benefits, but becomes more effective when combined with others. While the following discussion applies to all aspects of managing land and stormwater, the Rules of the Ingham County Drain Commissioner only govern the design of stormwater management systems within certain development projects.

A. Source Controls

Source controls reduce the volume of runoff generated on-site, and eliminate initial opportunities for pollutants to enter the drainage system, and are commonly referred to as Low Impact Design. By working to prevent problems, source controls are the best option for controlling stormwater, and are the preferred design standard for stormwater management systems in Ingham County. Source controls include the following key practices:

1. Preservation of existing natural features that perform stormwater management functions, such as depressions, wetlands, and woodland and vegetative buffers along stream banks.
2. The minimization of impervious surface area through site planning that makes efficient use of paved, developed areas and maximizes open space. Encouraging flexible street and parking standards, and the use of permeable ground cover materials can also reduce impervious surfaces.
3. Direction of stormwater discharges to open grassed areas such as swales and lawns rather than allowing stormwater to run off from impervious areas directly into the stormwater conveyance system.
4. Careful design and installation of erosion control mechanisms and rigorous maintenance throughout the construction period. Effective erosion control measures include minimizing the area and length of time that a site is cleared and graded, and the immediate vegetative stabilization of disturbed areas.

B. Site Controls

After the implementation of source controls, site controls are then required to convey, pre-treat, and treat the stormwater runoff generated by development. The range of engineering and design techniques available to achieve these objectives is to some degree dictated by site configuration, soil type, and the receiving waterway. For example, flat or extremely steep topography may preclude the use of grassed swales, which are otherwise preferable to curb and gutter systems. Likewise, sites upstream of cold-water fisheries may not be suitable for permanent wet basins that discharge heated surface waters. But while each site will be unique, some universal guidelines for controlling stormwater quality and quantity can be stated.

1. Preferred Ranking of Structural Site Controls

- a. In general, the most effective stormwater quality controls are infiltration practices, which reduce both the runoff peak and volume. But to date, structural infiltration devices such as basins and, to a lesser degree, trenches, have suffered extremely high failure rates due to clogging. Therefore, an aggressive maintenance program and extensive upstream pretreatment measures, such as oil/grit separators, sedimentation basins and grass filter strips, must be incorporated into any stormwater management system that employs these devices. In addition, these practices are only feasible for smaller drainage areas with suitable soils and no potential for groundwater contamination.
- b. The next most effective stormwater site controls reduce the runoff peak, and involve storage facilities such as retention/detention basins. In the selection of an appropriate stormwater basin design, retention/detention basins are generally preferable to detention basins, since they hold stormwater much longer, allowing more particulate matter to settle out. In addition, the aquatic plants and algae within retention/detention basins take up soluble pollutants (nutrients) from the water column. These nutrients are then transformed into plant materials that settle to the basin floor, decay, and are consumed by bacteria. Since this biological process is dependent upon the presence of water, it does not occur as frequently in detention basins.
- c. Where site conditions make the use of a retention/detention basin infeasible, detention basins should be designed to provide extended detention of stormwater, again to promote as much settling of particulate matter as possible. A notable exception to this preference exists within areas where thermal impacts are a concern. Since they hold stormwater longer retention/detention basins tend to increase the exposure of runoff to solar warming before releasing it. Where thermal impacts are of primary concern, a balance must be struck between the goals of pollutant removal and the reduction of thermal impacts. Source controls and infiltration of stormwater, where feasible, are preferable approaches.
- d. Once all possible methods of reducing and treating stormwater on-site have been implemented, excess runoff must be discharged into conveyance systems and carried off-site. Discharges must be at rates, velocities and volumes that will not cause adverse downstream impacts to land or waterways. For this purpose, vegetated swales with check dams are generally preferred to curb and gutter systems and enclosed storm drains.
- e. Regardless of the design, any stormwater system will lose effectiveness without regular maintenance. Depending on the specific BMP, maintenance must be performed at regular intervals. This may include inspection, sediment removal, maintenance of vegetation and structures, replacement of filters, etc. Maintenance plans should be developed concurrent with the system designs.

2. Stormwater Basin Design

- a. Stormwater must be pre-treated prior to entering a retention/detention or detention basin, by passing first through a sediment forebay. Sediment forebays function to reduce incoming water velocities, and to trap and localize incoming sediments, making their removal easier during maintenance. Sediment forebays also extend the flow path of stormwater, increasing its residence time.
- b. Whereas stormwater basin design for flood control is concerned with relatively infrequent, severe runoff events, such as the 25-, 50- or 100-year storm, design for water quality benefit is concerned with controlling the more frequent storm events (e.g. 2.0-year/24-hour storm or less). The negative impacts of erosive “bankfull” floods are effectively avoided by capturing and detaining the 2.0-year/24-hour storm.
- c. Also of primary importance to water quality is the capture and treatment of the “first flush,” a term used to describe the initial washing action that stormwater has on impervious surfaces. Pollutants that have accumulated on these surfaces are flushed clean by the early stages of runoff, which then carries a shock loading of these pollutants into receiving waterways. The majority of all pollutants that are washed off the land can be removed from stormwater before it leaves the site by capturing and treating the first 1/2-inch of runoff.
- d. Treatment of the “bankfull” flood and “first flush” may be accomplished via the design of “dual detention basins.” These basins control stormwater discharge rates for both extreme events to prevent flooding and more frequent runoff events to mitigate water quality impacts and channel erosion.
- e. The accumulated effect of improper discharge of stormwater from a site is an increase in flashiness and degradation of the stream.

SECTION 4: The Role of the Ingham County Drain Commissioner

The preferred ranking provides a comprehensive framework for evaluating the place and function of individual BMPs within a stormwater management system. The most important BMPs are source controls that preserve and protect the natural environment. The Ingham County Drain Commissioner looks to the staff and officials of local governments, as well as to developers and their design engineers and planners, to implement source reduction approaches described earlier, to the greatest extent feasible as the best development method for managing water quality and quantity.

The Ingham County Drain Commissioner exercises authority over the design and construction of structural facilities that convey and treat stormwater runoff that will be generated from a site. These Rules will govern the design of such management facilities with the following objectives:

- Incorporate design standards that 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

PART 2: PROCEDURES FOR PLAN SUBMISSION, REVIEW, AND CONSTRUCTION

SECTION 1: Purpose and Introduction

All plats recorded with the Register of Deeds must conform to The Land Division Act, 1967 PA 288, as amended. Under this Act, the Ingham County Drain Commissioner is responsible for ensuring that the drainage or stormwater management system of a subdivision is adequate for the development, and for protecting downstream landowners and resources. The procedures, standards and recommendations set forth in these Rules are designed for these purposes.

- A. In accordance with the provisions of Act 288, the Ingham County Drain Commissioner has the authority, through the subdivision review process, to require that county drains and natural water courses, both inside and outside a plat, be improved to the standards established by the Ingham County Drain Commissioner when necessary for the proper drainage of a proposed subdivision.
- B. Under these Rules, the Ingham County Drain Commissioner will ensure that all stormwater facilities necessary for a proposed subdivision have an appropriate governmental unit responsible in perpetuity for performing maintenance or for overseeing the performance of maintenance by a private entity, such as a property owner's association. As specified in Act 288, the Ingham County Drain Commissioner may acquire jurisdiction over the drainage systems within subdivisions as deemed necessary for adequate operation and maintenance. The appropriate forms may be obtained from the Ingham County Drain Commissioner.
- C. The general standards set forth herein will also be applied by the Ingham County Drain Commissioner in the review of the following:
 - 1. Land divisions and private roads prepared under the Land Division Act.
 - 2. Applications for permits to cross, connect/discharge to, or encroach within the easement of a county or intercounty drain under PA 40 of 1956, as amended.
 - 3. Review of stormwater system plans in other classes of development or redevelopment, when requested by local governments.
 - 4. Any development that proposes discharge to a county or intercounty drain within an urban area as defined by the Environmental Protection Agency pursuant to Phase II of the Clean Water Act.
 - 5. Mobile home plans prepared under PA 96 of 1987.
 - 6. Site Condominium plans prepared under PA 59 of 1978, as amended.
 - 7. Road projects, pursuant of PA 51 of 1951, as amended.
 - 8. Drainage projects under PA 40 of 1956, as amended.

These rules provide minimum standards to be complied with by proprietors, and in no way limit the authority of the local municipality in which the development is situated to adopt and enforce higher standards as a condition of approval of the final plat or site plan. If the local municipality has adopted different standards, the Ingham County Drain Commissioner's Office will review plans in accordance with those standards, if in the opinion of the Ingham County Drain Commissioner those standards are more stringent.

SECTION 2: Preliminary Plan Submittal and Approval

A. Submittal Requirements

These requirements have been developed in the context of preliminary plat submittal under the Michigan Land Division Act. However, they shall also be followed as closely as possible for all other categories of development, including site condominiums and site plans for commercial and residential development. Submittal requirements for small developments (<1 acre) may be varied or waived to take into account circumstances unique to small areas. Prior to submission of a preliminary plan, a pre-design meeting with the Drain Office Engineer is strongly encouraged to review the project in light of these standards and requirements. A conceptual plan should be prepared for this meeting. There is no charge for a conceptual plan review meeting.

1. A preliminary plan showing the layout of the area intended to be subdivided or developed shall be submitted to the Ingham County Drain Commissioner's Office by the proprietor. This plan will be prepared under the direction of, and sealed by, a registered professional engineer or a registered land surveyor. The preliminary plan shall be drawn to a standard engineering scale not smaller than 1"=200 feet on sheets not exceeding 24" x 36" in size.
2. Three copies of the preliminary plan, prepared in accordance with the Rules set forth in Section 2(B), of this section, will be submitted together with a letter of transmittal and completed Request for Services form asking that the preliminary plan be reviewed. The names of the proprietor and engineering or surveying firm, with mailing addresses, fax and telephone numbers for each, shall be included with the transmittal. If the proprietor or engineering firm submitting the plan is not the owner of the land, the owner's name and address, as well as evidence that the proprietor/engineer is acting on his behalf shall also be provided.
3. Payment of applicable review fees is required before any review will commence unless otherwise required by statute (See Fee Schedule, found at the County web site, www.ingham.org). Plan review fees shall be valid for the initial review and one additional review should the Ingham County Drain Commissioner require modifications to the original preliminary plan. An additional plan review fee will be required for plans returned multiple times for the same modification.
4. If maintenance is to be performed by a private entity, the proprietor will describe the mechanism to be established for long-term maintenance of the stormwater management system of the subdivision or development, and the governmental agency responsible for maintenance oversight. The Ingham County Drain Commissioner will require formal documentation from the local government of its intent to assume responsibility for oversight of maintenance to be performed by a private entity and for insuring maintenance will be performed if the private entity fails to do so, or where jurisdiction exists, a maintenance agreement with a drainage district may be established (see Part 4, Section 5(A). Maintenance Plans).
5. 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 must include the retention and detention as well as the drainage outlet for all phases. The first phase of the subdivision or development will be imposed upon the overall plan in order to illustrate the method of development that the proprietor intends to follow. Each subsequent plat or phase will follow the same procedure until the entire area controlled by the proprietor is subdivided.
6. Final acceptance by the Ingham County Drain Commissioner of one portion or phase of the subdivision 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 Ingham County Drain Commissioner are proposed.

B. General Information Requirements for Plans Submitted for Review

All preliminary plans submitted for site plan and drainage review are to include the following information:

1. The location of the proposed subdivision or development by means of a location map.
2. The township, city or village in which the parcel is situated.
3. The section and part of section in which the parcel is situated.
4. The total number of acres to be developed and acres in each phase.
5. Contours, at 2-foot intervals or less, with National Geodetic Vertical Datum (N.G.V.D.) elevations (one-foot intervals may be required for special site conditions).
6. The proposed drainage system for the subdivision or development, and whether the proposed drainage system will be private or public.
7. The proposed street, alley and lot layouts and approximate dimensions.
8. The location and description of all on-site and adjacent off-site features that may be relevant in determining the overall requirements for the subdivision or development. These features may include, but are not limited to the following:
 - a. Adjoining roads, subdivisions, and other developments
 - b. Schools, parks, and cemeteries
 - c. Drains, drain district boundaries, sanitary sewers, water mains, septic fields and wells and associated easements
 - d. High tension power lines, underground transmission lines, gas mains, pipelines or other utilities and associated easements
 - e. Railroads
 - f. Existing and proposed easements
 - g. Natural and artificial watercourses, wetlands and wetland boundaries, floodplains, lakes, and lagoons
 - h. Designated natural areas
 - i. Soils description in accordance with the United States Department of Agriculture, Natural Resource Conservation Service (USDA, NRCS) standard soils criteria
 - j. Any proposed environmental mitigation features or groundwater recharge areas
 - k. Any known contamination; type and location on the site
9. Soil borings may be required at various locations including the sites of proposed retention/detention facilities, and as needed in areas where high groundwater tables exist.

