

# VOLUME I

## ARTICLE I

### DEFINITIONS

Unless the context specifically indicates otherwise, the meaning of terms in these Rules and Regulations shall be as follows:

#### **Section ST 101**

##### **BUILDING PERMIT:**

A permit issued by the Hamilton County Department of the Building Commissioner, and required for the lawful construction, alteration, removal or demolition of any building or change in occupancy thereof from one use or use group to another; or the installation or alteration of any equipment for which provision is made or the installation of which is regulated in the Hamilton County Building Code, except that ordinary repairs as defined in the current applicable Section thereof, which do not involve any violation of the code shall be exempt.

#### **Section ST 102**

##### **BASE FLOOD:**

That flood having a one (1) percent chance of being equaled or exceeded in any given year (100 year flood).

#### **Section ST 103**

##### **BASE FLOOD LEVEL:**

The elevation above mean sea level (NGVD) of the base flood discharge.

#### **Section ST 104**

##### **COMBINED SEWERS:**

Shall mean a sewer, which is designed to carry sanitary sewage, industrial waste and storm water.

#### **Section ST 105**

##### **COUNTY:**

Any reference to County or Hamilton County in these Rules and Regulations apply to the unincorporated areas of Hamilton County, Ohio.

#### **Section ST 106**

##### **COUNTY WATERCOURSE:**

Shall mean a watercourse over which the County has easements for maintenance and channels.

#### **Section ST 107**

##### **DESIGNATED FLOODWAY:**

Prohibits encroachments within the adopted regulatory floodway that would result in any

increase in flood levels within the community during the occurrence of the base flood discharge.

**Section ST 108**

**DEVELOPMENT:**

Any manmade changes to improved or unimproved sites, including, but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.

**Section ST 109**

**DRAINAGE CHANNEL:**

Shall mean any artificially constructed open channel, ditch, swale, or flume, whether lined or unlined, for the drainage of storm water and ground water.

**Section ST 110**

**DRAINAGE COURSE:**

A system of well-defined natural or man-made facilities such as swales, valleys, streams, ponds, lakes, pipes, culverts, detention and/or retention basins to continuously or intermittently convey runoff.

**Section ST 111**

**EASEMENTS:**

A grant by a property owner of the use, for specific purposes, of a piece or portion of land without passage of fee title.

**Section ST 112**

**ENCROACHMENT:**

Any development (as defined) within the regulatory floodway of any Special Flood Hazard Area, which will result in any increase in base (100 year) flood level during the occurrence of the base flood discharge. Encroachment is determined by application of the equal degree of encroachment principle to the proposed development.

**Section ST 113**

**EQUAL DEGREE OF ENCROACHMENT:**

A standard applied in determining the location of floodway limits so that both sides of a stream are capable of conveying a proportionate share of flood flows. This is determined by considering the hydraulic conveyance of the flood plain along both sides of a stream for a significant reach.

**Section ST 114**

**EROSION:**

The wearing away of earth materials, either surface or subsurface, by the actions of water, wind, ice, gravity or a combination thereof.

**Section ST 115**

**FLOOD OR FLOODING:**

A general, or temporary condition, or partial, or complete inundation of normally dry land areas from the overflow of inland waters; the usual and rapid accumulation or runoff of surface waters from any source.

**Section ST 116**

**FLOOD PLAIN:**

Means any land area susceptible to being inundated by water from any source.

**Section ST 117**

**FLOOD PROTECTION ELEVATION (FPE):**

That elevation which is one (1) foot above the base flood elevation.

**Section ST 118**

**FLOODWAY:**

Represented by the Flood Boundary and Floodway Maps for unincorporated Hamilton County, Ohio, as defined in Section ST 403(b), (C) and (D), it means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot. This applies to Zones A1-30 only. For similar restrictions in unnumbered A Zones, refer to Section ST 112(b), 117(b), 142(b), 144 and 156.

**Section ST 119**

**FLOODWAY FRINGE:**

Represented by the Flood Boundary and Floodway Maps for unincorporated Hamilton County, Ohio, as defined in Section ST 403(b), (c) and (d), it means that part of any flood plain which is outside of the floodway area. This applies to Zones A1-30 only.

**Section ST 120**

**GRADE:**

Slope of a road, street, or other public way, specified in percent, and shown on street profile drawings.

**Section ST 121**

**GRADING PERMIT:**

A permit for earth disturbing activity means any grading, excavating, filling or other alteration of the earth's surface where natural or man-made ground cover is destroyed and which will have probable effect on the stability of hillsides and slopes and contribute to erosion and sediment pollution and also, as defined in Section ST 125, or a letter typed, indicating approval by the Hamilton County Public Works Director for special cases (Also, refer to Section ST 412 and 413).

**Section ST 122**

**GRADING PLAN:**

A plan showing existing and proposed contour lines of any new development. See Section ST 413.

**Section ST 123****HAZARD:**

Any earth condition of considerable consequence to any property, or to public health and safety, which has been established through experience to be of certain or probable consequence, or which can be determined to be, or which is obviously a threat to property or public health and safety, including, but not limited to conditions which cause inadequate drainage, disruption of the sewer system, slope stability problems, or imposition of unsafe loads on structures or slopes.

**Section ST 124****HIGH WATER ELEVATION:**

Generally the base flood level (100 year flood) or equivalent 100 year flood of the "Restrictive Flood Plain Zone" (Section ST 144), for land within any special flood hazard area. For other land, the highest level of flood water during past flooding events, or that which may be reasonably expected as determined by criteria to be used in Articles VII and VIII in these Rules and Regulations.

**Section ST 125****IMPROVEMENT PLANS:**

Detailed construction drawings of any new development that must conform to the Rules and Regulations of the Hamilton County Department of Public Works, Hamilton County Engineer, Metropolitan Sewer District or any other government agency that may be involved in the approval of the plans.

**Section ST 126****LOT:**

Any recorded unit area of land intended for transfer of ownership or for building development.

**Section ST 127****MANUFACTURED HOME:**

A structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. It includes park trailers, travel trailers, and other similar vehicles placed on a site for greater than 180 consecutive days.

**Section ST 128****MASTER PLAN:**

The comprehensive plan for Hamilton County or any part thereof adopted by the Planning Commission indicating the general location recommended for motorways, parks, and other public open spaces, public building sites, public utilities and the character and extent of neighborhood and community development.

**Section ST 129**

**NATURAL OUTLET:**

Any outlet of storm water into a watercourse, drainage course, or other body of surface or ground water.

**Section ST 130**

**PLANNING COMMISSION:**

The Hamilton County Regional Planning Commission and its technical staff.

**Section ST 131**

**PLAT OF SUBDIVISION:**

A map showing the division of any tract of land into two or more parcels, and prepared for the purpose of recording. (See Section ST 132,133,135,140 and 407 for various items of easement information which the plat must include).

**Section ST 132**

**PRIVATE DETENTION/RETENTION BASIN EASEMENT PLAT AND AS-BUILT DRAWING:**

A map showing the limits of the detention/retention basin and metes and bounds prepared for the purpose of recording. A storm water detention as-built will be required before the bond is released for subdivisions. A storm water detention "As-Built" and a "Private Drainage Easement for Storm Water Detention" signed mylar plat or Bond will be required before a Temporary Certificate of Occupancy (TCO) or Certificate of Occupancy (CO) is issued for commercial projects. No (TCO) or (CO) will be issued until the storm water detention "As-Built" and "Private Drainage Easement for Storm Water Detention" mylar plat is signed and submitted.

A Home Owner's Association (HOA) is responsible for the maintenance of all detention basins within subdivisions. The maintenance responsibility will be transferred to the proportional distribution of the property owners within the residential development if the (HOA) is dissolved.

If a Home Owner's Association (HOA) is not formed the maintenance responsibility will be the proportional distribution of the property owners within the residential development. If the property owners within the development do not maintain the storm water detention facility, Hamilton County reserves the right to maintain the detention basin and place the proportional costs plus 50% on the tax bill of each property within the development.

The easement shall be included with the plat of subdivision, etc. For additional requirements, refer to Section ST 407(b) and 1104(e) (4).

**Section ST 133**

**PRIVATE DRAINAGE EASEMENTS:**

An easement over existing water or drainage courses which extend over two or more adjacent lots, the owners of which are to be responsible for the maintenance of the courses.

**Section ST 134**

**PRIVATE SEWER:**

Shall mean a sewer, which is not owned and not maintained by the Public Authority.

**Section ST 135**

**PRIVATE STORM SEWER EASEMENT:**

An easement over existing storm sewers which extend over two (2) or more adjacent lots. The owners of which are to be responsible for the maintenance of the storm sewers.

**Section ST 136**

**PRIVATE STORM DRAINAGE LIMIT PLAT:** Not used

**Section ST 137**

**PUBLIC AUTHORITY:**

Shall mean any government agency having jurisdiction by law.

**Section ST 138**

**PUBLIC IMPROVEMENT:**

Any of the following: Roadway pavements; curbs; gutters; sidewalks; crosswalks; water mains; sanitary and storm sewers; drainage channels or other appurtenant construction as shown on any Improvement Plan that is to be maintained and operated by the public authority having jurisdiction.

**Section ST 139**

**PUBLIC OPEN SPACES:**

Small neighborhood parks, playgrounds, or other public recreational spaces.

**Section ST 140**

**PUBLIC EASEMENT:**

A grant by a property owner of the use, for a specific purpose or purposes, of a designated strip of land to the general public, permitting construction, maintenance, or repair of new or existing utilities or improvements; and in which no permanent building or structures will be permitted.

**Section ST 141**

**PUBLIC SEWER:**

Shall mean a storm sewer, which is owned and maintained by a public authority.

**Section ST 142**

**PUBLIC WORKS DEPARTMENT:**

Shall mean the Department established by the Board of County Commissioners of Hamilton County, Ohio, for the purpose of managing and operating the Public Storm Drainage System, which lies within the unincorporated areas of Hamilton County.

**Section ST 143**

**REGULATORY FLOODWAY:**

Means the channel of a river or other water courses and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

**Section ST 144**

**RESOLUTION ADOPTING FLOOD DAMAGE PREVENTION REGULATIONS FOR UNINCORPORATED HAMILTON COUNTY OHIO:**

This resolution (Exhibit No. 36), was adopted October 26, 1988 (Volume 232, Image 481 through 494), and supersedes a previous resolution that was adopted September 15, 1982. The resolution applies to all new construction, substantial improvements and other developments located within or affected by the Special Flood Hazard Areas. The resolution complies with the minimum requirements of the National Flood Insurance Program as specified in 44 CFR, Section 59.1, et seq.

**Section ST 145**

**RESTRICTIVE FLOOD PLANE ZONE:**

The floodway is the part of the flood plane, which carries and discharges the largest part of the flood flow. Fringe areas outside the floodway serve primarily as storage areas for floodwaters, and can be filled in or otherwise obstructed without causing more than a one-foot rise in the base flood elevation upstream. However, any obstruction in the floodway, which causes any rise, is prohibited. This is because any obstruction in the floodway, which causes a rise in the base flood elevation, will increase base flood elevations by more than one foot when the fringe areas are obstructed.

**Section ST 146**

**RIGHT-OF-WAY:**

That area of land within legally established boundaries occupied by a street, alley, crosswalk, railroad, electric power line, pipeline, sewer, drainage channel, or for any easement for special use.

**Section ST 147**

**ROADWAY:**

The paved portion of a street available for vehicular traffic; including paved and unpaved berms.

**Section ST 148**

**RUNOFF:**

Water which moves over the ground surface.

**Section ST 149**

**SANITARY SEWER:**

Shall mean a sewer, which carries sanitary sewage, sanitary effluent and industrial, wastes, and to which storm, surface, and ground water are not intentionally admitted.

**Section ST 150**

**SPECIAL FLOOD HAZARD AREAS:**

(a) All that area within Zones A1-30 on the Flood Insurance Rate Map for Unincorporated Hamilton County, Ohio.

(b) All that area within the unnumbered A Zones on the Flood Insurance Rate Map for Unincorporated Hamilton County, Ohio; also designated as being within the "Restrictive Flood Plain Zone" (assumed equivalent 100 year base flood) for the same area as indicated in Appendix "A" of the Consoer-Townsend Storm Drainage and Open Space Master Plan for Hamilton County, Ohio.

(c) All that area within the unincorporated territory of Hamilton County, Ohio, designated as being within the "Restrictive Flood Plain Zone" of other streams in Appendix "A" of the Consoer-Townsend Storm Drainage and Open Space Master Plan for Hamilton County, Ohio, that are not included in (a) and (b) above.

(d) Refer to Section ST 403 for additional information.

**Section ST 151**

**STORM SEWER:**

Shall mean a sewer which carries storm, surface waters and drainage, but which excludes sanitary sewage and industrial wastes other than unpolluted cooling water as indicated in Article VI.

**Section ST 152**

**STREET:**

A right-of-way designed for vehicular and pedestrian traffic and affording the principal means of access to abutting property.

**Section ST 153**

**SUBDIVISION:**

(As defined in Section 711.001 of the Revised Ohio Code)

(a) The division of any parcel of land shown as a unit or as contiguous units on the last preceding tax roll, into two or more parcels, sites, or lots, any one of which is less than five acres, for the purpose, whether immediate or future, of transfer of ownership; provided, however, that the division or partition of land into parcels of more than five acres not involving any new streets, or easements of access, and the sale or exchange of parcels between adjoining lot owners, where such sale or exchange does not create additional building sites, shall be exempted; or

(b) The improvement of one or more parcel of land for residential, commercial, or industrial structures or groups of structures involving the division or allocation of land for the opening, widening or extension of any street or streets, except private streets serving industrial structures; or

(c) The division or allocation of land as open spaces for common use by owners, occupants or lease holders or as easements for the extension and maintenance of public sewer, storm drainage or other public facilities.

**Section ST 154**

**SUBDIVISION IMPROVEMENT PLAN:** A drawing showing a proposed subdivision of land together with the public improvements, which are to be installed therein. (See Articles I and VI through XI for items of information which the plan must include as well as other applicable agency regulations).

**Section ST 155**

**UNNUMBERED A ZONES:**

The flood plain limits of areas designated as Zone A (unnumbered A Zones) on the Flood Insurance Rate Maps, the Flood Boundary and Floodway Maps for Unincorporated Hamilton County, Ohio represent approximate boundaries for the 100 year base flood. However, base flood elevations and flood hazard factors were not established under this Flood Insurance Study in the unnumbered A Zones. The one hundred (100) year flood data as defined under "Restrictive Flood Plain Zone", Section ST 145; is to be used to determine whether there is encroachment in the flood plain for any new development in the unnumbered A Zones. It must be noted here, that the fifty (50) year "Restrictive flood plain Zone" flood data was calculated by assuming ultimate upstream development. This is assumed to be equivalent, in the absence of any other available flood study, to the one (100) year base flood of the Flood Insurance Study which used existing upstream runoff conditions at the time the Flood Insurance Study was developed between 1974 and 1979. For Regulatory Floodway definition in an unnumbered A Zone, See Section ST 143(b).

**Section ST 156**

**WATERCOURSE:**

A natural channel through which a flow of water occurs, either continuously or intermittently.

**Section ST 157**

**ZONING:**

Regulation by districts of the height, area, and use of buildings; use of land; and density of population.

## ARTICLE II

### CONTROL OF STORM SEWERS

#### **Section ST 201**

All "public" storm sewers in the unincorporated area of Hamilton County shall be controlled by the Board of County Commissioners, Hamilton County, Ohio through the offices of the Hamilton County Public Works and the Hamilton County Engineer.

#### **Section ST 202**

All public or private storm sewers shall continue to be owned by the respective public or private owners now owning same until such time as the owner and the Board of Hamilton County Commissioners mutually agree to a transfer of Ownership to or from the Board of Hamilton County Commissioners.

#### **Section ST 203**

Except for storm sewer design by or for the Hamilton County Engineer for installation within the right-of-way or easement of a Hamilton County Road or otherwise installed within such right-of-way or easements under a permit issued by the office of the Hamilton County Engineer; no storm sewer should be constructed within the unincorporated areas of Hamilton County, Ohio without the prior written approval of the Hamilton County Director of Public Works. In addition no final development plan, as defined in the Hamilton County Zoning Resolution should be approved by the Hamilton County Regional Planning Commission until a detailed plan describing the methods of collection and deposition of storm water drainage be first submitted by the Developer for review and approval to the office of the Director of the Department of Public Works.

The Director of the Department of Public Works will ensure that the Hamilton County Engineers Office has the opportunity to review and approve the methods of collection and disposition of storm water drainage involving developments as they effect the Hamilton County Road System.

#### **Section ST 204**

Any connection to a storm sewer under the jurisdiction of the Board of Commissioners of Hamilton County, Ohio (excepting those within the right-of-way or easement limits of Hamilton County roads and maintained by the Hamilton County Engineer) shall be subject to these Rules and Regulations and to any charges, rates, fees, and assessments which are or may be established by the Board of Hamilton County Commissioners as being applicable, and shall be made under permits and/or written approvals issued by the County Public Works Department.

#### **Section ST 205**

Except for storm sewers within the right-of-way or easement limits of Hamilton County roads maintained by the Hamilton County Engineer, no extension or modification shall be made to any storm sewer controlled by the Board of Hamilton County Commissioners, without the prior written approval of the County Public Works

Director.

**Section ST 206**

Public Storm sewers shall not be located under any building. Private storm sewers, maintained by Property Owners, will only be permitted as a final solution. Only if all other options are not feasible will location of private storm sewers beneath buildings be permitted. If such construction is permitted, design of an adequate building foundation system and access to the storm system is required.

**Section ST 207**

Neither submission of a plan under provisions of these regulations nor compliance with provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law. Approval of plans or any action by the Enforcing Official under these regulations shall not create in Hamilton County, its officers, agents or employees any liability or responsibility for injury to persons or property caused by operations or conditions created pursuant to such permits. Nothing in these regulations shall be construed to relieve the owner or person in control of property from liability for injury to persons or property.

Approval of plans by the Hamilton County Department of Public Works does not relieve the designer's responsibility for accuracy, nor compliance with these regulations.

**Section ST 208**

No more than one building permit will be issued in a single family subdivision until all storm sewers are properly installed within the development phases.

## **ARTICLE III**

### **GENERAL POLICY**

#### **Section ST 301**

(a) Within the unincorporated areas of Hamilton County, Ohio, no building shall be erected on any land nor shall any changes be made in the existing contours of any land, including any change in the course, width, or elevation of any existing watercourse or drainage channel, in any manner that will obstruct, interfere with, or change the drainage of such land, considering future development, without providing adequate drainage in connection therewith.

(b) Prior to the issuance of a Building Permit for new structures by the Building Commissioner of Hamilton County, the Building Permit drawing shall be reviewed and approved regarding adequate flood protection measures by the Office of the Hamilton County Director of Public Works. This review and approval process shall be in accordance with the flood protection measures contained within these Rules and Regulations.

The Director of Public Works retains the authority to require and request from each developer additional information deemed necessary to properly and adequately review and approve the building permit plans.

#### **Section ST 302**

For buildings on developed lots, as in subdivisions, etc., adequate surface grading, building drains and/or sewer-connected drains shall be provided. This grading, and the drains where necessary, shall be shown on the survey/site plan of the building permit plans. The Hamilton County Building Commissioner is responsible for obtaining this plan prior to issuing any building permit. Requirements for out letting of downspouts are included in Section E-206 of the Hamilton County Engineers Subdivision Manual ("Rules and Regulations of the Office of the Hamilton County Engineer Governing Surface Public Improvements for Private Developments within the Unincorporated Areas of Hamilton County, Ohio") dated November 1, 1993 (or as subsequently revised). Downspout outlets shall comply with these Rules and Regulations as well as the Rules and Regulations of the Plumbing Division of the Hamilton County Board of Health and the Building Commissioner of Hamilton County. Developers are advised that when downspouts are out letted to the rear (or side) of a proposed lot, that flow should not be directed toward another building, or to a subdivision lot where a building is likely to be constructed, which would create storm water problems for such building.

The Hamilton County Director of Public Works is not responsible for review of plans for downspout outlets, or the issuance of permits for such. The review and approval shall be obtained from the office of the Hamilton County Engineer and the office of the Plumbing Division or the Hamilton County Board of Health.

### **Section ST 303**

For buildings in any development, adequate surface grading, roof downspouts, yard drains, driveway or parking lot drains, basement stairwell, patio, and window well or foundation drains must be provided, as necessary. The Developer, Owner, Builder, or Owner's Engineer and/or Architect, whichever individual applies, is responsible for investigating and resolving any potential flood hazard to the building as a result of allowing storm water in any of the above named drains to gravity flow into a flood prone watercourse, drainage channel or storm sewer system, thereby creating a potential water backup problem to the building due to the gravity flow system employed. Sump pump installations shall be installed and any flood prone building shall be protected against flooding to the one hundred (100) year flood, in accordance with these rules and regulations. See Section ST 804 (g). All downspout collector lines and all individual downspout and sump pump tees are to be shown on the subdivision improvement plans.

### **Section ST 304**

Every development shall be provided with a storm drainage system capable of handling storm waters flowing onto the development site from other areas as well as runoff from precipitation on the site itself. The drainage system shall discharge into a watercourse or drainage channel or other existing storm drainage facility.

### **Section ST 305**

All parts of the development shall be graded and drained to prevent the ponding of storm water, except for wetlands, approved detention and/or retention basins, ponds, lakes, lagoons, etc. Where necessary, drainage channels, culverts, or sewers shall be provided to convey the water to an existing watercourse or outlet. The method and means of drainage, including the treatment of paved and unpaved areas, shall be subject to approval by the County Public Works Director.

