# FLOYD COUNTY STORMWATER DESIGN MANUAL

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DESIGN MANUAL NOVEMBER 2020

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Adoption of the Stormwater Design Manual

This Floyd County Stormwater Design Manual shall be in full force and effect **November 2, 2020.** All prior versions and parts of Stormwater Design manual in conflict with this Stormwater Design Manual are hereby repealed.

Floyd County Drainage Board, Indiana

By _____

Floyd County Drainage Board, President

Prepared by: Lochmueller Group

# FLOYD COUNTY
# STORMWATER SEWER DESIGN MANUAL

## TABLE OF CONTENTS

# TABLE OF CONTENTS

# CHAPTER 1
# INTRODUCTION

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# INTRODUCTION

## 1.1 PURPOSE OF THE DESIGN MANUAL

This Design Manual is a guide for the planning and design of stormwater systems, erosion control structures, and associated activities for Floyd County. The guidelines and general design procedures in this manual are approved by the Floyd County Stormwater Board.

The contents of this design manual are based on the Louisville MSD design manual and the Indiana Storm Water Quality Manual.

This Manual:

A. Enumerates design standards that have been authorized by Floyd County to facilitate compliance with local, state and federal regulations.

B. Identifies submittal requirements and procedures for the review of infrastructure projects within the respective service areas.

C. Serves as a reference document for professional consultants in the design of infrastructure projects within the respective service areas.

## 1.2 DESCRIPTION AND USE OF THE DESIGN MANUAL

The Manual identifies a single set of standards, submittal requirements and approval procedures to be used in the planning and design of projects within the respective service areas.

This Manual is not intended to serve as a step-by-step design methodology nor can this Manual address every situation which may arise. The application of sound engineering/surveying principles and judgment combined with the information contained herein are necessary to complete the planning, design, and preparation of related construction documents for stormwater and sanitary sewer projects.

Approval of plans by Floyd County shall not relieve the designer or developer from required compliance with the provisions of this manual unless a written variance is received from Floyd County.

## 1.3 STRUCTURE OF THE DESIGN MANUAL

The Manual contains 15 chapters. A general table of contents is found at the beginning of the Manual. To facilitate use of the Manual, a detailed table of contents can be found at the

beginning of each chapter for text and exhibits. The Manual is structured as follows:

A. Chapters 2 and 3 describe general planning and design approach, required submittals and approval procedures.

B. Chapters 4 through 7 detail standards regarding drafting construction drawings, record drawings, surveying and easement documents.

C. Chapters 8 and 9 describe standards for performing geotechnical explorations and the design of erosion control structures.

D. Chapters 10 and 11 cover the design of stormwater systems and the submittal requirements for private development drainage in Floyd County.

## 1.4 DIGITAL VERSION OF DESIGN MANUAL

A digital version of the design manual and printable PDF versions of the respective chapters are located at the following website:

Floyd County: https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department#design-manual

Additionally, a digital version of the design manual may be requested from the Floyd County Stormwater office via email.

## 1.5 UPDATES TO THE DESIGN MANUAL

The Manual is intended to be a dynamic document. As design criteria and technology evolve, the Manual will require revisions and improvements. As changes are made, updates will be posted to the website version. It will be the designer's responsibility to stay updated on the manual.

# TABLE OF CONTENTS

# CHAPTER 2
# GENERAL INFORMATION

# CHAPTER 2
# GENERAL INFORMATION

# EXHIBITS

# CHAPTER 2
# GENERAL INFORMATION

## 2.1 PURPOSE

This chapter:

A. Provides an overview of the planning and design approach relating to stormwater sewers and their appurtenant facilities.

B. Summarizes the processes for submittal, review and approval of construction documents for private development projects in Floyd County.

C. Provides information relating to area utility and external agency coordination.

D. Provides direction relating to the preparation of opinions of capital, operation, and maintenance costs.

## 2.2 DESIGN APPROACH

Proposed construction or expansion of stormwater facilities shall be in compliance with the following:

A. Floyd County Stormwater:

1. Floyd County Ordinance Regulating Construction Site Runoff and Post-Construction Stormwater Management.

2. Floyd County Illicit Discharge Ordinance.

3. Indiana Administrative Code 327 IAC 15-5 (Rule 5).

4. The Indiana Storm Water Quality Manual by Indiana Department of Environmental Management (IDEM).

5. Best Management Practices Stormwater Management Manual for Southern Indiana by Southern Indiana Stormwater Advisory Committee (SISWAC).

6. This Floyd County Stormwater Design Manual.

Any person, company, corporation, or other entity proposing to develop land or to install new or replacement stormwater facilities in Floyd County must prepare planning and design documents in accordance with the standards and requirements of this Manual and the Indiana Administrative Code (IAC) for review and approval by Floyd County. Planning and Construction Documents must be prepared and signed by both a Professional Engineer and Land Surveyor (where applicable per IC 25-21.5-1-7), currently licensed in the State of Indiana. The service level of proposed facilities should be in accordance with standards

referenced in these documents.

The Design Engineer shall refer to Chapter 10 Stormwater Facilities Design of this design manual for design standards regarding stormwater facilities in Floyd County.

## 2.3 2.4 FLOYD COUNTY PRIVATE DEVELOPMENT REVIEW PROCESS

An applicant proposing to develop or redevelop land in Floyd County shall refer to Floyd County's Zoning and Subdivision Control Ordinances for a description of the review processes and required submittals as well as coordinate their efforts with the Planning Department and Building Officials. Refer to Floyd County's Zoning Ordinance for a description of the review processes for an Improvement Location Permit, a Planned Unit Development District (PUDD), Conditional Use and Special Exceptions approvals, etc. See the Floyd County Subdivision Control Ordinance for the requirements regarding subdivision approval. The Floyd County Stormwater Department shall be involved during the preliminary and secondary review processes. Refer to Chapter 11 of this design manual for the Floyd County Stormwater Department's submittal requirements for reviewing private development drainage projects.

## 2.5 STORMWATER QUALITY MANAGEMENT PERMIT (SWQMP)

A stormwater quality management permit (SWQMP) shall be obtained for all development or redevelopment activities in Floyd County that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre that are part of a larger common plan of development or sale. The SWQMP application and fee shall be submitted to the Floyd County Stormwater office. Once construction plans are complete for a development requiring a SWQMP, the developer shall submit the Notice of Intent (NOI), a Perimeter Control Plan (PCP), a Stormwater Pollution Prevention Plan (SWPPP), and a Post-Construction Stormwater Pollution Prevention Plan to the Floyd County Soil and Water Conservation District (SWCD) for review. These items must be approved by the Floyd County SWCD prior to breaking ground or disturbing soil.

For information on the SWQMP process and submittal and inspection requirements, refer to the Floyd County Stormwater Ordinance FCO-2019-25.

## 2.6 UTILITIES/AGENCY COORDINATION

The Design Engineer and/or Developer shall coordinate the design of all stormwater facilities with all utilities and external agencies actively involved in the provision of service in Floyd County. Documentation of agency coordination is required to be provided to the Floyd County Stormwater office. This may include a letter of determination, digital correspondence, or other contact with the agencies. For example, the involvement of external agencies may include:

A. Construction within regulated streams and regulatory floodplains requires the approval of and permit by IDEM and the U.S. Army Corps of Engineers.

B. Construction in a floodway requires a permit issued by the Indiana Department of Natural Resources.

C. Work within federal and state highway rights-of-ways requires approval and/or a permit by the Indiana Department of Transportation (INDOT).

Contact shall be made with such agencies prior to the final design submittal to Floyd County. Floyd County should be given a copy of all correspondence with utilities and external agencies. A partial listing of utilities and agencies is included in Exhibit 2-1.

## 2.7 OPINIONS OF COST (FOR CAPITAL IMPROVEMENT PROJECTS)

Opinions of probable cost shall be based on the best professional judgement of the Design Engineer. The Design Engineer should use recent bid tabulations, and information from suppliers and contractors in formulating opinions of cost. Opinions of capital cost shall be in the Construction Specification Institute (CSI) format and shall be grouped by category. Opinions of capital cost should include a construction contingency, allocations for planning and design, and a cost for necessary land, easement, or right-of-way acquisition. The amount or percentage of these contingencies and allocations are dependent upon project specifics and the stage of project development. Opinions of operation and maintenance cost shall include costs for labor, utilities, maintenance and repair. Energy efficiency shall be considered in the design.

## 2.8 PERMIT REQUIREMENTS

A summary of requirements for permits is shown as Exhibit 2-2. The Exhibit contains individual lists for drainage projects. The list should not be considered all-inclusive, and the designer will need to confirm all permit requirements as a part of the preliminary scope of the project. The following is a brief summary of the major permits that impact projects in the Floyd County service area. Some commonly required permits include:

A. **Section 404 - Nationwide Permit No. 12 of 33 CFR Part 330** from the U.S. Army Corps of Engineers. Conditions of this permit may require a Water Quality Certification from IDEM (see Item B below). A permit is required for discharges of soil, sand, gravel or dredged material into waters of the U.S. Design Engineers must inquire from the U.S. Army Corps of Engineers if a certain stream requires this permit.

B. **Section 401 - Application for Water Quality Certification** from IDEM must be issued or waived before a federal permit under Section 404 is granted (Item A above). Section 401 of the Clean Water Act requires certification from the state that the discharge of the dredge or fill material will not violate the water quality standards of the state.

C. **Construction/Land Disturbance Storm Water Permitting (327 IAC 15-5, Rule 5)** administered by IDEM. This is a general permit program that targets construction activities that result in land disturbance of one acre or more. 327 IAC 15-5 is designed to reduce pollutants, principally sediment, that are a result of soil erosion and other activities associated with land-disturbing activities.

EXHIBIT 2-1

FLOYD COUNTY UTILITIES AND AGENCIES

EFFECTIVE DATE: DECEMBER 2012

**Indiana-American Water**
2423 Middle Road
Jeffersonville, IN 47130
812-218-1500

**Silver Creek Water Corporation**
8104 County Line Road
Sellersburg, IN 47172
812-246-2889

**Edwardsville Water Corporation**
545 Maplewood Blvd
Georgetown, IN 47122
812-948-0900

**Floyds Knobs Water Company**
4781 Paoli Pike #1
Floyds Knobs, IN 47119
812-923-9040

**Borden Tri-County Regional Water District**
1791 West Water Street
Borden, IN 47106
812-967-2226

**Greenville Water Utility**
9706 Clark St.
Greenville, IN 47124
812-923-9821

**Ramsey Water Company**
415 Highway 64 NW
PO Box 245
Ramsey, IN 47166
812-347-2551

**Georgetown Utilities**
Georgetown Public Works Department
1070 Copperfield Drive
Georgetown, IN 47122
812-951-3800

**Elizabeth Water Company**
8128 Hurricane Street SE
Elizabeth, IN 47117
812-969-2025

**Vectren Gas**
P.O. Box 209
Evansville, IN 47702-0209
812-491-4000
800-227-1376

**Duke Energy**
1110 Clifty Dr.
Madison, IN 47250
812-265-4217

**Clark County REMC**
7810 State Road 60
PO Box 411
Sellersburg, IN 47172
812-246-3316

**Harrison REMC**
PO Box 517
1165 Old Forest Road
Corydon, IN 47112
812-738-4115

**Insight Cable**
1608 Vance Avenue
New Albany, IN 47150
502-357-4400

**AT&T**
510 E. Spring St.
New Albany, IN 47150
812-948-7181

**IDEM**
100 N. Senate Ave
Indianapolis, IN 46204-2251
317-232-8603

**INDOT- Seymour District**
185 Agrico Lane
Seymour, IN 47274
877-305-7611

**New Albany-Floyd County Consolidated School Corporation**
2813 Grant Line Road
New Albany, IN 47150
812-949-4200

**New Albany Wastewater Department**
38 W 10th Street
New Albany, IN 47150
812-948-5320

**Floyd County Stormwater Department**
Pine View Government Center
2524 Corydon Pike, Suite 201
New Albany, IN 47150
812-949-5446

**Floyd County Plan Commission**
Pine View Government Center
2524 Corydon Pike, Suite 203
New Albany, IN 47150
812-948-5440

**Floyd County Soil & Water Conservation Department**
Pine View Government Center
2524 Corydon Pike, Suite 103
New Albany, IN 47150
812-945-9936

**Floyd County Commissioners**
Pine View Government Center
2524 Corydon Pike, Suite 204
New Albany, IN 47150
812-948-5466

**REQUIRED PERMITS FOR DRAINAGE PROJECTS**

| SUBMITTED | APPROVED | PERMIT | REQUIRED SUBMITTALS | AGENCY | WHEN REQUIRED |
|---|---|---|---|---|---|
| | | Section 404- Nationwide Permit No. 12 of 33 CFR Part 330 | Application, drawings | Army Corps of Engineers | For discharges of soil, sand, gravel, or dredged material into a regulated stream. May require IDEM Water Quality Certification. |
| | | Section 401, Clean Water Act- Water Quality Certification | Application, location map, drawings, cross sections, site photos | Indiana Department of Environmental Management | When a project is planned in Indiana that will impact a wetland, stream, river, lake, or other Water of the U.S. A Section 401 WQC is a required component of a federal permit and must be issued before a federal permit or license can be granted. |
| | | Construction in a Floodway | Application, location map, site map, drawings, photos | Indiana Department of Natural Resources | For excavation, fill, or construction in a floodway. |
| | | Construction/Land Disturbance Storm Water Permitting (327 IAC 15-5, Rule 5) | Notice of Intent, proof of publication, application fee, construction plan review approval | Indiana Department of Environmental Management | General permit that targets construction activities that result in land disturbance of one acre or more. |
| | | Encroachment Permit | Application, drawings | Indiana Department of Transportation | When encroaching on state right-of-way |
| | | Encroachment Permit | Drawings | New Albany Street Department | When encroaching on city right-of-way |
| | | Encroachment Permit | Drawings | Floyd County Highway Department | When encroaching on county right-of-way |
| | | Lane Closure Approval | Drawings | New Albany Board of Public Works | When necessary to close lanes of traffic in New Albany |
| | | Lane Closure Approval | Drawings | Floyd County Commissioners | When necessary to close lanes of traffic in Floyd County |
| | | New Albany Improvement Location Permit | See New Albany Zoning Ordinance (Chapter 156) for required submittals | New Albany Plan Commission | For all newly erected, constructed, reconstructed, extended, structurally altered or moved structures and for changes in land, building, or structure use in New Albany. |
| | | New Albany Subdivision Approval | See New Albany Subdivision Control Ordinance (Chapter 154) for required submittals | New Albany Plan Commission | For a proposed subdivision in New Albany |
| | | New Albany Planned Unit Development District (PUDD) Approval | See New Albany Zoning Ordinance (Chapter 156) for required submittals | New Albany Plan Commission | For a Planned Unit Development District in New Albany |
| | | New Albany Stormwater Board Approval | See Chapter 10 (for capital improvement projects) or Chapter 11 (for private development) of this Design Manual for submittal requirements | New Albany Stormwater Board | For all land development or drainage projects in New Albany |
| | | New Albany Stormwater Quality Management Permit (SWQMP) | SWQMP Application, Notice of Intent (NOI), Perimeter Control Plan (PCP), Stormwater Pollution Prevention Plan (SWPPP), Post-Construction SWPPP, construction plans, etc. | Floyd County Soil and Water Conservation District | All development or redevelopment activities in New Albany that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre as part of a larger common plan of development or sale. |
| | | Floyd County Improvement Location Permit | See the Floyd County Zoning Ordinance for submittal requirements | Floyd County Building Commissioner | For all newly erected, constructed, reconstructed, extended, structurally altered or moved structures and for changes in land, building, or structure use in Floyd County |
| | | Floyd County Subdivision Approval | See the Floyd County Subdivision Control Ordinance for submittal requirements | Floyd County Plan Commission | For a proposed subdivision in Floyd County |
| | | Floyd County Planned Unit Development District (PUDD) Approval | See the Floyd County Zoning Ordinance for submittal requirements | Floyd County Plan Commission | For a Planned Unit Development District in Floyd County |
| | | Floyd County Stormwater Board Approval | See Chapter 10 (for capital improvement projects) or Chapter 11 (for private development) of this Design Manual for submittal requirements | Floyd County Stormwater Board | For all land development or drainage projects in Floyd County |
| | | Floyd County Storm Water Quality Management Permit (SWQMP) | SWQMP Application, Notice of Intent (NOI), Perimeter Control Plan (PCP), Stormwater Pollution Prevention Plan (SWPPP), Post-Construction SWPPP, construction plans, etc. | Floyd County Soil and Water Conservation District | All development or redevelopment activities in Floyd County that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre as part of a larger common plan of development or sale. |

**REQUIRED PERMITS FOR PUMP STATIONS/STRUCTURES PROJECTS**

| SUBMITTED | APPROVED | PERMIT | REQUIRED SUBMITTALS | AGENCY | WHEN REQUIRED |
|---|---|---|---|---|---|
| | | Section 404- Nationwide Permit No. 12 of 33 CFR Part 330 | Application, drawings | Army Corps of Engineers | For discharges of soil, sand, gravel, or dredged material into a regulated stream. May require IDEM Water Quality Certification. |
| | | Section 401, Clean Water Act- Water Quality Certification | Application, location map, drawings, cross sections, site photos | Indiana Department of Environmental Management | When a project is planned in Indiana that will impact a wetland, stream, river, lake, or other Water of the U.S. A Section 401 WQC is a required component of a federal permit and must be issued before a federal permit or license can be granted. |
| | | Construction in a Floodway | Application, location map, site map, drawings, photos | Indiana Department of Natural Resources | For excavation, fill, or construction in a floodway. |
| | | Sanitary Sewer Construction Permit | Application, drawings, specifications, Capacity Certification/Allocation Letter from Utility, design summary, affected parties list | Indiana Department of Environmental Management | For construction of sanitary sewer and lift stations |
| | | Construction/Land Disturbance Storm Water Permitting (327 IAC 15-5, Rule 5) | Notice of Intent, proof of publication, application fee, construction plan review approval | Indiana Department of Environmental Management | General permit that targets construction activities that result in land disturbance of one acre or more. |
| | | Encroachment Permit | Application, drawings | Indiana Department of Transportation | When encroaching on state right-of-way |
| | | Encroachment Permit | Drawings | New Albany Street Department | When encroaching on city right-of-way |
| | | Encroachment Permit | Drawings | Floyd County Highway Department | When encroaching on county right-of-way |
| | | Lane Closure Approval | Drawings | New Albany Board of Public Works | When necessary to close lanes of traffic in New Albany |
| | | New Albany Improvement Location Permit | See New Albany Zoning Ordinance (Chapter 156) for required submittals | New Albany Plan Commission | For all newly erected, constructed, reconstructed, extended, structurally altered or moved structures and for changes in land, building, or structure use in New Albany. |
| | | New Albany Subdivision Approval | See New Albany Subdivision Control Ordinance (Chapter 154) for required submittals | New Albany Plan Commission | For a proposed subdivision in New Albany |
| | | New Albany Planned Unit Development District (PUDD) Approval | See New Albany Zoning Ordinance (Chapter 156) for required submittals | New Albany Plan Commission | For a Planned Unit Development District in New Albany |
| | | New Albany Sanitary Sewer Board Approval | See Chapters 12, 14, and 15 (for capital improvement projects) or Chapter 13 (for private development) of this Design Manual for submittal requirements | New Albany Sanitary Sewer Board | For all land development or capital improvement sanitary sewer projects in New Albany |
| | | Sewer Credit Approval | Application, Calculations, Site Plan | New Albany Sanitary Sewer Board/ IDEM | For all sanitary sewer projects in New Albany. Sewer credits must be secured prior to design approval and connection to the sewer system. |
| | | New Albany Stormwater Quality Management Permit (SWQMP) | SWQMP Application, Notice of Intent (NOI), Perimeter Control Plan (PCP), Stormwater Pollution Prevention Plan (SWPPP), Post-Construction SWPPP, construction plans, etc. | Floyd County Soil and Water Conservation District | All development or redevelopment activities in New Albany that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre as part of a larger common plan of development or sale. |
| | | The City of New Albany Building Permit | Application, Property Survey, Site Plan, Assessor's Plat | New Albany Building Commission | For any project with a building in New Albany |
| | | Request for Final Inspection & Certificate of Occupancy | Application | New Albany Building Commission | |

**REQUIRED PERMITS FOR SANITARY SEWER AND FORCE MAIN PROJECTS**

| SUBMITTED | APPROVED | PERMIT | REQUIRED SUBMITTALS | AGENCY | WHEN REQUIRED |
|---|---|---|---|---|---|
| | | Section 404- Nationwide Permit No. 12 of 33 CFR Part 330 | Application, drawings | Army Corps of Engineers | For discharges of soil, sand, gravel, or dredged material into a regulated stream. May require IDEM Water Quality Certification. |
| | | Section 401, Clean Water Act- Water Quality Certification | Application, location map, drawings, cross sections, site photos | Indiana Department of Environmental Management | When a project is planned in Indiana that will impact a wetland, stream, river, lake, or other Water of the U.S. A Section 401 WQC is a required component of a federal permit and must be issued before a federal permit or license can be granted. |
| | | Construction in a Floodway | Application, location map, site map, drawings, photos | Indiana Department of Natural Resources | For excavation, fill, or construction in a floodway. |
| | | Sanitary Sewer Construction Permit | Application, drawings, specifications, Capacity Certification/Allocation Letter from Utility, design summary, affected parties list | Indiana Department of Environmental Management | For construction of sanitary sewer and lift stations |
| | | Construction/Land Disturbance Storm Water Permitting (327 IAC 15-5, Rule 5) | Notice of Intent, proof of publication, application fee, construction plan review approval | Indiana Department of Environmental Management | General permit that targets construction activities that result in land disturbance of one acre or more. |
| | | Encroachment Permit | Application, drawings | Indiana Department of Transportation | When encroaching on state right-of-way |
| | | Encroachment Permit | Drawings | New Albany Street Department | When encroaching on city right-of-way |
| | | Encroachment Permit | Drawings | Floyd County Highway Department | When encroaching on county right-of-way |
| | | Lane Closure Approval | Drawings | New Albany Board of Public Works | When necessary to close lanes of traffic in New Albany |
| | | New Albany Subdivision Approval | See New Albany Subdivision Control Ordinance (Chapter 154) for required submittals | New Albany Plan Commission | For a proposed subdivision in New Albany |
| | | New Albany Planned Unit Development District (PUDD) Approval | See New Albany Zoning Ordinance (Chapter 156) for required submittals | New Albany Plan Commission | For a Planned Unit Development District in New Albany |
| | | New Albany Sanitary Sewer Board Approval | See Chapters 12, 14, and 15 (for capital improvement projects) or Chapter 13 (for private development) of this Design Manual | New Albany Sanitary Sewer Board | For all land development or capital improvement sanitary sewer projects in New Albany |
| | | Sewer Credit Approval | Application, Calculations, Site Plan | New Albany Sanitary Sewer Board/ IDEM | For all sanitary sewer projects in New Albany. Sewer credits must be secured prior to design approval and connection to the sewer system. |
| | | New Albany Stormwater Quality Management Permit (SWQMP) | SWQMP Application, Notice of Intent (NOI), Perimeter Control Plan (PCP), Stormwater Pollution Prevention Plan (SWPPP), Post-Construction SWPPP, construction plans, etc. | Floyd County Soil and Water Conservation District | All development or redevelopment activities in New Albany that result in the disturbance of one or more acres of land, including land disturbing activities on individual lots of less than one acre as part of a larger common plan of development or sale. |

# TABLE OF CONTENTS

# CHAPTER 3
# GENERAL PLANNING INFORMATION

# CHAPTER 3
# GENERAL PLANNING INFORMATION

## 3.1 PURPOSE

This chapter:

A. Identifies the sources of planning and design information for development of stormwater drainage infrastructure in the respective service areas.

B. Identifies the goals of Floyd County's Comprehensive Land Use Plan.

## 3.2 PLANNING APPROACH

Floyd County's regional approach for the planning, design, construction, operation and maintenance of stormwater facilities is structured to ensure a level of service that protects the general health, safety, and welfare of the citizens of the respective service areas. This approach will also further efforts to satisfy local, state and federal regulations as they relate to water quality.

Floyd County planning documents, including the Floyd County Comprehensive Land Use Plan provide the framework for planning and design of stormwater facilities in the service area. The Design Engineer should use these documents for planning and as reference documents for the development of sanitary sewer and stormwater facilities.

## 3.3 FLOYD COUNTY COMPREHENSIVE LAND USE PLAN UPDATE

The Floyd County Comprehensive Plan was updated in 2017 in order to understand the present land development conditions and trends in Floyd County and to adjust the community's land development goals and objectives accordingly.

## 3.4 REGIONAL FACILITIES

Floyd County realizes that in some cases regional facilities are more appropriate, cost effective, and assure proper operation and maintenance compared to on-site detention facilities. The requirement to build or participate in the cost of regional facilities shall be determined concurrently with the review by Floyd County of the developer's proposed development plans and by an analysis of the development's impact on the general community. This impact includes watershed, other development, existing service facilities, and its conformance with existing master plans.

# TABLE OF CONTENTS

# CHAPTER 4
# CADD STANDARDS

# TABLE OF CONTENTS (cont.)

# CHAPTER 4
# CADD STANDARDS

# CHAPTER 4

# CADD STANDARDS
# EXHIBITS

# CHAPTER 4
# CADD STANDARDS

## 4.1 GENERAL

Floyd County has adopted CADD standards to provide consistency with respect to plan and document development and for compatibility with respect to the sharing of data and document storage. Floyd County operate in the AutoCAD environment. Emphasis has been placed on developing standards that are in line with current industry procedures but can be easily adapted to change with industry advancements.

Development plans for sanitary sewer and stormwater construction shall be prepared in a neat and professional manner and shall conform to the standards detailed in this chapter. It is important that information be presented in such a manner that it will be legible when the plans are scanned, reproduced, or reduced. The following section presents the standards that shall be adhered to on all Floyd County Capital Improvement projects and Private Development plans. The standard Text Heights, Line Weights, Standard Symbols, and Standard Abbreviations are shown in Exhibits 4-2 through 4-5 at the end of this chapter.

## 4.2 CADD STRUCTURE

### 4.2.1 CADD Environment

A. The electronic files may be shared and referenced by many different individuals. Therefore, this chapter outlines the minimum standards, conventions, and formats necessary to ensure a usable electronic file data set to all users.

B. It must be stressed that while the CADD Standards are to be applied to the deliverable files for design plans, they should not be used to restrict the user's options or workflows during plan development. Interim drawings for public meetings, reviews, etc. may deviate from the suggested workflows and standards if needed for particular display or presentation requirements.

C. All drawings submitted to Floyd County shall be in AutoCAD format, compatible with the current version that Floyd County are running. The project manager should check with Floyd County for version information before any CADD work begins.

D. In addition to two (2) full size hard copies of the drawings, all final drawings are to be submitted in AutoCAD and pdf formats per the requirements of this chapter.

E. Model space shall be used for all drafting. Paper space may be used for borders, viewports, and plotting. Modelspace contains the model at "real life" size. Printing is from paperspace at 1:1 scale for full-size prints.

## Scales

The appropriate scales for original plans are 1" = 50' horizontal with vertical scale of 1" = 5' and 1" = 20' horizontal with vertical scale of 1" = 2'. Other scales may be allowed with prior approval of Floyd County for the purpose of clarity. A graphic scale is required. In addition, crossings of state highways may require additional sheets at different scales. Coordination between Floyd County and INDOT will be necessary and all plan sheets will need to follow INDOT's CADD Standards.

## Standard Line Types

The color and line style attributes for all drawing elements shall be set to "By Layer" in the layers of the drawings. Custom Linestyles are also shown in Exhibits 4-1 and 4-2.

## Standard Symbols and Abbreviations

The standard symbols are presented in Exhibit 4-3 and standard abbreviations are presented in Exhibit 4-5.

## Screening

The intent is for existing features (topography, etc.) to be screened.

## Standard Sheets

The standard sheet size is 24" x 36" for all sanitary and stormwater projects. 22" x 34" sheet sizes are also acceptable for the intent that a true half-size set of plans can be printed on 11" x 17" paper. The sheets are presented in Exhibit 4-6 and the standard title block is to follow INDOT's Standards.

## Text Fonts, Sizes, and Weights

The standard font style on Floyd County projects is "simplex.shx".

The following chart shows the height for each text style used. In general, Upper and Lower Case shall be used to denote existing text and UPPER case shall be used to denote proposed text.

| HEIGHT (inches) | Notes |
|---|---|
| 0.06 | For existing text on plats where space is limited. (Upper & Lower Case) |
| 0.08 | All existing text. (Upper & Lower Case) |
| 0.10 | For Proposed Item Annotation where space is limited (UPPER CASE) |
| 0.12 | For Proposed Item Annotation / Construction Notes. (UPPER CASE) |
| 0.14 | For Note Titles & Other Misc. Labels (UPPER CASE) |
| 0.175 | Misc. Titles / Labels (UPPER CASE) |
| 0.20 | Misc. Titles / Labels (UPPER CASE) |

### 4.2.2 Submittal of Final Plans

**General**

A. All mapping features and all design features in plan view located in model space of the CAD drawings shall maintain their true coordinate location values. Please reference Chapter 6, "Surveying" for additional details on coordinate systems. Detail sheets do not have to be shown in true coordinate location.

**Plan Deliverables**

At the completion of the plans, the file delivarables to Floyd County are as follows:

A. Two (2) Printed full size, complete sets of plans (24" x 36" or 22" x 34" in

size.

B. Electronic versions in PDF and Current Autodesk format supplied on a Flash Drive (USB Drive). Containing all necessary CADD support files to open all of the drawings.

## 4.3 STANDARD AND TYPICAL DRAWINGS

### 4.3.1 Definitions

A. Standard Drawings - Details that indicate the acceptable procedure, dimensions, or timetable for a particular facet of construction. The details are not to be modified and can be made a part of the plan set by referencing the respective drawing number on the front Title Sheet. Floyd County have adopted standard drawings issued by INDOT and are included in Appendix A of this Design Manual. If changes are made to a particular standard drawing for a project, the detail ceases to be a standard drawing and becomes a special detail. The special detail will then need to conform to the requirements of Section 4.3.5.

B. Special Details - There are numerous exhibits and design aids found in other chapters of this manual. The details will vary from project to project. Use of the details is encouraged; however, the detail, in its final form, will need to conform to the requirements of Section 4.3.5.

C. Typical Drawings - Examples of typical sheets illustrating the format and information required on Floyd County contract plans are provided as reference. The respective sheets and exhibit numbers are listed below.

| Exhibit | Title |
|---|---|
| 4-8 | Sample Title Sheet |
| 4-9 | Sample Plan Index Sheet |
| 4-10 | Sample Drainage Map (Sanitary Collector System) |
| 4-11 | Sample Drainage Map (Storm Collector System) |
| 4-12 | Sample Horizontal and Vertical Control Map |
| 4-13 | Sample Plan Sheet |
| 4-14 | Sample Profile Sheet |
| 4-15 | Sample Cross Section Sheet |
| 4-16 | Sample Property Acquisition Summary Sheet |

### 4.3.2 Title Sheet Requirements

A Sample Title Sheet can be found on Exhibit 4-8. For each project, the title sheet shall have at least the minimum information listed on it:

A. Project No.

B. Name of Project

C. Index of Drawings

D. Name and Address of Engineer

E. Design Segment Designation (where applicable)

F. Sheet____of____

G. For sanitary interceptor and major storm sewer contracts, the proposed sewers for which the plans are drawn shall be shown. The stations at the extremities of the project shall be shown and identified with leaders and arrows. For example: BEGIN PROJECT MC-1, STA. 5+42.00 and END PROJECT MC-1, STA. 10+51.03.

H. To notify the Contractor of the procedure required for the location of utilities prior to construction, the following note should be placed on the Title Sheet.

"NOTE: CAUTION EXISTING UTILITIES"

"THE INFORMATION SHOWN ON THESE DRAWINGS CONCERNING TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL-INCLUSIVE. LOCATION, SIZE, AND MATERIAL SHOWN ON UTILITIES ARE FROM AVAILABLE RECORDS SUPPLIED BY THE RESPECTIVE UTILITY COMPANY. INDIANA 811-CALL BEFORE YOU DIG MUST BE NOTIFIED 2 BUSINESS DAYS PRIOR TO ANY EXCAVATION FOR VERIFICATION OF LOCATION, SIZE AND MATERIAL, DIAL 811 or 1-800-382-5544.

I. Other Agency's Standard Drawings pertaining to project (INDOT, etc.) with standard drawing number and description.

J. Revision Block with date & comments.

### 4.3.3 Title Block Requirements

All sheets included in the plans, except the Title Sheet and the Standard Drawings, shall contain a title block, which conforms to the sample shown in the Exhibit 4-7. Information in the Title Block should include the project title indicating sanitary or drainage plans, what type of sheet, and the specific information on the sheet.

### 4.3.4 Plan Index Sheet Requirements

A Plan Index Sheet shall be prepared to identify the location of the work shown on each Plan Sheet. A Sample Plan Index Sheet is shown on Exhibit 4-9. The Plan Index Sheet shall include a reference to the location of the profile for the sewer lines on each plan sheet if the profile is on a separate sheet. For most projects, the Plan Index Sheet may be shown on the Project Map, which is located on the Title

Sheet.

### 4.3.5 Special Details

The Design Engineer should show any proposed construction that is not covered by the Standard Drawings as a detail on a Special Detail sheet. The detail should clearly and accurately depict the proposed construction. Junction chambers, special pipe bedding, railroad crossings, pump stations, select erosion control measures, and modifications to any of the Standard Drawings are typical examples of items that may require a Special Detail.

### 4.3.6 Drawing Number Convention (Projects using Multiple Disciplines)

The drawing number shall consist of two parts: The 1st part is the letter corresponding to the discipline. The second part is the numerical page number in that subset.

| List of Discipline | |
|---|---|
| General | (G) |
| Civil/Site | (C) |
| Process | (D) |
| Structure | (S) |
| Architectural | (A) |
| Mechanical/HVAC | (M) |
| Electrical | (E) |
| Instrumentation & Control | (I) |

Examples: G-1, G-2, S-1, S-2, etc.

## 4.4 PLAN, PROFILE, AND CROSS-SECTION FORMAT

### 4.4.1 General Criteria

The plan view of proposed sewer or drainage construction generally should be shown on the same sheet as the profile with the plan view located at the bottom of the sheet and the profile at the top. Samples of the plan and profile sheets can be found in Exhibits 4-13 and 4-14. However, if drafting efficiency can be achieved, the plan view may be shown on a separate sheet from the profile. In this case, the plan sheet and profile sheets shall be cross-referenced. The entire profile for each line shall be shown on one sheet when possible. A profile sheet with profiles for more than one plan sheet can be accepted. Profiles shown on sheets separate from the plan views should follow the plan views in a logical order. The information, which appears, on both the plan and profile views shall, at the minimum, include:

A. The location of all proposed manholes, cleanouts, inlets, catch basins and all associated stations shall be shown.

B. House numbers for all residences and businesses shall be shown and drawn parallel with the streets in the plan view.

C. All existing pipes, culverts and appurtenances shall be hatched.

D. The sizes, locations, and invert elevations, if applicable, of the following items shall be shown:

1. Stubs

2. Drop Inlets

3. Stacks

4. Borings and Soundings

5. Catch Basin Inlets

6. Downspout Connections

7. Property Service Connections

E. All existing pipes, culverts, conduits, and utilities of any nature, crossing the proposed improvement location, shall be plotted and labeled in the plan and profile.

F. A beginning and ending contract note and station shall be shown on the Title Sheet and in the plans for all interceptor sewers, major through channels and major storm sewers.

G. Match lines shall be used for transitioning coverage from one sheet to the next. A cross-reference shall be shown on each sheet to identify the location of the attendant profile or plan sheet

H. No overlap of plan coverage from one sheet to the next is permitted. Match lines are to be used in plan view with proper referencing station and attendant sheet number.

I. Title Blocks are required for all sheets except cross-sections. Cross-section information to be used should be similar to that shown in Exhibit 4-15.

J. One-hundred-foot stations shall be shown.

K. Plan sheets must include a north arrow.

### 4.4.2 Plan View

In addition to those items listed in Section 4.4.1, the information to appear in the plan view shall include, but not be limited to, the following:

A. Locations of future connections (PSC, stubs, etc.).

B. The delta angle of all PI’s, except where more than one line intersects at the

same manhole or inlet. In those instances, the angles relating all lines shall be shown. When the delta angle is shown, its direction shall be noted (left or right), as the stations increase. All angles shall be shown to the nearest second.

C. The location of the centerline shall be referenced by dimensions to the easement lines and to the appropriate property lines.

D. When it is necessary to orient the alignment to a general locality, indicate the name and direction of the nearest street intersection with a distance to that intersection.

E. Bench marks shall be accurately plotted and labeled on the plans. A description and location of each bench mark, including its station and offset relative to the proposed line, shall be plotted and labeled. When bench marks cannot be plotted with the plan coverage, their location and description should still be shown on the plans where it would have appeared.

F. The precise location of all soundings and borings.

G. Houses, fences, and drives shall be shown for a minimum of 50 feet beyond the right-of-way or to the fronts of the houses for lines located in the street or rights-of-way. Trees, steps, walks and other topographic features shall be shown to the extent that they may be pertinent to the improvement location or construction. These items must be field located. Trees shall be shown with a designation of size and type with the dripline depicted graphically.

H. Property lines, lot lines, easement lines and other boundary lines shall be shown a minimum of 75 feet beyond any proposed or existing right-of-way. In instances where additional information might be required, the limit shall be extended.

I. Property Service Connection symbols for sanitary sewers, as shown in Exhibit 4-3 shall be shown near the lot line where service is expected to be required. For consistency, the symbol should be shown approximately 20 feet behind the property line. If a specific location for the connection needs to be shown, an arrow shall be added to the symbol indicating the desired location of service and a note shall be shown in the area indicating the station of the proposed Property Service Connection.

J. Generally, only the outside lines of a pipe shall be shown on the plans. However, a thin centerline shall be shown within these outside lines where any of the following conditions exist:

1. A distance is shown from a point or line to the centerline of the pipe.

2. The delta angle is shown.

3. The angle of intersection is shown.

Pipes larger than 24 inches in diameter should be drawn to scale to depict the true impact limits.

K. Existing ditches with a bottom width of 4 feet or less should be drawn using the centerline of the ditch. If the ditches and channels have a bottom width greater than 4 feet, each side of the ditch should be drawn, and its width be noted. Where ditch paving exists, the width of the paved area shall be shown.

L. Existing and proposed sewers, their direction of flow, size, and material shall be shown. The Deed Book and Page Number shall be shown for existing Sewer or Drainage Easements, which are impacted by sewer construction.

M. All water lines, gas lines, oil lines, electric and telephone conduits, fiber optic cables, and any other underground or overhead utilities shall be shown with the size or primary voltage and ownership identified.

N. All existing or proposed sewers, manholes and catch basins.

O. When sanitary sewers are to be in existing streets, the front dimension and bearing, if possible, of each lot shall be shown. When sanitary sewers are to be placed in easements or rights-of-way, property line dimensions adjacent to the proposed sewer construction shall be shown.

P. Highways, street names, alleys, or major streams and ditches shall be shown. The width and type of all surfaces shall be indicated.

Q. Street right-of-way widths shall be shown adjacent to and after the street name. For example: ROBIN ROAD (50' R/W) or ROBIN ROAD (R/W varies) - if the width is not uniform.

R. The name of all baselines shall be shown. The pipe size and direction of flow shall be noted on all pipes, above the pipe and between all manholes.

S. The general notes and a legend of the standard symbols used throughout the plans shall be shown on the Plan Index Sheet or on the first plan sheet if the plan index is shown on the Title Sheet.

T. Stations shall be shown above each 100-foot station on 50-scale and 20- scale plans and above each 500-foot station on 100-scale plans. For example: 1+00, 5+00, etc. All horizontal curve data shall be shown on the plans, if applicable.

U. The phrase, "Do Not Disturb", shall be used to indicate existing conditions or facilities, which are to remain in place during construction. The phrase or abbreviation, "DND", shall be shown adjacent to all such items on the plans. If used, "DND" must be shown and defined in the legend. Likewise, "DNR", "Do Not Remove", may be used to indicate existing conditions or facilities which are to remain in place during construction but which some level of disturbance is anticipated. The size and type of items, which are within the

construction area, must be clearly identified. This information is critical to assist in the easement acquisition process.

V. The resurfacing limits will be shown for all projects receiving final resurfacing.

W. Where applicable, add the following: storm sewer pipe and PSC charts.

### 4.4.3 Profile View

In addition to those items listed in Section 4.4.1, the information to appear in the profile view shall include the following as a minimum:

A. Stations and grid elevations shall be shown. The grid shall be set up on a 2-inch square basis. The vertical scale for 50-scale plans shall be 1" = 5' and for 20-scale plans shall be 1" = 2'.

B. The limits, by station, shall be shown for all concrete caps, cradles and encasements, tunnels, and bored segments.

C. When a line located in an easement crosses a public right-of-way, the limits of that right-of-way, including its width, shall be shown.

D. Information relative to whether the line will be constructed in an easement, right-of-way, or existing Floyd County property shall be shown directly above the profile grid.

E. The type of backfill used, when not identified in the general notes, shall be placed directly above the profile grid with a leader and arrow defining the limits of each type of backfill.

F. The ASTM or AASHTO designation (whichever applies) and pipe classification shall be shown below the pipe profile.

G. The pipe size, grade, and distance between the centerline of the manholes shall be indicated between all manholes. This information shall be parallel to and shown above smaller pipes; however, on pipes of sufficient diameter, this information should be placed inside the pipe. Grades shall be shown as a percent, i.e., 0.50%.

H. Invert elevations shall be shown to the nearest hundredth of a foot and at the following locations:

1. All breaks in the grade.

2. Breaks necessary for profile continuation onto another sheet.

3. Centerline of standard manholes with continuous grade. Other conduits critical to the pipe gradient.

4. Intersecting pipe.

5. All locations necessary to substantiate the profile grade.

6. Both pipe invert edges when there is a drop or slant inlet.

7. Other conditions shown on the typical drawings.

8. Each catch basin or surface inlet connection.

9. Labeled similar to: IE 479.48.

I. Manholes shall be identified by station, line and manhole number. Proposed manhole rim elevations shall be shown to the nearest tenth (Rim El. 424.9±) in earth areas and to the nearest hundredth in paved areas. Surface inlet grates shall also be shown to the nearest hundredth (Gr. El. 418.76).

J. The water surface elevations of ponding and/or 100-year flooding areas shall be shown.

K. Borings indicating depths and type of soils encountered shall be shown if not shown on a separate soils sheet.

L. The results of all soundings shall be shown using the proper symbol.

M. The vertical height of manhole collars shall be shown.

N. The flow line of all ditches having impact on sewer depth or location which are deeper than one foot shall be plotted and labeled as flowline ditch, left or right. On large channels, it may be necessary to show left and right tops of bank.

O. Existing ground profile including street grades or other improvements shall be shown as dashed lines. Proposed ground profile, including any proposed street grades or improvements, shall be shown as a solid line. See Exhibit 4-1.

P. If basements exist, the basement floor elevation shall be shown for sanitary plans. For houses without basements, the first-floor elevations shall be shown. When an existing basement floor elevation absolutely cannot be obtained, a first-floor elevation shall be obtained, and a basement elevation estimated. When the basement elevation is estimated, this fact shall be duly noted in the profile by using the word "Assumed" adjacent to the elevation. House numbers or lot numbers shall be indicated on the profile along with elevations indicated above.

Q. In order to show on which side of the sewer a house is located, houses on the left (when facing up station) shall be drawn using a solid line, and houses on the right (when facing up station) shall be drawn using a dashed line as shown

in Exhibit 4-2.