C. Drainage Information Requirements

1. Plans shall include Low Impact Design elements unless the site conditions are such that no elements can be incorporated, in such a case a variance must be requested. For examples of Low Impact Design contact the Ingham County Drain Commissioner's Office.
2. Plans must include calculations by a professional engineer, used in designing all components of the proposed stormwater management systems. For preliminary plats the calculation components must be sufficient to insure compliance with these standards on storage capacity and site runoff.
3. Submittal will require the following stormwater management information:

- a. The overall stormwater management system for the proposed subdivision or development, indicating how stormwater management will be provided and the location of the positive public outlet.
 - b. The location of any on-site and/or off-site stormwater management facilities and appropriate easements that will be dedicated to the entity responsible for their future operation and maintenance. Easement information will be consistent with these Rules.
 - c. A description of the off-site outlet and evidence of its adequacy.
 - d. A map at the U.S.G.S., 7.5-minute quadrangle scale, showing the drainage area tributary to the outlet from the proposed development and its relationship with existing drainage patterns. This drainage boundary shall include any drainage originating outside of the development limits, that flows onto or across the development.
 - e. Any drainage originating outside of the development limits that flows onto or across the development shall not be passed through on-site stormwater storage facilities unless alternatives are proposed for the off-site flow that will achieve the objectives of these standards, including but not limited to water quality standards, such as separate basins for water quality treatment and storage of the 100-year storm volume.
 - f. Any natural watercourses and/or Inter and Intra County Drains passing through the proposed development.
 - g. Provide calculations to show that the hydrology for all existing wetlands will not be affected by the proposed change, this would include the water budget and hydro period for the wetland.
4. Area of upstream watershed and current zoning.
 5. Preliminary calculations of runoff from the contributing lands for both the 100-year and 2.0-year/24-hour design storms, for existing conditions.
 6. Any natural watercourses or Inter and Intra County Drains that abut the development.
 7. The increased volume of water discharged due to development of the site must not create adverse impacts to downstream property owners and watercourses. These adverse impacts may include, but are not limited to flooding, excessive soil saturation, crop damage, erosion, and/or degradation in water quality or habitat.
 8. The proposed drainage plan will, in every way feasible, respect and conform to the natural drainage patterns within the site and the watershed in which it is located and shall conform to any established Intercounty or Intracounty Drain Drainage District. Any proposed district boundary change is to be made through a Section 433 Agreement (Section 433 of the Drain Code).
 9. In general, the Ingham County Drain Commissioner will not accept responsibility for roadside ditches serving public roads, unless established as a county drain under PA 40 of 1956, as amended. Roadside ditches, in general, are designed to keep roadbeds dry and not to convey stormwater from surrounding properties. Usually, either the Ingham County Road Commission or the Michigan Department of Transportation (MDOT) is responsible for maintaining roadside ditches. Written approval for any discharge to a roadside ditch must be obtained from the appropriate agency along with an agreement for maintenance for purposes of stormwater conveyance.

D. Preliminary Plan Approval for Plats

The Ingham County Drain Commissioner will approve, approve subject to conditions, or reject a preliminary plat within 30 days of the proprietor's submittal of the plat, as required by statute. If the proposed preliminary plat is approved, the Ingham County Drain Commissioner will note approval on a copy returned to the proprietor. If the proposed preliminary plat is approved subject to conditions or rejected, the reason for rejection and requirements for approval will be given in writing to the proprietor

and each and every officer and agency to which the proprietor was required to submit the preliminary plat. Approval of the preliminary plat is required before the Ingham County Drain Commissioner will proceed with review of final construction plans.

Preliminary plan approval shall remain in effect for one year. Extensions must be requested in writing and may be granted subject to the conformance with any changes in published standards.

SECTION 3: Construction Plan Submittal and Approval

A. Submittal Requirements

1. For all projects to be reviewed by the Ingham County Drain Commissioner, the proprietor will submit construction plans with a letter of transmittal requesting review and a completed request for services form.
2. For platted subdivisions which have already submitted preliminary plans with all required information under Part 2, Section 2, the construction plans will be reviewed after preliminary plat approval has been granted. Although there is no statutory time limit for the review of construction plans for plats, the Ingham County Drain Commissioner will review them in the shortest time possible.
3. For all developments other than platted subdivisions, which have not already submitted a preliminary plan with all required information under Part 2, section 2, the construction plans must be submitted with that information. The review of construction plans will proceed once all information has been received. Although there is no statutory time limit for the review of construction plans for development, the Ingham County Drain Commissioner will review them in the shortest time possible.
4. If there are proposed crossings, connections, or other work within an existing Inter or Intra County Drain or its easement, a permit application shall be submitted with the construction plans. These permits must be approved by the Ingham County Drain Commissioner prior to construction plan approval.
5. Prior to construction plan approval, copies of any required state or local environmental permits shall be submitted to the Ingham County Drain Commissioner.
6. If development is proposed in an area where special drainage problems exist or are anticipated at the site, on adjacent properties or downstream, more stringent design requirements than are contained within Part 2 of these Rules may be required.
7. For complex development or for purposes of expedited review, the Ingham County Drain Commissioner may retain the services of an outside consultant as allowed by the Ingham County Board of Commissioners. Any costs associated with this review shall be paid by the proprietor/applicant.
8. Payment of applicable review fees is required before any review will commence.

B. Construction Plan Requirements

The Ingham County Drain Commissioner will review construction plans to assure that adequate storm drainage will be provided and that the proposed stormwater management system provides adequately for water quantity and quality management to ensure protection of property owners, lands, and watercourses both within the proposed development and downstream.

1. The names of the proprietor and engineering firm, with mailing addresses, fax and telephone numbers for each, shall be included with the transmittal. Plans will be prepared under the direction of, and sealed by, a registered professional engineer and will be in accordance with these Rules.
2. Three complete sets of construction plans are required, drawn to a scale no smaller than 1" = 50', and on sheets no larger than 24" x 36". The plans shall be drawn to standard engineering scales. The construction plan submittal shall include all required information listed in PART 2, Section 2, as well as the following, where applicable:
 - a. The property legal description, the total acreage, and a project location map. If the project is to be completed in phases, the number of acres in each phase shall be included.
 - b. The proposed project layout with all dimensions, including the proposed drainage system for the project. Backyard drainage provisions will be shown for all subdivision, condominium and commercial developments.
 - c. Site grading and drainage plans consisting of topographic maps, at two-foot contour intervals or less on N.G.V.D. datum, showing existing and proposed grades, as well as off-site topography onto adjoining properties extending at least 100 feet for all projects over 5 acres and 25 feet for projects under 5 acres. Plans will also show all existing watercourses, lakes, floodplains and wetlands, and proposed drainage facilities. The extent of all off-site drainage areas contributing flow to the development shall be shown on the grading plan and be verified on an attached copy of a U.S.G.S. 7.5-minute quadrangle map.
 - d. Calculations, design data and criteria used for sizing all drainage structures, channels and retention/detention basins, including weighted runoff coefficient calculations.
 - e. Plans and details of proposed retention/detention facilities. Soil borings may be required at the sites of these facilities.
 - f. Plans, profiles and details of all proposed public storm sewers, drainage pipes and structures, and any roads must be provided. The storm sewer details will include type and class and size of pipe, length of run, percent of slope, invert elevations, rim elevations, and profile of the hydraulic gradient, as specified in Part 2 of these Rules.
 - g. Storm sewer calculations indicating the number of acres, calculated to the nearest tenth of an acre, contributing to each specific inlet/outlet, the calculated hydraulic gradient elevation, maximum flow in cubic feet per second (cfs) and the flow velocities for enclosed systems.
 - h. A drainage area map, overlaid onto a copy of the site-grading plan, which clearly shows the areas tributary to each inlet and/or storage basin.
 - i. Plans, profiles and details of all open drains, drainage swales and drainage structures.
 - j. Plans and details of the proposed soil erosion and sedimentation control measures, both temporary, during construction, and permanent.
 - k. All construction specifications for the stormwater management facilities.
 - l. Provide finished floor, basement floor and lowest opening elevations for each building site. Specify for each lot the type of basement, regular, lookout or walkout, called for by topography of each site.
 - m. Provide the corner elevations for each lot.
 - n. Locations of all drain fields as approved by the Ingham County Environmental Health Department and of all expansion areas. Drain fields shall not be located within drainage easements.
 - o. A single sheet showing all proposed storm drainage facilities with drainage easements shall be submitted. This sheet shall be overlaid on the overall road and utility plan and drawn to the largest scale possible to fit the sheet while using a standard engineering scale.

C. Construction Plan Approval

Plans that conform to these Rules will be approved by letter to the proprietor and/or proprietor's agent outlining any general or specific requirements for construction as follows:

1. Approval of construction plans shall be indicated by the return of one set of plans to the proprietor by first class mail or personal service, stamped "Approved--for Construction", signed and dated by the Ingham County Drain Commissioner. The cover letter will describe the number of additional sets of the approved plan that will be required.
2. Approval of construction plans by the Ingham County Drain Commissioner 's office is valid for one calendar year. If an extension beyond this period is needed, the proprietor will submit a written request to the Ingham County Drain Commissioner for an extension prior to expiration of approval. The Ingham County Drain Commissioner may grant a one-year extension of the approval. After this time, plans will have to be resubmitted as a new submission.
3. Plans needing modification will be returned to the proprietor with a cover letter outlining revisions required by first class mail or personal service. These plans will be stamped "Revisions Required" and will require that revisions and number of plans required be incorporated into the construction plans. If all revisions have been made as outlined, one set of plans shall be returned to the proprietor, stamped "Approved--for Construction", following procedure outlined above.
4. Plans returned for revision more than twice, will require submittal of an additional site plan review fee for each additional set of revisions.
5. Payment of all fees and compliance with all requirements set forth herein are prerequisites to approval.
6. For construction where stormwater facilities will be public, a cost estimate of the entire stormwater management system shall be submitted. This estimate shall include, but is not limited to, grading, soil erosion control, stabilization, basin construction, and pipe construction. All fees associated with construction inspection, setting up a drainage district and letters of credit will be based on this estimate. Construction approval will not be granted until the Ingham County Drain Commissioner is satisfied that all legal requirements for the establishment of public drainage have or will have been met.
7. A construction inspection deposit, equal to 8 % of the above-mentioned estimate, shall be deposited with the Ingham County Drain Commissioner prior to the construction plan approval. This deposit is to cover the cost of inspection of all approved plans and issued permits from the Ingham County Drain Commissioner. The proprietor shall cover any additional inspection costs, within 30 days of billing, should these costs exceed the original 8% estimate. The proprietor shall be refunded the balance of the 8% estimate within 60 days of punch list completion should inspection costs be less.
8. Completed plans as approved shall be submitted as electronic files compatible with AutoCAD, for those items that specifically relate to the storm drainage facilities and information required in these Rules. These items include, but are not limited to, storm sewers, swales, basins, grading plans, etc., as well as all available information such as complete site layout, sanitary sewer and water main plans, and topographic surveys.
9. A stormwater facility maintenance plan, schedule, and budget shall be submitted. This will be used to determine if plans are appropriate for the site and shall cover temporary, during construction maintenance, as well as permanent maintenance.
10. Prior to construction plan approval, complete master deed documents, including by-laws and drawings, must be submitted for the Ingham County Drain Commissioner's review and approval of all elements pertaining to drainage.

11. Prior to the approval of the final construction plans, the proprietor will make arrangements for construction layout and horizontal and vertical control during construction, acceptable to the Ingham County Drain Commissioner for inspection during construction, and for final verification of the construction by a Michigan registered professional engineer. These arrangements will include an inspection schedule that defines the specific junctures during construction when on-site inspection and written verification by a professional engineer will occur.

D. Construction

1. The Ingham County Drain Commissioner shall be invited to all pre-construction meetings with other agencies, utility companies and contractors.
2. The Ingham County Drain Commissioner shall provide construction inspection for all construction that will have drainage systems dedicated to a drainage district.
3. A soil erosion permit under, Part 91, PA 451, Public Acts of 1994 as amended, will be obtained before any construction starts on the site.
4. For projects which involve public drains or work within the easement of a public drains, the following construction procedure applies:
 - a. The proprietor's contractor must have an Ingham County Drain Commissioner inspector present whenever work is performed within any drainage district;
 - b. Contact the Ingham County Drain Commissioner's Office three business days before starting;
 - c. Inspector must witness all pipe installations pertinent to the storm system;
 - d. Submit all pipe, manhole, and gravel certifications for approval prior to installation;
 - e. Call for final inspection prior to paving;
 - f. Material testing of trench backfill is required, the cost is part of the inspection deposit;
 - g. Inspector reserves the right on behalf of the Ingham County Drain Commissioner to verify the accuracy of the installation of all facilities in accordance with approved plans. Such verification shall be at the proprietor's cost as part of the inspection deposit.
 - h. The proprietor's contractor must order the trench material to be tested and made available to the testing technician;
 - i. All material testing must be satisfactory prior to final acceptance;
 - j. Inspections by Ingham County Drain Commissioners Office personnel are required at the time of curb installation at curb catch basin inlets to insure that extraneous materials are not used to level or seal adjusting rings.
 - k. Punch list inspection must be completed satisfactorily prior to acceptance of the system.

