MERCER COUNTY
DESIGN CRITERIA

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800.00 Water Distribution

900.00 Sanitary Sewers

MERCER COUNTY
DESIGN CRITERIA REGISTRATION

Name: _____

Title: _____

Firm/Organization: _____

Address: _____

Telephone: _____

CHANGE OF ADDRESS CARD for receiving updates of the Mercer County Design Criteria.

(OLD INFORMATION)

Name: _____

Title: _____

Firm/Organization: _____

_____

Telephone: _____

(NEW INFORMATION)

Name: _____

Title: _____

Firm/Organization: _____

_____

Telephone: _____

FOREWORD

This manual has been prepared to aid engineers and developers in the preparation of development plans and engineering design and to inform interested persons of the procedures and standards for Mercer County, Ohio. It is also intended to be used during reconstruction or replacement of existing facilities or utility construction within the County right-of-way. The rules, standards, specifications, criteria, etc. are to supplement any applicable Zoning Regulations and the Subdivision Regulations of Mercer County.

It is not the intent of this manual to take away from the designing engineer any responsibility for the technical adequacy of this design or freedom to use his engineering judgment and discretion. It is recognized that matters of engineering design cannot be set out in writing to cover all situations, however, the design standards as set out herein represent good engineering practice. Any design methods or criteria different than that listed will receive consideration for approval, provided the proposed variances and the reasons for their use are submitted to Mercer County.

Mercer County, at any time during design or construction, shall have the authority to modify any engineering or construction detail, whenever required for the protection of the public interest.

Though Mercer County has no jurisdiction in areas outside of the County limits, the County strongly recommends that any development constructed within close proximity of the County be designed and constructed to these standards. This will help ensure that, if the development is brought into the County, the development will be accepted by the County without additional upgrades.

Mercer County, at their discretion, may request that infrastructure and utility facilities in any particular development be installed to accommodate future expansion within the County. If this is requested, the County will evaluate the Developer's eligibility to be compensated for the cost difference to oversize particular infrastructure items per the Subdivision Regulations of the County.

REFERENCES

Mercer County Design Criteria and Construction Standards and Drawings are to be used to supplement the following references. Whenever there are differences in these references and the Design Criteria and Construction Standards and Drawings, the more restrictive or higher standard shall apply as determined by Mercer County.

- Ohio Department of Transportation (ODOT), latest versions
  - ⇒ Construction and Material Specifications
  - ⇒ Location and Design Manuals
    - Volume 1 - Roadway Design
    - Volume 2 - Drainage Design
  - ⇒ Standard Construction Drawings
  - ⇒ Standard Design Drawings
  - ⇒ Supplemental Specifications
  - ⇒ Traffic Control for Uniform Control Devices

- American Association of State Highway and Transportation Officials (AASHTO), latest version
  - ⇒ A Policy on Geometric Design of Highways and Streets

- Great Lakes Upper Mississippi River Board (GLUMRB) (Ten State Standards), latest version
  - ⇒ Recommended Standards for Wastewater Facilities
  - ⇒ Recommended Standards for Water Works

100.00 GENERAL PROVISIONS

100.01 General

A. Any development within 1 mile of a municipal corporation limit must follow the Construction Standards and Drawings and Design Criteria of the municipality if one exists. Otherwise, the development must follow Mercer County Construction Standards and Drawings and Design Criteria.

B. The Design Criteria and Construction Standards and Drawings along with 100% surety and 10% maintenance surety shall apply to all public improvement construction projects that will eventually be taken over by Mercer County or applicable governing agency. The 100% performance surety and 10% maintenance surety shall follow the regulations in the Mercer County Subdivision Regulations even if the improvements are not part of a major subdivision.

C. The Developer/Owner shall design and construct improvements not less than the standards outlined in the Mercer County's Subdivision Regulations and this document. The work shall be done under County supervision and shall be completed within the time fixed or agreed upon by Mercer County.

D. It is the responsibility of the Developer/Owner and his engineer to investigate local conditions that may require additional improvements.

E. In the event any conflicting standards are encountered, the more restrictive shall apply as determined by Mercer County.

F. Upon request of the Developer or his representative, the County will evaluate requests for permission to do open excavation of existing utilities to allow accurate elevation information.

100.02 Construction Procedures and Materials

A. PRE-CONSTRUCTION MEETING

A pre-construction meeting with the County is required. The Developer/Owner, his contractor, his engineer, and representatives from utility companies involved shall be present at the meeting. It shall be the Developer/Owner's responsibility to arrange the preconstruction meeting.

B. MATERIALS

All work and materials shall conform to the Ohio Department of Transportation (ODOT) Construction and Material Specifications, and the Construction Standards and Drawings of Mercer County, Ohio.

C. INSPECTIONS

1. Definition

   Inspect, inspection is the visual observation or observation by instrument of construction to permit the County or its representative to render his or her professional opinion as to whether the contractor is performing the services in a manner indicating that, when completed, the services will be in accordance with the Mercer County Subdivision Regulations, Construction Standards and Drawings, and Design Criteria. Such observations shall not be relied upon in any part as acceptance of the services, nor shall they relieve any party from fulfillment of customary and contractual responsibilities and obligations.

2. Periodic Inspection

   Periodic inspection during the installation of improvements shall be made by the County to ensure conformity with the approved plans and specifications as required by these and other regulations. The Developer/Owner shall notify proper administrative officials at least 24 hours before each phase of the improvements is ready for inspection. The primary contact for all inspections shall be the County Engineer.

3. Inspections shall be at a minimum as follows:

   a) Sanitary Sewer
      1) Sanitary pipe and manhole installation
      2) Lateral location and inspection of all sewers
      3) Proper backfill installation
      4) Air test sanitary lines
      5) Vacuum test manholes
      6) Deflection test on PVC sewers

   b) Water Main
      1) Pipe installation
      2) Hydrant installation
      3) Valve installation
      4) Service installation
      5) Proper backfill installation
      6) Restraining glands and/or blocking installation
      7) Pressure test

8) Disinfection
9) Hydrant and valve operation
10) Hydrant assembly location and grade

c) Storm Sewer
1) Manhole and catch basin installation
2) Storm sewer pipe installation
3) Field tile connections
4) Proper backfill installation
5) Headwall installation

d) Roadway
1) Street excavation operations
2) Subgrade preparation and proofroll
3) Subgrade undercutting
4) Subbase installation
5) Curbing installation
6) Sidewalk and approach installation
7) Asphalt installation
8) Pavement coring after base course asphalt is placed
9) Calculate any assessment for deficient asphalt and aggregate base

4. The absence or presence of an inspector during construction shall not relieve the Developer/Owner or contractor from full responsibility of compliance with plans, specifications, and County requirements.

5. Weight and delivery tickets shall be furnished to the County to substantiate the type, quantity, and size of material used.

D. RESPONSIBILITY

All work shall be under the control and supervision of the Developer/Owner until written final approval is given by the County.

E. FINAL INSPECTION

Upon completion of all the improvements, the Developer/Owner shall request, in writing, a final inspection by the County. The final inspection shall be performed by officials from the County with the Developer/Owner. The Developer/Owner's Engineer and the Developer/Owner's Contractor will be present.

F. UTILITY COORDINATION

Coordination of utility location/installation such as electric, gas, telephone, and cable television shall be the responsibility of the Contractor, Developer, or Owner, in accordance with plans approved by the County.

CONSTRUCTION INSPECTION

PROJECT _____

DATE _____ INSPECTOR _____

This list could vary depending upon the types of construction included in the project. A typical list would require a 48-hour notice for inspections at the following points:

√	DESCRIPTION	REMARKS
A.	**PRIOR TO INSPECTION**	
	Review plans, special provisions, construction & materials manual & specifications that apply to your assigned duties.	
	Discuss your responsibility & authority with the project engineer.	
	Discuss notification, changes, connections, delays, rejections, and tolerances.	
B.	**PRE-CONSTRUCTION CONFERENCE**	
	Attendees: Owner/Administrator, Developer/Owner, his Contractor, his Engineer, and representatives from Utility Companies	
	Discuss phasing & schedules	
	Discuss materials	
	Discuss coordination	
	Discuss safety (public & job)	
	Discuss responsibilities	
C.	**SANITARY SEWER & LATERALS TO R/W**	
	Check pipe type & quality	
	Trench condition	
	Bedding	
	Proper initial backfill	
	Proper backfill	
	Prohibit groundwater from entering sanitary	
	Straight alignment & joints	
	Wye installation & location	
	Air test, mainline & laterals	
	Mandral test on PVC	

√	DESCRIPTION	REMARKS
D.	**SANITARY MANHOLE**	
	Check type & condition	
	Steps condition & alignment	
	Cone type & condition	
	Raisers precast/mastic	
	Casting - rim & lid	
	Proper pipe connection	
	Installation with O-rings	
	Installation on good base	
	Proper backfill, compacted granular under or near roadway	
	Vacuum test	
	Rim & risers to properly finish grade	
	Chimney Seal	
E.	**WATER MAIN**	
	Type & condition	
	Valve, type & condition	
	Hydrant, type & condition	
	Trench condition	
	Pipe alignment & joints	
	Air release valves	
	Isolation Valve installation & location	
	Hydrant assembly installation & location	
	Restrained as needed	
	Bedding	
	Initial backfill compacted granular	
	Proper backfill - compacted granular under or near roadway	
	Pressure test	
	Purification test	
	Valve & hydrant operation	
	Laterals: Corp Stop K-Copper Curb Stop	

√	DESCRIPTION	REMARKS
F.	**STORM SEWER**	
	Check pipe type size & quality	
	Check catch basin & grate type size & quality	
	Check manhole type size & quality	
	Trench condition	
	Bedding	
	Proper initial backfill	
	Proper backfill, compacted granular under or near roadway	
	Straight alignment & joint sealing	
	Proper connection to catch basin & manholes	
	C.B. set in good horizontal & vertical alignment with curbs	
	Slope & grade: Review control stakes & adjacent terrain for drainage	
	Field tile & other pipes reconnected & noted on plans	
G.	**ROADWAY**	
	Subgrade:	
	All topsoil removed in roadway	
	Compacted granular or clay fill only	
	Proper cross slope	
	Proper elevation	
	Free of roots, large stones, & excess dust	
	Proper compaction	
	Proofroll or density test, if soft undercut and/or underdrains	
	Measure elevation and cross slope	
	Subbase:	
	Proper material	
	Compacted in appropriate layers	
	Proofroll or density test, if soft undercut and/or tensar	
	Protect subgrade from being rutted or damaged	
	Proofroll subbase before prime coat	
	Measure elevation & cross slope	
	Surface; Asphalt	
	Appropriate moisture & temperature conditions	
	Visual inspection of material (be aware of acceptable temperature range of mix & compensation)	
	Proper distribution & roller	
	Proper prime coat	
	Watch joints, lapps, and around manholes, valves, etc.	
	Seal against concrete curbs, etc.	
	Measure elevation & cross slope	

√	DESCRIPTION	REMARKS
G.	**ROADWAY (Cont.O**	
	Keep traffic off for 24 hours, if possible	
	Pavement coring after base course asphalt is placed	
	Calculate any assessment for deficient asphalt and aggregate base	
	Surface; Concrete	
	Appropriate moisture and temperature conditions	
	Forms are set with reasonable conformance to grade and alignment	
	Forms are supported on thoroughly-compacted material	
	Appropriate consolidation of concrete	
	Check reinforcement	
	Check dowels	
	Check for expansion joints	
	Observe mix and placement	
	Observe finishing procedures	
	Needs curing as soon as possible	
	Observe saw joints	
	Note when forms are removed	
H.	**FIXED STRUCTURES, CURBS, SIDEWALK, HEADWALL, ETC.**	
	Check proper concrete mix	
	Appropriate moisture & temperature conditions	
	Check all underground portions	
	Check backfill, operation & material	
	Check subgrade, proofroll, or density check	
	Check subbase under curbs	
	Review requirements for reinforcing steel	
	Check all reinforcement	
	Check all dowels	
	Check for expansion joints	
	Be aware of time concrete was batched & allowable time for placement	
	Observe mix & placement	
	Observe finishing procedure	
	Needs curing material ASAP	
	If required, check cold weather protection	
	Needs saw joints ASAP	
	Note when forms are removed	
	Backfill as soon as possible	

I.	MISCELLANEOUS	
	Keep daily logs	
	Pre-mark all existing utilities	
	Reconnect all existing utilities	
	Mark ends of all laterals in field (Contractor's responsibility)	
	Mark ends of all laterals on plans	
	Restoration	
	Grade to drain	
	Check trench settlement	
	Seeding & Mulching	
	Erosion Control	
	Inlets	
	Outlets	
	Curb lines	
	Ditches	
	Basins	
	Final check for debris & flow	
	Sanitary sewer	
	Storm sewer manhole & catch basin	
	Curb lines	

100.03 Submission of Plans

A. CONSTRUCTION DRAWINGS

1. Complete construction drawings on 24"x36" and 11"x17" (half-scale) on bond paper media signed and approved by a registered engineer shall be made for all new streets, utilities and other improvements to be constructed in any development in the County. Said drawings are to be approved by the County before any construction may begin.

2. Plan line weights and style, topographic symbols, etc. shall conform to the plan requirements as established in ODOT's Location and Design Manual.

3. Submission of plans shall comply with Planning Commission regulations and Mercer County's Subdivision Regulations and Township Zoning Ordinance, if applicable.