### **Section ST 306**

For all new developments, improvements where necessary, shall be constructed in accordance with these Rules and Regulations when the storm water flow from the tributary area, as determined by the County Public Works Director, is a hazard to adjoining property. An investigation of immediate downstream conditions or as reasonably agreed upon by the Civil Engineer and Public Works is required by the Owner/Developer. If the downstream property owner(s) refuse to allow access a letter must be submitted by the downstream property owner(s) or the Owner/Developer stating the refusal.

### **Section ST 307**

(a) Storm sewers must be extended to an existing watercourse or drainage channel within a development, or to the developments outer limits a minimum of 40' from the property line where the existing watercourse or drainage channel enters and/or leaves the development, or connected to an existing storm sewer system.

(b) Storm sewers that are to be constructed in new subdivisions shall be located

as shown on the Hamilton County Engineers Subdivision Standard Drawings.

(c) Storm sewers must outlet into existing watercourses with the direction of the flow of water.

(d) Storm sewers for all new developments, in addition to the condition described in (b) and (c) above, shall be located in accordance with these Rules and Regulations in such a manner as to minimize future maintenance, hazards, and other considerations.

(e) There may be conditions existing where the Developer obtains a storm sewer easement from an adjacent property Owner for the purpose of extending the storm sewer to an existing watercourse or existing storm sewer system. This must be shown on the plans. Any required easement plat must also be reviewed and approved by the County Public Works Director.

(f) The use of curved storm sewer pipe is not permitted except by special permission of the County Public Works Director.

### **Section ST 308**

In general, closed storm sewer systems are recommended to be provided in all new developments. The intermittent or alternate use of storm sewers and open drainage channels in the same watercourse will not be approved without the direct consent of the Director of Public Works. Direct connection to existing off site storm sewer systems is required when practical and easements and Right-of-Entry can be reasonably obtained.

### **Section ST 309**

Storm water shall flow into catch basins before reaching any roadway intersection. Refer to Section ST 710(b) for catch basin design criteria to be used at intersections and elsewhere.

### **Section ST 310**

The storm water drainage system shall not be combined with any part of a sanitary sewer system, nor shall sanitary effluent pipe from any source be directly connected and discharged into a storm water drainage system. Refer to Exhibit No. 1, Note 16 also.

### **Section ST 311**

In the case of a development proposed within any special flood hazard area, as defined in Section ST 150, a special flood hazard area development permit must be issued by the County Public Works Director. Refer to Exhibit No. 35 for procedures to be followed.

### **Section ST 312**

Within the regulatory floodway of Zones A1-30 of any special flood hazard areas as defined in Section ST 150(a);

(a) Encroachments, as defined in Section ST 112 of these Rules and Regulations, are prohibited.

(b) Building sites (including manufactured homes as defined in Section ST 127) for, or, structures intended for human habitation shall not be approved.

(c) Building sites, and/or structures not intended for human habitation may be approved, if they do not constitute encroachment as defined in Section ST 112(a) of these regulations.

(d) Proposed construction of non-residential structures, on approved building sites shall meet all of the applicable requirements of the National Flood Insurance Program, the Hamilton County Building Code, and the Ohio Basic Building Code, and the Hamilton County Flood Damage Prevention Regulations.

(e) Refer to Exhibit Number 35 for other controls on any development to be constructed within the special flood hazard area, as defined in Section ST 150(a).

### **Section ST 313**

Within Zones A1-A30 of any special flood hazard area:

(a) Building sites, including manufactured homes (see ST 127), and/or structures intended for human habitation may be approved if the lowest floor, including basement, is elevated one foot above the Flood Protection Elevation (F.P.E.) as defined in Section ST 117.

(b) Building sites and/or structures not intended for human habitation may be approved, and subdivisions of land for commercial and industrial use may be approved if:

(1) They are proposed to be graded and developed as in Section ST 131(a) above; or

(2) Structural flood proofing, elevated one foot above the Flood Protection Elevation (F.P.E.), as defined in Section ST 117, shall be provided by the Builder/Developer and is certified pursuant to the various appropriate sections of the Hamilton County Building Code and the Ohio Basic Building Code, and the Hamilton County Flood Damage Prevention Regulations.

(c) Refer to Exhibit Number 35 for other controls on any development to be constructed within the Special Flood Hazard Areas as defined in Section ST 150(a).

## **ARTICLE IV**

### **IMPROVEMENT PLANS**

#### **Section ST 401**

##### **General**

(a) There shall be submitted, for review and approval by the County Public Works Director, drainage area maps, design calculations and detailed construction drawings for:

- (1) the proposed storm drainage system;
- (2) any flood studies required to resolve potential flooding problems created by the new development;
- (3) any detention or retention basins, when required (see Section ST 405, 711 and 712);
- (4) Additional requirements refer to Articles VII through XI and Exhibit No. 36.

(b) The improvement plans must respect any flooding problems. The one hundred (100) year flood, using the criteria established in Articles VII and VIII, shall apply. Flood plain limits and flood elevations shall be shown on the grading plan and profile if the project is in a flood prone area. Said flood prone areas include all Regulatory Flood Plains and areas subject to excessive backwater.

(c) Refer to Article XI for additional information on the review and approval procedures by the County Public Works Director for all new developments, including subdivisions. Refer to Article XII for information relative to inspection of the storm drainage systems on any new developments, including subdivisions that have been reviewed and approved by the County Public Works Director.

(d) Exhibit No. 3, "Check List Design Aid", may be used as an aid by the Developer/Owner/Engineer/Architect in the development of improvement plans. Hopefully, this design aid, if applied, will minimize review time, and prevent unnecessary delays in receiving approval for any project. Any other requirements in these Rules and Regulations for plan development that is not shown on the check list must be included.

#### **Section ST 402**

##### **Preparation of Subdivision Improvement Plans**

(a) In addition to all the requirements for submitting improvement plans as indicated under these Rules and Regulations, any of the following items applicable to the new development must also be included in the plans:

- (1) Drawings shall be standard size 24"x36", with a legible title block.

(2) Location and profiles of the sewers, detention and/or retention basins, drainage channels and watercourses, pump stations, structures, or any other storm drainage item shall be shown thereon.

(3) All existing and proposed topography and contours, including the proposed contours of any new roadways, parking lots, drives, etc, that are to be constructed.

(4) Existing driveways, water mains, valve boxes and basins, sanitary sewers, gas mains, electric power and telephone facilities, fire hydrants and other structures. All proposed features as required by the Metropolitan Sewer District shall also be a part of the detailed drawings.

(5) Drawings of pump stations, structures, detention and/or retention basins shall be shown in sufficient detail to permit a contractor to construct the facility without requiring supplemental drawings. Reference to the use of State of Ohio Standard Construction Drawings and County Public Works Director Standard Plate Drawings is acceptable if no modifications of the standard drawings are necessary.

(b) In submitting flood studies on proposed storm sewer systems for review and approval, provide the information requested in Section ST 1104 and other applicable sections of these Rules and Regulations.

(c) Provide plan and profiles of existing and proposed sanitary, storm or combined sewers, with elevations, lengths, grades, pipe sizes and pipe type. Show manholes, catch basins or other connections to any of these systems, some of which may be beyond the boundaries of the new development. Show plans, profiles and cross sections of all proposed watercourses and drainage channels, to be altered or improved.

(d) All downspout collector lines and all individual downspout and sump pump taps are to be shown on the subdivision improvement plans.

### **Section ST 403**

#### **Floodplain Limits in the Special Flood Hazard Areas**

The following scientific and engineering reports, and accompanying maps and profiles, identify in whole or in part, the special flood hazard areas, as defined in Section ST 150, within unincorporated Hamilton County, Ohio and shall be used to determine the elevation and extent of these areas subject to flooding.

(a) Storm Drainage and Open Space Master Plan for Hamilton County, Ohio (Consoer, Townsend and Associates, December 1966).

(b) Flood Insurance Study for the County of Hamilton, Ohio (Federal Emergency Management Agency, December, 1981, and as amended).

(c) Flood Boundary and Floodway Map for Unincorporated Hamilton County, Ohio, June 1, 1982 and as amended.

(d) Flood Insurance Rate Map for Unincorporated Hamilton County, Ohio, June 1, 1982, and as amended.

Where The FEMA Flood Insurance Study and The Consoer/Townsend Storm Drainage and Open Space Master Plan provide information for the same reaches of streams, the information which is more restrictive as to elevation, extent, and discharge shall be used. If Consoer/Townsend is most restrictive, and it can be demonstrated through engineering analysis to be in error, the firm flood study information shall be used.

#### **Section ST 404**

##### **Grading of Sites and Improvements**

Where feasible, there shall be sufficient difference in elevation between roadway grades and adjoining building sites so that roadway gutters can serve as runoff channels to supplement the storm sewers. Special care must be taken at the roadway low sag areas and low point cul-de-sacs to prevent flooding of buildings in these areas (refer to Sections ST 406(a)(4)(v), 707, 808 and 1104(d)(1) and (2) for addition information.

#### **Section ST 405**

##### **Detention and/or Retention Basins**

(a) Detention/Retention basins shall be required for every new development project and also, for renovation and replacement projects, where no detention has previously been provided. Pre-development runoff coefficient  $c=0.90$  for existing impervious area of renovation and replacement shall be adjusted to  $c=0.45$  for detention facility calculation purposes.

(b) If the volume of required storage, for detention or retention, is calculated, per Sections ST 711 and 712, to be eight hundred fifty (850) cubic feet or less (except that the one hundred (100) year frequency storm is to be used for both the pre & post conditions), the requirement for detention or retention will be waived unless known drainage problems exist immediately downstream of the project as determined by Public Works.

(c) Where two (2) or more existing watercourses, with separate, contributing drainage areas, discharge runoff at different locations in any new development, two (2) or more detention and/or retention basins may be required. The Developers/Engineers shall initially follow the procedures indicated in Section ST 1102 to determine how many detention and/or retention basins will be required.

(d) A Home Owner's Association (HOA) is responsible for the maintenance of all detention basins within subdivisions. The maintenance responsibility will be transferred to the proportional distribution of the property owners within the development if the

(HOA) is dissolved. If a Home Owner's Association (HOA) is not formed the maintenance responsibility will be the proportional distribution of the property owners within the development.

(e) The County Public Works Director will request from the Building Commissioner that no Final Certificate of Occupancy be issued for any single building permit development requiring a detention and/or retention basin if the site of the basin has not been completely constructed (as determined by the Director of Public Works), and approved, or constructed to the extent necessary to control the runoff generated by the portion of the development constructed, and a record plat or easement plat recorded. This procedure shall be used on any development, if considered necessary by the County Public Works Director. See Section ST 1201(c).

**Section ST 406**  
**Easements, Plats and Right-of-Entry Agreements**

(a) Easements: Utility and drainage easements shall be provided where necessary. Whenever a proposed storm sewer, drainage channel or drainage structure is located on public or private property, they shall follow lot lines, with easements, if feasible. The public agency or Owner responsible for maintenance of the storm drainage system must have free access to and use of the easements at any time. See Section ST 132, 133, 135 and 140 for definitions of various easements.

(1) The minimum acceptable width for a public storm sewer easement is fifteen (15) feet. The County Public Works Director may require, for maintenance purposes, wider easements than those shown on the following tables, whenever storm sewer depth becomes excessive, or whenever any building foundation may be located too close to the easement creating a potential undermining condition to the building in the event of future excavation for storm sewer maintenance or other purpose.

When construction of a proposed storm sewer system is to be provided in adjacent property and connected to a storm sewer system that is to be publicly maintained in any new development, a public easement having a width in accordance with Section ST 407(a)(1) or (2) must be obtained, by the Developer, from the adjacent property owner.

(2) Use the following table for establishing public storm sewer easement widths when including "Restrictions on Sewer Easements"

Note 20 (see EXHIBIT No. 1, Sheet 3 of 7) on the development plans.

PIPE SIZE	EASEMENT WIDTH
Under 24"	15' = 10' to centerline sewer on one side + 5' to centerline sewer on other side
24" to 60"	20' = 15' to centerline sewer on one side + 5' to centerline sewer on other side
60" or Greater	Width or diameter of sewer + 15' + adjustment to greater next highest 5' increment width diameter.
Example: For 72" dia. pipe, min. easement Width = 6' + 15' = 21' Use 25' Easement Width	

For any pipe size easement width shown above, The Hamilton County Director of Public Works may determine that an increase is required for maintenance purposes, etc.

(3) Public or private drainage easement limits for existing watercourses, swales, drainage channels, etc., shall be made wide enough to adequately protect, widen, deepen or otherwise improve the existing watercourses, drainage channels, etc., for drainage purposes, as indicated on the grading plan. In general, the smaller existing watercourses, swales and drainage channels that are to remain in new developments and are located in two (2) or more lots, are to be shown with minimum 20' wide private drainage easement lines, 10 on each side of the flow line. Larger existing watercourses and drainage channels shall have easements wider than 20' as indicated in Section ST 804(1).

(4) Private drainage easements are to be shown on development improvement plans for the following conditions:

(i) Where there are existing watercourses and two (2) or more lots involved, extend the easements to the development limits when the watercourses continue beyond the development.

(ii) Determine the location of new swales, ditches, drainage channels, etc., from the proposed grading plan. For two (2) or more lots involved, provide the easements and extend to the development limits or to an internal lot line, if it applies.

(iii) From the end of the rock channel protection at a storm sewer outlet, provide a private drainage easement along the existing watercourse, swale and/or drainage channel and extend to the development limits when two (2) or more lots are involved (refer to Section ST 809 regarding storm sewer

outlet locations).

(iv) From the inlet end of a storm sewer system where an existing watercourse, swale or drainage channel extends upstream, and when two (2) or more lots are involved, provide a private drainage easement and extend the easement upstream to the development limits, or extend the easement upstream to an internal lot line whenever the existing watercourse swale or drainage channel does not extend to the development limits. (Refer to Section ST 808 regarding storm sewer inlet locations).

(v) New development plans with proposed surface ditches provided for storm water overflow due to potential flooding at roadway low sag areas, low point cul-de-sacs or other practical locations must include a minimum ten (10) foot wide private drainage easement. (Refer to Section ST 707, 808 and 1104(d)(1) and (2) for additional information).

(vi) New developments, where two (2) or more lots are involved, that require detention and/or retention basins that are to be privately maintained, must indicate private drainage easement limits and the physical dimensions that control the size and depth of the basin/s on the improvement plans. (See Section ST 407(b)(2), (5) and (6), and 1104(e)(3) and (4) for additional information).

(b) Plats: For all new development requiring review and approval by the County Public Works Director, the following applies:

(1) An Easement Plat or Record Plat requiring public maintenance of proposed storm sewers, structures, detention and/or retention basin, channels, roadways, etc., must be prepared, sealed and signed by the Developer's Surveyor and must be notarized; then reviewed and approved by the County Public Works Director and then recorded by the Developer. (Refer to Section 406(b)(6) also).

(2) An easement plat requiring private maintenance of private storm sewers, structures, detention and/or retention basins, channels, etc., that extends through two (2) or more privately owned lots must be prepared, sealed and signed by the Developer's Surveyor and must be notarized; then reviewed and approved by the County Public Works Director and then recorded by the Developer. (Refer to Section ST 406(b)(6) also).

(3) A record plat requiring private maintenance of any private detention and/or retention basin, including all graded areas related to the basin that

lies wholly within a single lot, must be prepared, sealed and signed by the Developer's Surveyor and must be notarized; then reviewed and approved by the County Public Works Director and then recorded by the Developer. (See Section ST 406(b)(5), (6) and (7) also).

(4) For miscellaneous work required to be performed by a Developer in conjunction with an existing storm drainage system that is publicly maintained, such as a new storm sewer connection, relocation, replacement, etc., the County Public Works Director will determine whether or not the Developer must prepare a plat to expand the existing easement.

(5) A registered surveyor's signature and seal is required on any easement, record or dedication plat that has a detention and/or retention basin. A metes and bounds location of the private storm drainage limits completely surrounding any detention and/or retention basin and the storage volume required for any basin must be shown on the plat.

(6) After any plat is recorded by the Owner, or Engineer, the Developer is responsible for providing the County Public Works Director a print of the recorded record plat for filing.

(7) All plats for private detention and/or retention facilities must be recorded prior to the issuance of a Certificate of Occupancy for associated buildings.

(c) Right-of-Entry Agreements: When it has been determined by the County Public Works Director that in a new development an easement and/or plat is not required by a Developer where construction is necessary on adjacent property, the Developer must obtain a Temporary Right-of-Entry Agreement from the adjacent property owner to perform all necessary work for constructing any approved storm drainage system that involves any use of the adjacent property, including grading. The temporary Right-of-Entry Agreement shall describe all the work required to be performed. In addition, a sketch or plan, including profile and sections, if necessary, and drawn to scale, must be provided by the Developer showing the work required to be performed. The Agreement must be signed, witnessed and notarized by the Property Owner(s) and the Developer(s), then submitted to the County Public Works Director before commencement of construction.

## **Section ST 407**

### **Relation of Development to Existing Watercourses and Drainage Channels**

(a) The development shall be appropriately related to natural and artificial drainage features. The development layout shall include the existing watercourses, proposed drainage channels, the one hundred (100) year regulatory floodway and/or flood plain limits, detention and/or retention basins, if required, and all other storm drainage items. The watercourses and drainage channels, where practical, shall be

located along the rear or outer limit property lines of the development.

(b) All swales and small upper reaches of existing watercourses should be integrated with the proposed system of drainage channels and storm sewers.

(c) Refer to Section ST 804(k) for additional information.

### **Section ST 408**

#### **Relation of Development between Existing Watercourses, Drainage Channels and Proposed Roadways**

(a) Where it is deemed necessary, when a proposed roadway parallels or is located near an existing watercourse or drainage channel, profiles at the top of each bank, flow line and one hundred (100) year flood, and cross sections shall be provided. Also, show the proposed roadway grade in relation to these profiles and cross sections. Sufficient cross sections must be provided to verify conformance to Sections ST 404, 406 and 418.

(b) Roadway construction should not encroach on the flood plain limits of an existing watercourse or drainage channel. (See Sections ST 404, 406, 418 and 1102(b) for additional information).

(c) Existing and proposed contours should be shown in sufficient detail to verify and confirm the profiles and cross sections.

### **Section ST 409**

#### **Storm Sewer Profiles**

Storm sewers shall be shown in profile with the following information:

(a) Profile of existing ground at storm sewer centerline if not following or along the street.

(b) Profile of proposed finished grade, if not following or along the street.

(c) Percent of grade of proposed storm sewer.

(d) Size, type, length, and invert elevations of proposed pipe or structure.

(e) Show roadway catch basins, manholes, and special structures, together with proposed elevations of their inverts, any proposed taps, rims and/or grates. Also, show window and top or grate elevations for field inlets not located under a roadway.

(f) Where an existing watercourse is being filled in and replaced with a storm sewer system, show the headwater depth elevation for the one hundred (100) year flood elevation at the inlet entrance. Submit all drainage calculations for review and approval.

## **Section ST 410**

### **Datum for Elevations**

Give datum reference used for elevations, and correlate to NGVD, mean sea level datum.

## **Section ST 411**

### **Grading Permit**

A grading permit will be required if the project does not comply with Hamilton County Soil and Water Conservation District regulations per ST 3.00 Permits and Exemptions.

## **Section ST 412**

### **Grading Plan**

Grading plans must comply with Hamilton County Soil and Water Conservation District regulations per ST 6.00 Plans & Specifications.

## **Section ST 413**

### **Cut and Fill Slopes**

(a) Cut and fill slopes shall not result in a finished slope steeper than three (3) horizontal to one (1) vertical (3:1). If a request is made for a cut or fill slope steeper than 3:1, the applicant must obtain an opinion in writing from a qualified Geotechnical Engineer that the materials are capable of standing on steeper slope without creating a hazard. This opinion must be forwarded to the County Public Works Director for review and approval before the start of the cut and/or fill construction. Storm water detention construction including the control structure is to be installed at the grading stage of the development.

(b) If, in the opinion of the County Public Works Director, any cut slope exhibits the existence of inclined strata or fault, or any fill slope exhibits any of the conditions indicated under Section ST 806, he may require the Developer to furnish a report and recommendation from a qualified Geotechnical Engineer as to the probability of land sliding or other instability, and as to preventive measures required. If the Developer fails to follow such recommendations, the County Public Works Director shall declare the land affected to be unfit for human habitation, and shall so advise the Zoning Authority and Building Commissioner.

## **Section ST 414**

### **Temporary Erosion and Sediment Control**

(a) A Temporary Erosion and Sediment Control Plan shall be included with the Improvement Plans for any new development that must be reviewed and approved by the County Public Works Director. The plan must show the delineation of the contributing drainage area to each temporary erosion and sediment control structure, along with the permanent items such as catch basins, culverts, storm sewers, drainage channels, etc. The plan shall also show the existing contours, proposed grading

contours, and temporary grading contours on any scale that clearly shows the details.

(b) The temporary erosion and sediment control structures shall conform to the State of Ohio Standard Construction Drawing MC-11 (or DM-4.3 and DM 4.4M). Other erosion control schemes will be reviewed, when shown on the Temporary Erosion and Sediment Control Plan, and, if satisfactory, approved by the County Public Works Director.

(c) The Temporary Erosion and Sediment Control structures are to be placed at the strategic locations of all graded areas to prevent sediment and debris from being deposited on roadways, drainage courses, adjacent land and in any sewers. Special consideration must be given at low sag areas of roadways, at low point cul-de-sacs and at the outlet end of any existing or proposed storm sewer system. The Developer must notify the County Public Works Director and request approval of any change in the approved Temporary Erosion and Sediment Control Plan during the course of the construction. Sediment deposits from storm water flow within the development shall be controlled before the storm water is allowed to be discharged into any existing watercourse that flows through the development.

(d) Graded areas on slopes of 3:1 or steeper, shall be temporarily and/or permanently seeded, mulched, fertilized, watered and netted with any suitable plastic or other approved netting material before erosion occurs.