E. Final Subdivision Plat Submission and Approval

Final subdivision plat review will be completed by the Ingham County Drain Commissioner 's office within 10 days of submission by the proprietor. If the plat is not acceptable, written notice of rejection and the reasons therefore will be given to the proprietor by first class mail. A copy of the letter of rejection shall be sent to the clerk of the governing body and chairperson of the county plat board by first class mail. The Ingham County Drain Commissioner will approve the plat by signature affixed to it, and a copy of the plat shall be returned to the proprietor as notice of approval by first class mail. As a condition of final plat approval, the Ingham County Drain Commissioner will require the following:

1. Evidence of the approval of the municipal governing body in which the proposed development is located.

2. An executed agreement that assures long-term maintenance of all drainage improvements, such as a 425/433 Agreement, Maintenance Agreement, or similar agreement satisfactory to the Ingham County Drain Commissioner.
3. Copy of final subdivision agreements (such as covenants, deed restrictions, etc.) as previously approved by the Ingham County Drain Commissioner.
4. All requirements of inspector's "punch list" must be satisfied.
5. As-built stormwater management system drawings, as approved by the Ingham County Drain Commissioner, on paper, Mylar, and AutoCad.
6. If the proprietor desires to have the plat signed before completing the drainage improvements, he or she will enter into an agreement with the Ingham County Drain Commissioner and post a cash deposit, certified check or irrevocable bank letter of credit, whichever the proprietor selects, or a surety bond acceptable to the Ingham County Drain Commissioner, in an amount sufficient for the faithful performance of the agreement. The agreement shall include but not be limited to the following:
 - a. A financial mechanism established as completion insurance. Letters of credit will contain the following clause:

"It is a condition of this letter of credit that it shall be automatically renewed for additional periods of one (1) year from the present or each future expiration date, unless at least 60 days prior to such date, the Ingham County Drain Commissioner's Office is notified in writing via certified mail, that the credit (or account) will not be renewed for such an additional period."
 - b. Under this agreement, the time of completion of construction of stormwater management facilities will not extend for a period greater than one year from the original date of the agreement. If after this period the improvements are not completed, the Ingham County Drain Commissioner may exercise the right, under the terms of the escrow account or letter of credit, to use proceeds of the proprietor's deposit to fulfill the proprietor's obligation under such agreement, at such time and in such manner as the Ingham County Drain Commissioner may determine.
 - c. The financial assurance mechanism shall remain in place until construction and soil stabilization is complete. Thereafter, the Ingham County Drain Commissioner may refund portions of the original deposit after the work has been completed. The amount of deposit will not be reduced to less than the cost for completion of the remaining work.
7. Payment of all fees and deficiencies in the inspection deposit (8%) account.
8. A final plat, when submitted to the Ingham County Drain Commissioner for signature, will include the Ingham County Drain Commissioner's Certificate. The form of this certificate is as follows:

Approved on _____, 20__, as complying with Section 192 of Act 288, PA of 1967, and applicable rules and regulations published by my office in the County of Ingham.

Patrick E. Lindemann Ingham County Drain Commissioner

SECTION 4: Plans Affecting Drains Under the Jurisdiction of the Ingham County Drain Commissioner

The Ingham County Drain Commissioner has a permanent fiduciary responsibility to maintain drains for the benefit of all drainage district properties. As a public corporation, the drainage district executes a full range of legal responsibilities as outlined in the Drain Code, Public Act 40 of 1956. All of the following are necessary:

1. Drainage districts, and the route and course of drains within them, will not be altered when designating development drainage, except in conformance with the Drain Code, Public Act 40 of 1956, as amended. Proposed modifications to county drains will require a permit application to the Ingham County Drain Commissioner. The Ingham County Drain Commissioner will also receive applications for modifications to intercounty drains in Ingham County as authorized by the Intercounty Drainage Board and advise as to procedures to be followed for approval.
2. Existing county and intercounty drain easements are to be indicated on plans and final plats and will be designated by name of the drain and by status as a county or intercounty drain. Easements prior to 1956, were not required by statute to be recorded at the Register of Deeds office, but instead were recorded at the office of the Ingham County Drain Commissioner. It is advisable to check the permanent records of the Ingham County Drain Commissioner's office to see if a drain easement is in existence on any property.
3. Permission will be obtained from the Ingham County Drain Commissioner prior to any work that affects a county drain, including connecting to or the crossing of a county drain.
4. Detailed construction plans along with the appropriate review fees shall be submitted for review with the application. These shall be prepared in accordance with this Part.
5. Payment of all fees.
6. Upon receipt of an approved permit, the permittee must contact the Ingham County Drain Commissioner three (3) business days prior to the start of construction to arrange for an inspector.
7. All work shall be completed in accordance with the plans and specifications approved by the Ingham County Drain Commissioner.
8. A cash deposit in an amount satisfactory to the Ingham County Drain Commissioner may be required to insure satisfactory completion of the project in accordance with the approved plans. The permittee shall contact the Ingham County Drain Commissioner to perform an inspection of the permitted activity. The remainder of the cash deposit shall be returned upon satisfactory completion of the inspection and all cost to the Ingham County Drain Commissioner have been reimbursed.
9. The Ingham County Drain Commissioner shall be notified in writing within 10 days of completion of an approved project.
10. Authority granted by a permit from the Ingham County Drain Commissioner does not convey, provide or otherwise imply approval of any other governing act, ordinance, or regulation, nor does it waive the permittee's obligation to acquire any federal, state, county or local approval or authorization necessary to conduct the activity.

SECTION 5: Variances

Variances may be granted by the Ingham County Drain Commissioner upon a finding of practical difficulty, hardship or physical constraint of a property, not self-created that makes it infeasible to fully comply with these Rules. Variances may also be granted upon a finding that proposed improvements do not comply with these Rules but are in accordance with the intent and purpose. The burden is on the proprietor/landowner to demonstrate to the Ingham County Drain Commissioner's satisfaction one or more of these requirements for granting a variance. Variance requests shall be submitted in writing.

SECTION 6: Appeal

1. If the proprietor wishes to appeal a decision applying these Rules that is made by the Ingham County Drain Commissioner or the Ingham County Drain Commissioner's staff, a written appeal may be filed within 10 calendar days of the decision. If an appeal is filed, an informal hearing before the

Ingham County Drain Commissioner will be scheduled within 14 calendar days from the date of the filing.

2. The informal hearing will allow the proprietor an opportunity to submit additional information or re-emphasize previously submitted data and allow the Ingham County Drain Commissioner an opportunity to reconsider the decision in light of the information submitted.
3. This appeal procedure does not waive any party's legal rights. Involvement in the appeal process does not remove obligations to conform to the law.

PART 3: DESIGN CRITERIA FOR STORMWATER MANAGEMENT SYSTEMS

This section sets forth specific design and construction standards that will be used by the Ingham County Drain Commissioner in review of proposed stormwater management systems in accordance with the objectives of managing both the quantity and quality of stormwater runoff. A Glossary of Terms used throughout this section is provided.

A set of uniform standards as attached herein, may not accommodate unique site circumstances. In particular, it is recognized that these standards may be difficult to impose on small sites or sites that are being redeveloped. Waivers or variances from specific provisions of these standards may be requested in these and other special circumstances. Alternatives consistent with the overall intent of stormwater quantity and quality management may be proposed and will be reviewed and approved on a case by case basis by the Ingham County Drain Commissioner where there is exceptional hardship or practical difficulty complying with all of the Standards as outlined herein (see Part 2, Section 5 on Variances).

Whereas basin design for flood control is concerned with capturing and detaining relatively infrequent, severe runoff events, such as the 10-, 25-, or 100-year storm, designs for water quality control involve consideration of the more frequent storm events (e.g. 2.0-year/24-hour storm or less). The need for managing smaller storms is directly related to urbanization within Ingham County and the accompanying increase in impervious area, which affects surface water quality in two important ways.

First, eroded soil and other pollutants that accumulate on impervious surfaces, such as metals, fertilizers, pesticides, oils and grease, are flushed off by the early stages of runoff, which then carries a shock loading of these pollutants into receiving waterways. By capturing and treating the first 0.5-inch of runoff, pollutants that are washed off of the land can be removed from stormwater before it flows offsite.

Second, as impervious surface area increases and opportunities for infiltration are reduced, the frequency and duration of bankfull flow conditions, typically represented by the 2.0-year/24-hour storm event have intensified, causing stream flow fluctuations to increase dramatically. As a result, streams adjust their capacities to convey the increased flows, leading to channel and bank erosion and the destruction of aquatic habitat.

To manage both water quantity and quality, systems must be designed to capture and treat three different storm events:

- The 100 year/24 hour storm event
- The bankfull flood; the 2.0-year/24-hour storm event
- The first flush volume; the runoff from the first 0.5 inch of rain from the entire contributing watershed

Controlling both extremely large events, (to prevent flooding) and more frequent events, (to mitigate water quality impacts and channel erosion) can be achieved through the proper design of detention/retention basins. Among alternatives, wet basins, constructed basin/wetland marsh systems

and Low Impact Designs are the most effective for achieving control of both stormwater volume and quality. Combinations of these alternatives are frequently the most effective. Extended detention basins providing two-stage basin designs that contain an upper, dry stage and a lower stage with a permanent pool are also acceptable, though their ability to remove critical pollutants such as total phosphorus is limited. Dry basins providing extended storage will be accepted only when the site's physical characteristics or other local circumstances make the use of a wet basin infeasible, or when thermal impacts are a primary concern.

The phosphorus removal capability of wet basins, wet extended detention basins, multiple basins, basin/wetland marsh systems and infiltration systems is superior to other BMPs. Extensive literature is available on specific design concepts and alternatives.

Individuals seeking to develop land within Ingham County are encouraged to contact local governments regarding their stormwater BMP requirements. Standards in addition to those contained in these Rules may be in effect in specific communities or watersheds.

SECTION 1: Stormwater Discharge

1. In no event will the maximum design rate or volume of discharge exceed the maximum capacity of the downstream land, channel, pipe or watercourse to accommodate the flow. It is the proprietor's obligation to meet this Standard. Should a stormwater system, as built, fail to comply, it is the proprietor's responsibility to design and construct, or to have constructed at his/her expense, any necessary additional and/or alternative stormwater management facilities. Such additional facilities will be subject to the Ingham County Drain Commissioner's review and approval.
2. Identification of the off-site outlet and evidence of its adequacy is required.
3. If no adequate watercourse exists to effectively receive a concentrated flow of water from the proposed development, discharge will be reduced to sheet flow prior to exiting the site. Further, if the proposed stormwater management system cannot achieve pre-development conditions, with respect to both volume and rate of stormwater runoff, it is the responsibility of the developer to secure necessary easement(s) from downstream property owner(s).
4. Discharge should outlet within the drainage district where flows originate, and generally may not be diverted to another drainage district. Any diversion must receive the permission of the Ingham County Drain Commissioner pursuant to requirements of the Drain Code of 1956.

SECTION 2: Determination of Surface Runoff for Design and Construction of Drain Systems

The Ingham County Drain Commissioner uses an average runoff coefficient for each parcel of real property in a drainage district. The average runoff coefficient is not determined on a parcel-by-parcel basis, so the discussion is not applicable to drain special assessments.

1. The rational method of calculating stormwater runoff is generally acceptable for highly impervious sites less than 120 acres in size. However, it may not be considered an adequate design tool for sizing large drainage systems. All composite runoff coefficients shall be based on the values shown in the table below. The slopes listed for the semi-pervious surfaces are the proposed finished slope of the tributary area.

Type of Surface	Runoff Coefficient		
Water Surfaces	1.00		
Roofs	0.95		
Asphalt or concrete pavements	0.95		
Gravel, brick, or macadam surfaces	0.85		
Semi-pervious; lawns, parks, playgrounds	Slope <4%	Slope 4%-8%	Slope >8%
Hydrologic Soil Group A	0.15	0.20	0.25
Hydrologic Soil Group B	0.25	0.30	0.35
Hydrologic Soil Group C	0.30	0.35	0.40
Hydrologic Soil Group D	0.45	0.50	0.55

Table 1. Minimum Acceptable Runoff Coefficients for use in Rational Method

2. More precise methodologies for predicting runoff such as runoff hydrographs are widely available, and may be required by the Ingham County Drain Commissioner for sizing the drainage systems on large sites and/or smaller sites that are deemed potentially problematic. Acceptable alternative methods include:
 - a. U.S. Army Corps of Engineers HEC-HMS, HEC-1
 - b. Natural Resources Conservation Service UD-21, TR-20 and TR-55
 - c. U.S. EPA's SWMM
 - d. Continuous simulation (HSPF)
3. Unless a continuous simulation approach to drainage system hydrology is used, all design 24- hour rainfall events will be based on the SCS Type II distribution.
4. Computations of runoff hydrographs that do not rely on a continuous accounting of antecedent moisture conditions will assume a conservative wet antecedent moisture condition.
5. For sites with upstream watersheds equal to or greater than 2 square miles, approval of the MDEQ is required, pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The MDEQ will compute the runoff rates at no charge. The MDEQ requires applicants to use the UD-21 method by SCS in lieu of the rational method. This method was developed for small watersheds by SCS, and can be used for watersheds up to 10 square miles. Computer programs such as HEC-HMS, HEC-1 and HEC-RAS, MDEQ permit applications, and other relevant information, can be downloaded from the MDEQ web site.

SECTION 3: Retention and Detention Systems

A. General Requirements

All runoff generated by proposed developed sites must be conveyed into a stormwater storage facility for water quality treatment and detention/retention prior to being discharged to a public surface water outlet. The first flush must be controlled and treated through the use of a stormwater management facility. Under most circumstances detention must be provided for the 100-year, 24-hour storm. Stormwater leaving a developed site must be restricted to the pre-developed rate of flow of 0.15 cfs/acre. The Ingham County Drain Commissioner reserves the right to impose stricter standards for the discharge

rate when warranted to protect the public health safe and welfare and properties. The following criteria will apply to the design of all stormwater retention and detention facilities.