B. STANDARD TITLE BLOCK

All plan sheets shall display a standard title block containing the following:

1. Name, address, telephone number, and fax number (logo optional)
2. Plan sheet number
3. Development name
4. Sheet title
5. Date
6. Revision block
7. Drawn by
8. Checked by

C. REQUIRED PLAN LAYOUT ORDER

1. Title Sheet
2. Final Plat
3. Schematic Plan
4. Typical Sections
5. General Notes
6. General Details
7. Site Grading and Erosion Control Plan/Storm Water Pollution Prevention Plan
8. Erosion Control Details
9. Miscellaneous Details (example: Pump Station, Intersection Plan)
10. Plan and Profile
11. Cross-sections
12. Detention Basin Plan and Details
13. Off-site Utilities Plan and Profile

1. TITLE SHEET

   a) Title of Project, County, Township, and State
   b) Index of sheets and sheet numbering
   c) Vicinity map with north arrow and project site call-out
   d) County Construction Standards & Drawings reference
   e) Underground utilities note (O.U.P.S.)
   f) Signature and stamp
   g) Date of finished plans
   h) Project description
   i) Approval plan signatures of the County Engineer. The following statement shall be placed above the approval signature: "The Mercer County signatures on this plan signify only concurrence with the general purpose and location of the proposed improvement. All technical details remain the responsibility of the professional engineer who prepared and certified these plans."
   j) Name, address, telephone number, and fax number of firm that plans are prepared by

2. FINAL PLAT

   a) Copy of approved final plat with signatures
   b) See Subdivision Regulations

3. SCHEMATIC PLAN - LARGE SCALE LAYOUT OF SITE

   a) At a measurable scale to show the whole site on one sheet (max. scale 1" = 100').
   b) Show existing and proposed right-of-way, property lines and roadway, lot numbers, street names, existing adjoining property lines, and owners.
   c) Show proposed utilities and numbering of sanitary and storm manholes and catch basins.
   d) Stationing of intersections and streets.
   e) Multi-baseline legend, (street number, stationing, description, etc.)
   f) North arrow and scale.
   g) Benchmarks and locations
   h) Centerline stationing
   i) Overall plan view of the development depicting the layout of the proposed sanitary sewer, water, and drainage network. Plans should include all manholes, pipes, other structures, and the plan and profile sheet on which they are located.
   j) Plan and Profile sheet reference.

4. TYPICAL SECTIONS

   a) Detailed labeling.
   b) Legend of pavement composition.
   c) Limiting stations for each section.
   d) Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way, and pavement slopes.

5. GENERAL NOTES

   All notes necessary for construction which are not defined clearly elsewhere within the plans.

6. GENERAL DETAILS

   a) All details necessary for construction except those Mercer County Construction Standards and Drawings referenced on the title sheet.
   b) Modified Mercer County Standard Drawings shall be redrawn for approval.

7. SITE GRADING PLAN, EROSION CONTROL PLAN/
   STORM WATER POLLUTION PREVENTION PLAN

   Site Grading Plan

   a) A final site grading plan must be included with the construction drawings and approved by the County.
   b) Proposed 1' contours showing all lots having proper drainage.
   c) Proposed building pad elevation.

   Storm Water Pollution Prevention Plan

   A Storm Water Pollution Prevention Plan will be required to be included with the construction drawings and approved by the County. This plan shall follow OEPA and NPDES permit requirements and shall be submitted to and approved by the OEPA prior to construction.

   a) Show and label existing and proposed 1' contours.
   b) Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.
   c) Concentrated flows.
   d) Property lines and right-of-way, lot numbers and property owners.
   e) Proposed/existing roadways.
   f) Proposed diversions and erosion control (Example: diversion ditches, fabric fence, straw bales, sediment basin).
   g) Erosion control construction sequence list.
   h) Limits of grading.

i) Proposed storm sewer pipe flows and capacities.
j) Sediment basin location.
k) North arrow and scale.
l) At a measurable scale to show the whole site on one sheet (maximum scale 1" = 100').

8. EROSION CONTROL DETAILS

Any details necessary for construction except those Mercer County Construction Standards and Drawings and referenced on the title sheet.

9. MISCELLANEOUS DETAILS (Example: Pump Station, Intersection Plan, etc.)

Plans shall include a detailed drawing with all proper labeling and dimensioning.

10. PLAN AND PROFILE

a) The plan and profile shall be at a scale of.
b) Plan and profile sheets shall show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.
c) All grade elevations shall be based on U.S.G.S. and Mercer County datum.
d) Plan and profile sheets will be required for all off-site utility extensions.
e) More specifically, all plans and profile sheets must show and include the following items:

10A <u>General - Plan</u>

a) Show all proposed lots, streets and curbs, etc.
b) Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc. (existing infrastructure may be shown in lighter text and no less than 80% shading).
c) Typical street and curb sections.
d) Construction notes.
e) Structural details.
f) North arrow (preferably up or to the right) and scale (horizontal and vertical).
g) Street names.
h) Centerline stations and ticks every 100' (south to north and west to east where possible).
i) Easements for utilities and storm drainage.
j) Lot numbers, dimensions, and frontage.
k) Curb radius at intersections with back of curb elevations at quarter points (if not covered in separate intersection detail).

l) Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC.
m) Sheet reference.
n) Plat phase lines (boundary lines) show stations.
o) Dimension and station of utility locations.
p) Centerline bearings and/or intersecting centerline angles.
q) Final monument box callouts set at the intersection of streets and center of cul-de-sacs (in pavement).
r) Railroad spike call outs set at PC, PT, PCC, PI, PRC (in pavement).
s) Drive apron stationing and width callout, if known.
t) Show all existing features within 50' of right-of-way.
u) Proposed electric, telephone, gas, cable locations and easements.
v) Proposed light pole layout and electric feed.
w) Match lines with stationing.
x) Intersection elevation for proper storm water drainage.
y) Benchmarks

10B General - Profile

a) Existing centerline and proposed centerline profile.
b) Label proposed centerline grades (minimum grade 0. 40%).
c) Show all mainline existing utilities.
d) Existing and proposed grade elevations every 25' (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)
e) Show and label all vertical curves (Stations, elevations, length).

10C Storm Sewer - Plan

a) Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.
b) Label each pipe size and type.
c) Number proposed storm manholes and catch basins.

10D Storm Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Label existing pipe size and type.
c) Existing and proposed storm.

    1) Label existing and proposed mainline storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each.
    2) Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.
    3) Show elevation on top of manhole or catch basin.

4) Number proposed storm manholes and catch basins.

10E Water - Plan

a) Show and station with offsets the proposed waterline, laterals, deflection points, hydrants, valves, etc.
b) Label pipe size, tees, crosses, etc.
c) Station and offset above items.
d) Indicate the testing requirements for fire protection and water services.
e) Dry hydrants in subdivision with no public water and channel, pond, or lake access.

10F Water - Profile

a) Show length, size, depth, and class and/or type of pipe.
b) Show deflection points.
c) Show stations and any critical elevations for above items.
d) Label minimum/maximum coverage of water main.

10G Sanitary Sewer - Plan

a) Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.
b) Label each pipe size.
c) Number proposed sanitary manholes and cleanouts.
d) Proposed lateral locations.

10H Sanitary Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Show existing sanitary.
c) Show invert elevation of all pipe at manholes.
d) Show top elevations of manholes.
e) Number the proposed sanitary manholes and cleanouts.

11. CROSS-SECTIONS

a) The cross-sections shall be at a scale of 1" = 5' horizontal, 1" = 5' vertical.
b) Cross-sections shall be every 50' and at other critical areas.
c) Show all existing utilities with labels.
d) Show all proposed utilities with labels.
e) Show all proposed and existing roadway sections with existing and proposed centerline elevations.
f) Cross-section at each drive and intersection roadway (for reconstruction project and projects where drive locations are predetermined.)

12. DETENTION BASIN PLAN AND DETAILS

a) Detailed site plan including inlet and outlet elevations, top of bank elevations and emergency overflow elevations.

13. OFF-SITE UTILITIES PLAN AND PROFILE

Refer to Plan and Profile.

CONSTRUCTION PLANS
CHECKLIST

PROJECT _____ DATE _____

√	DESCRIPTION	REMARKS
	C. REQUIRED PLAN LAYOUT ORDER	
	Title Sheet	
	Final Plan	
	Schematic Plan	
	Typical Sections	
	General Notes	
	General Details	
	Site Grading and Erosion Control Plan	
	Erosion Control Details	
	Misc. Details (e.g. pump station, intersection plan)	
	Plan and Profile	
	Cross-sections	
	Detention Basin Plan and Details	
	Off-Site Utilities Plan and Profile	
	GENERAL	
	Acceptable natural drainage and erosion control	
	Right-of-way widths meet minimum criteria	
	Pavement widths	
	Radius of curvature	
	Horizontal visibility	
	Vertical alignment and visibility	
	Grades	
	Cul-de-sacs	
	Turn around radius, right-of-way, and pavement	
	Dead-end streets	
	Alignment of intersection	
	Space of intersection relative to difference in road classifications	
	Avoidance of multiple intersection	
	Pavement and right-of-way of intersection	
	Streets for commercial developments	
	Repair of pavements	

√	DESCRIPTION	REMARKS
	GENERAL (Con't)	
	Streets for industrial development	
	Lengths of blocks meet minimum criteria	
	Crosswalks	
	Street Monuments	
	Subgrade	
	Base Course	
	Surface Course	
	Grading Plan	
	Storm drainage system type	
	Manholes	
	Catch basins	
	Headwalls	
	Sufficient easements for utilities or open drainage	
	Other utilities	
	Underground utilities	
1.	**TITLE SHEET**	
	Title of Project, County, Township, and State	
	Index of sheets and sheet numbering	
	Vicinity map with north arrow and project site callout	
	County standard drawings reference	
	Underground utilities note (O.U.P.S.)	
	Signature and stamp	
	Date of finished plans	
	Project description	
	Approval plan signatures of County Engineer	
	Name, address, telephone number, and fax number of firm that plans are prepared by	
2.	**FINAL PLAT**	
	Copy of approved final plat with signatures	
	See Subdivision Regulations	

√	DESCRIPTION	REMARKS
3.	**SCHEMATIC PLAN - LARGE SCALE LAYOUT OF THE SITE**	
	At a measurable scale to show the whole site on one sheet (max. scale 1" = 100').	
	Show existing and proposed right-of-way, property lines and roadway, lot numbers, street names, existing adjoining property lines and owners.	
	Show proposed utilities and numbering of sanitary and storm manholes and catch basins.	
	Stationing of intersections and streets.	
	Multi-baseline legend, (street number, stationing, description, etc.).	
	North arrow and scale.	
	Benchmarks and locations.	
	Centerline stationing.	
	Overall plan view of the development depicting the layout of the proposed sanitary sewer and drainage network. Plans should include all manholes, pipes, other structures, and the plan and profile sheet on which they are located.	
4.	**TYPICAL SECTIONS**	
	Detailed labeling.	
	Legend of pavement composition.	
	Limiting stations for each section.	
	Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way and pavement slopes.	
5.	**GENERAL NOTES**	
	All notes necessary for construction which are not defined clearly elsewhere within the plans.	
6.	**GENERAL DETAILS**	
	All details necessary for construction except those Mercer County Construction Standards and Drawings on the Title Sheet.	
	Modified Mercer County Standards and Drawings shall be redrawn for approval.	

√	DESCRIPTION	REMARKS
7.	**SITE GRADING PLAN, EROSION CONTROL PLAN, AND STORM WATER POLLUTION PREVENTION PLAN**	
	A final site grading plan must be included with the construction drawings and approved by the County.	
	Proposed 1' contours showing all lots having proper drainage.	
	Proposed building pad.	
	A Storm Water Pollution Prevention Plan will be required to be included with the construction drawings and approved by the County. This plan shall follow the OEPA and NPDES permit requirements and shall be submitted to and approved by the OEPA prior to construction.	
	Show and label existing and proposed 1' contours.	
	Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.	
	Concentrated flows.	
	Property lines and right-of-way, lot numbers and property owners.	
	Proposed/existing roadways.	
	Proposed diversions and erosion control (e.g. diversion ditches, fabric fence, straw bales, sediment basins.)	
	Erosion control construction sequence list.	
	Limits of grading.	
	Proposed storm sewer pipe flows and capacities.	
	Sediment basin location.	
	North arrow and scale.	
	At a measurable scale to show the whole site on one sheet. (Maximum scale 1" = 100')	
8.	**EROSION CONTROL DETAILS**	
	Any details necessary for construction except those Mercer County Construction Standards and Drawings referenced on the Title Sheet.	
9.	**MISC. DETAILS (e.g. pump station, intersection plan etc.)**	
	Plans shall include a detailed drawing with all proper labeling and dimensioning.	

√	DESCRIPTION	REMARKS
10.	**PLAN AND PROFILE**	
	Use a scale of 1" = 20' horizontal, 1"=5' vertical.	
	Show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.	
	All grade elevations shall be based on U.S.G.S. and Mercer County datum.	
	Plan and profile sheets are required for all off-site utility extensions.	
	Dry hydrant, if applicable	
10A	**GENERAL – PLAN**	
	Show all proposed lots, streets, and curbs, etc.	
	Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc. (existing infrastructure may be shown in lighter text and no less than 80% shading).	
	Typical street and curb sections.	
	Construction notes.	
	Structural details.	
	North arrow (preferably up or to the right) and Scale: horizontal and vertical.	
	Street names.	
	Centerline stations and ticks every 100' (south to north and west to east where possible).	
	Easements for utilities and storm drainage.	
	Lot numbers, dimensions, and frontage.	
	Curb radius at intersections with back of curb elevations at quarter points (if not covered in separate intersection detail).	
	Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC.	
	Sheet reference.	
	Plat section lines (boundary lines) show stations.	
	Dimension and station utility locations.	
	Centerline bearings and/or intersecting centerline angles.	
	Final monument box callouts set at the intersection of streets and center of cul-de-sacs (in pavement).	