(e) The temporary erosion and sediment control structures shall comply with the following or "Best Management Practice": (See ODOT Location and Design Manual)

(1) For drainage areas less than one acre, straw bale ditch checks and, if inlets are included in the plans, bale inlet filters as per Standard Drawing MC-11 (or DM-4.3 and DM 4.4M) are required. Ditch checks should be spaced so that no check is within the backwater of a downstream check. A ditch check should be provided at all significant changes in ditch grades.

(2) For drainage areas between one (1) and five (5) acres, sediment basins as per State of Ohio Standard Construction Drawing MC-11 (or DM-4.3 and DM 4.4M) are required. Sediment basins shall provide a storage volume of 67 cubic yards per acre of contributing area, which is one-half inch ( $\frac{1}{2}$ " ) of runoff or an approximate two-year frequency. Should the failure of a sediment dam pose a significant danger to downstream property, the spillway should be checked to assure safe passage of a one hundred (100) year frequency storm. Specific size and location of sediment basins shall be shown on the plans.

(3) For drainage areas between five (5) and twenty (20) acres, sediment dams as per State of Ohio Standard Construction Drawing MC-11 (or DM-4.3 and DM 4.4M) shall generally be specified. However, for some conditions, a series of sediment basins may be more effective than a

sediment dam. However, it may be necessary to acquire a temporary easement to provide an adequate ditch control. The specific size and location of sediment basins and/or sediment dams shall be shown on the plans.

(4) When the drainage area exceeds twenty (20) acres and off-project drainage can not be diverted, the following method shall be specified. The watercourse carrying the off-project drainage may not be disturbed. Straw bale dikes, filters, ditch checks, sediment basins, and sediment dams in accordance with Standard Drawing MC-11 (or DM-4.3 and DM 4.4M) shall be placed in such a manner as to trap mud and debris from the disturbed project before it enters the watercourse that carries the off-project drainage. Where project drainage is not intercepted by a project ditch, a straw bale dike or other approved filter dike or fence shall be placed at the construction limits. The specific size and location of these controls shall be shown on the plans.

(f) All graded areas are to be maintained at all times to prevent erosion and excessive runoff. The County Public Works Director reserves the right to require additional measures to prevent erosion and excessive runoff if the Developer or Builder has not accomplished same.

#### **Section ST 415**

##### **Pipes, Culverts, Sewers, and Drains.**

All fills intended to support a drainage structure and sewer shall comply with ODOT 203.02 and 603.11. The work shall be performed under the supervision of a qualified soils engineer. The Soils Engineer registered in the State of Ohio shall furnish a certificate in duplicate to the County Public Works Director, certifying to the location and degree of compaction of such fills.

#### **Section ST 416**

##### **Mud and Debris**

Until subdivision improvements in the development have been completed, the Developer and/or Builder, whichever is responsible shall take such measures as are necessary to prevent erosion of graded surfaces onto roadways, into drainage courses, or sewers, or onto adjoining land. Refer to Temporary Erosion and Sediment Control, Section ST 414, for additional information. For any grading project or any development approved by the County Public Works Director, the Developer and/or Builder, whoever is responsible, shall clean up any mud and debris deposited on roadways, drainage courses, or adjoining property when the mud and debris originates from the graded surfaces.

#### **Section ST 417**

##### **Restriction on Filling in Flood Plain Areas within the Special Flood Hazard Areas**

The rules and regulations as indicated in Section ST 311 thru 313 and ST 419 apply in all cases.

**Section ST 418****Flood Damage Prevention Regulations (F.D.P.R.)**

Improvement plan development shall be in conformance with the F.D.P.R. (EXHIBIT No. 35) Rules and Regulations.

**Section ST 419****"As-Built" Floor Elevations within Flood Hazard Areas**

Following construction of all buildings within a Special Flood Hazard Area, and prior to the issuance of a Certificate of Occupancy, field verification (by a Surveyor registered in the State of Ohio) of the lowest floor elevation must be made and supplied to the Department of Public Works. See EXHIBIT No. 36.

## ARTICLE V

### MAINTENANCE OF THE COUNTY STORM SEWER SYSTEM

#### Section ST 501

All officially designated county watercourses and county storm sewers in the unincorporated areas of Hamilton County shall be maintained as outlined below:

(a) The Townships: The Township shall be responsible for maintaining the following storm drainage systems when they occur on or under a Township Road.

- (1) Street Inlets
- (2) Street Inlet Lead Pipes
- (3) Cross Culverts
- (4) Storm drainage systems, which service less than two (2) street intersections
- (5) Storm drainage systems which parallel a single street and have a trunk sewer pipe that travels less than five hundred (500) feet of the street's centerline
- (6) The township will also maintain storm water flow within a township road right-of-way such as roadside drainage ditches, culverts, and flow through driveway culverts
- (7) All vaults and or storm sewers utilized as storm water detention facilities.

(b) Hamilton County Engineer: The Hamilton County Engineer shall be responsible for maintaining all storm drainage systems, including cross culverts, within the right-of-way of the county road. The County Engineer shall maintain the flow through private driveway pipes within the right-of-way but the owner shall maintain the pipe.

(c) The Public Works Department: The Public Works Department shall be responsible for maintaining all remaining designated county storm sewer systems and designated county watercourses.

#### Section ST 502

All public watercourses or drainage channels and public storm sewer systems in municipalities will be maintained by the municipality in which they are located.

## **ARTICLE VI**

### **UNPOLLUTED WASTE WATER**

#### **Section ST 601**

The County Public Works Director will not approve any development plan showing a direct connection of any sanitary effluent system to a public or private storm sewer system.

#### **Section ST 602**

The effluent from private sanitary sewer treatment plants or private, individual, sanitary sewer treatment systems, either individually or collectively discharged, is not classed as unpolluted wastewater. These systems are not permitted to discharge into any public storm sewer system. It is recommended that these systems be discharged into existing watercourses, preferably in wooded areas. For discharge and restrictions in other areas, refer to EXHIBIT No. 1, Storm Drainage Note Number 15.

# VOLUME II

## ARTICLE VII

### BASIC DESIGN CRITERIA FOR STORM SEWERS, APPURTENANT STRUCTURES, DETENTION AND RETENTION BASINS

#### Section ST 701

##### Degree of Protection Required

The degree of protection required shall be adequate to handle the runoff as computed in accordance with Section ST 702 (a) through (e). The runoff shall include the area within the development site and all other areas draining thereto, with all areas considered as fully developed in accordance with the ultimate development planned in the Master Plan of Hamilton County. The following storm frequency will be used:

- (1) Design frequency for sizing storm sewers and structures.....10 Year
- (2) Design frequency for all Districts, not within a Special Flood Hazard area, to contain the hydraulic gradient within the storm drainage system (see ST 707)..... 100 Year
- (3) Design frequency for all Districts, within a Special Flood Hazard area, to contain the hydraulic gradient within the storm drainage system (see ST 707)..... 100 Year

#### Section ST 702

##### Determination of Quantity of Runoff

- (a) Rational Method (For Drainage Areas Not Exceeding 200 Acres)

Each portion of the storm water drainage system shall be capable of handling the peak flows of runoff as determined by the "Rational Method",  $Q = CIA$  where

$Q$  = peak runoff quantity in cubic feet per second;

$C$  = runoff coefficient varying with pervious and other characteristics of the drainage area;

$I$  = Average intensity of precipitation in inches per hour during the period of  $t_c$  minutes

$t_c$  = time of concentration, is the duration of rainfall in minutes

$A$  = area in acres of the tributary watershed.

- (b) Compare the Rational Method and the State of Ohio Bulletin 45 Method to

## Obtain Peak Runoff for Drainage Areas Exceeding 200 Acres

The peak flow of runoff as obtained from the Rational Method shall be compared to the State of Ohio Department of Natural Resources Bulletin 45 method for drainage areas exceeding 200 acres. The higher value shall be used for peak runoff. The Bulletin 45 regression equation for area 3 of southwest Ohio (Table 3), is represented as  $Q_T = aA^w S^x E^y P^z$ . This equation applies only to the rural areas of southwest Ohio. For Hamilton County, use EXHIBIT NO. 20 (Sheet Numbers 1 thru 4 of 4) for procedure to follow to calculate peak runoff when considering the Bulletin 45 method. Sheet Number 1 of 4, the computation sheet, includes an urbanization factor that must be considered.

### (c) Runoff Coefficients (C)

The runoff coefficient is the portion of the precipitation, expressed as a decimal that will reach the storm water drainage system. In the following table runoff coefficients are given, varying with the type of zoning of the area and the slope of the area. Interpolate for coefficient C when the slope occurs between flat slopes less than two percent (2%) and steep slopes six percent (6%) or greater. Calculate the average weighted coefficient C to reflect the actual existing. The following zoning classifications are to be used as a guide.

Zone District	Characteristics	Runoff Coefficient (C)	
		Flat Slope (Less than 2%)	Steep Slope (6% or Greater)
----	Parks, cemeteries, golf courses, lawns, playgrounds or unimproved land	0.20	0.38
"AA"	Residence District on 1 acre or more lot	0.32	0.42
"A"	Residence District 20,000 sq. ft. lot	0.36	0.47
"A-2"	Residence District 14,000 sq. ft. lot	0.41	0.52
"B"	Residence District 10,500 sq. ft. lot	0.47	0.58
"B-2"	Residence District 7,500 sq. ft. lot	0.53	0.64
"C"	Residence District 6,000 sq. ft. lot	0.60	0.71
"D"	Residence District 5,000 sq. ft. lot	0.74	0.80
"DD"	Planned Multiple Residence District	0.77	0.84
"O"	Office District	0.80	0.87

"OO"	Planned Office District	0.80	0.87
"E"	Retail Business District	0.80	0.87
"EE"	Planned Business District	0.80	0.87
"EF"	Excavation and Landfill District	0.26	0.40
"F"	Light Industrial District	0.82	0.87
"FF"	Planned Light Industrial District	0.82	0.87
"FPM"	Flood Plain Management District	Established on Case-by-Case Basis	
"G"	Heavy Industrial District	0.85	0.90
"GG"	Planned Heavy Industrial District	0.85	0.90
"H"	Riverfront District	Established on Case-by-Case Basis	
"MHP"	Mobile Home Park District	0.77	0.84
----	Parking lots (paved), roofs, driveways	0.90	0.94

(d) Intensity of Precipitation/(I) = Rainfall Intensity in In/Hr To find I, use the following precipitation formulas for various storm frequencies:

FREQUENCY, YEAR	PRECIPITATION FORMULA
1	$I = \frac{80}{tc+14}$
2	$I = \frac{106}{tc+17}$
5	$I = \frac{131}{tc+19}$
10	$I = \frac{170}{tc+23}$
25	$I = \frac{230}{tc+30}$
50	$I = \frac{250}{tc+27}$
100	$I = \frac{290}{tc+31}$

(e) Time of Concentration/TC = Duration of Rainfall in Minutes

(1) The time of concentration, in minutes, is the estimated time it will take the storm runoff, from the most remote part of the area, to reach the point of the storm drainage system under consideration. This includes the time for water to flow over roofs, through the roof gutters and downspouts, over the ground, turf areas, streets, through street gutters to the nearest inlet of the drainage system plus the time of flow in the sewer pipes to the point under consideration. The Overland Flow Chart (EXHIBIT NO. 4) may be used to determine tc, when applicable.

(2) Time of concentration, tc, to an inlet or catch basin may be used as follows for new developments in Hamilton County, if the most remote part of the contributing drainage area is less than 300 feet from the inlet or catch basin.

<b>Type of Development</b>	<b>Time of Concentration (tc)</b>
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Small commercial, Industrial storage, office, retail, etc. buildings with parking lots	5 minutes
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Subdivisions, other new developments	10 minutes
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For lengths greater than 300 feet, calculate the time of concentration.

(3) Flow time in sewers may be determined from the hydraulic properties of the sewers, assuming average flow-full velocity at the proposed sewer slopes.

**Section ST 703**

**Pipe Capacity and Design**

Pipe size shall be determined using the following pipe roughness coefficients, and the design procedures indicated in Sections ST 704 thru 707:"n" value

(a) For concrete smooth flow pipe 30" in diameter or larger = 0.013

(b) For concrete smooth flow pipe 27" in diameter or smaller = 0.015

(c) For aluminized, zinc or asphalt coated CMP (acceptable only for privately maintained storm sewer systems) ODOT L&D Table 1105.2

(d) For PVC smooth flow pipe = 0.010

(e) For HDPE smooth flow pipe = 0.013

**Section ST 704**  
**Minimum Pipe Size**

(a) The minimum diameter for storm sewer pipe that is to be publicly maintained shall be 12 inches.

(b) Private drain connections to publicly maintained storm sewer appurtenances are recommended to have a minimum 12" diameter. Also, see Section ST 709(c).

(c) Private storm sewer systems located three (3) feet or more beyond any building that may or may not originate from a building storm drainage system, are recommended to be six (6) inches or larger in diameter except as indicated in (b) above, with cleanouts provided for maintenance purposes. Private storm sewer systems shall be designed in accordance with these Rules and Regulations except for material and structure specifications.

**Section ST 705**  
**Minimum and Maximum Velocities**

(a) Minimum Velocity

Minimum velocity in storm sewer pipe, when flowing full for the ten (10) year design storm, shall be not less than 2.5 feet per second.

(b) Maximum Velocity for Publicly and Privately Maintained Storm Sewer Systems.

Maximum velocity in storm sewer pipe shall not be more than 16 feet per second, when flowing full for the ten (10) year design storm except that the velocity in the last section of storm sewer pipe at the outlet end shall not exceed 12 feet per second based on the hydraulic gradient slope for the 10 year design storm. Erosion control measures at the inlet and outlet ends must comply with EXHIBIT NO. 30. Storm sewer pipe with flow velocities exceeding 16 feet per second and/or slopes greater than 15% will require special pipe as per Section ST 713(c) and/or key blocking to protect the pipe against erosion and displacement by shock.

**Section ST 706**  
**Gradients of Pipe**

The sewer pipe shall be laid on such gradients so that the flow full velocities shall be kept within the maximum and minimum limits indicated in Section ST 705. Pipe sizes may also be controlled by flood conditions, and/or submerged outlet conditions (Refer to Section ST 1104(d)).

**Section ST 707**  
**Hydraulic Gradients**

(a) Starting at the outlet of the storm sewer and working upstream, the hydraulic gradient calculations are required to be submitted with any new, final improvement

plans to be reviewed and approved by the County Public Works Director, whenever storm sewer pipe systems exist, or are proposed. The one hundred (100) year hydraulic gradient must be developed for each storm pipe system in the development.

(b) For most cases, head losses at catch basins, inlets, manholes, inlet manholes and angle changes in storm sewer alignment need not be taken into account in developing hydraulic gradients. The criteria to be used for the storm sewer design is considered adequate to compensate for these losses.

(c) The hydraulic gradient elevation at any catch basin, inlet, manhole, or inlet manhole, may not be higher than six (6) inches below the grate, inlet sill, manhole rim, or final surface grade, whichever is lower.

(d) The hydraulic gradient elevation at the outlet end of any storm sewer system shall begin at the highest water level elevation as computed or as recorded on FEMA or Consoer/Townsend flood studies for one hundred (100) year frequency storm, or if free outfall conditions exist, simply begin hydraulic gradient at the crown of the sewer pipe.

(e) Where the hydraulic gradient developed for existing storm sewer systems indicates surface flooding problems, the Developer's Engineer must submit a design scheme to assure that no proposed building will be subject to flooding.

## **Section ST 708**

### **Manholes**

(a) Storm sewer manholes are to be designated as State of Ohio Standard Number 1, 3, and 5 manholes, or Hamilton County Std.. CB3MH, Catch Basin/Manhole Plate 9.

(b) State of Ohio Standard Number 4 manhole may be approved by the County Public Works Director, where applicable for straight storm sewer alignment entering and leaving the manhole and uniform flow at the manhole (No drop in invert elevation through the manhole).

(c) Drop manholes may be required to reduce the slope of any sewer that has a velocity that exceeds the requirements of Section ST 705(b). Whenever possible, connections shall be made at inverts of manholes and the storm sewer crowns shall match.

(d) Manholes will not be approved where the depth from bottom invert to the manhole rim exceeds twenty-four (24) feet.

(e) Drop manholes generally shall be designated as State of Ohio Standard Number 3 or 5. However, to improve maintenance conditions, where continual, or nearly continual storm flow will occur, and where the drop exceeds six (6) feet, drop pipe details similar to that shown on the State of Ohio Standard Number 2 manhole drawing shall be provided and detailed on the improvement plans to fit the State of Ohio

Standard Number 3 or 5 manhole. Maximum drop pipe size shall be eighteen (18") diameters.

### **Section ST 709**

#### **Building, Parking Lot, or Other Private Storm Drain Connections to Publicly Maintained Storm Sewer System**

(a) Any storm drain connections of private systems to public systems must be approved by the County Public Works Director.

(b) Storm Sewer Tap Permit and approval application shall be obtained from the County Public Works Director. All storm sewer taps shall be made at catch basins and manhole where practical. However, if necessary, tap shall be made at storm sewer pipes with approved bolted saddle and neatly drilled penetration, to correspond with private pipe inside diameter. All work shall be supervised and approved by the governing authority.

(c) Minimum pipe size of a private storm drain shall be twelve-inch (12") diameter within any public right-of-way. Except that this does not apply to owners who wish to make a storm sewer tap to convey an insignificant amount of runoff from downspouts yard drains, etc. The owner shall provide pipe size and material specifications that must be approved by the County Public Works Director. Also, refer to Section ST 704(b) and the County Engineer, where applicable.

(d) For additional information on private storm drain outlets, refer to the County Engineer Rules and Regulations Section E-206.

(e) Effluent from private sanitary sewer treatment systems will not be permitted to be directly connected to publicly maintained storm sewer systems, or allowed to enter a publicly maintained storm sewer system. See Section ST 602, and EXHIBIT NO. 1, Note Number 15 for additional information.

### **Section ST 710**

#### **Catch Basins, Inlets and Outlets**

##### **(a) General**

(1) This section applies only to catch basins, inlets and outlets proposed to be located outside of any Special Flood Hazard Area. Design criteria for catch basins, inlets and outlets proposed to be located within any Special Flood Hazard Area are to be established on a case-by-case basis.

(2) For inlets and outlets consisting of headwalls, wingwall headwalls, no headwalls, etc., refer to Section ST 809 thru 811.

(3) Use EXHIBITS 4 through 19, where applicable, to submit catch basin design calculations, when deemed necessary by the Department of Public

Works, for review and approval, or similar forms that produce the same results.

**(b) Design Criteria and Other Requirements for the CB-3A, CB-3, (CB3-M, Plate 12), (Catch Basin-Manhole CB-3MH, Plate 9)**

For items (1) through (9) that follow, use the ten (10) year design frequency storm.

(1) Maximum runoff to any CB-3A shall not exceed 2.5 cfs, including any by-pass flow from upstream catch basins.

(2) Maximum runoff to any CB-3, CB3-M and CB-3-MH shall not exceed 4.0 cfs, including any by-pass flow from upstream catch basins.

(3) Maximum allowable spread of flow = 8.0 feet.

(4) Maximum allowable by-pass flow = 1.0 cfs, except at roadway intersections.

(5) Maximum allowable by-pass flow = 0.2 cfs at any roadway intersection.

(6) Catch basins shall be located upstream of all crosswalks and roadway intersections and shall be located at roadway low sag areas and at all low point cul-de-sacs. Catch basins shall be spaced at intervals of 300 feet unless it can be substantiated by calculations that a greater spacing will not cause a spread of flow greater than 8 feet (as measured from a point 6" inside the face of curb) or result in a bypass of more than 1.0 cfs."

(7) A minimum depth catch basin is allowed, provided that the required headwater available depth is insignificant and/or the minimum ground cover is (18") or greater over the top of the pipe.

(8) The Hamilton County Public Works Standard Drawing CB-3M Plate 10 is to be used to intercept one upstream or adjacent drainage structure at the beginning of a continuous sewer run or within a street intersection to avoid excessive sewer runs within the pavement area and/or penetrations into a manhole, such as:

CB2-2-A from rear yard to CB-3M

CB-3A from the other side of the street to CB-3M

CB-3 from around the corner to CB-3M

CB-3A from the same side of the street to CB-3M

(9) For roadways where the length exceeds 300' from its beginning to a low point cul-de-sac, provide extra CB-3A's, CB-3's, CB3-M's, or Catch Basin-Manhole CB-3-MH (Plate 9) located on the roadway curb on each side of the beginning of the cul-de-sac. In addition, provide at least one (1) CB-3, CB3-M or Catch Basin-Manhole CB-3-MH at the low point of the

cul-de-sac, and a ten (10) feet wide x 1'-0" deep "V" ditch from the back of the curb to the rear of the houses, for an overflow ditch.

**(c) Design Criteria and Other Requirements for the CB2-2-A, CB2-2-B, CB2-3, CB2-4, CB2-5, and CB2-6 (off road catch basins)**

For items (1) through (7) that follow, use the one hundred (100) year design frequency storm for flood protection purposes. Use the ten (10) year design frequency storm where there is no potential flooding of any existing or proposed buildings. An emergency overland relief swale shall be provided starting at the first catch basin then be continued down stream beyond buildings subject to flooding to next lowest reach of the drainage basin.

(1) The CB2-2-A and CB2-2-B will be approved in a publicly maintained storm sewer system provided its depth, as measured from the top of grate to flow line, does not exceed 4'-0".

(2) Off road closed storm drainage systems may be constructed with the use of catch basins instead of manholes or a combination of manholes and catch basins. Access for maintenance purposes must be provided to this type of system from a public roadway by easement.

(3) Maximum spacing between appurtenant structures shall be 300', regardless of design requirements.