1. Wet basins and stormwater marsh systems will be preferred to dry basins. Dry basins providing extended storage will be accepted only when the development site's physical characteristics or other local circumstances make the use of a wet basin infeasible.
2. Public safety will be a paramount consideration in stormwater system and basin design. Providing a safe design for stormwater storage is the proprietor's responsibility. Basin designs will incorporate gradual side slopes, vegetative and barrier plantings, and safety shelves. Where further safety measures are required, the proprietor is expected to include them within the proposed development plans. For safety purposes and to minimize erosion, basin side slopes will not be steeper than four-foot horizontal to one foot vertical (4H:1V).
3. Detention and retention facilities shall be located on commonly owned property in multi-ownership developments such as subdivisions and site condominiums, and not on private lots or condominium units.
4. Adequate maintenance access from a public or private right-of-way to the basin shall be provided. The access will be on a slope of 5H:1V or less, stabilized to withstand the passage of heavy equipment, and shall provide direct access to the forebay, control structure, and the outlet.
5. When discharge is within a watershed where thermal impacts are a primary concern, deep wet basins with bottom draw or dry basins may be preferred. In addition, for extended dry detention basins, first flush and bankfull requirements may be reduced to 12 hours. Plantings that offer shade on the west and south sides of facilities are required. Infiltration of stormwater should be considered where site conditions allow.
6. On-site management of storm drainage will be designed for control of flooding, downstream erosion and water quality. It is generally preferred that stormwater management plans address stormwater issues on the same site. Submission of flow calculations, cross sections and other pertinent data will be required.
 - a. The volume of storage provided for flood control will be equal to or in excess of that required for a 100-year frequency storm.
 - b. The allowable release rate from the flood control storage volume will be 0.15 cfs/acre of the property being drained, or as determined by the Ingham County Drain Commissioner.
 - c. If the discharge does not outlet to a clearly defined public outlet, it is the developer's responsibility to secure necessary easement(s) from downstream property owner(s).
 - d. The volume and storage provided for controlling the bankfull flood will be equal to or in excess of the runoff from a 2.0-year/24-hour storm, which can be determined by: $(8170 \times \text{acreage} \times \text{the relative imperviousness factor } C)$.
 - e. The release rate from the bankfull storage volume will be such that this volume will be stored not less than 24 hours, nor more than 48 hours.
 - f. The first flush volume of runoff will be captured and detained for at least 24 hours or within a permanent pool. This volume is equivalent to the runoff from 0.5 inches of rain per acre of the land tributary to the basin. This volume can be determined by multiplying the number of acres by 1815 (Number of acres \times 0.5 inches \times 43,560 \times 1/12 feet).

B. Sediment Forebays

Sediment forebays are preferred at the inlet or outlet of all stormwater management facilities, to provide energy dissipation and to trap and localize incoming sediments.

1. The forebay will be a separate basin, which can be formed by a gabion, a compacted earthen berm, or other suitable structure.
2. The capacity of the forebay will be equivalent to 5% of the 100-year storm volume based on the area tributary to the inlet.
3. Exit velocities from the forebay shall not be erosive during the 2.0-year/24-hour design storm.
4. Direct maintenance access to the forebay for heavy equipment will be provided.
5. A permanent vertical depth marker will be installed in the forebay to measure sediment deposition over time. Stormwater system maintenance plans will require that sediment be removed when sediment reaches a depth of equal to 50% of the depth of the forebay or 12 inches, whichever is less.

C. Basin Inlet/Outlet Design

1. Velocity dissipation measures will be incorporated into basin designs to minimize erosion at inlets and outlets, and to minimize the re-suspension of pollutants.
2. To the extent feasible, the distance between inlets and outlets will be maximized to at least a 4 to 1 ratio. The length and depth of the flow path across basins and marsh systems can be maximized by:
 - a. Baffles may be used to increase the ratio.
 - b. Increasing the dry weather flow path within the system to attain maximum sinuosity.
 - c. Inlets and outlets will be offset at opposite longitudinal ends of the basin.
3. Basins with a dry pilot channel shall have a French drain located 2 to 3 feet below the riprap to prevent excessive warming of stormwater during periods of low flow.
4. The use of dual outlets, risers, V-notched weirs or other designs that assure an appropriate detention time for all storm events is required.
5. The outlet will be well protected from clogging.
6. Where a pipe outlet or orifice plate is to be used to control discharge, it will have a minimum diameter of 4 inches. If this minimum orifice size permits release rates greater than those specified in these Rules, an alternative outlet design that incorporates self-cleaning flow restrictors will be required, such as, perforated risers and "V" notch orifice plates that provide the required release rate. Calculations verifying this rate shall be submitted to the Ingham County Drain Commissioner for approval.
7. Any backwater effects on the outlet structure caused by the downstream drainage system will be evaluated when designing the outlet.
8. All outlets will be designed to be easily accessible for heavy equipment required for maintenance purposes.

D. Riser Design

1. Inlet and outlet barrels and risers will be constructed of reinforced concrete or plastic. Corrugated metal will not be acceptable as a riser material. Plastic is not acceptable as a riser material. The minimum diameter for riser pipes shall be 24". Riser pipes greater than 4 feet in height shall be 48" in diameter.
2. Riser pipes shall be set into a cast-in-place concrete base or properly grouted to a pre-cast concrete base. All riser pipes constructed of material other than concrete must be set into a cast-in-place base.
3. All orifice configurations shall consist of the minimum number of holes with the largest diameter that meets the detention requirements.
4. A gravel filtration jacket consisting of 3" washed stone and 1" washed stone shall be placed around all riser pipes. The orifice configuration shall be wrapped with hard wire of an appropriate opening size to prevent any stone from passing through the orifice. The 3" stone shall be placed immediately

adjacent to the riser pipe with the 1” stone covering the larger stone. The gravel jacket shall extend sufficiently above all orifice patterns.

5. Orifices used to maintain a permanent pool level should withdraw water at least one foot below the surface of the water.
6. Hoods or trash racks shall be installed on the riser to prevent clogging. Grate openings shall be a maximum of three inches on center.
7. The riser shall be placed near or within the embankment, to provide for ready maintenance access.

E. Protection of Receiving Waters

1. All tiled outlets greater than 12-inches in diameter shall have flared end sections with grates (rodent guards).
2. All outlets will be designed so that velocities will be appropriate to, and will not damage, receiving waterways.
3. In the case of environmentally sensitive riparian zones, a step pool arrangement shall be used to convey the discharge to the stream.
4. Outlet protection using riprap or other approved materials will be provided as necessary to prevent erosion.
5. The soils above and around the outlet will be compacted and stabilized to prevent piping around the structure. Riprap extending 3-feet above the ordinary high water mark is required for all outlets.
6. When the outlet empties into a detention/retention facility, channel or other watercourse, it will be designed such that there is no free overflow from the end of the apron to the receiving waterway.

F. In-line Detention Basins

In-line detention basins are not allowed. For purposes of these standards “In-line detention” refers to the placement of detention or retention for a new land use change in the route and course of an existing intercounty or intracounty drain.

G. Retention/Detention Basins within a 100-year Floodplain

The placement of retention/detention basins within a 100-year floodplain is prohibited. Any variance to this prohibition must be accompanied with adequate information that verifies that the facility will meet the requirements of these rules during flood events.

H. Anti-Seep Collars

Anti-seep collars should be installed on any piping passing through the sides or bottom of the basin to prevent leakage through the embankment.

I. Freeboard

A minimum of one foot of freeboard will be required above the 100-year stormwater elevation (NGVD) on all detention/retention facilities.

J. Emergency Spillway

All basins will have provisions for a defined emergency spillway, routed such that it will flow unobstructed to the main outflow channel.

1. The emergency spillway elevation will be set at the elevation of the maximum basin design volume.
2. The spillway will be sized to pass the maximum design flow tributary to the basin.

K. Vegetative Plantings Associated with Retention/Detention Facilities:

1. Basins and marsh designs will be accompanied by a landscaping plan that incorporates plant species native to the local region and indicates how aquatic and terrestrial areas will be vegetated, stabilized and maintained.
2. Native wetland plants should be encouraged in the basin design, either along the aquatic bench, fringe wetlands, safety shelf and side slopes or within the shallow areas of the pools.
3. A permanent buffer strip of natural vegetation within the drain easement will be maintained or restored around the perimeter of all stormwater storage facilities. No chemicals shall be applied to the buffer area. This requirement will be cited in the subdivision restrictions or master deed documents.
4. Viability of plantings will be monitored for two years after establishment by the proprietor, and reinforcement and replacement plantings provided as needed.

L. Waived Stormwater Quantity Control Structures

Requirements for stormwater quantity control may be waived for developments near the outlet of a watershed, although quality management will still be necessary. The Ingham County Drain Commissioner will make determinations on an individual site basis.

M. Additional Water Quality Measures

Additional water quality measures will be required at sites where land uses are identified as potential sources of pollution.

N. Chemical Storage

For sites where chemicals may be stored and used, such as certain commercial and industrial developments and gas stations a spill response plan will be developed that clearly defines the emergency steps to be taken in the event of an accidental release of harmful substances that may migrate to the stormwater system. As a result of this plan, design elements such as shut-off valves or gates may be required. The Ingham County Drain Commissioner shall be placed on any emergency contact list.

SECTION 4: Retention Basins

A. No Outlet Retention Basins

Retention basins with no outlet will be capable of storing two consecutive 100-year storms, which can be determined by:

$$(33,000 \times \text{acreage} \times \text{the relative imperviousness factor } C)$$

B. Overflow Assessment

An overflow assessment will be required. The assessment will include descriptions of the surrounding areas that would be impacted in the event of an overflow.

C. Soil Borings and Soil Boring Log

The proprietor must submit a soil-boring log, taken within the basin bottom area to a depth of 25 feet below existing ground or 20 feet below proposed basin bottom elevation. Information regarding the seasonal groundwater elevations must also be provided.

D. Modifying Required Volumes

The volume required may be modified based upon the percolation rate of the soil, groundwater elevation and supporting data prepared by a registered professional engineer, certified professional geologist or other licensed professional.

SECTION 5: Detention/Retention Basins

1. Storage volume on a gravity outflow wet basin is defined as, "the volume of detention provided above the invert of the outflow device." Any volume provided below the invert of the outflow device will not be considered as detention.
2. At a minimum, the volume of the permanent pool should be at least 10% of the 100 year storage volume:
(4540 x runoff coefficient x site drainage area)
3. Wet detention basin configuration will be as follows:
 - a. Surface area to volume ratio should be maximized to the extent feasible.
 - b. In general, depths of the permanent pool shall be varied and average between 18 and 30 inches.
 - c. A minimum length to width ratio of 4:1 shall be used unless structural measures are used to extend the flow path.
 - d. Basins shall be wedge-shaped, narrower at the inlet and wider at the outlet. Irregular shorelines are preferred.
 - e. A marsh fringe shall be established near the inlet and forebay and around at least 50% of the basin's perimeter.
 - f. A shelf, a minimum of 4 feet wide at a depth of one foot, will surround the interior of the perimeter to provide suitable conditions for the establishment of aquatic vegetation, and to reduce the potential safety hazard to the public.
 - g. To avoid drawdown, a reliable supply of base-flow and/or groundwater will be required.

SECTION 6: Extending Detention Time In Basins

A two-stage design is required with separate outlet controls to detain both the 2.0-year/24-hour and larger rain events.

1. The lower stage shall contain a shallow, permanent pool designed to store and treat the first flush volume, or the runoff from 0.5 inch of rain over the entire site.
 - a. This pool shall be managed as a shallow marsh or wetland, and average 6-12 inches in depth.

- b. At a minimum, the volume of runoff detained in the entire lower stage shall be equivalent to the runoff volume produced by a 2.0-year/24-hour storm.
2. The upper stage shall be sized for the 100 year, 2.0-year/24-hour storm and shall be graded to remain dry except during large storms.
 - a. A low flow channel, stabilized against erosion, will be provided through the dry portion of the basin. This channel should have a minimum grade of 0.5%, and the remainder of the basin should drain toward this channel at a grade of at least 1%.
 - b. The low flow channel should end at the lip of the lower stage, where riprap or gabion baffles will be placed, to prevent scour and re-suspension.

SECTION 7: Stormwater Wetland Systems

Stormwater wetlands are defined as constructed systems explicitly designed to mitigate the stormwater quality and quantity impacts associated with development. They do so by temporarily storing stormwater runoff in shallow pools that create growing conditions suitable for emergent and riparian wetland plants. The runoff storage, complex micro-topography and emergent plants in the stormwater facilities that couple basins and constructed wetlands together form an ideal system for the removal of urban pollutants. Because of their water quality benefits, the use of stormwater wetlands is encouraged.

1. As a general rule, stormwater wetlands may not be located within delineated natural wetland areas, nor within created wetlands that are used to mitigate the loss of natural wetlands.
2. The design of an effective and diverse stormwater wetland requires a sophisticated understanding of hydrology and wetland plant ecology. Therefore, a qualified professional with specific wetland expertise must oversee wetland construction, re-construction or modification.
3. Stormwater wetland systems must be designed to perform in conformance with all standards for storage volume and discharge rate established in these rules.
4. The proprietor will provide for the monitoring of wetland plantings and replacement as needed for a two-year period after construction or provide a bond to cover expenses until permanent perennial vegetation is established.
5. Planting plans will include species diversity and use of indigenous species.

SECTION 8: Stormwater Conveyance

Stormwater conveyance structures in the roadway will conform to standards of the Ingham County Drain Commissioner. In the event of no other governing specifications, the latest edition of the MDOT standards will be observed. Stormwater conveyance systems incorporating pumps shall not be permitted in developments with multiple owners, such as subdivisions and site condominiums.

A. Natural Streams and Channels

1. Natural streams, including intermittent streams, are to be preserved. Natural swales and channels should be preserved, whenever possible.
2. If channel modification must occur, the physical characteristics of the modified channel will duplicate the existing channel in length, cross-section, slope, sinuosity, and carrying capacity.
3. Streams and channels will be expected to withstand all events up to the 100-year storm without increased erosion. Armoring banks with riprap and other manufactured materials will be accepted only where erosion cannot be prevented in any other way, such as by the use of vegetation.