R. Any stacks to be shown on the profile, such as for interceptor sewers, shall be shown solid on the left side and dashed on the right side and should be labeled pipe size stack and left or right.

S. Any underground telephone conduit, water lines, gas lines, etc. shall be shown when crossing proposed Floyd County facilities.

### 4.4.4 Cross Sections

The information to be shown on cross-sections shall be, but not limited to, the following:

A. Horizontal and vertical scales shall be equal. Generally, a scale of 1" = 5' shall be used; however, 1" = 10' may be used in special circumstances. Any other scale to be used requires prior approval of the Project Manager.

B. Pre-printed colored grid sheets shall not be used because they cannot be scanned on computer for record.

C. Cross-sections shall be required for all proposed ditch projects as well as roadway or alley construction.

D. Cross-sections should show the existing and proposed ground lines, utilities, fences, structures, property lines, easement lines, and right-of-way lines.

E. Cross-sections shall be shown looking up station and shall be placed on the sheet progressing from bottom of sheet for lower station to top of sheet for higher station and left to right if more than one row of cross-sections is presented on one sheet.

F. Cross-sections shall generally be on even 50-foot stations along the improvement centerline or baseline.

G. If cross-sections are required on a project, pipe crossings may be shown on a cross-section rather than creating a separate profile for each pipe crossing.

H. Half-sections shall be shown for all driveways and a minimum of one half-section between driveways.

I. All water lines, gas lines, telephone conduit, and others shall be shown in the cross-section.

J. Existing ground shall be shown as dashed lines and proposed grade shall be shown with solid lines.

### 4.4.5 General Notes

General Notes are notes common to the complete set of plans and shall be shown on the first plan sheet, if space permits, or Title Sheet, if necessary. The type of backfill, pipe material and classification may be shown in the General Notes if the majority of the pipes on a particular project have these items in common. Additionally, a Legend shall be shown on the first plan sheet, which defines the standard symbols used in the plans.

### 4.4.6 Certification

#### 4.4.6.1 Surveyor's Certification

The following certification paragraph and signature is to be placed on all sanitary and drainage projects. This note will need to be adjusted if survey procedures deviate from the language as shown.

**CERTIFICATION**

I hereby certify that the topography for this plan was located under my supervision, and that the property lines shown hereon were obtained from recorded deeds or plats, and that only the property corners noted as monumented were located in the field.

Surveyor's Signature, L.S. # and Date

#### 4.4.6.2 Basement Elevation Certification (Sanitary Projects Only)

The registered Land Surveyor shall place the following certification on the preliminary plan cover sheet, or other appropriate location, prior to the request for a field review. The certification should also be placed on the first plan sheet or other appropriate location in the final plans prior to their submission to Floyd County for approval.

**CERTIFICATION**

I hereby certify that the houses shown on these plans, which have basement facilities controlling the elevation of the sanitary sewer, have been entered and controlling elevations determined under my supervision, and that these elevations are correct to the best of my knowledge and belief.

Surveyor's Signature, L.S. # and Date

NOTE: ON SANITARY PROJECTS THE CERTIFICATIONS CAN BE COMBINED AS A SINGLE NOTE IF APPLICABLE.

#### 4.4.6.3 Professional Engineer Certification

Plans and specifications shall be prepared by or under the personal supervision of a professional engineer, registered pursuant to IC 25-31-1. Final Plans and specifications submitted to Floyd County as well as applicable regulatory agencies shall be certified and sealed by a professional engineer. Registered land surveyors may prepare and certify plans for sanitary sewer extensions and storm drainage only as provided in IC 25-21.5-1-7.

EXHIBIT 4-1 PAGE 1
STANDARD LAYERS

EFFECTIVE DATE: DECEMBER 2012

| NAME | DESCRIPTION | COLOR | LINETYPE | LINETYPE EXAMPLES |
|---|---|---|---|---|
| BM | BENCH MARK | 50 | CONTINUOUS | |
| BORDER-0 | BASE SHEET LAYER | 12 | CONTINUOUS | |
| BORDER-1 | BASE SHEET LAYER | 20 | CONTINUOUS | |
| BORDER-2 | BASE SHEET LAYER | 40 | CONTINUOUS | |
| BORDER-3 | BASE SHEET LAYER | 50 | CONTINUOUS | |
| BORDER-4 | BASE SHEET LAYER | 150 | CONTINUOUS | |
| BORDER-ROLL | BASE SHEET LAYER | 2 | CONTINUOUS | |
| DRNA | DRAINAGE AREA | 230 | HIDDEN | |
| E-ASPH | EXISTING ASPHALT | 12 | HIDDEN | |
| E-BASE | EXISTING BASELINE | 130 | CONTINUOUS | |
| E-BLDG | EXISTING BUILDING | 32 | CONTINUOUS | |
| E-CONC | EXISTING CONCRETE | 12 | HIDDEN | |
| E-CONT-MJR | EXISTING MAJOR CONTOUR | 22 | HIDDEN2 | |
| E-CONT-MNR | EXISTING MINOR CONTOUR | 12 | HIDDEN2 | |
| E-CONT-TXT | EXISTING CONTOUR TEXT (L80) | 12 | CONTINUOUS | |
| E-CRST | EXISTING CRUSHED STONE | 172 | HIDDEN4 | |
| E-DTCH-E | EXISTING EARTH DITCH | 102 | FLOW LINES | |
| E-DTCH-P | EXISTING PAVED DITCH | 102 | DASHED2 | |
| E-ESMNT | EXISTING EASEMENTS | 102 | PERM ESMT | |
| E-FENC | EXISTING FENCES | 12 | FENCE | X X |
| E-FLTS | EXISTING FAULTS | 7 | CONTINUOUS | |
| E-GRND | EXISTING GROUND (TOP OF BANK) | 22 | EXIST SHOULDER | |
| E-PL | EXISTING PROPERTY LINES | 162 | CONTINUOUS | |
| E-PL-CH | EXISTING PROPERTY LINE CHORD | 162 | HIDDEN2 | |
| E-ROAD | EXISTING EDGE OF ROAD, PAVEMENT | 162 | EXIST EDGE PVMT | |
| E-RR | EXISTING RAILROADS | 32 | CONTINUOUS | |
| E-RW | EXISTING RIGHT OF WAY | 115 | RIGHT OF WAY | |
| E-SANI * | EXISTING SANITARY SEWERS | 102 | HIDDEN 2 | |
| E-SPOT | EXISTING SPOT ELEVATION (L80) | 195 | CONTINUOUS | |
| E-STRM * | EXISTING STORM SEWERS | 102 | EXIST PIPE OR STRUCT | |
| E-STRP | EXISTING PAVEMENT STRIPING | 16 | CONTINUOUS | |
| E-TOPO | EXISTING TOPOGRAPHY | 12 | CONTINUOUS | |
| E-U-CBTV | EXISTING OVERHEAD CABLE TELEVISION | 12 | OHC | OHC |
| E-U-CBTV2 | EXISTING UNDERGROUND CABLE TELEVISION | 12 | CABLETV | CTV |
| E-U-ELEC | EXISTING OVERHEAD ELECTRIC | 22 | OHE | OHE |
| E-U-ELEC2 | EXISTING UNDERGROUND ELECTRIC | 12 | ELEC | UGE |
| E-U-GAS * | EXISTING GAS | 92 | GAS | G G |
| E-U-TELE | EXISTING OVERHEAD TELEPHONE | 92 | OHT | OHT |
| E-U-TELE2 | EXISTING UNDERGROUND TELEPHONE | 92 | TELE | UGT |
| E-U-WATR * | EXISTING WATER | 172 | WATER | W W |
| E-VEG | EXISTING VEGETATION, TREES, SHRUBS | 12 | CONTINUOUS | |
| FILE-INFO | FILE INFORMATION | 7 | CONTINUOUS | |
| GL | GRID LINE | 252 | CONTINUOUS | |
| GT | GRID TEXT (L120) | 7 | CONTINUOUS | |
| HT | HATCH | 92 | CONTINUOUS | |
| P-ASPH | PROPOSED ASPHALT | 215 | CONTINUOUS | |
| P-ASPH-HT | PROPOSED ASPHALT HATCH PATTERN | 182 | CONTINUOUS | |
| P-BASE | PROPOSED BASELINE | 230 | CONTINUOUS | |
| P-BLDG | PROPOSED BUILDING | 230 | CONTINUOUS | |
| P-CONC | PROPOSED CONCRETE | 214 | CONTINUOUS | |
| P-CONC-HT | PROPOSED CONCRETE HATCH PATTERN | 188 | CONTINUOUS | |

* SEE EXHIBIT 4-2 FOR ADDITIONAL EXPLANATION.

EXHIBIT 4-1 PAGE 2
STANDARD LAYERS

EFFECTIVE DATE: DECEMBER 2012

| NAME | DESCRIPTION | COLOR | LINETYPE | LINETYPE EXAMPLES |
|---|---|---|---|---|
| P-CONT-MJR | PROPOSED MAJOR CONTOUR | 210 | CONTINUOUS | |
| P-CONT-MNR | PROPOSED MINOR CONTOUR | 200 | CONTINUOUS | |
| P-CONT-TXT | PROPOSED CONTOUR TEXT (L100) | 210 | CONTINUOUS | |
| P-CRST | PROPOSED CRUSHED STONE | 213 | CONTINUOUS | |
| P-CURB | PROPOSED CONCRETE CURB | 40 | CONTINUOUS | |
| P-DSTB | PROPOSED DISTURB LIMITS | 89 | DOT2 | |
| P-DTCH-E | PROPOSED EARTH DITCH | 210 | FLOW LINES | |
| P-DTCH-P | PROPOSED PAVED DITCH | 210 | CONTINUOUS | |
| P-EPSC | PROPOSED SILT CONTROL DEVICES | 50 | CONTINOUS | |
| P-FENC | PROPOSED FENCE | 210 | FENCE | |
| P-FLOW | PROPOSED DRAINAGE DIRECTIONAL FLOW ARROW | 20 | CONTINUOUS | |
| P-GRND | PROPOSED GROUND | 210 | CONTINUOUS | |
| P-PERM | PROPOSED PERMANENT EASEMENTS | 210 | PERM ESMT | |
| P-PL | PROPOSED PROPERTY LINE | 245 | CONTINOUS | |
| P-ROAD | PROPOSED EDGE OF ROAD, PAVEMENT | 240 | CONTINUOUS | |
| P-RW | PROPOSED RIGHT OF WAY | 233 | RIGHT OF WAY | |
| P-SANI * | PROPOSED SANITARY SEWERS | 210 | CONTINUOUS | |
| P-SF | PROPOSED SILT FENCE \ TREE PROTECTION FENCE | 50 | SF | SF |
| P-SPOT | PROPOSED SPOT ELEVATION (L80 w/o obliquing) | 40 | CONTINUOUS | |
| P-STRM * | PROPOSED STORM SEWERS | 211 | CONTINUOUS | |
| P-STRP | PROPOSED PAVEMENT STRIPING | 52 | CONTINUOUS | |
| P-TEMP | PROPOSED TEMPORARY EASEMENT | 190 | TEMP ESMT | |
| P-U-CBTV | PROPOSED OVERHEAD CABLE TELEVISION | 200 | PROP OHC | OHC |
| P-U-CBTV2 | PROPOSED UNDERGROUND CABLE TELEVISION | 200 | PROP UGC | UGC |
| P-U-ELEC | PROPOSED OVERHEAD ELECTRIC | 201 | PROP OHE | OHE |
| P-U-ELEC2 | PROPOSED UNDERGROUND ELECTRIC | 201 | PROP UGE | UGE |
| P-U-GAS * | PROPOSED GAS | 205 | GAS | G |
| P-U-TELE | PROPOSED OVERHEAD TELEPHONE | 203 | PROP OHT | OHT |
| P-U-TELE2 | PROPOSED UNDERGROUND TELEPHONE | 203 | PROP UGT | UGT |
| P-U-WATR * | PROPOSED WATER | 200 | WATER | W |
| P-VEG | PROPOSED VEGETATION, TREES, SHRUBS, ETC. | 205 | CONTINUOUS | |
| PAPER | PAPER | 7 | CONTINUOUS | |
| PNTS | POINTS MADE FROM LDD / CIVIL 3D | 7 | CONTINUOUS | |
| PRELIM | PRELIMINARY | 7 | CONTINUOUS | |
| SL | STATION LABELS (L140) | 7 | CONTINUOUS | |
| SNDG | ROCK SOUNDINGS | 55 | CONTINUOUS | |
| TX0 | TEXT L60 | 12 | CONTINUOUS | |
| TX1 | TEXT L80 | 20 | CONTINUOUS | |
| TX2 | TEXT L100 | 40 | CONTINUOUS | |
| TX3 | TEXT L120 | 50 | CONTINUOUS | |
| TX4 | TEXT L140 | 70 | CONTINUOUS | |
| TX5 | TEXT L175 AND ABOVE | 80 | CONTINUOUS | |
| XREF | EXTERNAL REFERENCE | 7 | CONTINUOUS | |

* SEE EXHIBIT 4-2 FOR ADDITIONAL EXPLANATION.

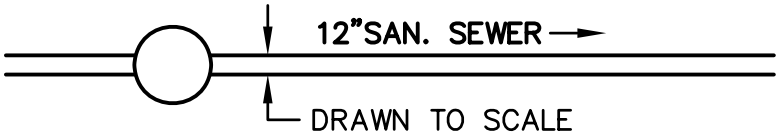
EXHIBIT 4-2
STANDARD LINETYPE EXHIBITS AND MISCELLANEOUS FEATURES

EFFECTIVE DATE: DECEMBER 2012

## LINETYPES

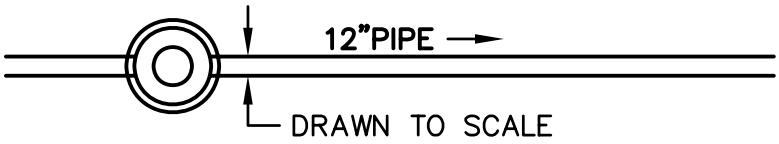
EXISTING SANITARY SEWER


PROPOSED SANITARY SEWER




EXISTING STORM SEWER


PROPOSED STORM SEWER




## APPLIES TO GAS AND WATER

EXISTING UTILITY UP TO 10"


EXISTING UTILITY 12"AND LARGER SHOWN WITH ACTUAL WIDTH ASSIGNED TO LINE,

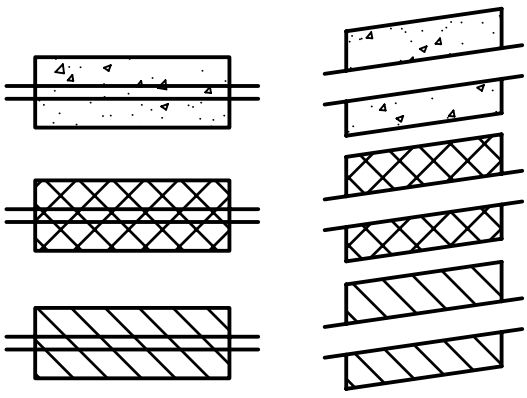

## MISCELLANEOUS FEATURES

PLAN PROFILE

CONCRETE ENCASEMENT

TUNNELING OR PIPE JACKING

BORE & JACK OR DIRECTIONAL DRILLING

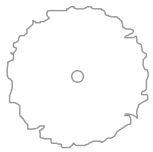


EXISTING BUILDINGS IN PLAN (FIELD LOCATED)

EX BUILDINGS IN PROFILE LEFT AND RIGHT OF BASELINE

EXHIBIT 4-3 PAGE 1
STANDARD SYMBOLS

EFFECTIVE DATE: DECEMBER 2012

| SYMBOLS | DESCRIPTION |
|---|---|
|  | *Existing Tree (with size, type & drip line diameter)** <br>* When locating tree sizes for plan views, measure diameter of trunk at breast height (in inches) and measure actual diameter of Drip line to the nearest foot. |
|  | *Existing Pine or Spruce W/Size* |
|  | *Existing Bush W/Size* |
|   | *Edge of Woods* |
|  | *Existing Traffic Sign* |
|   | *Existing Mailbox* |
|   | *Existing Paperbox* |
|  | *Contract Bench Mark* |
|  | *Existing Guy Anchor* |
|  | *Existing Power Pole* |
|  | *Existing Pole W/Light* |
|  | *Existing Light Post* |
|   | *Existing Electrical Pedestal* |
|  | *Existing Electrical Manhole* |
|  | *Existing Telecommunications Manhole* |
|   | *Existing Telecommunications Pedestal* |
|   | *Existing Cable T.V. Pedestal* |
|   | *Overhead Power Lines (Profile)* |
|   | *Existing Gas Meter* |
|   | *Existing Gas Valve* |
|   | *Existing Gas Line Marker* |
|  | *Existing Fire Hydrant* |
|   | *Existing Water Meter* |
|   | *Existing Water Valve* |
|  | *Existing Water Manhole* |
|   | *Existing Water Line Marker* |

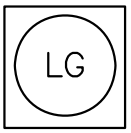
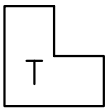
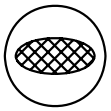
| SYMBOLS | DESCRIPTION |
|---|---|
| CO | *Existing Sewer Clean–out* |
| S | *Existing Sanitary Manhole* |
| M.H. | *Existing Storm Manhole* |
| | *Existing Catch Basin (Single)* |
| | *Existing Catch Basin (Double)* |
| | *Existing Catch Basin (Round)* |
| Steel | *Bridge (type of bridge shall be noted)* |
| R.P. | *Railway Pole* |
| | *Railroad Rails (Profile)* |
| P.L. (PIPE) | *Existing Property Line Pipe (TYPE)* |
| | *Right Of Way Marker* |
| 3 | *Parcel Number* |
| C–3 | *Consent and Release Parcel Number* |
| S• | *Sounding Location (Plan)* |
| | *Sounding To Rock or Refusal (Profile)* |
| | *Sounding No Rock (Profile)* |
| B–0 | *Boring Location And Number. Geotechnical borings were drilled utilizing a truck–mounted drill rig. Borings were taken to a depth of one foot below flow line or until refusal.* |
| | PROPOSED EMBANKMENT OR EXCAVATION SLOPE |
| | PROPOSED STORM MANHOLE |
| | PROPOSED DOUBLE CURB INLET |
| | PROPOSED CATCH BASIN DOUBLE |
| | PROPOSED SANITARY MANHOLE |

| SYMBOLS | DESCRIPTION |
|---|---|
|  | *Denotes 6" property service connection to be constructed to property or easement line as directed.* |
|  | *Denotes 6" Y or T branch with stopper. Property service connection is not to be constructed.* |
|  | ***Denotes 6" siamese property service connection (not permitted).*** |
|  | *Denotes 6" property service connection to be constructed from stack at sewer to property or easement line as directed. (See note below)* |
|  | *Denotes 6" Y or T branch with stopper to be constructed from stack at sewer. Property service connection is not to be constructed. (See note below)* |
|  | *Denotes a 6" property service connection (PSC) to be constructed. The PSC is <u>not</u> available for connection until the capacity charge, applicable at the time, is paid.* |

*Note: The following must be added to the general* notes:

***All stacks must conform to the requirements of section 12.14 of the New Albany and Floyd County Stormwater and Sanitary Sewer*** Design Manual.

MAPPING SYMBOLS AND NOMENCLATURE FOR EROSION AND SEDIMENT CONTROL PLANS FOR LAND DISTURBING ACTIVITIES

| DESCRIPTION | SYMBOL |
|---|---|
| SITE PREPARATION: | |
| LAND GRADING: |   |
| SURFACE ROUGHENING: |   |
| BULLDOZER TRACKED: |   |
| TREE PRESERVATION AND PROTECTION: |   |
| TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT: |   |
| BENCH TERRACING: |   |
| TOPSOILLING: |  |

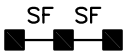
MAPPING SYMBOLS AND NOMENCLATURE FOR EROSION AND SEDIMENT CONTROL PLANS FOR LAND DISTURBING ACTIVITIES (CONT.)

| DESCRIPTION | SYMBOL |
|---|---|
| SURFACE STABILILIZATION: | |
| TEMPORARY SEEDING: | TS |
| PERMANENT SEEDING: | PS |
| SODDING: | SO |
| MULCHING: | M |
| DUST CONTROL: | DC |
| EROSION CONTROL BLANKET: | ECB |
| TURF REINFORCEMENT MAT: | TRM |

MAPPING SYMBOLS AND NOMENCLATURE FOR EROSION AND SEDIMENT CONTROL PLANS FOR LAND DISTURBING ACTIVITIES (CONT.)

| DESCRIPTION | SYMBOL |
|---|---|
| OUTLET PROTECTION: | |
| OUTLET STABILIZATION STRUCTURE: | OS |
| INLET PROTECTION: | IP |
| GRAVEL AND WIRE MESH INLET SEDIMENT FILTER: | GWI |
| FILTER FABRIC DROP INLET PROTECTION (TEMPORARY): | FDI |
| BLOCK AND GRAVEL INLET PROTECTION (TEMPORARY): | BGDI |
| STONE BAG INLET PROTECTION: | SIP |
| SEDIMENT TRAPS AND BARRIERS: | |
| TEMPORARY SEDIMENT TRAP: | TS |

MAPPING SYMBOLS AND NOMENCLATURE FOR EROSION AND SEDIMENT CONTROL PLANS FOR LAND DISTURBING ACTIVITIES (CONT.)

| DESCRIPTION | SYMBOL |
|---|---|
| SEDIMENT TRAPS AND BARRIERS (CONT): | |
| SEDIMENT BASIN: |   |
| SILT FENCE (SEDIMENT FENCE): |   |
| DITCH CHECK: |   |
| TEMPORARY SEDIMENT BASIN: |  |
| REINFORCED SILT FENCE: |   |
| STREAM PROTECTION: | |
| TEMPORARY STREAM CROSSING: |   |
| RIPRAP: |   |
| VEGETATED FILTER STRIPS: |   |

MAPPING SYMBOLS AND NOMENCLATURE FOR EROSION AND SEDIMENT CONTROL PLANS FOR LAND DISTURBING ACTIVITIES (CONT.)

| DESCRIPTION | SYMBOL |
|---|---|
| RUNOFF CONTROL MEASURES: | |
| PERMANENT CLEAN WATER: | PCW |
| TEMPORARY CLEAN WATER: | TCW |
| TEMPORARY SEDIMENT LADEN: | TSL |
| ROCKFILL: | RF |
| RUNOFF CONVEYANCE MEASURES: | RCM RCM RCM |
| GRASS–LINED CHANNELS: | GC GC GC |
| SOD LINED CHANNELS: | SC SC SC |
| RIPRAP–LINED CHANNELS: | RRC RRC RRC |
| TURF REINFORCED CHANNELS: | TRC TRC TRC |
| PAVED CHANNELS: | PC PC PC |
| TEMPORARY SLOPE DRAINS: | TSD TSD TSD |
| PIPE SLOPE DRAINS: | PSD PSD PSD |
| RUNOFF CONVEYANCE MEASURES (CONT): | |
| STONE BAG CHECK DAM: | SBCD SBCD SBCD |
| OTHER RELATED PRACTICES: | |
| SUBSURFACE DRAIN: | SSD SSD |
| CONSTRUCTION DEWATERING: | |

EXHIBIT 4-4
PEN SIZE ASSIGNMENTS

EFFECTIVE DATE: DECEMBER 2012

## STANDARD ASSIGNMENTS

| *PEN SIZE* | *COLOR* | *COLOR RANGE 1* | *COLOR RANGE 2* | *COLOR RANGE 3* | *COLOR RANGE 4* |
|---|---|---|---|---|---|
| 0.18mm | 1, 9, 250 | 10-19 | 90-99 | 170-179 | |
| 0.25mm | 2, 251 | 20-29 | 100-109 | 180-189 | |
| 0.30mm | 3, 252 | 30-39 | 110-119 | 190-199 | |
| 0.35mm | 4, 253 | 40-49 | 120-129 | 200-209 | 160-169 |
| 0.50mm | 5, 254 | 50-59 | 130-139 | 210-219 | |
| 0.60mm | 6, 255 | 60-69 | 140-149 | 220-229 | |
| 0.70mm | 7 | 70-79 | 150-159 | 230-239 | |
| 0.90mm | 8 | 80-89 | | 240-249 | |

## SHADING

**All pens in the following ranges ending with the number 2 except "2" will plot shaded as follow**

| **COLOR** | | | **PLOTS** | | |
|---|---|---|---|---|---|
| 12-172 | | | 40% of black | | |
| 182 | | | 6% of black | | |
| 192-242 | | | 40% of black | | |
| 188 | | | 2% of black | | |
| 16 | | | 30% of black | | |

EXHIBIT 4-5
STANDARD ABBREVIATIONS

EFFECTIVE DATE: DECEMBER 2012

## DESCRIPTION

| | |
|---|---|
| PUE | Public Utility Easement |
| ATT | AT&T |
| Conc | Concrete |
| Asph | Asphalt |
| Culv | Culvert |
| Hdwl | Headwall |
| Hdw | Headwater |
| RCP | Reinforced Concrete Pipe |
| CMP | Corrugated Metal Pipe |
| CIP | Cast Iron Pipe |
| VCP | Vitrified Clay Pipe |
| PE | Polyethylene |
| DIP | Ductile Iron Pipe |
| PVC | Polyvinylchloride |
| HERCP | Horizontal Eliptical Reinforced Concrete Pipe |
| HDPE | High Density Polyethylene |
| HP | High Pressure |
| MH | Manhole |
| CB | Catch Basin |
| CI | Curb Inlet |
| TG | Top of Grate Elevation |
| I.E. | Invert Elevation |
| BM | Bench Mark |
| TBM | Temporary Bench Mark |
| CSB | Crushed Stone Base |
| R.R. | Railroad |
| R/W | Right–of–Way |
| DND | Do Not Disturb |
| DNR | Do Not Remove |
| TBR | To Be Removed |
| TYP. | Typical |

EXHIBIT 4-6
STANDARD BORDER

EFFECTIVE DATE: DECEMBER 2012

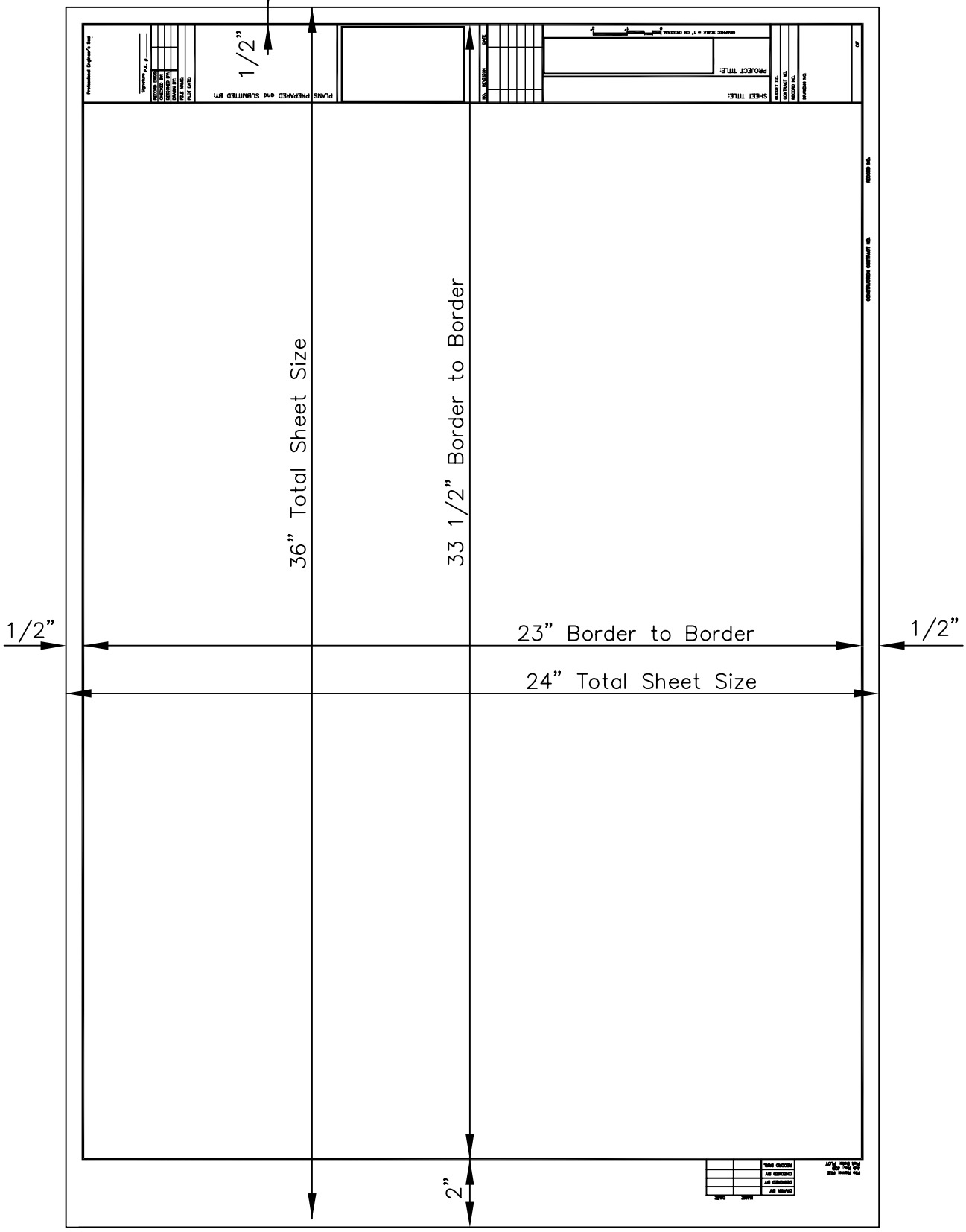


EXHIBIT 4-7
STANDARD TITLE BLOCKS

EFFECTIVE DATE: DECEMBER 2012

SHEET TITLE:

PROJECT TITLE:

SAMPLE DRAWINGS

GRAPHIC SCALE = 1" ON ORIGINAL

0 1" 2"

TITLE BLOCK

DESIGN
APPROVED: _____

APPROVED FOR
CONSTRUCTION: _____
DIRECTOR OF ENGINEERING DATE

APPROVAL BLOCK

| NO. | REVISION | DATE |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

REVISION BLOCK

CITY OF NEW ALBANY/FLOYD COUNTY

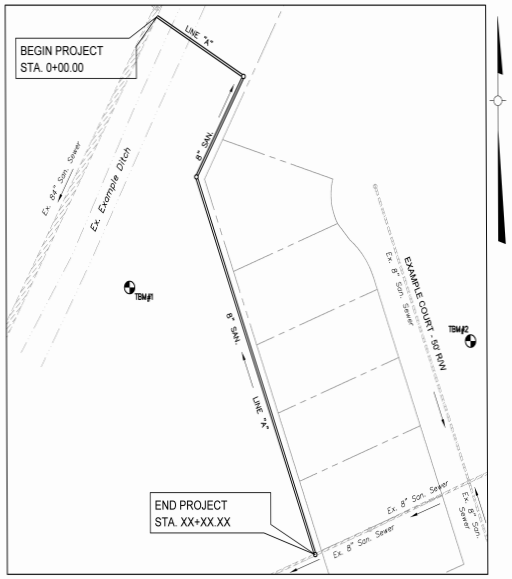
PROJECT NUMBER XXXXXX

# PROJECT TITLE

## SUB TITLE

| INDEX OF DRAWINGS | |
|---|---|
| SHEET NO. | DESCRIPTION |
| XX | COVER SHEET |
| XX | PLAN SHEET |
| XX | PROFILE SHEET |
| XX | PROPERTY SERVICE CONNECTION INLET SHEET |
| XX | DETAIL SHEET |
| XX | SERVICE AREA MAP |

PROJECT LOCATION MAP




SCALE: 1" = 50'

50' 25' 0 50' 100'

GRAPHIC SCALE

| | NAME | DATE |
|---|---|---|
| DRAWN BY: | XXX | XX/XX/XX |
| DESIGNED BY: | XXX | XX/XX/XX |
| CHECKED BY: | XXX | XX/XX/XX |
| ECORD DWG | XXX | XX/XX/XX |

| NO. | DATE | REVISION | CHK'D | APPR'D | DATE |
|---|---|---|---|---|---|
| XX | XX/XX/XXXX | XXXXXXXXXXX | XXX | XXX | XXX |
| XX | XX/XX/XXXX | XXXXXXXXXXX | XXX | XXX | XXX |
| XX | XX/XX/XXXX | XXXXXXXXXXX | XXX | XXX | XXX |
| XX | XX/XX/XXXX | XXXXXXXXXXX | XXX | XXX | XXX |
| XX | XX/XX/XXXX | XXXXXXXXXXX | XXX | XXX | XXX |

Signature Date — LAND SURVEYOR'S SEAL

Signature Date — PROFESSIONAL ENGINEER'S SEAL

PLANS PREPARED AND SUBMITTED BY:

DESIGN CONSULTANT

SAMPLE DEVELOPER NAME
XXXXX SAMPLE STREET, SUITE XXX
NEW ALBANY, IN 4713X–XXXX
(812) XXX – XXXX

OWNER / DEVELOPER

REVIEWER APPROVED: _____ DATE

DESIGN APPROVED: _____ DATE

APPROVED FOR CONSTRUCTION: _____ DATE

SPACE RESERVED FOR
CITY OF NEW
ALBANY/FLOYD COUNTY
LOGO AND ADDRESS

SCALE: AS SHOWN | DATE: | DRAWING NO.:

Sheet 1 of 1

EXHIBIT 4-8
STANDARD TITLE SHEET

EFFECTIVE DATE: DECEMBER 2012

EXHIBIT 4-9
SAMPLE PLAN INDEX SHEET

EFFECTIVE DATE: DECEMBER 2012

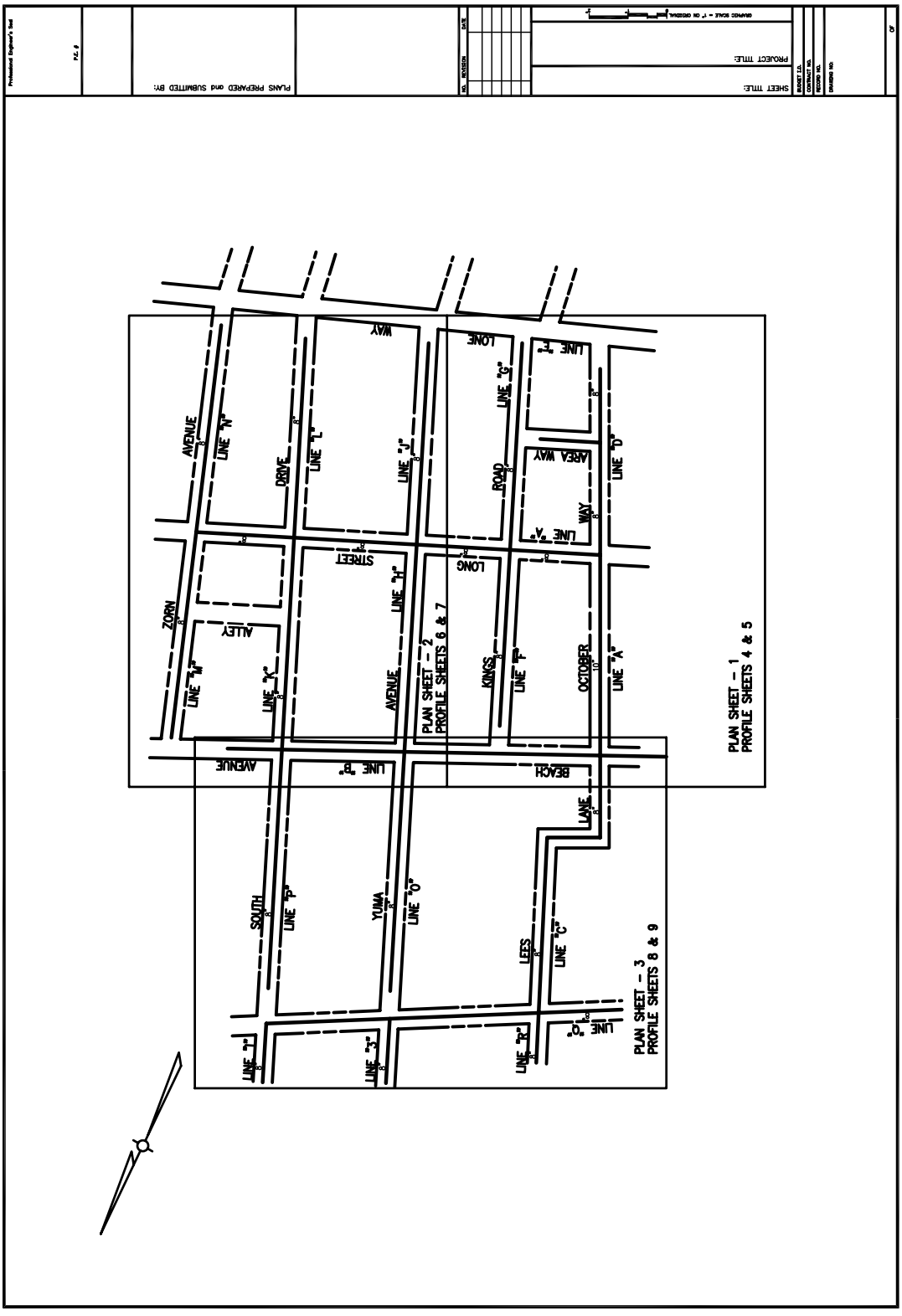


EXHIBIT 4-10
SAMPLE DRAINAGE MAP
(SANITARY COLLECTOR SYSTEM)

EFFECTIVE DATE: DECEMBER 2012

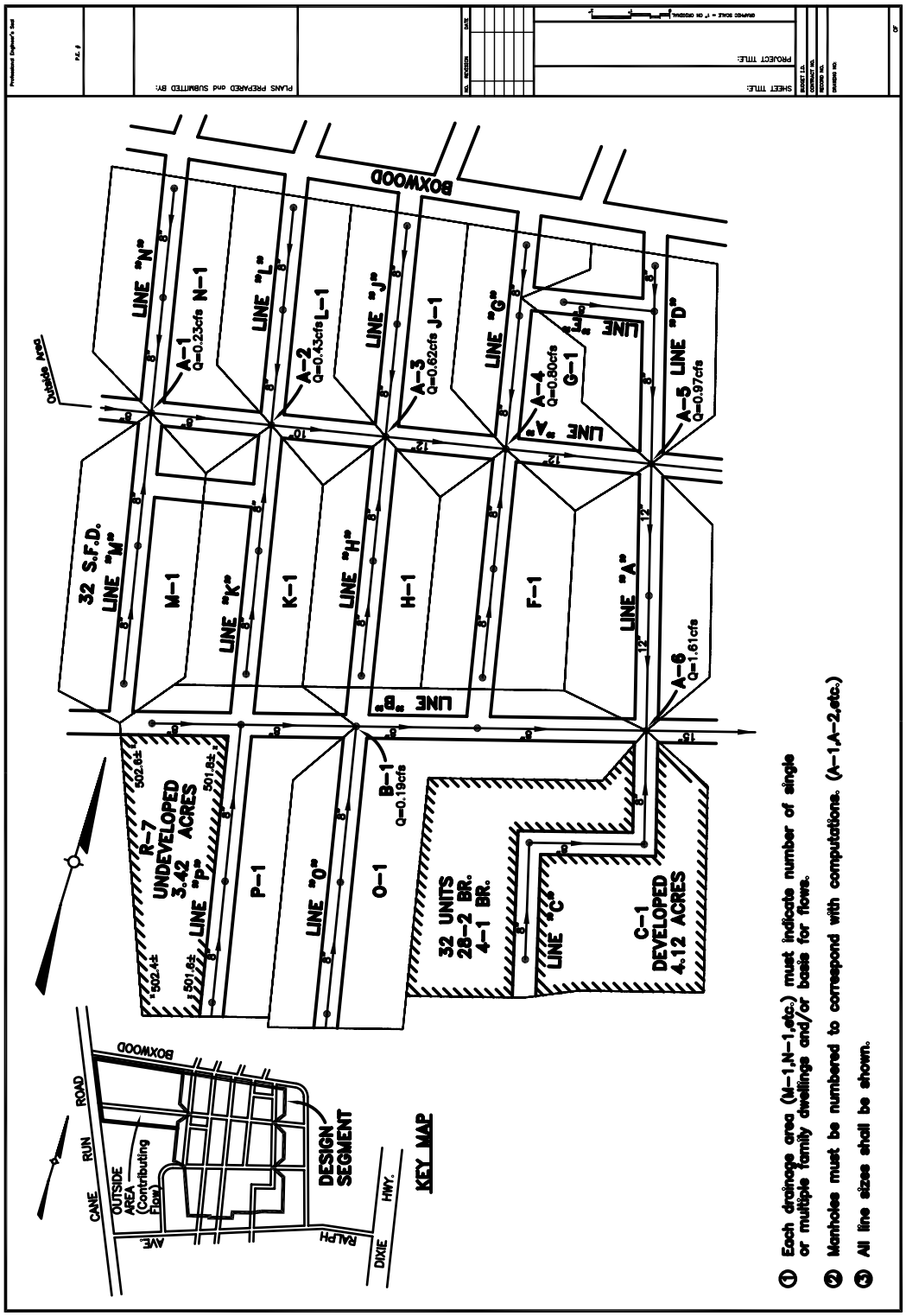


EXHIBIT 4-11
SAMPLE DRAINAGE MAP
(STORM COLLECTOR SYSTEM)