(4) The capacity of the catch basin shall be equal to, or more than the calculated flow to it from any existing watercourse, drainage channel, swale, ditch, etc.

(5) Use EXHIBIT NOS. 17, 18 and/or 19 for determining the headwater depth from the windowsill and indicate on the improvement plans the number of windows required at any catch basin location. The top of water elevation at the catch basin obtained from using the headwater depth shall not exceed the top of the water elevation for the tributary watercourse, drainage channel, swale, ditch, etc. except that a slight headwater increase at the catch basin shall be allowed if no backwater will occur on adjacent private property.

(6) Use EXHIBIT NO. 22, entrance type (1) and obtain a headwater depth to determine a top of water elevation for the pipe size used and discharge  $Q_{10}$  entering the catch basin. This elevation must not be higher than the elevation obtained from EXHIBIT NOS. 17, 18 and/or 19 as explained in (5) above.

(7) An earthen dike except at low sump areas is required to be constructed immediately downstream from any field catch basin to create a sump condition. The earth dike generally shall be constructed at least

six (6) inches higher than the top of water elevation of the calculated flow to the catch basin from any existing watercourse, drainage channel, swale ditch, etc., unless this causes a flooding problem. The earth dike shall have a minimum 1'-0" width at the top and shall be located on the grading plan. The top of dike elevation shall be shown on the storm sewer system profile sheet.

**(d) Requirements Relating to Surface Flow Between Residential Homes or Other Type Buildings**

Where a proposed drainage channel, swale, or ditch, etc., has surface flow that exceeds 2.5 cfs between residential homes or any other type buildings, located less than thirty (30) feet of each other, the storm water surface runoff must be collected in an approved catch basin, inlet, or culvert, and directed through an underground storm sewer system before it is permitted to flow between the buildings. The inlet structure should be located at least forty (40) feet away from any building if physically possible.

**(e) Requirements Relating to Surface Flow Onto a Public Roadway**

Where an existing watercourse, drainage channel, swale or ditch, other than an emergency overland relief swales, has a surface flow that exceeds 2.5 cfs, the flow is not permitted to be discharged onto the surface of the public roadway. Provide an inlet structure and storm sewer system to intercept the flow.

**(f) Requirements for Submitting Storm Drainage Calculations to Determine Whether Flooding of Any Building Will Occur**

Where catch basins and/or inlets are to be located in close proximity to any building, or where the site conditions may indicate a potential for flooding, the County Public Works Director may require headwater depth and/or storm drainage calculations to determine whether flooding of any building will occur. Also, refer to Section ST 810(c)(1).

**(g) Requirements for Modifying Standard State of Ohio Catch Basins and/or Inlets in New Developments**

(1) Modifying standard catch basins should be avoided, whenever possible. The County Public Works Director will approve modified catch basins and/or inlets, but the improvement plans must include all the necessary details and dimensions for review and approval.

(2) There may be cases in new developments, particularly, at a low point roadway cul-de-sac, where a proposed standard CB-3 is required, but is located at a driveway entrance. In this case, a heavy duty roll type frame and grate is required along with modification of other CB-3 details. It is recommended that an East Jordan Iron Works Inc., Catch Basin Curb Inlet Number 7391, a Neenah Foundry Company Inlet Frame and Double Grate Number R-3516, or an approved equivalent, be used. The catch basin masonry walls must support whatever frame is used, with the details included in the improvement plans.

**(h) Various Other Requirements for Catch Basin and/or Inlets Proposed In Private Developments**

**Separate Recommended Items**

(1) Location	Recommended Type of Catch Basin and/or Inlet to be Used
Private roadway with curb and gutter	State of Ohio Standard Construction Drawing CB-3A, CB-3 Hamilton County Standard Drawing Plate 9 CB3-M or Hamilton County Standard Drawing Plate 10 Catch Basin-Manhole CB-3-MH. Other type catch basins or inlets may be substituted.
Private roadway or private drive with side ditches and no curbs, existing watercourse, drainage channel, swale, ditch etc.	State of Ohio Standard Construction Drawing CB2-2-A (Depth not to exceed 4'-0" and used only at the beginning of a storm sewer system); otherwise, use State of Ohio Standard Construction Drawing CB2-3, CB2-4, CB2-5, OR CB2-6. Other type catch basins or inlets may be substituted.
Paved or unpaved parking lots.	State of Ohio Standard Construction Drawing CB2-2-B with heavy-duty frame and grate (Designate Type). Depth not to exceed 4'-0" otherwise, use CB2-3, CB2-4, CB2-5, or CB2-6 with full size grate. Use heavy-duty frames and grate (Designate Type). Other type catch basins or inlets may be substituted.
Private yards, other paved or unpaved areas	State of Ohio Standard Construction Drawing CB2-2-A, CB2-2-B, CB2-3, CB2-4, CB2-5, CB2-6. Other type catch basins or inlets may be substituted

(2) For any catch basins and/or inlets proposed in new developments that are not designated or identified as in Section ST 710(b) and (c), and EXHIBITS 10 through 19, the design data and design calculations must be submitted for review and approval. The design shall be in accordance with these Rules and Regulations.

(3) CB2-2-B's and CB2-3's through CB2-6's used in continuous runs such as in parking lots. Larger grates than those shown in the standard drawings may be provided to increase the flow to the catch basins thus reducing the number of catch basins required. The Developer must submit a parking lot drainage design scheme and design calculations for review and approval in all cases.

(4) The Developer will be required to submit a flood study, including storm drainage calculations and present a suitable scheme that will not worsen any existing or potential flooding problem related to the development using the one hundred (100) year design frequency storm.

## **Section ST 711**

### **Detention Basin Design Criteria**

#### **(a) General**

Detention basin/s are required for any new development, as indicated in Section ST 405, the design and details shall comply with these Rules and Regulations. It is recommended that the Engineer follow the procedure as indicated in EXHIBIT NOS. 33 and 34 and this section for developing detention basin design and details.

#### **(b) Special**

(1) When ever special or unusual field conditions require that a detention basin must be designed in a different manner than that indicated by this section, the Developer's Engineer must obtain approval from the County Public Works Director for the detention basin design and detail proposal, following the concept review procedures in Article XI, before proceeding with the final design.

(2) The design criteria for detention basins in these Rules and Regulations apply only to detention basins located outside of any special flood hazard area.

(3) Whenever the detention facility discharge pipe outlets near the bottom of a primary or major watercourse the design shall include a condition that the one hundred (100) year frequency flood is occurring at the same time the detention facility is at its high water level. Base Flood Elevation reference material is available at Hamilton County:

3.01 Consoer and Townsend Associates Storm  
Drainage and Open Space Master Plan.

3.02 Firm Flood Insurance Rate Map.

3.03 If the base flood elevation is not of record  
the designer shall determine the one

hundred (100) year base flood elevation by hydraulic analysis based on the field conditions.

**(c) State of Ohio Permit for Construction of Dams**

(1) A State of Ohio Construction Permit for construction of a detention basin dam is not required for:

1.01 A dam, which is or will be less than ten feet in height and which has or will have a storage capacity of not more than fifty acre-feet at the elevation of the top of the dam. For the purposes of this section the height of a dam shall be measured vertically from the natural stream bed or lowest ground elevation at the downstream or outside limit of the dam to the elevation of the top of the dam; (see dimension H, EXHIBIT NO. 34).

1.01 A dam, regardless of height, which has or will have a storage capacity of not more than fifteen (15) acre-feet at the elevation of the top of the dam.

1.03 A dam, regardless of storage capacity, which is or will be six (6) or less feet in height.

(2) Refer to Section ST 1104(e) for additional instructions, if a State of Ohio Construction Permit is required.

**(d) Plans, Drainage Area Maps, Design Calculations, etc., Required**

Most of the requirements for submitting Improvement Plans to the County Public Works Director for review and approval that include detention basin/s are covered under Articles IV and XI. When EXHIBIT NOS. 33 and 34 apply for developing the detention basin design and details, the Engineer shall include the following data, or any other related data necessary for proper review, in the submittal:

(1) Submit a topographic map delineating the off site and on site drainage areas that contribute runoff to the release structure. Also delineate on the map the flow line of the existing watercourse or drainage channel used to determine the most critical runoff length and calculate the ground slope based on the most critical runoff length for determining time of concentration (tc).

(2) Submit EXHIBIT NO. 4 for determining time of concentration (tc.) Use 5 minutes for small commercial sites.

(3) Submit EXHIBIT NO. 20 for determining discharge ( $Q_{100}$ ) or ( $Q_{100}$ ), whichever applies, for drainage areas exceeding 200 acres only.

(4) Submit EXHIBIT NOS. 17, 18, 19 and 21 through 28, when they apply, for the design of the primary spillway system.

(5) Submit EXHIBIT NO. 30 for determining size, type, width, and length of rock channel protection. Also refer to EXHIBIT NO. 34 for other rock channel protection controls.

(6) Submit EXHIBIT NO. 33 for determining required storage and other data relative to the detention basin.

**(e) Formulas to be Used to Obtain Discharge (Q)**

(1) The "Rational Method" formula,  $Q=cia$ , shall be used to determine the discharge as indicated in EXHIBIT NO. 33, for off site and on site drainage areas totaling 200 acres or less.

(2) When the runoff from a drainage area to a detention basin exceeds 200 acres, the design methods and formulas to be used for detention basin design must be established on a case-by-case basis. Consideration must be given to discharge as obtained by the method indicated in Section ST 702(b).

**(f) Determining Adjusted Pre-Development Runoff Coefficient  $c_3$**

Definitions for pre-development runoff coefficients  $c_1$ ,  $c_2$ , and  $c_3$ , and drainage areas  $a_1$ ,  $a_2$ , and  $a_3$  are indicated in EXHIBIT NO. 33. The adjusted pre-development runoff coefficient  $c_3$  is to be obtained by using the values for  $c_1$  (on site) and  $c_2$  (off site) in the following table:

EXPLANATION AND FORMULAS ~ C <sub>3</sub>		
LOCATION	AREA	COEFFICIENT
On Site Pre-Development	a <sub>1</sub>	c <sub>1</sub>
Off Site Existing	a <sub>2</sub>	c <sub>2</sub>
Adjusted Pre-Development	a <sub>3</sub>	c <sub>3</sub>
$c_3 = \frac{c_1 a_1 + c_2 a_2}{a_1 + a_2}$		
$a_3 = a_1 + a_2$		

NOTE: Use runoff coefficient "C" factors per Section 702(c), except for renovation and replacement projects. For renovation and replacement projects, the pre-development coefficient C=0.45 is to be used, (within the area of the construction limits).

**(g) Determining Adjusted Post-Development Runoff Coefficient c<sub>6</sub>**

Definitions for post-development runoff coefficients c<sub>4</sub>, c<sub>5</sub>, and c<sub>6</sub> are indicated in EXHIBIT NO. 33. The adjusted post-development runoff coefficient c<sub>6</sub> is to be obtained by using the values for c<sub>4</sub> (on site) and c<sub>5</sub> (off site) in the following table:

EXPLANATION AND FORMULAS ~ C <sub>6</sub>		
LOCATION	AREA	COEFFICIENT
On Site Post-Development	a <sub>1</sub>	c <sub>4</sub>
Off Site Existing	a <sub>2</sub>	c <sub>5</sub>
Adjusted Post-Development	a <sub>3</sub>	c <sub>6</sub>
$c_6 = \frac{c_4 a_1 + c_5 a_2}{a_1 + a_2}$		
$c_5 = c_2$		
$a_3 = a_1 + a_2$		

NOTE: When no off site runoff is tributary to the development and/or the detention/retention facility use the following:

Pre-Development Coefficient c<sub>1</sub>  
 Post-Development Coefficient c<sub>4</sub>

**(h) Determining Time of Concentration as Defined in EXHIBIT NO. 33 for  $tc_{10}$  and  $tc_{100}$**

When applicable, use EXHIBIT NO. 4 (Overland Flow Chart), to obtain  $tc_{10}$  and  $tc_{100}$ , as follows:

(1) To obtain  $tc_{10}$ , use the critical runoff length as explained in Section ST 711(d)(1), the pre-development runoff coefficient  $c$  and the ground slope (in percent) as explained in Section ST 711(d)(1).

(2) To obtain  $tc_{100}$ , use the same length as in (1) above, the adjusted post-development runoff coefficient  $c$  and the same ground slope as in (1) above.

**(i) Allowable Release Rates and Storage Volume Requirements**

(1) The detention of storm water shall occur in 2 stages.

1.01 Stage 1 shall allow the discharge of a 1-year pre-developed peak rate.

1.02 Stage 2 shall allow the discharge of a 10-year pre-developed peak rate and provide for the detention of a post-developed site 100 year storm.

(2) The required detention and/or retention facility limits are to be recorded on a new easement or record plat for any new development requiring storm water storage. For additional information, see EXHIBIT NO. 1 and General Notes.

**(j) Release Structures**

(1) Typical release structure as shown in EXHIBIT NO. 34 shall be a modified ODOT Standard catch basin, with STD. windows, frame and removable grate.

CB2-2-A and CB2-2-B(depth less than 4'-0")

CB2-3, CB2-4, CB2-5, CB2-6 (depth greater than 4'-0")

For catch basins greater than 4'-0" depth ODOT steps are required per ODOT #MH-1 Std.

The construction details shall include dimensions and additional reinforcement as required for orifices or other openings, footings and supports for paved gutters, discharge pipes, anti-vortex walls or training walls.

1.01 Orifice wall penetrations are to be sleeved with an eight (8) inch length minimum of pipe through the wall.

1.02 Pipes, sleeves and openings are to be cast into concrete walls or grouted solid (watertight) all around into precast concrete or solid concrete masonry unit walls.

1.03 Concrete masonry unit walls with hollow cores will not be approved.

1.04 A thin plate with a hole in it used for discharge control will not be approved

(2) When orifice wall penetrations are used as discharge controls they may be arranged in various sizes, shapes and locations, the smallest size allowed is a 3" diameter orifice when a paved gutter or approach apron and debris trap are provided.

(3) When pipes are used as discharge controls, they may be arranged in various sizes and locations.

3.01 To determine the pipe size for various headwater conditions for pipes flowing full, the ODOT's Tube Control Culvert Flow procedure is to be used, (see EXHIBIT NO. 24) unless inlet conditions clearly exist. The smallest pipe size is to be 12" diameter with required discharge control orifice grouted solid into the end of the 12" pipe.

3.02 The release structure is to be constructed of reinforced concrete walls.

3.03 The pipe inlet end is to be protected with a headwall and/or riprap. The limits of the riprap is to be two pipe diameters from the edge of the pipe all around.

(4) Discharge pipe shall be designed for post-development  $Q_{100}$ , (see EXHIBIT NO. 33, Sheet. 2 of 2)

4.01 The Headwater  $HW_{100}$  should not be any higher than 6" below the release structure windowsill elevation.  $HW_{100}$  is to be checked for inlet and outlet control.

4.02 The discharge pipe shall be extended from the release structure to the toe of the dam and be terminate with a headwall conforming to details included on Plate No. 5 of these rules, or headwall as provided by designer and approved by the Director of Public Works, or continued and connected to an existing storm drainage system or well defined watercourse.

4.03 Rock channel protection or other type energy

dissipaters are to be placed at the outlet ends as required.

4.04 Water tight pipe joints or concrete encased pipes are required through the dam.

4.05 Reinforced concrete pad or flowable control density fill for supporting the discharge pipe are required, so that impervious fill material may be thoroughly compacted on each side and over the pipe. Anti-seep collars will be approved for rigid pipes instead of concrete pad.

4.06 No discharge pipe smaller than 12" diameter will be approved.

(5) Primary spillway design discharge ( $Q_{PS}$ ) is to be routed through standard ODOT catch basin windows and grate to protect the detention facility in the event of a greater storm frequency than designed for or partial orifice plugging.

5.01 Minimum  $Q_{p.s.}$  = Post-Development  $Q_{100}$  - Pre-Development  $Q_{10}$  (see EXHIBIT 33, Sheet 2 of 2)

5.02 To determine headwater height ( $h_1$ ), size and number of windows required refer to EXHIBIT NO. 17, 18 and 19 or use orifice formula.

5.03 For underground storage (pipe or concrete vault) detention facilities, the  $Q_{PS}$  is to be routed over a weir or through an overflow pipe. A manhole is required to intercept the spillway and orifice controls and to connect the system to the discharge pipe.

(6) When the designer determines that Anti-vortex and training walls are necessary, the top elevation of the walls are to match the invert elevation of the emergency spillway.

(7) Release structures other than typical release structures, previously described, may be approved. However, the design and details must conform to the same Rules and Regulations.

(8) When the designer determines that a trash trap is required over the primary spillway, it shall be designed to be removable for maintenance purposes.

**(k) NOT USED**

**(I) Maximum Release Rate**

(1) The orifice formula for free-flow discharge is:

$$Q = ca \sqrt{2gh} \text{ where:}$$

Q = orifice discharge in cfs

c = coefficient of discharge

Note: Use c = .61

a = orifice cross-sectional area in square feet

g = gravitational acceleration constant = 32.2 ft/sec<sup>2</sup>

h = height of water surface over center of orifice in feet

(2) The orifice formula for submerged discharge also is:

$$Q = ca \sqrt{2gh}, \text{ same as in (1) above, except that:}$$

h = height of water measured as the difference between the water surface elevation on the outside of the release structure and the water surface elevation on the inside of the release structure.

(3) Dimensions h, as defined in (1) and (2) above, is represented by h<sub>2</sub>, h<sub>3</sub> and h<sub>4</sub> on (4) below.

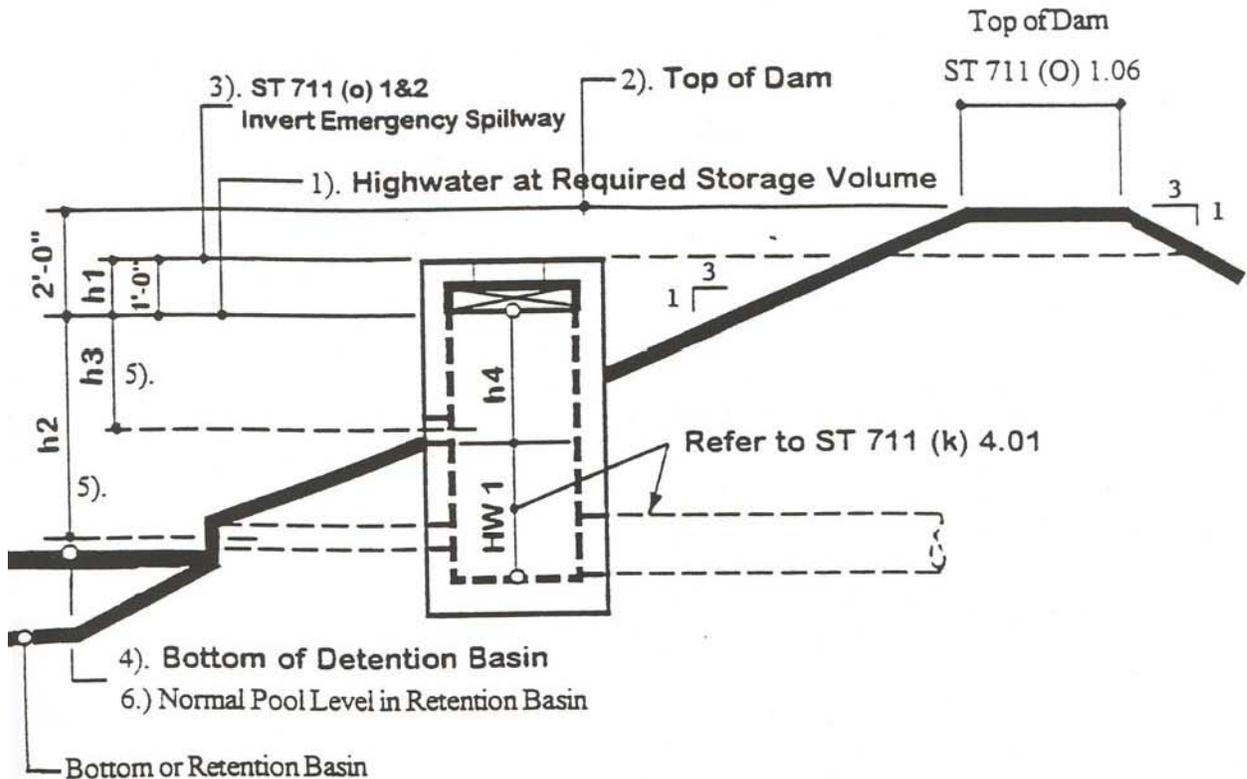
They are as follows:

h<sub>2</sub> = height of water over center of bottom orifice occurring at pre Q<sub>1</sub> or pre Q<sub>10</sub> maximum release rate, whichever applies.

h<sub>3</sub> = height of water over center of top orifice occurring at pre Q<sub>10</sub> maximum release rate. Sized for pre Q<sub>10</sub> - pre Q<sub>1</sub> capacity.

h<sub>4</sub> = h as defined in (J)(4)(4.01) above, occurring at pre Q<sub>10</sub> maximum release rate.

(4) Standard Outlet Control Structure (STD, ODOT catch basin as shown) refer to ST711(n)3.



- 1) Maximum release rate pre Q10 occurs at high water level at required storage volume (ST 711(n)1).
- 2) Top of dam shall be flood control elevation for buildings upstream and adjacent to detention basin.
- 3) Invert of emergency spillway shall be used for calculating the beginning of the hydraulic gradient for all storm sewers that terminate within the detention basin.
- 4) Provide paved gutter ODOTMC-5 for low flow routing and housekeeping purposes.
- 5) Provide 3" minimum diameter pipe or orifice for maintenance purposes.
- 6) Public Storm Drainage Systems tributary to retention pond shall not have submerged outlet pipes at normal pool level.