B. Vegetated Swales/Open Ditches

1. Open swale/ditch drainage systems are preferred to enclosed storm sewers where applicable governmental standards and site conditions permit.
2. Swales will be required to follow natural, pre-development drainage paths insofar as possible. Swales shall be well vegetated, wide and shallow, and designed to provide positive drainage.
3. Swale length will be based on soil type, slope and catchment area. Longer and wider swales have a potential to remove more pollutants and reduce velocity and are preferred.
4. Open ditch flow velocities will be neither siltative nor erosive. The minimum acceptable velocity will be 2.0 ft./sec., and the maximum acceptable velocity will be 5.0 ft./sec.
5. Open ditch slopes will depend on existing soils and vegetation. However the minimum acceptable slope is 1.0 %, unless other techniques such as infiltration devices are implemented. Maintenance for such devices must be detailed in the overall maintenance plan.
6. Side slopes of ditches shall be no steeper than 3:1. Soil conditions, vegetative cover and maintenance ability will be the governing factors for determining side slope requirements.
7. Slopes and bottoms of open ditches and swales will be permanently stabilized to prevent erosion.
8. Check dams or drop structures across swales will be required to enhance water quality performance and reduce velocities as need is determined by the Drain Commissioner.
9. Check dams, drop structures, or other energy dissipating measures shall be required when slopes are greater than 2%.
10. A minimum vertical clearance of at least 5 feet between open swale/ditch inverts and underground utilities will be required.
11. Permanent metal or plastic markers shall be placed on each side of the drain at the edge of the easement to show the location of underground utilities (or the edge of the bank if the ditch is in a farm field).
12. All bridges will be designed to provide a 2-foot minimum flood stage air space above the 100-year/24hour-storm elevation to the underside of the bridge. Footings will be at least three feet below the established grade of the drain. Depending on soils, additional footing depth may be required.
13. For additional redundant pollutant removal enhancement, features such as stilling basins and stone infiltration trenches shall be integrated into the design.

C. Enclosed Drainage System

1. Enclosed storm drain systems will be sized to accommodate the 10-year storm, with the hydraulic gradient kept below the top of the pipe.
2. For residential developments and commercial projects smaller than 10 acres in size, a time of concentration of 15 minutes shall be used. Other situations may require that the time of concentration be calculated using TR-55 or equivalent method
3. Pipe capacity will not be considered as part of the detention calculations.
4. Drainage structures will be located as follows:
 - a. To assure complete positive drainage of all areas of the development.
 - b. At all low points of streets, rear yards and adjoining lots.
 - c. Such that there is no flow across a street intersection.
 - d. For smaller enclosed drains, 12 to 24 inches in diameter, manholes will not be spaced more than 400 feet apart. Longer runs may be allowed for larger sized pipe, with approval from the Ingham County Drain Commissioner.
 - e. Limited main line deflection is allowable but generally all lines between structures must be straight and lie within the road right of way.

- f. Manholes and catch basins shall be ASTM C-478, 4' diameter or larger with pre-cast reinforced concrete adjusting rings for final grade. Minimum number of rings used shall be two (2). All structures shall be constructed to provide ingress/egress for maintenance and repairs.
- g. Construction plans must include pipe grades, sizes of pipes, class designations, top-of-casting elevations invert elevations of all pipes at each structure, steps – 16” on center and special structure details. Steps must be aligned with the opening of the structure.
5. Footing tile and/or sump pump leads are required for each proposed lot served by an enclosed county drain and shall be shown to lot lines on the plans. Leads shall be constructed of either SDR-35 (ASTM 3034) or PVC Schedule-40 (ASTM D1785), unless installation is less than three (3) feet in which case SDR-26 (ASTM D3034/F-1336) shall be required. Leads may be connected to catch basins or manholes, where available. All other leads must be connected to the nearest available storm line.
 - a. All collector lines are to be served by a manhole at each end.
 - b. Leads discharging directly into a pipe must connect through a wye or tee supplied by the pipe manufacturer, or through an approved fitting or boot.
 - c. Leads shall not protrude into the interior of the recipient pipe.
 - d. Full time inspection is required on storm lead installation for all pipes that will be dedicated as public drains.
 - e. Lot leads shall be properly capped on the upstream end and marked with an 8' length of 4" by 4" post painted green.
6. Sump pump discharge into roadside ditches is not permitted.
7. Joints within the interiors of all manholes and catch basins, including pipe-to-structure connections, must be sealed with a minimum of one-half (1/2) inch thick type M mortar or rubber boots. Pipe must not protrude into structures more than 6-inches and must be cut or sealed smoothly across the exposed surface. All exterior joints, and in particular, the grade or adjusting rings, are to be sealed in like manner.
8. Construction notes must indicate, by reference, MDOT Construction Standards (where applicable).
9. Temporary drains connected to catch basins and manholes located within the road right-of-way are not allowed.
10. The catch basin or inlet covers shall be designed to accept the 10-year design storm without ponding of water.
11. Catch basins and manholes must be designed as follows:
 - a. Structures must be on lot lines or at intersections, as directed by the review agency.
 - b. Structures shall have a minimum 3-foot sump and shall have accessible steps from the catch basins opening and shall extend into the sump area for maintenance. The steps shall be in alignment and the rungs no more than 18-inches apart.
 - c. Structure opening shall be a minimum of 22” in diameter.
 - d. The following castings are required for new construction on drains to be dedicated in Ingham County:

<u>Standard Manhole</u>	EJIW 1060-B	Neenah R-1784
<u>Standard Curb Inlet</u>	EJIW 7045	Neenah R-3031-A
<u>Rollback Curb Inlet</u>	EJIW 7065	Neenah R-3034-B
<u>Ditch (Beehive) Grate</u>	EJIW 6508	Neenah R-4340-A
<u>Basin (Stool) Grate</u>	EJIW 6488	Neenah R-4341-A
<u>Parking Lot Inlets</u>	EJIW 1020 M-2 (6" rise) or R2502 or (7" rise) or R2595 (4" rise)	

EJIW = East Jordan Iron Works
 - e. Covers must have the “Dump no waste...drains to Waterway” label.

- f. Proprietor must furnish one replacement lid, or the cash value for one replacement lid, for any casting category listed above which will be located within a paved or gravel surfaced roadway.
 - g. Castings shall be of a consistent manufacturer and model throughout all phases of a subdivision or other development.
12. Pipe design shall be as follows:
- a. Main line pipes within road right-of-way shall conform to ASTM C76 designation, unless road authority stipulates otherwise. Pipes lying outside of road right-of-way may be constructed of PVC SDR-35 or PVC Schedule-40 or HDPE Dual Smooth Wall Pipe with a minimum diameter of ten (10) inches.
 - b. Trench backfill must meet MDOT utility trench detail R-83-B and is required beneath all pipes and structures unless otherwise approved. Trench backfill in the road right-of-way shall be compacted to at least 95% modified proctor and is to meet requirements of the Ingham County Road Commission or other governing authority.
 - c. Pipe will conform to the following criteria:
 - The minimum acceptable main line pipe diameter is 12-inches.
 - Minimum catch basin lead size permitted is 12-inches in diameter.
 - In order to avoid accumulation of sediment in the drain, pipe will be designed to have minimum velocity flowing full of 3 ft/sec, with the exception of sediment chambers.
 - The maximum allowable velocity flowing full will be 10 ft/sec.
 - d. The pipe joints will be such as to prevent excessive infiltration or exfiltration. Wrap joints using MIRAFI 140N or equal are normally used. Premium joints may be required for site-specific situations.
 - e. All materials will meet appropriate A.S.T.M. Standards.
 - f. The minimum depth of cover shall be 36-inches over the top of any pipe.
 - g. Pipe deflections shall be limited to pipe manufacturer's tolerances.
 - h. In areas where local ordinance requires sump pump leads to be connected into an enclosed system, these connections shall be made directly into storm sewer structures or main line pipe with coring and booting as inspected by the Ingham County Drain Commissioner's office.
 - i. Sump pump lines (typically 4-inch and 6-inch diameter) and building connections shall not fall under the long term operation and maintenance of the Ingham County Drain Commissioner, and will not become part of an established county drain, this includes the lead in the public right of way. Header pipes for sump pump leads are not allowed. Maintenance of such lines will be the responsibility of the property owners, and should be so specified in subdivision rules or condominium master deed agreements.
13. Utilities crossing under enclosed drains must meet the requirements of this section.
14. Pipe line television inspection shall conform to the following:
- a. Newly constructed public stormwater pipes dedicated as public drains will be televised at the request of the Ingham County Drain Commissioner.
 - b. The following format must be used:
 - Pan and tilt camera
 - Speed of 2-ft/sec or slower
 - Digital format in color
 - Identification of each structure encountered by item and footage
 - Identification of each lead
 - Identification of direction of camera movement

D. Channel/Pipe Design

1. Manning's equation will be used to size the open channel or pipe. Roughness coefficients are found in Table 2.

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

Boundary Material	n value	Boundary Material	n value
HDPE pipe, (smooth wall)	0.011	Brick	0.016
Concrete pipe	0.013	Riveted steel	0.018
Vitrified clay pipe	0.014	Rubble	0.025
Cast iron pipe	0.015	Gravel	0.029
HDPE pipe, (corrugated)	0.018	Riprap	0.033
Finished concrete	0.012	Natural channels in good condition	0.025
Planed wood	0.012	Natural channels with stones & weeds	0.035
Unplanned wood	0.013	Natural channels in poor condition	0.060
Unfinished concrete	0.014	Natural channels with heavy brush	0.100

Table 2. Manning Roughness Coefficients for Various Surfaces

2. A minimum "n" of 0.035 will be used for the roughness coefficient for open channels, unless special treatment is given to the bottom and side slopes, such as sodding, riprap or paving.
3. Manning's equation must be used unless the Ingham County Drain Commissioner approves an alternative method.

E. Culvert Design

1. Under Michigan State Law, Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, crossroad culverts draining two square miles or more must be reviewed and approved by the Michigan Department of Environmental Quality and shall be approved by the Ingham County Road Commission and Ingham County Drain Commissioner.
2. Crossroad culverts draining less than 2 square miles of upstream watershed will be sized by the proprietor's engineer and approved by the Ingham County Road Commission and Ingham County Drain Commissioner.
3. At a minimum, culverts will be designed to convey the peak 10-year storm flow with the velocity not exceeding 8 fps. The 100-year storm must pass the embankment with no adverse increase in water elevation occurring off of the development property or flooding of structures within the development. A minimum of one foot of freeboard is required.
4. Acceptable methods of determining the flow rate required to pass through the culvert are listed below. The proprietor's engineer may use any of the methods listed or another if approved by the Ingham County Drain Commissioner's Office:

Rational Method

USDA Soil Conservation Service Method

The Michigan Department of Natural Resources Method

Continuous flow modeling

5. The discharge velocity from culverts should consider the effect of high velocities, eddies, or other turbulence on the natural channel, downstream property and roadway embankment. The culvert exit velocity should not cause downstream channel erosion or scour.
6. Sizing of culvert crossings will consider entrance and exit losses as well as tail water conditions on the culvert. Once the design flow is determined, the required size of the culvert will be determined by one of the following methods:
 - Manning's equation
 - The inlet headwater control/outlet tail water control nomographs (FHWA HY-8)
 - Other methods approved by the Ingham County Drain Commissioner
7. Wing walls, headwalls and all other culvert extremities will be designed to assure the stability of the surrounding soil. It is recommended that MDOT standard designs be observed unless special exemption is given.

SECTION 9: Easements

Wording relative to easement information will be as specifically required by the Ingham County Drain Commissioner. If a county drain is to be established under the Drain Code of 1956, related easement language will be depicted on final plat and condominium drawings as follows:

1. “ ____ foot wide private easement to ____ Drainage District for public drainage.”
2. The typical easement language will be included in the subdivision deed restrictions or condominium master deed.
3. The location and purpose of drainage easements should be clearly described in subdivision deed restrictions or condominium master deeds.
4. Language shall be included within the subdivision deed restriction or condominium master deed that clearly notifies property owners of the presence of stormwater management facilities and accompanying easements, as well as restrictions on use or modification of these areas.
5. If a utility is to be located within any county drain or drainage easement, it shall be located such that it will not increase the expense of maintaining the drainage facility.
6. Retention/detention basins or other stormwater management facilities shall have a minimum of a twenty-five (25) foot easement from the top of the freeboard elevation for maintenance purposes. Easements will be sized and located to accommodate access, operation of equipment, spoils deposition, and other activities identified in the development's stormwater system maintenance plan.
7. Easement widths will be determined by the Ingham County Drain Commissioner and be situated in such a way as to allow maximum maintenance access, for example, offsetting them from the centerline. In general, easement widths will conform to the following:
 - a. Open channels and watercourses: A minimum of 80 feet, 100 feet preferable, total width. Additional width may be required in some cases, including but not limited to: watercourses with designated floodplains, sandy soils, steep slopes, and road crossings used as access points.
 - b. Open swales (cross lot drainage): minimum of 30 feet total width.
 - c. Enclosed storm drains: A minimum of 30 feet will be required, situated in such a way as to allow maximum maintenance access. Additional width will be required in some cases.