EFFECTIVE DATE: DECEMBER 2012

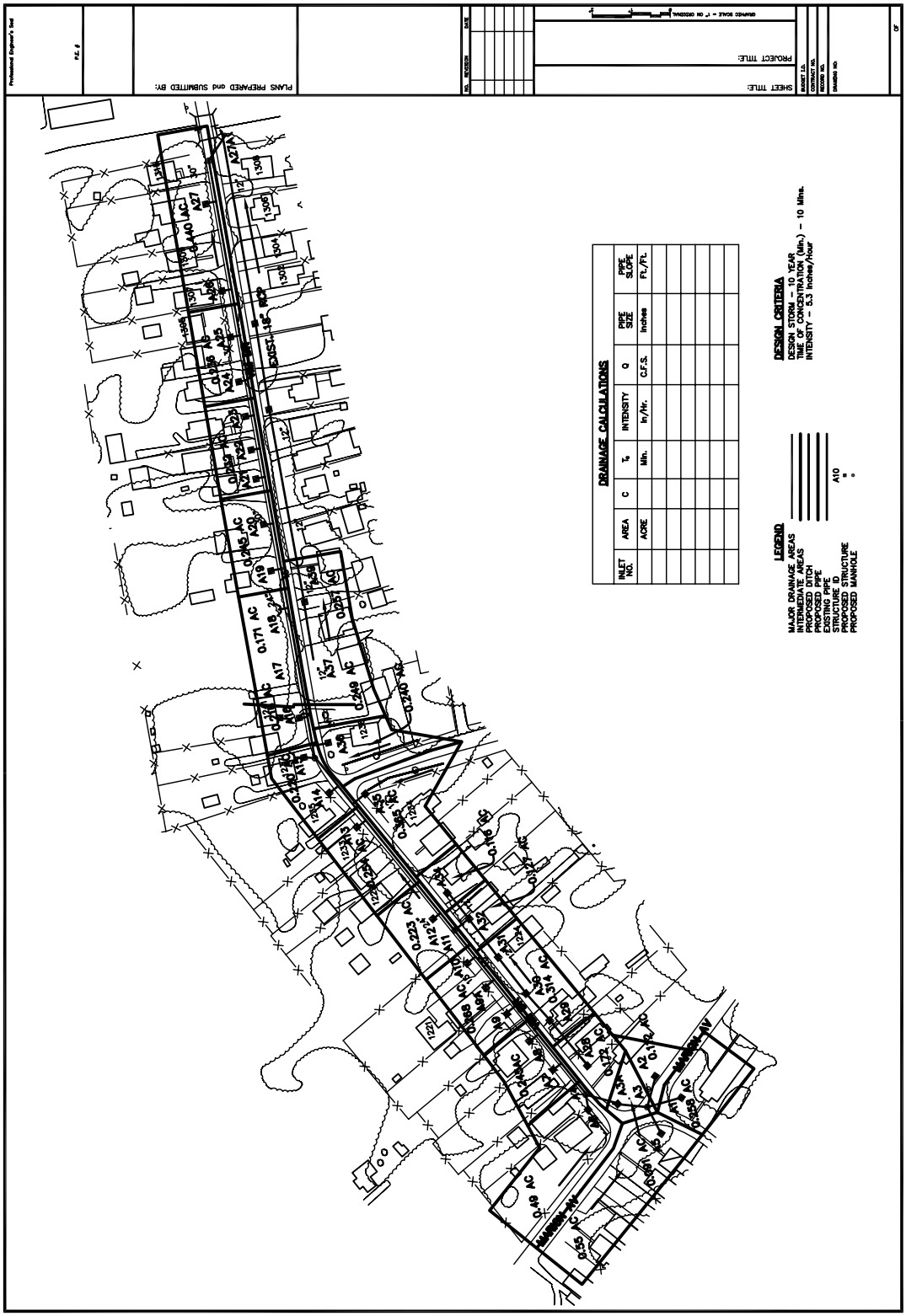
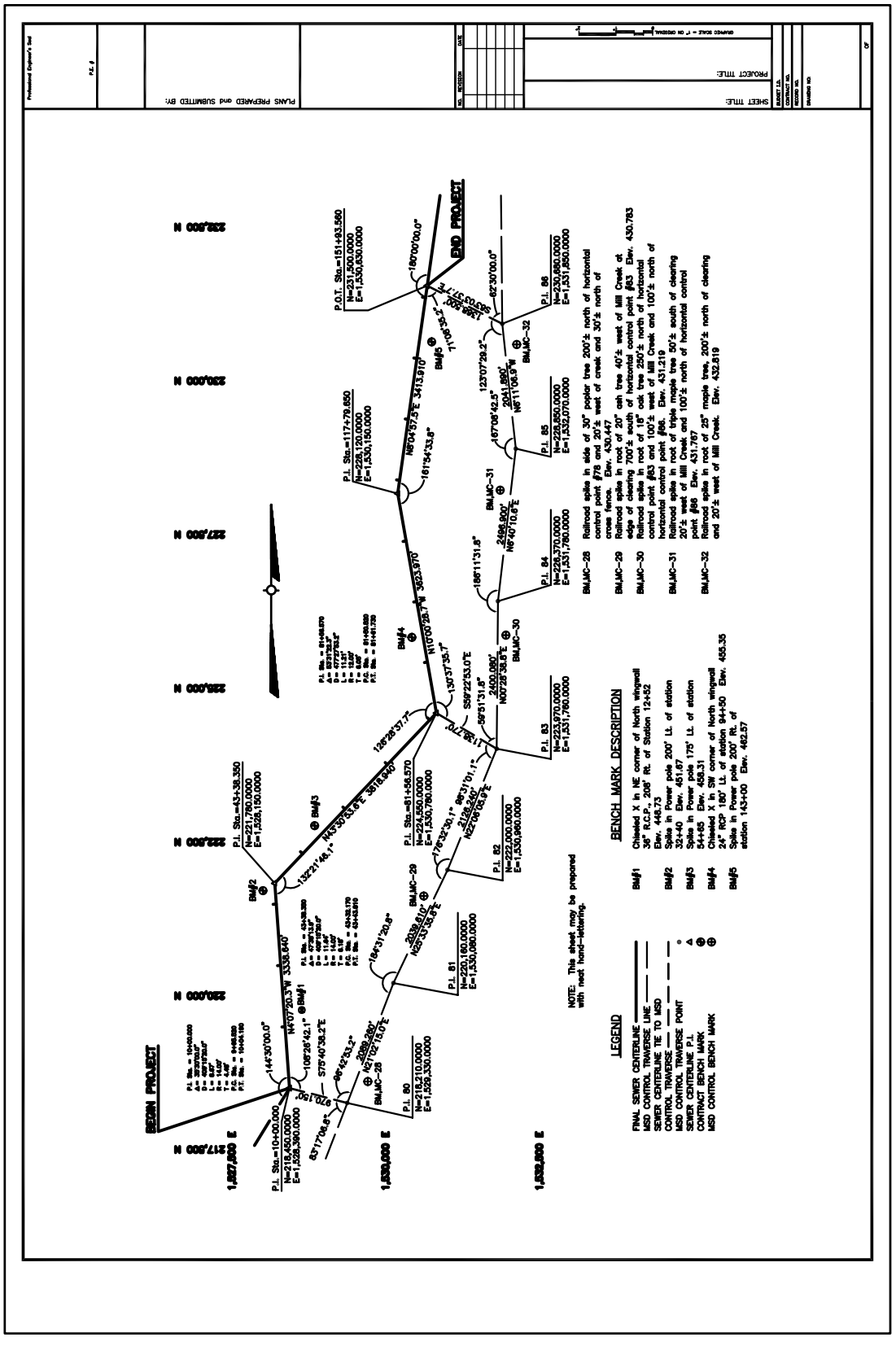


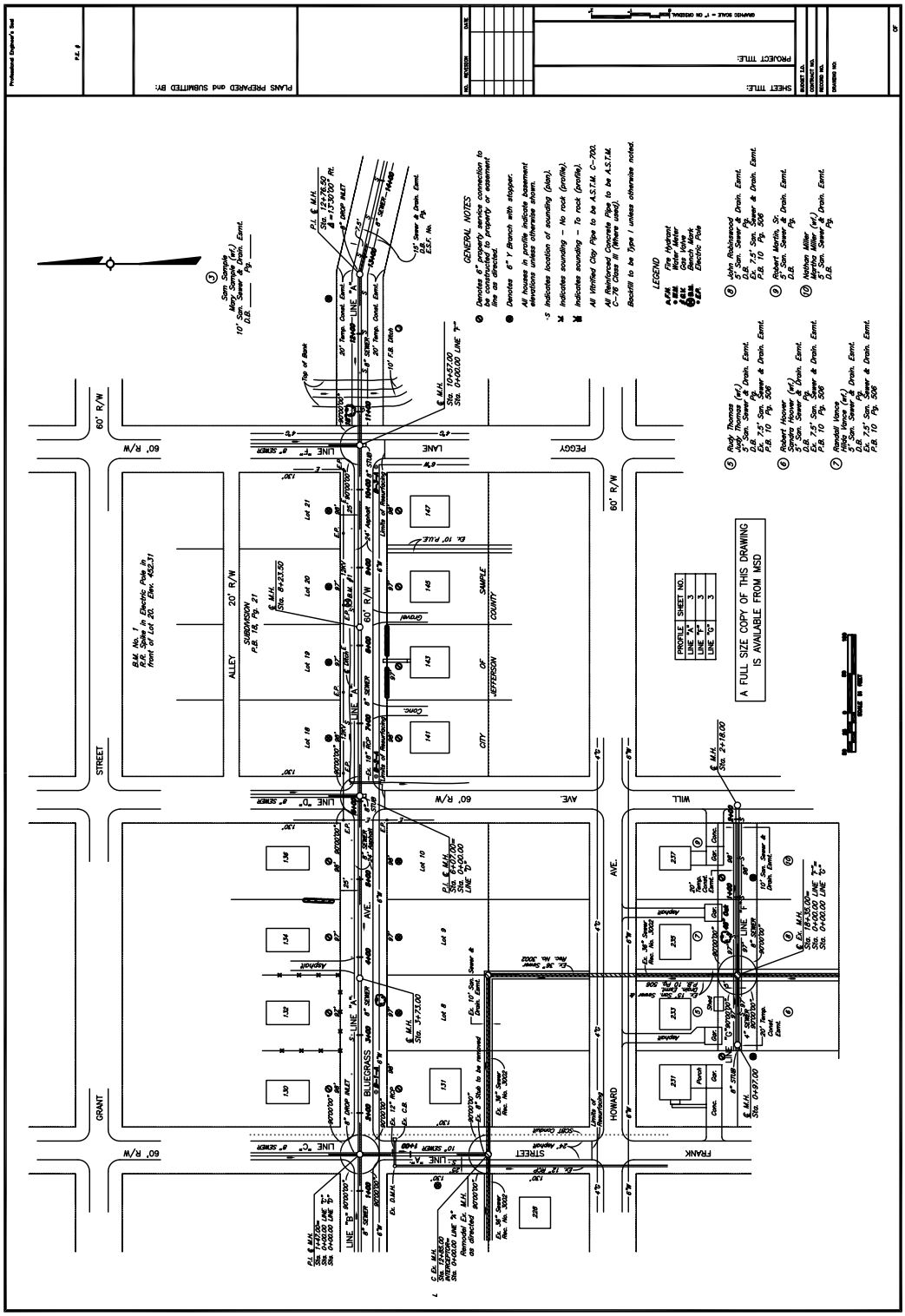
EXHIBIT 4-12
HORIZONTAL & VERTICAL
CONTROL MAP

EFFECTIVE DATE: DECEMER 2012



# EXHIBIT 4-13
# SAMPLE PLAN SHEET

## EFFECTIVE DATE: DECEMBER 2012



# EXHIBIT 4-14
# SAMPLE PROFILE SHEET

## EFFECTIVE DATE: DECEMBER 2012

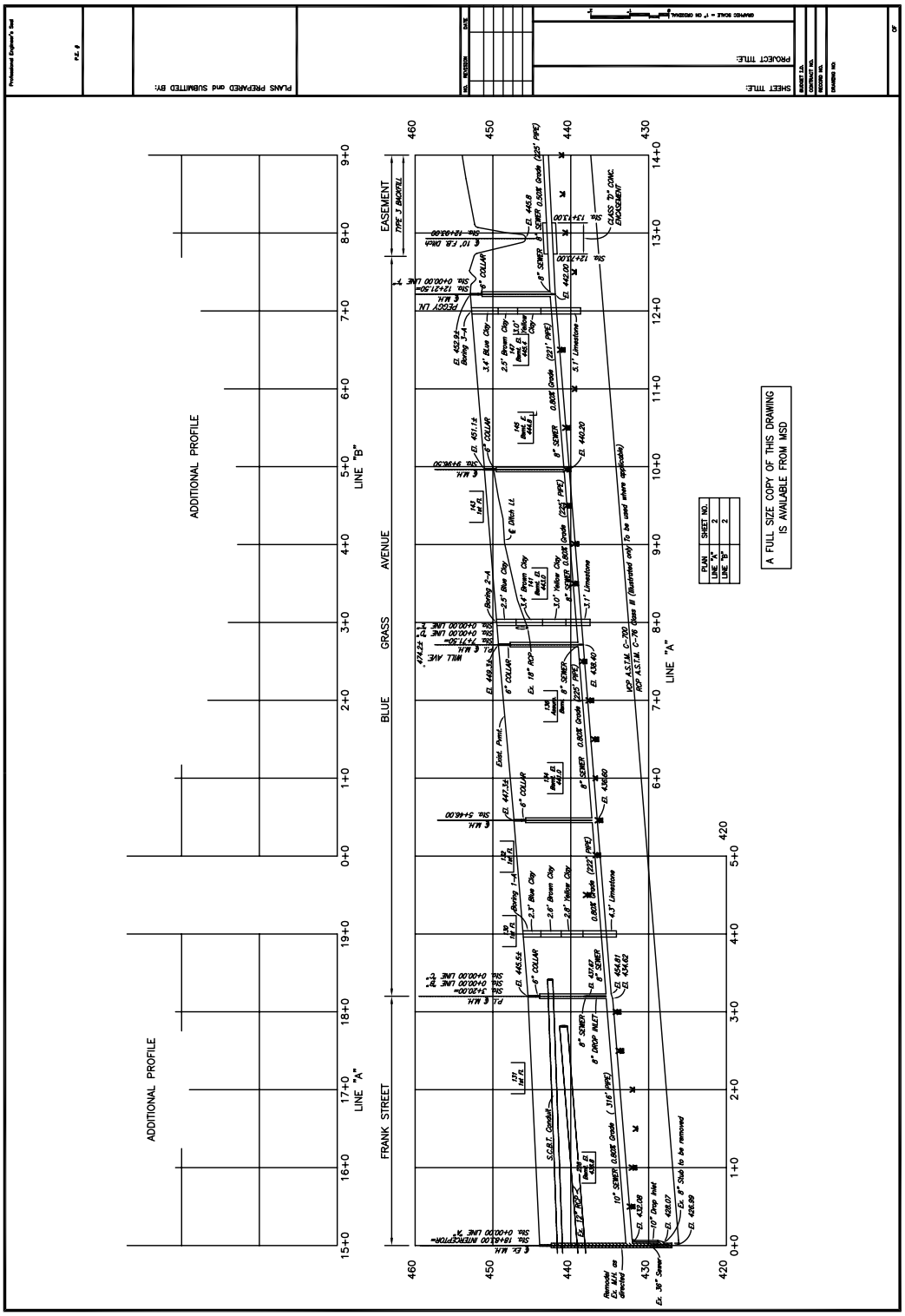
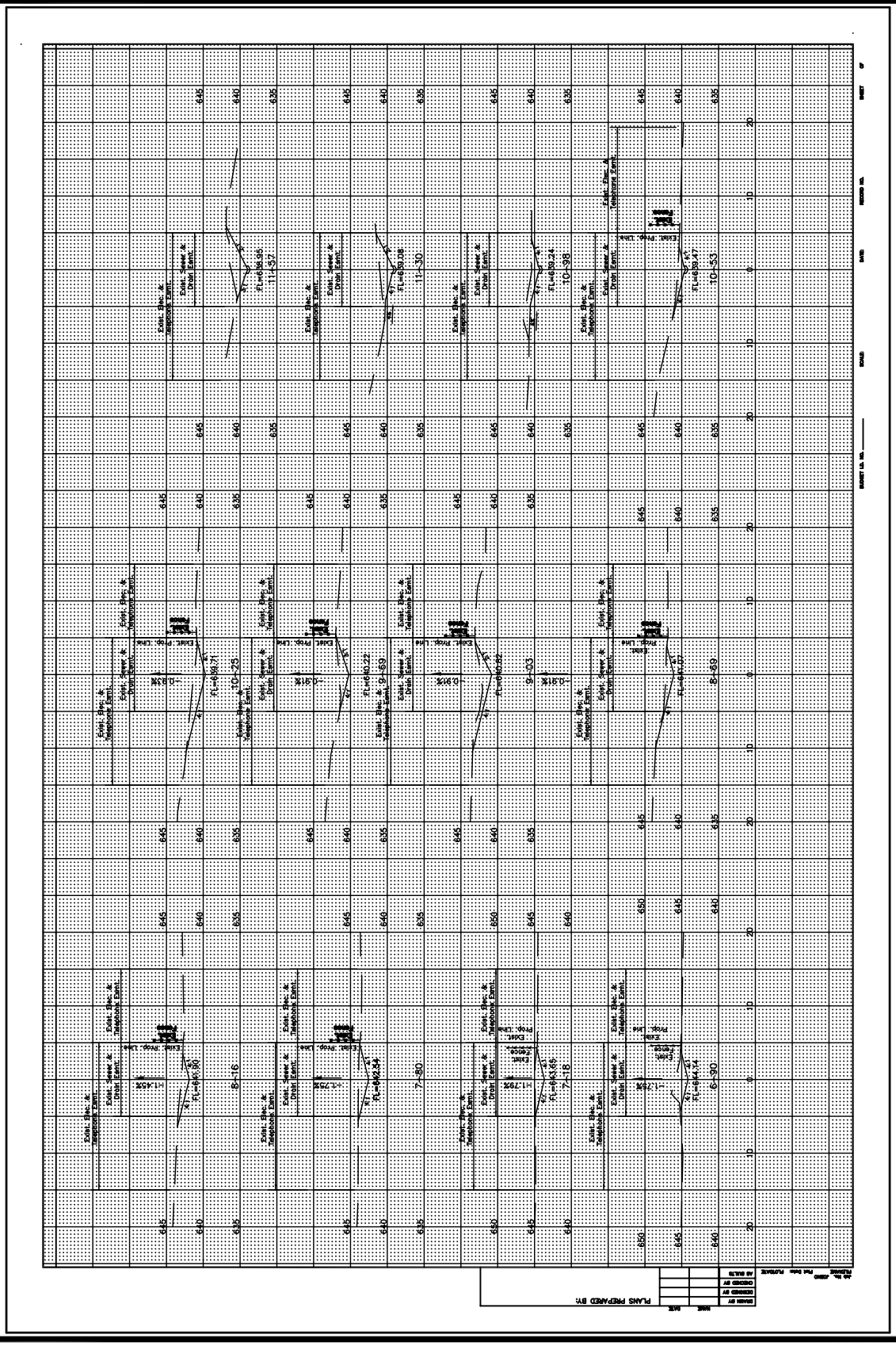
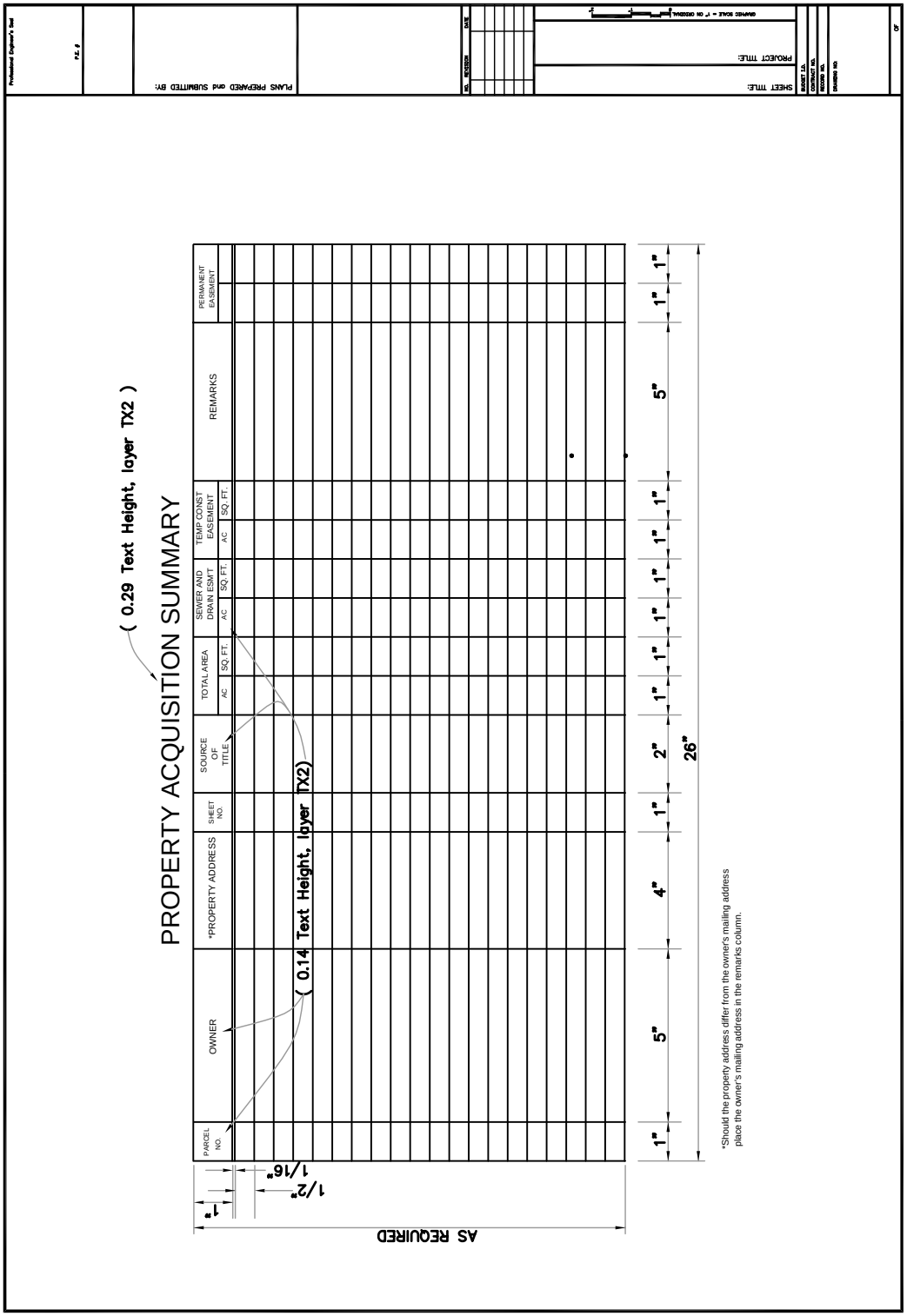


EXHIBIT 4-15
SAMPLE CROSS SECTION

EFFECTIVE DATE: DECEMBER 2012




PROPERTY ACQUISITION SUMMARY
( 0.29 Text Height, layer TX2 )
( 0.14 Text Height, layer TX2)
PARCEL NO.
OWNER
*PROPERTY ADDRESS
SHEET NO.
SOURCE OF TITLE
TOTAL AREA
AC.
SQ. FT.
SEWER AND DRAIN ESMT
TEMP. CONST EASEMENT
REMARKS
PERMANENT EASEMENT
1"
5"
4"
1"
2"
1"
1"
1"
1"
1"
1"
1"
5"
1"
26"
AS REQUIRED
1"
1/2"
1/16"
*Should the property address differ from the owner's mailing address place the owner's mailing address in the remarks column.

# TABLE OF CONTENTS

# CHAPTER 5
# FINAL RECORD DRAWINGS

# CHAPTER 5
# FINAL RECORD DRAWINGS

## 5.1 PURPOSE

This chapter establishes the procedures that must be followed by Design Engineers, Land Surveyors, Contractors, and Developers concerning Final Record Drawings to ensure that all proposed sanitary sewer and stormwater drainage plans correctly depict the facilities as constructed. The final record drawings are the "Bid Plans" that have been revised to identify changes that occurred during construction. This chapter applies to capital improvement and private development projects in Floyd County.

## 5.2 GENERAL

The Final Record Drawings shall be prepared by the project design engineer/consultant, based on record information provided by the contractor. At the completion of the project, the contractor will be responsible for providing Floyd County and the design engineer/consultant with a set of "Red Line Drawings" and "As-Built Survey Information". The information will be incorporated into the "Bid Plans" design AutoCAD files by the project design engineer/consultant to become the "Final Record Drawings" file. The Final Record Drawings are then saved in AutoCAD and PDF formats, with the file name format in accordance with the requirements of Chapter 4. The file will contain a "FRD" reference, differentiating it from the original "bid plans" file. In addition to submitting the Final Record Drawings in AutoCAD format, the project design engineer/consultant shall submit one (1) hard copy of the Final Record Drawings to Floyd County.

Note - On private development projects, the project owner will be responsible for preparing the Final Record Drawings, subject to the same above requirements.

In addition, it is preferable that the contractor also provides an ESRI geodatabase (shapefile) containing the attribute information shown on the template in Appendix D or an AutoCAD MAP file containing the required attribute information.

A. Construction Field Changes

Major deviations from the approved construction plans as a result of unexpected field conditions will require documentation and approval by Floyd County and the project design engineer/consultant prior to execution of the changes. It shall be up to the Floyd County inspector to determine if the deviation is minor and can be resolved on-site or if the deviation requires additional review and approval. If the inspector decides that the deviation needs to be reviewed by Floyd County and/or the design engineer, then the contractor shall submit four (4) copies of the marked-up (red line) plans showing the proposed revisions. Upon acceptance of the changes, Floyd County will mark the red line drawings approved, sign and date the approval and send the red line drawings to the construction site via the inspector. One copy will be for the contractor, one copy for the inspector, one copy for the design

engineer/consultant, and one copy for Floyd County's file. In the event that an inspector is not assigned to a project, then the contractor shall submit red line drawings for all deviations that occur from the construction plans.

B. Red Line Drawings

As the project progresses, the Contractor shall maintain a record of all deviations in location or elevation of any installation from that shown on the Plans. The information will be compiled in a red-lined format on a copy of the Bid Plans. At the completion of the project the information is submitted to Floyd County and the project design engineer/consultant. The information should be recorded in a clear and concise format, allowing for an easy transfer of information.

C. As-Built Survey Information

The Contractor's Licensed Professional Land Surveyor will be responsible for "as-builting" the items listed below. The Contractor may employ a Licensed Professional Engineer in place of a Land Surveyor to provide as-built survey information. The survey information shall be compiled in an electronic file, compatible with the *.dwg format. Location and elevations shall be tied to the project survey control.

## 5.3 PROCESS

On Floyd County projects, the noted as-built information will be provided to Floyd County as soon as possible after completion of the project. Final payment to the contractor will not occur until the as-built information is provided.

On private development projects, final project acceptance will not occur until the completed Final Record Drawings are reviewed by Floyd County's inspector for verification of information. Once verified, the plans are returned to Floyd County for final review and acceptance. If the plans are accepted, they become Final Record Drawings. If they are rejected the above process is repeated until accepted.

Reference is made to Chapter 4 for a detailed explanation of the documentation requirements. The as-built information is assigned to a specific layer within the drawing file. Predetermined font and pen sizes have also been established.

## 5.4 DRAWING INFORMATION

Where constructed information differs from the bid information, the plans will reflect a line through the bid information and show the corrected information near the crossed-out original data. Original information shall under no circumstances be removed from the original plans. No red line markings will be accepted. A check mark should be placed beside the original plan information, which has been verified to be correct as constructed. Floyd County will not accept Final Record Drawings that have color ink other than black or have plan information overlayed on aerial photos.

## 5.5 AS-BUILT ITEMS

The following construction items, at a minimum, should be reviewed and verified to produce the Final Record Drawings:

### 5.5.1 Alignment Changes

#### 5.5.1.1 Changes in Location

A. Manholes

B. Catch Basins or Surface Inlets

C. Headwalls

D. Retaining Walls

E. Slope Protection

F. Channel Linings

G. Pump Station Wet Wells

H. Pump Station Valve Vaults

I. Air Release Valves

J. Property Service Cleanouts

K. Detention Basins

#### 5.5.1.2 Changes in Elevation

To the nearest hundredth.

A. Inverts

B. Rims

C. Surface Inlet Grates

D. Paved Ditches

To the nearest tenth.

A. Turf Ditches

B. Miscellaneous Structures

C. Detention Basins

### 5.5.2 Structure Changes

#### 5.5.2.1 General

A. Manhole collar sizes

B. All revisions in pipe sizes, lengths, slopes, and angles

C. Identify pipe material if different from the plans

#### 5.5.2.2 Pump Stations

A. All revisions in pipe sizes

B. All revisions to electrical controls

C. All revisions to exhaust and ventilation systems

D. Pump modifications

E. Changes in elevation for inverts and level controls

F. Equipment layout modifications

G. Building modifications

### 5.5.3 Miscellaneous Changes

#### 5.5.3.1 Property Service Connections

A. Size

B. Length

**C.** Depth at R/W or Property Line

#### 5.5.3.2 Changes in Lot or Unit Designations

A. Lot Numbers

B. Tract Numbers

C. Apartment Unit Designations

D. Condominium Unit Designations

E. Patio Home Designations

### 5.5.4 General

A. Any unverified data shall show +/- thereby indicating that information has not been verified.

B. The following stamp will be inserted into each plan sheet after all as-built information has been added.

**Final Record Drawing**
**By_____Date _____**
**Contractor _____**
**Engineer _____**

Record Drawings have been prepared based on information provided by the Contractor in accordance with the specifications.

# TABLE OF CONTENTS

# CHAPTER 6
# SURVEYING

# TABLE OF CONTENTS (cont.)

# CHAPTER 6
# SURVEYING

# TABLE OF CONTENTS (cont.)

# CHAPTER 6
# SURVEYING

# CHAPTER 6

# SURVEYING
# EXHIBITS

# CHAPTER 6
# SURVEYING

## 6.1 PURPOSE

This chapter describes the various field surveys for design, construction and approvals required for capital projects. Private development requiring approval and/or acceptance of constructed facilities shall also follow these guidelines. Project engineers and field survey crew chiefs should familiarize themselves with this and all other chapters of this Design Manual prior to the start-up of any field survey effort. Familiarity with this Manual will enable the field survey crew to obtain the necessary field information for design and construction and minimize the occurrence of improper activities.

## 6.2 GENERAL

### 6.2.1 Conduct

The survey crews shall conduct themselves properly, both on the project and in the surrounding community. Survey vehicles should be adequately identified with their corresponding firm name.

Their work should be explained to the property owners and to the public, as necessary, but the survey crew should carefully refrain from outlining any plans or policies, which might be misconstrued. If approached, the survey crew should not convey any project specific information to the property owners. The property owner should be referred to the Stormwater or Sewer Utility Manager for answers to project specific questions. The crew must always be courteous when talking with the public and the crew members must maintain a written record of the names of owners or residents with whom they converse. During these conversations, the survey crews should inquire about the location of survey corners or monuments located on the owner's property.

### 6.2.2 Right of Entry

When it is obvious that the survey work will require entry onto private property, the owner shall be contacted, the survey work described, and permission to enter obtained. No project specific information should be conveyed to the property owner. Efforts to contact property owners shall include telephone calls, letters and a door hanger for those who are not at home. It should be explained in the notice that field inspection and soils investigation personnel might require entry from time to time during the course of the project. In the event that the owner does not grant permission and it is evident that the survey work will be delayed, the Stormwater or Sewer Utility Manager should be immediately notified in writing. It is the responsibility of the Stormwater or Sewer Utility Manager to take action to obtain legal right of entry.

## 6.3 HORIZONTAL AND VERTICAL CONTROL

### 6.3.1 General

Existing horizontal and vertical control monuments in the area of the survey shall be referenced for all centerlines, and/or baselines, and level circuits. These monuments or benchmarks shall be shown and identified on the plans.

Trees are not to be used for surveying purposes except in remote areas where there is no other practical alternative. No spikes or nails are to be driven into a tree as described previously. Trees shall not be "blazed" under any circumstances, and only water-based paint may be used if it is necessary to mark a tree.

### 6.3.2 Datum

All control shall be related to existing monuments that have been published by NGS or the State Plane Coordinate System and must reference the appropriate datum as indicated below:

A. Horizontal control shall be referenced to the Indiana State Plane Coordinate System, East Zone 1983 (NAD83).

B. Vertical control shall be referenced to the North American Vertical Datum 1988 (NAVD 88).

### 6.3.3 Placement

All horizontal control shall be located within the easement or public right-of-way whenever possible. Each monument should be placed to avoid movement caused by construction or other activities. Every horizontal control marker that is not being specifically set for individual project control points should be set at maximum intervals of one-half mile on all projects.

A vertical control marker that is not being specifically set for individual project control points should be placed similarly to horizontal control marker at maximum intervals of one-quarter mile.

### 6.3.4 Monuments

All horizontal and vertical control markers shall be of ferrous materials a minimum of 2-inch diameter with an X stamped in the center and SURVEY MARK stamped above the X and DO NOT DISTURB stamped below the X.

### 6.3.5 Project Control and Bench Marks

Project horizontal control shall be as described in this chapter.

Project vertical control (bench marks) shall be established at a maximum interval of 500 feet and must maintain a minimum distance of 25 feet from the improvement centerline. Each bench mark should be placed to avoid movement caused by construction or other activities.

All bench marks must conform to specifications for quality as referenced in Federal Geodetic Data Committee (FGDC) endorsed standards FGDC-STD007.4. Sidewalks, steps (unless massive), small concrete slabs and similar structures are not acceptable. Each project must contain at least one bench mark, which conforms to Federal Geodetic Data Committee (FGDC) endorsed standards FGDC-STD-007.4.

### 6.3.6 Survey Control Point References

With the advent of GPS and the coordinate control capabilities of most survey equipment, field references for horizontal survey control points are no longer required.

All bench marks are to be field located and shall be referenced to the centerline of the sewer by station, and offset. In addition, other field references, such as addresses, etc., should be referenced in field notes, plans, and any other pertinent documents submitted. If a spike in a power pole is used as a benchmark, the field notes, plan sheets, and the horizontal and vertical control sheet shall list the power pole number.

### 6.3.7 Vandalized Survey Project Points and Bench Marks

It is not the responsibility of Floyd County for any damage done to project centerline control points and bench marks until after the final plans, contract documents, and field notes with proper references have been accepted. Any damage done to those points up to that time will be repaired or replaced by the Land Surveyor at the Land Surveyor's expense. It is advised that these points are accurately field referenced at the earliest possible time.

### 6.3.8 Horizontal and Vertical Control Review

Floyd County retains the right to request any corresponding field notes either digital or hard copies that pertain to the horizontal and vertical control for the project together with horizontal and vertical closure statements for their review.

The control data sheets shall be submitted for each newly set horizontal and vertical control monument.

### 6.3.9 Horizontal and Vertical Control Map

A horizontal and vertical control map is required for all sanitary sewer surveys and major storm drainage projects. This map shall be prepared on a standard plan sheet and shall be included in the final plans. The final horizontal and vertical control map shall include final stations, station equations, all curve data, and the final location and description of bench marks. In addition, the following information shall be shown.

#### 6.3.9.1 Horizontal Information

A. Coordinate ties with adjacent projects.

B. Final coordinates of all horizontal control points, PI's, beginning and ending stations.

C. All bearings, coordinates, angles and point designations on baselines in the design segment.

D. Source of horizontal datum. (List the bearing and distance of the control line, and the deflection angle of the proposed centerline.)

#### 6.3.9.2 Vertical Information

A. New bench marks - their designations, locations, description and elevation.

B. Existing Vertical Control Monuments - their designations, elevation and location.

C. Source of vertical datum. (If a spike in a power pole is used for a bench mark, list the power pole number and the height of the spike above the ground, and house number(s) of adjacent homes.

### 6.3.10 Guidelines

Horizontal and vertical control shall be established according to the guidelines defined by these publications:

A. Federal Geodetic Data Committee (FGDC) endorsed standards FGDC-STD-003, FGDC-STD-007.1 through FGDC-STD-007.4 or the current Federal Geodetic Data Committee standards.

## 6.4 DEGREE OF ACCURACY

### 6.4.1 General

The instruments used shall meet the specifications indicated in these guidelines or in following sections. All instruments shall be certified to National Institute of

Standards and Technology (NIST) standards and manufacturer's specifications. NIST, the instrument manufacturer, or a certified instrument repairs facility must perform the certification.

All instruments should be serviced regularly by a certified repair facility and checked at a National Geodetic Survey baseline. EDM instruments should be calibrated by a certified repair facility annually. Field notes of all calibration checks can be requested by Floyd County.

Instrumentation for second order leveling as defined by the Federal Geodetic Control Subcommittee (FGCS) of the FGDC shall be used for any projects requiring second order, class II specifications.

### 6.4.2 Accuracy Criteria

#### 6.4.2.1 Sanitary Interceptor or Through Drainage System

Horizontal surveys will adhere to Second Order, Class II specifications, except that the error of closure shall equal or exceed 1:50,000.

Vertical control will adhere to Second Order, Class II specifications.

#### 6.4.2.2 Sanitary Collector or Local Drainage Systems

Horizontal surveys will adhere to Third Order, Class I specifications, except the adjustments being made by either the Least Squares or Compass Rule Method.

Vertical control will adhere to Third Order specifications, except the error of closure will be equal to or exceed Second Order, Class II requirements.

## 6.5 FIELD PROFILE AND TOPOGRAPHY

### 6.5.1 Field Profile Requirements

Profile elevations shall be determined along sanitary sewer or through drainage system centerlines at 25-foot intervals, where possible, or at 50-foot intervals on paved streets, and at all necessary intermediate breaks. Profiles shall delineate existing structures, roads, streams, etc. Elevations shall be established to the nearest one-tenth of a foot on natural terrain and to one-hundredth of a foot on artificial surfaces. Cross-sections shall be taken at critical locations when it is necessary to determine what effect open cuts or trenching might have on other facilities such as structures, utilities, pavements, fences, trees, or landscaping.

Roadside ditches within 30 feet, parallel to the sewer, and greater than 1.5 feet in depth shall be shown in profile with the sewer. These ditches and other elevations critical to design and/or construction must be shown on the plans.

### 6.5.2 Sanitary Service Connection Survey

A sanitary service connection survey shall be made along each street to properly determine the controlling elevations for design of a particular sanitary sewer line. The form found in Exhibit 6-1 shall be used in accomplishing this survey. The following information shall be shown on the form for each unit surveyed:

A. Type of structure.

B. Basement facilities present.

C. Size, type and location of service line.

D. Elevation of the lowest possible living area floor.

E. Any additional information that may be required for design of the sanitary sewer line.

All elevations should be determined by actual field measurements; however, if a unit cannot be entered, an estimated lowest living area floor elevation shall be made from a known elevation from some other point on the unit. In this case, the elevation must be clearly marked as being estimated. Should an estimated elevation control or have the potential to control the vertical elevation of the sewer, Floyd County shall arrange provision for entry and actual determination of the service elevation.

The completed forms shall be submitted along with the preliminary plans for review. They need not be included in the final plan submission but shall be included with the as built drawings submitted at the conclusion of the project.

### 6.5.3 Topographic Requirements

The following information shall be obtained in the field:

A. All topography critical to the design of the improvement shall be located and recorded in the field notes.

B. Topography generated from aerial photography shall be identified and field checked for any errors or omissions. Omitted topography shall be located by field survey and appropriately recorded. This work is the specific responsibility of the Engineer or Land Surveyor, even though the aerial photography may have been provided from other sources. All topography within the project construction limits and/or easements and rights-of-way shall be field located.

### 6.5.4 Survey Information Needed for Trees

A. Species of Tree (Use the Audubon Society Field Guide to North American Trees, Eastern Region).

B. Size (DBH - Diameter at Breast Height).

C. Dripline (Diameter).

D. Encroachment Allowed within the Dripline.

E. Location:

1. All trees 6 inches in diameter or greater within the temporary or permanent easement shall be located and the species given within 30-feet of the centerline for pipe projects or 15 feet outside the top of slope for ditches.

2. All trees less than 6 inches in diameter shall be located and species given, when within an existing or proposed sewer and drainage easement.

3. When trees are grouped together, at a very close interval, locate the approximate center of the grouping and list the most dominant species of the group.

## 6.6 SPECIAL SURVEYS

### 6.6.1 Property Surveys

Where the relationship of the improvement location and adjacent property line is critical, the location of existing property lines and other boundaries shall be established by a property survey sufficient to define the easement. Property lines, boundary lines, easements, etc. shall be referenced by stations and offsets from the centerline or baseline to the nearest one-hundredth of one foot, by measurement of the angles at the PI with the centerline, and by other means of comparable accuracy. Surveys shall ascertain the names of owners, lessees or tenants, sources of title and date of acquisition and shall be verified from the appropriate Floyd County records.

### 6.6.2 Utility Surveys

All publicly and privately-owned surface and subsurface utilities affected by the proposed improvement shall be located and identified by field survey and by use of maps supplied by the utilities. Locations, elevations, and other pertinent data as may be required for possible relocation or adjustment shall be secured for all such utilities to the limits of information currently available. Overhead power lines near the intended improvement alignment, or those which may be a construction hazard,

should be shown on the plans using the proper symbol and labeled with their primary voltage.

### 6.6.3 Railroad and Highway Surveys

When the centerline of improvements crosses a railroad or highway, all existing and proposed railroad tracks, roadways, and affected structures shall be tied to the improvement centerline. The topography shall be provided on either side of the proposed crossing to the extent required by the affected reviewing agency. An attempt to contact the railroad owners shall be made prior to the survey work in the railroad R/W. Typical information shall include, but not be limited to, the following sections.

#### 6.6.3.1 Railroads

A. Top of rails - 300 feet minimum in either direction locate horizontally and vertically at 50-foot intervals.

B. Angle between centerline of tracks and centerline of improvement.

C. Name and address of Railroad Company.

D. Location of railroad right-of-way and easements (source of record where possible).

E. Horizontal and vertical information relative to transmission lines, such as telephone or electric.

F. Stations on the centerline of each track.

G. Mile post locations measured from centerline crossing.

#### 6.6.3.2 Highways

A. Station on centerline of highway and each edge of pavement, or front face of curb, as may be appropriate.

B. Angle between highway centerline and centerline of improvement.

C. Location of highway rights-of-way and easements (source of record where possible).

D. Location of any crossings, parallel utilities, or drainage structures, which may be in conflict with the improvement construction.

E. Number and width of lanes and the type and condition of the surface.

## 6.7 STAKING SANITARY SEWER AND THROUGH DRAINAGE SYSTEM CENTERLINES

### 6.7.1 Preliminary Centerlines

Improvement centerlines shall be staked for a preliminary field review by using highly visible temporary markers. These markers shall be placed on the centerline at convenient locations, such as fence lines, streets, and borders of timber areas. Intermediate markers shall be placed as necessary to maintain continuous visibility. Plastic flagging shall be used on the markers to increase their visibility. Approximate stations and line designation shall be placed on the markers. The method of designating the centerline in urban areas may be modified as required to provide the information previously noted, including the use of paint on streets. Final staking of improvement lines and the assignment of final line designations before a preliminary field review is not encouraged. These requirements are subject to revision Floyd County to suit specific projects.

### 6.7.2 Final Centerlines

#### 6.7.2.1 Staking

Prior to acceptance of the final plans, the centerline shall be staked at PI's and as needed to maintain line of sight for purposes of easement acquisition, bidding, field reviews, etc. Stations and line designation shall be clearly marked with an indelible marker on 1" x 2" x 18" (minimum) flat stake adjacent to the PI. Guard stakes of 1" x 1" x 48" (minimum), marked "Centerline Sewer" shall be provided at all PI's, manholes, structures, and other control points.

Stake markings shall include the designation of the sewer, such as Line "A" and the station of the point for which the guard stake is provided.

Points in pavement areas shall be identified by painting the necessary information adjacent to the permanently located point. PK nails or spikes are to be used for final centerline staking. Where necessary, offset stakes shall be utilized to identify points in streets, highways, and railroads.

#### 6.7.2.2 Monuments

Iron pins shall be placed at all PI's and POT's necessary to establish the centerline, beginning and ending stations of the contract, and at those points specifically requested by Floyd County. These points shall be field referenced, per this design manual specifications, so they may be located or reestablished at a later date. Iron pins shall be placed at all other manhole locations but do not need to be field referenced. Iron pins shall be made of or contain ferrous material and be a minimum of 30 inches in length and 5/8 inches in diameter. In lieu of iron pins, railroad spikes, 6 inches minimum length, or PK nails shall be used in bituminous pavements and a scribed cross ("X") shall be used on concrete surfaces.

#### 6.7.2.3 Centerline Verification

The Design Consultant shall verify the improvement alignment by obtaining field angles and distances along all segments of the improvement centerline. This shall include tying the final centerline alignment by traverse into the control baseline. The alignment shown on the Horizontal and Vertical Control Map shall be the final approved alignment.

#### 6.7.2.4 Acceptance

The Design Consultant shall verify, in writing, that the alignment shown on the final construction plans has been located correctly in the field. This shall include returning to the field and verifying that all permanent points are intact and reestablishing all damaged or missing points. This must be accomplished before Floyd County will accept the original drawings, contract documents, and authorize final payment to the Design Engineer.

## 6.8 CERTIFICATION NOTES

Example Surveyor Certification notes can be found in Section 4.4.6.1. A certification note, placed on the project title sheet, is required for all projects and should reflect the specific type of survey performed.