NOTE: All details and notes above apply to Detention and Retention Basins except (4) and (6) or as noted.

(5) The following table may be used as an aid when designing circular orifice openings for maximum release rate.

RADIUS AND AREA OF CIRCULAR ORIFICE OPENINGS					
Orifice Diameter (Inches)	Radius (Feet)	Area (Sq. Ft.)	Orifice Diameter (Inches)	Radius (Feet)	Area (Sq. Ft.)
*3	0.125	0.049	10	0.417	0.545
*3½	0.146	0.06	10½	0.43	0.601
*4	0.167	0.087	11	0.458	0.66
*4½	0.188	0.110	11½	0.479	0.721
*5	0.208	0.136	12	0.500	0.785
*5½	0.229	0.165	12½	0.521	0.852
6	0.250	0.196	13	0.542	0.922
6½	0.271	0.230	13½	0.563	0.994
7	0.292	0.267	14	0.583	1.069
7½	0.312	0.307	14½	0.604	1.147
8	0.333	0.349	15	0.625	1.227
8½	0.354	0.394	16	0.667	1.396
9	0.375	0.442	17	0.708	1.576
9½	0.396	0.492	18	0.750	1.767
* Generally acceptable in parking lots only. See Section ST 711(q) for additional controls					

(6) If pipes are used instead of orifices to control maximum release rate, the release structure and pipe requirements must conform to (l)(3) and (l)(4) above.

The following table indicates which EXHIBIT NO. is to be used when designing for the proper pipe sizes in controlling maximum release rate:

<b>TO DETERMINE HEADWATER DEPTH HW WHEN OUTLET CONTROL GOVERNS</b>			
<b>Pipe Type</b>	<b>Pipe Diameter</b>	<b>Applicable Storm Event</b>	<b>Exhibit No. To Use</b>
Concrete or Other Smooth Surface Pipe	*12" or Greater	Pre Q <sub>1</sub> per Section ST 711(j) or Pre Q <sub>10</sub> as per EXHIBIT NO. 33	22
Corrugated Metal Pipe	Same As Above	Same As Above	26

Or

<b>TO DETERMINE HEADWATER DEPTH HW WHEN INLET CONTROL GOVERNS</b>			
<b>Pipe Type</b>	<b>Pipe Diameter</b>	<b>Applicable Storm Event</b>	<b>Exhibit No. To Use</b>
Concrete or Other Smooth Surface Pipe	*12" or Greater	Pre Q <sub>1</sub> per Section ST 711(j) or Pre Q <sub>10</sub> as per EXHIBIT NO. 33	24
Corrugated Metal Pipe	Same As Above	Same As Above	27

\* For pipe diameters less than 12", but in no case less than 6" as per Section ST 711(k)(3), headwater depth (HW) and head (H), whichever applies, must be determined by other methods. It is not recommended to use pipe diameter less than 12" to control maximum release rate.

**(m) NOT USED**

**(n) NOT USED**

**(o) Emergency Spillway (refer to EXHIBIT NO. 34)**

(1) An emergency spillway is required with every retention and detention facility. The emergency spillway design discharge ( $Q_{es}$ ) is to be routed safely downstream to an existing well defined watercourse or storm drainage system/

$$1.01 Q_{es} \text{ (emergency spillway discharge)} = Q_{ps} \text{ (Primary spillway discharge)}$$

1.02 The emergency spillway is to be routed through a standard ODOT paved gutter MC-5 (or DM-2.1M) sloped at  $\frac{1}{4}$ " per foot overtop of dam with invert 1'-0" minimum above the primary spillway window sill. Turn down edge of paved gutter 4'-0" minimum along slope of upstream and downstream face of dam. Construct per ST 805 (b)(2) or as detailed by designer.

1.03 Weir formula for design of emergency spillway

$$Q_{es} = 2.7 L(H)^{3/2}$$

L = Length of the emergency spillway at the invert in feet. The invert is to be at least 1'-0" above the release structure windowsill.

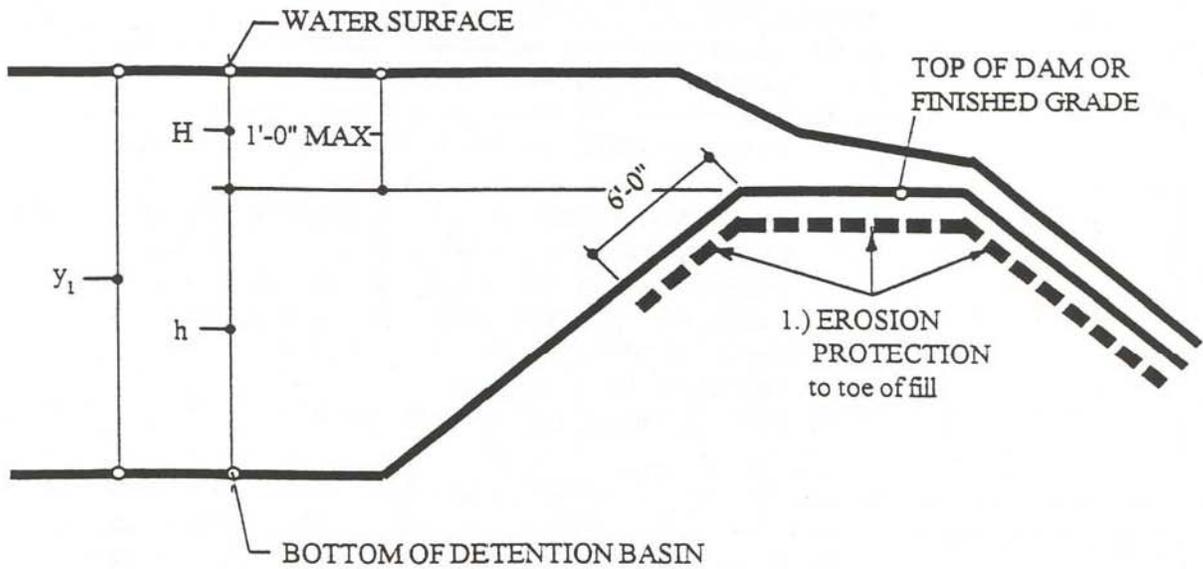
H = Height of emergency spillway flow above the invert. Height of design flow is to be at least 6" below the top of the dam.

1.04 The top of the dam is to be 10'-0" width minimum or in cases of nominal size dams 4'-0" width minimum. In either case, the paved gutter shall extend the full width of the top of the dam and be turned down 2'-0" on both sides of the dam.

1.05 Unavoidable overtopping of the dam shall be allowed if no dam construction is required or the dam is constructed straight across a ravine and the abutment ends are keyed straight into impervious undisturbed material. The total length of the dam shall be designed as a broad crested weir.

1.06 Broad Crested Weir / Emergency Spillway

Note: Broad Crested Weir shall not be allowed unless no other option is available (see 1.05).



FORMULA: 
$$q = 0.433 \sqrt{2g} \left( \frac{y_1}{y_1 + h} \right)^{\frac{1}{2}} H^{\frac{3}{2}}$$

q = Discharge per unit length

g = Gravitational acceleration constant (32.3 ft/sec<sup>2</sup>)

h = Height of dam

H = Crest of water above top of dam

$$y_1 = h + H$$

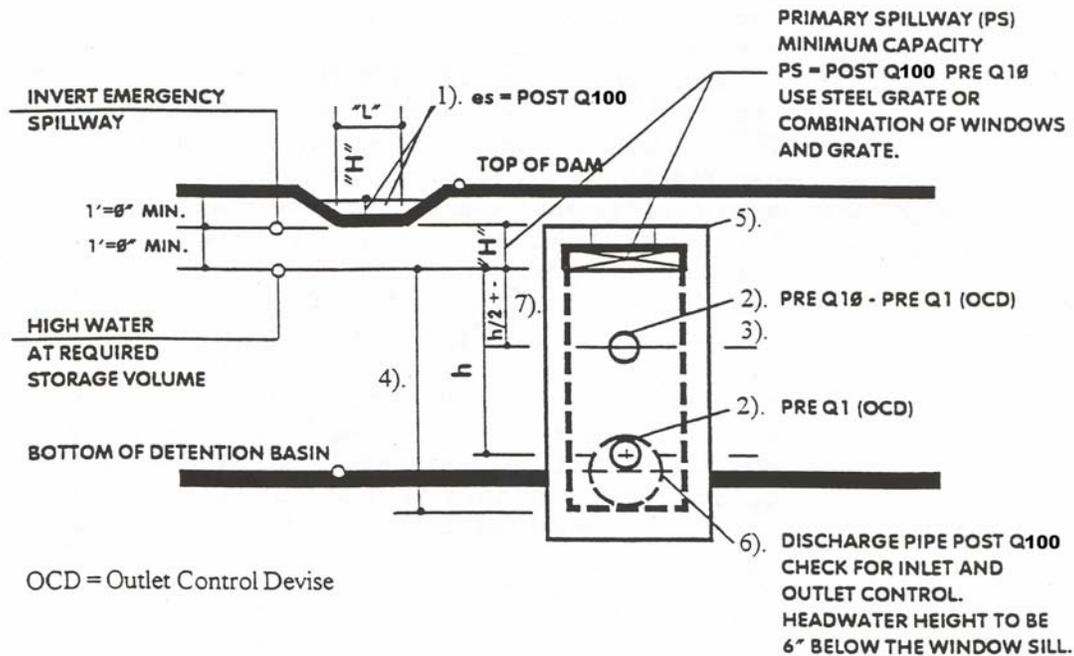
(1) Erosion Protection: Refer to item (2) in this section and or owner's Geotechnical Engineer's Report.

(2) Erosion protection for the dam shall be provided, so that the emergency spillway may be routed safely downstream from the detention facility. The upstream face, top of dam and downstream face at the gutter or broad crested weir shall be lined with concrete pavement, rock protection, sod, seeded geotechnical fabric, etc., whichever is required for erosion protection.

(3) If site conditions indicate that an emergency and primary spillway system is not feasible as recommended in these Rules and Regulations, especially on small sites where the drainage area to a detention basin is less than one (1) acre, the Engineer may submit preliminary plans of the proposed detention basin in accordance with Section ST 1102(b) for review and approval before proceeding with final design. The proposed detention basin shall provide for an emergency spillway if a primary spillway system is not used. The emergency spillway shall be designed to allow the post  $Q_{100}$  storm (as obtained from EXHIBIT No. 33) to continue downstream in the event of plugging or partial plugging of the system proposed to control maximum release rate.

(4) Standard Outlet Control Structure and Outlet Control Devices (STD, ODOT catch basins as shown).

NOTE: OCD – Metal plate with a hole will not be allowed.



- 1) Broad crested weir may be used instead of emergency spillway ditch is unavoidable (see Section ST 711 (0)5).
- 2) If pipes are used instead of wall penetrations the pipe size is to be determined by tube control.
- 3) Second OCD may not be required for insignificant size detention facility.
- 4) 4'-0" or greater depth outlet control structures required STD ODOT manhole rungs.
- 5) Provide anti-vortex walls at outlet control/primary spillway if required by Engineer.
- 6) Crown of discharge pipe shall match crown of OCD or drop down lower to allow free out fall from OCD pipe or penetration. If inverts match, check OCD for submerged outlet control.
- 7) Second OCD location shall be adjusted to suit normal size pipe.

**(p) Detention Basin Construction**

Detention basin construction shall conform to the following specifications or designed and sealed by an Ohio Registered Geotechnical Engineer and details as shown on EXHIBIT NO. 34 (Sheets 1, 2, and 3 of 3), when applicable. The Rules and Regulations as listed in

Section ST 711(a)(1) and (2) also apply. Specifications for construction of the detention basin are as follows:

(1) Scope - The work shall consist of all site preparation, excavation, earth fill, construction of storm sewer/s, release structure/s, discharge pipe/s, paved gutter, reinforced concrete emergency spillway, rock channel slope protection, earth dam, temporary erosion and sediment control, placing of topsoil and vegetative treatment and any other item required as shown on the approved improvement plans.

(2) Site Preparation - The foundation area and borrow area will be cleared of all trees, stumps, roots brush, rocks, and other debris. All cleared material will be removed from the site. The foundation area will be stripped to a minimum depth of six (6) inches. After stripping, an examination of the foundation area will be made and all pockets of organic soil, sand, and gravel and other unsuitable material will be removed. After excavation is complete, all slopes within the foundation area will be no steeper than 1:1 and will be shaped to accommodate compaction equipment. Borrow areas will be stripped of all vegetation, organic matter, and other unsuitable materials.

(3) Impervious Cutoff Trench, Release Structure/s and Discharge Pipe/s - A cutoff trench, as detailed on the approved Improvement Plans and similar to that shown in EXHIBIT NO. 34 (Sheet Nos. 1 and 2 of 5), consisting of relatively impervious material shall be provided under the earth dam. The material shall consist mainly of clay, with some silt, sand, and gravel. The cutoff shall extend along the centerline of the earth dam and be deep enough to extend into a relatively impervious layer. In all cases the minimum depth shall be three (3) feet. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall be no steeper than 1:1. Prior to backfilling, the excavated cutoff trench should be examined for unanticipated unsuitable material, which will require additional excavation. The cutoff trench will be backfilled with the most impervious material available from the designated borrow area/s. Placement, compaction, and moisture requirements are the same as specified for earth fill as indicated in (5) below. Before the impervious core is constructed as specified in (4) below, the release structure/s and discharge pipe/s, with reinforced concrete pads when required as indicated in Section ST 711 j 4.05, are to be constructed. They shall be placed on a firm foundation to the lines and grades as shown on the plans. Selected backfill material shall be placed in 4 inch horizontal layers and compacted with hand operated power tampers. Special care shall be taken to prevent lifting the pipe by pressure exerted by tamping earth under the haunches of the pipe. Moisture control and compaction requirements will be equivalent to that specified for the earth fill. At least

three (3) feet of impervious fill and earth fill, with limits designated on the approved Improvement Plans, shall be compacted over the discharge pipe/s, using either hand operated power tampers or lightweight power driven tampers. Additional fill required over discharge pipe/s shall be constructed as indicated in (4) and (5) below.

(4) Impervious Core - An impervious core, similar to that shown in EXHIBIT NO. 34 (Sheet 2 of 5), consisting of relatively impervious material, as indicated in (3) above, shall be provided along the centerline of the earth dam. The impervious core shall be placed in horizontal lifts with a maximum thickness of six (6) inches prior to compaction. Unless otherwise specified on the plans, each lift shall be compacted with at least four (4) passes of the sheepsfoot roller (200-psi minimum rating).

(5a) Earth Fill - Prior to beginning placement of earth fill, the release structures and discharge pipes shall be placed on firm foundation to the line and grades shown on the plans then the surface of the foundation area will be scarified to a depth of six (6) inches and compacted to the same requirements as specified for earth fill below. Fill material shall be free of all sod, roots, frozen soil, stones larger than six (6) inches diameter, and other objectionable material. The material shall consist mainly of sand and gravel with some silt and clay. The placing and spreading of the fill material shall begin at the lowest point in the foundation area and shall be placed in horizontal lifts with a maximum thickness of six (6) inches prior to compaction. Unless otherwise specified on the plans, each lift will be compacted with at least four (4) passes of sheepsfoot roller (200-psi minimum rating). The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the fill. The moisture content of the fill material being placed must be maintained within the limits required to permit satisfactory compaction.

(5b) All soil embankments shall be constructed as per ODOT 203 under the supervision of a qualified soils engineer. The Soils Engineer registered in the State of Ohio shall furnish a certificate in duplicate to the County Public Works Director certifying the location and degree of compaction of such fills.

(6) Topsoil - The topsoil stockpiled during site preparation shall be placed as a top dressing on the surface of the earth fill and borrow area. Provide additional topsoil if necessary to obtain a minimum 3" depth throughout these areas.

(7) Borrow Area - All borrow areas shall be graded in such a manner that they can be drained and re-vegetated.

(8) Temporary Erosion and Sediment Control - Provision for temporary erosion and sediment control during construction of detention basin generally shall follow the Rules and Regulations of Section ST 414. The details shall be shown on the Temporary Erosion and Sediment Control Plan included with the Improvement Plans.

**(q) Parking Lot Detention Basin**

Parking lot detention basin design criteria shall be the same as for detention basin design except that intermediate storage design and primary spillway design is not required. Use EXHIBIT NO. 33 to obtain volume of storage required maximum release rate, etc. Other controls for parking lot detention basin design area as follows:

(1) The maximum storage depth in automobile parking spaces shall not exceed 7 inches during the 100 year design storm.

(2) An emergency flood route shall be provided to allow the post  $Q_{100}$  storm to continue downstream without causing flooding problems. The emergency flood route system shall be designed to limit the maximum depth of water in the parking lot to a maximum of 9 inches. Openings in adjacent buildings, including drain outlets for window wells, basements, sump pumps and foundations, shall be at least 1'0" above the 100 year flood elevation.

(3) Recommended release structure/s for parking lot/s are shown on EXHIBIT NO. 34, Sheet 3 of 5. Removable plates in release structure/s that are to be privately maintained will not be approved.

(4) Maximum release rate  $q_0$ , as obtained from EXHIBIT NO. 33, shall be discharged through the release structure/s generally using either weir/s or orifice/s. Some weir and orifice formulas are shown in Section ST Nos. 711(l)(1) & (2) and ST 711(o)(1.03). Minimum orifice openings shall not be less than three (3) inches when paved parking lots are used and four (4) inches when unpaved parking lots are used. Unpaved parking lots to be used as detention basins are not recommended because of maintenance problems with mud, debris, etc.

(5) The maximum surface slope recommended for paved parking lot detention basin/s is five (5) percent and the minimum surface slope is one half (0.5) percent. For unpaved parking lots, if used, the minimum slope shall be one (1) percent.

**(r) Other Type Detention Basins**

Underground storage detention structure design criteria shall be the same as for detention basin design except that intermediate storage design and primary spillway design may or may not be required, depending on whether site conditions allow for their use. Use EXHIBIT NO. 33 to obtain volume of storage required maximum release rate, etc. Other controls for underground storage detention structures are as follows:

(1) A flood routing system is required. When a primary spillway system has not been designed in the storage structure, the flood routing shall be designed to allow the post  $Q_{100}$  storm (as obtained from EXHIBIT NO. 33) to continue downstream, without causing flooding problems. The flood routing system shall be located above ground and any potential downstream flooding problems must be investigated.

(2) The underground storage detention structures generally shall be constructed of reinforced concrete.

Various other types of detention basins, such as rooftop storage, oversized storm sewer pipe storage, dry-well storage, impoundments utilizing fills of existing roadways, etc., generally are acceptable.

**(s) Miscellaneous Items**

(1) Detention basin/s located inside of Special Flood Hazard Areas generally will not be approved. Any detention basin proposed within any Special Flood Hazard Area must conform to the following:

1.01 The detention basin design and detail must meet the requirements of the Flood Damage Prevention Regulations (EXHIBIT NO. 36).

1.02 The detention basin design criteria must be established on a case-by-case basis.

(2) The use of pumps in any detention basin system is not permitted.

(3) If fencing is provided by an Owner or Developer, a gate or gates large enough to permit trucks and equipment to enter the detention basin site for maintenance purposes must be provided.

**(t) As-built for Detention / Retention Basins**

Following installation and prior to the release of the subdivision bond or the certificate of occupancy for commercial projects, actual field verified "As-Built" drawings (prepared by a Land Surveyor registered in the State of Ohio) must be submitted to the Hamilton County Department of

Public Works. Drawings shall be on tracing cloth or film (mylar). The following minimum information must be included:

(1) Complete plan view of the entire detention / retention basins and / or storm sewer systems.

(2) Contours generated by the survey or field shots for parking lot detention.

(3) Length, grade, size, and material of all pipes.

(4) Horizontal angles at all horizontal changes in pipe runs or state plane coordinates on all storm structures (preferred).

(5) Drainage structures are to be referenced by way of two (2) offset dimensions, one (1) from the right-of-way line and one (1) from the nearest lot line or state plane coordinates on all storm structures (preferred).

(6) Invert elevations of all pipes and orifices.

(7) Type, invert and top elevation of all structures.

(8) Q1, Q10, and Q100 release rates.

(9) Volume measured to the Q100 window or weir elevation.

(10) Surveyor's seal and signature.

## **Section ST 712**

### **Retention Basin Design Criteria**

#### **(a) General**

Retention basin design criteria shall be the same as for detention basin design criteria except as modified herein.

Whenever special or unusual field conditions require that a retention basin must be designed in a different manner than that indicated by this Section, the Developers/Engineer must obtain approval from the County Public Works Director for the retention basin design and detail proposal, following the concept review procedures in Article XI, before proceeding with the final design.

#### **(b) Allowable Release Rates and Storage Volume Requirements**

Refer to Section ST 711(i) for design criteria and other Rules and Regulation. The storage volume shall be that amount of stored runoff above the normal pool level as shown on ST 711 (o)(4).

#### **(c) Release Structures**

Release structure/s will be required in all retention

basins, refer to ST 711 (j) as follows:

(1) The release structure shall be constructed of reinforced concrete, pre-cast concrete or solid masonry footing and walls so as to be watertight. Hollow or metal material is unacceptable.

(2) The bottom of the footing shall be at least 3'-6" below the proposed ground line.

**(d) Primary Spillway System**

A primary spillway system must be provided with every retention basin to provide for passage of storm water overflow in the event of plugging or partial plugging of the openings in the side of the release structure with debris, as per ST 711 (o)(4). The primary spillway system shown provides for excess storm water to flow through the top of the release structure above the window sill level and outlet through the discharge pipe, the same as recommended for detention basins.

**(e) Maximum Release Rate**

Refer to Section ST 711 for maximum release rate design criteria and other Rules and Regulations.