Minimum acceptable easement width for a drain is as follows:

1. Backyard swale (under 3' deep) thirty (30) feet
2. Pipe buried between 3' – 7.5' thirty (30) feet

- | | |
|--|------------------------------|
| 3. Pipe buried over 7.5' | forty (40) feet |
| 4. Open ditch (3' – 6' deep) | eighty (80) feet |
| 5. Open ditch (6' - 10' deep) | one-hundred (100) feet |
| 6. Open ditch over 10' deep | one-hundred fifty (150) feet |
| 7. Character of the drain shall determine actual width and alignment in each instance. | |

8. Easements for back yard drainage will be provided for each lot at a minimum of 30 feet unless otherwise approved. A fifteen-foot easement on each side of a centerline shall be the standard.
9. Drain fields (septic areas) shall not be located within drainage easements.

SECTION 10: Crossings, Connections and Licenses To Encroach

All persons intending to cross, to connect, or to encroach upon a drain or drain easement must apply for and obtain a permit from the Ingham County Drain Commissioner prior to commencement of any proposed work. Crossing permits are required to cross over or under a drain, or to install a culvert in a drain. Connection permits are required to connect to or tap into an open or enclosed drain or any of its structures for purposes of discharging stormwater. Any use of a drain easement or right of way that will interfere with the operation of the drain or will increase the cost to the Drainage District of performing any maintenance or improvement to the drain is deemed to be inconsistent with the easement. In such a case, a License to Encroach may be issued at the discretion of the Ingham County Drain Commissioner upon such conditions, as the Ingham County Drain Commissioner considers appropriate to protect the District's ability to maintain and improve the drain.

The following items apply to Crossings, Connections, and Licenses to Encroach:

1. Permittee will release, waive, and discharge Ingham County and the Ingham County Drain Commissioner, its employees and agents, and the drainage district from any and all liability to permittee arising under or in any manner related to the privileges granted under the permit.
2. With acceptance of the permit, the property owner agrees to hold harmless, indemnify, and defend Ingham County and the Ingham County Drain Commissioner, its employees, agents and the drainage district from any and all claims for injury to persons or property arising from the permitted crossing of or connection to the drain.
3. Permittee is required to obtain all Federal, State, and local permits necessary prior to construction, and to provide copies to the Ingham County Drain Commissioner. The Ingham County Drain Commissioner reserves the right to require copies of environmental permits prior to crossing permit issuance.

A. Crossings

1. General Crossings

Crossing means going through, under, or over the right of way of an established county drain. All crossings must comply with the requirements in these Rules.

- a. A complete application includes a completed form, payment of applicable fees, and three copies of a scaled drawing, sealed by a registered professional engineer, of the crossing in both plan and profile perspective showing the vertical separation distance and the width of the drain easements. This requirement for an engineer's seal may be waived for residential and agricultural crossings.
- b. Crossings must not interfere with safe maintenance and/or improvement of the established drain.

- c. A Drain Office inspector must be present at all times during any crossing construction. The drain office must receive notice three (3) business days before the inspection services are required.
- d. Upon completion of the construction of the crossing, the permittee must provide the Ingham County Drain Commissioner with a certified “as-built” of the crossing. If at any time it is determined that the facilities were installed inconsistent with the approved plan, or with any written approved changes to the plan, permittee shall be responsible for all costs associated with reconstruction of said crossing to comply with the terms of the permit.
- e. The permit holder must provide confirmation of elevations to the nearest 0.1 foot.
- f. Soil borings may be required at the discretion of the Drain Office.
- g. The permit shall be posted at the site of the work and available for inspection at all times during the construction.
- h. Permanent markers must be installed above all crossings at the edges of the right-of-way or as close to that as possible.
- i. All utilities crossing easements shall be encased in larger pipes detectable by a metal detector.

2. Culvert Crossing

- a. Any application for crossings involving culverts shall include upstream and downstream elevations and hydraulics, and on the plan shall include measures for re-establishment of the stream bank and erosion control at the culvert ends. Flared end sections may be required along with additional information including, but not limited to elevations, size of upstream and down stream culverts, and confirmation of elevation of established drain.
- b. All culverts are privately owned and installed at the owner’s expense.
- c. The Ingham County Drain Commissioner’s office will approve the culvert size. Oval shaped pipes may be used when elevations are critical. Pipes must be installed according to manufacturer’s specifications.

3. Other Drain Crossings

- a. Drain crossings must be at least five (5) feet below the elevation of the drain as it was established (the invert elevation for enclosed drains must be used) for the entire width of the easement. All crossings over a drain will be reviewed and requirements determined on a case-by-case basis.
- b. All crossings of open drains must be bored or directional drilled unless special permission is obtained from the Ingham County Drain Commissioner. If special permission is received, additional standards will be required, including but not limited to standards which will maintain the hydraulics of the drain, reconstruct the drain to its established profile, temporarily and permanently stabilize the earth disturbance, and post bonds to insure that all work is completed.
- c. Open cut crossings require washed aggregate backfill compacted to 95% modified proctor.
- d. Special permission can be given by the Ingham County Drain Commissioner for encasement of utility lines in concrete or sleeve with ductile iron pipe when crossing under the drain.
- e. In no case will less than 18 inches of separation be allowed.
- f. Sanitary sewers must be ductile iron pipe for the full width of the drain maintenance easement.

B. Connections

- 1. All persons requesting a connection to a county drain must have permission from the Ingham County Drain Commissioner. The Ingham County Drain Commissioner on a case-by-case basis will determine requirements for residential and agricultural applications.
- 2. Each connection requires a Tap-in Permit or Agreement.

3. The Tap-in Permit process includes submission of a completed application, three copies of the required drawings, and payment of all applicable fees. All inspection fees must be paid prior to permit approval.
4. Inspection by the Drain Office at the time of connection is required. A 72-hour notification must be provided.
5. Stormwater leads connected into manholes, catchbasins, and pipes must be cored and lined with a rubber boot.
6. A scale drawing of the connection in plan and profile view must be submitted with the application showing: the diameter of the pipe; diameter of the hole to be cored; the type of boot for stormwater lead; the method of connecting to the boot; location of any other pipes in the structure; backfill material 6" around the pipe for two feet from the structure; and compaction of backfill material adjacent to the structure to 95% of modified proctor density.
7. All connections to an open drain require a rodent guard.
8. Outlets to ditches will be placed at the average low water elevation of the watercourse. Outlet velocities will be non-erosive.

C. Licenses To Encroach

All encroachments in drain maintenance easements for structures or land use changes that impair or impede the maintenance of the drain shall be reviewed and approved by the Ingham County Drain Commissioner. The written documentation supporting a license shall be prepared by the Ingham County Drain Commissioner's Office or can be prepared by the property owner and reviewed by the Ingham County Drain Commissioner's Office on a case-by-case basis. All costs associated with the review and/or preparation of a License to Encroach shall be the responsibility of the applicant of the License to Encroach.

If said encroachment creates an increase in the maintenance costs, the property requesting the encroachment is subject to an increased assessment reflective of that cost.

SECTION 11: Natural Wetlands

This section governs natural wetlands (as distinct from stormwater wetland systems that are constructed expressly for stormwater management purposes), when a natural wetland is incorporated in an overall stormwater management scheme.

1. Wetlands will be protected from damaging modification and adverse changes in runoff quality and quantity associated with land developments. Before approval of the final plan, all necessary wetland permits from the MDEQ and local governments will be in place.
2. Direct discharge of untreated stormwater to a natural wetland is prohibited. All runoff from the development will be pre-treated to remove sediment and other pollutants prior to discharge to a wetland. Such treatment facilities will be constructed before property grading begins. All basins must be cleaned and stabilized prior to final acceptance.
3. Site drainage patterns will not be altered in any way that will modify existing water levels in protected wetlands without proof that all applicable permits from the MDEQ and/or local government agencies have been obtained.
4. A qualified professional with specific wetland expertise will oversee wetland construction, reconstruction, or modification.
5. Whenever possible, a permanent buffer strip, vegetated with native plant species, will be maintained or restored around the periphery of wetlands.

6. Wetlands will be protected during construction by appropriate soil erosion and sediment control measures.

SECTION 12: Lot Grading

Approval of final lot grading is the responsibility of the local municipality. The Ingham County Drain Commissioner's office is not responsible for inspection of, or enforcing corrections to, final lot grading. It is the Ingham County Drain Commissioner's responsibility to ensure that the overall plan is consistent with sound stormwater management and drainage practices. Assurance that lot grading is consistent with the approved overall drainage plan of the development is the responsibility of the local municipality, and should occur through local ordinance.

The subdivision stormwater management plan will provide for the following:

1. The grading of lots will be such that surface runoff is away directed from homes and toward swales, ditches or drainage structures. Provision for drainage through properly graded stormwater conveyance systems will be made for all areas within the proposed subdivision.
2. Where finished grades indicate a substantial amount of drainage across adjoining lots, a drainage swale of sufficient width, depth and slope will be provided on the lot line to intercept this drainage. To ensure that property owners do not alter or fill drainage swales, easements will be required over areas deemed necessary by the Ingham County Drain Commissioner.

PART 4: SOIL EROSION, SEDIMENTATION AND POLLUTION CONTROL FOR COUNTY DRAINS

The Ingham County Drain Commissioner serves as the County Enforcing Agent for Part 91, Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act, Act 451 of the Public Acts of 1994, as amended, being Section 324.9101 to 324.9123 of the Michigan Compiled Laws. The Ingham County Rules and Procedures governing soil erosion and sedimentation were approved by the Ingham County Board of Commissioners in 1998.

In addition, the Ingham County Drain Commissioner, under the jurisdiction of the Michigan Drain Code Sec. 280.421 and 280.423 of the Michigan Compiled Laws, considers the discharge of sediment or other polluting materials to a waterway that is a county or intercounty drain, to be pollution and/or an obstruction of that drain, and may require additional measures to protect the drain or drains. Under the Michigan Drain Code, pollution of a county drain is a criminal misdemeanor, punishable by fine of \$25,000 or imprisonment for up to 90 days or both.

SECTION 1: Soil Erosion/Sedimentation Control

(All erosion control measures will be regularly inspected and maintained.)

A. During Construction

1. The development plan shall fit the topography and soil so as to create the least erosion potential.
2. An approved soil erosion permit from the enforcing agent, as well as a National Pollution Discharge Elimination System (NPDES) permit where applicable, will be required.
3. Sediment shall not be permitted to leave the site. Recommended procedures to achieve this goal are as follows:
 - a. Wherever feasible, natural vegetation should be retained and protected.
 - b. The smallest practical area of raw land should be exposed at any one time (i.e. only areas under active construction).
 - c. The entire site should be planted with temporary vegetation immediately after mass grading operations.
 - d. Temporary vegetation and/or mulching should be used to protect critical areas exposed during development.
 - e. Sediment basins where needed should be installed at the beginning of construction and maintained by the proprietor.
 - f. Temporary stabilization of the site to will be required to protect the waters of the State throughout construction. A plan for temporary stabilization shall include, but will not be limited to the following:
 - i. Seeding
 - ii. Silt fencing
 - iii. Tackifiers
 - iv. Polyacrylamide Clarifiers
 - v. Rolled Erosion Control Matting (RECM)
 - vi. Geosynthetics

- vii. Construction access drives
 - g. The permanent, final vegetation and structures should be installed as soon as practicable in the development.
- 4. Areas within open drain easements that have been cleaned, reshaped or disturbed in any manner will be stabilized with seed and mulch or sod as quickly as possible.
- 5. All storm sewer facilities that are or will be functioning during construction will be protected, filtered, or otherwise treated to prevent sediment from entering the system. Construction activities will be complete before the construction of any stormwater management facilities susceptible to clogging such as infiltration devices.

B. Permanent Erosion Control Measures

1. Best management practices will be utilized to remove pollutants, including sediment, from stormwater runoff before it enters any natural watercourse, protected wetland, county drain or other body of water. Pollutant removal methods will include capture and treatment of the first flush and bankfull storm events, as previously described in these standards. In addition, receiving waters shall be protected as previously described.
2. Permanent erosion protection will be placed at bends, drain inlets and outlets, and other locations as needed in all open ditches. Headwalls, grouted riprap, soil bioengineering methods, or other stabilization measures will be provided where necessary to prevent erosion.
3. Outlets to ditches will be placed at the average low water elevation of the watercourse. Outlet velocities will be non-erosive.
4. Ditches with steep grades or unstable soils will be protected by sod, vegetative erosion control, geotextile fabric, riprap or other means to prevent scour.
5. All detention/retention basins will be permanently stabilized to prevent erosion early in the construction schedule and prior to discharge of storm water into the basin or from the basin to a county drain.

SECTION 2: Other Pollution Control

1. Discharge of runoff that may contain oil, grease, toxic chemicals, or other polluting materials is prohibited. Measures shall be employed to reduce and trap pollutants and meet any prevailing federal, state, or local water quality requirements.
2. In commercial and industrial developments where large amounts of oil and grease may accumulate, appropriate methods for separating pollutants shall be required. When used, oil and grit separators will be installed off-line or in locations where flow velocities have been determined to be lower than scouring velocity in a 10-year storm. Where such facilities are proposed, a maintenance program, including an identified method and site for waste disposal, is required.
3. For sites where chemicals may be stored and used (e.g. certain commercial and industrial developments) a spill response plan must be developed that clearly defines the emergency steps to be taken in the event of an accidental release of harmful substances to the stormwater system.
4. Structures designed to remove trash and other debris from stormwater shall be installed as required on stormwater management facilities prior to their outlet.
5. Additional water quality protection measures may be required depending on the nature and location of the development and the receiving waters.

SECTION 3: Buffer Strips

1. Buffer strips are defined as zones where construction, paving, and lawn care chemical applications are prohibited.
2. Buffer strips shall be established adjacent to all surface waters through deed restrictions or provisions of condominium master deed documents.
3. Plantings capable of filtering stormwater shall be preserved or established.
4. The minimum width of the buffer strip shall be 25 feet measured from the top of freeboard.