√	DESCRIPTION	REMARKS
10A	**GENERAL – PLAN (cont.)**	
	Railroad spike callouts set at PC, PT, PCC, PI, PRC (in pavement).	
	Drive apron stationing and widths callout, if known.	
	Show all existing features within 50’ of right-of-way.	
	Proposed electric, telephone, gas, cable locations, and easements.	
	Proposed light pole layout and electric feed.	
	Match lines with stationing.	
	Intersection elevation for proper storm water drainage.	
	Benchmarks.	
10B	**GENERAL - PROFILE**	
	Existing centerline and proposed centerline profile.	
	Label proposed centerline grades (minimum grade 0.40%).	
	Show all mainline existing utilities.	
	Existing and proposed grade elevations every 25’ (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)	
	Show and label all vertical curves (stations, elevations, length).	
10C	**STORM SEWER - PLAN**	
	Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.	
	Label each pipe size and type.	
	Number proposed storm manholes and catch basins.	

√	DESCRIPTION	REMARKS
10D	**STORM SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe.	
	Label existing pipe size and type.	
	Label existing and proposed mainline storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each.	
	Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.	
	Show elevation on top of manhole or catch basin.	
	Number proposed storm manholes and catch basins.	
10E	**WATER - PLAN**	
	Show and station, with offsets, the proposed waterline, laterals, deflection points, hydrants, valves, etc.	
	Label pipe size, tees, crosses, etc.	
	Station and offset above items.	
	Proposed meter pit location.	
	Indicate the testing requirements for fire protection and water services.	
10F	**WATER - PROFILE**	
	Show length, size, depth, and class and/or type of pipe.	
	Show deflection points.	
	Show stations and any critical elevations for above items.	
	Label minimum coverage of water main.	
10G	**SANITARY SEWER - PLAN**	
	Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.	
	Label each pipe size.	
	Number proposed sanitary manholes and cleanouts.	
	Dry hydrants for subdivisions without public water with access to pond, channel, or lake.	

√	DESCRIPTION	REMARKS
10H	**SANITARY SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe.	
	Show existing and proposed sanitary.	
	Show invert elevation of all pipe at manholes.	
	Show top elevations of manholes.	
	Number proposed sanitary manholes and cleanouts	
11.	**CROSS-SECTIONS**	
	Cross-sections shall be at a scale of 1”=5’ horizontal, 1”=5’ vertical.	
	Cross-sections shall be every 50’ and at other critical areas.	
	Show all existing utilities with labels.	
	Show all proposed utilities with labels.	
	Show all proposed and existing roadway sections with existing and proposed centerline elevations.	
	Cross-section at each drive and intersection roadway.	
12.	**DETENTION BASIN**	
	Detailed site plan including inlet and outlet elevations, top of bank elevations and emergency overflow elevations.	
13.	**OFF-SITE**	
	Refer to Plan and Profile.	
14.	**CHECKLIST**	
	Final construction drawings checklist.	

100.04 Record Drawings (As-Built) Requirements

A. RECORD DRAWINGS (AS-BUILT) REQUIREMENTS

1. At the completion of construction, the original tracings shall be revised as necessary to provide "Record Drawings". This work shall be done by the Developer/Owner's Engineer, who was responsible for setting grades and staking for improvements. The "Record Drawings" shall include the following information:

   a) Location of all water and sanitary services as well as storm outlets if provided.

   b) Final elevations and locations of the following:

      1) Storm sewer inlets, outlets and manholes with all inverts.
      2) Drainage swales, detention basins including structures with all elevations and capacity recalculated.
      3) Sanitary sewer manholes and inverts and lateral locations, if applicable.
      4) Curb, gutter and centerline elevations at locations where they are ended for future roadway extensions.

   c) The location of any additional improvements, construction as additions, or changes to the approved plans, such as tapping sleeves, blind taps, joint clamps, or any other field change item.

   d) The original tracings and a copy of the revised computer drawings transferable to electronic media downloadable by the County shall become the property of the County.

2. The Maintenance Surety shall not be released until a satisfactory set of Record Drawings are delivered to the County.

200.00 DEFINITIONS

Interpretation of Terms or Words

Regardless of capitalization, definitions are standard for the intent of these Design Criteria.

AASHTO
American Association of State Highway and Transportation Officials

ANSI
American National Standards Institute

ASCE
American Society of Civil Engineers

ASTM
American Society for Testing and Materials

AVERAGE DAILY FLOW
The total quantity of liquid tributary to a point divided by the number of days of flow measurement.

AWWA
American Water Works Association

BEDDING
The earth or other materials on which a pipe or conduit is supported

BUILDING SEWER
A pipe conveying wastewater from a single building to a common sewer or point of immediate disposal.

CATCH BASIN
A structure intended to collect surface runoff and direct it into the storm sewer system.

COLLECTOR SEWER
A sewer normally less than 15" in diameter that receives wastewater from the sanitary laterals and transports it to the interceptor sewer.

COMBINED SEWER
A sewer intended to receive both wastewater and storm or surface water.

CROSS-CONNECTION

A. A physical connection through which a supply of potable water could be contaminated or polluted.

B. A connection between a supervised potable water supply and an unsupervised supply of unknown portability.

CULVERT

A structure which allows surface runoff to flow through a roadway fill or similar obstruction of open flow. Culverts may be corrugated metal pipe, reinforced concrete, etc.

CURB INLET

A specialized catch basin (see catch basin) designed to collect runoff from pavement with curbing.

DESIGN STORM

The expected frequency of the storm for which the capacity of a structure will be equaled or exceeded. The capacity of a storm sewer designed for a 10-year design storm has a 1 in 10 chance of being equaled or exceeded in any given year.

DETENTION/RETENTION

The term detention/retention basin refers to the use of a storm water storage facility which will store storm water and release it at a given rate. The objective of a detention/retention facility is to regulate the rate of runoff and control the peak discharges to reduce the impact on the downstream drainage system.

Type of Storm Water Storage Facilities:

A. Detention Basin or Dry Basin - Dry basins are surface storage areas created by constructing a typical excavated or embankment basin.
B. Retention Basins or Ponds - Retention basins are permanent ponds where additional storage capacity is provided above the normal water level.

C. Parking Lot Storage - Parking lot storage is a surface storage facility where an inlet is undersized causing shallow ponding to occur in specific graded areas of the parking lot.
D. Subsurface Storage - Subsurface storage is a structure constructed below grade for the specific purpose of detaining storm water runoff.

DISCHARGE

The amount of flow carried by a culvert or storm sewer, normally measured in cubic feet per second.

DRAINAGE AREA

The area, in acres, which drains to a particular catch basin, culvert, or similar structure.

DROP MANHOLE
A manhole installed in a sewer where the elevation of the incoming sewer considerably exceeds that of the outgoing sewer; a vertical waterway outside the manhole is provided to divert the wastewater from the upper to the lower level so that it does not fall freely into the manhole except at peak rate of flow.

EARTH-DISTURBING ACTIVITY
Any grading, excavating, filling or other alteration of the earth's surface where natural or manmade ground cover is destroyed and which may result in or contribute to erosion and sediment pollution.

ENERGY GRADIENT
The slope of the energy line of a body of flowing water with reference to a datum plane.

ENERGY GRADIENT LINE
The line representing the gradient which joins the elevation of the energy head.

ENERGY HEAD
The height of the hydraulic grade line above the centerline of a conduit plus the velocity head of the mean velocity of the water in that section.

ENERGY LINE
A line joining the elevation of the energy heads; a line drawn above the hydraulic grade line by a distance equivalent to the velocity head of the flowing water at each section along a stream, channel or conduit.

EROSION

A. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

B. Detachment and movement of soil or rock fragments by wind, water, ice, or gravity.

C. Erosion includes:

   1. Accelerated erosion: Erosion much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of the activities of man.
   2. Floodplain erosion: Abrading and wearing away of the nearly level land situated on either side of a channel due to overflow flooding.

3. Gully erosion: The erosion process whereby water accumulates in narrow channels during and immediately after rainfall or snow or ice melt and actively removes the soil from this narrow area to considerable depths such that the channel would not be obliterated by normal smoothing or tillage operations.
4. Natural erosion (geological erosion): Wearing away of the earth's surface by water, ice or other natural environmental conditions of climate, vegetation, etc., undisturbed by man.
5. Normal erosion: The gradual erosion of land used by man which does not greatly exceed natural erosion.
6. Rill erosion: An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed soils.
7. Sheet erosion: The removal of a fairly uniform layer of soil from the land surface by wind or runoff water.

EXFILTRATION
The quantity of wastewater which leaks to the surrounding ground through unintentional openings in a sewer. Also, the process whereby this leaking occurs.

FIELD TILE
A tile designed to convey subsurface drainage and not generally designed for surface drainage, especially to these Design Criteria.

FIRE HYDRANT
A fixture installed throughout the water distribution systems to provide water for fire fighting needs.

GRASSED WATERWAY
A broad or shallow natural course or constructed channel covered with erosion-resistant grasses or similar vegetative cover and used to conduct surface water.

HEADWALL
A structure placed at the ends of a culvert to prevent movement of the culvert and reduce erosion.

HEADWATER
The vertical distance from a culvert invert at the entrance to the water surface upstream from the culvert.

INFILTRATION
The discharge of ground waters into sewers, through defects in pipe lines, joints, manholes or other sewer structures.

INFILTRATION/INFLOW
A combination of inflow wastewater volumes in sewer lines with no way to distinguish either of the two basic sources, and with the same effect as surcharging capacities of sewer systems and other sewer system facilities.

INFLOW
The discharge of any kind of water into sewer lines from such sources as roof leaders, cellars, sump pumps and yard-area drains, foundation drains, commercial and industrial so-called "clean water" discharges, drains from springs and swampy areas, etc. It does not "infiltrate" into the system and is distinguished from such wastewater discharge, as previously defined.

INLET CONTROL
A situation where the discharge capacity of a culvert is controlled at the culvert entrance by the depth of headwater and the entrance geometry, including the area, shape, and type of inlet edge.

INTERCEPTOR SEWER
A sewer which receives the flow from collector sewers and conveys the wastewater to treatment facilities.

JOINTS
The means of connecting sectional lengths of storm sewer pipe into a continuous sewer line using various types of jointing materials with various types of pipe formation.

JURISDICTION
Any governmental entity, such as town, city, county, sewer district, sanitary district or authority, or other multi-community agency which is responsible for and operates sewer systems, pumping facilities, regulator-overflow structures, and wastewater treatment works.

MAIN
The large water-carrying pipe to which individual user services are connected. Mains are normally connected to each other in a grid type system.

MANHOLE
An opening in a sewer provided for the purpose of permitting a man to enter or have access to the sewer.

MANNING ROUGHNESS COEFFICIENT
The roughness coefficient in the Manning Formula for determination of the discharge coefficient in the Chezy Formula.

METER

The flow measuring device installed at each service on a distribution system to measure the amount of water consumed by users at that service.

NORMAL DEPTH
The depth at which water will flow in a pipe or channel by virtue of its slope and roughness, based on the Manning Formula.

OEPA
Ohio Environmental Protection Agency.

OUTLET CONTROL
A situation where the discharge capacity of a culvert is controlled by the barrel of the culvert, rather than the inlet.

OVERFLOW
A pipeline or conduit device, together with an outlet pipe, which provides for the discharge of a portion of sewer flow into receiving water or other points of disposal.

PEAK
The maximum quantity that occurs over a relatively short period of time. Also called peak demand, peak load.

RAINFALL INTENSITY
The amount of rain falling over a specified period of time. Rainfall intensity is usually measured in inches per hour.

RATIONAL FORMULA
The method used to determine the amount of runoff from a specified area of known surface characteristics.

RUNOFF COEFFICIENT
A coefficient used in the Rational Formula to express the ratio of runoff to rainfall.

SANITARY WASTEWATER

A. Domestic wastewater with storm and surface water excluded.
B. Wastewater discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial plants, or institutions.
C. The water supply of a community after it has been used and discharged into a sewer.

SEDIMENT
Solid material both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by wind, water, gravity, or ice, and has come to rest on the earth's surface above or below sea level.

SEDIMENT BASIN
Barrier, dam, or other suitable detention facility built across an area of waterflow to settle and retain sediment carried by the runoff waters.

SEDIMENT CONTROL PLAN
A written description, acceptable to the approving agency, of methods for controlling sediment pollution from accelerated erosion on a development area of five or more contiguous acres or from erosion caused by accelerated runoff from a development area of five or more contiguous acres.

SEDIMENT POLLUTION
Failure to use management or conservation practices to abate wind or water erosion of the soil or to abate the degradation of the waters of the state by soil sediment in conjunction with land grading, excavating, filling, or other soil-disturbing activities on land used or being developed for commercial, industrial, residential, or other purposes.

SERVICE
The pipe carrying water to individual houses or other users on a distribution system.

STORM SEWER
Conduit which conveys storm water to an outlet.

TAILWATER
The vertical distance from a culvert invert at the outlet to the water surface downstream from the culvert.

TIME OF CONCENTRATION
The time required for water to flow from the hydrologically remote point of a basin to the outlet or collection point being analyzed. The time of concentration is the maximum time for water to travel through the watershed, which is not always the maximum distance from the outlet to any point in the watershed. The time of concentration for all drainage design of areas larger than 20 acres should be computed using the TR-55 method. A sample calculation sheet is provided in Figure 6.2 Time of Concentration Worksheet. For smaller areas, Figure 6.4 Roughness coefficient for TR-55 Sheetflow may be used.

WATER RESOURCE
Any natural or unnatural body of water, swale, ditch, conduit, pond, lake, etc. that receives or transports storm water runoff.

300.00 ROADWAYS

300.01 General

All street design and layout shall follow the Mercer County Construction Standards and Drawings, the Ohio Department of Transportation (ODOT) Location and Design Manual, Volume One, Roadway Design, latest version, and AASHTO. The most restrictive shall apply as determined by the County Engineer. These criteria cover design factors and provide guidelines for evaluations of plans and specifications by the County department having jurisdiction over the review of the plans and specifications. The design shall be consistent with the requirements of AASHTO and ODOT.