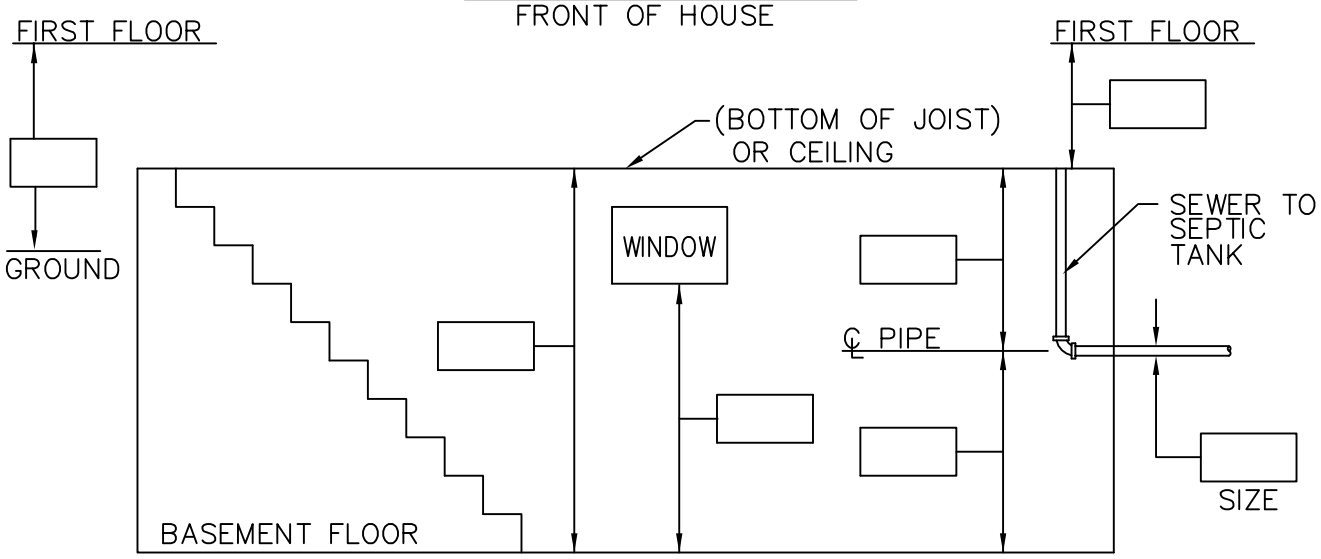
EXHIBIT 6-1
SERVICE CONNECTION SURVEY FORM

EFFECTIVE DATE: DECEMBER 2012

PROPERTY OWNER: _____

SHOW LOCATION OF SEWER SERVICE EXITING RESIDENCE:


IF HOUSE SITS ON CORNER, SHOW AND LABEL EACH STREET




TYPE OF STRUCTURE:

Basement _____ BiLevel _____ TriLevel _____ Slab on Grade _____ Crawl Space _____

Other _____

BASEMENT FACILITIES:

| | | DISCHARGE TO: Septic Tank (Gravity) | Sanitary Pump |
|---|---|---|---|
| Sink | Yes _____ No _____ | _____ | _____ |
| Shower | Yes _____ No _____ | _____ | _____ |
| Toilet | Yes _____ No _____ | _____ | _____ |
| Washer | Yes _____ No _____ | _____ | _____ |
| Sump Pump | Yes _____ No _____ | _____ | _____ |
| Sanitary Pump | Yes _____ No _____ | _____ | _____ |
| Floor Drain | Yes _____ No _____ | _____ | _____ |
| Other | Yes _____ No _____ | _____ | _____ |

COMMENTS: _____

_____

_____

Date: _____ Survey By: _____

# TABLE OF CONTENTS

# CHAPTER 7
# EASEMENTS

# TABLE OF CONTENTS (cont.)

# CHAPTER 7
# EASEMENTS

# CHAPTER 7

# EASEMENTS
# EXHIBITS

# CHAPTER 7
# EASEMENTS

## 7.1 PURPOSE

All public sanitary sewers, storm drains, and open channels must be constructed in public rights-of-way, easements or on publicly owned properties. No approval will be given for construction or improvement of any public sewer, storm drain, or channel without provision of suitable permanent easement or right-of-way. The developer on private development projects will be responsible for acquiring all easements. Document recording will be the responsibility of the developer.

## 7.2 EXISTING EASEMENTS

Each existing easement to be used shall be shown on the plans submitted for review and approval. The information shown on the plans shall include the Deed Book and Page Number, or Instrument Number, of the recorded easement. All restrictive clauses as to the use of the easements, i.e., for utility purposes, drainage, sanitary sewers, etc., shall be noted on the plan adjacent to the pertinent easement. Construction of sanitary sewers or drainage systems will not be permitted in existing exclusive gas, electric, water, or telephone easements unless a Sanitary Sewer and Drainage Easement is acquired overlapping the existing easement with approval of the affected agency.

Existing drainage easements generally do not provide for the construction of sanitary sewers. In order to use these easements for sanitary sewer construction, a new easement will be required to convert the existing Drainage Easement into a Sanitary Sewer and Drainage Easement. Construction plans and easement plats shall be prepared accordingly, and the proposed new easement should be shown in the same manner as an entirely new easement.

## 7.3 DEFINITIONS

The following terms define the methods under which Floyd County will acquire interest in property for the purpose of constructing, operating, and maintaining wastewater pumping, drainage facilities and sanitary sewers:

### 7.3.1 Fee Simple Title

For the purpose of constructing major aboveground structures, Floyd County will normally acquire all rights to the required property in fee simple and permanently retain ownership. This generally refers to large pumping stations, and major detention basins.

### 7.3.2 Sanitary Sewer and Drainage Easement

For the purpose of constructing facilities (sanitary sewers, storm drainage systems, etc.), Floyd County will acquire the right to construct facilities within the limits of easements. They will have the right to operate and maintain those

facilities within the same limits and have reasonable ingress and egress over each affected property to the easements for construction, operation, maintenance and reconstruction. These easements are permanent in nature and are referred to as Sanitary Sewer and Drainage Easement. Crossings between Sanitary Sewer and Drainage Easements, and Utility Easements, are acceptable.

The limits of Sanitary Sewer and Drainage Easements shall be set for permanent structures. Existing structures shall not be within the easement area unless the sewer construction actually requires the removal of such buildings or structures.
A property owner generally is restricted from constructing any facility within the limits of the easement that might interfere with the maintenance and operation of the facility.

### 7.3.3 Temporary Construction Easement

A temporary construction easement will be required adjacent to all new Sanitary Sewer and Drainage Easements when necessary for construction operations. Temporary construction easements shall be required for structure removal, access roads, stockpiling, and other construction activities when necessary. Structure removal includes the removal of treatment plants, pump stations, etc. Sufficient area shall be supplied for movement of equipment and materials to accomplish the intended activity within the Temporary Construction Easement. If possible, Temporary Construction Easements will not be acquired on adjacent private property when the proposed facility lies within a dedicated right-of-way or an existing Sanitary Sewer and Drainage Easement. Only under certain unusual conditions will a Temporary Construction Easement be acquired from a parcel if a new permanent easement is not being acquired from that same parcel. Accordingly, no plats shall be prepared showing Temporary Construction Easements only. "Consent and Release" may be used in lieu of temporary easement. Temporary Construction Easement lines may be drawn through permanent structures; however, the Contract Documents shall contain language, which clearly indicates that all such permanent structures shall not be disturbed during construction. After the project is completed and the property is restored to its prior condition, all rights to the property are relinquished.

### 7.3.4 Access Easement

All Sanitary Sewer and Drainage Easements must have access to a public right of way. If there is no access from a public right of way, a permanent access easement will be required. The access easement will allow the City Ingress/Egress from a public right of way to the Sanitary Sewer and Drainage Easements. The maximum distance between access easements is 300 linear feet. No fences shall be constructed in an access easement. The access easement shall be labeled as a Sanitary Sewer and Drainage Easements.

## 7.4 EASEMENT WIDTHS

Whenever possible, the total easement width, permanent and temporary, should be sufficient to permit the contractor to have flexibility in the method of construction.

Widths of Sanitary Sewer and Drainage Easements and Temporary Construction Easements using trench construction are tabulated below. In no case shall these guidelines be a substitute for sound engineering judgment. Access Easements in Floyd County shall be a minimum 15'.

**Table 1. Minimum Easement Widths**

| Size of Pipe | Sanitary Sewer and Drainage* | Temporary | Total |
|---|---|---|---|
| Minimum | 15' | 20' on each side | 55' |
| 24" - 48" | 20' | 20' on each side | 60' |
| 54" and larger | 30' | 25' on each side | 80' |

* Unless otherwise approved by Floyd County

## 7.5 CONSTRUCTION PLAN REQUIREMENTS

### 7.5.1 General

Construction plans shall be prepared in a manner, which will show clearly, and correctly, the information necessary for the acquisition of each parcel of land required. They must accurately show the location of each parcel and its relationship with surrounding areas. The alignment, as shown on the construction plans and easement plats, must agree with the alignment staked in the field. The information shown must be authentic and thoroughly checked since it will become legal evidence regarding the parcels of land required. The plans shall carry appropriate certifications and seals indicating that the surveying has been accomplished under the supervision of a Land Surveyor registered with the State of Indiana. They shall also meet the Minimum Standards of Practice for Land Surveying in Indiana and the following guidelines:

A. An effort should be made to parallel property lines with the facility when topographic features permit.

B. Easements shall be referenced to property corners and/or known landmarks to the degree that they can be accurately reestablished prior to construction.

C. In residential areas, all topographic features, such as trees, shrubs, sheds, etc., located within the easements shall be properly identified on the plans. When

undeveloped wooded areas are encountered, only those trees of unusual size or nature need to be specifically identified on the plans. Any items within these easements, which are not to be disturbed during the construction, shall be clearly noted "Do Not Disturb" (DND). Items, which remain, but which must be disturbed for construction shall be noted "Do Not Remove" (DNR).

### 7.5.2 Easement Description Criteria

The construction plans shall show the following information for each parcel from which easements are to be acquired:

A. Property owner's name of record and address on the Property Acquisition Summary Sheet.

B. Subdivision name and plat number.

C. Existing rights-of-way and easements.

D. Existing Sanitary Sewer and Drainage Easements, their Deed Book, Page Number.

E. Property lines with label.

F. Parcel numbers.

In addition, the Deed Book and Page Number, or Instrument Number, for the new easement shall be added to the plans when the information is made available by Floyd County.

## 7.6 EASEMENT PLAT CRITERIA

### 7.6.1 General

A. Sanitary Sewer and Drainage Easements

Easement plats shall be prepared for each property having a Sanitary Sewer and Drainage Easement or other type of acquisition. The phrase "Sanitary Sewer and Drainage Easement" shall be used on all plats and acquisition documents.

All plats shall have the title block in the lower right corner of the plat and the Land Surveyor's Certification and Seal in the lower left corner. No other format should be submitted, and none will be accepted.

Permanent easement on all plats is to be hatched for clarity. Temporary easements are not to have hatching, cross-hatching, or shading. A sample “Easement Plat” is shown in Exhibit 7-1.

B. Release of Existing Easements

Any release of easement is to have its own plat and the area of easement to be released is to be crosshatched. No plat containing both easement dedication and release of easement will be accepted. Floyd County must approve the release of easement and the applicable fees must be paid. All other requirements of easement plats shall apply to easement release plats. A sample "Release of Easement Plat" is shown on Exhibit 7-2. The easement release ("Quitclaim") requirements and procedures are found on the Floyd County web page.

C. Encroachment Plats

On occasion a permanent structure is found to be, or required to be, encroaching upon an existing easement. In such situations, an easement encroachment plat must be prepared and recorded. A sample "Easement Encroachment Plat" is shown on Exhibit 7-3.

Easement plats should contain sufficient information to enable a Land Surveyor to locate and stake the easements in the field.

D. Consent and Release

In order for work to be done on a property with no easement, the property owner must sign a Consent and Release Form. A sample "Consent and Release Form" is shown in Exhibit 7-4.

### 7.6.2 Plat Information

The "Easement Plat Checklist" indicates the plat requirements and should be referenced prior to all submittals. It is located in Exhibit 7-6, and can be found at https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department.

### 7.6.3 Property Service Connection Easement

Occasionally, a Sanitary Sewer may be located such that the permanent easement does not extend to the property line of an adjacent property to be served with a proposed property service connection.

In these instances, a 15' Sanitary Sewer and Drainage Easement shall be provided from the proposed service facility easement to the property line at the most likely location of the property service connection. Sufficient Temporary Construction Easement shall also be depicted.

### 7.6.4 Easements on Railroad Rights-of-Way

Sanitary Sewer and Drainage Easements may be acquired on railroad rights-of-way. However, acquisition of easement on a railroad right-of-way does not eliminate the requirement of submitting a Railroad Crossing Conflict Drawing for approval of conduits crossing under rails of the affected railroad.

### 7.6.5 Certificates

A Certificate of Easement, Certificate of Easement Release, or Certificate of Encroachment Agreement, as applicable, must be made a part of each easement plat submittal. The certificate forms are available at https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department

It is the responsibility of the Land Surveyor to attach the proper certificate to each easement plat submitted. No changes in the format of these certificates by the Land Surveyor shall be permitted.

### 7.6.6 Submission

After the easement requirements have been defined, one set of preliminary plats shall be submitted for review. After incorporating any review comments, the final submittal will be in the following form:

A. The original of each plat, signed in ink.

B. One copy of each plat.

C. One copy of each plat with the appropriate easement certification sheets attached.

Copies of all easement plats submitted shall be clearly legible and shall be made on bond, or better grade, paper using an electrostatic or equivalent copier utilizing a dry process. Plats submitted that are not clearly legible or do not meet the above requirements, will not be accepted.

Easement plats submitted shall contain a Land Surveyor's original stamp, signature and date. If any changes or revisions are necessary on the easement plats, the Surveyor shall be notified and must make the necessary revisions and resubmit the plats as previously described.

Easement location and requirements shall be determined as early as possible on all projects in order to initiate the acquisition procedures as early as possible. Adherence to this procedure should minimize the possibilities of project delays due to unavailability of required easements.

## 7.7 PROPERTY ACQUISITION SUMMARY SHEET

Property data shall be shown on the Property Acquisition Summary Sheet, as well as on the construction plan sheet and easement plat. However, a separate Property Acquisition Summary Sheet will not be required if a project has five parcels or less. In such instances, the property acquisition information in the same format may be placed on the Plan Sheet Index, on the first plan sheet if adequate space is available or be included in the plan index on the cover sheet.

An example of the layout for the Property Acquisition Summary Sheet is shown in Chapter 4 on Exhibit 4-16. The Property Acquisition Summary Sheet shall show the following data for each parcel required for right-of-way purposes:

### 7.7.1 Parcel Number

Parcel numbers shall be assigned to each parcel of property to be acquired and shown on the plans. Parcel number 1 shall be assigned to the first parcel, and the remaining parcels shall be numbered consecutively from the beginning to the end of the project. Parcel numbers shall not be assigned to publicly owned rights-of-way.

Parcel numbers assigned to each tract shall not be changed after submission of the final easement plats. If it is then determined that acquisition from any parcel will not be required, that number shall be removed from the plans and the notation "NOT USED" shall be placed in the owner's block on the Property Acquisition Summary Sheet.

### 7.7.2 Owner's Name

The name of the current owner of the property and address, at the time of the preparation of the plans, shall be shown. Final changes to the Property Acquisition Summary Sheet will be made when the property is being acquired.

### 7.7.3 Property Address

The address of the property served shall be shown. Should the owner's mailing address differ from that of the property, the owner's mailing address should be shown in the remark’s column.

### 7.7.4 Plan Sheet Number

The sheet number is the number assigned to the plan sheet on which the particular parcel is shown. Some parcels, of course, will appear on more than one plan sheet and all sheet numbers must be included.

### 7.7.5 Source of Title

This column shall show the Deed Book and Page Number, or Instrument Number, of the parcel or the subdivision name, section number and lot number when a deed has not been recorded, or such other evidence of title information as may be available.

### 7.7.6 Total Area of Tract

The total area of the tract from which an easement is being obtained shall be shown in either acres or square feet in the appropriate column. In general, the area of subdivision tracts shall be shown in square feet, while the area of larger tracts, generally more than an acre, shall be shown in acres.

### 7.7.7 Area of Easements

The area required for a Sanitary Sewer and Drainage Easement shall be shown in square feet or acres in the appropriate column. The area required for a Temporary Construction Easement shall be shown in square feet or acres in the appropriate column. Areas shall be shown to the nearest square foot or one-thousandth of an acre as appropriate.

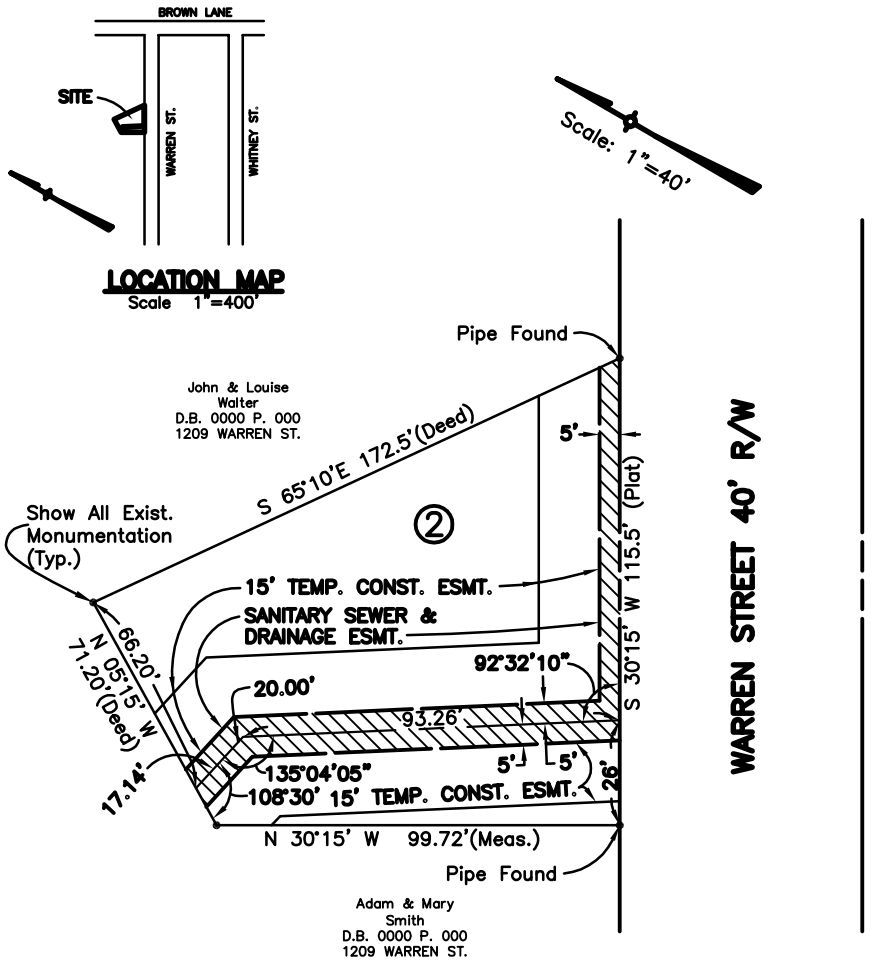
The easement areas required on the Property Acquisition Summary Sheet shall generally be shown in square feet for easements of one acre or less and shown in acres for easements of more than one acre.

### 7.7.8 Permanent Easement

The Deed Book and Page Number, or Instrument Number, of the newly recorded easement will be entered in the appropriate columns if the information is available prior to the submittal of final plans.

EXHIBIT 7-1
SAMPLE SANTIARY SEWER & DRAINAGE EASEMENT PLAT

EFFECTIVE DATE: DECEMBER 2012




GRAPHIC SCALE: 1"=40'

0' 40' 80'

**PERMANENT EASEMENT = 1,502.5 SQ. FT.**
**TEMPORARY CONSTRUCTION EASEMENT = 4,506 SQ. FT.**

The reference meridian used on this plat to determine the directions of survey lines was based on the deed bearing of the NORTH line of the tract.

LAND SURVEYOR'S STAMP

I hereby certify that this plat was made under my supervision and is correct to the best of my knowledge and belief. Distances as shown on this plat have not been adjusted for closure. This easement Plat meets or exceeds the minimum standards of governing authorities.

LAND SURVEYOR'S SIGNATURE Surveyor

Being a part of the same property conveyed to the GRANTOR by deed dated January 1980, recorded in Deed Book 4911, Page 125, in the office of the Clerk of the Floyd County Court.

Tax Block _____ Lot No. _____

**SAMPLE ENGINEERING COMPANY**
&
ADDRESS/PHONE NO.

**SANITARY SEWER & DRAINAGE EASEMENT**

Property of
TOM & JANE POWERS
2001 GREEN CIRCLE WAY
**NEW ALBANY, IN 47150**

Property Address
DICK & JANE DOE
1207 WARREN STREET
**NEW ALBANY, IN 47150**

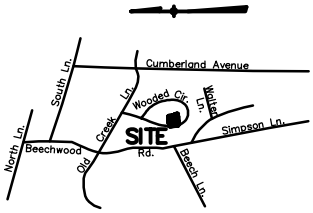
Parcel No. 2 Record No. 5199

Date 10-01-00

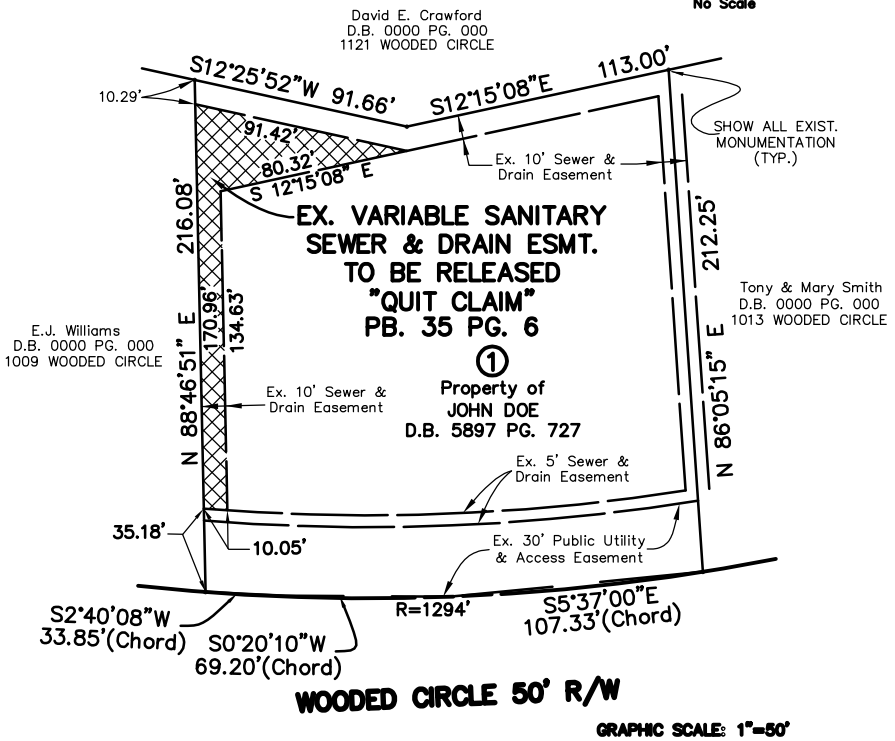
Sheet 1 of 3

EXHIBIT 7-2
SAMPLE RELEASE OF
EASEMENT PLAT

EFFECTIVE DATE: DECEMBER 2012




**LOCATION MAP**
No Scale




**WOODED CIRCLE 50' R/W**

**GRAPHIC SCALE: 1"=50'**

0' 50' 100'

**LEGEND**

Area to be released = 3,075 Sq.Ft.

All lot dimensions are per deed of record.

The reference meridian used on this plat to determine the directions of survey lines was based on the deed bearing of the NORTH line of the tract.

NEW ALBANY, IN 47150

LAND SURVEYOR'S STAMP

I hereby certify that this plat was made under my supervision and is correct to the best of my knowledge and belief. Distances as shown on this plat have not been adjusted for closure. This easement Plat meets or exceeds the minimum standards of governing authorities.

LAND SURVEYOR'S SIGNATURE Surveyor

Being a part of the same property conveyed to the Grantor by deed dated SEPTEMBER 14, 1989, recorded in Deed Book 5897, Page 727, in the office of the Clerk of the Floyd County Court.
Tax Block _____ Lot No. _____

**SAMPLE ENGINEERING COMPANY**
**&**
ADDRESS\PHONE NO.

**RELEASE OF**
**SANITARY SEWER & DRAINAGE EASEMENT**

Property of
TOM & JANE POWERS
2001 GREEN CIRCLE WAY
**NEW ALBANY, IN 47150**

Property Adress
JOHN DOE
1011 WOODED CIRCLE
**NEW ALBANY, IN 47150**

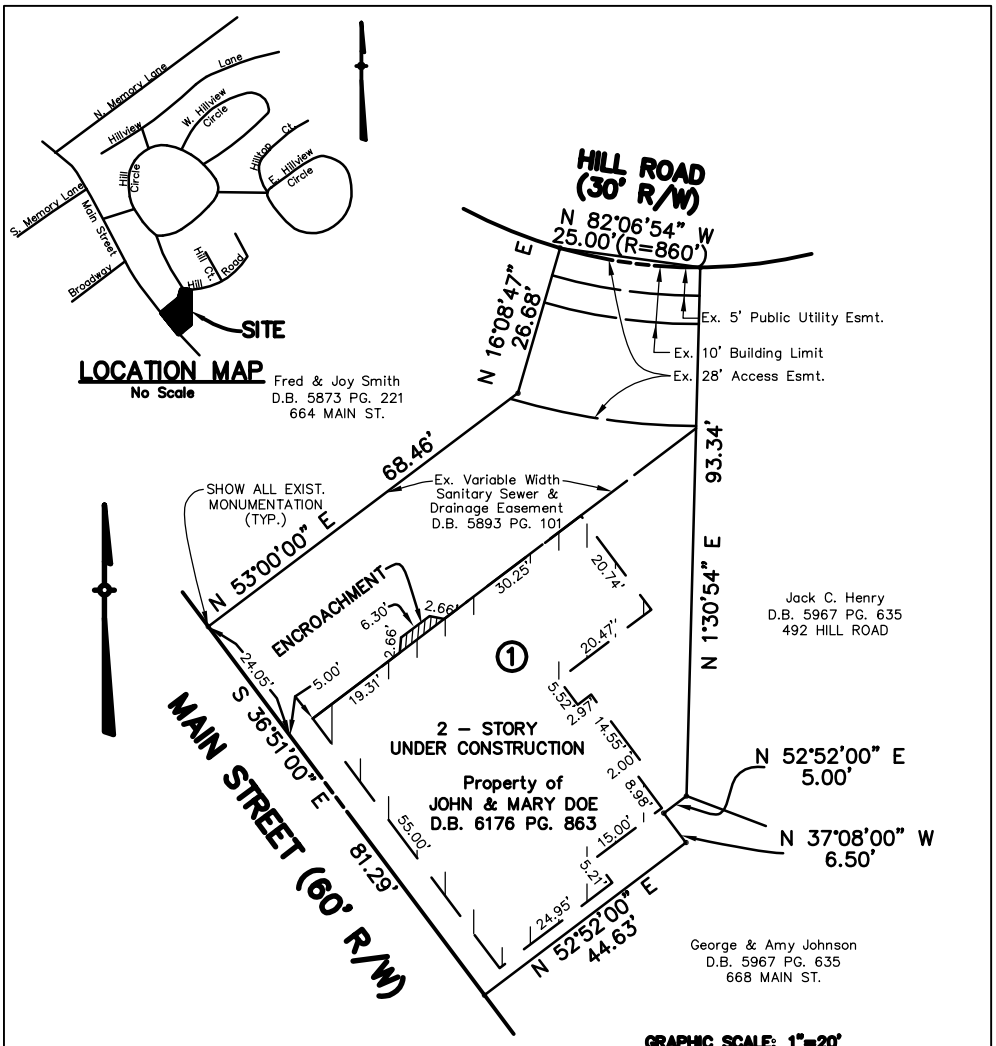
Parcel No. 1 Record No. 11105

Date 10-01-00

Sheet 1 of 3

EXHIBIT 7-3
SAMPLE EASEMENT
ENCROACHMENT PLAT

EFFECTIVE DATE: DECEMBER 2012




**LEGEND**

Area of Encroachment 16.24 Sq.Ft.

All lot dimensions are per deed of record, unless noted.

The reference meridian used on this plat to determine the directions of survey lines was based on the deed bearing of the NORTH line of the tract.

LAND SURVEYOR'S STAMP

I hereby certify that this plat was made under my supervision and is correct to the best of my knowledge and belief. Distances as shown on this plat have not been adjusted for closure. This easement Plat meets or exceeds the minimum standards of governing authorities.

LAND SURVEYOR'S SIGNATURE Surveyor

Being a part of the same property conveyed to the Grantor by deed dated AUGUST 2, 1985, recorded in Deed Book 6176, Page 863, in the office of the Clerk of the Floyd County Court.
Tax Block _____ Lot No. _____

**SAMPLE ENGINEERING COMPANY**
&
ADDRESS\PHONE NO.

**EASEMENT OF ENCROACHMENT**

Property of
TOM & JANE POWERS
2001 GREEN CIRCLE WAY
**NEW ALBANY, IN 47150**

Property of
JOHN & MARY DOE
666 MAIN STREET
**NEW ALBANY, IN 47150**

Parcel No. 1 Record No. 6100

Date 10–01–00

Sheet 1 of 3

EXHIBIT 7-4
SAMPLE CONSENT AND RELEASE FORM

EFFECTIVE DATE: DECEMBER 2012

**CONSENT AND RELEASE**

This Consent and release made and entered into this _____ day of _____, 20____, by and between _____, parties of the first part, and

**Floyd County**

**WHEREAS**, Floyd County deems it necessary to perform the following work in order to improve the storm drainage for the following described property, and

**WHEREAS**, the parties of the first part, being the owners of said property and desirous of having said work performed.

Address of Property: _____
_____

Description of Work: _____
_____
_____

NOW THEREFORE, in consideration of the benefits accruing to said property, the parties of the first part hereby consent and agree that Floyd County. its agents, employees and assigns may enter ant come upon the above described property for the purpose of performing the work as described above and further expressly agree that the parties of the first part will assert no claim whatsoever, of any kind or type, against Floyd County, its agents, employees or assigns by reason of the performing of said work, but by these presents shall be forever barred except that Floyd County shall be liable for any damage to persons or property which results from its acts or omissions during the course of the project as it is performed on party of the first part's property and which occurs during such performance.

IN TESTIMONY WHEREOF, witness the signatures of the parties this _____ day of _____, 20____.

PROPERTY OWNERS

_____
Party of the First Part

_____
Party of the First Part

BY: _____
Floyd County

(Provide one copy for property owner and one copy for Floyd County files

EXHIBIT 7-4
SAMPLE CONSENT AND RELEASE FORM

EFFECTIVE DATE: DECEMBER 2012

**CONSENT AND RELEASE**

This Consent and release made and entered into this _____ day of _____, 20____, by and between _____, parties of the first part, and

**New Albany**

**WHEREAS**, New Albany deems it necessary to perform the following work in order to improve the storm drainage for the following described property, and

**WHEREAS**, the parties of the first part, being the owners of said property and desirous of having said work performed.

Address of Property: _____
_____

Description of Work: _____
_____
_____

NOW THEREFORE, in consideration of the benefits accruing to said property, the parties of the first part hereby consent and agree that New Albany. its agents, employees and assigns may enter ant come upon the above described property for the purpose of performing the work as described above and further expressly agree that the parties of the first part will assert no claim whatsoever, of any kind or type, against New Albany, its agents, employees or assigns by reason of the performing of said work, but by these presents shall be forever barred except that New Albany shall be liable for any damage to persons or property which results from its acts or omissions during the course of the project as it is performed on party of the first part's property and which occurs during such performance.

IN TESTIMONY WHEREOF, witness the signatures of the parties this _____ day of _____, 20____.

PROPERTY OWNERS

_____
Party of the First Part

_____
Party of the First Part

BY: _____
New Albany

(Provide one copy for property owner and one copy for New Albany files

EXHIBIT 7-5
EASEMENT PLAT CHECKLIST

EFFECTIVE DATE: DECEMBER 2012

# Easement Plat Checklist

*Using guidelines set forth in the New Albany/Floyd County Design Manual all easement plats must clearly provide the following:*

1. A plat of the parent tract with bearing and length of each line shown and labeled (meas.) if measured in the field, (deed) if taken from deed, (plat) if taken from plat, or (calc.) if calculated. Curve lines must be labeled with enough curve data to define the curve.

2. Delineation of the new permanent easement with the bearing and length of each line (angle at each P.I. may replace bearing). Curved lines are to be labeled with curve data sufficient to define the curve.

3. Delineation of the temporary construction easement (if any).

4. Area of permanent easement to be acquired.

5. Area of temporary easement to be acquired.

6. Reference of at least one corner of the permanent easement to a corner of the present tract. More may be required in some instance.

7. Description of any monuments and notation.

8. Names of property owners and record sources of each property adjoining the new permanent easement.

9. Name of roads and width of R/W.

10. North point or reference meridian and its basis.

11. Location map of sufficient detail to locate the parcel being surveyed. Include a separate north point.

12. Parcel number to be shown within the parent tract.

13. Permanent easement to be hatched. Easement releases must be cross-hatched.

14. Limits of the permanent easement are to be clearly identified and labeled "Sanitary sewer and Drainage easement" and width to be labeled.

15. Limits of the temporary construction easement are to be clearly identified and labeled "temporary construction easement" and width to be labeled.

16. Show all existing easements with identification and record source.

17. Graphic and written scale.

18. Statement that the unadjusted error of closure meets or exceeds governing authorities.

19. Indicate method of survey where applicable: i.e. random traverse, direct-on-line, parallel offsets etc.

20. Dated signature and seal of the PLS responsible for the survey.

21. Record source of the parent property.

22. Title block containing the following:
    - Title of the survey
    - Address of the property
    - Address of the property owner
    - Name and address of the PLS or the surveying firm
    - Parcel number
    - Record number
    - Tax block and lot number
    - Date

Esmtchecklist.doe

# TABLE OF CONTENTS

# CHAPTER 8
# EROSION AND SEDIMENT CONTROL and STORMWATER POLLUTION PREVENTION PLAN

# CHAPTER 8
# EROSION AND SEDIMENT CONTROL and STORMWATER POLLUTION PREVENTION PLAN

## 8.1 PURPOSE OF THIS CHAPTER

This chapter of the Design Manual provides the user with guidance to meet the Erosion and Sediment Control (ESC) requirements for Floyd County. The information contained in this chapter, including the application forms, and checklists are available in digital format and can be downloaded from https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department. This chapter also establishes requirements to be used when preparing plans for minimizing soil erosion and sedimentation during and after construction of any land development, improvement or retrofit project.

## 8.2 OVERVIEW OF ESC REQUIREMENTS

An ESC plan must be developed by the developer/engineer and approved by Floyd County for land disturbing activities. In an Improvement Location Permit is required prior to initiating land disturbing activities in excess of one acre or situated closer than 50 feet to a Sensitive Feature or require a building permit.

Guidelines on how to select and design ESC Best Management Practices (BMPs) for specific construction activities have been developed by IDEM and the Southern Indiana Stormwater Advisory Committee (SWAC). The BMPs can be found in the Indiana Storm Water Quality Manual at https://www.in.gov/idem/stormwater/2363.htm and the Best Management Practices Stormwater Management Manual for Southern Indiana at http://www.siswac.org/lib/man_BMP_200910009.pdf.

The detailed ESC plan shall contain the information required by the ESC Detailed Construction Plan Checklist found at https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department. When Sensitive Features are identified, a narrative description of how the delineated Sensitive Features will be protected during the proposed land-disturbing activity must be included on the plans. Submit the ESC Detailed Construction Plan Checklist with the detailed ESC plans to Stormwater Board or Floyd County Stormwater Department for review and approval.

## 8.3 SENSITIVE FEATURE IDENTIFICATION

Sensitive Features include land containing any one the following features:

A. Wetlands.

B. Stream corridors.

C. Karst features.

D. Steep Slopes and Highly Erodible Lands.

E. Lakes and Impoundments.

## 8.4 ESC PLAN DEVELOPMENT STANDARDS

ESC plans shall be developed to achieve the standards in the Indiana Storm Water Quality Manual and the Best Management Practices Stormwater Management Manual for Southern Indiana. The design storm event associated with this level of control is the 10-year, 24-hour SCS Type II storm event. NRCS procedures should be used to determine runoff amounts. Each ESC Plan must delineate the following elements:

A. All Sensitive Features.

B. Potential sources of sediment that may potentially leave the site.

C. The location of all BMPs.

D. Installation and maintenance requirements of BMPs.

E. The sequencing of construction activities to be utilized on the project.

The following site management practices shall be utilized on the plans when feasible:

A. Minimize site disturbance to preserve and maintain existing vegetative cover.

B. Limit the number of temporary access points to the site.

C. Phase and sequence construction activities.

D. Locate temporary and permanent soil disposal areas, haul roads, and construction staging areas to minimize erosion, sediment transport, and disturbance to existing vegetation.

Detailed ESC plans shall comply with the following standards and review criteria:

A. Sediment Tracking Control - Stabilized construction entrances shall be located and utilized at all points of ingress/egress on a construction site in accordance with the Indiana Storm Water Quality Manual and the Best Management Practices Stormwater Management Manual for Southern Indiana.

B. Construction Dewatering Operations - Whenever construction dewatering operations are required on a site, they shall be conducted according to the Indiana Storm Water Quality Manual and the Best Management Practices Stormwater Management Manual for Southern Indiana.

C. Crossings of waterways during construction shall be minimized. Encroachment into stream buffers, riparian areas, and wetlands shall be avoided.

D. Topsoil shall be stockpiled and protected from erosion or dispersal both during and

after site grading operations.

E. Temporary Stabilization Measures - Where construction or land disturbance activity will or has temporarily ceased on any portion of a site, temporary site stabilization measures shall be installed in accordance with the Indiana Storm Water Quality Manual and the Best Management Practices Stormwater Management Manual for Southern Indiana.

F. Final Stabilization - Final Stabilization of the site shall be required within 14 calendar days of construction completion.

G. Temporary Structural Controls installed during construction shall be designed to accomplish maximum stabilization and control of erosion and sedimentation, and shall be installed, maintained, and removed according to the Indiana Storm Water Quality Manual and the Best Management Practices Stormwater Management Manual for Southern Indiana. All temporary structural controls shall function as designed when controlling the peak runoff resulting from the storm event identified in this Section.

H. All Permanent Structural Controls including drainage facilities such as channels, storm sewer inlets, and detention basins, shall be designed according to the standards set forth in this Design Manual.

## 8.5 EROSION PREVENTION MEASURES

Erosion prevention measures shall be used during and after construction site preparation in order to safely convey clean water to storm drains or adequate watercourses. One or more measures should be utilized as appropriate during the project's construction phase. Such measures may include but are not limited to phasing and construction sequencing, surface roughening, temporary seeding, mulching, matting, and geotextile blankets. Each of these measures is discussed in the Indiana Stormwater Quality Manual developed by the IDEM, and the Best Management Practices Stormwater Management Manual for Southern Indiana developed by the SWAC.

In addition to site-specific erosion prevention measures, the grading plan should include the following general measures as a minimum:

A. Cuts or fills should not be so close to property lines as to endanger adjoining property without adequately protecting such properties against erosion, sedimentation, slippage, settlement, subsidence, or other damages.

B. Subsurface drainage should be provided in areas having a high water table to intercept seepage that would affect slope stability, bearing strength or create undesirable wetness.

C. No fill shall be placed where it can slide or wash onto another property.

D. Fill shall not be placed adjacent to channel banks where it can create bank failure, reduce the capacity of the stream, or result in downstream sediment deposition.

E. All borrow and disposal areas should be included as part of the grading plan.

F. Adequate channels and floodways should be provided to safely convey runoff from the developed area to an adequate outlet without causing significant channel erosion, degradation, or increased off-site flooding.

G. The site should be graded to direct flows to appropriate controls.

## 8.6 TEMPORARY SEDIMENT CONTROL MEASURES

Floyd County emphasizes erosion prevention in ESC plans. However, there are always instances where erosion cannot be prevented. For these situations, temporary sediment controls must be implemented to control the migration of eroded sediment off site. Temporary sediment control measures, in the Indiana Stormwater Quality Manual developed by the IDEM, and the Best Management Practices Stormwater Management Manual for Southern Indiana developed by the SWAC, are to be followed. One or more of the measures should be utilized as appropriate during the project's construction phase.

## 8.7 RUNOFF CONTROL AND CONVEYANCE MEASURES

Runoff control and conveyance measures, in the Indiana Stormwater Quality Manual developed by the IDEM, and the Best Management Practices Stormwater Management Manual for Southern Indiana developed by the SWAC, are to be followed.

## 8.8 CONSTRUCTION DEWATERING

Construction dewatering measures, in the Indiana Stormwater Quality Manual developed by the IDEM, and the Best Management Practices Stormwater Management Manual for Southern Indiana developed by the SWAC, are to be followed.

## 8.9 PERIMETER CONTROL PLAN REQUIREMENTS

A. A Perimeter Control Plan (PCP) shall be approved by the city prior to breaking ground or disturbing soil in order to install sediment control practices at the hydraulic perimeter/outfall(s) of a construction site.

B. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control devices have been installed and have been stabilized.

C. The PCP does not give permission to the permit holder to break ground or disturb soil on the entire construction site, as is granted through the approval and issuance of a Storm Water Quality Management Permit (SWQMP).

D. Contractors shall install sediment control measures in accordance with the PCP and weekly inspect and maintain the facilities throughout construction.

E. The PCP shall:

1. Include measures to minimize erosion and prevent sediment from leaving the site during initial disturbance activities and prior to temporary or permanent erosion prevention and/or sediment control practices;

2. Address downstream outfall points;

3. Prevent sediment deposition on properties adjacent to the project site. Consider applicable BMPs relevant to the type of flow, site terrain, soil type and other factors;

4. Only utilize buffer strips for sheet flow which shall be at least, but not limited to, 25 feet in width;

5. Include locations and descriptions of construction entrances and exits that comply, at a minimum, with BMP standards; and

6. Protect outlets such as pipes, drains, culverts, conduits or channels and significantly minimize erosion and sedimentation by implementing BMPs to reduce the velocity of flows from the project site.

F. The Indiana Stormwater Quality Manual developed by the IDEM, and the Best Management Practices Stormwater Management Manual for Southern Indiana developed by the SWAC, are to be followed when preparing the PCP.

G. The Stormwater Board reserves the right to develop or adopt other guidance documents to serve as design and implementation standards. These documents may be applied by the Stormwater Board as standards by which designs are to be prepared and controls implemented.

## 8.10 PERIMETER AND OUTFALL INSPECTIONS

A. Upon implementation of the PCP, a perimeter and outfall protection inspection will be performed to ensure that the contractor installed the sediment control measures in accordance with the PCP approved by the Stormwater Board. The inspection shall include participation by the Stormwater Board, the permittee and the permittee's contractor.

B. Inspection shall be performed within seven normal business days after the submittal of a written request to the Stormwater Board, but prior to any disturbance or clearing of soil permitted under the SWQMP. The inspector shall either approve the portion of work completed or shall notify the permittee where the work fails to comply with the approved PCP. If the inspection is not performed within seven business days of receipt of written notice, then it shall be considered approved for site wide work, but open to future comments from the Stormwater Board.

C. Inspection of perimeter protection BMPs shall consist of a visual check for each type of BMP to ensure that each was designed and installed according to site specific

conditions.

D. The PCP shall consider and address any seasonal variations which may hinder the effectiveness of the BMPs. Seasonal variations may include changes in flow, hydrology, temperature, and vegetation. BMPs shall be designed according to these variations and maintained to the appropriate level of service.

## 8.11 STORMWATER POLLUTION PREVENTION PLAN REQUIREMENTS

A. Construction plan sheets and an accompanying narrative report shall be submitted describing existing and proposed site conditions.

