



# Construction Design Criteria

# CITY OF HILLSBORO DESIGN CRITERIA

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**City of Hillsboro**  
**DESIGN CRITERIA REGISTRATION**

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Firm/Organization: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

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CHANGE OF ADDRESS CARD for receiving updates of the City of Hillsboro  
Design Criteria.

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## **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 the City of Hillsboro, Ohio. It is also intended to be used during reconstruction or replacement of existing facilities or utility construction within the City right-of-way. The rules, standards, specifications, criteria, etc. are to supplement any applicable Zoning Regulations and the City of Hillsboro Subdivision Regulations.

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 the City.

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

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

## REFERENCES

The City of Hillsboro 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 the City.

- ◆ 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**

### **100.1 General**

- A. The Design Criteria and Construction Standards and Drawings along with 100% performance surety and 10% maintenance surety shall apply to all public improvement construction projects that will eventually be taken over by the City of Hillsboro. The 100% performance surety and 10% maintenance surety shall follow the regulations in the City of Hillsboro Subdivision Regulations even if the improvements are not part of a major subdivision.
- B. The Developer/Owner shall design and construct improvements not less than the standards outlined in the City of Hillsboro's Subdivision Regulations and this document. The work shall be done under City supervision and shall be completed within the time fixed or agreed upon by the City of Hillsboro.
- C. It is the responsibility of the Developer/Owner and his engineer to investigate local conditions that may require additional improvements.
- D. In the event any conflicting standards are encountered, the more restrictive shall apply as determined by the City of Hillsboro.
- E. Upon request of the Developer/Owner or his representative, the City will evaluate requests to provide open excavation of existing utilities to allow accurate elevation information.

### **100.2 Construction Procedures and Materials**

#### **A. PRE-CONSTRUCTION MEETING**

A pre-construction meeting with the City 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**

Unless otherwise noted, all work and materials shall conform to the Ohio Department of Transportation (ODOT) Construction and Material Specifications and the Construction Standards and Drawings of the City of Hillsboro, Ohio.

#### **C. INSPECTIONS**

- 1. Periodic inspection during the installation of improvements shall be made by the City 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 improvement is ready for inspection.



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 (by Fire Department)
    - 10) Hydrant assembly location and grade (by Fire Department)
  - 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
    - 3) Subgrade undercutting
    - 4) Subbase installation
    - 5) Curbing installation
    - 6) Sidewalk and approach installation
    - 7) Pavement installation
- 2. The absence or presence of an inspector during construction shall not relieve the Developer/Owner or contractor from full responsibility for compliance with plans, specifications, and City requirements.
  - 3. Weight and delivery tickets shall be furnished to the City 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 City.

**E. FINAL INSPECTION**

Upon completion of all the improvements, the Developer/Owner shall request, in writing, a final inspection by the City. The final inspection shall be performed by officials from the City 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 City.



## 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 24-hour notice for inspections at the following points:

√	DESCRIPTION	REMARKS
<b>A.</b>	<b>PRIOR TO INSPECTION</b>	
	Review plans, special provisions, construction & materials manual & specifications that apply to your	
	Discuss your responsibility & authority with the project engineer.	
	Discuss notification, changes, connections, delays, rejections, and tolerances.	
<b>B.</b>	<b>PRE-CONSTRUCTION CONFERENCE</b>	
	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	
<b>C.</b>	<b>SANITARY SEWER &amp; LATERALS TO R/W</b>	
	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
<b>D.</b>	<b>SANITARY MANHOLE</b>	
	Check type & condition	
	Steps condition & alignment	
	Cone type & condition	
	Raisers recast/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	
<b>E.</b>	<b>WATER MAIN</b>	
	Type & condition	
	Valve, type & condition	
	Hydrant, type & condition	
	Trench condition	
	Pipe alignment & joints	
	Air release valves	
	Isolation Valve installation & location	
	Hydrant assembly installation & location (by Fire Dept.)	
	Restrained as needed	
	Bedding	
	Initial backfill compacted granular	
	Proper backfill - compacted granular under or near roadway	
	Pressure test	
	Purification test	
	Valve & hydrant operation (by Fire Dept.)	
	Laterals: Corp Stop K-Copper Curb Stop	
<b>F.</b>	<b>STORM SEWER</b>	
	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	

√	DESCRIPTION	REMARKS
<b>G.</b>	<b>ROADWAY</b>	
	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; Pavement	
	Appropriate moisture & temperature conditions	
	Visual inspection of material (be aware of acceptable temperature range of mix &	
	Proper distribution & roller	
	Proper prime coat	
	Lay in proper layer	
	Watch joints, lapps, and around manholes, valves, etc.	
	Seal against concrete curbs, etc.	
	Measure elevation & cross slope	
	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 & 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	

√	DESCRIPTION	REMARKS
<b>H.</b>	<b>FIXED STRUCTURES, CURBS, SIDEWALK, HEADWALL, ETC.</b>	
	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	
<b>I.</b>	<b>MISCELLANEOUS</b>	
	Keep daily logs	
	Pre-mark all existing utilities	
	Reconnect all existing utilities	
	Mark ends of all laterals in field (Contractor's	
	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	

### **100.3 Submission of Plans**

#### **A. CONSTRUCTION DRAWINGS**

1. Complete construction drawings on 24" x 36" 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 City. Said drawings are to be approved by the City 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 the City of Hillsboro's Subdivision Regulations and Zoning Ordinance.

#### **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
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, City, County, Township, and State
- b) Index of sheets and sheet numbering
- c) Vicinity map with north arrow and project site call-out
- d) City of Hillsboro Construction Standards and 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 City Engineer. The following statement shall be placed above the approval signature: “The City of Hillsboro 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 prepared plans.

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 City of Hillsboro Construction Standards and Drawings referenced on the title sheet.
- b) Modified City of Hillsboro Construction Standards and Drawings shall be redrawn for approval.

#### 7. SITE GRADING PLAN AND EROSION CONTROL

##### a) Site Grading Plan

- 1) A final site grading plan must be included with the construction drawings and approved by the City.
- 2) Proposed 1' contours showing all lots having proper drainage.
- 3) Proposed building pad elevation

##### b) Storm Water Pollution Prevention Plan

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

- 1) Show and label existing and proposed 1' contours.
- 2) Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.
- 3) Concentrated flows.
- 4) Property lines and rights-of-way, lot numbers and property owners.
- 5) Proposed/existing roadways.
- 6) Proposed diversions and erosion control (Example: diversion ditches, fabric fence, straw bales, sediment basin).
- 7) Erosion control construction sequence list.
- 8) Limits of grading.
- 9) Proposed storm sewer pipe flows and capacities.
- 10) Sediment basin location.
- 11) North arrow and scale.
- 12) 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 City of Hillsboro Construction Standards and Drawings 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 1" = 50' horizontal, 1" = 10' vertical.
- 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 City of Hillsboro 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. General - Plan

- 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 PC, PT, PCC, PI, PRC (in pavement) intersections.
- r) Drive apron stationing and width callout.
- s) Show all existing features within 50' of right-of-way.
- t) Proposed electric, telephone, gas, cable locations, and easements.
- u) Proposed light pole layout and electric feed.
- v) Match lines with stationing.
- w) Intersection elevation for proper storm water drainage.
- x) Benchmarks

10B. General - Profile

- a) Existing centerline and proposed centerline profile.
- b) Label proposed centerline grades (minimum grade 0.50%).
- 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.