300.02 Driveway Approaches along Streets with Curbs and Open Ditches and Yard Enclosures

A. Profile Grades

1. Open Ditch Drives: Driveway approaches with open ditches shall slope away from the edge of pavement to the centerline of the proposed drive pipe location. From the centerline of the pipe the drive profile shall slope upward creating a "V" type of channel in the drive approach. The center of this V-channel shall be a minimum of 10' from the edge of pavement unless otherwise approved by the County Engineer. Driveway grade within the right-of-way limits shall not exceed a grade of 8% for commercial drives and 15% for residential drives. When a driveway continuously slopes away from the pavement or due to the other special terrain conditions, a drive approach design shall be required. This design shall be submitted to the County Engineer for review and approval.

2. Curb and Gutter Driveways: Driveway approaches on curbed and gutter streets shall be constructed to match the requirements of the Mercer County Construction Standards and Drawings. The profile of the driveway beyond 1 foot from the back of the sidewalk shall conform to the maximum profile grades stated above.

3. Composition

   a.) Non-Curbed Streets: Approach shall have an asphalt concrete surface with the public rights-of-way. The minimum pavement composition shall be 2" of asphalt concrete on 6" of aggregate base for a residential driveway and 9" of aggregate base for a commercial driveway within the rights-of-way. If a concrete driveway is desired on a non-curbed street, it

shall conform to the above composition within the rights-of-way before beginning the
concrete portion. This is to allow for proper transition to the concrete driveway for future overlays. No curbs are permitted within the rights-of-way on non-curbed streets.

b.) Curb and Gutter Street: Shall be constructed of 6" of Class "C" Portland cement concrete for a residential driveway and 8" for a commercial driveway within the public rights-of-way.

4. These standards and the permit process are applicable for County and Township roads, including the need to apply for and obtain a permit for this work.

5. When approved by the County Engineer, aggregate drive approaches may be permitted on existing County and Township roads that are not within an approved subdivision. Approval of these are generally limited to unimproved County or Township roads.

B. Common Access Drive Approaches: When a computer-aided drawing is constructed, the portion of the computer-aided drawing's pavement within the rights-of-way shall be constructed consistent with the requirements of this section.

C. Vertical Curves: To help prevent center or overhang drag, with some allowance for load and bounce, crest vertical curves should not exceed a 3-¼" hump in a 10' length. Sag vertical curves should not exceed a 2" depression in a 10' length.

D. Width of Driveway Approach: The actual width of a driveway approach may vary depending on the type of usage and type of street it provides access to. Normally, residential drives will range from a minimum of 10' to a maximum of 20' in width and commercial drives will range from a minimum of 20' to a maximum of 35' in width. When any driveway approach width is less than or greater than these Standards, the County Engineer will review the requested variance to see if the variance will adversely affect the traffic flow on the through street. The width shall be measured perpendicular to the driveway approach centerline.

E. Driveway Intersection Angle: The driveway intersection angle is the interior angle between the driveway approach centerline and the centerline of the street. The allowable intersection angle shall be within the range of 70° to 90°.

F. Approach Flares or Radii: Each approach shall have a flare or radius return. For residential drives this flare shall be a minimum of 2' wide at the edge of pavement to a maximum of 5'. The flare shall transition from the edge of pavement to driveway width no sooner than 10' or to the right-of-way line. Radius returns

shall be a minimum of 15' to a maximum of 20' for residential driveways. For commercial drives, the flare or radius shall be based on the type of vehicles that will be using the drive. In no case shall the flare be less than 5' or the radius less than 20'.

G. Sight Distance: Driveways should be located and designed to enable vehicles traveling at or near legal highway speeds to see a driveway approach in time to safely reduce speed and enter the driveway approach. Conversely, the driveway approach should be placed in areas to allow vehicles, while within the approach area, to observe the through highway traffic for a distance sufficient to make a safe entry onto the highway. The length adequate to accomplish the above varies with each installation and depends on the horizontal and vertical alignment of the highway, speed along the highway and the location of existing objects, such as trees, signs, buildings, etc. which may restrict visibility along the highway. When in the opinion of the County Engineer, the proposed driveway location will cause a safety problem, the application request may be denied.

H. Driveway Pipes: In a subdivision where new roads are being built, all driveway pipe sizes shall be predetermined and submitted to the County Engineer for approval at the same time the preliminary engineering plan is submitted. When new lots are being created or new access points are requested on existing streets, the permit request including the proposed driveway pipe shall be submitted to the County Engineer for approval. After the minimum driveway pipe sizes have been approved, they shall be shown on the final engineering and construction plan or driveway permit application. These pipe sizes shall be shown in a tabular form on the sheet with the estimated quantities. The following information shall be shown: lot number, size, pipe elevations, and type of pipe.

   The length of driveway pipes shall be such that they extend beyond the limits of the edges of the driveway (including flare and radii returns) a minimum distance of 4'. This minimum offset is further controlled in that no slope from the edge of a driveway shall be steeper than 4:1 to flow line of the pipe. If Township requirements are greater, than those shall be met.

300.03 Road Widening and Ditch Set-Back Plan

All projects fronting on an existing public road shall provide a pavement, shoulder, and ditch modification plan to comply with the approved typical section and the Mercer County Thoroughfare Plan. The plan shall include, but is not limited to, the following items:

A. Typical Section.

B. Cross-section at 50' intervals and at existing structures, drives, and road entrances.

C. Proposed drive profiles.

D. Plans for modification and/or extension of existing drainage structures and/or culverts.

E. Calculations for drive culverts.

F. Identification, horizontal and vertical locations of existing utilities, and subsurface drainage systems.

600.00 STORM DRAINAGE

600.01 General

The following Design Criteria are summarized herein to establish practical uniform design of storm sewers for Mercer County. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the County department having jurisdiction over the review of plans and specifications. These design criteria are to be used in conjunction with the Construction Standards and Drawings for storm sewers. Storm sewer design should follow these criteria and Ohio Department of Transportation Location and Design, Volume Two, Drainage Design.

600.02 Adequate Drainage Outlet

Surface water runoff from a development shall be drained offsite in accordance with the Mercer County Design Criteria and Mercer County Construction Standards and Drawing to an adequate outlet(s). The County Engineer shall approve the location of the outlet(s). The outlet(s) may consist of a ditch, stream, storm sewer excluding a field tile, or approved detention basin having sufficient capacity to accommodate the surface water runoff in a reasonable manner. The Developer shall submit in writing evidence indicating the adequacy of the outlet(s) through the first drainage structure offsite of the proposed improvement. The County Engineer shall review and determine the adequacy of the drainage outlet and reserves the right to require the outlet(s) to be cleaned, reconstructed, and/or replaced as deemed necessary.

An adequate outlet is defined as an outlet functioning as designed and able to carry the existing flows as well as the proposed flows in the post development condition. Even though the discharge rate is controlled to the two-year storm, these are often concentrated flows.

The lack of an adequate drainage outlet may be cause for disapproval of the plan.

600.03 Storm Sewer Design

A. GENERAL DESIGN REQUIREMENTS

An adequate storm drainage system shall be constructed for all proposed developments including septic drains, if applicable. Natural drainage patterns should be closely followed.

Outlets for the storm water runoff for development upstream of the proposed development must be provided. All storm sewer calculations must be submitted to the County before any approvals will be given.

Storm runoff from urban areas may constitute a large volume of flow. The Rational Method is the preferred method for estimating storm runoff for areas less than or equal to 200 acres. For areas over 200 acres, other methods will be as approved by the County Engineer. Once the runoff is determined, the Manning Formula is the preferred method to calculate the capacity of the storm sewer pipes. Storm sewer shall be designed based on the full flow capacity of all pipes being able to carry at least the runoff from a 5-year storm event.

Also, the Hydraulic Grade Line (HGL) should be checked to ensure that a 25-year storm event will not cause ponding water at catch basins and manholes.

B. DRAINAGE AREA DETERMINATION CRITERIA

The drainage area(s) (watershed area) shall be determined by a review of, but not limited to, the sources listed below. Watershed area(s) are subject to the approval of the County Engineer. Existing watershed boundaries shall be maintained.

1. Contour Map: U.S. Geological Survey quadrangle (7.5 minute series) maps or other topographic contour map.

2. Field Investigation

3. Soil Survey of Mercer County, Ohio, USDA.

4. Others approved for use by the Mercer County Engineer.

Other methods for determination of peak runoff rates may be used upon approval from, or by request of the Mercer County Engineer.

C. RATIONAL METHOD

The Rational Formula used to compute the runoff that reaches a storm sewer inlet consists of the following:

$$Q = CiA$$

Q = Peak rate of runoff in cubic feet per second (cfs)
C = A coefficient expressing the ratio of runoff to the average rainfall rate during the time of concentration
i = Intensity of rainfall, in inches per hour
A = Drainage area, in acres

D. MANNING FORMULA

The Manning Formula, used to compute flow in open conduits, consists of the following:

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

Q = Flow in cubic feet per second (cfs)
n = Coefficient of conduit roughness (n = 0.013)
R = Hydraulic radius, ratio of flow area to wetted perimeter in feet
S = Channel or pipe slope, in feet per feet
A = Area of cross-section of flow in square feet

E. STORM SEWER DESIGN PROCEDURE

The design of storm sewers in Mercer County shall be outlined as follows:

1. Prepare a contour map of the drainage area including the surrounding area, drainage limits, and direction of surface flow utilizing the drainage area criteria.

2. Divide the area into the subareas tributary to the proposed sewer inlets. These inlets should be located at low points of road grade and at street intersections. See Section 600.12 Catch Basins and Inlet Design for spacing criteria.

3. Figure 6.6, Computation for Storm Sewer Design, shall be used for storm sewer calculation and provided as part of submittals.

4. Determine the acreage and imperviousness of each area.

5. The appropriate time of concentration shall be calculated utilizing Figure 6.2 Time of Concentration Worksheet for overload flow less than 1000' and Figure 6.3 Time of Concentration Worksheet Derived From TR-55 for overload flow greater than 1000'.

6. Calculate the required capacity of each inlet using the appropriate time of concentration, the tributary area and the Rational Method.

7. Beginning at the highest elevation, compute the flow to be carried by each line. The time of concentration for each line other than the first in a series is the sum of the time of concentration to the inlet next upstream and the flow time in the connecting pipe. Where more than two lines meet, the time of concentration to be used for the succeeding line is the longest time in the lines meeting. Each line will thus require calculation of time of concentration, tributary area (all upstream areas), and flow.

8. Select tentative pipe sizes and grades using the Manning Formula. Each line must be selected in order since the time of concentration for subsequent lines will be dependent upon the time of flow in all upstream lines.

9. Minimum cover requirements specified herein must be met.

FIGURE 6.1
RUNOFF COEFFICIENT – C

Lists values of "C" for several land uses and surface characteristics. If more than one land use is present in a particular drainage area, a composite "C" value should be computed to represent the site.

Predominant Land Use	
Business:	
Downtown Area	.80
Neighborhood Area	.70
Residential:	
Single-Family Areas	.40
Multi-Family Areas	.60
Industrial:	
Light Areas	.70
Heavy Areas	.80
Parks, Cemeteries	.30
Playgrounds	.35
Railroad Yard Areas	.35
Row Crops or Open Land	.25

Surface Characteristics	
Street:	
Asphalt	.90
Concrete	.90
Drives and Walks	.90
Roofs	.85
Lawns	
Flat -- 2% or less	.25
Average -- 2% to 7%	.35
Steep -- 7% or greater	.40

Figure 6.2
Time of Concentration Worksheet
(to be utilized when overland flow is less than 1,000')

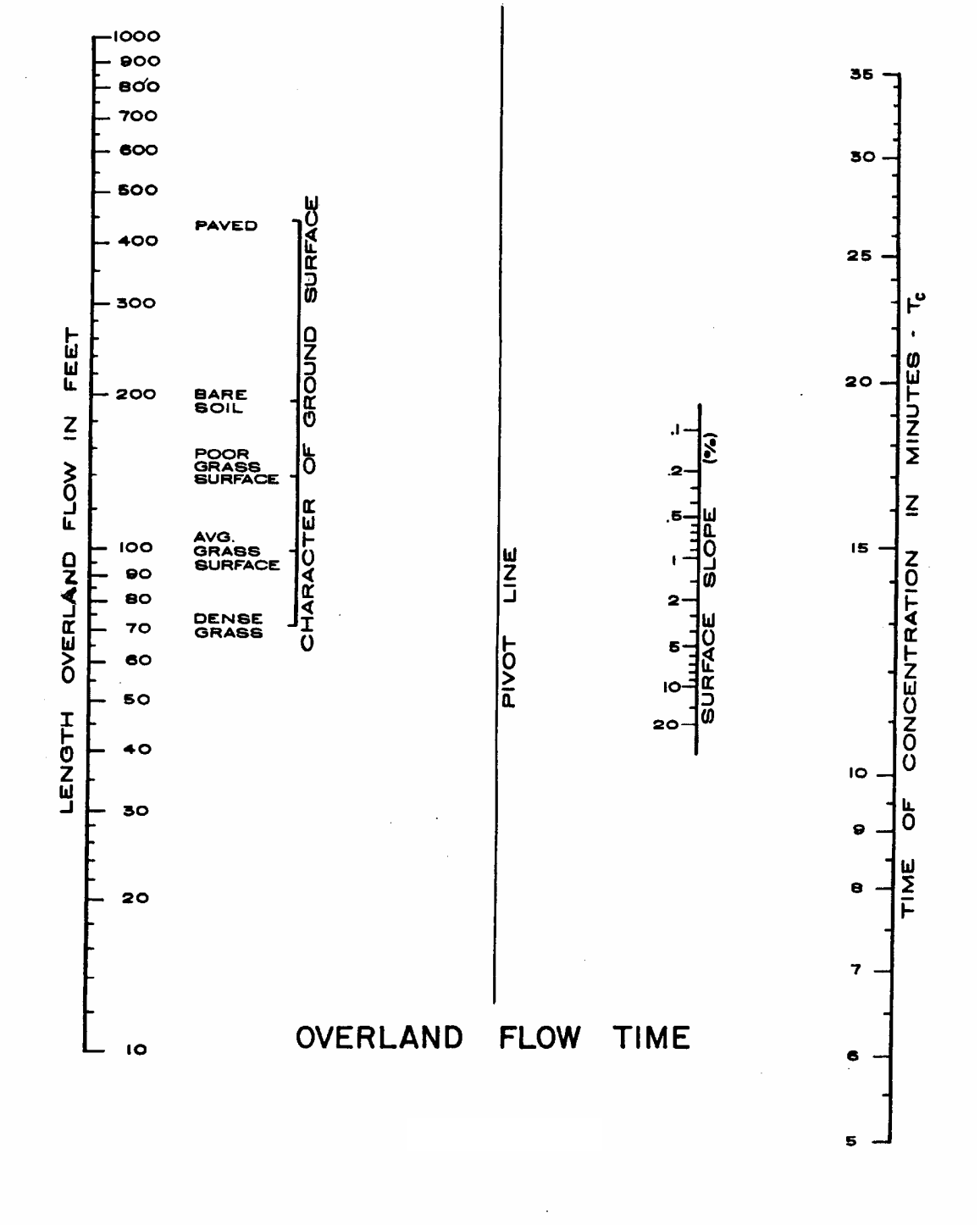


Figure 6.3
Time of Concentration Worksheet, Derived from TR-55
(to be utilized when overland flow is greater than 1,000')