**(f) Emergency Spillway**

An emergency spillway is required with every retention basin to provide for passage of storm water overflow in the event of plugging or partial plugging of the openings in the release structure, including the opening at the top of the release structure that is required for the primary spillway system as indicated in Section ST 711 (o) 1 through 5.

**(g) Retention Basin Construction**

Retention basin construction must conform to the applicable Rules and Regulations as listed in Section ST 711, and also the following:

(1) The impervious cutoff trench "d" dimension shall be 6'-0" minimum. Unless design by a Geotechnical Engineer. Refer to Section ST 711(p) and EXHIBIT NO. 34, Sheet 2 of 3, for all other impervious earth core details and Rules and Regulations.

(2) For any new development requiring a retention basin, details shall be included on the Improvement Plans that provide for the complete draining of the ponded area to allow for inspection, debris removal, built up sediment deposit removal or any other maintenance item, a maintenance pipe, having a 12" minimum diameter, is recommended to be used.

#### **(h) Miscellaneous Items**

(1) Aeration devices such as fountains are recommended to reduce or prevent water stagnation.

(2) If fencing is provided, a gate or gates large enough to permit trucks and equipment to enter the retention basin site for maintenance purposes must be provided.

(3) Retention basins proposed to be located within any Special Flood Hazard Area shall conform to Section ST 711(s)(1).

(4) A permanent maintenance width around the perimeter of any retention basin shall be shown on the easement or record plat as indicated in Section ST 1104 (e)(4).

(5) The alternate retention basin scheme may be considered at sites where the available vertical depth at the retention basin location is so restrictive that the maximum release rate ( $q_0 = \text{pre } Q_{10}$ ) must enter the top of the release structure. This condition may prevent the use of a primary spillway system and may eliminate the possibility of providing for intermediate storage. In that event, the retention basin must be designed as follows:

5.01 The opening at the top of the release structure must be large enough to receive the maximum release rate as obtained and controlled by the applicable design criteria and Rules and Regulations of Section ST 711.

5.02 The top (crest) of the emergency spillway shall be at least three (3) inches higher than the high water level calculated by using the maximum release rate  $q_0 = \text{pre } Q_{10}$ , or at least one (1) foot higher than the window sill elevation of the release structure, whichever is higher.

5.03 The emergency spillway shall be designed to allow the post  $Q_{100}$  storm (as obtained from EXHIBIT NO. 33) to continue downstream in the event of plugging or partial plugging of the system proposed to control maximum release rate.

5.04 For General and Special Design Criteria explanation, see ST 711(a) and ST 711(b).

#### **Section ST 713**

##### **Specifications for Construction and Materials**

(a) Culvert pipe material shall be as specified for Type "A" conduit 603.02 and meet pertinent contents of Specification 706.02.

(b) Unless otherwise indicated in Article VII of these Rules and Regulations, the design, materials, and construction shall be as specified in the latest edition of the State of Ohio Department of Transportation "Construction and Material Specifications", the State of Ohio Department of Transportation "Standard Construction Drawings". Unless otherwise specified, concrete storm sewer pipe shall be Type "B" Conduit 706.02 Class IV with Class B bedding as per 603.06. Backfilling is to comply with 603.10 and 603.11 for all storm sewers. Certification of proper backfill compaction shall be provided by a qualified geotechnical testing firm contracted by the developer for all trenches and fills supporting storm sewers.

NOTE: Conduit Types A, B and C are as indicated in Section 1104 of the State of Ohio Department of Transportation "Location and Design Manual".

(c) Smooth flow Polyvinyl Chloride (PVC) and high density polyethylene (HDPE) storm sewer pipe may be specified for Type "B" and Type "C" conduits. The type of pipe and ASTM or AASHTO numbers must appear on the plans and profiles. Also, the pipe shall be stamped by the manufacturer prior to shipment for field verification. Thermoplastic (PVC and HDPE) pipe shall comply with the specifications that follow:

**SCOPE:** This specification covers smooth flow integral bell and spigot Polyvinyl Chloride (PVC) and smooth flow integral bell and spigot High Density Polyethylene solid and profile wall non-perforated pipe and fittings, 12" to 60" nominal inside diameter for the use in gravity flow storm sewer and drainage applications.

**PIPE:** All pipe and fittings shall be manufactured and tested in accordance with the specifications listed in TABLE 1. The pipe stiffness, for all diameters, at 5% deflection, shall be as follows in TABLE 1 when tested in accordance with ASTM D2412.

**TABLE 1 - PIPE STIFFNESS (p.s.i.)**

Specification	Material	Diameter (in.)											
		12	15	18	21	24	27	30	36	42	48	54	60
ASTMD3034	PVC	46	46										
ASTM F679	PVC			46	46	46	46	46	46				
ASTM F949	PVC	50	50	50	50	50	50	50	50				
ASTM F794	PVC	46	46	46	46	46	46	46	46	46	46		
ASTM F-1803	PVC				46	46	46	46	46	46	46	46	46
AASHTO M294 Type S or D	HDPE	50	42	40	-	34	-	28	22	20	18	16	14

**DEPTH OF COVER:** The maximum depth of cover for Thermoplastic pipe shall be ten (10) feet. Consideration of twenty (20) foot cover minimum pipe stiffness of 46 if it is installed as per ASTM D2321, and certified by an approved testing firm.

**JOINING SYSTEM:** Joints shall consist of a bell and spigot gasket system meeting the requirements of ASTM D3212.

**MATERIAL:**

**Pipe and Fittings:** PVC materials shall have a minimum cell classification of 12454C or 12364C as defined in ASTM D1784. HDPE material shall be made of virgin material that conforms with the requirements of 335400C as described in ASTM D 3350.

**Gaskets:** Elastomeric Gaskets shall be manufactured in accordance with ASTM F477.

**INSTALLATION:** All Thermoplastic pipe and fittings supplied to meet this specification shall be installed in accordance with ASTM D2321.

**TESTING:** All Thermoplastic sewer pipe shall be mandrel tested for excessive deflection no sooner than 60 days after final grade/backfill has been completed. The contractor shall provide a 9 arm 5% go/no go mandrel (ASTM 02412) used for this test. The average inside diameter shall be used as the datum to measure the 5% deflection. Any sewer line not passing the 5% deflection test as determined by the Hamilton County Public Works Department shall be repaired or replaced at the contractor's expense. Any sewer line requiring repair or replacement shall be retested for deflection after 60 days.

**CERTIFICATION:** Prior to being installed, the contractor shall submit plant certifications from the manufacturer certifying the product used is in compliance with the appropriate National Specification listed herein. Any material not meeting these requirements will be rejected.

(d) For storm drains constructed on grades in excess of 15% ductile iron pipe (AWWA C151 Class 52) shall be used.

Key Blocking is required as follows:

(1) For grades 15% through 25%, key blocks every other joint.

(2) For grades greater than 25%, key block every joint.

(3) Use Type B key block (see Std. Drawing Plate 11).

(4) No differentiation between cut and fill slope on the above grades if Section ST 415 is adhered to.

### **Backfilling of Trenches**

Excavations for structures, manholes, catch basins, flush holes, water valve chambers etcetera, which are not located within the existing or proposed street pavement area shall be backfilled with granular material compacted in layers. In such cases a one inch (1") maximum diameter weep hole, formed by tubing, shall be cast into the base of storm manholes and catch basins to provide drainage for water that may accumulate in the granular material. The backfilling shall consist of furnishing, transporting, placing and compacting in layers, porous granular aggregate meeting ODOT Standards for backfill material, from the bottom of the excavation, up to an elevation twelve inches (12") below the final grade live or cross section of the sub grade, as shown on the approved plan. The stability at sub grade (12" thickness) must be equal to that immediately adjacent to the excavation. Incorporation of additional material such as soil fines, crushed stone, CLSM-CDF and so forth, may be necessary to achieve this requirement. For other sub grade requirements refer to Section 307 Preparation of Sub grade in the Rules and Regulations of the Hamilton County Engineer.

All mainline and lateral trenches between the pavement limits and for backfill of excavations for manholes, catch basins, flush holes, water valve chambers, etc. which are located under the pavement, shall be backfilled with Controlled Low Strength Material-Controlled Density Fill (CLSM-CDF) as described in Addendum "A" of the Hamilton County Engineer's Permit Manual.

As an alternate to the requirements described in the previous paragraph, excavation, bedding and backfill for all lateral trenches between pavement limits and for backfill of excavations for manholes, catch basins, flush holes, water valve chambers, etc. which are located wholly or in part under the pavement, shall be done in accordance with sections 603.05, 603.11, and 603.10 of the ODOT Construction and Materials Specifications (C&M.S.) The final twelve inches (12") shall be compacted in accordance with Section 307 of this manual. Density tests shall be performed and certification shall be provided by an approved geotechnical firm, documenting that the backfill was so placed and including actual satisfactory test results for the compacted layers.

All trench backfill, other than for mainline and lateral trenches, within the right-of-way and/or utility easements adjacent and parallel thereto shall be compacted in layers to achieve a density of not less than ninety-five percent (95%) (and to sub grade requirements at sub grade level). Compaction tests shall be made by a certified testing firm, approved by the Hamilton County Engineer and employed by the developer. (See Appendix "G" in the Rules and Regulations of the Hamilton County Engineer for testing procedures.)

In trench locations or excavation for structures where the use of controlled low strength material-controlled density fill (CLSM-CDF) is not required, it can be used as an alternate backfill material, in which case the requirements for compaction testing will be waived.

## **ARTICLE VIII**

### **Basic Design Criteria for Storm Water Open Channels, Culverts, and Bridges**

#### **Section ST 801**

##### **General**

(a) The Developer's Engineer should become familiar with these Rules and Regulations, in particular, Articles I, III, IV, VII, XI, XII. The hydraulic principles of open channels such as drainage channels, existing watercourses, existing watercourse alterations or relocations, swales, ditches, gutters, etc., (paved and/or unpaved), and the various design aids that pertain to open channel flow in the EXHIBITS and PLATES before proceeding with open channel, culvert, and bridge design and detail. The Hamilton County Department of Public Works reviews only the hydraulic design of bridges. The Hamilton County Engineers or the Hamilton County Department of Building Inspections regulate all structural elements of bridge construction.

(b) Open channels, culverts, and bridges proposed to be located partially or wholly within any special flood hazard area will be approved if they do not constitute encroachment as defined in Section ST 112, and all requirements of the Flood Damage Prevention Regulations (EXHIBIT NO. 36) are met. Design criteria must be established on a case-by-case basis.

#### **Section ST 802**

##### **Degree of Protection**

Storm water open channels shall be adequate to handle runoff from storms of the frequencies of occurrence shown for the degrees of site development as follows:

(a) For all areas/sites with drainage sheds of less than 1 acre, 10 year frequency.

(b) For all areas/sites with drainage sheds 1 acre or greater, 100 year frequency.

(c) For all areas/sites flood routing relative to buildings and roadways, 100 year frequency.

(d) The runoff capacity of existing swales and watercourses that are to be altered or relocated shall be maintained, if flooding problems do not exist. Flood controls, when necessary, shall be the same as for Section ST 802(c) above, 100 year frequency.

### **Section ST 803**

#### **Determination of Quantity of Runoff**

Each portion of the storm water open channel shall be capable of handling the peak flows as determined by the methods indicated in Section ST 702(a) or (b) except that flow quantities provided in the Flood Insurance Study for Unincorporated Hamilton County, Ohio and the Storm Drainage and Open Space Master Plan for Hamilton County, Ohio shall be used within any Special Flood Hazard Area as defined herein, whichever provides the more stringent restrictions.

### **Section ST 804**

#### **Open Channel Capacity and other Controls**

(a) The required capacity of an open channel involves a determination of the velocity and depth of flow for a given discharge. Those characteristics can best be obtained from the Manning Formula See EXHIBIT NO.7 (Sheet 1 and/or 2 of 2) and EXHIBIT NO. 32.

(b) Open channel cross section areas shall be determined by the Manning Formula, using a value of "n" as indicated in EXHIBIT NO. 6. The cross section areas shall be designed and sized for the degree of protection as indicated in Section ST 802 and the velocities as indicated in Section ST 805.

(c) Various construction details recommended for the cross sectional areas are shown in Sta. Drawing. Plates 4, 6, 7 and 8.

(d) Cut and fill side slopes of open channels shall not be steeper than 4:1 as indicated in Section ST 414. Where side slopes must be steeper than 4:1, the Developer's Engineers shall follow the procedures as indicated in Section ST 414 to obtain approval.

(e) The longitudinal slope of an open channel shall be established so as to provide a velocity somewhere between the recommended minimum and maximum velocities as indicated in Section ST 805. A longitudinal slope flatter than 0.5% is not acceptable.

(f) For any building proposed to be constructed adjacent to, but outside of any Special Flood Hazard Area and/or the one hundred (100) year flood plain limits of any open channel not designated as a special flood hazard area, the lowest flood elevation is to be at least one (1) foot higher than the applicable flood elevation indicated above.

(g) Where existing swales or watercourses are permitted to remain undisturbed in any new development, the Developer's Engineer may be required to provide flood study information as indicated in Section ST 1104(d), (not needed for preliminary plan).

(h) At the discretion of the Director of Public Works, existing swales and watercourses with runoff through a new development, that are not to be disturbed by the development, shall be studied to determine the need for remedial work. This work may consist of tree, debris and obstruction removal, bottom channel and side slope erosion control, re-grading of side slopes to eliminate slope instability, or elimination of other potential hazards. The Developer may be required to provide the necessary labor and/or materials to perform required construction items. The Improvement Plans to be submitted for approval shall indicate the work to be performed.

**Section ST 805**

**Ditch Design Criteria**

**(a) Velocity**

(1) Determination of velocity shall be based on the storm frequencies indicated in Section ST 802, (refer to EXHIBIT NO. 32 for open channel symbols, equations and geometric formulas).

(2) The velocity for the design frequency storm shall not exceed the values shown in the following table.

(3) Allowable Ditch Velocities Table:

<b>Grass Lining Maximum Flow Velocity</b>				
<b>Soil</b>			<b>Maximum Velocity ft./sec.</b>	
Texture	Type	Seed Lining	Seed & Mulching	Sod
Sand, Silt, Sandy Loam, Silt Loam	Sand	1.5	3.0	3.5
Silty Clay Loam, Sandy Clay Loam	Firm Loam	2.0	4.0	4.0
Clay	Clay	2.5	4.0	5.0-6.0
N/A	Gravel	3.5	5.0	
N/A	Weathering Shale	4.5	5.0	N/A

Note: Soil texture/type can be determined from the soil surveys. If the channel is on fill, the soil should be tested.

<b>Maximum Permissible Velocities for Bare Soil Channels</b>	
<b>Soil Texture</b>	<b>Maximum Velocity ft./sec.</b>
Sand, Silt, Sandy Loam, Silt Loam, Loamy Sand	1.5
Silty Clay Loam, Sandy Clay Loam (ML-CL, SC)	2.0
Clay (CL)	2.0
Shale, Hard Pans	6.0

**NOTE:** REFER TO ODOT CONSTRUCTION & MATERIAL SPECIFICATIONS FOR ABOVE ITEMS.

If the calculated velocity exceeds that shown in the table, a concrete lining or

rock channel protection lining shall be provided, (refer to ODOT Standard Paved Gutter MC-5 (or DM-2.1M) and Hamilton County Storm water Standard Details Plates 4,5,6,7 & 8). The designer may substitute alternative concrete paving specifications for approval by the Public Works Director.

Seeding and erosion control with matting may be used instead of RCP or concrete pavement, where average flow velocity is less than ten (10) feet per second and the ditch slope is less than 10%, with approval by the Public Works Director.

Check dams' drop structures, energy dissipaters, etc., for open channel erosion control when velocities exceed ten (10) feet per second may be used with approval by the Public Works Director.

### **(b) Roughness**

Suggested values for Manning's Roughness Coefficient "n" for the various types of open water carriers.

(1) Existing Watercourses - (Dense weeds, irregular sections, meandering, some trees, assumed average for Hamilton County)= 0.100

(2) Drainage Channels - (For analysis of a drainage channel to be constructed to replace a segment of an existing watercourse that will be sodded or seeded, privately maintained, connected on both ends to an existing watercourse and assumed over the subsequent years to have the same natural growth characteristics of Item (1) above = 0.100

(3) Consoer/Townsend Streams - Large drainage channels subject to flooding with published pre-determined depth of flow for one hundred (100) year frequency storm = 0.07

(4) TABLE ROUGHNESS COEFFICIENT

Type of Lining	Roughness Coefficient
Bare Earth	.02
Seeded	.03
Sod	.04
Jute Mat	.04
Excelsior Mat	.04
Item 838 Matting	.04
Concrete	.015
Bituminous	.018
Grouted Rip Rap	.02
Rock Channel Protection	.06 for ditches
	.04 for large channels
Drainage Channels Not Maintained	.07

**(c) Depth of Flow**

(1) Depth of flow shall be limited to twelve inches (12") below edge of pavement for paved ditch and twelve inches (12") below top of bank for non-paved ditch for the design discharge.

(2) Depth for less significant flows may be limited to a few inches below top of bank or pavement for paved gutter, where flooding is not a potential problem.

**Section ST 806**

**Open Channel Alterations or Relocation**

All earthwork should conform to the "Earthwork Rules and Regulations" of the Hamilton County Soil and Water Conservation District. The Hamilton County

Public Works Director may also require the developer to have a report prepared by a qualified Geotechnical Engineer as indicated in Section ST 414 to make recommendations. Also, refer to Section ST 416, relative to compaction of fill.

### **Section ST 807**

#### **Swales, Ditches, Gutters (Paved and Unpaved)**

(a) Swales, ditches, gutters (paved and unpaved) may be used for the collection of surface flows from relatively small drainage areas of less than one acre, and designed for a ten (10) year storm frequency, as per Section ST 802(a). Any potential flooding problem should be resolved using the one hundred (100) year storm frequency.

(b) Where the drainage areas exceed one acre, swales, ditches, gutters, etc., shall be designed for a one hundred (100) year storm frequency, as per Section ST 802(b). The Minimum Opening Elevation (MOE) for all buildings shall be 1'- 0" above the flow elevation.

(c) Swales, ditches, gutters, etc., should, if practical, be located at the rear of lots or along common property lines. The flow shall discharge into an open channel, catch basin or inlet.

(d) Refer to Section ST 710(d) for maximum surface flow between buildings in a new development.

(e) Refer to Section ST 710(e) for maximum surface flow onto a public roadway.

(f) If an owner desires to eliminate a swale, ditch, or gutter through his property, he shall first secure approval by the Public Works Director and obtain a work permit for the installation therein, of a yard drain of adequate capacity, with a sewer connection to a storm sewer or open channel.

### **Section ST 808**

#### **Emergency Overflow Ditches Required a Low Point Cul-de-sacs, Low Sag Areas.**

(a) Surface ditches required at low point cul-de-sacs, low sag areas, etc. shall be designed in the same manner as indicated in Section ST 801 through 805 and 807 for open channel flow, to give all buildings flood protection for a one hundred year frequency storm. The maximum water level at the centerline of pavement shall be 12". All Section A-A emergency overflow swales within subdivisions are to be directed to the property line. No diagonal swales across the front of single-family lots will be permitted. Also a note shall be on the improvement plans indicating that no utility boxes are to be placed within Section A-A swales.

(b) The surface ditches normally shall begin at the roadway right-of-way

line and end at least forty (40) feet where practical beyond the rear of any building, or end at an existing watercourse if the additional surface ditch length is not excessive.

(c) Other means of disposing of floodwater at these locations must be provided if a surface ditch is not feasible.

## **Section ST 809**

### **Culvert Design Criteria and Controls**

(a) Culvert analysis and design methods for the unincorporated areas of Hamilton County shall be basically the same as described in the State of Ohio Department of Transportation "Location and Design Manual" except as follows:

(1) The drainage area to the culvert entrance shall be indicated on the 200 scale City of Cincinnati and Hamilton County Metropolitan Topographic Survey or CAGIS Topographic maps.

(2) Design discharge (Q) shall be adequate to handle runoff as indicated in Section ST 802 and 803.

(3) Inlet or outlet control must be determined in the analysis.

(4) The hydraulic analysis shall include a determination of the headwater and tail water or backwater depths of any downstream open channel for the one hundred (100) year flood, to determine whether any flooding problems are being created. The downstream open channel shall be assumed to flood at the same time as the open channel with the proposed culvert.

(5) EXHIBIT NOS. 4, 6, 20 through 32 and 36 shall be used as design aids, when applicable.

(6) Minimum Cover: The minimum cover for culverts generally shall be two (2) feet from the bottom of the roadway base material to the top of the culvert.

Maximum Cover: The maximum cover for any culvert shall be as specified in ODOT "Height of Cover" tables.

(7) Refer to Section ST 404 (a) and (b), 409, 801(a), 810, 811 and 812 for additional controls.

(b) For storm sewer culverts, Type "A" or "B" conduit shall be used under publicly maintained roadways. Type "A" or "B" conduits are also recommended for privately maintained roadways that serve two (2) or more lot owners. Refer to

Section ST 713.

(c) For storm sewer culverts, Type "C" conduit shall be used in embankments without roadways. Refer to Section ST 713.

(d) For storm sewer culverts, Type "D" conduit may be used under the driveway to a single owner lot. Refer to Section ST 713.