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 proposed sanitary manholes and cleanouts.

11. CROSS-SECTIONS

- a) The cross-sections shall be at a scale of 1" = 10' horizontal, 1" = 10' 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

Detailed site plan including storm water calculations, 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
	<b>C. REQUIRED PLAN LAYOUT ORDER</b>	
	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	
	<b>GENERAL</b>	
	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	
	Streets for industrial development	
	Lengths of blocks meet minimum criteria	
	Crosswalks	
	Street Monuments	
	Subgrade	
	Base Course	

√	DESCRIPTION	REMARKS
	<b>GENERAL (Cont.)</b>	
	Surface Course	
	Grading Plan	
	Storm drainage system type	
	Manholes	
	Catch basins	
	Headwalls	
	Sufficient easements for utilities or open drainage	
	Other utilities	
	Underground utilities	
<b>1.</b>	<b>TITLE SHEET</b>	
	Title of Project, City, County, Township, and State	
	Index of sheets and sheet numbering	
	Vicinity map with north arrow and project site callout	
	City of Hillsboro Construction Standards and Drawings reference	
	Underground utilities note (O.U.P.S.)	
	Signature and stamp	
	Date of finished plans	
	Project description	
	Approval plan signatures	
	Name, address, telephone number, and fax number of firm that prepared plans	
<b>2.</b>	<b>FINAL PLAT</b>	
	Copy of approved final plat with signatures	
	See Subdivision Regulations	
<b>3.</b>	<b>SCHEMATIC PLAN - LARGE SCALE LAYOUT OF THE SITE</b>	
	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.	
	Plan and Profile sheet reference	

√	DESCRIPTION	REMARKS
<b>4.</b>	<b>TYPICAL SECTIONS</b>	
	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.	
<b>5.</b>	<b>GENERAL NOTES</b>	
	All notes necessary for construction which are not defined clearly elsewhere within the plans.	
<b>6.</b>	<b>GENERAL DETAILS</b>	
	All details necessary for construction except those City of Hillsboro Constructions Standards and Drawings referenced on title sheet.	
	Modified City of Hillsboro Construction Standards and Drawings shall be redrawn for	
<b>7.</b>	<b>SITE GRADING PLAN AND EROSION</b>	
	A final site grading plan must be included with the construction drawings and approved by the City.	
	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 City. 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 rights-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')	
<b>8.</b>	<b>EROSION CONTROL DETAILS</b>	
	Any details necessary for construction except those City of Hillsboro Construction Standards and Drawings referenced on title sheet.	



√	DESCRIPTION	REMARKS
<b>9.</b>	<b>MISC. DETAILS (e.g. pump station, intersection plan, etc.)</b>	
	Plans shall include a detailed drawing with all proper labeling and dimensioning.	
<b>10.</b>	<b>PLAN AND PROFILE</b>	
	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 City of Hillsboro datum.	
	Plan and profile sheets are required for all off-site utility extensions.	
<b>10A.</b>	<b>GENERAL – PLAN</b>	
	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	
	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 phase lines (boundary lines) show stations.	
	Dimension and station of utility locations.	
	Centerline bearings and/or intersecting centerline	
	Final monument box callouts set at PC, PT, PCC, PI, PRC (in pavement) intersections.	
	Drive apron stationing and widths callout.	
	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.	

√	DESCRIPTION	REMARKS
<b>10B.</b>	<b>GENERAL - PROFILE</b>	
	Existing centerline and proposed centerline profile.	
	Label proposed centerline grades (minimum grade 0.50%).	
	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).	
<b>10C.</b>	<b>STORM SEWER - PLAN</b>	
	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.	
<b>10D.</b>	<b>STORM SEWER - PROFILE</b>	
	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.	
<b>10E.</b>	<b>WATER - PLAN</b>	
	Show and station, with offsets, the proposed waterline, laterals, deflection points, hydrants,	
	Label pipe size, tees, crosses, etc.	
	Station and offset above items.	
	Indicate the testing requirements for fire protection and water services.	
<b>10F.</b>	<b>WATER - PROFILE</b>	
	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/maximum coverage of water main.	

√	DESCRIPTION	REMARKS
<b>10G.</b>	<b>SANITARY SEWER - PLAN</b>	
	Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.	
	Label each pipe size.	
	Number proposed sanitary manholes and cleanouts.	
	Proposed lateral locations.	
<b>10H.</b>	<b>SANITARY SEWER - PROFILE</b>	
	Show length of span, size, grade, and class and/or type of proposed pipe.	
	Show existing sanitary.	
	Show invert elevation of all pipe at manholes.	
	Show top elevations of manholes.	
	Number proposed sanitary manholes and cleanouts.	
<b>11.</b>	<b>CROSS-SECTIONS</b>	
	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 (for reconstruction projects and project where drive locations are predetermined).	
<b>12.</b>	<b>DETENTION BASIN</b>	
	Detailed site plan including inlet and outlet elevations, top of bank elevations and emergency overflow elevations.	
<b>13.</b>	<b>OFF-SITE</b>	
	Refer to Plan and Profile.	

#### **100.4 Record Drawings (As-Builts)**

##### **A. Record Drawings (As-Builts) 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
    - 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 City.
2. Maintenance Surety and Certificate of Completion shall not be released until satisfactory Record Drawings (As- Builts) are delivered to the City.



## **200.1 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 inches 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 connection or a potential connection between any part of a potable water system and any other environment containing other substances in a manner that, under any circumstances, would allow such substances to enter the potable water system. Other substances may include gases, liquids, or solids, such as chemicals, water products, steam or water from other sources (potable or non-potable).

### **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.
- E. Green Storm water Practice – A storm water management facility that reduces discharge during and after precipitation events by requiring collected runoff to either soak into the ground and/or be consumed by evapotranspiration, thereby retaining storm water pollutants in the facility. Examples include, but are not limited to, green roofs, bioretention, and porous pavements.

### **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.

### **FIRE HYDRANT**

A fixture installed throughout 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” 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 person 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. Roughness coefficient (n) of channel is based on actual tests typically provided in standard tables.

**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 pipe line 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 or 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.

**RECORD DRAWING**

A survey shown on a plan or drawing prepared by a Registered Surveyor in Ohio indicating the actual dimensions, elevations, and locations of any structures, underground utilities, swales, storm water facilities, and sewage treatment facilities after construction is completed.

**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.

**STORM WATERCONTROL PLAN**

A written description, acceptable to the approving agency, of methods for controlling sediment pollution from accelerated erosion on a development area required to apply for Ohio EPA's General Permit Authorization for Storm Water Discharge Associated with Construction Activity Under the National Pollutant Discharge Elimination System.

**SEDIMENT POLLUTION**

Wind or water erosion of the soil or 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.

**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 for areas larger than 20 acres should be computed using the TR-55 method.

**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 City of Hillsboro 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 City Engineering Department. These criteria cover design factors and provide guidelines for evaluations of plans and specifications by the City department having jurisdiction over the review of the plans and specifications. The design shall be consistent with the requirements of AASHTO and ODOT.