SECTION 4: Floodplains

1. It is the responsibility of the developer to demonstrate that any activity proposed within a designated 100-year floodplain shall not diminish flood storage capacity.
2. In certain instances, an analysis to determine the 100-year floodplain may be required. Where available, the community flood insurance study shall be used.
3. Compensatory storage shall be required for all lost floodplain storage at a ratio of between 2 to 3:1 as determined by the Drain Commissioner based on the factors of the land and watershed. (Two (2) to Three (3) acres of mitigation for each one (1) filled acre).

SECTION 5: Stormwater Management System Maintenance Plans

A. Maintenance Plans

Maintenance plans will be submitted with all construction plans for privately owned stormwater facilities and included in the subdivision agreement or master deed documents of all subdivisions and site condominiums. These plans shall include the following information:

1. An annual maintenance budget itemized in detail by task. The financing mechanism shall also be described.
2. A copy of the final approved drainage plan for the development that delineates the facilities and all easements, maintenance access, and buffer areas.
3. A listing of appropriate tasks defined for each component of the system described, and a schedule for their implementation. The following areas shall be covered:
 - a. Maintenance of facilities such as pipes, channels, outflow control structures, infiltration devices and other structures.
 - b. Debris removal from catchbasins, channels and basins.
 - c. Dredging operations for both channels and basins to remove sediment accumulation. Stormwater system maintenance plans shall require that sediment be removed when sediment reaches a depth of equal to 50% of the depth of the forebay or 12 inches, whichever is less.
4. The party responsible for performing each of the various maintenance activities described, which shall be recorded with final approved plans and plats.
5. A detailed description of the procedure for both preventative and corrective maintenance activities. The preventative maintenance component will include:
 - a. Periodic inspections, adjustments and replacements.
 - b. Record-keeping of operations and expenditures.
6. Provision for the routine and non-routine inspection of all components within the system described:

- a. Wet weather inspections of structural elements and inspection for sediment accumulation in detention basins shall be conducted annually, with as-built plans in hand. A professional engineer reporting to the responsible agency or owner should carry these out.
 - b. Housekeeping inspections, such as checking for trash removal, should take place at least twice per year.
 - c. Emergency inspections on an as-needed basis, upon identification of problems, should be conducted by a professional engineer.
7. A description of ongoing landscape maintenance needs. Landscaping shall consist of low maintenance native plant species. The proprietor shall monitor the viability of plantings for at least two years after establishment and plantings will be replaced as needed. Subsequent monitoring shall be conducted by the landowner or development association. The Ingham County Drain Commissioner is not responsible for landscape maintenance.
 8. Provision for the maintenance of vegetative buffers by landowner, development associations, conservation groups or public agencies. Buffers must be inspected annually for evidence of erosion or concentrated flows through or around the buffer. Any erosion must be repaired and stabilized.

B. Infiltration Systems

Infiltration systems must be aggressively maintained and protected from clogging by sediment.

1. In the event of clogging by accumulated sediments, partial or total reconstruction of infiltration facilities may be required.
2. Porous pavement shall be vacuum swept and jet hosed at least four times per year to remove any grit or sediment trapped in the pores of the open-graded asphalt.
3. Evidence of a regular service contract for performing this activity will be required.
4. Infiltration systems need to have a positive public outlet.

C. Property Deed Restrictions or Condominium Master Deed Documents

Property deed restrictions or condominium master deed documents shall specify the timeframe for action to address needed maintenance of stormwater management facilities. These restrictions or documents shall also specify that, should the private entity fail to act within this timeframe, the responsible governmental entity may perform the needed maintenance and assess the costs against the property owners within the subdivision or condominium association:

1. Routine maintenance of stormwater management facilities shall be completed per the schedule submitted with the construction plans or within 30 days of receipt of written notification by the responsible governmental entity that action is required, unless other acceptable arrangements are made with the supervising governmental entity.
2. Emergency maintenance will be completed within 36 hours of written notification unless threat to public health, safety and welfare requires immediate action.

D. The Proprietor's Obligation

The proprietor may fulfill the obligation to ensure that a governmental entity will be responsible for drainage system maintenance by establishing a county drainage district, or any other similar mechanism approved by the Ingham County Drain Commissioner, to provide for the permanent maintenance of stormwater management facilities and necessary funding.

E. No Established County Drain

If an outlet drain is not established as a county drain, the proprietor shall submit evidence of a legally binding agreement with another governmental agency responsible for maintenance oversight.

F. Maintenance Agreement

A legally binding maintenance agreement shall be executed before final project approval is granted. Maintenance agreement shall provide for the long-term maintenance of all storm water facilities such as pipes, channels outflow control structures, infiltration devices and other structures. The agreement shall be included in the property deed restrictions or condominium master deed documents so that it is binding on all subsequent property owners and shall include an annual maintenance budget itemized in detail as to task with finance mechanism submitted.

Glossary of Terms

Antecedent Moisture Content (AMC)

The quantity of moisture present in the soil at the beginning of a rainfall event. The Soil Conservation Service has three classifications, AMC I, II, and III.

A.S.T.M.

American Society for Testing Materials.

Backwater

The increased depth of water upstream of a restriction or obstruction, such as a dam, bridge or culvert.

Bankfull Flood

A condition where flow completely fills the stream channel to the top of the bank. In undisturbed watersheds, this occurs on average every 1.5 to 2 years and controls the shape and form of natural channels.

Barrel

The concrete or corrugated metal pipe that passes runoff from the riser through the embankment, and finally discharges to the basin's outfall.

Base Flow

The portion of stream flow that is not due to runoff from precipitation, usually supported by water seepage from natural storage areas such as ground water bodies, lakes or wetlands.

Benthic

Relating to or characteristic of the bottom of a sea, lake, or deep river, or the animals and plants that live there.

Best Management Practice (BMP)

A practice or combination of practices that prevent or reduce stormwater runoff and/or associated pollutants.

Borings

Cylindrical samples of a soil profile used to determine infiltration capacity.

Buffer Strip

A zone where plantings capable of filtering stormwater are established or preserved, and where construction, paving and chemical applications are prohibited.

Catch Basin

A collection structure below ground designed to collect and convey water into the storm sewer system. It is designed so that sediment falls to the bottom of the catch basin and not directly into the pipe.

Check Dam

1. An earthen, aggregate or log structure, used in grass swales to reduce velocity, promote sediment deposition, and enhance infiltration.
2. A log or gabion structure placed perpendicular to a stream to enhance aquatic habitat.

Commercial Development

A change in land use that is not intended as one single family home.

County Drain

An open or enclosed stormwater conveyance system that is under the legal jurisdiction of the Ingham County Drain Commissioner for construction, operation, maintenance and improvement.

Culvert

A closed conduit used for the passage of surface water under a road, or other embankment.

Design Storm

A rainfall event of specified size and return frequency, (e.g., a storm that occurs only once every 2.0 years). Typically used to calculate the runoff volume and peak discharge rate to or from a BMP.

Detention

The temporary storage of storm runoff, to control peak discharge rates and provide gravity settling of pollutants.

Detention Time

The amount of time that a volume of water will remain in a detention basin.

Discharge

The rate of flow or volume of water passing a point in a given time. Usually expressed as cubic feet per second.

Down Cutting

The cutting or the erosion of the bed of a water course.

Drainage area

The area of a watershed usually expressed in square miles or acres.

Drawdown

The gradual reduction in water level in a basin BMP due to the combined effect of infiltration and evaporation.

Easement

A legal right, granted by a property owner to another entity, allowing that entity to make limited use of the property involved for a specific purpose. The Ingham County Drain Commissioner secures temporary and permanent easements adjacent to county drains for the purpose of construction and maintenance access. Easements are recorded on the title to the land and transfer with the sale of land. Also known as a right-of-way.

Erosion

The process by which the land surface is worn away by the action of wind, water, ice, and gravity. Process where soil particles are dislodged or detached and put into motion.

Extended Detention

A stormwater design feature that provides for the holding and gradual release of stormwater over a longer period of time than that provided by conventional detention basins, typically 24-40 hours. Extended detention allows pollutants to settle out before stormwater is discharged from the basin.

Extended Detention Control Device

A horizontal pipe or series of pipes or vertical riser pipe designed to gradually release stormwater from a basin over a 2440 hour interval.

Fill

Added earth that is designed to change the contour of the land.

Filter Fabric

Textile of relatively small mesh or pore size. The two major classifications are as follows: Permeable. This allows water to pass through while holding sediments back. Impermeable. This type prevents both runoff and sediment from passing through.

First Flush

The delivery of a highly concentrated pollutant loading during the early stages of a storm, due to the washing effect of runoff on pollutants that have accumulated on the land.

Floodplain

For a given flood event, that area of land adjoining a continuous watercourse that has been covered temporarily by water.

Flow Path

The distance that a parcel of water travels through a stormwater detention basin or wetland. It is defined as the distance between the inlet and outlet, divided by the average width.

Flow Splitter

An engineered, hydraulic structure designed to divert a portion of stream flow to a BMP located out of the channel, or to direct stormwater to a parallel pipe system, or to bypass a portion of baseflow around a basin.

Forebay

A small, separate storage area near the inlet to a detention basin, used to trap and settle incoming sediments before they can be delivered to the basin.

Freeboard

The space from the top of an embankment to the highest water elevation expected for the largest design storm to be stored or conveyed. The space is required as a safety margin in a basin, basin or channel.

French Drain

A subgrade drain consisting of a trench filled with aggregate to permit movement through the trench and into the soil. The trench may also contain perforated pipe to enhance the efficiency of the system.

Gabion

A rectangular box of heavy gage wire mesh that holds large cobbles and boulders. Used in streams and basins to change flow patterns, stabilize banks, or prevent erosion.

Gradient

A gradual rate of change in a direction.

Ground Water

Naturally existing water beneath the earth's surface between saturated soil particles and rock that supplies wells and springs.

Ground Water Table

The upper surface or top of the saturated portion of the soil or bedrock layer, indicates the uppermost extent of groundwater.

Hydraulic Radius

The area of a stream of conduit divided by its wetted perimeter.

Hydrograph

A graph showing the variation in stage or discharge in a stream or channel, over time, at a specific point along a stream.

Infiltration

The absorption of water into the ground, expressed in terms of inches/hour.

Infiltration Capacity

The maximum rate at which the soil can absorb falling rain or melting snow. Usually expressed in inches/hour, or centimeters/second.

In-line Detention

Detention provided within the flow-carrying network.

Invert

The elevation of the bottom interior surface of a conduit at any given cross section.

Level-Spreader

A device used to spread out stormwater runoff uniformly over the ground surface as sheet flow i.e., not through channels. The purpose of level spreaders is to prevent concentrated, erosive flows from occurring, and to enhance infiltration.

Low Impact Development

Low Impact Development consists of systems to provide water quality control, runoff peak flows and volume control strategies in an attempt to match the pre-development runoff hydrograph for a site. These are based on design elements that reflect soft engineering rather than hard engineering principles. These elements include but are not limited to grass swales, rain gardens, constructed wetlands, and porous pavement.

Manhole

A structure that allows access into the sewer system.

Manning's Roughness Coefficient ("n")

A coefficient used in Manning's Equation to describe the resistance to flow due to the surface roughness of a culvert or stream channel.

Mean Storm

Over a long period of years, the average rainfall event, usually expressed in inches.

Morphology

The external structure of rocks/earth in relation to the development of erosional forms or topographical features.

Multiple Basin System

A collective term for a cluster of basin designs that incorporate redundant runoff treatment techniques within a single basin or series of basins. These basin designs employ a combination of two or more of the following: extended detention, permanent pool, shallow marsh or infiltration.

Natural Wetland

Land characterized by the natural presence of water sufficient to support wetland vegetation.

Non-point Source Pollution

Stormwater conveyed pollution that is not identifiable to one particular source, and is occurring at locations scattered throughout the drainage basin. Typical sources include erosion, agricultural activities, and runoff from urban lands.

Off-line BMP

A water quality facility designed to treat stormwater that has been diverted outside of the natural watercourse or storm sewer system.

Off-site Detention

Detention provided at a regional detention facility as opposed to storage on-site.

One Hundred Year Flood (100-year flood)

The flood that has a 1 percent chance of occurring in any given year.

Ordinary High Water Mark

The line between upland and bottomland which persists through successive changes in water level, below which the presence of water is so common or recurrent that the character of the soil and vegetation is markedly different from the upland.

Orifice

An opening in a wall or plate.

Peak Discharge

The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.

Petition (Under PA 40 of 1956)

A legal request to the Ingham County Drain Commissioner to perform maintenance or construction, or to establish a drainage district. Municipality(s), or freeholders(s), or road commission/MDOT can petition to have work performed or a district established.

Pilot Channel

A riprap or vegetated low flow channel that routes runoff through a BMP to prevent erosion of the BMP surface.

Plat, Platting Process

A legal procedure, and the document that depicts it, whereby a larger piece of property is divided into smaller sections, and is accompanied by a full description of the original property, the dimension of each lot to be subdivided, and all relevant deed restrictions and easements.

Plunge Pool

A small permanent pool located at either the inlet to, or outfall from a BMP. The primary purpose of the pool is to dissipate the velocity of stormwater runoff, but it can also provide some pre-treatment.

Pocket Wetlands

A stormwater wetland design adapted for small drainage areas with no reliable source of base flow. The surface area of pocket wetlands is usually less than a tenth of an acre. The pocket wetland is usually intended to provide some pollutant removal for very small development sites.