B. Included are the following:

1. An index indicating the location in the construction plans of all information required by this division;

2. Description of the nature and purpose of the project;

3. Legal description of the project site. The description should be to the nearest quarter section, township and range, and include the civil township;

4. Soil properties, characteristics, limitations, and hazards associated with the project site and the measures that will be integrated into the project to overcome or minimize adverse soil conditions;

5. General construction sequence of how the project site will be built, including phases of construction;

6. Fourteen-digit watershed hydrologic unit code (HUC);

7. A reduced plat or project site map showing the lot numbers, lot boundaries and road layout and names. The reduced map must be legible and submitted on a sheet or sheets no larger than 11 inches by 17 inches for all phases or sections of the project site;

8. A general site plan exhibit with the proposed construction area superimposed on ortho aerial map at a scale of one-inch equals 100 feet. The exhibit should provide two-foot contour information and include all roads and buildings within a minimum 500 feet radius beyond the project boundaries;

9. Identification of any other state or federal water quality permits that are required for construction activities associated with the owner’s project site;

10. Temporary stabilization plans and sequence of implementation;

11. Permanent stabilization plans and sequence of implementation;

12. Temporary and permanent stabilization plans shall include the following:

    a. Specifications and applications rates for soil amendments and seed mixtures; and

    b. The type and application rate for anchored mulch.

13. Anticipated inspection and maintenance requirements for permanent and temporary measures. This shall include weekly routine inspections and the expected maintenance activities (such as removal of waste concrete).

14. A description of potential pollutant sources associated with the construction activities that may reasonably be expected to add a significant amount of pollutants to stormwater discharges, including:

    a. Waste concrete management;

    b. Material delivery, handling and storage;

    c. Sanitary/septic waste management;

    d. Solid waste/trash and debris management;

    e. Spill prevention control and countermeasures;

    f. Vehicle and equipment cleaning, fueling and maintenance; and

    g. Sensitive and vegetated area preservation.

15. Material delivery, handling and storage associated with construction activities shall meet the spill prevention and spill response requirements of 327 I.A.C.2 6.1.

16. The Storm Water Pollution Prevention Plan (SWPPP) shall include provisions for addressing the following issues as applicable to the site-specific construction activities:

    a. Dewatering operations;

    b. Contaminated soil management;

    c. Hazardous materials and waste management;

    d. Pesticides, herbicides and fertilizer use;

    e. Collection system maintenance;

    f. Drainage system flushing;

    g. Over water activities;

h. Fueling; and

i. Oil Changes.

17. The Stormwater Board reserves the right to develop or adopt other guidance documents to serve as design and implementation standards;

18. Vicinity map depicting the project site location in relationship to recognizable local landmarks, cities and major roads, such as USGS topographic quadrangle map or county or municipal road map;

19. An existing project site layout that must include the following information:

    a. Location, name and normal water level of all wetlands, lakes, ponds and water courses on, or adjacent to, the project site;

    b. Location of all existing structures on the project site;

    c. One hundred-year floodplains, floodway fringes and floodways. Please note if none exists;

    d. Soil map of the predominant soil types, as determined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey or as determined by a soil scientist. A soil legend must be included with the soil map;

    e. Identification and delineation of vegetative cover, such as grass, weeds, brush and trees, on the project site;

    f. Location of storm, sanitary, combined sewer and septic tank systems and outfalls;

    g. Location of regulated drains, farm drains, inlets and outfalls, if any exist of record;

    h. Land use of all adjacent properties; and

    i. Existing topography at a contour interval appropriate to indicate drainage patterns.

20. Final project site layout, including the following information:

    a. Location of all proposed site improvements, including roads, utilities, lot delineation and identification, proposed structures and common areas;

    b. One hundred-year floodplains, floodway fringes and floodways. Please note if none exists; and

c. Proposed final topography at a contour interval appropriate to indicate drainage patterns.

21. Plans shall include the following information:

a. Provisions for operation and maintenance of measures identified in the PCP;

b. Make clear the erosion and sediment controls which are most appropriate to the specific site conditions;

c. Illustrate the location and extent of erosion and sediment controls;

d. Sequencing and schedule information, structural and nonstructural BMPs, temporary and permanent stabilization measures;

e. Provisions for construction phasing. This shall be designed so that stripping and clearing of the site exposes only the area necessary for immediate activities and minimizes the amount of soil exposed at any one time. This includes rough grading, construction of utilities, infrastructure and buildings and final grading and landscaping. Phasing shall identify an expected date when clearing of the area will begin and the estimated duration of exposure. The sequence of phased clearing and the installation of temporary and permanent erosion control measures shall be identified;

f. Provisions for stabilizing denuded areas and soil stockpiles within 15 days of final grade;

g. Provision for stabilizing cut and fill slopes.

(1) Minimization of erosion shall be the objective when designing and constructing cut and fill slopes. Length, steepness, soil type, upslope tributary area, groundwater and other relevant factors shall all be considered.

(2) Stabilization practices such as rock rip rap, geosynthetic material or other methods approved by the Stormwater Board shall be used on cut and fill slopes at three to one (3:1) (horizontal to vertical) or greater.

(3) Cut and fill slopes, except those indicated below, shall be stabilized with permanent or temporary soil stabilization measures within 15 days of either achieving the final grade, or within 15 days to any area that will remain dormant for over 60 days.

(4) Any cut and fill slopes with a grade of 18% or greater shall be either temporarily or permanently stabilized within 48 hours.

h. Erosion prevention measures shall be designed to minimize the suspension of sediment from the soil. The controls may function independently or in

combination with sediment control measures, to prevent sediment laden runoff from leaving the construction site. Acceptable erosion prevention practices shall be defined by the Stormwater Board guidance documents referenced in Section 8.2; and

i. Sediment control measures shall be designed to remove sediment, by settling, flocculating, filtering, or other means, from storm runoff prior to discharge from the construction site. The controls may function independently or in combination with erosion prevention measures to prevent sediment laden runoff from leaving the construction site. Acceptable sediment control practices shall be defined by Stormwater Board guidance documents referenced in Section 8.2.

## 8.12 REQUIREMENTS FOR INDIVIDUAL LOTS

A. Although no ESC permit is required for individual lots disturbing less than one (1) acre within a larger permitted project, a formal stormwater review shall be required prior to the issuance of Floyd County's approval.

B. The information described must be submitted for review and approval prior to the issuance of a building permit for an individual lot regardless of size.

a. A site location plan showing the individual lot and all adjacent lots' dimensions, elevations, drainage patterns, and swales.

b. Individual lot plans must show how on-site stormwater will drain onto adjacent parcels.

C. All stormwater management measures necessary to comply with this section must be implemented in accordance with the permitted ESC plan for the larger project. Existing drainage channels and flow patterns that are part of the larger project shall not be modified.

D. Temporary erosion and sediment control measures may be removed during finish grading and reinstalled after completion. Prior to permanently removing temporary erosion and sediment control measures, permanent stabilization shall be in place a minimum of seven calendar days for sod and 45 calendar days for seed and straw.

## 8.13 NOTICE OF TERMINATION

A. The project site owner shall plan an orderly and timely termination of the construction activities, including the implementation of stormwater quality measures that are to remain on the project site.

B. The project site owner shall submit a Notice of Termination (NOT) letter, at the completion of construction, to the Stormwater Board in accordance with the following:

1. The project site owner shall submit an NOT letter when the following conditions

have been met:

a. All land disturbing activity, including construction on all building lots, has been completed and the entire site has been stabilized; and

b. All temporary erosion and sediment control measures have been removed.

2. The NOT letter must contain a certified statement that each of the conditions in this section have been met.

3. A representative designated by the Stormwater Board may inspect the project site to evaluate the adequacy of the remaining stormwater quality measures and compliance with the NOT letter requirements. If the inspection finds that the project site owner has sufficiently filed a NOT letter, the Stormwater Board shall forward notification to IDEM. Upon receipt of the certified NOT letter and receipt of written approval from IDEM, the project site owner shall no longer be responsible for compliance with this section.

4. After a certified NOT letter has been submitted for a project site, the project site owner shall notify all current individual lot owners and all subsequent individual lot owners of the remaining undeveloped acreage and acreage with construction activity. Maintenance of the remaining stormwater quality and sediment control measures shall be the responsibility of the individual lot owner as well as occupier of the property.

5. The project site owner may submit an NOT letter to obtain early release from compliance with this section, if the following conditions are met:

a. The remaining 95% is built and stabilized with contiguous areas not exceeding one acre;

b. A map of the project site, clearly identifying all remaining undeveloped lots, is attached to the NOT letter. The map must be accompanied by a list of names and addresses of individual lot owners or individual lot operators of all undeveloped lots;

c. All public and common improvements, including infrastructure, have been completed and permanently stabilized and have been transferred to the city or another appropriate local entity;

d. The remaining acreage does not pose a significant threat to the integrity of the infrastructure, adjacent properties, or water quality; and

e. All permanent stormwater quality measures have been implemented and are operational.

C. Acceptance of site conditions shall be made by the Stormwater Board or its designated representative based upon an inspection. If any of the following items are deemed to be insufficient, inappropriate, and/or inconsistent with the SWPPP or objectives stated in

this section, the NOT application shall not be approved:

1. Pipes, channels, catch basins, water quality treatment devices and other infrastructure are clear of sediment, obstructions and debris and are designed and operating as appropriate for final site conditions;

2. Slopes are permanently stabilized;

3. Temporary erosion prevention or sediment control devices (such as silt fence and staking, outlet protection and the like) have been removed (as appropriate) and any resulting soil disturbance stabilized;

4. Temporary pollution prevention practices have been demobilized or removed and affected areas stabilized;

5. Sediment has been removed and slopes stabilized for permanent flood control and water quality control practices;

6. Detention pond grading is stabilized and/or excess sediment removed so that actual volume is at least equal to designed volume and condition; and

7. Other items as deemed to be important by the Stormwater Board.

D. As-Built Drawing Submittal requirements.

1. A SWQMP shall be considered open and active until a time when the Stormwater Board or its representative accepts the site conditions and as built requirements have been completed.

2. Prior to issuance of a certificate of occupancy by the city, the as-built condition of critical stormwater management facilities must be reviewed and approved by the Stormwater Board.

3. The volume, capacity, slope, configuration, condition, as built plans and topographic information, as well as all pipe size, material, lengths, for all detention, retention and water quality practices shall be certified by a professional engineer or land surveyor licensed in the State of Indiana. This information shall be provided to the Stormwater Board in the form of an as-built drawing or other electronic format accepted by the Stormwater Board. The as built certification shall indicate if final conditions are consistent with, or exceed, the SWQMP provisions.

4. If it is determined that information provided in the as built drawing, certification, inspection, or survey of the site do not meet or exceed the SWQMP requirements, the city reserves the right to withhold certification of occupancy. Furthermore, other enforcement mechanisms may be applied to the person certifying the as-built information.

5. If, upon inspection by the Stormwater Board or designated representative, it is

determined that there is an item that must be addressed to receive acceptance of the site conditions, then the inspections and maintenance shall continue as described in the SWQMP.

6. See Chapter 5 for additional as-built drawing submittal requirements.

## 8.14 POST CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

A. The Post Construction SWPPP shall include the following information:

1. Location, dimensions, detailed specifications, and operation details of all post construction stormwater quality best management practices (BMPs), as defined in the Stormwater Board guidance documents, referenced in Section 8.2.

2. A long-term operation and maintenance agreement containing maintenance guidelines for all post construction stormwater quality measures to facilitate their proper long-term function. This agreement shall be made available to future parties, including property owners, who will assume responsibility for the operation and maintenance of the post construction stormwater quality measures.

3. A sequence describing when each post construction stormwater quality BMP will be installed.

B. The post construction SWPPP shall include provisions for buffers.

1. The waterway buffer will be used to define areas where land disturbance activities shall be permitted, but construction of any building or structure shall not be permitted.

2. A waterway buffer shall be applied as required by IDEM Rule 5 and IDEM Rule 13.

3. Automatic exemptions are granted so long as, erosion and sediment control, water quality and cut-fill policies are adequately addressed. Exemptions shall be granted for:

(a) Roads and utilities crossing waterways; and
(b) Pedestrian trails and walkways proximate to waterways.

4. The waterway buffer and floodplain may be used for the application of water quality devices. This may only be permitted if erosion and sediment control, water quality and cut fill polices are adequately addressed as determined by the Stormwater Board according to the provisions of this section.

C. A licensed professional engineer in the State of Indiana shall stamp all construction plans and long-term maintenance documentation. This shall include all proposed improvements or modifications to existing or new stormwater

infrastructure and other related improvements or modifications.

## 8.15 BMP DESIGN REQUIREMENTS AND CRITERIA

A. The Stormwater Board reserves the right to develop or adopt other guidance documents to serve as design and implementation standards. Other guidance documents distributed by the Stormwater Board should be reviewed and considered when preparing the post construction SWPPP. These documents may be applied as standards by which designs are to be prepared and controls implemented.

B. The post construction SWPPP shall include provisions for stormwater quality BMPs functioning independently or in combination and shall comply with Rules 5 and 13. Acceptable stormwater quality BMPs shall be defined by policy and guidance documents as approved by the Stormwater Board.

C. The post construction SWPPP shall include provisions for stormwater quality BMPs that are designed to achieve the following design/performance objectives:

1. Reduce or buffer increases in stormwater runoff temperature caused by contact with impervious surfaces;

2. Reduce or buffer increases in stormwater flow rate caused by increases in directly connected impervious area and overall impervious area; and

3. Storm water detention facilities shall be designed to address the rate at which flow is released over the entire runoff discharge period over the critical design storm period if defined by Stormwater Board stormwater master plans. The primary outlet structure shall be designed as a v-notch weir or other multiple stage configurations capable of controlling the discharge rates for the two, ten and 25-year design storm events. The emergency outlet shall be designed to safely bypass the 100-year storm event. Flows from the two, ten and 25-year design storm events shall not enter the emergency outlet.

D. If available, each post construction SWPPP shall be evaluated for consistency with the stormwater master plan or watershed study for the major watershed or watersheds within which the project site is located. The individual project evaluation will determine if stormwater quantity and quality management practices can adequately serve the property and limit impacts to downstream public and private properties. The presence of a regional facility(s) will be considered in determining the extent to which quantity and/or quality controls will be necessary.

E. The Stormwater Board reserves the right to require superseding or additional treatment criteria or objectives for specific pollutant(s) as necessary to meet overall storm water quality management program objectives or directives under a watershed improvement or Total Maximum Daily Load (TDML) program as administered by the USEPA or the State of Indiana.

F. On site BMP coordination with regional BMPs.

1. All properties are expected to implement on site stormwater quality control measures, but the extent of application may be reduced given the availability, proximity, and nature of regional stormwater quality BMPs.

2. The extent and type of onsite stormwater quality management practices implemented shall be proportionate to the land use, pollutant discharge potential and proximity to regional stormwater quality management practices.

## 8.16 INSPECTIONS AND MAINTENANCE

A. Permittee-Performed Inspections and Maintenance

1. Permittee-Performed Inspections (Self Inspections) must be performed by a Qualified Professional.

2. Inspections shall be performed at all control measures every seven (7) days and within twenty-four (24) hours of a one-half (0.5) inch rain event. The inspections will determine the overall effectiveness of the Grading and Stormwater Pollution Prevention Plans, needed maintenance activities and the need for additional control measures

3. All inspections shall be documented in written form and made available to Floyd County or submitted at the time interval specified in the approved permit

4. Inspections shall be performed consistent with specific visual maintenance checklists approved by Floyd County

5. Documentation of permittee performed inspections and inspection findings shall be kept on site if appropriate facilities (such as project trailer or building) are available. In the event that appropriate facilities are not available, a copy of the most recent inspection shall be displayed at the site along with other documents that must be displayed to the public per local, state, and federal regulations.

6. Documentation of permittee performed inspections and inspection findings shall be made available within three (3) days of a request by Floyd County. Failure to post or timely submit documentation as requested will be assumed to indicate that inspections were not performed and may result in corresponding enforcement procedures. Inspection documentation shall include, but not limited to, the following:

    - The address of the site.
    - The parcel identification number.
    - The name of the owner or owner's agent.
    - The location of the stormwater system(s).
    - The name and signature of the Qualified Professional Inspector performing the inspection and the date of the inspection.
    - A description of the current operational or functional status of the stormwater system(s).
    - For sediment control structures, an indication of used and remaining

capacity (fraction, percentage, depth, or volume) shall be given to identify when the control must be cleaned out.
- Identification of any necessary repairs, sediment debris removal or replacement of all or portions of the stormwater system(s).
- The results of any field or laboratory analyses performed.
- Other relevant or unusual observations related to the system(s).
- Action plant to prevent stormwater system failure as consistent with the Stormwater Quality Management Permit provisions.
- Action plan to prevent the premature system failure that exceed the Stormwater Quality Management Permit provisions but are necessary to prevent stormwater pollution from leaving the site.

7. The Qualified Professional Inspector is responsible for the reporting of result of the inspection to the site owner or owner's representative including stormwater quality management system maintenance needs.

B. Oversight Inspections

1. Floyd County shall have the authority to periodically inspect the site of land disturbing activities for which permits have been issued; may make inspections of the site at its discretion; and shall either approve the portion of the work completed or shall notify the permittee wherein the work fails to comply with the Grading or Stormwater Pollution Prevention Plans as approved or is ineffective (regardless of consistency with an approved Grading Plan).

2. The results of the inspections and findings will be presented and reviews with the permittee at the time of inspection (as available to site personnel) and be available in the permit file within seven (7) days.

3. In order to obtain inspections, the permittee shall contact the County at least two (2) working days before the following:

    - Bond release inspections.
    - Upon completion of the project in order to receive approval to cease permittee inspection in compliance with the Stormwater Quality Management Permit.

4. Floyd County man identify any repairs, sediment/debris removal or replacement of all or portions of the stormwater system(s) necessary to comply with the objectives of this section and the Stormwater Quality Management Permit. Floyd County may develop and require the implementation of an action plan and compliance schedule that prevents the premature stormwater quality management system failure as consistent with the Stormwater Quality Management Permit provisions.

5. Floyd County may develop and require the implementation of an action plan to prevent the premature system failure that exceeds the Stormwater Quality Management Permit provisions but are necessary to prevent stormwater pollution from leaving the site.

C. Maintenance

1. Maintenance must be performed under the direction and/or supervision of a Qualified Professional Inspector.

2. Maintenance activities shall be performed in accordance with action plans developed through the course of permittee-performed inspections. This may represent activities that exceed provisions of the Grading and Pollution Prevention Plans but are necessary to prevent stormwater pollution from leaving the site.

D. Qualified Professional Registration and Certification

1. A Qualified Professional is required to perform routine inspections and direct and /or supervise maintenance activities to ensure that the Stormwater Quality Management Permit provisions are being implemented properly.

2. All Qualified Professional performing inspections or overseeing maintenance activities under this Article must be registered with Floyd County and certified prior to execution of those actions. All applicants must file an application with Floyd County. Applicants must demonstrate knowledge of 1.) Construction practices, 2.) Operational standards, 3.) Cause and failure indicators and 4.) Maintenance measures used to prevent and correct failures.

3. Floyd County reserves the right to require that Qualified Professional applicants pay a registration fee.

4. Floyd County reserves the right to require that Qualified Professional applicants satisfactorily complete an approved training course.

5. Floyd County reserves the right to require that Qualified Professional applicants be re-certified as often as every three (3) years.

6. Floyd County reserves the right to require that Qualified Professional applicants successfully pass a written exam covering construction practices, operational standards, causes and indicators of stormwater quality management system failures, and corrective actions as approved by Floyd County.

7. Floyd County may de-certify any Qualified Professional under one or more of the following circumstances:

    - The individual fails to comply with this section.
    - Floyd County determines that the individual is not qualified to perform his/her duties hereunder.
    - The individual is unable to properly perform an evaluation of a stormwater quality management system.
    - The individual is negligent in the discharge of his/her duties as outlined in the certification requirements.
    - The individual submits false or misleading information.

- The individual fails to maintain the required certification as required by this section.

8. Floyd County shall give written notice to a Qualified Professional Inspector prior to revoking Qualified Inspector registration. The inspector shall be given an opportunity at an informal meeting to show cause why he/she should continue to be registered. Any Qualified Professional Inspector may appeal that decision by following the procedure set out for re-instatement.

    - If a Qualified Professional Inspector loses his/her registration, he/she may apply to be re-instated contingent upon completing the requirements established after a period of at least one (1) year. The application to be re-instated shall not be permitted prior.

9. It shall be the responsibility of Floyd County to:

    - Administer and enforce this section.
    - Develop and administer a process for certifying Qualified Professionals.
    - Maintain a list of certified Qualified Professionals.
    - Require corrective actions where there is evidence of a system failure.
    - Establish criteria for the inspections and the certification of Qualified Professionals and make such criteria and related forms available to the public.

E. Fees

1. Floyd County reserves the right to require fees to cover expenses including, but not limited to, overhead, labor, storage, training, etc., associated with the certification, training, and inspection process.

2. Fees shall be paid prior to a certification training course and/or exam.

## 8.17 ENFORECEMENT

A. Floyd County may institute appropriate actions or proceedings by law or equity for the enforcement of this section and shall, in each instance, be entitled to recover its costs and attorney fees. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, and other appropriate forms of remedy or relief. Each day of noncompliance is considered a separate offense; and nothing herein contained shall prevent Floyd County from taking such other lawful action as necessary to prevent or remedy any violation, including application for injunctive relief. Any of the following enforcement remedies and penalties may be applied independently, collectively, or in a sequence deemed necessary and shall be available to Floyd County in response to violations of this section. If the Person, property or facility has, or is required to have, a stormwater discharge permit from the IDEM, Floyd County shall alert the appropriate State authorities of the violation.

1. Notice of Violation (NOV) – Whenever Floyd County finds that any Person owning or occupying premises has violated or is violating this section or an order

issued hereunder, the enforcement official may serve such person, personally, or by registered or certified mail, a written NOV. Within thirty (30) days of the receipt of this notice, or shorter period as may be prescribed in the NOV, an explanation of the violation and a plan for the satisfactory correction and prevention thereof, which shall include specific required actions, shall be submitted to Floyd County. Submission of this plan shall not, however, affect liability for violations of this section.

2. Revocation of Permit – Floyd County may revoke and require the surrender of a permit or certificate by notifying the permit holder, in writing, the reason for the revocation. Permits or certificate shall be revoked for any substantial departure from the approved application plans or specifications; refusal or failure to comply with the requirements of State or local law; or, for false statements or misrepresentations made in securing the permit or certificate. Any permit or certificate mistakenly issued in violation of any applicable state or local law may also be revoked.

3. Stop Work Order – Floyd County may issue a Stop Work Order and require that all activities cease, except those actions that are necessary to eliminate the illicit discharge. Unacceptable or untimely actions to eliminate the illicit discharge may be used as grounds to revoke permits for the construction site.

4. Compliance Order – If any Person shall violate the provisions of this section, Floyd County may give notice to the owner, responsible party, or to any Person in possession of the subject property ordering that all unlawful conditions existing thereupon be abated within a scheduled period defined from the date of such notice.

5. The enforcement official shall have the authority to establish elements of a Stormwater Pollution Prevention Plan and require any business to adopt and implement such a plan as may be reasonably necessary to fulfill the purposes of this section. The enforcement official may establish the requirements of BMPs for any premises.

6. If it is determined by Floyd County that the unlawful condition is such that there is imminent dander or peril to the public, the Floyd County may, with or without notice, proceed to abate the same. The costs of such abatement shall be charged to the owner, responsible party, or against the property.

B. Civil Penalties – Any Person that has been found to have violated any provision of this section may be assess a civil penalty not to exceed the lesser of (1) the amount presented in this subsection, or (2) the maximum amount permitted by law.

1. The penalty shall increase by twenty-five percent (25%) of the previous penalty amount for every subsequent but separate offense made by the same Person. This penalty shall be in addition to other enforcement actions of this section.

2. The penalty may be assessed for each day that the prohibited activity continues beyond those schedules set forth in compliance orders or other abatement

schedules issued to the property owner or other person deemed responsible by Floyd County.

3. In determining the amount of the penalty, the Court shall consider the following:

    - The degree and extent of the harm to natural resources, the public health, or public or private property resulting from the violation;
    - The duration and gravity of the violation;
    - The effect on ground or surface water quality;
    - The cost of rectifying the damage;
    - The amount of money saved by noncompliance;
    - Whether the violation was committed willfully or intentionally;
    - The cumulative effect of other enforcement actions applied for the same offense;
    - The prior record of the violator in complying or failing to comply with the stormwater quality management program; and
    - The cost of enforcement to Floyd County.

4. A civil penalty of not more than twenty-five hundred (2,500) dollars may be assessed for each of the following offenses:

    - Development without permit.
        - The engage in any development, use, construction, remodeling, or other activity of any nature upon land or improvements thereon, subject to the jurisdiction of this section without all required permits, certificates, or other forms of authorization as set forth in this section.

    - Development inconsistent with permit.
        - To engage in any development, use, construction, remodeling, or other activity of any nature in any way inconsistent with any approved plan, permit, certificate, or other form of authorization granted for such activity.

    - Violation by act or omission
        - To violate, by act or omission, any term, variance, modification, condition, or qualification placed by Floyd County or its designated representative upon any required permit, certificate, or other form of authorization of the use, development, or other activity upon land or improvements thereon.

5. In the event there are penalties assessed by the State against Floyd County and resulting from a violation of this section, the Person responsible for such violation may be assessed the lessor of (1) the amount of the penalty assessed as against Floyd County, or (2) twenty-five hundred (2,500) dollars.

C. Order to clean and abate/restore – Any violator may be required to clean and/or restore land to its condition prior to the violation.

D. Cost Recovery – If corrective action, including maintenance delinquency, is not taken in the time specified or within a reasonable time, Floyd County may undertake the corrective action, and the cost of the abatement or corrective action shall be assessed against the responsible party, owner of the premises, and/or the developer. If these costs are not paid within ninety (90) days of invoice, the enforcement official may initiate all appropriate legal actions to enforce the claim.

E. Injunctions and/or proceedings at law or in equity – Any violation of this section or of any condition, order, requirement, or remedy adopted pursuant hereto may be restrained, corrected, abated, mandated, or enjoined by other appropriate proceedings pursuant to State law.

F. Civil Actions – In addition to any other remedies provided in this Article, any violation of this Article may be enforced by civil action brought by Floyd County. Monies recovered under this subsection shall be paid to Floyd County to be used exclusively for costs associated with implementing or enforcing the provisions of this section. In any such action, Floyd County may seek, as appropriate, any or all the following remedies:

- A temporary and/or permanent injunction.
- Assessment of the violator for the costs of any investigation, inspection or monitoring survey which lead to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection, to include reasonable attorney fees and costs of the action.
- Costs incurred in removing, correcting, or terminating the adverse effects resulting from the violation.
- Compensatory damages for loss or destruction to water quality, wildlife, fish, and aquatic life.
- Emergency Orders and Abatements. Floyd County may order the abatement of any discharge from any source to the stormwater conveyance system when, in the opinion of Floyd County, the discharge causes or threatens to cause a condition that presents an imminent danger to the public health, safety, or welfare of the citizens of Floyd County, the environment, or is a violation of a NPDES permit. If such emergency situations occur and the property owner or other responsible party is unavailable or time constraints are such that service of a notice and order to abate cannot be effected without presenting an immediate danger to the public health, safety, or welfare, Floyd County may perform or cause to be performed such work as shall be necessary to abate said threat or danger. The costs of any such abatement may be recovered as stated in this section.
- Remedies Not Exclusive – The remedies listed in this section are not exclusive of any remedies available under any applicable Federal, State, or local law and Floyd County may seek cumulative remedies.

# TABLE OF CONTENTS

# CHAPTER 9
# GEOTECHNICAL

# CHAPTER 9
# GEOTECHNICAL EXHIBITS

# CHAPTER 9
# GEOTECHNICAL

## 9.1 PURPOSE

This section establishes the minimum standards for performing geotechnical explorations on Floyd County projects. Geotechnical explorations are required on all Floyd County projects, unless otherwise directed by Floyd County. Reasons for performing geotechnical explorations include, but are not limited to, the following:

A. To establish the bedrock depth along the alignment of proposed sewers or at the location of proposed structures.

B. To determine the subsurface profile and properties (texture, moisture content, density, shear strength, compressibility, etc.) of soil and bedrock materials. This information is needed for the design of below grade structures, (wetwells, junction structures, tanks, etc.) building foundations, sheeting and bracing systems, retaining walls, stable channel slopes, pavements, and embankments.

C. Additionally, this information is necessary when unsuitable foundation conditions are at the trench subgrade level or when unstable trench wall conditions are anticipated.

D. To investigate the subsurface conditions at tunnel or boring and jacking sites. The composition and nature of materials at underground crossings is needed to establish the conditions to be encountered (soft ground, hard ground, or mixed face tunneling) and the appropriate construction method.

E. To provide information regarding groundwater so that the contractor can plan for an adequate dewatering system.

F. To determine pavement section makeup, layer thickness and condition.

## 9.2 GENERAL

### 9.2.1 Right of Entry

When the geotechnical exploration work will require entry onto private property, the property owner shall be contacted, the work described, and permission to enter obtained. Efforts to contact property owners shall include telephone calls and the leaving of letters for those who are not at home. In some instances, Floyd County may deem it necessary to issue a letter of introduction and identification (on Floyd County letterhead), which the geotechnical field party will provide to the owner. In the event that the owner does not grant permission, and it is evident that the geotechnical work will be delayed, Floyd County should be notified, in writing, immediately. It is the responsibility of Floyd County to take whatever course of action is deemed necessary to obtain the legal right of entry in accordance with state statutes.

### 9.2.2 Protection of Underground Structures and Utilities

Prior to drilling and sampling in public rights-of-way and easements, Indiana811 shall be called at 811 or 1-800-382-5544 and requested to mark the locations of existing underground facilities. At least 3-business days notice is required for service. Indiana811 confirmation numbers should be documented so that a record for the request is available. Drilling should not begin until clearance has been provided or notification that all underground utility lines are marked has been received.

On private property, Indiana811 may not maintain records. It then becomes necessary to employ the property owner's assistance and knowledge of service lines, underground storage tanks, septic tank facilities and/or use visible surface features, such as meter vaults, shut-off valves, etc., to estimate the locations of underground facilities. Borings should be offset accordingly, if necessary, to avoid any conflicting utilities.

If there is any reason to believe that an underground facility exists in an area to be drilled, and its location cannot be determined with reasonable accuracy, then that boring should not be advanced.

### 9.2.3 Erosion Prevention and Sediment Control/Ground Restoration

All efforts should be extended to avoid rutting, especially in residential areas. Ruts should be repaired with leveling the area with topsoil and seeding or sodding as required by Floyd County or as agreed upon with the property owner.

When using a truck-mounted drill rig, efforts should be made to access boring locations without crossing streams. In the event that crossing a stream is necessary to access a critical boring location, a ford in the stream, which is regularly used by the property owner, should be used after receiving approval from the property owner and Floyd County. Any rutting should be repaired with seeding and sodding as described above.

Dozer roads cut to permit access to boring and sounding locations should be leveled and seeded and strawed immediately following completion of the work.

Upon completion, borings should be completely backfilled from the bottom to the ground surface, using excavated cuttings. Reversed auger rotation or down pressure on the drill tools should be used to achieve compaction. In sodded areas, the sod should first be carefully cut, lifted from the boring site, and set aside. After backfilling, the sod should be replaced over the boring and tamped. Asphalt cold patch or concrete should be used to repair borings in pavements.

When drilling around sinkholes or at a site with the potential to drain storm water directly into a water feature (including streams, lakes or impoundments, or along steep slopes), special care should be taken to place all auger cuttings back into the hole. If excess cuttings remain, they should be removed from the site.

## 9.3 DRILLING AND SAMPLING

### 9.3.1 Methods and Equipment

Unless otherwise authorized by Floyd County, power equipment shall be utilized to obtain geotechnical data. In most cases, this will involve a truck or skid-mounted soils drilling rig equipped with continuous flight mechanical augers. In some instances, it may be advantageous to use an air track rock drill if only rock soundings are being performed. In areas where drilling rig access is restricted with steep slopes, heavy woods, soft ground, or where the rock surface is known to be shallow with reasonable assurance (for example, next to a rock bottom stream), Floyd County may permit the use of manually driven sounding rods or hand augers.

In general, all soil test borings shall be performed in accordance with ASTM D 1586 "Standard Method for Penetration Test and Split Barrel Sampling of Soils". Split-barrel samples shall be taken at five-foot depth intervals and at changes in strata. When undisturbed samples in clay soils are required (for example, when shear strength determinations are needed), samples should be obtained in accordance with ASTM D 1587 "Standard Practice for Thin-Walled Tube Sampling of Soils".

Observation wells should be installed in completed soil borings whenever groundwater is encountered during the drilling process. Casing should be of 1-inch diameter field slotted PVC pipe. Water table readings should be obtained from observation wells no sooner than seven days from completion of the boring.

Rock core drilling shall be performed in accordance with ASTM D 2113 "Standard Practice for Diamond Core Drilling for Site Investigation", except when wire line drilling is permitted. The diameter of the rock core shall not be less than 2-1/8 inches.

### 9.3.2 Location, Frequency and Depth Requirements for Soundings and Borings

Rock soundings should be performed at intervals of 50 feet where rock is encountered and 100 feet where rock is not encountered along the proposed alignment of collector and interceptor sewers, manholes, pump stations, and underground structures. The soundings should be advanced to a maximum depth, which corresponds to one foot below the invert elevation or to auger refusal, whichever occurs first. The requirements for rock soundings may be waived by or Floyd County in areas of or Floyd County where the bedrock surface is known to be deeper than excavation depths.

The requirements for soil test borings will be evaluated by Floyd County on a project-by project basis. In general, soil test borings will be required for sewers located in areas with deep, potentially unstable soils or where high groundwater may be expected. When required, soil test borings should be drilled at approximate intervals of 500 feet and should be terminated 4 feet below the invert

elevation or at auger refusal, whichever occurs first. If bedrock occurs higher than the invert elevation, then rock core drilling should extend the boring to 2 feet below the invert elevation.

Whenever possible, the boring plan should be developed to position test borings at locations of special interest. For example, test borings should be sited at the deepest excavation or where the open trench may affect existing buildings or major utilities. Borings should be drilled at the access pits or shafts of tunnels. If access is available, intermediate borings along the tunnel alignment should be advanced at 100-foot intervals. For pump stations, the number of borings needed may vary based on the number and layout of the individual facilities, but at a minimum, borings will be advanced at the wet well and valve vault.

## 9.4 LABORATORY ANALYSES

Representative split-barrel samples should be analyzed for Atterberg limits, (ASTM D 4318) particle size distribution (ASTM D 422), specific gravity (ASTM D 854) and moisture content (ASTM D 2216). The samples should then be classified in accordance with ASTM D 2487 "Test Method for Classification of Soils for Engineering Purposes".

Representative samples of soil materials, which are to be placed and compacted to controlled moisture-density conditions, should be subjected to Standard Proctor moisture-density tests (ASTM D 698) to determine the maximum dry density and optimum moisture content. Additionally, for any projects requiring pavement design, representative samples of proposed subgrade soils should be subjected to laboratory California Bearing Ratio tests (ASTM D 1883) to provide design CBR values.

When shear strength parameters are required for geotechnical analyses, these parameters should be determined as follows. The shear strength for non-cohesive materials (sand and sand-gravel mixtures) should be measured in accordance with ASTM D 3080 "Standard Test Method for Direct Shear Test of Soils under Consolidated-Drained Conditions". The undrained shear strength for cohesive soils (clays) should be measured in accordance with ASTM D 2166 "Standard Test Method for Unconfined Compressive Strength of Cohesive Soil". The drained shear strength for cohesive soils should be measured in accordance with ASTM D 4767 "Standard Test Method for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils."

## 9.5 REPORT DEVELOPMENT AND DRAFTING

Reports of geotechnical explorations should include discussions on the project, general site conditions, site geology, scope of work, results of the exploration, and conclusions and recommendations relative to the proposed design and construction. More specifically, the site description should include discussions of the site topography, site drainage characteristics, any existing improvements, proposed improvements, etc. Descriptions of the site geology should include underlying soil types and rock formations. Other geologic features such as faults or susceptibility to sinkholes should also be included. A description of the scope of work should also be provided and should include a complete description of the drilling, sampling, and laboratory analysis programs. The results of the exploration should include

descriptions of soil types, depths, the presence and depth of any groundwater, etc. Descriptions of rock cores should note the presence of joints, voids, mudseams, recovery ratios and rock quality designation values. References to site locations should also be included. In addition, any engineering analysis performed (slope stability, settlement, etc.) should be discussed. Finally, the conclusions and recommendations relative to design and construction from a geotechnical standpoint should be included.

When submitting the results of rock line soundings, the depth intervals of any rock remnants or hard clay soils encountered above the top of rock should be reported.

Geotechnical exploration data, including boring locations, graphical boring logs, sounding symbols, penetration test blowcounts, unconfined compressive strengths, natural moisture contents, groundwater elevations, top of rock elevations, etc., should be placed on the plan and profile drawings by the Design Engineer. The drawings should reflect the difference between soundings performed with mechanical augers and soundings performed with manually driven sounding rods. For intervals that have been sounded by mechanical augers and by manually driven soundings rods, report both sets of data. The elevations of any rock remnants or hard clay soils encountered above the top of rock should also be noted on the drawings. Refer to the Floyd County Geotechnical Legend Sheet, Exhibit 9-1, for the appropriate symbols. Floyd County drafting standards as outlined in Chapter 4 should be followed.

# EXHIBIT 9-1
# GEOTECHNICAL LEGEND SHEET

**EFFECTIVE DATE:** DECEMBER 2012



Description of Soil Relative Density or Consistency

| SOIL TYPE | RELATIVE DENSITY OR CONSISTENCY | RANGE OF PENETRATION RESISTANCE | RANGE OF UNCONFINED COMPRESSIVE STRENGTH |
|---|---|---|---|
| Fine grained soils (More than half of material is smaller than No. 200 sieve size) | Very Soft<br>Soft<br>Medium<br>Stiff<br>Very Stiff<br>Hard | Less than 2 blows per foot<br>2 – 4<br>4 – 8<br>8 – 15<br>15 – 30<br>>30 | Less than 0.25 tsf<br>0.25 – 0.50<br>0.5 – 1.0<br>1.0 – 2.0<br>2.0 – 4.0<br>>4.0 tsf |
| Coarse grained soils (More than half of material is larger than No. 200 sieve size) | Very loose<br>Loose<br>Medium<br>Dense<br>Very Dense | Less than 4 blows per foot<br>4 – 10<br>10 – 30<br>30 – 50<br>>50 | Not Applicable |

| ROD (%) | Rock Quality |
|---|---|
| 90–100 | Excellent |
| 75–90 | Good |
| 50–75 | Fair |
| 25–50 | Poor |
| 0–25 | Very Poor |

LIMESTONE

SANDSTONE

NONDURABLE SHALE (SDI≤89)

DURABLE SHALE (SDI≥90)

Unified Soil Classifications

| MAJOR DIVISIONS | | SYMBOL | NAME |
|---|---|---|---|
| COARSE GRAINED SOILS | GRAVEL AND GRAVELLY SOILS | GW | Well-graded gravels or gravel-sand mixtures, little or no fines |
| | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines |
| | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SAND AND SANDY SOILS | SW | Well-graded sands or gravelly sands, little or no fines |
| | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | Silty Sands, sand-silt mixture |
| | | SC | Clayey sands, sand-clay mixture |
| FINE GRAINED SOILS | SILTS AND CLAYS LL IS LESS THAN 50 | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | SILTS AND CLAYS LL IS GREATER THAN 50 | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | Inorganic clays of high plasticity, fat clays |
| UNCLASSIFIED MATERIAL | | NONE | Non-classified material (i.e. concrete, asphalt, crushed stone, cinders, slag, rubble, talus, etc.) Include visual description |

| | |
|---|---|
| AI | Activity Index |
| LI | Liquidity Index |
| N | Penetration Resistance |
| S+C(%) | Material finer than No. 200 sieve |
| •S | Location of Sounding |
| •SB | Location of Soil Boring |
| ● | Location of Soil Boring and Rock Core |
| ▽ | Water Elevation |
| ▮ | Thin-walled Tube Sample |
| ⟨ | Standard Penetration Test Sample |
| Qu | Unconfined Compressive Strength |
| w(%) | Moisture Content |
| RQD(%) | Rock Quality Designation |
| SDI(%) | Slake Durability Index |
| Rec.(%) | Core Recovery |
| ø | Angle of Internal Friction |
| ø̄ | Effective Angle of Internal Friction |
| c | Cohesion |
| c̄ | Effective Cohesion |
| ɣ | Total Unit Weight |
| ⩗M | Manual Rod Sounding – No Rock Encountered |
| ⩗M | Manual Rod Sounding to Rock |
| ⩗A | Auger Sounding – No Rock Encountered |
| ⩗A | Auger Sounding to Rock |

PLANS PREPARED AND SUBMITTED BY:

CONSTRUCTED BY:

FINAL RECORD DRAWING BY:

# TABLE OF CONTENTS

# CHAPTER 10
# STORMWATER FACILITIES DESIGN

# TABLE OF CONTENTS (cont.)

# CHAPTER 10
# STORMWATER FACILITIES DESIGN

# TABLE OF CONTENTS (cont.)

# CHAPTER 10
# STORMWATER FACILITIES DESIGN

# TABLE OF CONTENTS (cont.)

# CHAPTER 10
# STORMWATER FACILITIES DESIGN

# CHAPTER 10

# STORMWATER FACILITIES DESIGN EXHIBITS

# CHAPTER 10
# STORMWATER FACILITIES DESIGN

## 10.1 PURPOSE

This chapter establishes the minimum standards for the planning and design of drainage systems and stormwater management facilities. The criteria in this section shall apply to all drainage facility design in both the local and through drainage systems, which collect offsite stormwater and convey it across the property, except where facilities have significant and immediate impact upon State or Federal property or highways. In those cases, the most restrictive of State, Federal or these standards shall govern.

Stormwater design information may be retrieved from the Floyd County web page at https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department.

## 10.2 HYDROLOGY FOR STORMWATER FACILITIES DESIGN

### 10.2.1 General

This section describes the recommended procedures for calculating the runoff generated from a project site. Correct utilization of these procedures should result in the best available estimation of existing and projected runoff. The procedure will also provide the consistency of results necessary when applied to project sites throughout Floyd County.

It is assumed that practicing Engineers involved with preparing drainage plans have adequate knowledge of the recommended procedures. There is, therefore, no attempt in this Design Manual to provide step-by-step calculation methodologies.

The runoff calculation procedures to be utilized depend upon the size of the proposed development or project as follows. See Exhibit 10-1 for guidance in selecting the appropriate method. Note: Watershed delineations must include the total watershed area draining to the point of interest, including offsite acreage that flows onto the project site.

A. If the total tributary area to an existing or proposed stormwater facility on the project site is 50 acres or less, and no storage design is required, the method of runoff calculation shall be the Rational Method.

B. If the total project drainage area is greater than 50 acres, or storage design is required, a discharge hydrograph must be calculated using the NRCS method or another method that has been approved.

C. If the site area is less than 1 acre, the recommended method for calculating required detention volumes is the Modified Rational Method regardless of storage design requirement.

## 10.2.2 Design Storm

The selection of a design storm is the basis for all runoff calculations and facility design for a project site. The facility specific requirements and associated check frequencies are found in Section 10.3.7.

Localized restrictions may be placed on some areas, based upon existing drainage problems or flooding frequency. The elevation of the 100-year pre- and post-development discharge shall be checked for all drainage system designs to assure conformance with the guidelines of the FEMA Program. The elevation for the 100-year post-development discharge shall be conveyed within the limits of the proposed easement.