**Section ST 810**

**Inlet Controls Placed in Open Channels**

(a) For inlet controls that are to be publicly maintained within open channels refer to the following table:

<b>INLET CONTROLS FOR PUBLICLY MAINTAINED SYSTEMS</b>		
<b>Description</b>	<b>Type of Inlet Structure to be Used</b>	<b>Type of Erosion Control to be Used</b>
Pipe culvert or storm sewer system for pipe size up to and including 72" in diameter	"Plate 5 Wingwall Headwall	Rock Channel Protection as per EXHIBIT NO. 30; sodding, seeding, and mulching as indicated in Section ST 805
Pipe Culvert or storm sewer pipe system for pipe size over 72" in diameter	State of Ohio Std. Construction. Drawing. HW-3 (or HW-1.1M) Headwall, but modified by providing reinforced concrete cutoff wall, apron and wingwalls to conform to 3:1 side slopes	SAME AS ABOVE
Precast reinforced concrete box or arch sections used for culverts as per State of Ohio specifications	Reinforced concrete headwalls and wingwalls required	SAME AS ABOVE

For any culvert or storm sewer system a special inlet structure is required to fit existing or proposed conditions	Structure shall include reinforced concrete wingwalls, headwall, cutoff wall and apron. Details must be shown on Improvement Plan	SAME AS ABOVE
For any culvert or storm sewer system where the inlet is located within any roadway right-of-way maintained by the Hamilton County Engineer	To be controlled by the Hamilton County Engineer	To be controlled by the Hamilton County Engineer

(b) For inlet controls that are to be privately maintained within open channels, refer to the following table:

<b>RECOMMENDED INLET CONTROLS FOR PRIVATELY MAINTAINED SYSTEM</b>		
<b>Description</b>	<b>Type of Inlet Structure to be Used</b>	<b>Type of Erosion Control to be Used</b>
Pipe culvert or storm sewer pipe system for pipe sizes up to and including 72" in diameter, under privately maintained roadway serving two (2) or more lot owners	"Plate 5 Wingwall Headwall"	Rock Channel Protection as per EXHIBIT NO. 30; sodding, seeding and mulching as indicated in Section ST 805
Pipe culvert or storm sewer pipe system for pipe sizes over 72" in diameter, under privately maintained roadway serving two (2) or more lot owners	State of Ohio Std. Construction Drawing "HW-3 (or HW-1.1M) Headwall", but modified by providing reinforced. conc. cut off wall, apron and wingwalls to conform to 3:1 slopes	SAME AS ABOVE
For any culvert or storm sewer system under a privately maintained roadway serving two (2) or more lot owners where a special inlet structure is required to fit existing or proposed conditions	Structure shall include reinforced concrete wingwalls, headwall, cutoff wall and apron. Details must be shown on Improvement Plans.	SAME AS ABOVE

Precast reinforced concrete box or arch sections used for culverts as per State of Ohio Specifications	Reinforced concrete headwalls and wingwalls required	SAME AS ABOVE
Pipe culvert or storm sewer pipe system under a privately maintained roadway or driveway and serving only one (1) lot owner.	Plate 5 wingwall headwall or State of Ohio Std. Construction Drawing half headwalls are recommended but not required under favorable field conditions	SAME AS ABOVE

(c) Other inlet controls in open channels are as follows:

(1) A culvert inlet end or storm sewer inlet structure should not be constructed within forty (40) feet of any proposed or existing building where practical. Also, one hundred (100) year flood plain limits should not be closer than thirty (30) feet to any proposed building. See Section ST 804(g), also.

(2) Multiple span culverts or multiple storm sewer pipes used as culverts with single or multiple inlet headwalls and wingwalls generally will not be accepted. See Section ST 812 also, regarding multiple span structures.

(3) Flood study information and other inlet controls must be provided by the Developers Engineer as per Section ST 710(d), (e), (f), 1104(d)(5) and any other applicable Rules and Regulations.

(4) Drop Channel detail on EXHIBIT NO. 29 is generally not recommended in the unincorporated areas of Hamilton County. If they are proposed for any Improvement Plan, safety features such as trash racks, chain link fencing, etc., will be required.

**Section ST 811**

**Outlet Controls in Open Channels**

(a) For outlet controls in open channels that are to be publicly maintained refer to the following table:

<b>OUTLET CONTROLS FOR PUBLICLY MAINTAINED SYSTEMS</b>		
<b>Description</b>	<b>Type of inlet Structure to be Used</b>	<b>Type of Erosion Control to be Used</b>

Pipe culvert or storm sewer pipe system for pipe size up to and including 72" in diameter	Plate 5 Wingwall Headwall	Rock Channel Protection as per EXHIBIT NO. 30; sodding, seeding, and mulching as indicated in Section ST 805
Pipe culvert or storm sewer pipe system for pipe size over 72" in diameter	State of Ohio Std. Construction Drawing "HW-3 Headwall" (or HW-1.1M), but modified by providing reinforced concrete cutoff wall apron and wingwalls to conform to 3:1 side slopes	SAME AS ABOVE
Precast reinforced concrete box or arch sections used for culverts as per State of Ohio Specifications	Reinforced Concrete headwalls and wingwalls required	SAME AS ABOVE
For any culvert or storm sewer system where a special outlet structure is required to fit existing or proposed conditions	Structure shall include reinforced concrete wingwalls, headwall, cutoff wall and apron. Details must be shown on Improvement Plans	SAME AS ABOVE
For any culvert or storm sewer system where the outlet is located within any roadway right-of-way maintained by the Hamilton County Engineer	To be controlled by the Hamilton County Engineer	To be controlled by the Hamilton County Engineer

(b) For outlet controls in open channels that are to be privately maintained, refer to the following table:

<b>RECOMMENDED OUTLET CONTROLS FOR PRIVATELY MAINTAINED SYSTEMS</b>		
<b>Description</b>	<b>Type of Inlet Structure to be Used</b>	<b>Type of Erosion Control to be Used</b>
Pipe culvert or storm sewer pipe system for pipe sizes up to and including 72" in diameter under privately maintained roadway serving two (2) or more lot owners	"Plate 5 Wingwall Headwall"	Rock Channel Protection as per EXHIBIT NO. 30; sodding, seeding and mulching as indicated in Section ST 805
Pipe culvert or storm sewer pipe system for pipe sizes over 72" in diameter, under privately maintained roadway serving two (2) or more lot owners	State of Ohio Std. Construction Drawing. "HW-3 Headwall" (or HW-1.1M), but modified by providing reinforced concrete cutoff wall, apron and wingwalls to conform to 3:1 side slope	SAME AS ABOVE
For any culvert or storm sewer system under privately maintained roadway serving two (2) or more lot owners where a special outlet structure is required to fit existing or proposed conditions	Structure shall include reinforced concrete wingwalls headwalls, cutoff wall and apron. Details must be shown on Improvement Plan	SAME AS ABOVE
Precast reinforced concrete box or arch sections used for culverts as per State of Ohio Specifications	Reinforced concrete headwalls and wingwalls required	SAME AS ABOVE
Pipe culvert or storm sewer pipe system under a privately maintained roadway or driveway and serving only one (1) lot owner.	Plate 5 wingwall, headwall or State of Ohio Std. Construction. Drawing half headwalls are recommended but not required under favorable field conditions.	SAME AS ABOVE

(c) Other outlet control requirements in open channels are as follows:

(1) A culvert outlet end or storm sewer outlet structure should not be constructed within forty (40) feet where practical of any proposed or existing building. One hundred (100) year flood plain limits should not be closer than thirty (30) feet to any proposed building. See Section ST 804(g), also.

(2) Outlet structures are required if multiple span culverts or multiple storm sewer pipes used as culverts are accepted. Refer to Section ST 810(c)(2) and 812 regarding multiple span structures.

(3) When a culvert or storm sewer outlet structure outlets into the flood plain of another existing watercourse or drainage channel, the outlet structure may be subject to frequent floods or backwaters. The flow line elevation may be set at some convenient location between the ten (10) and one hundred (100) year flood level, or higher, if practical.

(4) If the outlet structure aligns favorably with an existing watercourse or drainage channel not subject to floodwater from another downstream open channel, the flow line of the outlet structure should meet the flow line of the existing watercourse or drainage channel.

(5) If the velocity, based on the design discharge, at the outlet of a storm sewer pipe requires an energy dissipater as per EXHIBIT NO. 30, a reinforced concrete stilling basin similar to EXHIBIT NO. 31 or an alternate by the Designer.

## **Section ST 812**

### **Large Culverts and Bridges**

(a) Large culverts and bridges with spans of ten (10) feet or greater, or multiple span culverts with total spans of ten (10) feet or greater, or multiple storm sewer pipes used as culverts whose diameters total ten (10) feet or greater, shall be reviewed for approval by the Hamilton County Public Works Director, the Hamilton County Engineer and/or the Hamilton County Building Commissioner, depending on the type of development being proposed.

(b) The Hamilton County Engineer will review for approval these type of structures on township and/or county roads and those that will become a township or county road.

(c) The Hamilton County Engineer will review and make recommendations

and comments to the Hamilton County Public Works Director relative to these type of structures on private developments and private roads that are not destined for public dedication and acceptance, the details of which are included on Improvement Plans to be approved by the Hamilton County Public Works Director.

(d) The Hamilton County Engineer will review and make recommendations and comments to the Hamilton County Building Commissioner relative to these type of structures for any development that requires only a building permit and the Hamilton County Public Works Director is otherwise not involved in the review and approval process.

(e) Multiple span culverts and multiple storm sewer pipes used as culverts generally are not acceptable because of maintenance problems and debris blockage potential. The only time a multiple opening culvert shall be approved by the Hamilton County Department of Public Works is when no other single span structure is feasible.

(f) Culverts, except as otherwise indicated in Article VIII, and bridges shall be designed in accordance with the "Standard Specifications for Highway Bridges" adopted by the American Association of State Highway and Transportation Official, 1992 and the Ohio Supplement to these specifications. The culverts and bridges shall also be capable of handling runoff quantities that are determined as follows:

(1) For new culverts and bridges proposed to be located, or constructed, on private property and located within any Special Flood Hazard Area as herein defined. Section 802(e) shall be used. Compliance with this Section and EXHIBIT NO. 36 shall be certified by a Registered Professional Engineer prior to issuance of a building permit by the office of the Building Commissioner for all bridges and prior to approval of Improvement Plans by the Hamilton County Public Works Director for all culverts.

(2) For culverts and bridges proposed to be relocated or replaced on private property within the same reach of a watercourse or drainage channel that is within any Special Flood Hazard Area as herein defined, the proposed structure(s) shall not allow any increase to the flood levels during the base flood beyond that condition which existed with the prior structure(s) in place.

(3) For culverts and bridges proposed to be located, relocated, constructed, or reconstructed within the existing or proposed public right-of-way any county or township maintained roadway, the Hamilton County Engineer will have jurisdiction over the

development of design details.

(4) For culverts and bridges proposed to be located, relocated, constructed, or reconstructed within the existing or proposed public right-of-way of any state maintained roadway, the State of Ohio Department of Transportation will have jurisdiction over the development of design details.

(5) For culverts and bridges proposed to be located, constructed, relocated, or reconstructed on private property outside any Special Flood Hazard Area as herein defined, Section 802(b) shall apply as appropriate. Consideration must be given to potential flooding and its effect on adjacent properties using the one hundred (100) year flood frequency as indicated in Section 802(c) and (d).

### **Section ST 813**

#### **Bridge Openings in Consoer/Townsend Streams**

1.00 To determine Consoer/Townsend  $Q_{100}$  for new bridge located between published structures

1.01 SAMPLE

$Q_{100}$  at nearest upstream structure = 745 c.f.s.

Tributary acreage at nearest upstream structure = 694 AC

$Q_{100}$  per 1 AC =  $\frac{745}{694} = 1.07$  cfs = 1.07 c.f.

Tributary acreage at new structure = 720 AC

$Q_{100}$  at new structure = 720 (1.07) = 770 c.f.

2.00 Design opening with outlet control

2.01 Determine depth of flow at outlet by measuring Consoer/Townsend profiles at new bridge location.

2.02 Maximum headwater fifty ( $HW_{100}$ ) is to be 0 to 1'-0" or as directed by Hamilton County Department of Public Works.

2.03  $HW_{100}$  is to be at least 1'-0" below any existing floor including basement floor elevation.

2.04 Provide new structure with emergency spillway by setting top of embankment at least 1'-0" below existing floor including basement floor elevation.

2.05 Use ODOT charts for submerged outlet control to determine standard drainage structure sizes available that will limit the  $HW_{100}$  as required.

3.00 In the event ODOT charts indicate that no standard drainage structure limits  $HW_{100}$  to 0 to 1'-0" use Manning's formula to determine bridge opening.

3.01 Manning's Formula

$$Q = A \frac{(1.486)}{(n)} R^{-1} (S)^{1/2}$$

A = Area

n = Manning's roughness coefficient

$$R = \frac{A}{WP}$$

WP = Wetted perimeter

S = Slope in feet per feet

3.02 For bridge openings in Consoer/Townsend stream use  $n = 0.07$  (unless requested in writing and approved by Hamilton County Department of Public Works) and based on actual site investigations, the use of  $n = 0.04$  will not be allowed.

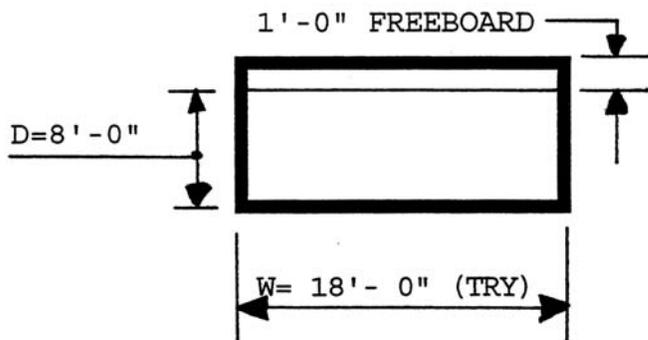
### 3.03 EXAMPLE GIVEN

$$Q_{100} = 770$$

Depth of Flow = 8'-0" C/T

Slope = 1%

$$n = 0.07$$



FIND: WIDTH  
SOLVE:

$$A = 8 (18) = 144$$

$$WP = 34$$

$$R^{2/3} = \left( \frac{144}{34} \right)^{2/3} = 2.59$$

$$S^{1/2} = (0.01)^{1/2} = 0.1$$

$$Q = 144 \left( \frac{1.486}{0.07} \right) 2.59 (0.1) = 791.7 \text{ cfs}$$

792 > 770 (bridge opening okay)

### Section ST 814

#### Specifications for Construction and Materials

Unless otherwise indicated in Section ST 713 or other articles in these Rules and Regulations, the design, materials, and construction shall be as specified in the current edition of the State of Ohio Department of Transportation "Construction and Material Specifications", the State of Ohio Department of Transportation "Standard Construction Drawings" and the Hamilton County Public Works Department "Standard Drawings".

## ARTICLE IX

### BASIC DESIGN CRITERIA FOR STORM WATER PUMP STATIONS LOCATED OUTSIDE OF SPECIAL FLOOD HAZARD AREAS

#### Section ST 901

##### Drawings

Any plans for construction or revision of a storm water pump station shall also include a contour map of the site to be used. The drawings shall show the location of the existing pump station, the proposed pumping station including provisions for auxiliary or stand by pumps, elevation of high water at the site, one hundred (100) year flood level and maximum elevation of the storm water in the collection system during a condition of power failure. Logs of test borings, with ground water elevations, shall also be provided.

#### Section ST 902

##### Design Criteria

##### (a) Type

Storm water pumping stations shall be the dry well type. "Package" Plants will be approved if they conform to the following requirements.

##### (b) Structures

Storm water pump stations shall not be subject to flooding for the one hundred (100) year flood. Superstructures shall be located off the right-of-way of streets or alleys. The station shall be readily accessible. Inside space shall be ample enough to permit removing pumps and motors. Suitable and safe means of access, preferably stairs, to wet wells containing either bar screens or mechanical equipment requiring maintenance shall be provided.

##### (c) Pumps

(1) Duplication: At least two (2) pumps shall be provided. Duplicate units shall each be capable of handling flows in excess of the expected maximum flow. When several pumps of different size are provided they shall be capable of handling the expected maximum flow with the largest capacity pump out of service.

(2) Pump Openings: Pumps should be capable of passing spheres of at least three (3) inches in diameter.

(3) Priming: The pump shall have a positive head on the suction side under all conditions of operation.

(4) Intake: Each pump shall have its own individual intake.

(5) Valves: Suitable shutoff valves shall be placed on the suction and discharge lines of each pump.

(6) Controls: Provisions shall be made to automatically alternate the pumps in use.

**(d) Water Supply**

There shall be no physical connection between any potable water supply lines in the storm water pumping station, which under any conditions could cause pollution of the potable water supply.

**(e) Power**

Duplicate power supply, or emergency power generation, shall be provided. Where not feasible, provide an overflow at such elevation to prevent basement flooding or stream backup affecting operation.

**(f) Construction**

In all other respects, the design and construction of the pump stations shall comply with the requirements of the pertinent sections of the Ohio Basic Building Code, current edition, and the pertinent sections of the State of Ohio Department of Transportation Construction and Material Specifications, current edition, if applicable.

## ARTICLE X

### STORM SEWER PLACEMENT

#### Section ST 1000

##### Storm Sewer Placements

Placement of storm sewers need not be restricted to the roadway construction area and generally shall be placed within the street right-of-way outside the paved roadway and gutter area. However, consideration must be given to other existing and/or proposed features in these areas. (See Sections ST 307 through 311 for additional information).

All storm sewers, except those within the right-of-way of Hamilton County roads, shall be approved by the Hamilton County Department of Public Works. Location of storm sewers within the existing or proposed right-of-way or highway easement, of Hamilton County roads shall be as approved by the Hamilton County Engineer.

#### Section ST 1001

##### "As-Built" for Storm System

Following installation and prior to acceptance of public owned storm system, actual field verified "As-Built" drawings (prepared by a Surveyor registered in the State of Ohio) must be supplied to the Hamilton County Department of Public Works. Drawings shall be on tracing cloth or film, and standard 24" x 36" sheets. The following minimum information must be included:

- (1) Complete plan view of entire storm system,
- (2) Distances between structures, or length of pipe,
- (3) Grade, size and material of all pipes,
- (4) Horizontal angles at all horizontal changes in pipe runs,
- (5) Drainage structures are to be referenced by way of two (2) offset dimensions, one (1) from the right-of-way line and one (1) from the nearest lot line,
- (6) Invert elevation of all pipes,
- (7) Type, and invert and top elevation of all structures,
- (8) Accurate location of storm easements referenced to both storm system and property lines.
- (9) Surveyor's seal and signature.

# VOLUME III

## ARTICLE XI

### IMPROVEMENT PLAN REVIEW PROCEDURES

#### Section ST 1101

##### General

The Rules and Regulations in this article supersede any of those under Article I through X, if they appear to be in conflict.

No storm sewers, culverts, proposed grading, or other surface drainage facilities shall be constructed as indicated on detailed construction drawings without prior review and written approval by the County Public Works Director as to; (a) concept, whenever a concept report by the County Public Works Director has been submitted to the Hamilton County Regional Planning Commission, and; (b) design and detail.

Concept approval of Improvement Plans shall become void if plans for detailed review have not been submitted within twelve (12) months from the date of the concept approval.

Detailed approval of storm system Improvement Plans shall become void if construction has not commenced within twelve (12) months from the date of approval by the Hamilton County Public Works Director, and shall become void if construction is not completed within three (3) years from the date of approval by the Hamilton County Public Works Director.

Concept and detailed approval may be extended by the County Public Works Director for a period not to exceed twelve (12) months provided there is no problem in doing this with the other County agencies or Metropolitan Sewer District.

#### Section ST 1102

##### Concept Review

Generally, the following procedure is required for the review and approval of plans, schemes, details, etc., in the concept stage:

##### **(a) Letter or Transmittal form (SDS Application) Requirements**

A letter or transmittal form (SDS Application, see EXHIBIT NO. 2) must be submitted and signed by the applicant for all concept review and approval work performed by the County Public Works Director. The following information shall be included on this form:

- (1) The applicant must make a request for a concept review and approval.
- (2) Indicate the type of development, e.g., residential, commercial, industrial, etc.
- (3) Indicate any zone change request and include the zone letter designations.
- (4) The applicant will be billed for the concept review, initial site inspection, and approval work by the County Public Works Director. If the billing must be submitted to someone other than the applicant, the form must state who is to be billed and signed by that individual or the individual who may represent the company or organization. For additional information, see Section ST 1105.
- (5) The Hamilton County Director of Public Works reserves the authority to require billing and payment prior to approval of application in special circumstances as deemed appropriate by him/her.

**(b) Preliminary Site Development Information to be provided**

Preliminary site development plans, schemes, details, etc., submitted in the concept stage must include the following information relating to storm water management:

- (1) Prepare a map of the site and surrounding area to be drained including existing features, streets, property lines, underground utilities, and arrows which denote general directions of flow for lots and streets.
- (2) Provide topographic map or 50' grid elevations plot and indicate source of information.
- (3) Show tentative major system to drain the entire site and surrounding area, which includes all paved areas and hard surfaces and locations of major swales and storm sewers. Also include arrows which denote all directions of flow.
- (4) Submit drainage area map of watershed basin affected.
- (5) Plot highest flood plain limits to be inundated from the applicable flooding event.
- (6) Submit flood study also for Special Flood Hazard areas. Include copies of FEMA and/or Consoer-Townsend maps or files and

descriptions of downstream and/or upstream drainage structures.

(7) Indicate tentative location of detention/retention storage areas available on site. (Refer to Section ST 405 to determine when detention/retention basins are generally required).

(8) Two sets of preliminary plans/schemes, etc. and one (1) set of drainage area maps as required above are to be submitted to the Director of Public Works for concept review. After the review, the plans will be distributed with the comments and concept report for information to the various county agencies involved, M.S.D., the City of Cincinnati, if the development is near the city corporation line and there will be increased runoff into the city, ODOT, if the development has direct access to a state route, and there will be increased runoff into the state route, and the Developer and/or Owner and applicant who submitted the plans.

(9) The Director of Public Works will send notice of approval of the concept plan to concerned governmental agencies, the Developer and Owner.

### **Section ST 1103**

#### **Concurrent Concept and Detailed Construction Drawing Review**

The following procedure is required for a concurrent concept and detailed construction drawing review.