## **600.00 STORM DRAINAGE**

### **600.1 General**

The purpose of the regulation is to establish practical uniform design of storm sewers and retention/detention facilities for the City and to prevent the undue polluting of public waters by sediment from accelerated soil erosion and accelerated storm water runoff caused by earth-disturbing urban areas. Control of such pollution will promote and maintain the health, safety, and general well-being of all life and inhabitants herein the City.

Criteria herein cover design factors and provide guidelines for evaluation of plans and specifications by the City department having jurisdiction over the review of plans and specifications. These design criteria are also intended to conform to the standard drawings for storm sewers. Storm sewer design should follow these criteria first and secondly the Ohio Department of Transportation Location and Design, Volume Two, Drainage Design, if appropriate.

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 City or its appointed representative for damage to any person or property.

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.

### **600.2 Soil Sediment Pollution Control Regulations**

#### **A. 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 City unless otherwise excluded within or unless expressly excluded by state law. A copy of the OEPA Notice of Intent (NOI) is to be supplied whenever one acre or more is disturbed.

#### **B. STORM WATER CONTROL PLAN**

Whenever one acre or more is disturbed, the City of Hillsboro requires that a storm water Control Plan be developed and implemented according to the requirements set forth in the most recent version of the Ohio Environmental Protection Agency's General Permit Authorization for Storm Water Discharges Associated with Construction Activity Under the National Pollutant Discharge Elimination System. The submittal shall also include applicable detention/retention basin calculations and pipe network flow calculations. Plans must include the following notes:



1. At the end of construction, all storm water pipes, basins, channels, etc. shall be cleaned out of all sediment accumulation and restored to the original design as shown per these plans.
2. Forty-eight hours prior to any earth disturbance work, the Contractor shall notify the City Engineer.
3. All mud/dirt tracked onto roads from the site, due to construction, shall be promptly removed at the end of the day.
4. No construction shall commence until all City of Hillsboro permits and connection fees have been issued as required.
5. Erosion control practices made of straw are not prohibited.
6. Clearing, grading, and equipment storage is prohibited within twenty-five feet of a ditch, channel, wetland, stream or other water feature's high water mark unless otherwise approved by the City Engineer.
7. Construction projects scheduled to last six months or more shall not use silt fence as perimeter protection; instead, Filltrex erosion control sock or similar protection shall be used.
8. Dewatering discharges shall not be directed into the City of Hillsboro's storm water system without prior approval of the Underground Utility Director.

#### C. SITE GRADING PLAN

Site grading plans shall be prepared with 1 foot existing and proposed contours showing all lots or 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.

### **600.3 Adequate Drainage Outlet**

Surface water runoff from a development shall be drained offsite in accordance with the City of Hillsboro Design Criteria and Construction Standards and Drawings to an adequate outlet(s). The City 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 that does not cause erosion or degradation of existing facilities. The Developer shall submit in writing evidence indicating the adequacy of the outlet(s) to at least and through the first drainage structure offsite of the proposed improvement. The City 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 as described herein.

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

#### **600.4 Storm Sewer and Inlet Grate Design**

An adequate storm drainage system shall be constructed for all proposed developments. Natural drainage areas should be closely followed.

Outlets for the storm water runoff for development upstream of the proposed developments must be provided. All storm sewer calculations must be submitted to the City 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.

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.

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 City 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 Highland County, Ohio, USDA
4. Others approved for use by the City Engineer

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

The design of storm sewers in the City shall be outlined as follows:

- A. Prepare a contour map of the drainage area including the surrounding area, drainage limits, and direction of surface flow.
- B. Divide the area into the subareas tributary to the proposed sewer inlets. These inlets should be located at reversals of road grade from negative to positive and at street intersections. A maximum distance of 300 feet between catch basins will be allowed along long street grades.
- C. Determine the acreage and imperviousness of each area.
- D. Calculate the required capacity of each inlet using the appropriate time of concentration, the tributary area and the rational method.

- E. 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.
- F. 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.
- G. Minimum cover requirements specified by ASTM specifications must be met.
- H. Figure 6.4, Computation for Storm Sewer Design, may be used for storm sewer calculation.

#### **600.5 Minimum Diameter**

The minimum diameter of storm sewer pipe shall be 12 inches. The diameter shall be increased as necessary according to the design analysis.

#### **600.6 Minimum Cover**

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

#### **600.7 Minimum Slope**

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

#### **600.8 Minimum Velocity**

The absolute minimum mean velocity for all storm sewers shall be 2.0 feet 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 feet per second based on the same criteria.

#### **600.9 Maximum Velocity**

The maximum velocity of all storm sewers shall be 10 feet per second. If the velocity is greater than 10 feet per second, provisions should be made to protect against displacement and erosion of the pipe or as approved by the City Engineer.

#### **600.10 Maximum Headwater**

The maximum allowable headwater depth for culverts shall be 1 foot below pavement surfaces and/or finish floor elevations.

### **600.11 Manholes**

Manholes or inlets shall be installed at the end of each line except at the discharge end; at all changes in grade, size, and alignment; and at all pipe intersections. Manholes shall be installed at distances not greater than 400 feet. Intervals of more than 400 feet may be approved in sewers 42 inches and larger. Manholes may be either poured-in-place or precast concrete. Concrete construction shall conform to ASTM C-478. Any changes of manhole or inlet placement shall be approved by the City Engineer.

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 inches of precast adjusting collars.

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

### **600.12 Manhole Minimum Diameter**

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

### **600.13 Catch Basins**

Curb inlets shall be placed at all low points, points of change to a flatter street grade, the dead end of descending streets, and at the Point of Curvature and Point of Tangency of all intersection radius curves where the street grade descends toward the radius curve and at all intersections. 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 feet to 300 feet maximum with an average of 250 feet spacing 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. Driveway cuts shall not be placed at curb inlets.

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

### **600.14 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 2 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 foot 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 and storm water elevations.

#### **600.15 Open Drainage Ditches**

The basis of design for drainage ditches shall follow the *Grassed Swale* design criteria in the most current version of Ohio Department of Natural Resources Rainwater and Land Development Manual. Calculations of open ditch capacity should be provided to the reviewing agency along with the construction drawings.

#### **600.16 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 adhere to the most current version of Ohio Department of Natural Resources Rainwater and Land Development Manual.

#### **600.17 Storm Water Detention/Retention Size Requirements**

It is recognized that in order to better serve the long-range interests of the City 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.

Excluding development of a single family home not associated with a Planned Unit Development, all proposed developments which would increase the amount of onsite impervious area shall submit storm water detention calculations described herein. At the discretion of the City Engineer, proposed developments showing a required detention volume less than 1000 cubic feet may be exempted from the detention requirements. The Village 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 City for approval.

Design of storm water detention/retention facilities shall adhere to the following:

- A. The Critical Storm for each specific development drainage area shall be determined according to the Ohio Storm Water Control Guidebook (ODNR, 1980)
- B. Critical Storm calculations shall meet the following standards:
  - 1. Calculations shall be based on the entire contributing watershed to the development area.
  - 2. Curve numbers for the pre development condition may reflect any curve number from 10 years preceding application
- C. The peak discharge rate of runoff from the Critical Storm and all more frequent storms occurring under post development conditions shall not exceed the peak discharge rate of runoff from a 1-year, 24-hour storm occurring on the same development drainage area under pre development conditions.
- D. The peak discharge rate of runoff from storms of less frequent occurrence (longer return periods) than the Critical Storm, up to the 100-year, 24-hour storm shall have peak runoff discharge rates no greater than the peak runoff rates from equivalent size storms under pre development conditions. The 1-, 2-, 5-, 25-, 50-, and 100-year storms shall be considered in designing a facility to meet this requirement.
- E. Storage volume shall not be less than the storm runoff created by the post-developed site during a 100-year storm event.