## 10.2.3 Runoff Calculation Methods (Design Flow)

### 10.2.3.1 Rational Method

#### *10.2.3.1.1 General*

The Rational Method is the recommended runoff calculation procedure for project sites where:

A. The total drainage area is 50 acres or less.

B. Detention/Storage design is not required.

#### *10.2.3.1.2 Calculation*

A. The Rational Method shall be performed as follows:

$$Q = C \times I \times A$$

Where:

Q = Peak runoff (cu. ft. per sec.)
C = Runoff coefficient
I = Rainfall intensity (inches/hour)
A = Contributing area (acres)

B. Rainfall Intensity-Duration Curves, available through the NOAA Atlas 14 Point Precipitation Frequency Estimates at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html, shall be utilized in the Rational Method to determine rainfall depths and storm intensities. NOAA Atlas 14 is published by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service

C. The duration, Tc, shall be determined by calculating the time for a particle of water to travel from the most hydrological remote point of the project area to the point of interest. Acceptable methods to derive duration are the TR-55 (Technical Release - 55, available from the NRCS) and the Kinematic Wave

method. The minimum Tc shall not be less than 5 minutes to any given inlet or analysis point. Manning's Equation should be used to estimate any in-pipe or channel travel.

D. The runoff coefficient, C, must represent a composite of the surface condition tributary to the point under consideration.

To determine the appropriate C-Factor, the hydrologic soil group and land use for each surface condition must be obtained. Hydrologic soil group descriptions can be found in Exhibit 10-2. Exhibit 10-3 then combines this information with surface slope to provide the correct C-Factor for that area. The C-Factors given may be used directly when the drainage area is homogeneous. When it is not, an appropriately weighted C-Factor must be determined.

For areas where no hydrologic soil group information can be obtained, the C-Factor shall be the values for soil group C.

If the project site conditions differ significantly from those used as the basis for the C-Factor figures, the Design Engineer must develop a specific composite C-Factor for the area. To determine the composite C-Factor for the entire project site, a weighted average must be calculated based upon the percentage of the areas with different C-Factors. The Design Engineer shall select or calculate runoff coefficients, which reflect actual proposed designs. For subdivisions, the Design Engineer shall accommodate the maximum imperviousness permitted under land use guidelines.

E. To calculate flow rates in series, i.e., in ditch or storm sewer design, the C*A term shall be summed for all contributing drainage areas. The intensity shall be selected from the duration, Tc, to that point. The Tc selected shall be the larger of: 1) Tc for the subject inlet or analysis point based on overland flow to said inlet/analysis point, or 2) the Tc from the previous in-line inlet or analysis point plus the travel time from the previous inlet or analysis point.

### 10.2.3.2 Natural Resource Conservation Service (NRCS) Methods

#### *10.2.3.2.1 General*

The NRCS Methods are required for runoff calculation procedures for project sites where:

A. The total project drainage area is greater than 50 acres or;

B. Detention/Storage design is required, and the site is larger than one acre.

When these project conditions exist, the Design Engineer shall confer with Floyd County to determine if there is a hydrologic model available for the area. If a model exists, site calculations must be performed and correlated with this data.

If models do not exist, the Design Engineer must use the NRCS Methodology to develop a hydrologic model.

#### *10.2.3.2.2 Methods*

The NRCS Methods also include the TR-20 and TR-55 Methods. Detailed descriptions, example calculations, and worksheets for these methods are available in:

A. Project Formulation - Hydrology, Technical Release No. 20 User's Manual;

B. Urban Hydrology for Small Watersheds, Technical Release No. 55; and

C. A Guide to Hydrologic Analysis Using NRCS Methods.

#### *10.2.3.2.3 Curve Number*

The Curve Number (CN) is similar to the Rational Method C-Factor in that it is based on the surface conditions of the project site. The correct CN can be determined from Exhibit 10-4.

Maps depicting the NRCS hydrologic soil groups and existing land use for each watershed are available through the NRCS. Projected land use should be determined using project specific data and local zoning data. This information may be used to determine the appropriate surface condition factors for use in runoff calculations as described in this Section.

#### *10.2.3.2.4 Antecedent Runoff Condition*

The index of runoff potential before a storm event is termed the Antecedent Runoff Condition (ARC). The ARC is an attempt to account for the variation in CN at a particular site for various storm conditions. The CNs in Exhibit 10-4 are for average ARC, which are used primarily for design applications. Please refer to the NRCS National Engineering Handbook, Section 4 - Hydrology (NEH-4, NRCS) for a detailed discussion of storm to storm variations and upper and lower CN limits. Adjustments to the ARC will normally be involved only in calibration.

#### *10.2.3.2.5 Directly Connected Impervious Areas*

Directly connected impervious areas shall be considered where applicable in NRCS runoff calculations. The Design Engineer shall select or calculate curve numbers, which reflect actual proposed designs. For subdivisions, the Design Engineer shall accommodate the maximum imperviousness permitted under land use guidelines.

#### *10.2.3.2.6 Rainfall Duration*

The minimum design storm duration for planning and design will utilize a critical storm duration analysis with the Huff distributions as presented in Rainfall Frequency Atlas of the Midwest by Floyd Huff and James Angel, Midwestern

Climate Center, NOAA, and the Illinois State Water Survey, A Division of the Illinois Department of Energy and Natural Resources.

#### *10.2.3.2.7 Rainfall Depth*

NOAA Atlas 14, published by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service, shall be utilized to determine total rainfall depths for Floyd County for use by the NRCS methods. NOAA Atlas 14 can be accessed at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.

#### *10.2.3.2.8 Rainfall Distribution*

Synthetic rainfall distributions shall be used for design storm generation. When critical storm analyses are not required, the distributions shall match the NRCS Type II curve as published in NRCS Technical Report 55, with 5-minute time steps.

In some cases, Floyd County may require a critical storm analysis to determine the rainfall duration and distribution that produces the worst runoff conditions for a specific site. A critical storm analysis is necessary for design of drainage plans and storm water quality best management practices. Since the NRCS Type II distribution represents a 24-hour duration storm only, it is not applicable to the critical storm analysis. This analysis will be based on dimensionless Huff Distributions.

#### *10.2.3.2.9 Surface Condition Data*

Maps depicting the NRCS hydrologic soil groups and existing land use for each watershed in Floyd County are available through the NRCS Web Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Projected land use should be determined using project specific data and local zoning data. This information may be used to determine the appropriate surface condition factors for use in runoff calculations as described in this Section.

## 10.3 HYDRAULICS FOR STORMWATER FACILITIES DESIGN

This section contains the technical criteria required for the design of stormwater facilities. The Design Engineer must make adequate reference to other chapters of this manual for additional design guidelines.

### 10.3.1 General Guidelines

#### 10.3.1.1 Design Flows

A. Design flows must be calculated by the appropriate method described in Section 10.2. At a minimum, the facility must have the capacity to transport the 10-year post-development discharge, except in retrofit projects (with approval from the Floyd County Stormwater Department). The water surface

profile and capacity to convey off-site water across the property shall be checked for the 100-year post-development discharge. All systems must be capable of passing the 100-year design flow within the drainage easement.

Onsite conveyance systems must accommodate the design flow from the full watershed, including offsite acreage that flows onto the project site. If offsite water cannot be routed to bypass a required detention basin, the detention control structure should be designed to allow the offsite water to flow through the basin and be released at the existing rate. Only runoff from the project area needs to meet the detention requirements listed in Section 10.3.8.1 below.

Tailwater, or downstream water surface elevation, conditions must be considered during the design of storm sewers, open channels, culverts, and detention basins. Additional facility-specific requirements are found in following portions of this Section.

### 10.3.1.2 Allowable Pipe Materials

A. Pipe material will be selected from the products identified in the City of Indianapolis Stormwater Specifications Manual at https://www.indy.gov/activity/public-works-specifications-and-manuals. CMP is not allowed.

### 10.3.1.3 Roughness Coefficients "n" (See Exhibit 10-5)

| | | |
|---|---|---|
| A. | Concrete Pipe: | 0.012 |
| B. | Plastic (Smooth Interior Wall): | 0.011 |
| C. | Sod: | 0.030 |
| D. | Placed Riprap: | 0.030 |
| E. | Dumped Riprap: | 0.035 |
| F. | Gabions: | 0.028 |

G. Coefficients for other approved materials shall be source documented for review.

### 10.3.1.4 General Pipe Design Requirements

A. Minimum velocity shall be 2 feet per second at design flow or 3 feet per second at full flow; whichever requires the greater slope. Regardless of velocity, the minimum slope for all pipes is 0.3%.

B. Minimum pipe size shall be 12 inches unless otherwise approved by Floyd County.

C. Maximum manhole spacing

1. Less than 18" diameter- 400'

2. 18" to 30" diameter- 500'

3. 33" and greater diameter- 600'

D. All pipes are to have headwalls. Design of headwalls shall consider traffic safety.

E. Stubs for storm sewers when required shall be 1 foot long measured from the outside of the manhole or surface inlet for PVC and PE pipe or one length of pipe for concrete pipe.

F. Submerged pipes are not desirable but may be approved on a case-by-case basis.

G. The maximum change in direction of flow, in a stormwater structure or channel bend, is 90 degrees.

## 10.3.2 Storm Sewers

### 10.3.2.1 Design Methodology/Design Storm

All storm sewer systems will be designed for the 10-year storm. The 100-year storm discharge elevation must be checked to ensure the system does not surcharge out of any inlets and/or manholes. Manning's Equation is recommended to calculate pipe flow and velocity. The storm sewer hydraulic grade line shall be below the crown of the pipe at all points for the 10-year design event. For the 100-year event, the hydraulic grade line may not rise higher than the ground line or building drain elevation, whichever is lower. Losses at all inlets, junction structures and bends are to be considered. Pipes on grades greater than or equal to 20% shall have anchors at each pipe joint. The Design Engineer shall check to ensure that all pipes have sufficient cover and that all structures, inlets, and manholes have sufficient dimension to receive pipes, bells, frames, and grates.

## 10.3.3 Culverts

### 10.3.3.1 Design Method/Design Storm

A method as described in the INDOT Design Manual Chapter 203 Hydraulics and Drainage Design, along with the maximum allowable headwater and general requirements below, shall be used to design culverts. The design method utilized must be submitted for review.

### 10.3.3.2 Maximum Allowable Headwater

The most stringent requirement of the following will apply:

A. Cul-de-sacs, alleys, local streets, and collectors: Use the subgrade elevation of the adjacent roadway for the 10-year discharge.

B. Major and minor arterials: Use 12-inches below the shoulder elevation of the adjacent roadway for the 100-year discharge.

C. Headwater for the 10-year discharge shall not exceed 1.2 times the structure rise except as specifically approved on a case-by-case basis. For pipes 30” in diameter and larger, the headwater shall not exceed 1.0 times the structure rise except as specifically approved on a case-by-case basis.

D. If a culvert has a drainage area greater than one square mile or is in a regulated floodway the 100-year storm headwater depth shall not be greater than 1.0 times the structure rise except as specifically approved on a case-by-case basis.

#### 10.3.3.3 General

A. Downstream channel must receive appropriate protection or energy dissipation.

B. Traffic safety must be considered in the design of culvert end treatments. This may include extending the culvert beyond the right-of-way limits, installing catch basins to intercept roadside swales, and installing guardrails. Designs must conform to meet the requirements of the agency responsible for road maintenance and safety.

C. Non-roadway culverts must be made of HDPE. Use of alternate materials must be approved by the Floyd County engineer or the Floyd County Stormwater Board.

### 10.3.4 Trenchless Pipe Installation

Trenchless pipe installation for storm sewers and culverts is described in Chapter 12 of this manual.

### 10.3.5 Conventional Channels and Ditches

This section describes the technical criteria necessary to design stormwater channels and ditches using conventional design procedures. These procedures shall be applied to roadside and rear yard ditches and highly urbanized channels. Where possible, all waters of the state (especially in undisturbed areas) shall be designed using Natural Channel Design techniques as described in Section 10.3.6. This criterion represents minimum requirements. Justification shall be submitted for review and approval in cases where different slopes or other protective measures are recommended.

#### 10.3.5.1 Design Methodology/Design Storm

Manning's Equation is recommended, except in cases where backwater conditions

are significant. All calculations must be submitted for review. Software programs utilized must be approved.

A. Design Storm

1. Channels and ditches shall be capable of conveying the 10-year storm flow within their banks. Through drainage systems shall be designed to collect and transport the onsite post-development rate and the offsite existing rate of runoff for the 100-year design storm. In all cases, the 100-year discharge elevation must be checked to ensure that adjacent structures do not suffer flood damage.

2. All systems must be capable of passing the 100-year design flow within the drainage easement.

B. Channel Criteria

The Minimum Channel Slope shall be 0.5%, except in special cases such as retrofit projects or major channels.

C. Maximum Side Slope

1. Earth 3:1 (when depth < 8.0 feet)
   4:1 (when depth > 8.0 feet)
   2:1 (may be allowed on case-by-case basis)

2. Riprap and Aggregate 2:1

3. Concrete 1:1

4. No maintenance ground cover 2:1

5. Bioengineered systems on various slopes

D. Channel Depth

Channels created for new residential subdivisions shall not have a design depth of greater than 2.0', unless otherwise approved.

E. Channel Lining

1. Channel slope 0.5% or less - Concrete. Evaluate the use of a low flow channel.

2. Channel Slope between 0.5% and 2.0% - Concrete low flow channel with durable lining for the remainder of the protected section.

3. Channel Slope greater than 2.0% - Natural vegetation, geosynthetic turf reinforcement, Riprap or concrete based on shear stress requirements.

4. If the design parameters are beyond the limits of natural vegetation, then a non-degradable durable material must be used. Durable channel lining is required to the depth of the 10-year storm. Durable channel lining may be low maintenance ground cover, sod, soil bioengineered systems, turf reinforcement mats or concrete. Riprap, aggregate channel lining, and gabion baskets are to be limited to areas immediately downstream of an outlet pipe to reduce velocities and erosion potential. The use of these materials shall be a last alternative and approved on a case by case basis.

5. Trapezoidal or rectangular paved channels shall have bottom slopes no less than 1:12 sloping either to the center or to one side of the channel to provide self cleaning.

6. Channel and channel lining design shall consider the effects of open channel junctions, curved alignment, obstructions, transitions, constrictions, changes in slope and other characteristics including the effects of subcritical and supercritical flow.

### 10.3.5.2 General

A. Roadside ditches on retrofit projects, which have less than a 4-foot shoulder, shall not exceed 1'-6" in depth, measured from the edge of pavement.

B. Roadside ditches and channels must have a minimum 4-foot shoulder from the edge of the pavement to the top of the bank.

C. Roadside ditches and channels in through drainage systems must have a minimum 8-foot shoulder from the edge of the pavement to the top of the bank.

D. In areas where new sidewalks are proposed to cross swales, ditches, or channels, a culvert meeting design storm requirements must be installed extending past the sidewalk sufficiently to allow a maximum 4:1 slope.

E. Ditches and channels adjacent to state highways may require more stringent criteria. The Design Engineer must obtain the criteria from the INDOT.

F. Cutoff walls shall be placed at the beginning and end of all paved channels.

G. Utilities and their facilities should not be located within or interfere with swales, ditches, detention/retention facilities, stormwater quality treatment devices and facilities, manholes, pipes, or landscaping such as trees and bushes.

### 10.3.5.3 Channel Design Procedure

A. The method of designing channels and ditches as presented agrees with Hydraulic Engineering Circular HEC-15 that is based on the tractive force theory. The calculated shear stress resulting from flow in a channel is

compared to the maximum permissible shear stress for the channel lining selected. If the shear force induced by the flowing water equals or exceeds the permissible shear stress of the lining, failure may occur, and a more resilient lining must be proposed. This concept allows for calculation of the maximum discharge a channel can carry by equating the calculated and permissible shear[1]. The procedure is applicable to channels of uniform cross section and constant bottom slope.

The suggested step-by-step design procedure is shown below. Additional information is taken from the Federal Highway Administration's HYDRAIN software documentation manual. Other procedures and references may be utilized by the design engineer. However, it will be the design engineer's responsibility to satisfy all design requirements.

B. The design procedure as shown assumes steady uniform flow with the energy slope equal to the bed slope and flow calculated using Manning's equation. For conditions other than these, the designer should consult other references; one of which is HEC-11, which focuses on natural channels with irregular cross sections, varying bottom slopes, and flows exceeding 50 cfs.

The maximum shear stress on the side slopes is always less than or equal to that on the channel bottom and does not limit the design of a single, rigid, vegetative, gabion, or temporary lining, but may affect the design of composite linings[1]. The designer is alerted to this situation and should consult the previously noted references.

C. Design Procedure

1. Determine drainage area contributing to the channel.

2. Select channel cross-section side slopes & bottom width.

3. Determine channel longitudinal grade.

4. Calculate design flow. Adjust channel cross-section and grade as necessary for capacity.

5. Select channel lining.

   a. Determine maximum permissible shear stress ($\tau_p$) for the selected lining. See Table 8-11 in the Stream Restoration Design National Engineering Handbook at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/manage/restoration/?cid=stelprdb1044707 for a summary list of various protection measures or the manufacturer's recommendations for specific turf reinforcement products.

   b. Estimate flow depth in the channel.

[1] Federal Highway Administration's HYDRAIN Software Documentation (GKY and Associates, Inc.)

c. Determine Manning "n" for selected lining and depth of flow.

d. Calculate flow using Manning's equation and the estimated flow depth.

e. If calculated flow varies from design flow, repeat steps (b) and (d) until flows agree.

f. Calculate actual shear stress($\tau_d$)

$$\tau_d = \gamma d_n s,$$

Where:

$\tau_d$ = actual shear stress 1b/ft$^2$
$\gamma$ = specific weight of water 62.4 lbf/ft$^3$
$d_n$ = flow depth in ft.
s = energy slope (bed slope); ft/ft

g. If $\tau_d < \tau_p$, the lining selected is acceptable.

If $\tau_d > \tau_p$, consider the following:

- Select a lining with a higher permissible shear stress
- Decrease slope
- Increase the channel width and/or flatten side slopes

### 10.3.6 Natural Channel Design Procedures

This section describes Natural Channel Design procedures to be utilized where possible for the design of streams especially along waters of the state and in undisturbed areas. It should be noted that Natural Channel Design techniques promote enhanced stormwater quality and aquatic habitat over conventionally designed channels and ditches and is the preferred method for the design of streams.

#### 10.3.6.1 Design Methodology

Streams designed using natural channel design techniques shall emulate naturally formed streams. The design shall be based upon measurements from reference reaches in similar physiographical regions exhibiting similar characteristics to the desired stream. The designed stream shall exhibit characteristics consistent with stream types expected to occur within the given valley type. Both the pre-existing stream type and the designed stream shall be classified in accordance with the Rosgen Stream Classification system[2].

[2] Applied River Morphology (Dave Rosgen, 1994).

### 10.3.6.2 Design Discharge

Streams designed using Natural Channel Design techniques shall include a bankfull channel design based on the bankfull discharge (also commonly referred to as the channel forming event). It approximates a 1.5-year storm event and can range between a 0.8 to 2.0-year storm event. The bankfull discharge used for design shall be determined based on field bankfull indicators and shall be checked against regional curves developed from gauged streams within the same physiographical region as the stream to be designed. Where flooding of nearby structures may occur, the floodplain area adjacent to the bankfull channel shall be designed to convey a 100-year storm event.

### 10.3.6.3 Design Submittals

All parameters/information used for the basis of design shall be submitted for review. Where an existing stream is present, the design submittal shall include calculations for the proposed channel as well as measurements from the existing channel. Information submitted shall include reference reach data and location of reference reaches.

As a minimum, the following design parameters/information shall be included in the design submittal: longitudinal profile; cross sectional geometry for pool, riffle and cross-over reaches; stream type; drainage area; bankfull width; mean bankfull depth; bankfull cross sectional area; bankfull discharge; mean bankfull velocity; maximum bankfull depth; width to depth ratio; width of flood prone area; entrenchment ratio; ratio of pool depth to mean bankfull depth; ratio of pool width to mean bankfull width; average riffle, pool, run and glide slope; average water surface slope; valley slope; meander length; belt width; radius of curvature; ratio of meander length to bankfull width; ratio of radius of curvature to bankfull width; meander width ratio; sinuosity; pool to pool spacing; ratio of pool to pool spacing to bankfull width; D50 of bed materials; D84 of material which will be transported during a bankfull event; critical dimensionless shear stresses; minimum mean bankfull depth calculated using dimensionless shear stress equations.

### 10.3.6.4 Channel Stabilization Methods

Methods to be utilized to stabilize channel banks below the bankfull depth should be included within the design submittal.

The use of rock should be limited to areas exhibiting shear stresses above allowable shear stresses for vegetation. The use of native vegetation and soil bioengineering treatments is the preferred method to stabilize channel banks.

### 10.3.6.5 Aquatic Habitat Enhancements

The use of aquatic habitat enhancements should be included where possible and consistent with stream types. Enhancements may include a variety of structures consistent with stream types such as woody material, rock or wood overhangs, rock vanes, cross vanes, W-weirs, J-hook weirs, stream gravel/boulders, etc. Details for all structures shall be included with the design submittal. In most instances, it is not

necessary to extend any in-stream structures or bank revetments above the bankfull depth.

#### 10.3.6.6 Riparian Corridor Enhancements

Where practical, the design shall include enhancements to the riparian corridor on either side of the reconstructed stream. Riparian corridor enhancements shall include native plantings consistent with anticipated inundation periods. Submittals shall include a description of existing vegetation within the riparian corridor as well as proposed plantings and frequency schedules.

### 10.3.7 Surface Inlets and Gutter Spreads

This section describes the technical criteria necessary to design surface inlets/catch basins. Please reference HEC-22, Urban Drainage Design Manual for more in-depth discussions and procedures.

#### 10.3.7.1 Design Storm

All surface inlets and gutter spreads shall be designed for the 10-year storm return period for the system.

#### 10.3.7.2 Design Methodology

The design methodology utilized shall be those presented in HEC-22, Urban Drainage Design Manual or the INDOT Design Manual.

#### 10.3.7.3 Maximum Flow Spread on Pavement

Maximum flow spreads on pavement shall be as follows:

A. Cul-de-sacs, Alleys, and Local Streets - 6 feet onto travel lane; 8 feet with 2-foot-wide concrete curb and gutter.

B. County Through Roads - 4 feet onto travel lane; 6 feet with 2-foot-wide concrete curb and gutter.

Flow spread is measured from the face of curb. The minimum slope for gutters shall be 0.50%. In addition, the flow depth at any location along the curb shall not exceed 4 inches.

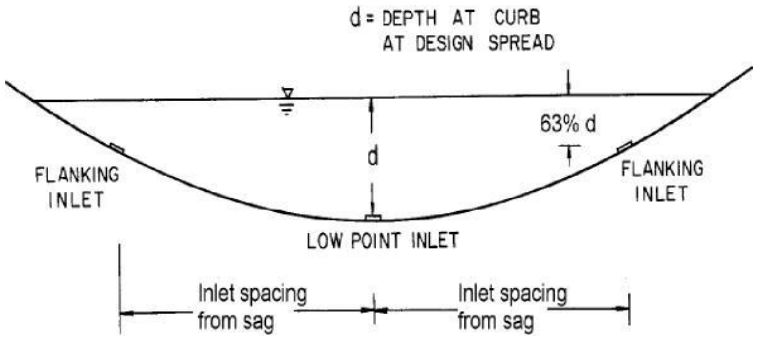
#### 10.3.7.4 General

A. Inlets shall be placed immediately upstream of pedestrian walkways and intersections and designed to intercept as close to 100% of the flow as possible.

B. Inlets placed at locations other than that described above shall be placed at locations that prevent the allowable spread or depth at curb criteria from being exceeded. Vane grates shall be used at all inlet locations.

C. Inlets shall not be placed within 2 feet of driveways or mailboxes. Exemptions may be requested from the Floyd County engineer or the Floyd County Stormwater Board.

D. Inlets at sags in curb and gutter applications shall receive careful design to prevent violation of the gutter spread requirements above. In addition, it is good engineering practice to place flanking inlets on each side of the low point inlet when in a depressed area that has no outlet except through the system. This is illustrated in the figure shown below.




The purpose of the flanking inlets is to act in relief of the inlet at the low point if it should become clogged or if the design spread is exceeded. Flanking inlets can be located so they will function before water spread exceeds the allowable spread at the sump location. The flanking inlets should be located so that they will receive all of the flow when the primary inlet at the bottom of the sag is clogged. They should do this without exceeding the allowable spread at the bottom of the sag.

If the flanking inlets are the same dimension as the primary inlet, they will each intercept one-half the design flow when they are located so that the depth of ponding at the flanking inlets is 63% of the depth of ponding at the low point. If the flanking inlets are not the same size as the primary inlet, it will be necessary to either develop a new factor or do a trial and error solution using assumed depths with the weir equation to determine the capacity of the flanking inlet at the given depths.

### 10.3.8 Detention Basins

This section describes the technical criteria necessary to design stormwater detention basins. Detention basins are typically designed to remain empty during dry weather and to backup or detain excessive runoff generated during a storm.

The designer is directed to the Detention Analysis Checklist included in this chapter and found at the Floyd County web page at https://www.floydcounty.in.gov/index.php/floyd-county-government/floyd-county-indiana-stormwater-department.

### 10.3.8.1 Detention Basin Design

A. The minimum basin volume shall be such that the 100-year post-development condition be released from a detention system at the 10-year pre-developed rate and that the 10-year post-developed condition be released at the 2-year pre-developed rate. The design calculations must not only show that the required volume has been created, but that the basin functions to detain the volume difference. Basin volume may also be dictated by limitations of downstream conditions or other requirements on a case-by-case basis.

In many areas increased runoff volumes can be as critical, if not more critical, than the rate of discharge. This issue will be addressed on a site-specific basis. All development submittals will be evaluated for the impacts of increased runoff and volume control. Satisfying the volume requirement may be met onsite, at approved off-site locations, or by purchase of volume in a Flood Compensation Bank if one is available, with Board approval.

Floodplain compensation at a ratio of 1.25:1 is required throughout Floyd County. In the Falling Run watershed, the volume of increased runoff must be mitigated at a ratio of 1.5:1.

The Stormwater Board may require 10% additional detention upstream of known flooding problem areas. If the Board requires detention above the additional 10% then the Board will compensate the developer for the increased cost.

If the basin is to be located directly on a portion of the through drainage system, volume calculations must also consider the total system flow reaching the basin. If the basin is to be constructed on a perennial or intermittent stream, it must be beneficial to the stream corridor or the public.

Detention basins for private development projects shall not be constructed in a floodway. They may be constructed in a floodplain with Board approval. Capital project detention basins are constructed to compensate for additional flow from existing development. Some capital project detention basins must be built in a floodplain to accomplish their goals.

In the case that a floodway is not delineated within a floodplain, the entire floodplain is considered the floodway. Alternatively, a Floodplain Analysis and Regulatory Assessment (FARA) can be requested from the Indiana Department of Natural Resources (IDNR) prior to request for Board approval of construction within the floodplain.

The discharge from a detention basin must be to an existing drainage swale, creek, or ditch. All discharges to a curb or roadway must flow through a piped system with a hard structure (i.e. catch basin, manhole or junction box).

B. Maximum basin side slopes shall be 3:1, unless retaining walls are provided.

C. Low flow channels may be grass if the channel grade is greater than 1.0%. Tile underdrains must be provided for channels with less than a 1.0% grade.

D. Basin design must include maintenance accessibility and responsibility.

E. Requirements of dam safety laws shall be observed.

F. The Design Engineer shall address provisions for anti-seep collars, extended detention basins, wet ponds, soil bioengineering, baffles, outlet protection and length to width ratios.

G. The minimum length to width ratio of detention basins shall be 3:1. Inlets (pipes or ditches) shall be no closer to the outlet than the midpoint of the basin.

H. No sanitary sewer manholes shall be located within the detention basin.

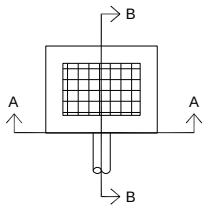
I. Detention basins in single family developments are to be placed in a lot recorded as "Open Spaces". All other detention basins must be completely within a recorded easement.

J. Retention basins (permanent pool basins or wet basins) shall have a minimum depth of 8'.

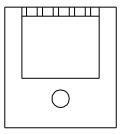
K. If the basin requires a wall or other structure, such structures must be designed by a structural engineer. Documentation of the design must be provided for approval by Floyd County Planning Commission.

### 10.3.8.2 Basin Discharge

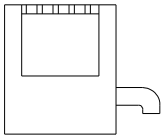
A. Discharge control structures shall be multi-stage and capable of limiting 2, 10, and 100-year post-development discharges to pre-development peak discharge rates or downstream system capacity, whichever is less, and shall be constructed of concrete or approved alternate. Principal spillways shall be designed to discharge flows from the 10-year storm with no flow in the emergency spillway. Orifices smaller than 12" shall take precautions to avoid clogging.




PLAN VIEW



SECTION A-A



SECTION B-B

B. The emergency spillway shall be sized to accommodate a flow equal to the design overflow of the 100-year storm post-development discharge, assuming all other outlets are completely blocked, without overtopping the dam. Discharge must be conveyed to a public outlet of sufficient capacity. Erosion protection must be provided for the spillway and receiving stream and energy dissipation must be employed.

C. The dam elevation shall not be less than one foot above the 100-year storm storage and overflow elevation.

D. Appropriate downstream channel protection must be installed, and the basin outlet pipe must be placed no closer than 15’ from an adjacent property line.

E. Storage, discharge, and routing calculations for the 2, 10, and 100-year discharges must be submitted for review and have a Professional Engineer’s stamp and signature.

F. The top of dam shall be at least one foot below the lowest opening of any structure adjacent to and upstream of the dam.

G. Detention basins shall be fully discharged, or returned to normal pool elevation in the case of wet basins, within 36 hours after the storm event unless specifically approved.

H. The detention basin shall be the first item of construction and must be designed to function as a sediment basin through the construction period. The basin design must be checked for capacity due to additional runoff generated by disturbed site conditions. The detention basin may be designed with over-excavation to account for planned sedimentation during construction. Excess sedimentation shall be removed and disposed of properly to establish design capacity of the detention basin.

#### 10.3.8.3 Parking Lot Surface Storage

A. Parking lot storage involves shallow ponding in a specifically graded area of a parking lot.

The major disadvantage is the inconvenience to users during the ponding function. Clogging of the flow control device and icy conditions can be maintenance and safety problems. This method is intended to control the runoff directly from the parking area and is not appropriate for storing large volumes.

B. The general design requirements are:

| | | |
|---|---|---|
| 1. | Maximum water depth: | 8 inches |
| 2. | Maximum surface grade: | 5.0% |
| 3. | Minimum surface grade: | 1.0% |

#### 10.3.8.4 Other Alternatives

A. The use of underground detention must be approved by Floyd County. Underground detention and oversized piping shall be bonded for the full construction cost, have a pre-treatment device and be tele-inspected before bond release.

B. Vegetated recessed islands, bio-swales or micro-detention are acceptable alternatives in appropriate soil conditions and will be approved on a case-by-case basis.

### 10.3.9 Sinkholes

#### 10.3.9.1 General

A sinkhole is any closed depression in a limestone region formed by the removal of water, surfacial soil, rock or other material that is connected to a cavern or underground passage. The sinkhole drainage area shall include any area that contributes surface water directly to the sinkhole.

The use of sinkholes as stormwater management facilities is not permitted unless there are no other cost-effective alternatives. The use of sinkholes must be submitted for approval.

#### 10.3.9.2 Design

Specific design considerations for the use of sinkholes, when permitted, include but are not limited to:

A. The sinkhole shall have the volume to store a 100-year, 24-hour NRCS Type II storm with a no outlet condition.

B. Capacity of the sinkhole, including a hydrogeologic study along with dye test results.

C. Protection measures for the sinkhole inlet.

D. Trash barriers.

E. Detention requirements.

F. An alternate means of surface water disposal in the event of sinkhole failure.

G. Restriction of development in floodplain areas adjacent to the sinkhole.

H. Review of construction methods and staging.

I. The design of sinkhole structures must be supervised by a Geotechnical Engineer, licensed in Indiana. The engineer shall also inspect and certify the construction of the sinkhole structure and certify the ability of the sinkhole to accept anticipated flows without flooding or causing property damage in the case of failure.

J. Any structural failures must be fully documented and a Geotechnical Engineer, licensed in the Indiana, must supervise design of, inspect and certify construction of repairs.

## 10.4 HYDROLOGIC AND HYDRAULIC MODELING STANDARDS

Development of uniform modeling standards is a means by which Floyd County can regulate the quality of the floodplain models. Successful floodplain management requires that the hydrologic and hydraulic floodplain models be updated as changes in watersheds occur. These changes include those resulting from continued development in the watershed, as well as from physical changes in the drainage system. As the watersheds evolve over time, the modeling standards provide guidance on how changes should be incorporated into the models. The implementation of a comprehensive set of modeling standards promotes consistency in floodplain modeling, standardizes review efforts, and provides a means to educate the engineering/development community.

The following modeling guidelines are consistent with current engineering standards of practice not necessarily to the exclusion of other sound and technically supported procedures. If an alternative modeling method is proposed, a licensed professional engineer shall justify the use of any methods other than those described below in writing prior to the model submittal and review process.

### 10.4.1 Software Selection

HEC-HMS is the recommended program for rainfall/runoff hydrologic simulations requiring hydrograph analysis at one or more points along a stream. HEC-RAS is the recommended program for open channel flow or floodplain calculations excluding streams with extremely low or high gradient. The most current versions of these software packages are available from the Hydrologic Engineering Center's

website at www.hec.usace.army.mil. Changes made for the newer model to work properly should be fully documented. The HEC manuals offer guidance for conversions to the newer versions of their software.

Other software may be accepted for floodplain analysis if approved by FEMA for National Flood Insurance Program (NFIP) usage. A list of accepted models may be found at www.fema.gov. Civil site analysis, local detention basin design, water quality analysis, natural channel design, and interior drainage system design may be performed with models not on FEMA's approved NFIP list if approved by Floyd County prior to use, on a case by case basis.

## 10.4.2 Hydrologic Modeling

The following methods and/or parameters shall be used for single event hydrologic analyses for streams and/or detention basin calculations.

### 10.4.2.1 Basin Parameters

A. Subbasin Delineation. Depending on the size and location of the watershed being analyzed, and the extents of previous modeling attempts, tributary boundaries may need to be redefined or subdivided. Drainage areas must be delineated using mapping with 2-foot contours available in parts of Floyd County. In areas where watersheds extend into other counties and 2-foot contour data is not available, supplement the topographic data with 7-1/2 Minute USGS Topographic Quadrangles. Subbasin size in developable watershed areas should be 50 to 200 acres. Areas that are not expected to develop due to land use or zoning criteria can have larger subbasin areas based on natural drainage patterns.

B. Loss Rate. The NRCS Runoff Curve Number (CN) Method, as described in TR-55 (NRCS 1986) and NEH-4 (NRCS 1985), shall be used to estimate runoff from design storms. Continuous simulations, if necessary, may use other loss rate methodology where applicable.

C. Transform. Rainfall excess shall be transformed into runoff using the NRCS Unit Hydrograph approach.

D. Base Flow. Unless modeling the Ohio River, base flow may be ignored during floodplain analyses.

E. Time of Concentration ($T_c$). The time of concentration shall be calculated for each subbasin using the combined travel times for sheet flow, shallow concentrated flow, and open channel flow in accordance with TR-55 (NRCS 1986).

F. Antecedent Runoff Conditions (ARC). Average ARC shall be used in all cases except for model calibration.

G. Infiltration. Runoff infiltration will be calculated using the NRCS Runoff Curve Number (CN) Method, as discussed above. CNs should be developed

for both the existing watershed conditions (EX) and the fully developed watershed conditions (FD) and analyzed separately. EX CNs shall be estimated using NRCS Web Soil Survey (located at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) data for hydrologic soil groups, land cover type and treatment, hydrologic condition, and percentage of impervious area (connected or unconnected). Impervious area calculations should include buildings, roads, and miscellaneous transportation such as sidewalks and driveways. FD CNs shall be estimated using soils data, existing zoning regulations, and Exhibit 10-4 with maximum impervious area limitations to CN values.

H. Channel Routing. Hydrograph routing through a subbasin or along a reach of stream shall use either the Modified Puls (low gradient) or Muskingum-Cunge (moderate to high gradient) routing techniques. Muskingum-Cunge 8-point cross sections are recommended for natural channels. Routing results in the hydrologic model must correlate with the hydraulic model for the same reach.

I. Reservoir Routing. Reservoir routing may be used for modeling storage effects at bridges or culverts, or it may be used for detention facility analysis. In either case, the routing method shall use an elevation-volume-outflow relationship developed by the engineer with consideration of backwater effects on the outlet hydraulics. FEMA does not allow for consideration of detention effects in areas that are not certified as flood control structures. The initial conditions of reservoir elements shall be controlled by normal dry-weather water surface elevations. Documentation of methods used to derive the hydraulic response and storage capacity of structures associated with reservoir routing should accompany the submittal.

#### 10.4.2.2 Meteorological Parameters

A. Rainfall Duration. All models used for hydraulics analysis shall use 24-hour duration design storms provided that the NRCS Type II distribution is used.

B. Total Rainfall Depth. Rainfall depths associated with various annual exceedance probabilities are available at *NOAA Atlas 14 Precipitation-Frequency Atlas of the United States*, https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.

C. Temporal Distribution. The NRCS Type II rainfall distribution (5-minute increment) will be used for design storm definition in Floyd County.

D. Spatial Distribution. Design storms shall be applied uniformly and simultaneously to subbasins of the hydrologic simulation.

#### 10.4.2.3 Control Specifications

A. Calculation Time Step. There are five-minute (or less) calculation steps required for hydrologic modeling.

B. Simulation Length. Hydrologic models must simulate the 24-hour design storm and describe watershed response until all elements are within 5% of their initial discharge conditions.

### 10.4.3 Hydraulic Modeling

Water surface profile modeling is required for analyzing impacts to waters of the state and intermittent streams. The one-dimensional, steady flow calculations performed by HEC-RAS are suitable for most watershed conditions.

#### 10.4.3.1 Study Limits

The hydraulic study shall extend upstream and downstream of the impacted reach to a point that the modified profile converges with the existing condition profile for the same event. When creating new models, verify the modeling extent with Floyd County prior to starting the project.

#### 10.4.3.2 Cross Sectional Geometry

A. Width. The minimum width is set by extending the left and right ends of the cross section to one foot above the 100-year floodplain elevation.

B. Spacing. Cross section locations shall be based on sound engineering judgment. Higher density is required at tributary locations, slope changes, roughness changes, valley morphology changes, and at bridges or other structures. In general, cross section locations should be based on the riffle spacing of the stream being studied. Pool cross sections may be necessary for geomorphic channel design but are not required for floodplain determination. Cross section spacing on any stream in Floyd County should not exceed 500 feet (excluding the Ohio River).

C. Number of Data Points. A minimum of seven data points is required to describe each cross section. The maximum number of data points is limited by software constraints.

D. Source of Geometry Data. Elevation data in the active channel shall be collected with field survey and tied to the North American Vertical Datum of 1988 (NAVD 88). The cross-section geometry shall have the density of points necessary to accurately quantify the area under bankfull elevation and the location of the stream thalweg. Two-foot contour mapping may be used to supplement cross section data in the floodplain (overbanks). A licensed Land Surveyor or Professional Engineer must document the accuracy of survey information at cross sections and structures.

E. Bank Stations. Bank stations in natural cross sections shall be placed at the geomorphic bankfull elevation. Variations in roughness values shall be included for the channel bed, left and right banks, and left and right floodplains.

F. Reach Lengths. The distances measured between cross sections at similar points are called reach lengths. HEC-RAS uses this information to compute discharge-weighted reach overbank segments. Floodplain models should use the distance measured along the stream thalweg for the centerline reach length. Left and right overbank reach lengths should be estimated as the center of mass of the floodplain discharge.

G. Roughness Values. Channel and floodplain roughness values significantly influence model accuracy. Roughness values should be reflective of the natural variations in the bed materials and overbank vegetation. Consistent with models developed in the past, Manning's n should be used to describe frictional energy losses. There are a variety of methods available for calculating Manning's n from particle size distributions of channel materials (USDA, Rosgen, and others). Listed below are some additional references available that have photographs of reaches with measured values. A listing and description of roughness values with photographs should be included in the documentation of the model development.

References:

*Open-Channel Hydraulics*, Chow, 1959
*Roughness Characteristics of Natural Channels*, Barnes, Harry H., USGS, 1967
*Roughness Characteristics of New Zealand Rivers*, Hicks and Mason, 1991
*Stream Corridor Restoration Principles, Practices, and Processes*, USDA, 1998
*The Reference Reach Field Book*, Rosgen, 1998

H. Expansion and Contraction Coefficients. Subcritical flow contraction and expansion coefficients are used to estimate energy losses caused by abrupt changes in the flowing cross-sectional area. Typical losses occur upstream and downstream of bridge or culvert crossings and flow through a narrower portion of the valley. Where contraction and expansion losses are expected to occur, contraction coefficients should vary between 0.1 and 0.3, expansion coefficients should vary between 0.3 and 0.5. FEMA requires documentation of loss coefficients higher than these ranges.

I. Ineffective Flow Areas. Effective flow, in one-dimensional modeling, is the portion of the flow traveling in the downstream direction. Portions of the cross section that are occupied by water but not flowing in the downstream direction are described as ineffective flow areas and should be specified. A definition of ineffective flow areas should be justified in the report. Ineffective flow areas in urban watersheds must reflect current development. It is typical to have ineffective flow areas upstream and downstream of bridges.

J. Levees. The use of the levee option in HEC-RAS must be used to describe a levee in accordance with FEMA regulations and justified for NFIP use. Use of the levee option in the hydraulic model for other reasons than the

description of a legitimate flood control measure must be approved in advance.

#### 10.4.3.3 Structures

A. Required Structures. Bridges, culverts, significant pedways and other stream crossings shall be included in the hydraulic model. The geometry of the obstruction shall be surveyed and related to NAVD 88. Normal stream debris should be reflected in the reach's roughness values.

B. Analysis Methods. Refer to *Hydraulic Reference Manual* Version 2.0 or higher (HEC). The selected method is at the discretion of the engineer but must be documented in the report.

#### 10.4.3.4 Steady Flow and Boundary Conditions

A. Frequency of Flow Data. The hydrologic model must be sufficiently subdivided to provide flow change locations along the study reach. New flow data shall be added to the hydraulic model when the flow rate changes by +10%.

B. Upstream or Downstream Boundary Conditions. Hydraulic models shall be connected by junctions or downstream boundary conditions representing larger streams. Normal depth is used to represent the upstream or downstream boundary condition, or starting water surface, when the study reach is sufficiently remote from streams with existing models. If the study reach can be extended to a modeled reach then either a junction shall be used or the downstream boundary of the new reach shall be set at the water surface elevation of the larger tributary modeled with the same storm event. This conservative "simultaneous peak" approach is used for regulatory models to define the worst possible case of floodplain inundation. A minimum of ten cross sections should be placed between the boundary conditions and the study reach.

C. Internal Boundaries (Junctions). Where possible, newly modeled tributaries will be connected to larger streams with junctions. Under most floodplain modeling conditions the energy losses occurring at locations where streams come together can be calculated with the Energy Equation option in HEC-RAS. The reach distance across junctions should be minimized to reduce errors when using this option.

#### 10.4.3.5 HEC-RAS Methodology

A. Friction Slope. Use the HEC-RAS Average Conveyance Method.

B. Calculation Tolerances. Use the HEC-RAS Defaults.

C. Conveyance Method. The suggested method, for consistency, is to use the HEC-RAS default, which calculates conveyance in areas defined by changes

in Manning's "n" values only.