Project: _____ By: _____ Date: _____
Location: _____ Checked: _____ Date: _____
Circle one: Present Developed _____
Circle one: T_c T_t through subarea _____
NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Overland (Sheet) flow (Applicable as part of T_c computation only) Segment ID					
1. Surface description: paved or unpaved					
2. Roughness coeff. for TR-55 sheetflow, n (See Figure 6.4)					
3. Flow length, L (total L≤ 300 ft for unpaved, L≤ 100 ft for paved) ..... ft					
4. Two-yr 24-hr rainfall, P_2 ..... in	2.16	2.16			
5. Land slope, s .....ft/ft					
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t .....hr		+		=	
Shallow concentrated flow Segment ID					
7. Surface description: paved or unpaved.....					
8. Flow length, L..... ft					
9. Watercourse slope, s .....ft/ft					
10. Average velocity, $V_{unpaved} = 16.1345(s)^{0.5}$, or $V_{paved} = 20.3282(s)^{0.5}$. ft/s					
11. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
Channel flow Segment ID					
12. Cross sectional flow area, a .....ft^2					
13. Wetted perimeter, p_w..... ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... ft					
15. Channel slope, s .....ft/ft					
16. Manning's roughness coeff., n.....					
17. $V = \frac{1.49\,r^{2/3}s^{1/2}}{n}$ Compute V ..... ft/s					
18. Flow length, L..... ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr					

Figure 6.4 Roughness Coefficient for TR-55 Sheetflow

Surface Description	n[1] Coeff.
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover < = 20%	0.06
Residue cover > = 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: *TR-55, Urban Hydrology for Small Watersheds,* U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, June 1986.

Figure 6.5 Intensity – Duration – Frequency Table

Hours	Minutes	Return Frequency – Rainfall Intensity (in/hr)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
.08	5*	4.15	5.54	6.25	7.12	7.82	8.54
.17	10	3.35	4.51	5.08	5.87	6.20	6.97
.25	15	2.90	3.81	4.37	5.08	5.57	6.08
.33	20	2.50	3.29	3.81	4.46	4.80	5.36
.50	30	1.86	2.54	2.97	3.50	3.86	4.28
.75	45	1.40	1.88	2.20	2.60	2.88	3.22
1	60	1.12	1.52	1.78	2.10	2.34	2.61
2	120	0.68	0.91	1.08	1.27	1.42	1.55
3	180	0.50	0.675	0.80	0.94	1.05	1.16
6	360	0.30	0.40	0.48	0.56	0.62	0.68
12	720	0.16	0.23	0.27	0.37	0.36	0.39
24	1440	0.09	0.13	0.15	0.18	0.20	0.22

* Minimum Time of Concentration ** Interpolation is acceptable to obtain values not provided in the above table.

Figure 6.6

COMPUTATION FOR STORM SEWER DESIGN

MANNING FORMULA: n _____ Project: _____ Date _____ Sheet No. _____

Manhole No.	Begin/ End Sta.	Δ "A"	"C"	Δ "CA"	Sum "CA"	Δ "T"	Sum "T"	"I" ___YR	"I" ___YR	"Q" Disch ____ YR	"Q" Disch ____ YR	"L" FT.	Slope Ft./Ft.	Pipe Dia. In.	"V" FPS	CAP CFS	Flow Line Elev. Inlet/ Outlet

600.04 Minimum Diameter

The minimum diameter of storm sewer pipe shall be 12" unless otherwise approved by the County Engineer. The diameter shall be increased as necessary according to the design analysis.

600.05 Minimum Cover

The minimum cover over storm sewer pipe shall be 2' unless otherwise approved by the County Engineer. Cover is measured from the top of pipe to the finished grade directly above the pipe.

600.06 Minimum Slope

The minimum recommended slope for storm sewers shall be 0.10' per 100', unless a greater slope is required to obtain the minimum mean velocity. Culverts may be installed on flatter grades as approved by the County Engineer.

600.07 Minimum Velocity

The absolute minimum mean velocity for all storm sewers shall be 2.0' per second when flowing full based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered if deemed justifiable on the basis of extensive field data. The desirable minimum velocity is 3.0' per second based on the same criteria.

600.08 Maximum Velocity

The maximum design velocity of all storm sewers shall be 10' per second. If the velocity is greater than 10' per second, provisions should be made to protect against displacement and erosion of the pipe.

600.09 Maximum Headwater

The maximum allowable headwater depth for culverts shall be 1' below pavement surfaces and 2' below finish floor elevations.

600.10 Manholes

Manholes shall be installed at the end of each line, at all changes in grade, size, alignment, and at all pipe intersections. Manholes shall be installed at distances not greater than 400'. Intervals of more than 400' may be approved in sewers 42" and larger. Manholes may be either poured in place or precast concrete. Concrete construction shall conform to ASTM C-478.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

All manhole covers shall be adjusted to grade by the use of no more than 12" of precast adjusting collars.

Manholes shall be consistent with those shown in the standard drawings.

600.11 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to all sewers. The minimum diameter of manholes shall be 48". Where large sewers require the use of manholes diameters greater than 48", the manhole shall be returned to the 48" diameter as soon as practical above the sewer crown. Manhole openings of 24" or larger are recommended for easy access with safety equipment and to facilitate maintenance.

600.12 Catch Basins and Inlet Design

Curb inlets shall be placed at:

A. All low points
B. Where spacing requirements dictate
C. Dead end of descending streets
D. At the Point of Curvature and Point of Tangency of all intersection radius curves where the street grade descends toward the radius curve

The basis for the design and spacing of curb inlets shall conform to the Bureau of Roads Hydraulic Engineering Circular No. 12, "Drainage of Highway Pavements".

Under normal conditions, curb inlets shall be placed on both sides of the street at intervals indicated by the street grade. Approximate spacing ranges from 150' to 300' maximum under normal conditions for the spread of flow-in gutters.

Catch basins not placed in the street shall be selected and placed so that they blend with the surrounding and not appear unsightly.

Curb inlets shall be placed on the property lines if at all possible.

Catch basin types shall be consistent with the types shown in the standard drawings.

600.13 Basis of Culvert Design

The basis of design for street and roadway culverts shall be the Ohio Department of Transportation's Location and Design Manual, Volume Two, Drainage Design.

Hydraulic analysis of culverts may also be performed utilizing Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts, Federal Highway Administration and Computer Program HY-8.

Design shall be based on a 25-year storm for full flow capacity and an overtopping capacity of at least a 100-year storm.

Culvert flow type must be determined for each culvert design. There are two types of culvert flow: Inlet Control and Outlet Control. This must be determined to help ensure proper culvert design.

Maximum allowable headwater shall be 1' below the low edge of the pavement. However, the designer should generally limit the maximum 100-year headwater depth to twice the diameter or rise of the culvert.

Tailwater conditions shall also be analyzed for all culverts. In some locations, a high tailwater will control the operation of the culvert. This condition can greatly effect the capacity and headwater of the culvert and shall be checked to help determine upstream design storm, storm water elevations.

600.14 Open Drainage Ditches

The basis of design for drainage ditches shall be the Manning Formula, as defined in Section 600.03 Storm Sewer Design. Figure 6.4 Roughness Coefficient for TR-55 Sheetflow may be used to determine the value of "n", Manning's Roughness Coefficient, to be used in the calculations. These calculations of open ditch capacity should be provided to the reviewing agency along with the construction drawings.

FIGURE 6.7

CHANNEL MATERIAL	n
Vitrified clay	0.014
Cast iron pipe	0.015
Smooth earth	0.018
Firm gravel	0.023
Corrugated metal pipe	0.022
Natural channels in good condition	0.025
Natural channels with stones and weeds	0.035
Very poor natural channels	0.060

600.15 Channel Protection

Channel protection material shall be placed at pipe outlets and other areas of high velocity flow to prevent erosion. The type, location and depth of the protective material shall be reviewed and approved by the County.

600.16 Storm Water Detention Basin/Retention Pond Size Requirements

It is recognized that certain outlets for storm water runoff in the County may be very limited. These outlets do not have the capacity to receive and convey the increased runoff resulting from rapid development around the County.

Developers/Owners must participate in providing detention storage to eliminate the excessive runoff during heavy storm periods. Where impervious areas are planned or contemplated, it is the intent that detention be provided as required by the provisions hereinafter set forth. It is proposed that well maintained landscaped areas would be provided to act jointly as detention reservoirs and recreation facilities as aesthetic focal points in new developments. Other control methods to regulate the rate of storm water discharge which may be acceptable, include detention on parking lots, streets, lawns, underground storage, oversized storm sewers with restricted outlets, etc. However, these methods must be approved by County officials.

It is recognized that in order to better serve the long-range interests of the County and the surrounding area, comprehensive basin-wide planning for runoff control should be formulated, adopted, and implemented. Comprehensive planning is far more

beneficial than small, on-site detention areas, although on-site detention does provide protection and is acceptable for compliance.

Detention of storm water shall be required for all developments and proposed development which would alter storm runoff as to flow, velocity, or time of concentration. These basins are required to detain the peak post-developed runoff which exceeds the runoff created by a 5-year storm under predeveloped condition. The County reserves the option to require more stringent detention requirements based upon the estimated capacity of the existing storm sewers. All calculations must be submitted to the County for approval. Calculations must include a profile of the existing storm sewer from the proposed connection point to a point 500' downstream or the first outfall structure nearest to or beyond the required 500'. The calculated full flow capacity of the existing storm water outfall shall also be provided.

Design of storm water detention facilities shall be based on the following:

A. The County suggests that runoffs and capacities are to be computed using the Rational Method and Manning Formula as determined in Section 600.03 Storm Sewer and Inlet Grate Design of these regulations for areas less than 200 acres.

B. The release rate from on-site detention shall not be greater than the storm runoff created by the pre-developed site during a 5-year frequency storm. The allowable outflow rate used in Figure 6.9 "Computation Worksheet for Detention Storage Using Rational Method" is derived using a C coefficient of 0.2 and a rainfall intensity of 3.65" based on 5 years with a duration of 15 minutes multiplied by the site area. Consideration may be given for different intensity and coefficient based on the situation. If runoff from off-site acreage flows through the detention basin, storage volume should be calculated using Figure 6.9 for the on-site area only. After the volume has been calculated, the allowable outflow rate should be calculated using the acreage of the entire area draining across the site.

C. Storage volume shall not be less than the storm runoff created by the post-developed site during a 100-year storm event. The storage volume may be computed by using Figure 6.9, "Computation Worksheet for Detention Storage Using Rational Method".

   The percentage of impervious area is used to calculate detention required. Generally 30% may be used for single-family residences, 50% for multi-family residences, 70% for industrial sites, and 90% for commercial property. If another percentage would be more appropriate for the individual site, the more appropriate number should be used.

   The Runoff Coefficient C for various storm durations is given in Figure 6.8 for each land use.

Figure 6.8

Storm Duration t_d (hrs)	30% of Impervious Area	50% of Impervious Area	70% of Impervious Area	90% of Impervious Area
0.17	0.28	0.36	0.44	0.51
0.33	0.36	0.45	0.53	0.61
0.50	0.42	0.50	0.59	0.67
0.67	0.46	0.54	0.63	0.71
0.83	0.49	0.57	0.66	0.74
1.0	0.51	0.59	0.68	0.77
1.5	0.56	0.65	0.73	0.82
2.0	0.59	0.69	0.76	0.84
3.0	0.64	0.72	0.79	0.86

D. Outlet size shall be determined by using the orifice equation as defined by:

$$Q = CA\sqrt{2gH}$$

C = 0.6
A = Area in square feet
g = 32.2 ft./s^2
H = height from the center of the pipe to the top of the water surface

E. Special detention consideration may be given by the County Engineer for high impervious areas that are smaller than two acres in size.

An emergency overflow from the basin to a major storm system must be provided to protect the facility and adjacent properties. The designer should investigate the capacity of the downstream drainage facilities to determine if they will be adequate to handle the design flow from this particular development. If the downstream facilities are inadequate, it shall be necessary to provide on-site retention or ponding basins to limit the flow to an amount which the downstream system can accept.