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 may be necessary to provide on-site retention or ponding basins to limit the flow to an amount which the downstream system can accept.

#### **600.18 Detention Basin/Retention Basin Guidelines**

##### **A. RECOMMENDATIONS FOR DRY DETENTION BASINS**

- 1. 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.
- 2. Concrete low flow channels are prohibited unless the channel terminates a minimum of 30 feet from the basin's outlet. All basin inlets, including the end of concrete low flow channels, shall have an appropriately sized apron of stone to slow and disperse the storm water.
- 3. The detention basin may be designed to have a multi-purpose function. Recreational facilities, aesthetic qualities, wildlife habitat, etc., as well as flood water storage should be considered in planning the basin. Developers are encouraged to consider creating basins with bio retention features.

4. Side slopes shall be 3:1 or flatter.
5. There shall be a minimum of a 3-foot berm at 2% between right-of-way 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 5 feet to inhibit weed and insect growth. A system to augment storm flows into the lake with water from other sources should be provide to enhance the water quality, if necessary. These systems would include the use of public water supplies or wells on site.
2. In excavated lakes, the underwater side slopes in the lake should be stable.
3. A safety ledge 4 feet to 6 feet in width is recommended and should be installed in all lakes approximately 18 inches to 24 inches below the permanent water level to provide a footing if people fall into the water. In addition, there shall be a minimum of a 5 ft. berm at 2% slope beginning at least 1 foot above normal pond elevation. The slope between 2 ledges should be stable and of a material which will prevent erosion due to wave action (see Figure 6.6). 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 3:1 or flatter.
4. Side slopes of the pool shall be 2:1 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 Conservation, Division of Fisheries, or similar organizations.
6. Periodic maintenance will be required in lakes to control weed and larval growth. The basin should also be designed to provide for the easy removal of sediment which will accumulate in the lake during periods of basin operation. A means of maintaining the designed water level of the lake during prolonged periods of dry weather is also recommended. One suggested method is to have a water hydrant near the pond site.
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. All basins shall have an emergency overflow.

2. 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 12 vertical for safety, minimal erosion, stability, and ease of maintenance.
3. 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 enter the City storm water system.
4. 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 inches.
5. Grass or other suitable vegetative cover should be maintained throughout the entire reservoir area.
6. Debris and trash removal and other necessary maintenance should be performed in accordance to the Operation and Maintenance Agreement described herein.

#### D. INSPECTION OF BASINS

1. Prior to issuance of a Certificate of Completion, record drawings will be submitted for all basins to assure compliance with all applicable requirements.
2. The City 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, weather permitting.
3. The City shall perform such work as it deems necessary and charge owner if the owner fails to correct the problem.

#### DI. DETENTION BASIN OWNERSHIP

1. Detention basin maintenance and ownership shall remain private.
2. Owners will be responsible for routine maintenance of the development detention basin located on 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 City 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.

#### DII. 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 also be after the last pavement crossing. The invert elevation of the pipe into this manhole



will be at least 1 foot 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.

#### G. OUTLET MATERIAL

Outlet structure materials shall be reinforced concrete and/or RCP pipe. Stainless steel plates shall be used if orifice size is smaller than available RCP sizes.

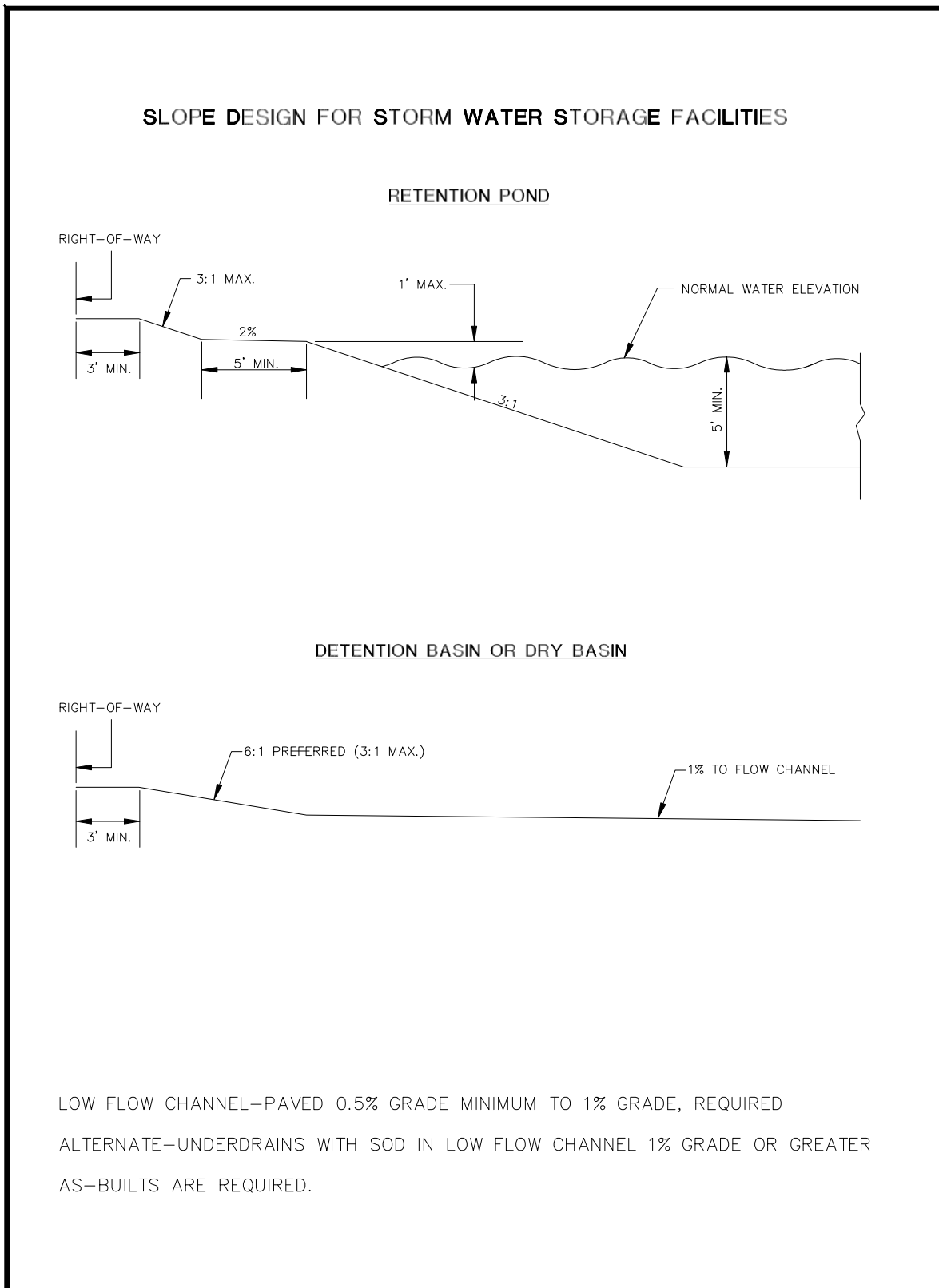
#### H. OPERATION AND MAINTENANCE AGREEMENT