D. Floodway Methodology. Floodway determinations are required for waters of the state or intermittent streams. The floodway is determined by using the encroachment options available in HEC-RAS. The floodway boundaries are established by encroaching into the floodplain, producing equal loss in conveyance from both sides of the channel until the water surface has risen 0.14 feet. Floodway determination shall include consideration of expansion and contraction losses at bridges and valley nick points. For additional guidelines refer to HEC-RAS and Indiana DNR's General Guidelines for the Hydrologic-Hydraulics Assessment of Floodplains in Indiana.

## 10.4.4 Submittals

### 10.4.4.1 The Floodplain/Floodway Report Details

The report shall be submitted to the Floyd County Stormwater Department and include the following:

A. Discussion of the reasons for development or modifications of floodplain models and the standards or assumptions made. The report shall be a bound document including a cover letter signed by a licensed professional engineer.

B. Include a table defining the changes to the floodplain and the floodway limits containing the information provided in HEC-RAS with the standard table "Encroachment 1". HEC-RAS results shall be submitted for the existing, or effective model, if available, the corrected effective model showing additional geometry information from the study reach, and the proposed model.

C. Tables of the watershed and basin parameters, i.e. time of concentrations, curve numbers for existing and fully developed conditions and watershed areas.

D. Photographs of representative reaches and all bridges or culverts in the hydraulic model.

E. A table of HEC-HMS elements that correspond to flow change locations in HEC-RAS including junction name, cross section name, and the floodplain discharge.

F. Water surface profiles for all events modeled.

G. Typical cross sections showing water surface elevations and encroachment limits.

H. Hardcopies of HEC data files, if requested.

I. A hardcopy summary of HEC-HMS results (standard output table).

J. Digital versions of models prepared for the analysis.

### 10.4.4.2 Watershed Analysis Mapping

A. Mapping shall include soils, land use, zoning, streams, buildings, roads, existing and proposed floodplain/floodway boundaries, hydraulic cross sections, and study reach limits, at a minimum. The standard scale for paper maps is 1" = 400' or less using 2-ft contours. Encroachment stations shown on final mapping shall be represented in the final model runs.

B. Digital copies of cross section or subbasin modifications are required. Submittals may be as ESRI shapefiles or *.DXF files referenced to the Indiana State Plane Coordinate System, East Zone 1983 (NAD83).

### 10.4.4.3 Transmittal Medium

All digital materials, including HEC models, ESRI shapefiles, *.DXF files, digital photographs, H&H modeling parameters, etc. should accompany submittals on a USB flash drive bound into the report or as a digital download.

# EXHIBIT 10-1
# HYDROLOGIC METHOD SELECTION FLOWCHART

EFFECTIVE DATE: DECEMBER 2012

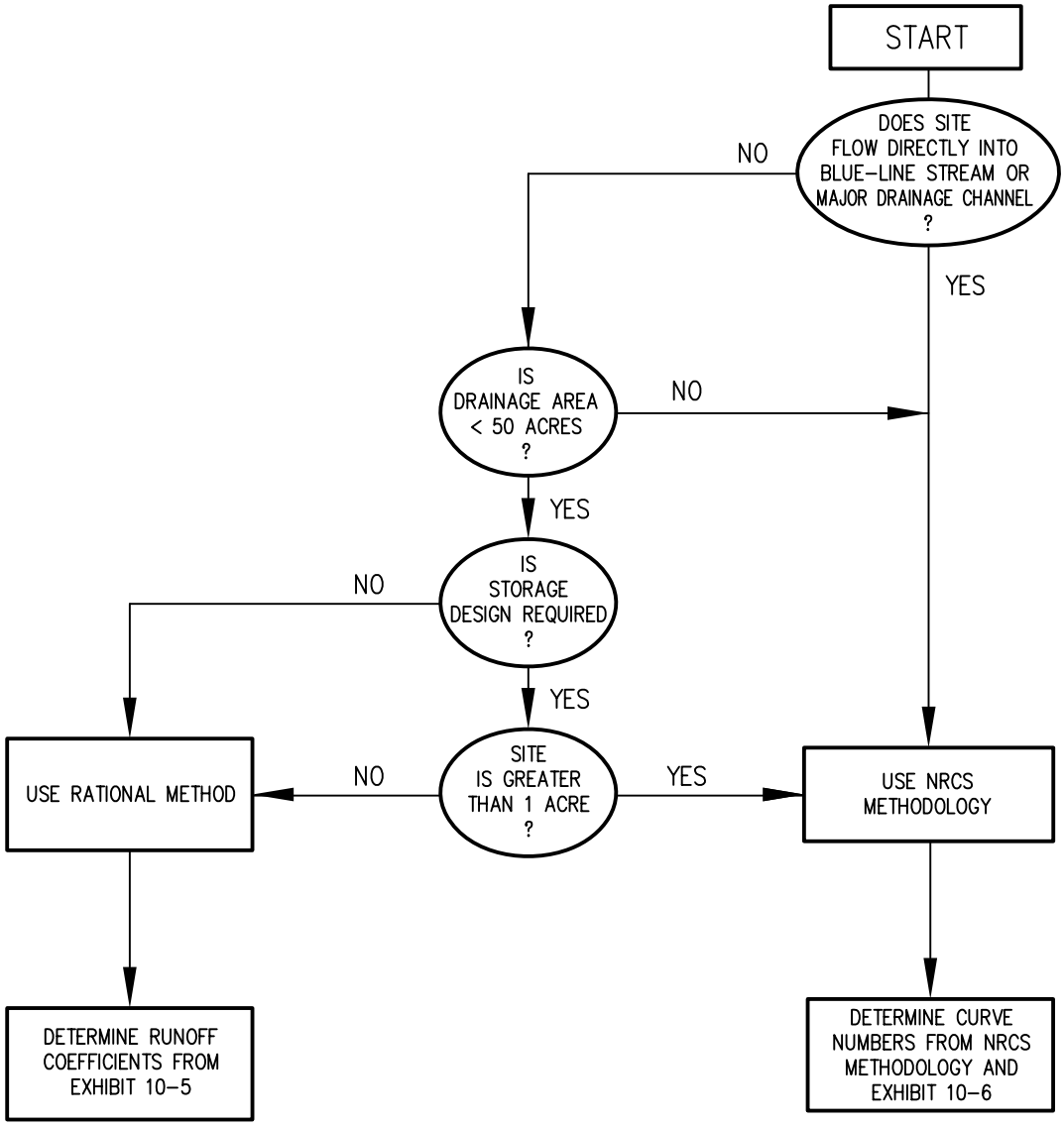


EXHIBIT 10-2
RAINFALL INTENSITY-
DURATION CURVES

EFFECTIVE DATE: DECEMBER 2012

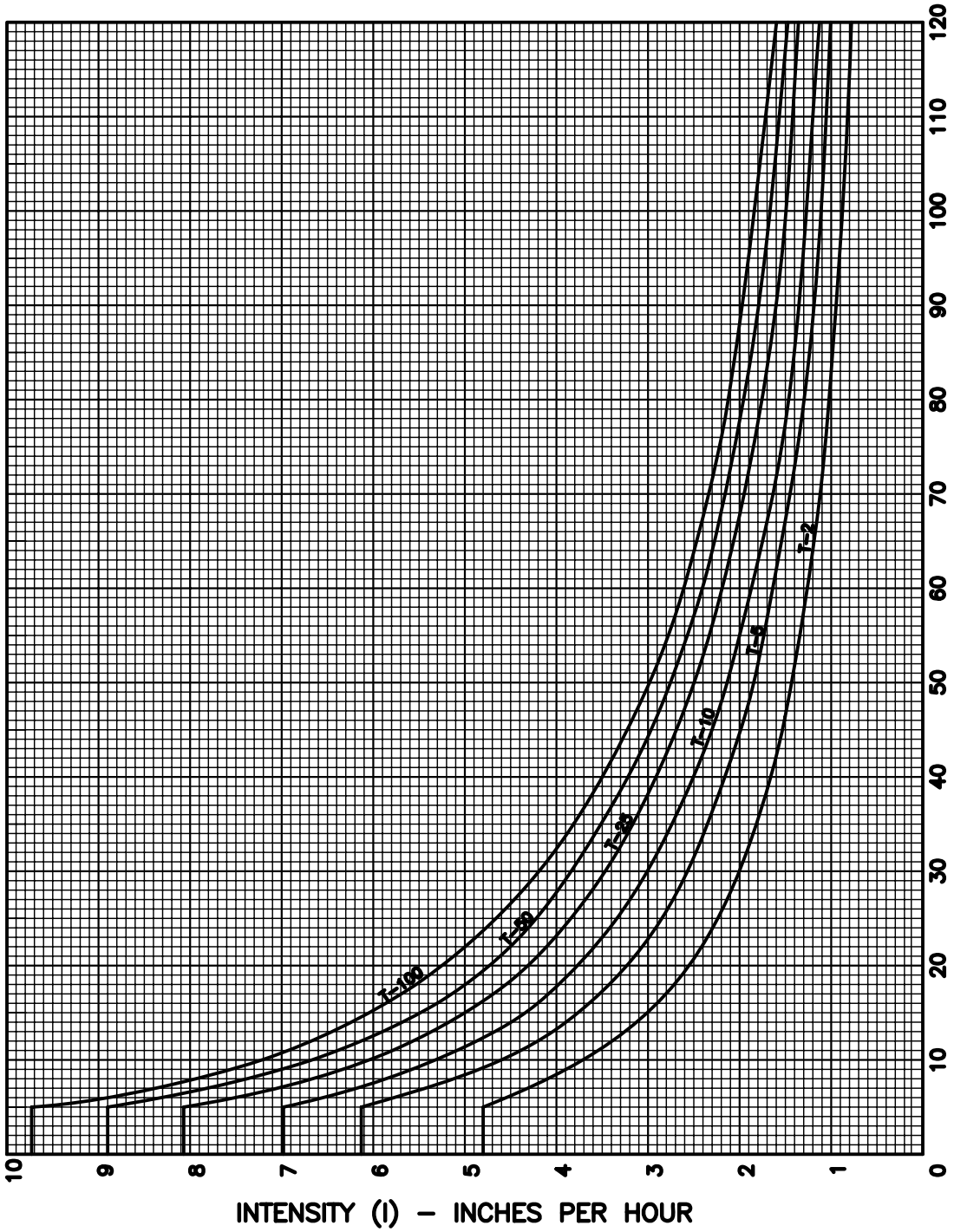


EXHIBIT 10-3
RAINFALL FOR FLOYD COUNTY
(INCHES)

EFFECTIVE DATE: DECEMBER 2012

## FREQUENCY (YEARS)

| DURATION | 1 | 2 | 5 | 10 | 25 | 50 | 100 |
|---|---|---|---|---|---|---|---|
| 30 min. | 0.94 | 1.12 | 1.36 | 1.54 | 1.78 | 1.96 | 2.15 |
| 1 hour | 1.14 | 1.38 | 1.71 | 1.97 | 2.31 | 2.59 | 2.87 |
| 2 hour | 1.38 | 1.66 | 2.06 | 2.39 | 2.84 | 3.21 | 3.60 |
| 3 hour | 1.49 | 1.79 | 2.23 | 2.59 | 3.09 | 3.52 | 3.96 |
| 6 hour | 1.83 | 2.19 | 2.72 | 3.16 | 3.79 | 4.32 | 4.88 |
| 12 hour | 2.16 | 2.59 | 3.21 | 3.72 | 4.44 | 5.04 | 5.68 |
| 24 hour | 2.56 | 3.07 | 3.81 | 4.43 | 5.31 | 6.05 | 6.84 |
| 2 day | 3.06 | 3.67 | 4.54 | 5.25 | 6.27 | 7.11 | 8.00 |
| 4 day | 3.47 | 4.15 | 5.10 | 5.87 | 6.94 | 7.82 | 8.75 |
| 7 day | 4.12 | 4.91 | 5.99 | 6.89 | 8.16 | 9.22 | 10.3 |

Rainfall data taken from NOAA's National Weather Service Hydrometeorlogical Design Studies Center Precipitation Frequency Data Service (PFDS).

EXHIBIT 10-4
HYDROLOGIC SOIL GROUPS

EFFECTIVE DATE: DECEMBER 2012

**Hydrologic Soil Group** *(HSG)* is NRCS's way of summarizing soil's hydrologic effects. This classification, with land use, is one of the determinants of NRCS's Curve Number. NRCS has categorized every soil in the country into four groups, lettered A to D. Group A is the lease likely to create runoff; group D is the most likely.

**The four groups** are defined by NRCS soil scientists as follows:

- **Group A** soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/hr). This group also includes sand, loamy sand and sandy loam that have experienced urbanization but not been significantly compacted.
- **Group B** soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15 to 0.30 in/hr). This group also includes silt loam and loam that have experienced urbanization but not been significanly compacted.
- **Group C** soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05 to 0.15 in/hr). This group also includes sandy clay loam that has experienced urbanization but not been significantly compacted.
- **Group D** soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0 to 0.05 in/hr). This group also includes clay loam, silty clay loam, sandy clay, silty clay and clay that have experienced urbanization but not been significantly compacted.

**Compound classification A/D** indicates that the natural soil is in group D because of a high water table which impedes infiltration and transmission, but following artificial drainage using such methods as perforated pipe underdrains, the soil's classification is changed to A.

**For a specific site,** *HSG* designations can be obtained by refering to a local NRCS soil survey where one is available. If the survey does not specify *HSG*s, you can look up the soil names in the complete national listing given in NRCS's *Technical Release 55.* If there is no NRCS survey at all, you can make an on-site investigation of soil charateristics, and compare them with the above definitions.

Information about HSG on this page is from page A-1 of U.S. Soil Conservation Service, 1986, *Urban Hydrology for Small Watersheds,* Technical Release 55.

EXHIBIT 10-5 PAGE 1
RATIONAL METHOD
RUNOFF COEFFICIENTS (C-factor)

EFFECTIVE DATE: DECEMBER 2012

RUNOFF COEFFICIENTS BASED ON LAND USE, SOIL GROUP AND SLOPE RANGE

| LAND USE | | A | | | B | | | C | | | D | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0–2 | 2–7 | 7+ | 0–2 | 2–7 | 7+ | 0–2 | 2–7 | 7+ | 0–2 | 2–7 | 7+ |
| Residential | %Imp | | | | | | | | | | | | |
| RE, R–1, R–2 | 25 | .31 | .35 | .39 | .33 | .38 | .43 | .37 | .41 | .48 | .40 | .44 | .52 |
| R–3, R–4, R–5 | 38 | .42 | .45 | .49 | .44 | .48 | .52 | .47 | .50 | .56 | .50 | .53 | .59 |
| R–5A, R–6, R–7, CN, OR–1 | 65 | .65 | .67 | .69 | .66 | .68 | .71 | .68 | .70 | .73 | .69 | .71 | .75 |
| R8A OR–2, OR–3, OFT | 75 | .73 | .75 | .77 | .75 | .76 | .78 | .76 | .77 | .79 | .77 | .78 | .80 |
| Commercial Business C–M, C–1 thru C–5 | 85 | .82 | .83 | .84 | .83 | .84 | .85 | .84 | .85 | .86 | .84 | .85 | .86 |
| Industrial RT, M–1, M–2, M–3 | 72 | .71 | .73 | .74 | .72 | .74 | .76 | .73 | .75 | .77 | .75 | .76 | .79 |
| Roofs, Driveways Streets, Etc. | 100 | .95 | .95 | .95 | .95 | .95 | .95 | .95 | .95 | .95 | .95 | .95 | .95 |
| Open Spaces, Lawns, Parks, Etc. | 0 | .09 | .15 | .21 | .13 | .19 | .26 | .18 | .23 | .32 | .22 | .27 | .37 |
| Woodlands, | 0 | .09 | .15 | .20 | .13 | .18 | .23 | .17 | .22 | .26 | .20 | .25 | .30 |
| Pasture, Grass, and Farmland | 0 | .15 | .20 | .25 | .18 | .23 | .30 | .22 | .26 | .35 | .25 | .30 | .40 |
| Newly Graded/Disturbed, | | .65 | .67 | .69 | .66 | .68 | .71 | .68 | .70 | .73 | .69 | .71 | .75 |

Unclassified Areas – These are areas where the Natural Resources Conservation Service has not identified any hydrologic soil groups

| | | 0–2 | 2–7 | 7+ |
|---|---|---|---|---|
| Residential | %Imp | | | |
| RE, R–1, R–2 | 25 | .37 | .41 | .48 |
| R–3, R–4, R–5 | 38 | .47 | .50 | .56 |
| R–5A, R–6, R–7, CN, OR–1 | 65 | .68 | .70 | .73 |
| R8A OR–2, OR–3, OFT | 75 | .76 | .77 | .79 |
| Commercial Business C–M, C–1 thru C–5 | 85 | .84 | .85 | .86 |
| Industrial RT, M–1, M–2, M–3 | 72 | .73 | .75 | .77 |

Notes:

1. Where the imperviousness is significantly different from the assumed values, a weighted coefficient should be computed using the actual percent impervious.
2. Consideration should be given to whether the soil group has been changed due to soil compaction by heavy equipment or mixing of the surfaces and subsurface soils

References:

1. Rossmiller, Ronald L., The Rational Formula Revisited, Proceedings International Symposium on Urban Storm Runoff, University of Kentucky, Lexington, Kentucky, July 28 – 31, 1980.

**Runoff Curve Numbers for Urban Areas**
**(See Section 10.2.3.2)**

| Cover Description | | Curve Numbers for Hydrologic Soil Group | | | |
|---|---|---|---|---|---|
| **Cover Type and Hydrologic Condition** | **Average Percent Impervious Area** | **A** | **B** | **C** | **D** |
| *Fully Developed Urban Areas (vegetation established)* | | | | | |
| **Open space** (lawns, parks, golf courses, cemeteries, etc.): | | | | | |
| Poor Condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair Condition (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good Condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| **Impervious areas:** | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding right–of–way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; curbs and storm sewers (excluding right of way) | | 98 | 98 | 98 | 98 |
| Paved; open ditches (including right–of–way) | | 83 | 89 | 92 | 93 |
| Gravel (including right–of–way) | | 76 | 85 | 89 | 91 |
| Dirt (including right–of–way) | | 72 | 82 | 87 | 89 |
| **Western desert urban areas:** | | | | | |
| Natural desert landscaping (previous areas only) | | 63 | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2 inch sand or gravel mulch and basin borders) | | 96 | 96 | 96 | 96 |
| **Urban districts:** | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| **Residential districts by average lot size:** | | | | | |
| 1/8 acre or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acres | 12 | 46 | 65 | 77 | 82 |
| *Developing urban areas* | | | | | |
| **Newly graded areas** (pervious areas only, no vegetation) | | 77 | 86 | 91 | 94 |
| **Idle lands** (CN's are determined using cover types similar to those in table 2–2c) | | | | | |

**Reference Table 2–2a. pg.2–5 of 210–VI–TR–55, Second Ed., June 1986**

**Runoff Curve Numbers for Cultivated Agricultural Lands**

| Cover Description | | | Curve Numbers for Hydrologic Soil Group | | | |
|---|---|---|---|---|---|---|
| Cover Type | Treatment | Hydrologic Condition | A | B | C | D |
| Fallow | Bare Soil | – | 77 | 86 | 91 | 94 |
| | Crop Residue Cover (CR) | Poor | 76 | 85 | 90 | 93 |
| | | Good | 74 | 83 | 88 | 90 |
| Row crops | Straight Row (SR) | Poor | 72 | 81 | 88 | 91 |
| | | Good | 67 | 78 | 85 | 89 |
| | SR and CR | Poor | 71 | 80 | 87 | 90 |
| | | Good | 64 | 75 | 82 | 85 |
| | Contoured (C) | Poor | 70 | 79 | 84 | 88 |
| | | Good | 65 | 75 | 82 | 86 |
| | C + CR | Poor | 69 | 78 | 83 | 87 |
| | | Good | 64 | 74 | 81 | 85 |
| | Contoured and Terraced (C&T) | Poor | 66 | 74 | 80 | 82 |
| | | Good | 62 | 71 | 78 | 81 |
| | C&T and CR | Poor | 65 | 73 | 79 | 81 |
| | | Good | 61 | 70 | 77 | 80 |
| Small grain | SR | Poor | 65 | 76 | 84 | 88 |
| | | Good | 63 | 75 | 83 | 87 |
| | SR and CR | Poor | 64 | 75 | 83 | 86 |
| | | Good | 60 | 72 | 80 | 84 |
| | C | Poor | 63 | 74 | 82 | 85 |
| | | Good | 61 | 73 | 81 | 84 |
| | C and CR | Poor | 62 | 73 | 81 | 84 |
| | | Good | 60 | 72 | 80 | 83 |
| | C&T | Poor | 61 | 72 | 79 | 82 |
| | | Good | 59 | 70 | 78 | 81 |
| | C&T and CR | Poor | 60 | 71 | 78 | 81 |
| | | Good | 58 | 69 | 77 | 80 |
| Close–seeded or broadcast legumes or rotation meadow | SR | Poor | 66 | 77 | 85 | 89 |
| | | Good | 58 | 72 | 81 | 85 |
| | C | Poor | 64 | 75 | 83 | 85 |
| | | Good | 55 | 69 | 78 | 83 |
| | C&T | Poor | 63 | 73 | 80 | 83 |
| | | Good | 51 | 67 | 76 | 80 |

**Table 2–2b. pg. 2–6 of 210–VI–TR–55, Second Ed., June 1986**

**Runoff Curve Numbers for Other Agricultural Lands**

| Cover Description | | Curve Numbers for Hydrologic Soil Group | | | |
|---|---|---|---|---|---|
| Cover Type | Hydrologic Condition | A | B | C | D |
| Pasture, grassland, or range – continous forage for grazing. | Poor | 68 | 79 | 86 | 89 |
| | Fair | 49 | 69 | 79 | 84 |
| | Good | 39 | 61 | 74 | 80 |
| Meadow – continous grass, protected from grazing and generally mowed for hay. | – | 30 | 58 | 71 | 78 |
| Brush – brush–weed–grass mixture with brush the major element. | Poor | 48 | 67 | 77 | 83 |
| | Fair | 35 | 56 | 70 | 77 |
| | Good | 30 | 48 | 65 | 73 |
| Woods – grass combination (orchard or tree farm). | Poor | 57 | 73 | 82 | 86 |
| | Fair | 43 | 65 | 76 | 82 |
| | Good | 32 | 58 | 72 | 79 |
| Woods. | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | 30 | 55 | 70 | 77 |
| Farmsteads – buildings, lanes, driveways, and surrounding lots. | – | 59 | 74 | 82 | 86 |

**Table 2–2c. pg. 2–7 of 210–VI–TR–55, Second Ed., June 1986**

| Land Use Definition | Soil Group A | Soil Group B | Soil Group C | Soil Group D | Unclassified |
|---|---|---|---|---|---|
| High Density | 89 | 92 | 94 | 95 | 93 |
| Medium Density | 77 | 85 | 90 | 92 | 87 |
| Low Density | 61 | 75 | 83 | 87 | 79 |
| Open/Undisturbed | 49 | 69 | 79 | 84 | 74 |

The Land Use Definitions are based upon the following conditions:

High Density – 85% Impervious – Commercial

Medium Density – 65% Impervious – 1/8 Acre lots

Low Density – 38% Impervious – 1/4 Acre lots

Open/Undisturbed – Grass cover on 50% to 75% of the area

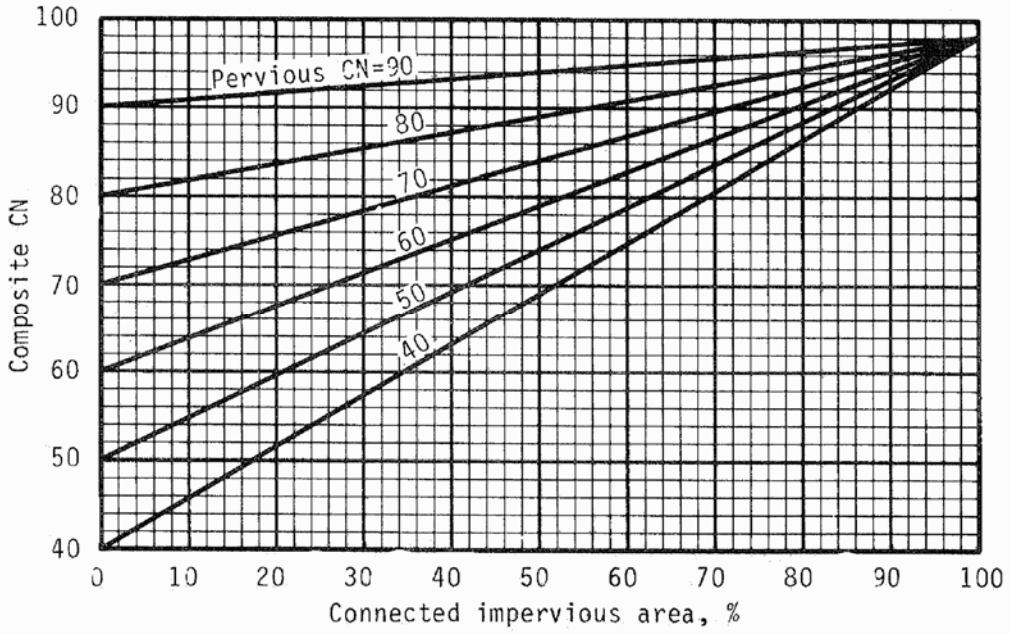



Figure 4-5 - NRCS Composite CN with connected impervious area

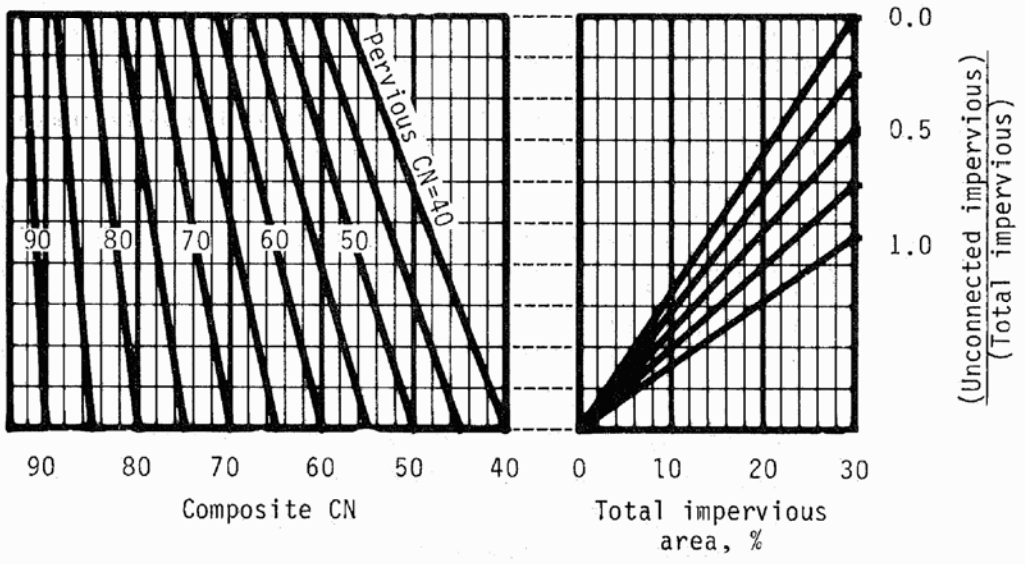



Figure 4-6 - NRCS Composite CN with connected impervious area and total impervious area less than 30%

EXHIBIT 10-7 PAGE 1
MANNING ROUGHNESS COEFFICIENTS, (n)

EFFECTIVE DATE: DECEMBER 2012

| | | Manning's n Range |
|---|---|---|
| I. | CLOSED CONDUITS: * | |
| A. | Concrete pipe | 0.012 |
| B. | Smooth wall PVC | 0.011 |
| C. | Corrugated–metal pipe or pipe–arch: | |
| 1. | 2–2/3 by 1/2 in. corrugation (riveted pipe): | |
| a. | Plain or fully coated | 0.024 |
| b. | Paved invert (range values are for 25 and 50 percent of circumference paved: | |
| (1) | Flowing full under pressure | 0.021–0.018 |
| (2) | Flowing part full, depth 0.8D | 0.021–0.016 |
| 2. | 6 by 2 in. corrugation (field bolted) | 0.030 |
| D. | Vitrified clay pipe | 0.012–0.014 |
| E. | Cast–iron pipe, uncoated | 0.013 |
| F. | Steel Pipe | 0.009–0.011 |
| G. | Brick | 0.014–0.017 |
| H. | Monolithic Concrete: | |
| 1. | Wood forms, rough | 0.015–0.017 |
| 2. | Wood forms, smooth | 0.012–0.014 |
| 3. | Steel forms | 0.012–0.013 |
| I. | Cemented rubble masonry walls: | |
| 1. | Concrete floor and top | 0.017–0.022 |
| 2. | Natural floor | 0.019–0.025 |
| J. | Laminated treated wood | 0.015–0.017 |
| K. | Vitrified clay liner plates | 0.015 |
| II. | OPEN CHANNELS, NONVEGETATED LINING, (Straight Alignment): * | |
| A. | Concrete, with surfaces as indicated: | |
| 1. | Formed, no finish | 0.013–0.017 |
| 2. | Trowel finish | 0.012–0.014 |
| 3. | Float finish | 0.013–0.015 |
| 4. | Float finish, some gravel on bottom | 0.015–0.017 |
| 5. | Gunite, good section | 0.016–0.019 |
| 6. | Gunite, wavy section | 0.018–0.022 |
| B. | Concrete, bottom float finished, sides as indicated: | |
| 1. | Dressed stone in mortar | 0.015–0.017 |
| 2. | Random stone in mortar | 0.017–0.020 |
| 3. | Cement rubble masonry | 0.020–0.025 |
| 4. | Cement rubble masonry, plastered | 0.016–0.020 |
| 5. | Dry rubble (riprap) | 0.020–0.030 |

| | | Manning's n Range |
|---|---|---|
| II. | (CONTINUED) | |
| | C. Gravel bottom, sides as indicated: | |
| | 1. Formed concrete | 0.017–0.020 |
| | 2. Random stone in mortar | 0.020–0.023 |
| | 3. Dry rubble (riprap) | 0.023–0.033 |
| | D. Brick | 0.014–0.017 |
| | E. Asphalt: | |
| | 1. Smooth | 0.013 |
| | 2. Rough | 0.016 |
| | F. Wood, planed, clean | 0.011–0.013 |
| | G. Concrete–lined excavated rock: | |
| | 1. Good section | 0.017–0.020 |
| | 2. Irregular section | 0.022–0.027 |
| III. | HIGHWAY CHANNELS AND SWALES WITH MAINTAINED VEGETATION (Values shown are for Velocities of 2 and 6 f.p.s.): * | |
| | A. Depth of flow up to 0.7 foot: | |
| | 1. Bermudagrass, Kentucky bluegrass, buffalograss: | |
| | a. Mowed to 2 inches | 0.070–0.045 |
| | b. Length 4–6 inches | 0.090–0.050 |
| | 2. Good stand, any grass: | |
| | a. Length about 12 inches | 0.180–0.090 |
| | b. Length about 24 inches | 0.200–0.100 |
| | 3. Fair stand, any grass: | |
| | a. Length about 12 inches | 0.140–0.080 |
| | b. Length about 24 inches | 0.250–0.130 |
| | B. Depth of flow 0.7–1.5 feet: | |
| | 1. Bermudagrass, Kentucky bluegrass, buffalograss: | |
| | a. Mowed to 2 inches | 0.050–0.035 |
| | b. Length 4–6 inches | 0.060–0.040 |
| | 2. Good stand, any grass: | |
| | a. Length about 12 inches | 0.120–0.070 |
| | b. Length about 24 inches | 0.200–0.100 |
| | 3. Fair stand, any grass: | |
| | a. Length about 12 inches | 0.100–0.060 |
| | b. Length about 24 inches | 0.170–0.090 |

| IV. STREET AND EXPRESSWAY GUTTERS: * | Manning's n Range |
|---|---|
| A. Concrete gutter, troweled finish | 0.012 |
| B. Asphalt pavement: | |
| 1. Smooth texture | 0.013 |
| 2. Rough texture | 0.016 |
| C. Concrete gutter with asphalt pavement: | |
| 1. Smooth | 0.013 |
| 2. Rough | 0.015 |
| D. Concrete pavement: | |
| 1. Float finish | 0.014 |
| 2. Broom finish | 0.016 |
| E. For gutters with small slope, where sediment may accumulate, increase above values of n by | 0.002 |

| V. OPEN CHANNELS, EXCAVATED OR DREDGED ** | Minimum | Normal | Maximum |
|---|---|---|---|
| A. Earth, straight and uniform | 0.016 | 0.018 | 0.020 |
| 1. Clean, recently completed | 0.018 | 0.022 | 0.025 |
| 2. Clean, after weathering | 0.022 | 0.025 | 0.030 |
| 3. Gravel, uniform section, clean | 0.022 | 0.027 | 0.033 |
| B. Earth, winding and sluggish | | | |
| 1. No vegetation | 0.023 | 0.025 | 0.030 |
| 2. Grass, some weeds | 0.025 | 0.030 | 0.033 |
| 3. Dense weeds or aquatic plants in deep channels | 0.030 | 0.035 | 0.040 |
| 4. Earth bottom and rubble sides | 0.025 | 0.030 | 0.035 |
| 5. Stony bottom and weedy sides | 0.025 | 0.035 | 0.045 |
| 6. Cobble bottom and clean sides | 0.030 | 0.040 | 0.050 |
| C. Dragline–excavated or dredged | | | |
| 1. No vegetation | 0.025 | 0.028 | 0.033 |
| 2. Light brush on banks | 0.035 | 0.050 | 0.060 |
| D. Rock cuts | | | |
| 1. Smooth and uniform | 0.025 | 0.035 | 0.040 |
| 2. Jagged and irregular | 0.035 | 0.040 | 0.050 |
| E. Channels not maintained, weeds and brush uncut | | | |
| 1. Dense weeds, high as flow depth | 0.050 | 0.080 | 0.120 |
| 2. Clean bottom, brush on sides | 0.040 | 0.050 | 0.080 |
| 3. Same, highest stage of flow | 0.045 | 0.070 | 0.110 |
| 4. Dense brush, high stage | 0.080 | 0.100 | 0.140 |

VI. NATURAL STREAM CHANNELS: **

| | Minimum | Normal | Maximum |
|---|---|---|---|
| A. Minor streams (top width at flood stage < 100 ft) | | | |
| 1. Streams on Plain | | | |
| a. Clean, straight, full stage, no rifts or deep pools. . . | 0.025 | 0.030 | 0.033 |
| b. Same as above, but more stones and weeds . . . . . | 0.030 | 0.035 | 0.040 |
| c. Clean, winding, some pools and shoals . . . . . | 0.033 | 0.040 | 0.045 |
| d. Same as above, but some weeds and stones . . . . . | 0.035 | 0.045 | 0.050 |
| e. Same as above, lower stages, more ineffective slopes and sections . . . . | 0.040 | 0.048 | 0.055 |
| f. Same as 4, more stones . | 0.045 | 0.050 | 0.060 |
| g. Sluggish reaches, winding, deep pools . . . . | 0.050 | 0.070 | 0.080 |
| h. Very winding reaches, deep pools, floodways with heavy stand of timber and underbrush . . . . . | 0.075 | 0.100 | 0.150 |
| 2. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages | | | |
| a. Bottom: gravels, cobbles, few boulders . . . . . | 0.030 | 0.040 | 0.050 |
| b. Bottom: cobbles with large boulders . . . . . | 0.040 | 0.050 | 0.070 |
| B. Flood Plains | | | |
| 1. Pasture, no brush | | | |
| a. Short grass . . . . . | 0.025 | 0.030 | 0.035 |
| b. High grass . . . . . | 0.030 | 0.035 | 0.050 |
| 2. Cultivated area | | | |
| a. No crop . . . . . | 0.020 | 0.030 | 0.040 |
| b. Mature row crops. . . . . | 0.025 | 0.035 | 0.045 |
| c. Mature field crops . . . . . | 0.030 | 0.040 | 0.050 |
| 3. Brush | | | |
| a. Scattered brush, heavy weeds . . . . . | 0.035 | 0.050 | 0.070 |
| b. Light brush and trees in winter. . . . . | 0.035 | 0.050 | 0.060 |
| c. Light brush and trees in summer. . . . . | 0.040 | 0.060 | 0.080 |
| d. Med. to dense brush, in winter. . . . . | 0.045 | 0.070 | 0.110 |
| e. Medium to dense brush, in summer . . . . . | 0.070 | 0.100 | 0.160 |

VI. (CONTINUED)

| 4. Trees | Minimum | Normal | Maximum |
|---|---|---|---|
| A. Dense Willows, summer, straight . . . . . | 0.110 | 0.150 | 0.200 |
| B. Cleared land w/ stumps, no sprouts . . . . . | 0.030 | 0.040 | 0.050 |
| C. Same as b., with heavy growth of spouts . . . . . | 0.050 | 0.060 | 0.080 |
| D. Heavy timber, a few down trees, little undergrowth, flood stage below branches | 0.080 | 0.100 | 0.120 |
| E. Same as d., with flood stage reaching branches . | 0.100 | 0.120 | 0.160 |

C. Major Streams (top width at flood stage > 100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.

| | | | |
|---|---|---|---|
| 1. Regular section with no boulders or brush . . . . . | 0.025 | ***** | 0.060 |
| 2. Irregular and rough section . . . | 0.035 | ***** | 0.100 |

* SOURCE:
KENTUCKY DEPARTMENT OF HIGHWAYS DESIGN MANUAL
EFFECTIVE DATE 3–77, EXHIBIT 2–507.1
MANNING ROUGHNESS COEFFICIENTS, n

** SOURCE:
KENTUCKY DEPARTMENT OF HIGHWAYS DESIGN MANUAL
EFFECTIVE DATE 01–01–93, EXHIBIT DR–05.901
MANNING ROUGHNESS COEFFICIENTS, n

# TABLE OF CONTENTS

# CHAPTER 11
# PRIVATE DEVELOPMENT DRAINAGE PLAN SUBMITTAL REQUIREMENTS

# TABLE OF CONTENTS (cont.)

# CHAPTER 11
# PRIVATE DEVELOPMENT DRAINAGE PLAN SUBMITTAL REQUIREMENTS

# CHAPTER 11
# PRIVATE DEVELOPMENT DRAINAGE PLAN SUBMITTAL REQUIREMENTS

## 11.1 PURPOSE

This chapter establishes the submittal requirements to the Floyd County Stormwater Department for private development storm sewer projects. This chapter also summarizes the processes required by Floyd County for approving a private development project. Storm sewer systems should be designed in accordance with the applicable provisions of this and other chapters of the Floyd County Design Manual.

## 11.2 FLOYD COUNTY STORMWATER DEPARTMENT REVIEW

The drainage facilities for a proposed development in Floyd County must be reviewed and approved by the Floyd County Stormwater Department. The applicant shall meet with the Stormwater Department during the planning phase of development to discuss the feasibility of the storm sewer design before creating final construction plans.

### 11.2.1 Preliminary Review

A meeting should be arranged with the developer and the Floyd County Stormwater Department to discuss a preliminary plan and if sufficient downstream capacity is available. A preliminary plan shall be submitted on a 24" x 36" drawing identifying the limits of the project. The preliminary plan should generally show a location map, the lot layout with topography, drainage areas in each segment, proposed storm sewer alignment, proposed detention basin location with preliminary volume calculations, the existing storm sewer, and the discharge points. The Stormwater Board/Stormwater Department will review the submittal, primarily examining the development for the following:

A. Potential impacts to upstream, downstream, and adjacent properties.

B. Adequacy of drainage system outlet.

C. Public outlet for drainage.

D. Floodplain impact.

E. Erosion and Sediment Control.

F. Adherence to any applicable drainage master plan criteria.

In Floyd County the developer should consult with the Floyd County Stormwater Department prior to submitting preliminary plans. The purpose is to confirm adherence to applicable drainage criteria and ensure the downstream drainage system has adequate capacity.

### 11.2.2 Final Review

Final plans shall include the following items:

A. Drainage Construction Plans and Specs

Two copies of the final drainage plans shall be submitted on 24”x36” size sheets as well as one digital copy containing both AutoCad and PDF file formats. One hard copy and one digital copy of the storm sewer specifications shall also be submitted. A Professional Engineer and/or Professional Land Surveyor (where applicable per IC 25-21.5-1-7) licensed in the State of Indiana shall seal, sign, and date each sheet of the drainage plans. A Professional Land Surveyor, licensed in the State of Indiana, shall seal, sign, and date any sheets with Boundaries shown. Drafting standards shall be according to Chapter 4 “CADD Standards” of this design manual.

The use of the standard details located in Appendix A of this manual is required. Nonstandard details and deviations from the standard details must be shown within the plan set. Deviations from the standard details must be approved by Floyd County.

B. Drainage Calculations

The drainage design calculations shall be as described in Chapter 10 “Stormwater Facilities Design” of this design manual and shall be included in the final submittal. Floyd County may require improvements to downstream facilities in order to accommodate the flow from the proposed development.

C. Approval by IDEM (if required)

For developments requiring IDEM approval, a copy of the permit and permit approval letter shall be submitted to the Floyd County Stormwater Department.

D. Correspondence with other Utilities

Documentation must be provided showing that potential conflicts with existing utilities have been addressed to the satisfaction of the utility company. Floyd County must be copied on all letters and transmittals to and from the various utility companies.

E. Other Permits

Documentation must be provided showing that all applicable permits have been obtained for the construction of the project, such as encroachment permits, railroad crossing permits, and Floyd County shall be copied on all letters and transmittals to and from the various regulatory agencies.

F. Easement Plats (if required)

Two copies of any sewer and drainage easement plats required for the proposed development shall be included with the final submission of documents. Easement Plats shall be recorded prior to construction approval.

G. Record Plat

A copy of the record plat for the development must be submitted in order for Floyd County to determine whether or not additional sewer and drainage easements will be required. The Developer shall record the Record Plat.

H. Erosion and Sediment Control (ESC) Plan

The developer must submit a plan for erosion and sediment control (ESC) as part of their plan set. The ESC plan must include the actual depths and locations of all control measures. The ESC plan must be stamped and sealed by an Indiana licensed Professional Engineer or Professional Land Surveyor (where applicable per IC 25-21.5-1-7). See Chapter 8 "Erosion and Sediment Control" for ESC measures.

### 11.2.3 Construction Phase

Floyd County Stormwater Department will issue an approval letter after all final design submittal requirements are provided and deemed satisfactory. This letter is the notice to proceed, and construction of the storm sewer must commence within one year of approval.

A. Drainage Facilities Contract

The developer agrees to construct the project according to the plans and specifications and to furnish record drawings once the job is finished. In the case that Floyd County desire to take ownership of the facilities a Drainage Facilities Contract will be prepared by Floyd County. This document is the legal agreement between the developer and Floyd County regarding the construction of drainage facilities. It conveys the drainage facilities to Floyd County upon completion and acceptance by Floyd County.

B. Inspector

Floyd County Stormwater Department will provide part-time inspection as needed for the construction of all drainage systems. Construction of storm sewers shall not begin in a development until an inspector has been assigned to the construction site.

Floyd County requires a three (3) working day advanced notice to schedule an inspector for a project.

C. Construction Field Changes

Final approved construction plans bearing the Engineer's original seal, signature, and date are required prior to beginning storm drainage construction

Deviations from approved construction plans as a result of unexpected field conditions will require documentation and approval by the Floyd County Stormwater Department. To obtain this approval, the contractor shall submit three (3) copies of the marked-up REDLINE plans showing the proposed revisions. Upon acceptance of the changes, the Floyd County Stormwater Department will mark the REDLINE drawings approved, sign and date the approval and send the REDLINES to the construction site via the inspector. One copy will be for the contractor, one copy for the inspector and one copy for the Floyd County Stormwater Department file.