Figure 6.9

COMPUTATION WORKSHEET FOR DETENTION STORAGE USING RATIONAL METHOD

Project Information

Project _____

Designer _____

Determination of Allowable Outflow Rate

Watershed Area (A) _____ acres

Allowable Outflow Rate (O) _____ cfs

Storm Duration t_d (hrs)	Runoff Coefficient C ____% Impervious	Rainfall Intensity i (inches/hr)	Post Inflow Rate (100 year) $I(t_d)$ (CiA) (cfs)	Pre Allowable Outflow Rate (5 year) O (.2)(3.65)(A) (cfs)	Storage Rate $I(t_d)$-O (cfs)	Required Storage $[I(t_d)-O]t_d/12$ (acre-ft)
0.17		6.97				
0.33		5.36				
0.50		4.28				
0.67		3.58				
0.83		3.05				
1.0		2.61				
1.5		2.01				
2.0		1.55				
3.0		1.16				

600.17 Detention Basin/Retention Pond Guidelines

Where water quality during dry weather periods in a small basin would be a potential problem due to lack of adequate dry weather flow, direct pollution from surface water runoff, or high nutrients in the flow, the basin should be designed to remain dry except when in flood use.

A. RECOMMENDATIONS FOR DRY DETENTION BASINS

1. Dry detention basins shall be designed so that water does not remain standing in the bottom; thereby harboring insects and limiting other potential use of the basin. This shall be accomplished by means of a concrete low-flow channel between inlet and outlet structures. Minimum slope shall be no less than 0.5%. An acceptable alternative to a concrete low-flow channel will be an underdrain. In this case, a minimum of 1% slope shall exist between inlet and outlet structures and the surface above the underdrain shall be grass sod.

2. The detention basin may be designed to have a multi-purpose function. Recreational facilities, aesthetic qualities, etc., as well as flood water storage can be considered in planning the basin.

3. Side slopes shall be 3 to 1 or flatter.

4. There shall be a minimum of a 3’ berm at 2% between any County or Township street right-of-way line and top basin slopes.

B. RECOMMENDATIONS FOR BASINS CONTAINING PERMANENT WATER

1. In order to provide better management for water quality, retention basins containing permanent lakes should have a water area of at least one-half acre. The lake area should be an average depth of 8’ to inhibit weed and insect growth, and should have no extensive shallow areas. A system to augment storm flows into the lake with water from other sources should be provided to enhance the water quality, if necessary.

2. In excavated lakes, the underwater side slopes in the lake should be stable.

3. There shall be a minimum of a 5’ berm at 2% slope beginning at least 1’ above normal pond elevation. The slope between two ledges should be stable and of a material which will prevent erosion due to wave action (see Figure 6.6 Slope Design for Storm Water Storage Facilities). Walkways consisting of a non-erosive material should be provided in areas where extensive population use tramples growth. One area in particular would be along the shoreline of a heavily fished lake. Side slopes above the berm shall be 3 to 1 or flatter.

4. Side slopes of the pond shall be 3 to 1 or flatter.

5. To obtain additional recreational benefits from developed water areas and provide for insect control, ponds may be stocked with fish. For best results, stocking should follow recommendations for warm water sport fishing by the Ohio Department of Natural Resources, Division of Fisheries, or similar organizations.

6. Periodic maintenance will be required in lakes to control weed and larval growth.

7. No rubble or construction refuse shall be disposed of at any time.

8. No pond with a permanent water elevation shall be placed within 1 mile of a runway approach or landing approach to an airport.

C. RECOMMENDATIONS COMMON TO EITHER DRY DETENTION BASINS OR RETENTION BASINS WITH PERMANENT WATER

1. A 20-foot-wide County easement shall be provided for access to all storm water storage facilities. The top of berm centerline plus a 15’ buffer/access area will be included in the storm sewer petition.

2. All basins shall have an emergency overflow.

3. All excavated spoils should be spread so as to provide for aesthetic and recreational features such as sledding hills, sports fields, etc. Slopes of 6 horizontal to 1 vertical are recommended except where recreation uses call for steeper slopes. Even these features should have a slope no greater than 3 horizontal to 1 vertical for safety, minimal erosion, stability, and ease of maintenance.

4. When conduits are used for the outlet of the reservoir, they shall be protected by bar screens or other suitable provisions so that debris or similar trash will not interfere with the operation of the basin.

5. Safety screens should also be provided for any pipe or opening to prevent children or large animals from crawling into the structures. For safety, a suggested maximum opening is 6”.

6. Grass or other suitable vegetative cover should be maintained throughout the entire reservoir area. Grass should be cut regularly no less than five times a year.

7. Debris and trash removal and other necessary maintenance should be performed after each storm to assure continued operation in conformance to the design.

D. INSPECTION OF BASINS

1. Record drawings will be required for all basins to assure compliance with all applicable requirements.

2. The County may inspect all private detention basins and if problems exist, report these to the owner. The owner shall be given a reasonable amount of time to correct the problem.

3. The County shall perform such work as it deems necessary and charge the owner if the owner fails to correct the problem in a reasonable time.

E. DETENTION BASIN OWNERSHIP

1. Detention basin maintenance and ownership shall remain private.

2. Owners will be responsible for routine maintenance of the detention basin located on or abutting their lots. Grass mowing, ornamental landscaping, and fencing are considered routine maintenance. No activity which will interrupt the operation of the detention basin will be allowed. No accessory buildings or gardens will be permitted. The County will be responsible for major erosion control and fixed structures such as piping, manholes, and inlets, if covered under petition. This statement shall be added to each deed of transfer.

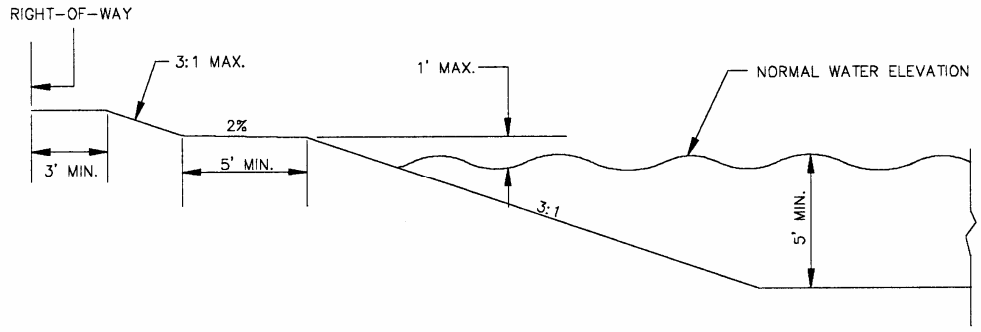
F. SUBMERGED OUTLETS

Submerged outlets may be permitted provided a manhole is constructed between the outlet at the retention pond and the main storm system. This manhole must be between the last pavement crossing and the pond. The invert elevation of the pipe into this manhole will be at least 1’ above the normal pool elevation. The slope of the basin at the outlet shall be no flatter than 2:1 to avoid siltation at the outlet. The manhole shall have a grated casting or, in some cases, may require being a manhole with a catch basin with windows frame and top.

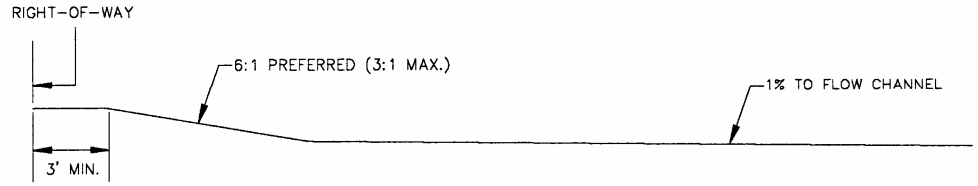
Figure 6.10

SLOPE DESIGN FOR STORM WATER STORAGE FACILITIES

RETENTION POND



DETENTION BASIN OR DRY BASIN



LOW FLOW CHANNEL–PAVED .5% GRADE

ALTERNATE–UNDERDRAINS WITH SOD IN LOW FLOW CHANNEL 1% GRADE

AS–BUILTS ARE REQUIRED.

600.18 Flood Routing Path

A. CAPACITY

The flood routing path is that part of the major storm drainage system that carries the runoff that exceeds the capacity of the designed drainage facilities. The major storm drainage system shall have the capacity to carry runoff from a storm with a return period of not less than 100 years without causing significant threat to property or public safety.

B. SURFACE FLOOD ROUTING PATHS

Generally, it is not economically feasible to size a storm sewer system to collect and convey more than the frequent storm runoff. Essentially, the complete drainage system of an urban area contains two separate drainage elements. While the storm sewers belong to the initial system, surface drainageways must be provided for the major flow from more intense storms.

C. INTENT IN PROVIDING FLOOD ROUTING PATHS

The intent of planning for the major drainage element is to ensure storm water runoff which exceeds the capacity of the initial drainage system has a route to follow which will not cause a major loss of property or any loss of life. It should be remembered that the major drainage system exists even when it is not planned for and whether or not development exists in respect to it.

D. STREET RIGHTS-OF-WAY

Street rights-of-way are a common choice for conveying major drainage flows. Such use must be anticipated when the street layout is established. Side and rear lot lines offer one alternative to the street. The problem with this alternative is the possibility of individual property owners encroaching on the major drainage easement. Rarely is the problem recognized until significant rainstorm occurs and the major system fails to operate properly.

Where the street is designated as the major drainageway, the depth of flow shall not exceed 12” at the gutter line for local and collector streets and the crown for arterial streets. The same maximum depth criteria will apply where a major drainageway crosses the street. Where a major drainageway is located outside a street right-of-way, easements shall be provided. All major storm routing easements shall be shown on the grading plan.

E. MULTI-PURPOSE FLOOD ROUTING PATHS

In order to protect the integrity of the non-street drainage rights-of-way, the Developer is encouraged to design flood routing paths for multi-purpose functions. Pedestrian and bicycle paths lend themselves naturally to this application. Linear parks aligned along the major drainage corridor are also very effective, but usually require greater width than would normally be necessary for drainage purposes.

F. MAJOR STORM RUNOFF

The major storm runoff is calculated through the drainage system to determine if the combined capacity of the flood routing path and storm sewer system is sufficient.

600.19 Site Grading

A. SITE GRADING PLAN

Site grading plans shall be prepared with 1' existing and proposed contours showing all lots having proper drainage. Site grading plans for developments shall also have proposed building pad elevations to ensure proper drainage of the development. Individual site plans within a development must conform to the subdivision drainage site plan.

B. CUTS AND FILLS

No land shall be graded, cut, or filled so as to create a slope exceeding a vertical rise of 1' for each 3' of horizontal distance between abutting lots, unless a retaining wall of sufficient height and thickness is provided to retain the graded bank.

C. COMPACTION OF FILL

All fill shall be compacted to a density of 95% standard proctor or greater unless in the right-of-way or for a building pad which will require the fill to be compacted to a density of 100% standard proctor. Inspection of fill shall be conducted by the County Engineer.

D. RETAINING WALLS

Retaining walls may be required whenever topographic conditions warrant or where necessary to retain fill or cut slopes within the right-of-way. Such improvements shall require the approval of the County Engineer.

E. FILLING OF EXISTING AREAS

No existing area shall be filled or graded to adversely affect adjoining properties, as determined by the County Engineer.

600.20 Runoff from Upstream Drainage Areas

The runoff from drainage areas upstream of the proposed development or improvement must be provided with an unobstructed outlet and an emergency overflow. The outlet should provide the capacity needed to carry the runoff from a 5-year storm in its existing land use condition.

600.21 Runoff onto Contiguous Properties

All altered site drainage shall be contained on-site and routed to the on-site detention. No land altering activity shall disperse runoff into areas adjacent to the area experiencing development.

600.22 Soil Sediment Pollution Control Regulations

A. The purpose of this regulation is to prevent the undue polluting of public waters by sediment from accelerated soil erosion and accelerated storm water runoff caused by earth-disturbing activities. Control of such pollution will promote and maintain the health, safety and general well-being of all life and inhabitants of the County.

B. SCOPE

This shall apply to earth-disturbing activities on areas of land used or being developed for commercial, industrial, residential, recreational, public service or other non-farm purposes which are within the County unless otherwise excluded within or unless expressly excluded by state law.

C. DISCLAIMER OF LIABILITY

Neither submission of a plan under provisions of this article nor compliance with provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law, nor imposed any liability upon the County or its appointed representative for damage to any person or property.

D. SEVERABILITY

If any clause, section, or provision of this resolution is declared invalid or unconstitutional by a court of competent jurisdiction, validity of the remainder shall not be affected thereby.

E. REQUIREMENTS

No person shall cause or allow earth-disturbing activities on a development area except in compliance with the standards and criteria and the applicable item listed below:

1. When a proposed development area consists of five or more acres and earth-disturbing activities are proposed for the whole area or any part thereof, the responsible person shall develop and submit for approval a sediment control plan prior to any earth-disturbing activity. Such a plan must contain sediment pollution control practices so that compliance with other provisions of this resolution will be achieved during and after development. Such a plan shall include specific requirements established by regulation.

2. When a proposed development area involves less than five acres, it is not necessary to submit a sediment control plan; however, the responsible person must comply with the other provisions of these regulations. All earth-disturbing activities shall be subject to surveillance and site investigation to determine compliance with the standards and regulations.

F. STANDARDS AND CRITERIA

In order to control sediment pollution of water resources, the owner or person responsible for the development area shall use conservation planning and practices to maintain the level of conservation established by one or more of the following standards:

1. Timing of Sediment-Trapping Practices - Sediment control practices shall be functional throughout earth-disturbing activity. Settling facilities, perimeter controls, and other practices intended to trap sediment shall be implemented as the first step of grading and within 7 days from the start of earth disturbing activities. They shall continue to function until the upslope developed area is restabilized.

2. Stabilization of Denuded Areas - Denuded areas shall have soil stabilization applied within 7 days if they are to remain dormant for more than 45 days. Permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the site, and shall also be applied within 7 days to denuded areas which may not be final grade, but will remain dormant (undisturbed) for longer than 45 days.

3. Settling Facilities - Concentrated stormwater runoff from denuded areas shall pass through a sediment-settling facility. The facility’s storage capacity shall be 67 cubic yards per acre of drainage area.

4. Sediment Barriers - Sheet flow runoff from denuded areas shall be filtered or diverted to a settling facility. Sediment barriers such as sediment fence or diversions to settling facilities shall protect adjacent properties and water resources from sediment transported by sheet flow.