Storm water facilities are infrastructure that requires maintenance. The City will not be responsible for maintaining private infrastructure. Prior to issuance of a Certificate of Certification, a signed Operation and Maintenance Agreement shall be submitted to the City by the party responsible for post construction operation and maintenance of the storm water facility. At a minimum, the Inspection and Maintenance Plan shall include a method and frequency for the following activities:

1. Inspection of all permanent structures,
2. Debris/clogging control through appropriate removal and disposal,
3. Vegetation control (mowing, harvesting, eradication of undesirable plants),
4. Erosion repair,
5. Non-routine maintenance should include pollutant and sediment removal and the “rejuvenation” or replacement of filters and appropriate soils, and
6. Disposal of collected pollutants, sediments, and filter media in accordance with local, state, and federal regulations.
7. Inspection and Maintenance Plans shall include language affirming the following:

- a. The City of Hillsboro has the authority and right to enter upon the development area to conduct inspections as necessary to verify that the storm water management practices are being maintained and operated in accordance with this regulation.
- b. Notice that the City of Hillsboro maintains public records of the results of site inspections for the period of time specified in the City of Hillsboro's record retention schedule, shall inform the site owner(s) or organization responsible for maintenance (by written notice served on the tax mailing address for the subject land) of the inspection results, and shall specifically indicate any corrective actions required to bring the storm water practices into proper working condition.
- c. If the City of Hillsboro notifies the site owner(s), or other entity responsible for maintenance, of maintenance deficiencies that require correction, the specific corrective actions shall be taken within thirty (30) days of the service of the notice; unless the City Engineer grants an extension of time to complete correcting deficiencies due to the impracticality of completing the correction of deficiencies within thirty (30) days.
- d. Maintenance deficiencies not corrected within thirty (30) days may be declared a public nuisance in accordance with Chapter 1323 of Hillsboro's codified ordinances.
- e. The method of funding long-term maintenance and inspections of all storm water management practices, facilities and improvements.

**Figure 6.6**



## **600.19 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 drainage ways 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 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 the frequent rainstorm occurs and the major system fails to operate properly.

Where the street is designated as the major drainage way, the depth of flow shall not exceed 12 inches 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 drainage way crosses the street. Where a major drainage way 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 consultant 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 routed through the drainage system to determine if the combined capacity of the flood routing path and storm sewer system is sufficient.

**600.20 Site Grading**

A. CUTS AND FILLS

No land shall be graded, cut, or filled so as to create a slope exceeding a vertical rise of 1 foot for each 2½ feet of horizontal distance between abutting lots, unless a retaining wall of sufficient height and thickness is provided to retain the graded bank. Major cuts, excavation, grading, and filling, where the same material changes the site and its relationship with surrounding areas, shall not be permitted as such excavation, grading, and filling will result in a slope exceeding a vertical rise of 1 foot for each 2½ feet of horizontal distance between abutting lots or between adjoining tracts of land, except where adequate provision is made to prevent slides and erosion by cribbing and retain walls.

B. COMPACTION OF FILL

All fill shall be compacted to a density of 95% or greater. Inspection of fill shall be conducted by the City Engineer.

C. 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 City Engineer.

D. FILLING OF EXISTING AREAS

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

**600.21 Runoff from Upstream Drainage Areas**

The runoff from drainage areas upstream of the proposed development or improvement must be considered when designing a Storm Water Control Plan.

**600.22 Runoff from Contiguous Properties**

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

**600.23 Drainage Easement Criteria**

- A. An adequate easement shall be required along any storm sewer to be publically dedicated at project completion and 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 flood routes (100-year) shall be established to 1 foot 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 Developer 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 City Engineer’s supplement to these Standards.
- 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 feet.

**Minimum Permanent Easement Width for all Storm Sewers**

<b>Depth (Feet)</b>	<b>Total Min. Width</b>	<b>* Min. Dist. C.L. Offset</b>	<b>Total Min. Width</b>	<b>* Min. Dist. C.L. Offset</b>	<b>Total Min. Width</b>	<b>* Min. Dist. C.L. Offset</b>	<b>Total Min. Width</b>	<b>* Min. Dist. C.L. Offset</b>
	<b>12-inch</b>		<b>15-inch</b>		<b>18-inch</b>		<b>21-inch</b>	
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
	<b>24-inch</b>		<b>27-inch</b>		<b>30-inch</b>		<b>36-inch</b>	
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
	<b>42-inch</b>		<b>48-inch</b>		<b>54-inch</b>		<b>60-inch</b>	
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**

### **800.1 General**

The following Design criteria are summarized herein to establish practical, uniform design of water distribution systems for the City. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the City 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 City Engineer's Office and the Superintendent of the Water Treatment Plant and/ or public works.

### **800.2 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 City Engineer.

### **800.3 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 design purposes shall be 600 gallons per minute at a residual pressure of 20 pounds per square inch.

### **800.4 Maximum Velocity**

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

### **800.5 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 inches in diameter. Dead-ending mains shall be minimized by looping of all mains. In the event the City permits a dead-end, they should be provided with a fire hydrant for flushing purposes.



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

#### **800.6 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 1 inch. Table 8.1 lists required minimum service sizes as determined by residential population. Fire hydrant services shall have a minimum diameter of 6 inches, but shall be no larger than the water main. For all  $\frac{3}{4}$ -inch through 2-inch services, a corporation stop shall be installed on the main at a  $45^\circ$  angle above horizontal. For services larger than 2 inches, a tapping sleeve and valve must be installed.

**TABLE 8.1**

**MINIMUM SIZE -- WATER SERVICES AND METERS  
RESIDENTIAL AREAS**

<u>No. of Families</u>	<u>Service Size (inches)</u>	<u>Meter Size (inches)</u>
1	$\frac{3}{4}$	$\frac{5}{8} \times \frac{3}{4}$
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

## 800.7 Meter Installation

When not completed by the City Water Department, meter installation for individual services shall be consistent with the standard drawings. Table 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 City Water Dept."

**TABLE 8.2**

### **METER SIZE FOR COMMERCIAL-INDUSTRIAL APPLICATIONS**

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

## 800.8 Backflow Prevention

As a condition for water service, all commercial, industrial and residential services as required by the Ohio Environmental Protection Agency shall be protected from backflow and/or backsiphonage. Additionally, all cross connections to auxiliary potable or non-potable or hazardous water systems as outlined in Ohio EPA regulations Chapter 3745-95 or the latest revision thereof, must be protected in a manner approved by the City.

### A. GENERAL PROVISIONS

#### 1. Boiler Heating Systems

All boiler heating systems shall be protected at a minimum with a device conforming to ASSE 1013. Additionally, all protected water heating systems whether domestic, HVAC or process shall be protected from thermal expansion through installation of a device for controlling pressure as specified in Ohio Plumbing Code: Sec. 607.3.2.