#### **(a) Letter or Transmittal Form (SDS Application) Requirements**

A letter or transmittal form (SDS Application) must be submitted and signed by a Registered Professional Engineer for all concurrent concept and final detailed construction drawing review and approval work performed by the County Public Works Director. The following information shall be included on this form:

(1) The Registered Professional Engineer must make a request for a concurrent concept and final detailed construction drawing review.

(2) Indicate the type of development, e.g., residential, commercial, industrial, etc.

(3) Explain any zone change request and include any zone letter designations.

(4) The County Public Works Director will bill the Registered Professional Engineer for the concurrent concept and final detailed construction drawing review. If any billing must be submitted to

someone other than the Registered Professional Engineer, the form must state who is to be billed and signed by that individual or the individual who may represent a company or organization. For additional information, see Section ST 1105.

(5) The Hamilton County Director of Public Works reserves the authority to require billing and payment prior to approval of application in special circumstances as deemed appropriate by him/her.

**(b) Preliminary and Detailed Construction Drawing Information to be provided**

Any preliminary plan, schemes, details, etc. to be submitted for concept review must also be accompanied by the detailed construction drawings. The information requested under Items 4 through 9 of 1102(b) to develop a concept report will generally be required by the County Public Works Director. The detailed construction drawings will be reviewed in accordance with these Rules and Regulations, including Section ST 1104. Comments, along with the concept report, will be distributed in the same manner as indicated under Section ST 1102(b)(11). However, only two (2) sets of detailed construction drawings are required to be submitted for the initial storm drainage review as indicated in Section ST 1104.

**(c) Review Procedures**

(1) Revisions of any plans in the concurrent concept and detailed construction drawing review stage that have already been reviewed and approved by the County Public Works Director must be re-processed and then re-reviewed by the County Public Works Director in the same manner as indicated in Section ST 1103(a)(1) thru (4), above. Pre-construction revisions on the plans are to be numbered, circled and resubmitted to aid in reducing review time. Field revisions made from previously approved detailed construction drawings are also to be numbered, circled and resubmitted in a different manner than the pre-construction revisions to aid in reducing review time. For billing of revisions, see Section ST 1105(c).

**Section ST 1104**

**Detailed Construction Drawing Review**

**(a) Review Procedures for Various Types of Developments**

(1) The County Public Works Director reviews, for approval, new residential subdivision developments in the unincorporated areas of Hamilton County for conformance to these Rules and Regulations.

(2) The County Public Works Director reviews, for approval, all new frontage type subdivision developments for flood controls in the designated Special Flood Hazard Areas and any other areas where there may be flooding problems. Detailed construction drawings may be required by the County Public Works Director, whenever they are deemed necessary, to provide flood controls for any new construction in a frontage type subdivision.

(3) The County Public Works Director reviews, for approval, all new, private shopping centers, private condominiums, commercial and industrial subdivisions, multiple (two or more) building developments, single commercial, industrial, office, retail, storage building addition, etc., type developments, any single or multiple residential apartment building/s where there will be more than two (2) families, in the same manner as a new residential subdivision using these Rules and Regulations.

(4) The County Public Works Director will determine if it is necessary to review and approve any single, private, residential, residential storage, residential building addition, residential apartment (two family or more), etc., type building/s in the same manner as a new, residential subdivision, using these Rules and Regulations. Refer to Section ST 405(a) for additional information. Generally, the following procedure is required for the review and approval of detailed construction drawings:

**(b) Transmittal Form and SDS Application Requirements**

A transmittal form and SDS Application must be submitted and signed by the applicant for all final detailed construction drawing review and approval work performed by the County Public Works Director. The following information shall be included on this form.

(1) Indicate the type of development, e.g. residential, commercial, industrial, etc.

(2) Explain any zone change request and include the zone letter designations.

(3) The County Public Works Director will bill the applicant for final detailed construction drawing review. If any billing must be forwarded to someone other than the applicant, the form must state who is to be billed and signed by that individual or the individual who may represent the company or organization. For additional information, see Section ST 1105.

(4) The Hamilton County Director of Public Works reserves the authority to require billing and payment prior to approval of application in special circumstances as deemed appropriate by him/her.

**(c) Detailed Construction Drawing Information to be provided**

(1) All detailed construction drawings single family development shall be drawn on standard 24" x 36" sheets to a scale not to exceed one (1) inch equal to fifty (50) feet. Schematic plans, vicinity maps, etc., not used for detailing purposes, may exceed the fifty (50) scale. Reduced prints will not be accepted.

(2) All elevations proposed and shown shall be referenced to NGVD (mean sea level datum) and each set of plans shall show the description and elevation of the public benchmark (or marks) used in the development survey.

(3) Each detailed construction drawing that is to be reviewed and approved by the County Public Works Director shall bear the signature and seal of the registered professional engineer who has prepared them.

(4) The analysis, design and development of the detailed construction drawings shall conform to all county agency Rules and Regulations and the Rules and Regulations of the Metropolitan Sewer District. Also, see Section ST 1104(f).

**(d) Flood Study Information to be provided**

In addition to any flood studies required to be submitted as indicated in Articles III, IV, VII, VIII and IX, the Registered Professional Engineer must submit any analyses, including drainage area maps, design calculations, etc., wherever an existing or potential flood problem may occur.

**(e) Detention and/or Retention Basin Information to be provided.**

In addition to the requirements set forth for detention and/or retention basins as indicated in Section ST 711 and/or 712, the following Rules and Regulations also apply:

(1) A construction permit for constructing any detention and/or retention basin may be required by the Ohio Department of Natural Resources under the conditions described in Section ST 711(c).

(2) The County Public Works Director will review and approve any detention and/or retention basin design and details that are in accordance with these Rules and Regulations. Additional review by ODNR maybe required.

(3) The Improvement Plans must show all the physical dimensions as necessary, horizontally and vertically, and details, so that the detention and/or retention basin can be properly constructed and inspected.

(4) The storage volume required for any detention and/or retention basin must be shown on the Improvement Plans and easement or record plat.

(5) Temporary separate silting basins directly upstream of detention basins are required for all Subdivisions. The Public Works Director may approve a combined silting-detention basin in an area where the design engineer can demonstrate that the construction of separate basins are not possible due to engineering restrictions and limitations only.

**(f) Submitting Design Calculations and Studies; Review Procedures**

(1) For the initial storm drainage review, the County Public Works Director requires two (2) sets of detailed construction drawings and one (1) set of drainage area maps, hydraulic analyses, flood calculations, detention and/or retention basin design calculations, and storm drainage design calculations.

(2) When the runoff from of the upstream drainage area thru the site is 400 acres or less, the Developers Engineer shall submit print/s of the 200 scale Cincinnati Metropolitan Topographical Sheets superimposed on the 200 scale property line Auditors sheets or CAGIS Topo. The new development limits and drainage area limits shall be plotted on the print/s. For upstream drainage areas greater than 400 acres, the information required above may be submitted on USGS prints or similar, maps to scale and the new development limits shall also be plotted on the 200 scale topo and Auditor sheets as indicated above.

(3) When additional reviews due to revisions or other reasons are required, two (2) sets of revised detailed construction drawings and any additional analyses, calculations, etc., are to be submitted for further review.

(4) Processing of the final approved detailed construction drawings are to be coordinated with the other government agencies.

(5) Revisions of any plans that have already been reviewed and approved by the County Public Works Director must be resubmitted

and re-reviewed by the County Public Works Director. Pre-construction revisions on the plans are to be numbered, circled and re-submitted to aid in reducing review time. Field revisions made from previously approved detailed construction drawings are also to be numbered, circled, and re-submitted in a different manner than any pre-construction revisions to aid in reducing review time. For billing of revisions, see Section ST 1105(c).

## **Section ST 1105**

### **Review/Initial Site Inspection Fees**

#### **(a) Billing Procedure**

The cost of concept plan review, revisions, initial site inspection and detailed construction drawing review performed by the County Public Works Director shall be at a rate established and published from time to time by the Board of County Commissioners. Refer to Section ST 1102(a)(4) for the procedure to be followed if someone other than the applicant who submitted the plans is to be billed for the review of concept plans. Checks shall be made payable to the "Treasurer of Hamilton County" and mailed to the Department of Public Works, Room 800, County Administration Building, 138 East Court Street, Cincinnati, Ohio 45202. Enclosed with the check, the applicant must make reference to the Project Title, Hamilton County Public Works Project Number and Invoice Numbers. In the event that any bill has not been paid in full within thirty (30) days, the applicant or person to be billed will receive a delinquent notice and if payment is not made within thirty (30) days thereafter, inspection of construction and any further review on the project will be stopped and the claim will be forwarded to the Prosecuting Attorney for collection.

#### **(b) Billing Procedure for Accounts Not Paid In Full**

Until such time as all billing accounts have been paid in full, review and approval work, on subsequent new developments submitted by the applicant, will not be performed by the County Public Works Director. If the applicant has developments previously submitted that are in various stages of review, the County Public Works Director will allow a maximum of thirty (30) days for final payment to be made on any of the previously submitted development plans that has been approved, starting from the final billing date for that particular development. After that time has expired, no further review work will be continued.

#### **(c) Billing Procedure for Revised Plans that Were Previously Reviewed, Approved, and Billed For**

If bills have been questioned, the procedures in (a) above will not apply until agreement on invoices has been reached.

**Section ST 1106****Review Expiration Date**

Concept approval of any proposed storm drainage system shall become void if plans of the detailed construction drawings have not been submitted for final review to the County within twenty four (24) months from the date of concept review report by the County Public Works Director.

Detailed construction drawing approval of proposed storm drainage systems shall become void if construction has not commenced within twenty four (24) months from the date of the approval of the detailed construction drawings.

The County Public Works Director may extend concept and detailed construction drawing approval for a period not to exceed twelve (12) months.

## ARTICLE XII

### INSPECTION OF CONSTRUCTION

#### Section ST 1201

#### Inspection of Construction

##### **(a) Storm Drainage Systems to be Publicly Maintained**

(1) All storm drainage systems for new developments that are to be maintained by the Public Works Department or Township shall be inspected under the supervision of the County Public Works Director or his designated representative. The Contractor or his representative must contact the County Public Works Director (632-8431) at least two (2) days in advance of construction.

(2) Any storm drainage system for a new development to be located within an existing county roadway right-of-way that is maintained by the County Engineer, or located within any new subdivision roadway that has not yet been accepted by the Board of County Commissioners, as indicated in the Hamilton County Engineers Rules and Regulations, shall be inspected by the County Engineers representative and the Director of Public Works representative in a manner as set forth in these Rules and Regulations and the County Engineers Rules and Regulations.

##### **(b) Private Drainage Connections to a Publicly Maintained System**

Any private storm drainage system that is to be connected directly into any public storm drainage system maintained by the Hamilton County Public Works Director shall be inspected at the connection under the supervision of the County Public Works Director or his designated representative. Such connections must be made at a manhole or catch basin. Except that this does not apply to owners of single family residence who may properly tap a storm pipe into the nearest available existing public storm sewer, when it is not practical to extend the storm pipe to a catch basin or manhole (see Section ST 709(c)).

The Contractor or his representative must contact the County Public Works Director (632-8431) at least two (2) days in advance of construction of the direct connection.

##### **(c) Inspection of Private Storm Drainage Systems**

Various proposed private storm drainage systems shown on new development plans such as new drainage channels and detention and/or retention basins that have been reviewed and approved by the County Public Works Director shall be inspected by the County Public Works Director or his

designated representative for conformance to the approved plans. The Contractor or his representative must phone the County Public Works Director (632-8431) at least two (2) days in advance of construction.

**(d) Periodic Inspection of Other Private Storm Drainage Systems**

Periodic inspection of privately maintained storm drainage systems for any new developments that were reviewed and approved by the County Public Works Director may be made at the discretion of the County Public Works Director.

**(e) Final Inspection and Establishing Bond Amount**

When the Developer requests a final inspection or desires to establish a bond amount for incomplete items in any storm drainage system to be publicly maintained, the procedures indicated in the Hamilton County Engineers Subdivision Rules and Regulations are to be followed. The County Public Works Director representative will make inspections, establish bond amount for the incomplete storm drainage items and submit the bond amount to be required to the County Engineer for their information and processing.

Also, the County Public Works Director will submit an itemized list of the incomplete storm drainage items to the Developer for completion in conformance with the approved plans and specifications. When the storm drainage system is complete and approved the County Public Works Director will notify the County Engineer in writing requesting release of any bond amounts withheld.

**Section ST 1202**

**Construction Inspection Fees**

**(a) Applicant Responsibility for Payment of Inspection**

The cost of construction inspection on all storm drainage systems (public or private within subdivisions) shall be at a rate established and published from time to time by the Board of County Commissioners. The Applicant responsible for the construction of the public or private (within subdivisions) storm drainage system must pay in full, the cost of construction inspection. Checks shall be made payable to the "Treasurer of Hamilton County" and mailed to the Department of Public Works, Room 800, County Administration Building, 138 East Court Street, Cincinnati, Ohio 45202. Enclosed with the check, the Applicant must make reference to the Project Title, Public Works Project Number and Invoice Numbers. In the event that any bill has not been paid in full within thirty (30) days, the Applicant will receive a delinquent notice and if payment is not made within an additional thirty (30) days, inspection of construction and any further review on the project will be stopped and the claim will be forwarded to the Prosecuting Attorney for collection.

**(b) Procedure for Delinquent Payment**

If the Applicant has other new developments in progress being inspected for construction or will begin subsequent new developments requiring future inspection, the County Public Works Director will order work to be stopped on

these developments until all previous construction inspection costs that were billed for have been paid in full. However, if bills have been questioned, the procedure will not apply until agreement on invoices has been reached.

# **VOLUME IV**

## **ARTICLE XIII**

### **BOARD OF STORM DRAINAGE VARIANCE AND APPEALS**

#### **Section ST 1301**

##### **Members of the Board**

A Board of Storm Drainage Variances and Appeals is hereby established. Such Board shall consist of five (5) members, who shall be residents of the unincorporated territory of Hamilton County, Ohio to be appointed by the Board of County Commissioners of Hamilton County, Ohio. One (1) member shall be a Registered Architect. One (1) member shall be a Registered Professional Structural Engineer. One (1) member shall be an Attorney-at-Law admitted to the bar of this State. Each of these three (3) members shall be presently serving on the Hamilton County Board of Building Appeals. Of the remaining two (2) members, one (1) shall be a Registered Professional Civil Engineer specializing in hydraulics and hydrology. The other member shall be a representative of the Property and Casualty Insurance Industry in unincorporated Hamilton County, Ohio, with special knowledge of the National Flood Insurance Program. Each of the five (5) members shall be a person of recognized ability and broad training, and shall be licensed to practice his/her profession.

#### **Section ST 1302**

##### **Appointments**

Members shall be appointed for five (5) year terms, in such a way that the terms of one (1) member shall expire each year, except that the original appointments of the three (3) members who also serve on the Hamilton County Board of Building Appeals shall be for the duration of their terms on that Board. Each member shall hold office from the date of appointment until the end of the term for which the member was appointed. Any member appointed to fill a vacancy occurring before the expiration of the term for which the predecessor was appointed shall hold office for the remainder of that term. Any member shall continue in office subsequent to the expiration date of the term for which the member was appointed, until a successor takes office, or until sixty (60) days have elapsed, whichever occurs first.

#### **Section ST 1303**

##### **County Employees to Assist the Board**

The Board of County Commissioners of Hamilton County, Ohio, shall provide and assign to such Board of Storm Drainage Variances and Appeals such of its employees as are required to perform its functions.

## ARTICLE XIV

### POWERS OF THE BOARD

#### Section ST 1401

##### **Variations and Appeals**

Such Board may:

(a) Hear and decide appeals where it is alleged that there is an error in any order, requirement, decision, or determination of any administrative officer of Hamilton County, Ohio, empowered to enforce these Regulations, or any resolution, or part thereof, adopted pursuant thereto;

(b) Authorize, upon request, in specific cases, such variations from the terms of these Regulations, or any resolution, or part thereof, adopted pursuant thereto, as will not be contrary to the public interest or sound flood plain management, where owing to special conditions, a literal enforcement of the same will result in unnecessary hardship, and so that the spirit of these Regulations shall be observed and substantial justice done. In granting such variations, in specific cases, such board shall also consider the following, where applicable:

(1) the danger that materials proposed to be stored at the proposed development may be swept onto other lands to the injury of other property or persons in times of flood, and that such materials would fill in the flood plain.

(2) the danger to life and property due to flooding or erosion damage from the proposed development;

(3) the susceptibility of the proposed development and its contents to flood damage, and the effect of such damage on the individual property owner(s);

(4) the importance to the community of the proposed services provided by the proposed development;

(5) the availability of alternative locations for the proposed development which are not subject to flooding or erosion damage;

(6) the necessity to the proposed development of a waterfront location, where applicable;

(7) The proposed provisions for safety of access to the proposed development, in times of flood, for ordinary and emergency vehicles and services; and

(8) The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as water, sewer, gas, and electrical systems and streets and bridges.

(c) not authorize any variance within any Regulatory Floodway in the unincorporated territory of Hamilton County, Ohio as defined in Section 3.3 of the Flood Damage Prevention Regulations for Unincorporated Hamilton County, Ohio (Volume 232 Image 484 and 485, dated October 26, 1988, if any increase in the base flood level during the base flood discharge would result in the County; and

(d) only authorize such variances with Zones A1-30 and the unnumbered A Zones on the Flood Insurance Rate Map for Unincorporated Hamilton County, Ohio, which also conform to the provisions of 44 CFR Section 60.6(a)(1)-(4) which stated, in part, as follows:

#### Section 60.6 Variance and Exceptions

(a) The Administrator (i.e. Flood Plain Administrator - Hamilton County Director of Public Works) does not set forth absolute criteria for granting variances from the criteria in Section 60.3, 60.4 and 60.5 within FEMA's National Flood Insurance Program Regulations 44 CFR 60.6. The issuance of a variance is for flood plain management purposes only. Insurance premium rates are determined by statute according to actuarial risk and will not be modified by the granting of a variance. The community, after examining the applicant's hardship, shall approve or disapprove a request. While the granting of variances is limited to a lot size less than one half acre (as set forth in paragraph (a)(2) of this section), deviations from that limitation may occur. However, as the lot size increases beyond one half acre, the technical justification required for granting a variance increases. The Administrator may review a community's files justifying the granting of a variance, and if that review indicates a pattern inconsistent with the objectives of sound flood plain management, the Administrator may take appropriate action under Section 59.24(b) of this sub-chapter. Variances may be issued for the reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic Places or a State Inventory of Historic Places, without regard to the procedures set forth in this section. Procedures for the granting of variance by a community are as follows:

(1) Variances shall not be issued by a community within any designated regulatory floodway if any increase in flood levels during the base flood discharge would result;

(2) Variances may be issued by a community for new construction and substantial improvements to be erected on a lot of one half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, in conformance with the procedures of paragraphs (a)(3), (4),.... of this section;

(3) Variances shall only be issued by a community upon (i) a showing of good and sufficient cause, (ii) a determination that failure to grant the variance would result in exceptional hardship to the applicant, and (iii) a determination that granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisance, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances;

(4) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

## **Section ST 1402**

### **Determination of the Board**

The determinations of such Board shall be binding upon the enforcement of all applicable rules, regulations, codes, or resolutions, or specific parts thereof, within the unincorporated territory of Hamilton County, Ohio. In exercising this power, such Board may, in conformity with the provisions of this Article, reverse or affirm, wholly or partly, or modify the order, requirement, decision, or determination appealed from which a variance was requested and may make such order, requirement, decision, or determination as ought to be made. This Section does not give such Board any other authority, explicitly or implied, in the enforcement of any other rules, regulations, codes, or resolutions, or specific parts thereof, adopted pursuant thereto, of the County.

## **ARTICLE XV**

### **RULES FOR THE CONDUCT OF BUSINESS**

#### **Section ST 1501**

##### **Adopting Rules**

The Board shall organize and adopt rules for the conduct of its business. Meetings of the Board shall be held at the call of the chairperson and at other such times as the Board determines. All meetings of the Board shall be open to the public. The Board shall keep minutes of its proceedings showing the vote of each member upon each question, or if absent, or failing to vote indicating such fact, and it shall keep records of its examinations and other official actions, all of which shall be immediately filed in the office of the Board of County Commissioners of Hamilton County, Ohio, and be a public record.

#### **Section ST 1502**

##### **Appeals or Requests for Variance**

Appeals or requests for variance permitted under Volume 4 may be taken by any person aggrieved or affected by any decision of any administrative officer of Hamilton County, Ohio, empowered to enforce these Regulations. A hearing on the appeal or request for a variance shall be taken within fifteen (15) working days after the filing of an appeal or request for a variance. The officer from whom the appeal or request for a variance was taken shall transmit to such Board all the papers constituting the record of the appeal or request for a variance.

#### **Section ST 1503**

##### **Notice of Appeal or Request for a Variance**

Such Board shall fix a reasonable time for a hearing on the appeal or request for a variance, and give at least ten (10) calendar days prior notice, in writing, to the parties of interest. At the hearing, any person may appear to give testimony.

Such Board shall decide the appeal or request for a variance within thirty (30) calendar days after its hearing on the matter. In its decision, such Board shall declare the reasons for its actions.

## **ARTICLE XVI**

### **COURT OF COMMON PLEAS**

#### **Section ST 1601**

##### **Court of Common Pleas**

Any person aggrieved, or any officer of Hamilton County, Ohio, adversely affected by any order, requirement, decision, or determination of such Board may appeal to the Court of Common Pleas of Hamilton County, Ohio, pursuant to the provisions of Section 2506 of the Ohio Revised Code. The court may affirm, reverse, vacate, or modify the decisions complained of in the appeal.