5. Storm Sewer Inlet Protection - All storm sewer inlets which accept water runoff from the development shall be protected so that sediment-laden water from soils that are not permanently stabilized will not enter the storm sewer system without first being filtered or otherwise treated to remove sediment, unless the storm sewer system drains to a settling facility.

6. Working in Crossing Streams

    a. Streams including bed and banks shall be restabilized immediately after in-channel work is completed, interrupted, or stopped. To the extent practical, construction vehicles shall be kept out of streams. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.

    b. If a live (wet) stream must be crossed by construction vehicles regularly during construction, a temporary stream crossing shall be provided.

7. Construction Access Routes - Measures shall be taken to prevent soil transport onto surfaces where runoff is not checked by sediment controls, or onto public roads.

8. Sloughing and Dumping

    a. No soil, rock, debris or any other material shall be dumped or placed into a water resource or into such proximity that it may readily slough, slip, or erode into a water resource unless such dumping, or placing is authorized by the approving agency, and, when applicable, the U.S. Army Corps of Engineers, for such purposes, including but not limited to, constructing bridges, culverts, and erosion control structures.

    b. Unstable soils prone to slipping or land sliding shall not be graded, excavated, filled or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

9. Cut and Fill Slopes - Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration shall be given to the length and steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization.

10. Stabilization of Outfalls and Channels - Outfalls and constructed or modified channels shall be designed and constructed to withstand the expected velocity of flow from a post-development, 10-year frequency storm.

11. Establishment of Permanent Vegetation - A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized.

12. Disposition of Temporary Practices - All temporary erosion and sediment control practices shall be disposed of within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed, unless otherwise authorized by the approving agency. Trapped sediment shall be permanently stabilized to prevent further erosion.

13. Maintenance - All temporary and permanent erosion and sediment control practices shall be designed and constructed to minimize maintenance requirements. They shall be maintained and repaired as needed to assure continued performance of their intended function. The person or entity responsible for the continued maintenance of permanent erosion controls shall be identified to the satisfaction of the approving agency.

The standards are general guidelines and shall not limit the right of the approving agency to impose additional, more stringent requirements, nor shall the standards limit the right of the approving agency to waive individual requirements.

Erosion and sediment control practices used to satisfy the standards shall meet the specifications in the current edition of Water Management and Sediment Control for Urbanizing Areas (Soil Conservation Service, Ohio).

G. MAINTENANCE

The property owner shall assume responsibility for maintenance of structures and other facilities designed to control erosion.

600.23 Drainage Easement Criteria

A. An adequate easement shall be required along any subsurface drainage tile, detention basin, drainageway, ditch, watercourse, stream, or storm sewer that is not already within the street right-of-way. The easement shall be of sufficient width to allow cleaning, widening, deepening, and replacing or otherwise general maintaining of such drainage course.

Easements for 100-year flood routes shall be established to 1’ above the 100-year storm elevation.

B. When it is required to convey subsurface drainage or surface water outside the limits of the proposed improved area in order to discharge into an approved

adequate outlet, it shall be the responsibility of the Subdivider to obtain easements or rights-of-way for construction and maintenance of said drainage course.

C. All drainage easements shall be shown on the final plat and the final engineering and construction plan. The drainage easements shall be recorded for public use, and the maintenance of such drainage courses shall be the responsibility of the property owners receiving direct benefit therefrom, unless otherwise provided. Drainage easement widths shall conform to the County Engineer's supplement to these Regulations.

D. Where no direct access is provided to a drainage feature, an adequate access easement shall also be provided. The minimum width of any such easement shall be 15'.

Figure 6.11 Minimum Permanent Easement Width for all Storm Sewers

Depth (feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	12-inch		15-inch		18-inch		21-inch	
2	25	10	-	-	-	-	-	-
3	30	11	30	12	30	12	30	12
4	30	12	30	12	30	12	30	12
5	30	12	30	12	30	12	30	12
6	30	12	40	12	40	12	40	12
7	40	12	40	12	40	12	40	12
8	40	12	40	12	40	12	40	12
9	40	12	40	12	40	12	40	12
10	40	12	40	13	45	13	45	13
	24-inch		27-inch		30-inch		36-inch	
3	30	12	-	-	-	-	-	-
4	30	12	30	12	30	12	30	13
5	30	12	30	12	30	12	40	13
6	40	12	40	12	40	12	40	13
7	40	12	40	13	40	13	40	13
8	40	13	40	13	40	13	40	13
9	40	13	45	13	45	13	45	13
10	45	13	45	13	45	13	45	13
11	45	13	45	13	45	13	45	13
	42-inch		48-inch		54-inch		60-inch	
5	35	13	35	13	-	-	-	-
6	35	13	35	13	35	14	35	14
7	35	13	35	13	35	14	35	14
8	45	13	45	14	45	14	45	14
9	45	14	45	14	45	14	45	14
10	45	14	45	14	45	14	45	14
11	45	14	45	14	55	14	55	15
12	55	14	55	14	55	14	55	15

* *Minimum distance from centerline of pipe to either side of easement.*
Table values are in feet unless otherwise noted.

800.00 WATER DISTRIBUTION

800.01 General

The following Design Criteria are summarized herein to establish practical, uniform design of water distribution systems for the County. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the County departments having jurisdiction over the review of plans and specifications. These design criteria are also intended to conform to the standard drawings for water systems. All improvements to the water distribution system shall be coordinated with the County Engineer's Office and the Superintendent of the Water Treatment Plant.

800.02 Basis of Design

The basis of design for water distribution systems shall be the Hazen-Williams Equation, an empirical formula for estimating pipe flow:

$$V = 1.318CR^{0.63}S^{0.54}$$

V = Velocity in feet per second
C = Roughness Coefficient
R = Hydraulic Radius (pipe diameter in feet for pipes flowing full) in feet
S = Head loss per unit length of pipe

Distribution systems shall be designed for the estimated maximum day rate of flow, or the fire flow plus the estimated average day rate of flow, whichever is more demanding. Selection of a roughness coefficient shall be coordinated through the County Engineer.

800.03 Minimum Pressure

The minimum desirable pressure in the water distribution system, at times of no fires, shall be 50 pounds per square inch in all mains, and 8 pounds per square inch at the most remote house fixture in the system. The minimum fire flow for residential design purposes shall be 1250 gallons per minute at a residual pressure of 20 pounds per square inch. All other design requirements shall be as required by the County.

800.04 Maximum Velocity

The maximum velocity of the water in the system shall be 10' per second.

800.05 Water Mains

The value of C to be used in the Hazen-Williams Equation shall be C=130. The minimum size of water mains shall be 6" diameter. Dead-ending mains shall be minimized by looping of all mains. In the event the County permits a dead-end, a flushing hydrant shall be installed at the end of the line.

The minimum depth of water mains shall be 4' 6" from the top of the pipe to the finished grade elevation. The maximum depth of water mains shall be 6' from the top of the main to the finished grade elevation, except where utilities must be underpassed or as directed by the County.

800.06 Water Service Lines

The value of C to be used in the Hazen-Williams Equation shall be C = 130. The minimum diameter of service lines shall be ¾", unless the distance from the main to the meter exceeds 120', where the minimum service line diameter shall be 1". Figure 8.1 lists required minimum service sizes as determined by residential population. Fire hydrant services shall have a minimum diameter of 6", but shall be no larger than the water main. For all ¾" through 2" services, a corporation stop shall be installed on the main at a 45° angle above horizontal. For services larger than 2", a tapping sleeve and valve must be installed.

FIGURE 8.1

MINIMUM SIZE -- WATER SERVICES AND METERS
RESIDENTIAL AREAS

No. of Families	Service Size (inches)	Meter Size (inches)
1	3/4	1/2 x 5/8
2-5	1	1
6-8	1-1/2	1-1/2
9-12	2	1-1/2
13-20	2	2
21-50	4	3
51-115	4	4

800.07 Meter Installation

When not completed by the County Water Department, meter installation for individual services shall be consistent with the standard drawings. Figure 8.2 lists

required meter sizes as determined by Maximum Flow Demand for Commercial-Industrial applications. Meters must be installed prior to connecting the service to the main and before service starts. No common meters will be approved. All plans shall indicate meter and service stop location with a note stating "Location shall be coordinated with County Water or Engineering Staff".

FIGURE 8.2

METER SIZE FOR COMMERCIAL-INDUSTRIAL APPLICATIONS

Maximum Flow Demand (GPM)	Meter Size (inches)
20	1/2 x 5/8
30	3/4
50	1
100	1-1/2
160	2
320	3
500	4
1000	6

800.08 Backflow Prevention

All commercial, industrial and other OEPA required users shall provide adequate backflow prevention between the public water system and the customer's system. These devices shall be approved by the OEPA and Mercer County prior to construction and installation. These devices shall be tested and inspected annually under the supervision of the Water Superintendent or his designee and paid for by the owner of the property. These devices shall be repaired or replaced if they do not meet the testing requirements. An annual report shall be submitted by a licensed plumber in the State of Ohio to Mercer County detailing the testing procedures and results.

900.00 SANITARY SEWERS

900.01 General

The following Design Criteria are summarized herein to establish practical, uniform design of sanitary sewers within Mercer County, Ohio. These criteria cover design factors and approved guidelines for evaluation of plans and specifications by the County departments having jurisdiction over the review of plans and specifications. These design factors are consistent with the requirements of the OEPA. If these design criteria should conflict in the future with the requirements of the OEPA, these criteria shall be modified to conform to their requirements. These design criteria are also intended to correspond to the Construction Standards and Drawings for sanitary sewers.

900.02 Basis of Design

The basis of design shall be the Manning Formula. This is used to calculate the capacity of a pipe flowing full:

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

Q = Flow in cfs
A = Area of Cross-section - square feet
n = Coefficient of roughness (n = 0.013)
R = Hydraulic Radius - feet
S = Slope in ft/ft

900.03 Maximum Depth of Flow

Recommended design practices limit the depth of flow in a sanitary sewer. The maximum depth of flow should be equal to or less than 0.8 of the diameter of the pipe.

900.04 Average Daily Design

The average daily design shall be 100 gallons per capita per day. This includes normal infiltration.

900.05 Population Density

For design purposes use four capita per equivalent single-family dwelling.

900.06 Peak Design Flow

Sanitary sewers shall be designed on a peak design flow basis using one of the following methods:

1. The ratio of peak average flow (ADF).

2. Values established from the infiltration/inflow study approved by the OEPA.

3. Values obtained from the flow records of a similar facility over a period of time sufficient to establish with a reasonable degree of reliability the relationship between average dry weather flow and peak design flow.

4. Peak flows as determined by the Great Lakes Upper Mississippi River Board (GLUMRB) (Ten States Standards), latest version.

Use of other values for peak design flow will be considered if justified on the basis of extensive documentation.

SUGGESTED SEWAGE FLOW GUIDE

ESTIMATED SEWAGE FLOW (ADF)

WASTEWATER SOURCE	GALLONS PER DAY	LITERS PER DAY
Airports		
Per Employee	20	76
Per Passenger	5	19
Apartment		
One Bedroom	250	947
Two Bedrooms	300	1,137
Three Bedrooms	350	1,326
Assembly Halls		
Per Seat	2	8
Bowling Alleys (no food service)		
Per Lane	75	284
Camps		
Individual bath units - per units	50	189
Central Bathhouse - per person	35	133
Car Wash (per bay, no recycling)	80	304
Churches		
Small - per sanctuary seat	3-5	11-19
Large with kitchen-per sanctuary seat	5-7	19-27
Country Clubs (including food service)		
Per member	50	189
Dance Halls		
Per person	2	9
Factories		
No showers - per employee	25	95
With showers - per employee	35	133

WASTEWATER SOURCE	GALLONS PER DAY	LITERS PER DAY
Family Dwellings		
Per person	100	379
*Food Service Operations		
Restaurant		
(not 24 hours) per seat	35	133
24-hour Restaurant	50	189

*The listed estimated sewage flows are to be used for the design of sewers and should not be used for the design of treatment units.

Banquet Rooms - per seat	5	19
Tavern (very little food service) per seat	35	133
Curb Service (drive in) - per car space	50	189
Vending Machine Restaurants - per seat	35	133
Highway Rest Areas		
Per Car	1-9	4-34
Hospitals		
No resident personnel - per bed	300	1,137
Institutions		
Residents - per bed	100	379
Laundries		
Coin operated - per machine		
(Standard size machine)	400	1,137
Motels		
Per Unit	100	379
Nursing and Rest Homes		
Per patient	150	568
Per resident employee	100	379
Office Buildings		
(exclusive of cafeteria or kitchen)		
Per employee per shift	20	76

	GALLONS	LITERS

WASTEWATER SOURCE	PER DAY	PER DAY
Parks		
With toilet facility - per person	5	19
With showers, bathhouse toilets - per person	10	38
Schools		
Elementary (not incl. showers or cafeteria) - per pupil	10	38
High and Junior High (not including showers or cafeteria) - per pupil	15	57
Add for cafeteria - per pupil	5	19
Add for showers - per pupil	5	19
Service Stations		
First Bay	1,000	3,789
Each additional bay	500	1,895
Shopping Centers (without food service or laundries) -per area of floor space	0.2 per sq. ft.	8 per sq. meter
Stores		
Per toilet per shift	400	1,516
Swimming Pool (average with hot water shower) - per swimmer (design load)	3-5	11-19
Theaters		
Drive-In Movies - per car space	5	19
Movie - per seat	5	19
Trailer Parks		
Per trailer space	300	1,137
Travel Trailer Dumping Stations	Consult District Office of OEPA	

WASTEWATER SOURCE	GALLONS PER DAY	LITERS PER DAY
Travel Trailer Parks and Camps		
- Per trailer or tent space	125	474
Vacation Cottage		
- Per person	50	189
Youth and Recreation Camps		
- Per person	50	189

900.07 Minimum Velocity

All sanitary sewers shall be designed to give a mean velocity of at least 2.0' per second, when flowing full, based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered, if deemed justifiable, on the basis of extensive field data. See Figure 9.1, Required Minimum Slope.