Positive Public Outlet

An existing drainage facility that is owned by a public entity. A "Positive Public Outlet" must be available in perpetuity through some legal instrument and is certified by a professional engineer to have adequate capacity without detriment or diminution of the drainage service, which the outlet presently provides.

Pretreatment

Technique to capture or trap coarse sediments within runoff, before they enter a BMP to preserve storage volumes or prevent clogging. Examples include swales, forebays and micro pools.

Project

Any land change that will affect drainage volume, rate or flow pattern.

Proprietor

Any person, firm, association, partnership, corporation or any combination thereof.

Protected Wetland

Any wetland protected by state law or local government regulation.

Punch List

A list of completed components of a project that are built to the satisfaction of the inspector in accordance with the approved plans for the project.

Rational Formula

A simple technique for estimating peak discharge rates for very small developments, based on the rainfall intensity, watershed time of concentration, and a runoff coefficient.

Recharge

When surface water enters the ground and becomes part of the ground water system.

Release Rate

The rate of discharge in volume per unit time from a detention facility.

Retention

The holding of runoff, without release except by means of evaporation, infiltration, or emergency bypass.

Retention Basin

A stormwater management facility designed to capture runoff that does not discharge directly to a surface water body. The water is "discharged" by infiltration or evaporation. Also known as a Wet Basin.

Retention/Detention Basin

This basin has two functions. The first is to retain a permanent level of stormwater. The second is to detain a quantity of stormwater as defined in the definition of detention basin.

Return Interval

A statistical term for the average time of expected interval that an event of some kind will equal or exceed given conditions (e.g., a stormwater flow that occurs every 2 years).

Reverse Slope Pipe

A technique for regulating extended detention times that is resistant to clogging. A reverse slope pipe is a pipe that extends downwards from the riser into the permanent pool and sets the water surface elevation of the pool. The lower end of the pipe is located up to 1 foot below the water surface.

Riffle

A shallow extending across a streambed and causing broken water.

Riparian Lands

Land directly adjacent to a surface water body.

Riprap

A combination of large stones, cobbles and boulders used to line channels, stabilize banks, reduce runoff velocities, or filter out sediment.

Riser

A vertical pipe extending from the bottom of a basin that is used to control the discharge rate from the basin for a specified design storm.

Routing

The derivation of an outflow hydrograph for a given reach of stream or detention basin from known inflow characteristics. The procedure uses storage and discharge relationships and/or wave velocity.

Runoff

The excess portion of precipitation that does not infiltrate into the ground, but "runs off" and reaches a stream, water body or storm sewer.

Runoff Coefficient

The ratio of the amount of water that is NOT absorbed by the surface to the total amount of water that falls during rainstorm.

Sedimentation

The process whereby the detached soil particles generated by erosion are deposited elsewhere on the land or in the waters of the State.

Sheetflow

Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.

Short Circuiting

The passage of runoff through a BMP in less than the theoretical or design detention time.

Soil Group, Hydrologic

A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from "A Soils" which are very permeable and produce little runoff, to "D Soils" which are relatively impermeable and produce much more runoff.

Spillway

A depression in the embankment of a basin or basin, used to pass peak discharges in excess of the design storm.

Stormwater Basin

Basins can be classified into four groups:

1. Detention Basin: A basin that remains dry except for short periods following large rainstorms or snow melt events. This type of basin is not effective at removing pollutants.
2. Extended Detention Basin A dry detention basin that has been designed to increase the length of time that stormwater will be detained, typically between 24-40 hours. This type of basin is not effective at removing nutrients such as phosphorus and nitrogen, unless a shallow marsh is incorporated into the lower stage of the design.
3. Wet Detention Basin A basin that contains a permanent pool of water that will effectively removes nutrients in addition to other pollutants.
4. Extended Wet Detention Basin A wet detention basin that has been designed to increase the length of time that stormwater will be detained, typically between 24-40 hours.

Stormwater Wetland

A conventional stormwater wetland is a shallow pool that creates growing conditions suitable for the growth of marsh plants. Stormwater wetlands are designed to maximize pollutant removal through wetland uptake, retention and settling. These constructed systems are not located within delineated natural wetlands.

Stream

By MDNR definition: "a river, creek, or surface waterway that may or may not be defined by Act 40, PA of 1956; has definite banks, a bed, and visible evidence of continued flow or continued occurrence of water, including the connecting water of the Great Lakes." Even if water flow is intermittent, it is classified as a stream.

Swale

A natural depression or wide shallow ditch used to temporarily convey, store, or filter runoff.

Tail water

The depth of water at the downstream end of a culvert or crossing.

Time of Concentration

The time it takes for surface runoff to travel from the hydraulically farthest portion of the watershed to the design point.

Timing

The relationship in time of how runoff from sub-watersheds combines within a watershed.

Undercutting

The cutting or the erosion of the bank of a water course.

Underdrain

Perforated pipe installed to collect and remove excess runoff.

Watershed

The complete area or region of land draining into a common outlet such as a river or body of water.

Weir

A structure that extends across the width of a channel, and is used to impound, measure, or in some way alter the flow of water through the channel.

Wetland Mitigation

A regulatory term that refers to the process of constructing new wetland acreage to compensate for the loss of natural wetlands during the development process. Mitigation seeks to replace structural and functional qualities of the natural wetland type that has been destroyed. Stormwater wetlands typically do not count for credit as mitigation, because their construction does not replicate all the ecosystem functions of a natural wetland.

Wetted Perimeter

The wetted surface of a stream or culvert cross section that causes resistance to flow. The water to surface interface is a distance, typically expressed in feet.

Supplemental Standards No. 1 – March 18, 2008

Section 8: C Enclosed Drainage System – 7

Add - Wrap all manhole and catchbasin joints on the outside with at least two wraps of geotextile.

Section 8: C Enclosed Drainage System – 11e

Add – Furnish all manholes with the Ingham County Drain Commissioner's cover, East Jordan Ironworks EJIW 1040 C frame and cover (Product Number NCR07-205A for the lid).

Section 10: B Connections – 5

The referenced specification section of the Rules of the Ingham County Drain Commissioner, 2005 Edition is hereby amended to read "Stormwater leads connected into manholes, catchbasins, and pipes must be cored " *whenever possible. Block and brick structures must have approval of the ENGINEER before coring. Boots are required for PVC and HDPE pipe. Concrete pipe connections must be filled with non-shrink grout, hydraulic cement or Type-M mortar, on the inside and outside of the structure with a final smooth finish and wrapped on the outside with at least two wraps of geotextile.*



Patrick E. Lindemann
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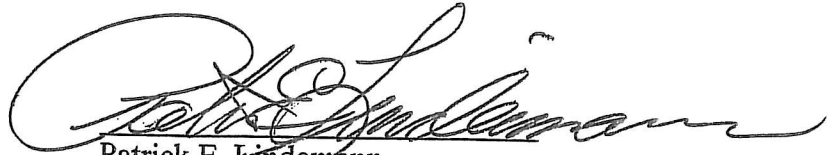
Dated this 18th of March 2008

Patrick E. Lindemann, Ingham County Drain Commissioner
Signed copy in the Office

Supplemental Standards No. 2 – July 30, 2009

Section 10: (at the end of the first paragraph);

In any event, prior to the issuance of a permit to cross, connect or encroach upon a drain or drain easement, all applicants must demonstrate that any and all other crossings, connections or encroachments within Ingham County are in compliance with this Section 10.



Patrick E. Lindemann
Ingham County Drain Commissioner
707 Buhl Avenue
P.O. Box 220
Mason, MI 48854
(517) 676-8395

Dated this 30th day of July, 2009

Standards for Stormwater Management
Systems, Procedures and Design Criteria

Supplemental Standards No. 3 – November 30, 2015

The following Sections of the Rules of the Ingham County Drain Commissioner, 2005 Edition, are hereby revised and amended as follows:

PART 2: PROCEDURES FOR PLAN SUBMISSION, REVIEW AND CONSTRUCTION

Section 2: Preliminary Plan Submittal and Approval

C. Drainage Information Requirements

1. through 2. remain unchanged.
3. Submittal will require the following stormwater management information:
 - a. The overall stormwater management system for the proposed subdivision or development, indicating how stormwater management will be provided and the location of the positive public outlet.
 - b. The location of any on-site and/or off-site stormwater management facilities and appropriate easements that will be dedicated to the entity responsible for their future operation and maintenance. Easement information will be consistent with these Rules.
 - c. An easement dedication to the applicable intra or inter county drainage district will be contained in the proposed plat or plan. Applicant shall also provide Easement(s) in recordable form and consistent with these Rules for all on-site and/or off-site stormwater management facilities. The easement(s) shall be recorded upon final approval.
 - d. A description of the off-site outlet and evidence of its adequacy.
 - e. A map at the U.S.G.S., 7.5-minute quadrangle scale, showing the drainage area tributary to the outlet from the proposed development and its relationship with existing drainage patterns. This drainage boundary shall include any drainage originating outside of the development limits, that flows onto or across the development.
 - f. Any drainage originating outside of the development limits that flows onto or across the development shall not be passed through on-site stormwater storage facilities unless alternatives are proposed for the off-site flow that will achieve the objectives of these standards, including but not limited to water quality standards, such as separate basins for water quality treatment and storage of the 100-year storm volume.
 - g. Any natural watercourses and/or Inter and Intra County Drains passing through the proposed development.
 - h. Provide calculations to show that the hydrology for all existing wetlands will not be affected by the proposed change, this would include the water budget and hydro period for the wetland.

Standards for Stormwater Management
Systems, Procedures and Design Criteria

Supplemental Standards No. 3 – November 30, 2015

4. through 9. remain unchanged.

PART 2: PROCEDURES FOR PLAN SUBMISSION, REVIEW AND CONSTRUCTION

SECTION 3: Construction Plan Submittal and Approval

E. Final Subdivision Plat Submission and Approval

1. remains unchanged.

2. An executed agreement in recordable form that assures long-term maintenance of all legally described drainage improvements such as an agreement as provided under Sections 425 or 433 of the Michigan Drain Code, as amended (MCL 280.425; MCL 280.433), Maintenance Agreement, or other similar agreement that is acceptable to the Ingham County Drain Commissioner. The agreement shall legally describe the location of the drainage improvements, e.g. stormwater management facilities, and the entity responsible for their future operation and maintenance. The term stormwater facilities include, but are not limited to, catch basins, detention basins, oil/water separators, pump stations, secondary containment, vegetated swales, constructed wetlands, infiltration basins and trenches, porous pavement, rain gardens, underground storage vaults or tanks, or biofilters. The applicant shall record the agreement along with any easement(s) in the county register of deeds. The agreement and easement(s) may be combined in one document provided the form and substance are acceptable to the Ingham County Drain Commissioner.

3. through 8. remain unchanged.

PART 3: DESIGN CRITERIA FOR STORMWATER MANAGEMENT SYSTEMS

Revise and amend the fourth paragraph to read as follows:

First, eroded soil and other pollutants that accumulate on impervious surfaces, such as metals, fertilizers, pesticides, oils and grease, are flushed off by the early stages of runoff, which then carries a shock loading of these pollutants into receiving waterways. By capturing and treating the first 1.0 inch of runoff, pollutants that are washed off the land can be removed from stormwater before it flows offsite.

Revise and amend the sixth paragraph, third bullet point to read as follows:

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- The first flush volume; the runoff from the first 1.0 inch of rain from the entire contributing watershed.

PART 3: DESIGN CRITERIA FOR STORMWATER MANAGEMENT SYSTEMS

SECTION 3: Retention and Detention Systems

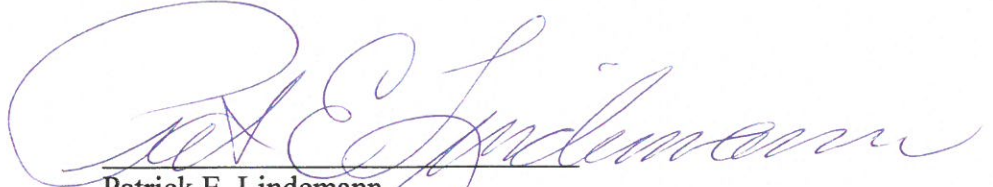
A. General Requirements

1. through 5. remain unchanged.
6. On-site management of storm drainage will be designed for control of flooding, downstream erosion and water quality. It is generally preferred that stormwater management plans address stormwater issues on the same site. Submission of flow calculations, cross sections and other pertinent data will be required.
 - a. The volume of storage provided for flood control will be equal to or in excess of that required for a 100-year frequency storm.
 - b. The allowable release rate from the flood control storage volume will be 0.15 cfs/acre of the property being drained, or as determined by the Ingham County Drain Commissioner.
 - c. If the discharge does not outlet to a clearly defined public outlet, it is the developer's responsibility to secure necessary easement(s) from downstream property owner(s).
 - d. The volume and storage provided for controlling the bankfull flood will be equal to or in excess of the runoff from a 2.0-year/24-hour storm, which can be determined by: $(8170 \times \text{acreage} \times \text{the relative imperviousness factor } C)$.
 - e. The release rate from the bankfull storage volume will be such that this volume will be stored not less than 24 hours, nor more than 48 hours.
 - f. The first flush volume of runoff will be captured and detained for at least 24 hours or within a permanent pool. This volume is equivalent to the runoff from 1.0 inches of rain per acre of the land tributary to the basin. This volume can be determined by multiplying the number of acres by 3630 (number of acres x 1.0 inch x 43,560 x 1/12 feet).

Rules of the Ingham County Drain Commissioner, 2005 Edition, as amended

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Dated this 30 day of NOV., 2015