2. Lawn Irrigation Systems

All connections made to lawn irrigation systems shall be protected at a minimum with a device conforming to ASSE 1015 or ASSE 1020. All connections made to lawn irrigation systems where chemicals are added shall be protected at a minimum with a device conforming to ASSE 1013.

3. Use of Yard Hydrants

The use of yard hydrants having drip-openings below ground surface connected to the City public water supply is prohibited unless such hydrants are fitted with approved devices to prevent the entrance of ground water into chambers connected with the public water supply. The following models are approved for installation and do not require the use of a backflow prevention assembly.

- American, Model 126 & 226
- Eclipse Freeze Flow Model
- Murdock Accello (Sanitary Post Type)
- Woodford, Model S3 & Model S4
- Campbell J3
- Simmons 6804

4. Auxiliary Water Supplies

An auxiliary water supply for domestic, process or fire protection may only be interconnected with the consumer's piping through the means of an approved interchangeable connector. Approved interchangeable connectors include swing connectors and four-way valves. If the use of an interchangeable connector is approved by the Public Work's Superintendent, then an approved containment principle reduced pressure backflow preventer must be installed at the water meter and on the leg prior to the interchangeable connector that is supplying water from the consumer's water distribution system.

Any premises that have an auxiliary water supply on or available to the premises must have a containment reduced pressure principle backflow prevention assembly installed at the water meter even though there is no intent to interconnect the two sources. This requirement also applies to private wells used for non-potable applications.

In a residential application the public water service shall not be interconnected with an auxiliary water supply under any condition.

5. Temporary Water Service

All temporary water services for construction or any other purpose shall be protected with a means of backflow prevention with prior approval from the Public Work's Superintendent.

## 6. Booster Pumps

All booster pumps, domestic or fire protection, shall be installed and maintained in strict conformance with Ohio Administrative Code 3745-95-07.

## B. APPROVED DEVICES

All backflow prevention assemblies must be listed on the Ohio Environmental Protection Agency's most current list of approved devices, be approved by the City and meet the requirements listed below prior to installation.

### 1. ASSE 1015 – Double Check Valve Assembly (3/4" – 2")

A double check valve assembly shall be installed as required by the Water System Superintendent at each location. The body of the assembly shall be constructed of cast bronze. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be top entry through access cover(s) secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves and four top mounted resilient seated test cocks. All connections to the body shall be NPT. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510. The double check valve assembly shall be a:

- Watts Regulator Company Series 007
- Febco Series 850
- Or approved equal

### 2. ASSE 1013 – Reduced Pressure Principle Assembly (3/4" – 2")

A reduced pressure zone assembly shall be installed as required by the Water System Superintendent at each location where a potential health or system hazard exists to prevent backflow due to backsiphonage and/or backpressure. The body of the assembly shall be constructed of cast bronze. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves. Backsiphonage protection shall include a provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. The assembly shall include two tightly closing shutoff valves before and after the assembly, test cocks and a protective strainer upstream of the No.1 shutoff valve. All bolts used to secure access covers shall be stainless steel. All connections to the body shall be NPT. The assembly shall meet the requirements of ASSE Std. 1013 and AWWA Std. C511-92. The reduced pressure principle assembly (RPZ) shall be a:

- Watts Regulator Company Series 909QTS
- Febco Series 825Y
- or approved equal

3. ASSE 1020 – Anti-Siphon Pressure Vacuum Breaker (3/4” – 2”)

An anti-siphon pressure vacuum breaker assembly shall be installed as required by the Public Work's Superintendent at each location to prevent back siphonage of contaminated water into the City of Hillsboro Public Water System. This assembly is not to be used where there is a possibility that a back pressure condition may develop. The body of the assembly shall be constructed of cast bronze. The assembly will incorporate an acetal bonnet with silicone rubber O ring seal and silicone rubber seat disc. The valve shall have replaceable seats. Check assembly shall be guided over its full stroke by “V” notched guides. The assembly shall include two tightly closing shutoff valves before and after the assembly and test cocks. All bolts used to secure access covers shall be stainless steel. All connections to the body shall be NPT. The assembly shall meet the requirements of ANSI/ASSE Std. 1020. The anti-siphon pressure vacuum breaker assembly shall be a:

- Watts Regulator Company Series 800M4QT
- Febco Series 765
- or approved equal

4. ANSI A112.1.2 – Air Gap Separation (All Sizes)

An air gap separation shall be installed as required by the Public Work's Superintendent at each location to prevent cross-connection contamination where the potential for severe health risks including death or significant morbidity. This separation shall be an unobstructed vertical distance through the atmosphere and shall be equal to two times the effective diameter of the water supply outlet piping, but not less than one inch. For installations where the outlet is a distance of twice the effective opening from a wall or obstruction, the air gap vertical separation shall be extended to three times the effective opening. For installations where the outlet is near two intersecting walls, the air gap vertical separation shall be extended to four times the effective opening. Air gap vertical separation shall be measured from the lowest point of the outlet to the flood rim level of the vessel being filled. Air gaps shall not be installed in area where toxic gases are present and may be drawn into the supply piping. All air gap separations shall meet the requirements of ANSI Std. A112.1.2.

5. Domestic and Irrigation Service Protection in Excess of 2”

All domestic and irrigation containment devices in excess of 2” shall be approved through the Public Work's Superintendent on a case-by case basis.

6. Fire Protection System Devices (All Sizes)

All fire protection and private fire hydrant mains shall be protected from backflow and backsiphonage conditions with a minimum of an ASSE 1048, Double Detector Check Assembly. All fire protection and private fire hydrant mains determined by the Public Work's Superintendent to be of high hazard to the potable water supply shall be protected at a minimum of an ASSE 1047, Reduced Pressure Detector Assembly. All backflow prevention assemblies

installed on fire protection or private fire hydrant mains are subject to the approval of the City of Hillsboro Fire Chief.

a) ASSE 1048 – Double Detector Check Assembly (All Sizes)

A Double Detector Check Assembly shall be installed on all fire protection systems and private fire hydrant mains as required after determination of the degree of hazard by the Public Work's Superintendent is less than high. The backflow preventer shall be a complete assembly including UL listed resilient seated OSY shutoff valves and four test cocks. The test cocks located on the backflow preventer shall be mounted at the top of the valve to reduce clearance problems and to assist in the evacuation of air from the assembly. The assembly shall consist of two independently operating modular poppet-type check valves. The check valves shall utilize captured springs and shall have replaceable seats. The check valves shall be double-guided, both along the outside edge of the check module and through the center stem assembly. The seats shall be replaceable without the use of special tools. Seat retention shall be accomplished by the use of an interlocking bayonet-style cage and the use of threaded seats or seat screws is prohibited. Access to the internal check assemblies shall be through a single top entry cover. The cover shall be secured by stainless steel bolts. The unit shall be FM approved with FM approved resilient seated shutoff valves. The assembly shall include an auxiliary bypass line consisting of an approved ASSE 1015 – Double Check Valve Assembly and an approved water meter registering in gallons. The assembly shall be approved under the requirements of ASSE Std. 1048 and AWWA Std. C510-92. The Double Detector Check Assembly shall be a:

- Watts Regulator Company Series 007DCDA or 709DCDA
- Febco Series 856
- Ames 3000SS
- or approved equal

b) ASSE 1047 – Reduced Pressure Detector Assembly (All Sizes)