FIGURE 9.1
REQUIRED MINIMUM SLOPE
Based on "n" Value of 0.013
Sewer Sizes - 8 through 36 inches

Sewer Size	Minimum Slope in Feet Per 100 Feet
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

900.08 Maximum Velocity

The maximum velocity shall be 15' per second. If the velocity is greater than 15' per second, provisions should be made to protect against displacement.

900.09 Sanitary Sewers

In general, the minimum size of sanitary sewers shall be 8". However, 6" sanitary sewers may be used as private lateral sewers for apartments, camps, schools, restaurants, and other semi-public operations, provided their hydraulic capacity is not exceeded because of short run-off periods (high peak flows).

The lateral connections shall be premium joint construction and should be made of the same material as the street sewer whenever possible to minimize infiltration from the connection between the street main and house lateral. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided.

900.10 House Laterals

Four-inch sewer pipe may be used for house connections. The cover over the lateral coming out of the house shall be a minimum 3' depth. The house connections shall be of premium joint construction and made of PVC schedule 40 pipe or SDR-35. Cleanouts are required outside all structures or units. In multi-tenant buildings, individual services shall be provided to a common pipe, then to the main. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided. Each building shall have its own building sewer directly connected to the public sewer.

900.11 Invert Drop in Manhole

When a smaller sewer discharges into a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing this result is to match the top elevation of the pipes.

900.12 Illegal Connections

Roof drains, foundation drains, sump pumps, yard drains and all other clear water connections to the sanitary sewer are prohibited.

There shall be no physical connection between a public or private potable water supply system and a sewer or appurtenances thereto which would permit the passage of any sewage or polluted water into the potable supply.

900.13 Horizontal Separation

If possible, sanitary sewers and sewage force mains should be laid with at least a 10' horizontal separation from any water main.

900.14 Vertical Separation

Sewers (or sewage force main) may be laid closer than 10' to a water main if it is laid in a separate trench and elevation of the crown of the sewer (or sewer force main) is at least 18" below the bottom of the water main. If it is impossible to maintain the 18" vertical separation when the sewer is laid closer than 10' to the water main, the sanitary sewer should be constructed of (or encased in) water main type materials which will withstand a 50 psi water pressure test.

If a sewage force main is laid closer than 10' to a water main, in no case should the sewage force main be laid such that the crown of the sewage force main is less than 18" below the water main.

900.15 Crossing Utilities

Whenever a sanitary sewer and water main must cross, the sewer shall be laid at such an elevation that the crown of the sewer is at least 18" below the bottom of the water main. If it is absolutely impossible to maintain the 18" vertical separation, the sanitary sewer should be constructed of (or encased in) water main type material which will withstand a 50 psi water pressure test for a distance of 10' on both sides of the water main.

Whenever a sewage force main and water main must cross, the sewage force main is at least 18" below the bottom of the water main.

900.16 Parallel Installation

Sanitary sewers and manholes should be laid with at least 10', measured from edge to edge, horizontal separation from any water main. If separation cannot be maintained, the sanitary sewer shall be constructed to water main standards.

900.17 Manholes

Manholes shall be installed at the end of each line, at all changes in grade, size, alignment, and at all pipe intersections. Manholes shall be installed at a distance not greater than 400'. Greater spacing may be allowed in larger sewers and in those carrying a settled effluent.

Manholes shall be pre-cast concrete. Concrete construction shall conform to ASTM C-478 with joints between sections conforming to
ASTM C-443.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers, change in direction shall be accomplished using the longest sweep possible.

All manhole covers shall be adjusted to grade by the use of no more than 12" of pre-cast concrete adjusting collars. In areas outside the pavement, the manhole casting should be adjusted so that the top is slightly above grade to prevent the entrance of the surface water.

Manholes located in isolated areas should be provided with bolted covers for safety and to discourage vandalism.

900.18 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to the sewer. The minimum diameter of manholes shall be 48". Where manhole diameters of greater than 48" are used to accommodate the sewer pipes, the manhole shall be returned to 48" diameter as soon as practical above the sewer crown. Manhole openings 24" or larger are required for easier access with safety equipment to facilitate maintenance.

900.19 Manhole Water Tightness

Manholes shall be constructed to permit casting adjustments by use of cast-in-place or pre-cast concrete adjusting collars not to exceed 12" in height. Solid manhole covers shall be used in all pavement locations. In other areas, the manhole casting shall be adjusted so the top of the manhole cover is slightly above grade to prevent the entrance of the surface water. In areas subject to flooding, secured watertight and solid manhole covers should be used. All manhole covers, seating frames, and adapter rings shall be machined to a firm and even bearing to provide a true fit into the frames. Manholes shall be installed with chimney seals and water- tight dishes.

Inlet and outlet pipes should be joined to the manhole with a gasketed and/or flexible watertight connection meeting ASTM Specification C-443. Where three or more manholes in sequence are to be constructed with solid, unvented covers, adequate ventilation shall be provided.

900.20 Flow Channel

Cut pipe shall not extend beyond the inside face of the manhole wall. Concrete placed inside the manhole to form the channel through the manhole shall not be placed between the pipe and the opening so as to interfere in any way with the flexibility of the joint.

900.21 Drop Manholes

Drop manholes shall be used when the invert of the inflow sewer is 2' or higher than the manhole invert. When this difference of elevation is less than 2', the manhole invert shall be filled and channeled to prevent solids deposition.

Due to the unequal earth pressure that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete.

Drop manholes shall be constructed with outside drop connection, except where such connection is not practical. Inside drop connection to be used only with the approval of the County. Minimum inside diameter for inside drop shall be 5' inside the diameter.

900.22 Test Inspection

The leakage and deflection tests are to be carried out by the contractor and witnessed and certified by the County officials and/or their representative.

All pipe which does not meet the testing requirements must be repaired and retested until it meets the requirements.

900.23 Railroad and Highway Crossings

When boring is required, the casing pipe shall be designed to meet the requirements of the authority having jurisdiction and in compliance with the Mercer County Construction Standards and Drawings. The size of the casing pipe shall be at least 4" greater than the largest outside diameter of the sewer pipe, joints or couplings.

900.24 Stream Crossings

A. LOCATION OF SEWERS IN STREAMS

1. Cover depth

The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, the following cover requirements must be met:

a) One foot of cover where the sewer is located in rock
b) Three feet of cover in other material. In major streams, more than 3' of cover may be required

c) In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.

Less cover will be approved only if the proposed sewer crossing will not interfere with the future improvements to the stream channel. Reasons for requesting less cover shall be provided in the project proposal.

2. Horizontal Location

Sewers located along streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future possible stream widening and to prevent pollution by siltation during construction.

3. Structures

The sewer outfall, headwalls, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flow through the stream.

4. Alignment

Sewer crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.

B. CONSTRUCTION

1. Materials

Sewers entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints; otherwise they shall be constructed so they will remain watertight and free from changes in alignment or grades. Material used to backfill the trench shall be stone, course aggregate, washed gravel or other materials which will not readily erode, cause siltation, damage pipe during placement or corrode the pipe.

2. Siltation and Erosion

Construction methods that will minimize siltation and erosion shall be employed. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping silt-laden water into the stream. Specifications shall require that cleanup, grading, seeding, and planting or

restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than 7 days.

900.25 Sewage Pumping Stations

A. GENERAL

1. When sewage pump stations are required, they shall be designed and installed per the following standards:

   a) Great Lakes Upper Mississippi River Board (GLUMRB) (Ten States Standards) "Recommended Standards for Wastewater Facilities", latest version.
   b) Ohio Environmental Protection Agency's latest requirements.
   c) Mercer County Design Criteria and Standard Construction Drawings.
   d) All other applicable codes and regulations.

2. Flooding

   The wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood. Wastewater pumping stations should remain fully operational and accessible during the 25-year flood. Regulations of state and federal agencies regarding flood plain obstructions shall be followed.

3. Grit

   No individual residence or common residence grinder pumps will be permitted. Gravity sewers outletting into a common pump station will be required.

B. PUMP STATION TYPE AND STANDARD REQUIREMENTS

Listed below are the standard requirements for pump stations in the County. However, it is realized that certain situations may require other types of pump stations. It is highly recommended that early preliminary pumping station plans be submitted to the County for their approval prior to beginning final engineering.

1. Type

   Submersible Pump Stations with separate wet well and valve chamber is preferred by the County.

2. Pump Type

   Submersible explosion-proof pumps capable of pumping raw, unscreened sewage, 3" spherical solids and stringy materials typical of domestic sewage will be required. Multiple pumps shall be provided.

3. Electrical Installation

   a) All electrical installations and components shall be designed and installed per the National Electric Code (NEC) and all other electrical codes.
   b) All equipment and components shall be housed in NEMA 4X stainless steel enclosures.
   c) Controls and other equipment shall be Cutler-Hammer, or equivalent, as approved by the Engineer.
   d) The cabinet shall be provided with a removable backplate on which all the components shall be mounted, with the exception of the H-O-A switches. The pump run lights shall be located on the outside door of the enclosure.
   e) The pump control panel shall contain a circuit breaker, magnetic starter, hand-and-off-auto-selector-switch, run light, and seal leak indicating light for each pump.
   f) There shall be furnished atop the control panel enclosure, a high water alarm flashing red light.

4. Liquid Level Control

   The pumps are to be controlled by four mercury float switches, with brackets fastened inside the wet well.

5. Alarm Appurtenances

   Any of the following may apply at the County's discretion:

   a) Alarm signal shall be initiated by liquid level control system which shall be connected to a telemetering alarm system.
   b) Power failure relay: Provide relay with N.O. contacts for hook up to a telephone line to be de-energized and contacts closed when power to station is interrupted.
   c) High wet well level alarm: Provide high water alarm for hook up to the telemetering system.

6. Guide System

   a) System Design

      1) Permit removal of pumping units for inspection or service without dewatering wet well or interrupting operation of other pump equipment.
      2) Pumps, when lowered into place, to be automatically connected to discharge piping with positive seal.
      3) Incorporate fabricated aluminum access frame with provisions for mounting guide rails and hooks to retain pump cables.

   b) Guide Rails

      Two lengths of stainless steel pipe with pilots; 2" Schedule 40, stainless steel (304) size per pump manufacturer's recommendation. Top and bottom pilots shall be Class 30 cast iron with flake glass/polyester coating.

   c) Pump Guides

      1) Fabricated from bronze for spark proof operation.
      2) Attached to pump volute with 316 stainless steel hex head cap screws.

   d) Lift Chain

      Lift chain shall be 304 stainless steel, sized to support pump with 4 to 1 safety factor.

7. Valve Pit

   a) Valve pit structure (minimum 6' diameter) shall be constructed of precast concrete sections conforming to ASTM C-478.

   b) Valve Pit Access

      1) An aluminum access door and frame assembly shall be installed in the top slab (minimum size to be 36" x 36" unless a larger size is required by Mercer County).
      2) The door shall have a handle, latch in the open position, and have a hasp for a padlock. Surface shall be non-skid, diamond tread.

c) Valve Pit Drain

The valve pit floor shall be sloped to drain with a 3" drain pipe and check valve at the wet well as shown on the plans.

8. Wet Well Structure

a) The wet well (minimum 6' diameter) shall be constructed of precast concrete sections conforming to ASTM C-478.

b) Wet Well Access

The door shall be of aluminum construction and have a handle, latch in the open position, and have a hasp for padlock. Surface shall be non-skid, diamond tread (minimum size to be 36" x 36" unless a larger size is required by Mercer County).

c) Vent

A vent with screen shall be installed in the top slab.

9. Piping and Valves

a) Materials

All piping and fittings beginning after the hydraulic sealing flange unit shall be 4" diameter ductile iron pipe with flanged joints or Schedule 80 PVC. Pipe joints shall be flanged and conform with ANSI Specification A21.10 (AWWA C110) for cast iron pipe flanges and flanged fittings, Class 125. Link seals shall be used around all piping which passes through structures.

b) Valves

1) Check valves to be 4" minimum and sized to not impede the design flow with outside lever and spring. Valves to be rated for 175 psi water working pressure and 350 psi hydrostatic test pressure.
2) Eccentric plug valve to be 4" minimum and sized to not impede the design flow, specifically designed for sewage applications with 100% port opening. Valve to have cast iron with Buna-N rubber coating to minimize wear and corrosion. Seat rings to seal at 175 psi. Valves to have flanged ends (ANSI B16.1) and nut operator.

900.26 Force Mains

A. VELOCITY AND DIAMETER

At design pumping rates, a cleansing velocity of at least 2' per second should be maintained. The minimum force main diameter for raw wastewater shall be 4".

B. AIR AND VACUUM RELIEF VALVE

An air relief valve shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. The force main configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Force mains shall be installed to keep high points and low points to a minimum.

C. TERMINATION

Force mains should enter the gravity sewer system at a point not more than 2' above the flow line of the receiving manhole.

D. PIPE AND DESIGN PRESSURE

Pipe and joints shall be equal to water main strength material suitable for design conditions. The force main, reaction blocking and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater pump stations.

E. DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula or other acceptable methods. When the Hazen and Williams formula is used, the value of "C" shall be 100 for unlined iron or steel pipe for design. For other smooth pipe materials such as PVC, lined ductile iron, etc., a higher "C" value not to exceed 120 may be allowed for design.

F. IDENTIFICATION

Where force mains are constructed of material which might cause the force main to be confused with potable water mains, the force main shall be appropriately identified.

G. LEAKAGE TESTING

Leakage tests shall be required per the water main testing requirements as shown in the Mercer County Standard Construction Drawings.

100.00
General Provisions

300.00
Roadways

600.00
Storm Drainage

800.00
Water Distribution

900.00
Sanitary Sewers