A Reduced Pressure Detector Assembly shall be installed on all fire protection systems and private fire hydrant mains as required after determination of the degree of hazard by Public Work's Superintendent is high. The unit shall be a complete assembly including UL listed and FM approved OSY shutoff valves and four test cocks. The test cocks located on the backflow preventer shall be mounted at the top of the valve to reduce clearance problems and to assist in the evacuation of air from the assembly. Backsiphonage protection shall include a provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. All bolts used to secure access covers shall be stainless steel. The assembly shall include an auxiliary bypass line consisting of an approved ASSE 1013 – Reduced Pressure Principle Assembly and an approved water meter registering in gallons. The assembly shall be approved under the requirements of ASSE Std. 1047 and AWWA Std. C511-92. The

Reduced Pressure Detector Assembly shall be a:

- Watts Regulator Company Series 909RPDA
- Febco Series 826YD
- Ames 5000SS
- or approved equal

### C. INSTALLATION

Upon approval of the Public Work's Superintendent to install a backflow prevention assembly, the City shall allow the specified device to be installed by a competent installer that is competent and licensed to install backflow prevention devices as prescribed by the Ohio Department of Commerce. All installations shall be performed at the consumer's expense.

#### 1. ASSE 1015 / ASSE 1048 – Double Check Valve Assembly / Double Detector Check Assembly (All Sizes)

All domestic, irrigation, fire protection and private fire hydrant main double check valve assemblies and double detector check assemblies shall be installed at the consumer's expense by those installers registered with the Ohio Department of Commerce only after the approval of the Public Work's Superintendent. All double check valve assemblies and double detector check assemblies shall be installed according to the manufacturer's installation recommendations. Unless otherwise noted, all double check valve assemblies shall be installed in a horizontal position. All double check valve assemblies and double detector check assemblies shall be installed in a location that is not susceptible to freezing conditions and is easily accessible by City Water System Staff to inspect the said assembly at all times. All double check valve assemblies and double detector check valve assemblies shall be installed at a minimum of 12" and a maximum of 36" from the floor. All test cocks shall be pointed toward the inside of the room if side mounted. All double check valve assemblies and double detector check valve assemblies shall be installed downstream of the water meter and upstream of the first fixture as to serve as a containment device. Any bypass, manifold, parallel, dual or tandem setting shall be protected with equal or greater protection as the domestic, irrigation or fire service. Initial testing of the said assembly shall be performed at the time of installation by the installer upon installation and a report shall be submitted to the Public Work's Superintendent within 30 days of installation. All double detector check assembly installations for the purpose of fire protection are subject to the approval of the City of Hillsboro Fire Chief.

#### 2. ASSE 1013 / ASSE 1047 - Reduced Pressure Principle Assembly / Reduced Pressure Detector Assembly (All Sizes)

All domestic, irrigation, fire protection and private fire hydrant main reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed at the consumer's expense by those installers registered with the Ohio Department of Commerce only after the approval of the Public Work's Superintendent. All reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed according to the manufacturer's

installation recommendations. Unless otherwise noted, all reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed in a horizontal position. All reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed in a location that is not susceptible to freezing conditions and is easily accessible by City Water System Staff to inspect the said assembly at all times. All reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed in an area that is not susceptible to flooding or toxic gases. All reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed at a minimum of 12" and a maximum of 36" from the floor. All test cocks shall be pointed toward the inside of the room if side mounted. All reduced pressure principle assemblies and reduced pressure detector assemblies shall have a permanent air gap separation affixed to the relief valve port. All reduced pressure principle assemblies and reduced pressure detector assemblies shall be installed downstream of the water meter and upstream of the first fixture as to serve as a containment device. Any bypass, manifold, parallel, dual or tandem setting shall be protected with equal or greater protection as the domestic, irrigation or fire service. Initial testing of the said assembly shall be performed at the time of installation by the installer upon installation and a report shall be submitted to the Public Work's Superintendent within 30 days of installation. All reduced pressure detector check assembly installations for the purpose of fire protection are subject to the approval of the City of Hillsboro Fire Chief.

3. ASSE 1020 – Anti-Siphon Pressure Vacuum Breaker (All Sizes)

All domestic and irrigation anti-siphon pressure vacuum breaker assemblies shall be installed at the consumer's expense by those installers registered with the Ohio Department of Commerce only after the approval of the Public Work's Superintendent. All anti-siphon pressure vacuum breaker assemblies shall be installed according to the manufacturer's installation recommendations. All anti-siphon pressure vacuum breaker assemblies shall be installed in an upright position. All anti-siphon pressure vacuum breaker assemblies shall be installed in a location or manner that is not susceptible to freezing conditions and is easily accessible by City Water System Staff to inspect the said assembly at all times. All anti-siphon pressure vacuum breaker assemblies shall be installed in an area that is not susceptible to flooding or toxic gases. All anti-siphon pressure vacuum breakers shall be installed at a minimum of 12" above the highest point of downstream usage or elevated piping. All anti-siphon pressure vacuum breaker assemblies shall be installed in a manner and conditions where the potential for backpressure does not exist. All anti-siphon pressure vacuum breaker assemblies shall be installed with a shut-off upstream and downstream of the body. All test cocks shall be pointed in a manner as to allow for ease of testing the said assembly. All anti-siphon pressure vacuum breaker assemblies shall be installed downstream of the water meter and upstream of the first fixture as to serve as a containment device. Any bypass, manifold, parallel, dual or tandem setting shall be protected with equal or greater protection as the domestic or irrigation service. Initial testing of the said assembly shall be performed at the time of installation by the installer upon installation and a report shall be submitted to the Water



System Superintendent within 30 days of installation.

#### 4. ANSI A112.1.2 – Air Gap Separation (All Sizes)

All domestic, irrigation and fire service air gap separations shall be installed at the consumer's expense by those installers registered with the Ohio Department of Commerce only after the approval of the Public Work's Superintendent. All air gap separations shall be installed according to Public Work's 112.1.2. The distance of the air gap separation shall be the unobstructed vertical distance through the atmosphere and shall be determined by the minimum effective diameter of the water supply outlet piping. All air gap separations shall be installed in a location or manner that is not susceptible to freezing conditions and is easily accessible by City Water System Staff to inspect the said separation at all times. All air gap separations shall be installed in an area that is not susceptible to flooding or toxic gases. All air gap separation outlets shall be solid piping and not have any threaded or other means of attaching hoses or additional piping to defeat the separation. All air gap separations shall be installed downstream of the water meter and upstream of the first fixture as to serve as a containment device. Any bypass, manifold, parallel, dual or tandem setting shall be protected with equal protection as the domestic, irrigation or fire service. The required separation shall be determined by the Public Work's Superintendent and initial testing shall be performed by the installer upon installation and a report shall be submitted to the Public Work's Superintendent within 30 days of installation.

#### D. INSPECTION, TESTING, AND MAINTENANCE

All backflow prevention assemblies including air gap separations shall be tested and certified upon installation as a condition of water service. This testing shall be performed by a competent individual who is certified by the Ohio Department of Commerce to test backflow prevention devices. All backflow prevention assemblies shall also be retested annually between July 1 and September 31 by an individual meeting the previously stated requirements. Upon testing the said device, a backflow prevention device inspection form shall be submitted to the Public Work's Superintendent within 30 days. All backflow prevention devices shall be dismantled, inspected internally, and rebuilt every 36 months from the time of installation. Failure to follow this testing procedure as prescribed may result in termination of water service until correction.

## **900.00 SANITARY SEWERS**

### **900.1 General**

The following Design Criteria are summarized herein to establish practical, uniform design of sanitary sewers within the City of Hillsboro, Ohio. These criteria cover design factors and approved guidelines for evaluation of plans and specifications by the City 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 conform to the standard drawings for sanitary sewers.

### **900.2 Minimum Velocity**

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet 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.

### **900.3 Maximum Velocity**

The maximum velocity shall be 15 feet per second. If the velocity is greater than 15 feet per second, provisions should be made to protect against displacement. The provisions will be concrete collars, anchoring, and ductile iron pipe.

### **900.4 Minimum Grades**

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet per second when flowing full based on Manning's Formula. Values of "n" to be used with the Manning Formula vary from 0.010 to 0.015 with 0.013 recommended. Use of "n" values other than 0.013 may be considered if justified. Use of formulas other than Manning's Formula may be accepted. If plans are recommended for approval with a slope less than the minimum, the consulting Engineer must show justification for the recommendation and obtain approval from OEPA. See Table 9.1.

**TABLE 9.1**  
**REQUIRED MINIMUM SLOPE**

**Based on “n” Value of 0.013**  
**Sewer Sizes - 8 through 36 inches**

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
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

#### **900.5 Sanitary Sewers**

The minimum size of sanitary sewer mains shall be 8 inches. All commercial sewer laterals shall be 6 inches (i.e. 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). In multi-tenant buildings, individual services shall be provided to a common pipe, then to the main. All laterals are property owners responsibility to the center of mains.

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.

#### **900.6 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 depth of 3 feet. The house connections shall be of premium joint construction and made of PVC schedule 40 pipe or SDR-35 and include back water valves. Cleanouts for laterals longer than 100 feet are required outside all structures or units. Individual meters shall be used for separate sanitary sewers. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided. A copy of an ordinance or regulation requiring this type of construction must be on file with OEPA district office or submitted with all sewer plans to receive approval.

#### **900.7 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 place the 0.8 depth point of both sewers at the same

elevation or matching the top elevation of the pipes. When a larger sewer discharges into a smaller, the invert of the smaller should not be raised to maintain the same energy gradient.

#### **900.8 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.

#### **900.9 Utility Separations**

Sanitary sewers and sewage forcemains should be laid with at least a 10-foot horizontal and 18-inch vertical separation from any water main. This is enforceable for both main line and laterals. If a repair occurs with both water and sanitary in the same trench, the City will allow the utilities to remain in the same trench.

If it is impossible to maintain the 18-inch vertical separation when the sewer is laid closer than 10 feet to the water main, the sanitary sewer should be constructed of (or encased in) water main type materials (ductile iron is preferred) which will withstand a 50 psi water pressure test.

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

Sewers (or sewage forcemain) may be laid closer than 10 feet to a water main if it is laid in a separate trench and elevation of the crown of the sewer (or sewer forcemain) is at least 18 inches below the bottom of the water main

#### **900.10 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 inches below the bottom of the water main. If it is absolutely impossible to maintain the 18-inch vertical separation, the sanitary sewer should be constructed of water main type material which will withstand a 50 psi water pressure test for a distance of 10 feet on both sides of the water main.

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

#### **900.11 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 feet for 8-inch to 15-inch and 350 feet for 15-inch or greater. Greater spacing may be allowed in larger sewers and in those carrying a settled effluent. Water-

tight castings are to be non-vented. Vented manholes will be determined by the Utility Supervisor.

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 inches of precast concrete adjusting collars. Metal adjustment rings will not be allowed. 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 off pavement

#### **900.12 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 inches are used to accommodate the sewer pipes, the manhole shall be returned to a 48-inch diameter as soon as practical above the sewer crown. Manhole openings 24 inches or larger are recommended for easier access with safety equipment to facilitate maintenance.

#### **900.13 Manhole Water Tightness**

Manholes shall be constructed to permit casting adjustments by use of cast-in-place or precast concrete adjusting collars not to exceed 12 inches 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, watertight covers, adequate ventilation shall be provided.

#### **900.14 Flow Channel**

The invert of the lowest pipe entering manhole shall be at least 3 inches (75 mm) above the top of the base slab so that the sewer flow channel maybe installed and shaped. The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

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.

### **900.15 Drop Manholes**

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

Ductile iron pipe on “deep” manholes will be as directed by the City Engineer. Pre-cast drop structure at the base is required.

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.

### **900.16 Test Inspection**

The leakage and deflection tests are to be carried out by the contractor after 30 days of installation and witnessed and certified by the City officials and/or their representative.

### **900.17 Railroad and Highway Crossings**

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

### **900.18 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 stream bed 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 feet 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 stream bed 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, coarse 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.

**900.19 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) City of Hillsboro 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.

## B. Pump Station Type & Standard Requirements

Listed below are the standard requirements for pump stations in the City of Hillsboro. 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 City for their approval prior to beginning final engineering.

## 2. Smith and Loveless Dog House Pump Stations

## 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 Square D, Allen Bradley, or equivalent, as approved by the City.
- 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.
- g) Ronk transfer switch and generator receptacle compatible with City of Hillsboro equipment shall be provided.

#### 4. Liquid Level Control

Pumps shall be controlled by an electronic pressure switch.

#### 5. Alarm Appurtenances

- a) Alarm signal shall be initiated by liquid level control system and mercury type float switches 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-inch 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, size to support pump with a 4 to 1 safety factor.

## 7. Wet Well Structure

- a) The wet well 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.

- c) Vent

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

- d) Hoist Stand

A hoist stand to fit existing pump hoist shall be mounted to the top slab to assure easy pump removal.

## 8. Piping and Valves

- a) Materials

All piping and fittings beginning after the hydraulic sealing flange unit shall be 4-inch diameter ductile iron pipe with flanged joints. Pipe joints shall be flanged and conform with ANSI Specification A21.10 (AWWA C110) for cast iron pipe flanges and flanged fittings, Class 125.

- b) Valves

- 1) Check valves to be 4" with outside lever and weight. Valves to be rated for 175 psi water working pressure and 350 psi hydrostatic test pressure.
- 2) Eccentric plug valve to be 4", 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.
- 3) A guide disconnect assembly as shown on the plans shall be installed in the valve pit.

## **900.20 Forcemains**

### **A. VELOCITY AND DIAMETER**

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. The minimum forcemain diameter for raw wastewater shall be 4 inches.

## B. AIR AND VACUUM RELIEF VALVE

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

## C. TERMINATION

Forcemains should enter the gravity sewer system at a point not more than 2 feet 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 forcemain, 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 forcemains shall be based on the Hazen-Williams formula or other acceptable methods. When the Hazen-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 forcemains are constructed of material which might cause the forcemain to be confused with potable water mains, the forcemain shall be appropriately identified.

## G. LEAKAGE TESTING

Leakage tests shall be required per the water main testing requirements as shown in the City of Hillsboro Construction Standards and Drawings.