D. Close-Out Procedures

After completion of the storm sewer installation, and appropriate restoration of the disturbed area has been completed in accordance with the Erosion and Sediment Control Plan, and all other close out criteria are met, the Floyd County Stormwater Department will accept the storm sewers as complete.

E. Record Plans

At the completion of construction, final record (as-built) drawings of the construction plans bearing the Land Surveyor's and/or Professional Engineer's original seal, signature, and date, and incorporating all approved changes shall be submitted to the Floyd County Stormwater Department. Final record drawings shall be prepared in accordance with Chapter 5 "Final Record Drawings" of this manual. The developer shall submit one hard copy of the final record drawings and one electronic copy containing both AutoCAD and PDF file formats. Floyd County's inspector will coordinate and check the work prior to submitting the record drawings to the Floyd County Stormwater Department. Record plans shall be sent to the following address:

Floyd County Stormwater Department
Pine View Government Center
2524 Corydon Pike, Suite #201
New Albany, IN 47150
Phone Number: (812) 945-9936

## 11.3 MINIMUM CONSTRUCTION PLAN SUBMITTAL STANDARDS

### 11.3.1 Subdivision Plans

Subdivision Plans for the development of more than four (4) lots require dedication of roadways for access.

All plans must be submitted on 24” x 36” inch sheets.

#### 11.3.1.1 Cover Sheet

A. Location Map with the site outlined.

B. Title Block: Title of Subdivision, name and address of developer; name, address and email address of Engineer; date of preparation; revision dates.

C. Index of Sheets and Legend.

D. Engineer’s and Land Surveyor's seals, signatures, and dates.

E. Utility Notes.

#### 11.3.1.2 Composite Drainage Plan

A. Topography

Minimum Scale 1" = 100' with existing and proposed contours at 2-foot intervals, NAVD 88 datum. Contours to extend a minimum of 50 feet beyond property lines.

B. Proposed Development

Street rights-of-way, street names, street centerline stationing, lot lines, lot numbers, property boundary, existing drainage structures, proposed drainage structures (labeled by number or other designation) and easements with widths shown.

C Hydrologic Data

Designate pre-development and post-development drainage areas (in acres) to individual inlets, and off-site drainage areas (acres), which generate through drainage.

D. Pipe Chart

Pipe number, drainage area, coefficient of runoff (c), time of concentration, intensity, discharge (Q), size, length, slope, capacity, velocity, and headwater depth for both the 10-year and 100-year flows.

E. 100-year FEMA floodplain and floodway, if applicable, with flood elevations noted.

F. Identification of outlet system.

### 11.3.1.3 Grading and Erosion and Sediment Control Plan

A. Existing and Proposed Contours.

B. Erosion and Sediment Control (Reference Chapter 8 and ESC Checklist).

C. Proposed Development

Street rights-of-way, street names, street centerline stationing, lot lines, lot numbers, property boundary, existing drainage structures, proposed drainage structures (labeled by number or other designation) and easements.

D. Grading Plan may be combined with Composite Drainage Plan provided the plan remains legible.

E. Areas of slope greater than or equal to 30% shall be identified.

F. Stream Buffers if applicable.

G. Limits of disturbance and number of acres disturbed.

### 11.3.1.4 Plan and Profile (Road) Sheets

***Plan View***

A. Catch Basins

Line and station number (structure number), grate type and elevation, and invert elevation.

B. Pipe Designation

Length, size, type, slope, pipe number.

C. Headwalls

Type, invert elevation.

D. Ditches and Swales

Type, stations.

E. Easements

Type, size, existing easements labeled with deed book and page numbers or instrument number.

F. Utilities

Existing and proposed (including sanitary sewers.)

G. Other drainage structures to be labeled accordingly.

***Profile View***

A. Storm lines and structures to be shown on road profiles.

B. Utility and sanitary sewer crossings.

### 11.3.1.5 Storm Drainage Profiles (pipes, ditches, box culverts)

A. Catch Basins

Station or number, type, grate type and elevation, invert elevation, and headwater elevation (10 and 100 year).

B. Pipes

Length, size, type, class, grade, line number if applicable, HGL (10 and 100 year).

C. Ditches

1. Type
2. Grade
3. Flow line elevation at grade changes
4. Design Depth
5. Mannings “n”
6. Slope
7. 10- and 100-year discharge depths
8. Channel Shear Stress

D. Headwalls

Type and invert elevation.

E. Existing and proposed ground surfaces.

### 11.3.1.6 Standard Detail Sheet

Refer to Appendix A in this Design Manual for Standard Details. Any detail not covered in the appendix must be approved by the Floyd County Stormwater Department.

#### 11.3.1.7 Additional Submittal Items

A. Quantities - Detailed breakdown of all items, related to storm drainage construction needed to determine the amount of the subdivision bond.

B. Approved Preliminary Plan - including sanitary sewer layout.

C. Clearing and Grading Plan - required if site clearing and grading is to precede approval.

D. Detention Basin Calculations - if applicable and in accordance with the provisions of Chapters 10 and 11 of this design manual.

E. Highway Encroachment Permit - (if applicable) from the Indiana Department of Transportation.

F. Section 404 Permit - (if applicable) from the U.S. Army Corps of Engineers.

G. Section 401 Water Quality Certification Permit - (if applicable) from the Indiana Department of Environmental Management.

H. Application for Culverts and Stream Crossings Permit - from the Indiana Department of Environmental Management.

I. Other required permits not identified here.

#### 11.3.1.8 Submittal

Two sets of 24" x 36" construction plans and specifications are to be submitted for initial review.

### 11.3.2 All Other Development Plans (Site, etc.)

#### 11.3.2.1 Existing Topography Plan

This plan shall conform to Chapter 4 of this design manual with the following additional data:

A. Spot elevations at critical points.

B. 100-year FEMA floodplain and floodway, if applicable, with flood elevations noted.

C. Off-site drainage area in acres, which generate through drainage.

#### 11.3.2.2 Proposed Development and Grading Plan

This plan may be combined with the plan described in paragraph 11.3.2.1 if existing features can still be discerned. This plan shall include the following

additional data:

A. Revised hydrologic data, runoff calculations, and detention basin design, if applicable.

B. Hydraulic data, such as pipe charts and ditch data on profiles, showing quantity of flow, velocities, and degree of protection.

C. Erosion and sediment control measures and details.

D. Show public outlet and evaluate capacity of downstream facilities.

E. Proposed easements for through drainage, detention facilities, and/or offsite increase in runoff.

F. Note specific conflicts with other utilities.

G. Written explanation of any proposed deviation from policies, standards, or design criteria and any supplemental data that would aid the understanding of the proposed plan work.

H. The stamp of a professional engineer licensed in Indiana shall be affixed to the plan when the proposed facilities affect public drainage, downstream properties, floodplains or detention.

## 11.4 INSPECTION OF SUBDIVISION CONSTRUCTION

### 11.4.1 General

Floyd County will provide on-site inspection for the construction of public drainage systems in public rights-of-way or public easements. Drainage construction may begin following approval of the construction plans and issuance of all permits as described in Chapter 2.

### 11.4.2 Inspector Assignment

Construction of drainage structures and pipes shall not begin in a development until an inspector has been assigned to the construction site by Floyd County. In certain situations, which will be identified during construction plan review, full-time inspection may be required. In the event that inspection personnel are not available to provide the level of inspection necessitated by a contractor's schedule, the owner may retain (at the owner's expense) an independent inspector working under the direct supervision of a professional engineer. The independent inspector will be required to certify that the materials and methods of construction are in compliance with the approved plans. Arrangements for owner-provided inspection including schedule and level of effort must be approved in advance.

Three working days' notice is required to schedule an inspector for a project. To schedule an inspector, please contact Floyd County at:

Floyd County Stormwater Department
Pine View Government Center
2524 Corydon Pike, Suite #201
New Albany, IN 47150
Phone Number: (812) 945-9936

## 11.5 FEES

### 11.5.1 Plan Review Fees

Floyd County plan reviews are conducted by county staff and/or persons contracted by Floyd County. The developer will pay plan review fees directly to Floyd County. All fees must be paid prior to approval of the plans. The fee, based on the table below, includes the review of the original submittal and one (1) resubmittal. If additional submittals are needed beyond original and one (1) resubmittal, then the review must be resubmitted at the original fee price.

| DEVELOPMENT SIZE | FEE |
|---|---|
| **Residential** | |
| **1-4 lots** | $450 |
| **5-25 lots** | $600 |
| **26-75 lots** | $1,100 |
| **76-150 lots** | $1,600 |
| **151+ lots** | $2,600 |
| **Commercial** | |
| **5.0 acres or less** | $600 |
| **5.1-10.0 acres** | $1,300 |
| **10.1-25.0 acres** | $2,100 |
| **25.1+ acres** | $2,600 |

### 11.5.2 Stormwater Fees

#### 11.5.2.1 Regional Facility Fee

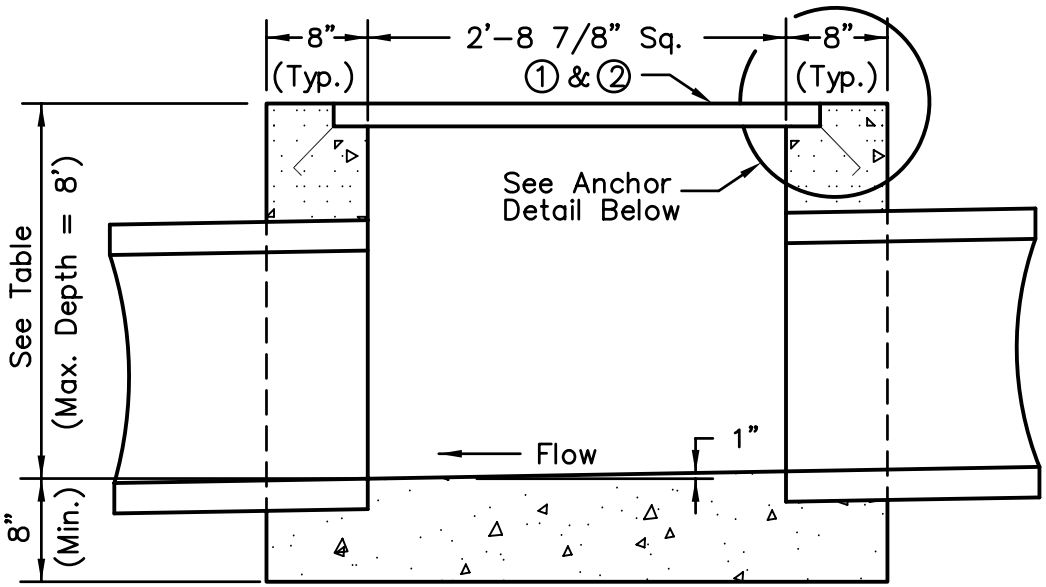
This is a stormwater impact fee, paid by the developer on sites where Floyd County has determined on-site detention will not be required. This fee allows the developer to pay a proportionate share of the cost of constructing Regional Stormwater Detention Facilities.

### 11.5.3 Compensation Fees

Fees are applicable to sites in floodprone watersheds where runoff volume compensation is required.

# Appendix A

# Standard Details

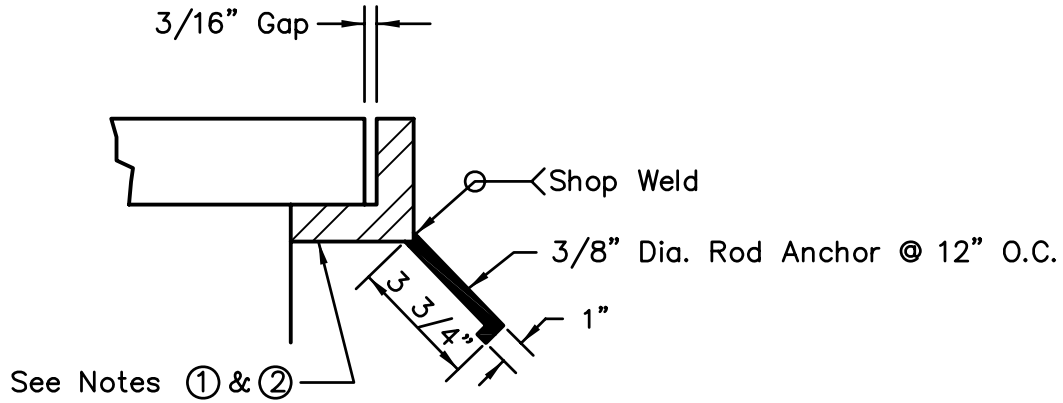



TYPICAL SECTION

## NOTES

1. J.R. Hoe & Sons Model Hoe-595 grates with 2-1/2" x 2-1/2" x 1/2" angle iron frame or approved equal.
2. Neenah R-4884-A with L 2" x 2" x 1/4" angle iron frame or approved equal. (outside right-of-way only)
3. All concrete shall be Class "A".
4. Designed for a minimum of HS-20 loading.
5. Depth greater than 4'-0" require #4, GR. 60, reinforcing bars on 12" centers each way in both walls and base.

| TABLE | |
|---|---|
| PIPE SIZE | MIN. DEPTH |
| 12" | 1'-9" |
| 15" | 2'-1" |
| 18" | 2'-4" |
| 24" | 2'-10" |



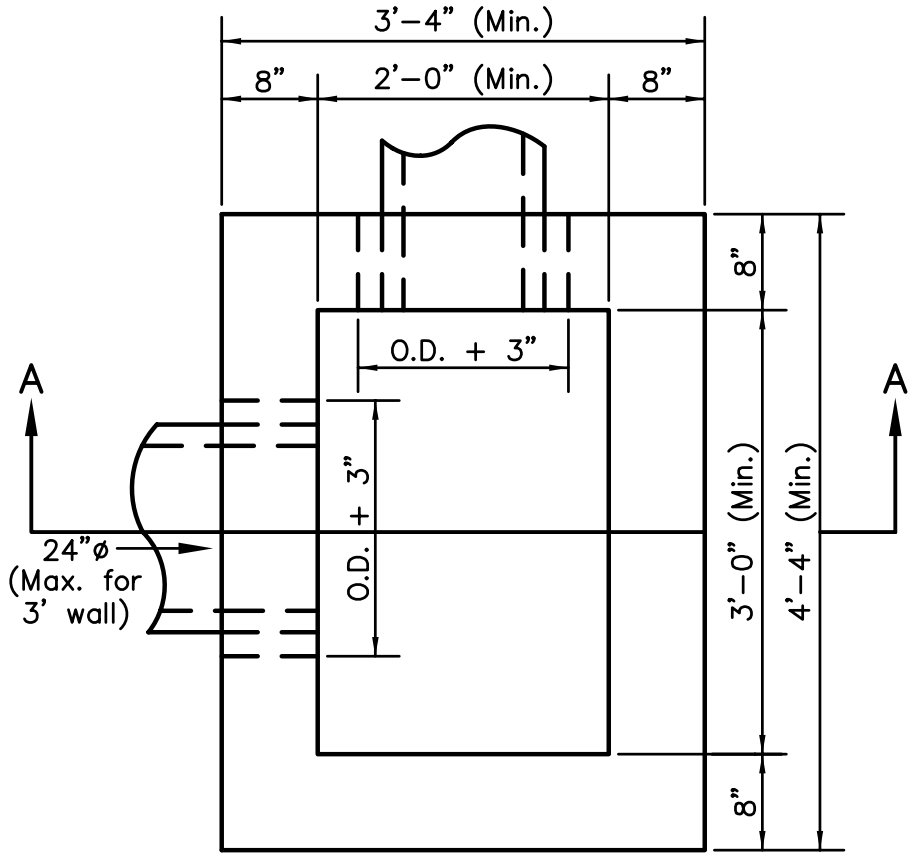

ANCHOR DETAIL

CATCH BASIN TYPE 1

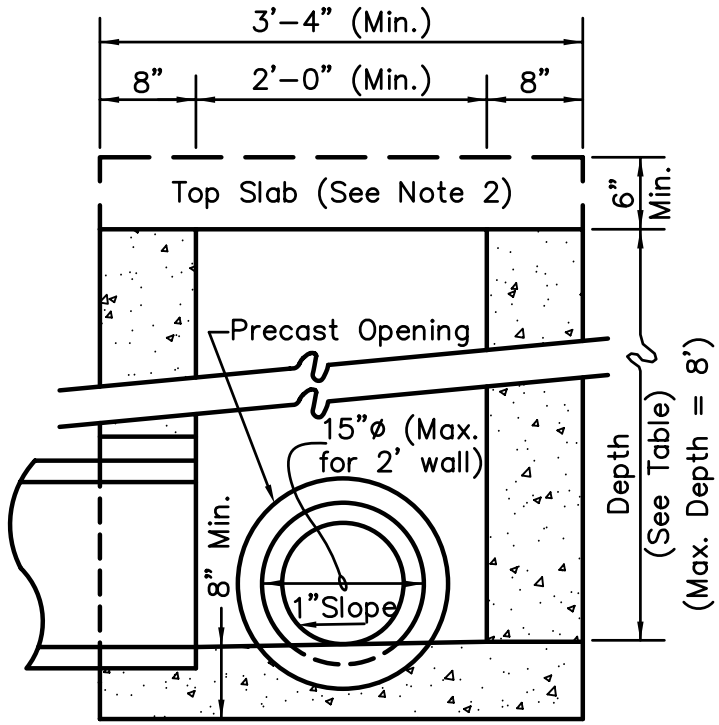
STANDARD DRAWING NO. DC-01-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




PLAN




SECTION A–A

NOTES:

1. Concrete shall be Class "A".
2. Any catch basin exceeding interior dimensions of 2'x3' will require a concrete top slab of appropriately sized thickness and reinforced with an opening (2'x3') to receive frame and grate.
3. For precast basins the opening for the pipe shall be the outside diameter of the pipe plus 3 inches if non–shrink grout is used.
4. Size of basin needs to be checked if pipe is skewed.
5. Use DG–05 or DG–06 Frame and Grate as specifed.
6. Depths greater than 4'–0" require #4, Gr. 60 reinforcing bars on 12–inch centers each way in both walls and base.

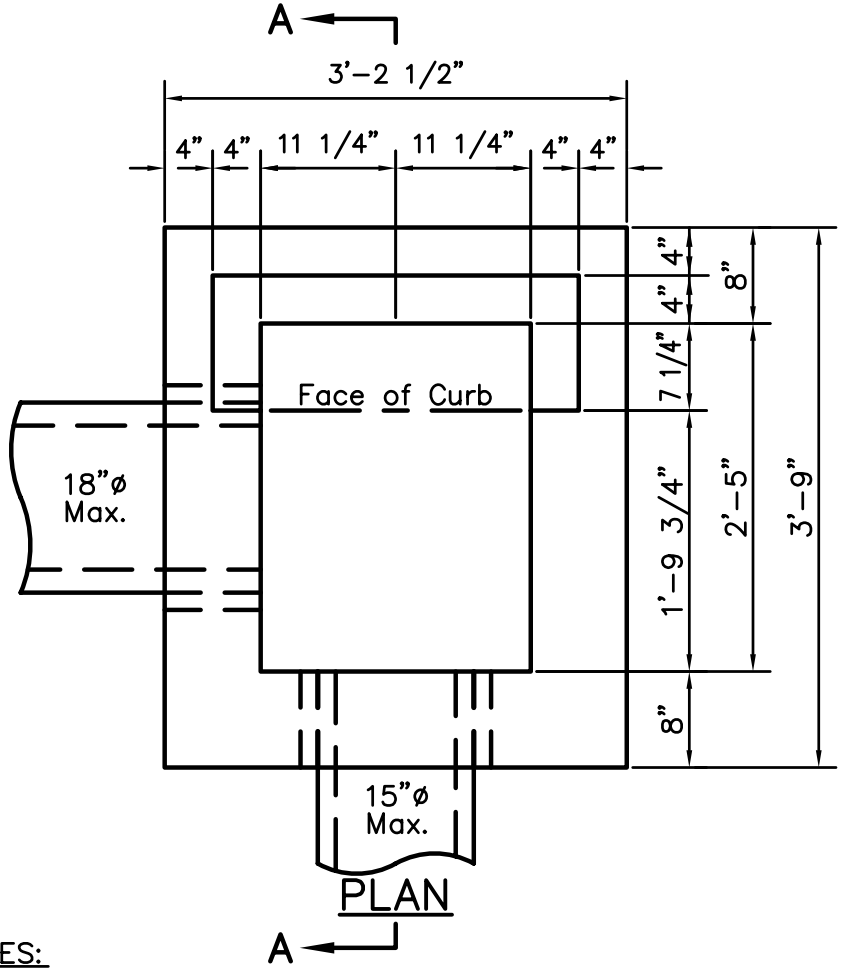
| TABLE | |
|---|---|
| PIPE SIZE | MIN. DEPTH |
| 12" | 1'–8" |
| 15" | 1'–11" |
| 18" | 2'–2" |
| 21" | 2'–6" |
| 24" | 2'–9" |
| 30" | 3'–3" |
| 36" | 3'–10" |

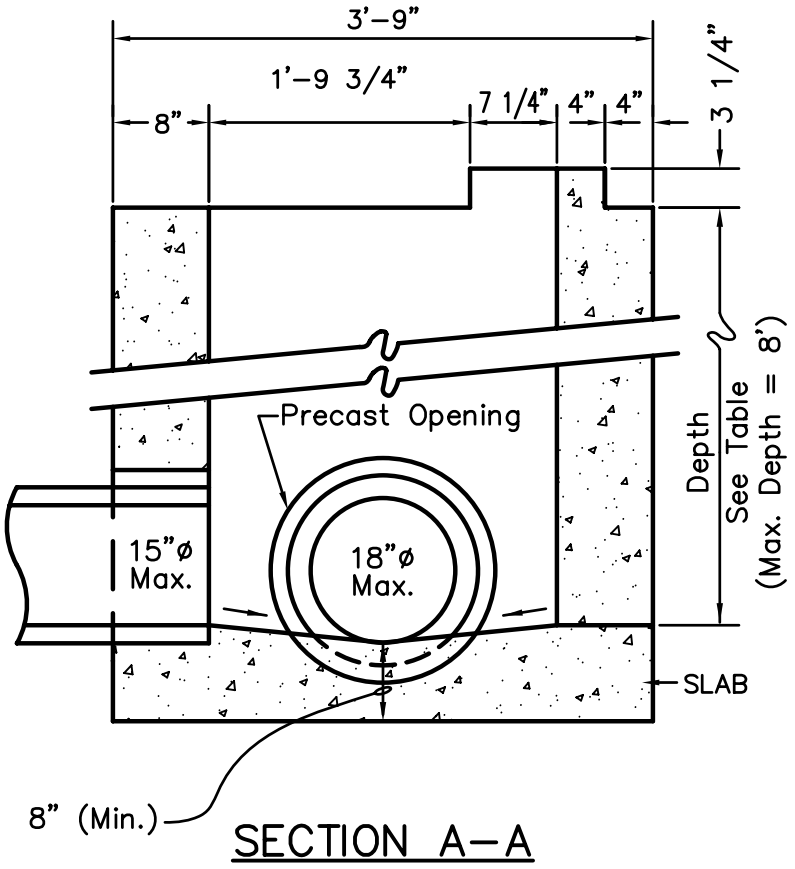
# CATCH BASIN TYPE 2

STANDARD DRAWING NO. DC–02–02

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




NOTES:

1. Concrete shall be Class "A".
2. For precast basins the opening for the pipe shall be the outside diameter of the pipe plus 3 inches if non–shrink grout is used.
3. Size of basin needs to be checked if pipe is skewed.
4. Formerly City of Louisville single grate street inlet Type T–109.
5. Use Frame and Grate DG–01 or DG–02 as specified.
6. Depth greater than 4'–0" require #4, Gr. 60 reinforcing bars on 12 inch centers each way in both walls and base.

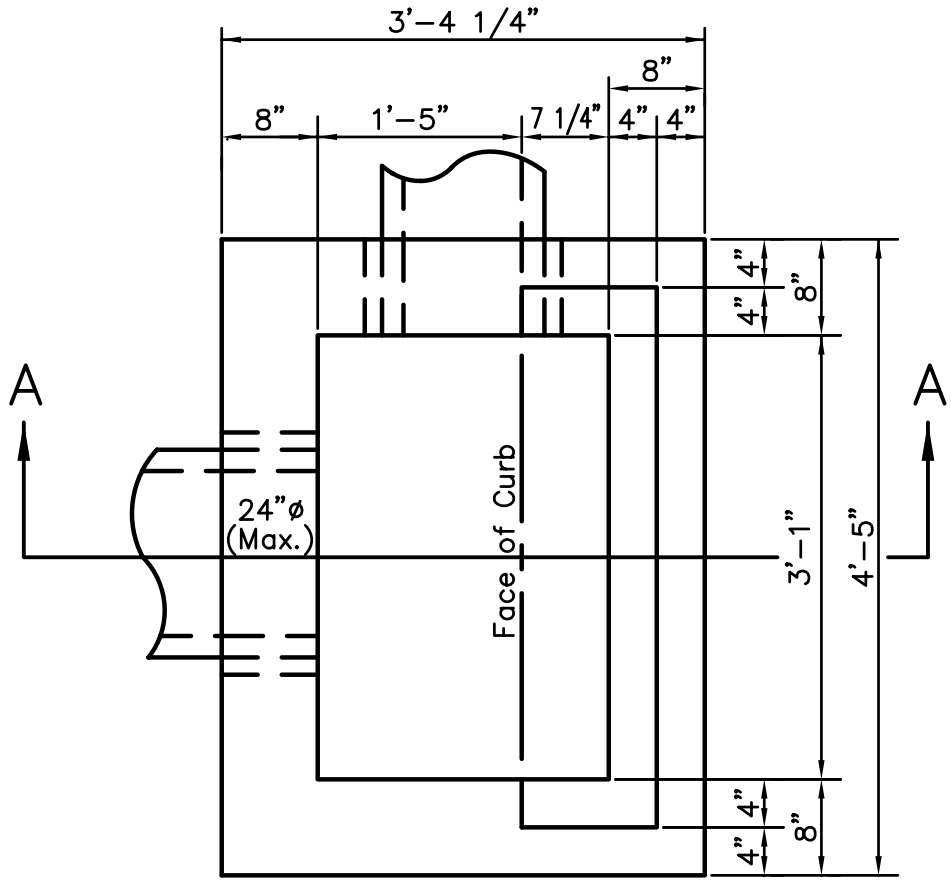
| TABLE | |
|---|---|
| Pipe Size | Minimum Depth |
| 12" | 2'–2" |
| 15" | 2'–5" |
| 18" | 2'–8" |

# SINGLE CURB INLET

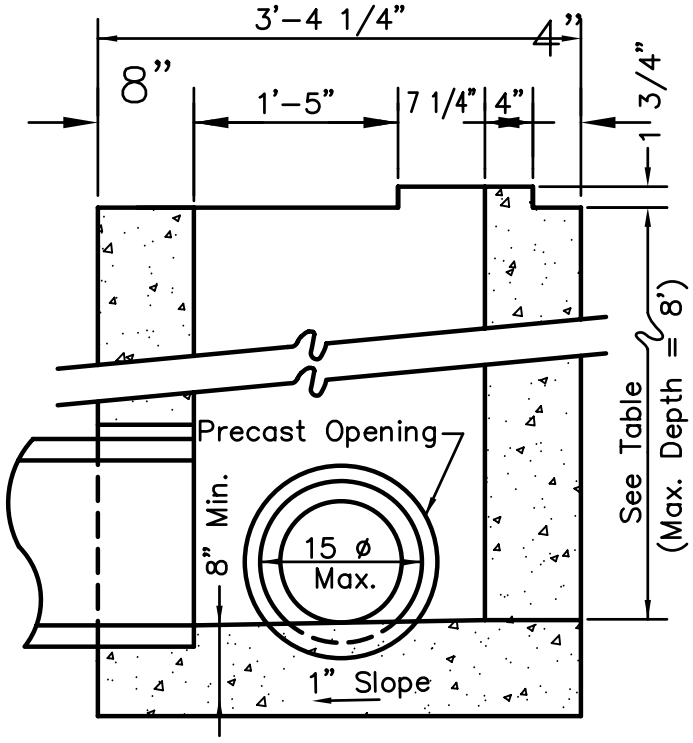
STANDARD DRAWING NO. DI–01–02

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




PLAN




SECTION A–A

NOTES:

1. Concrete shall be Class "A".
2. For precast basins the opening for the pipe shall be the outside diameter of the pipe plus 3 inches if non–shrink grout is used.
3. Size of basin needs to be checked if pipe is skewed.
4. Formerly City of Louisville double grate street inlet Type T–109.
5. Use DG–03 or DG–04 Frame and Grate as speciifed.
6. Depths greater than 4'–0" require #4, Gr. 60 reinforcing bars on 12–inch centers each way in both walls and base.

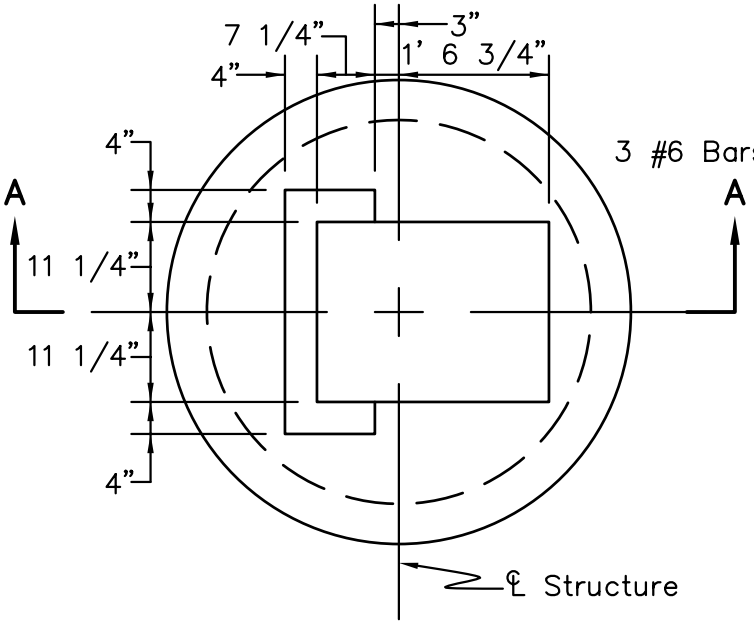
| TABLE | |
|---|---|
| Pipe Size | Minimum Depth |
| 12" | 2'–2" |
| 15" | 2'–5" |
| 18" | 2'–8" |
| 21" | 3'–0" |
| 24" | 3'–3" |

# DOUBLE CURB INLET

STANDARD DRAWING NO. DI–02–02

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

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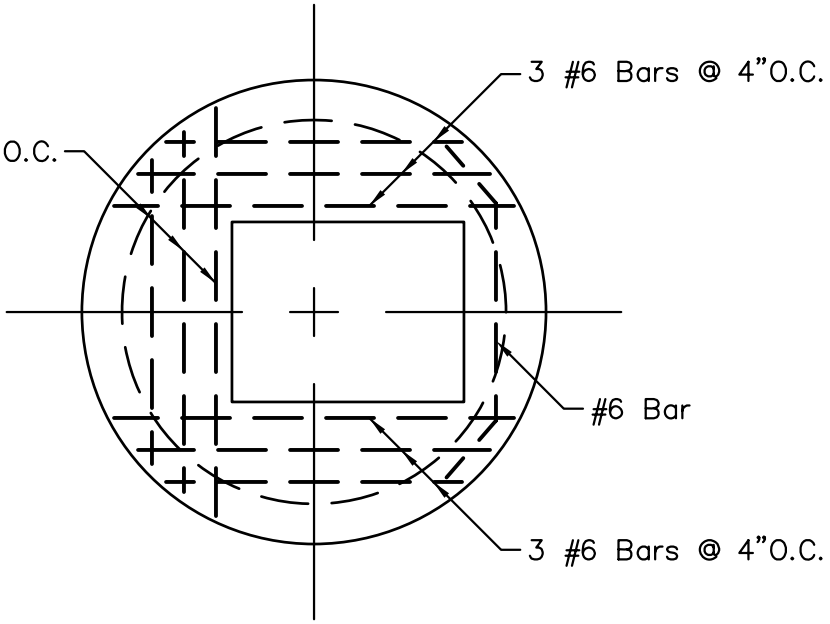
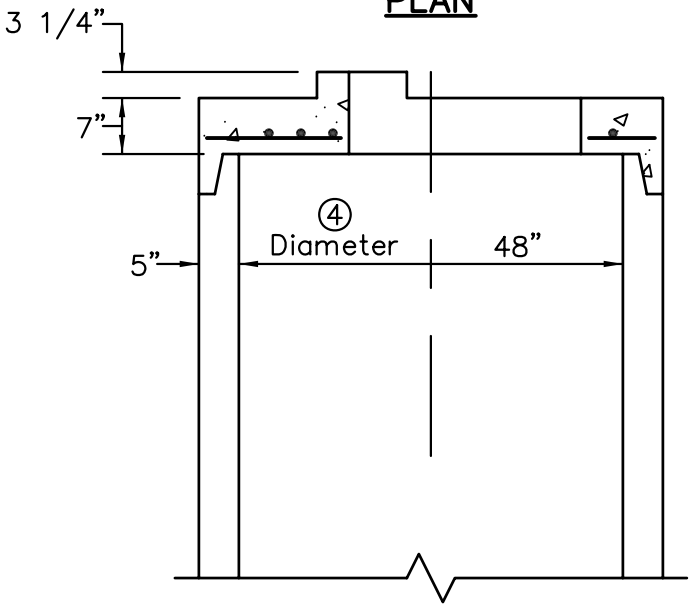



PLAN VIEW–REINFORCEMENT




SECTION A–A

## NOTES

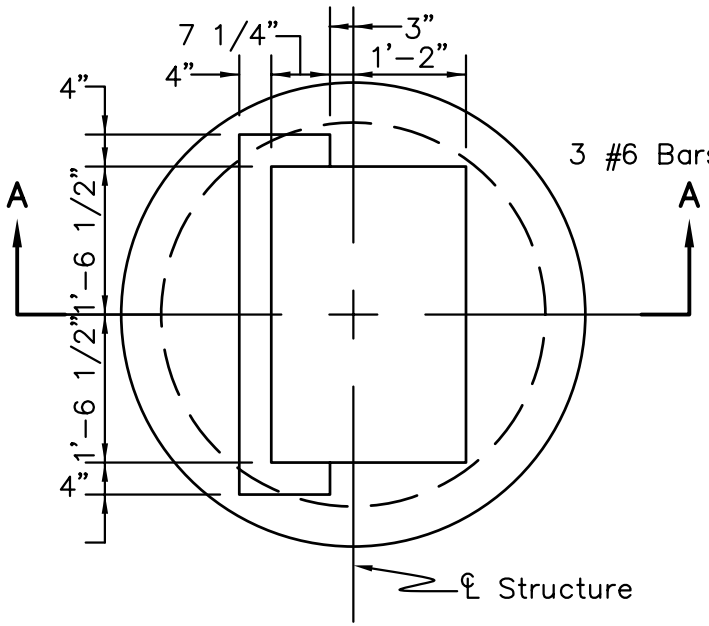
1. Concrete shall be Class "A".
2. Reinforcing steel shall be Grade 60.
3. For frame and arate see Std. Dwgs. DG-02.
4. For lower portion of structure see Std. Dwgs. GM–02 or GM–03.

PRECAST SURFACE INLET SLAB FOR SINGLE FRAME & GRATE TYPE1

STANDARD DRAWING NO. DI–03–02

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

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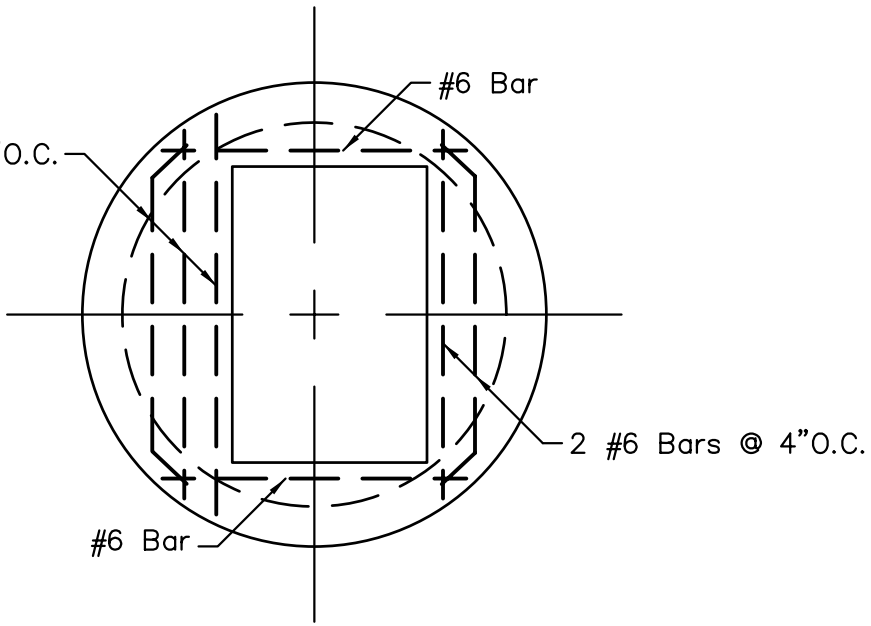
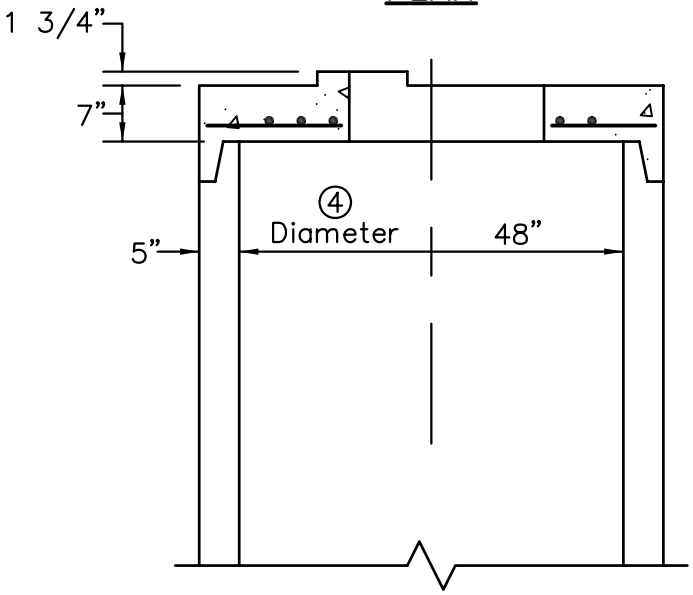



PLAN VIEW–REINFORCEMENT




SECTION A–A

## NOTES

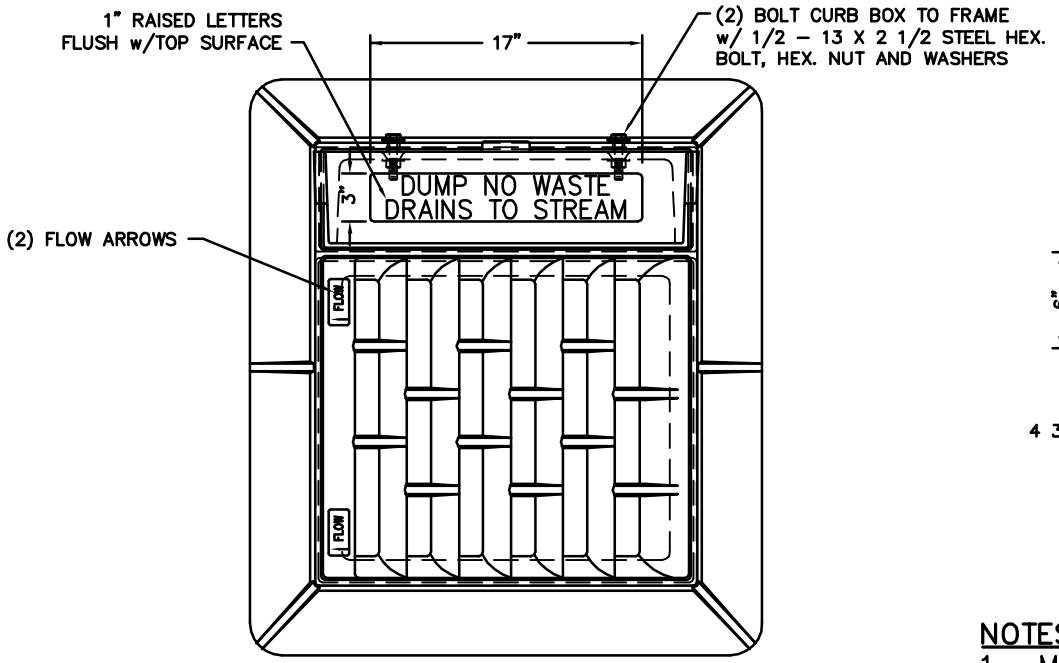
1. Concrete shall be Class "A".
2. Reinforcing steel shall be Grade 60.
3. For frame and arate see Std. Dwgs. DG-04.
4. For lower portion of structure see Std. Dwgs. GM–02 or GM–03.
5. Design for HS-20 loading.

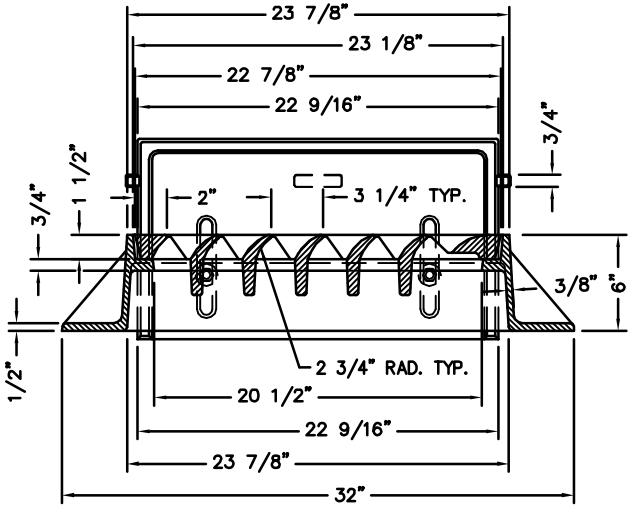
PRECAST SURFACE INLET SLAB
DOUBLE FRAME & GRATE TYPE 2

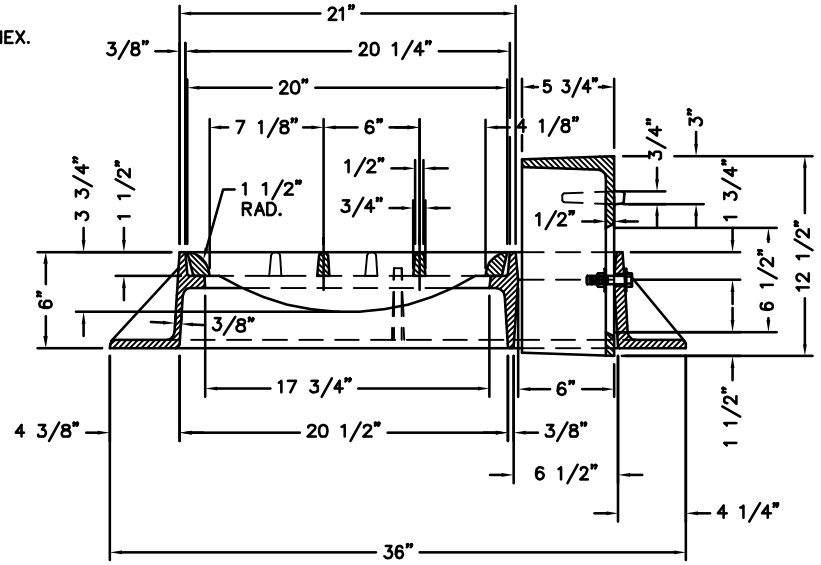
STANDARD DRAWING NO. DI–04–02

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.



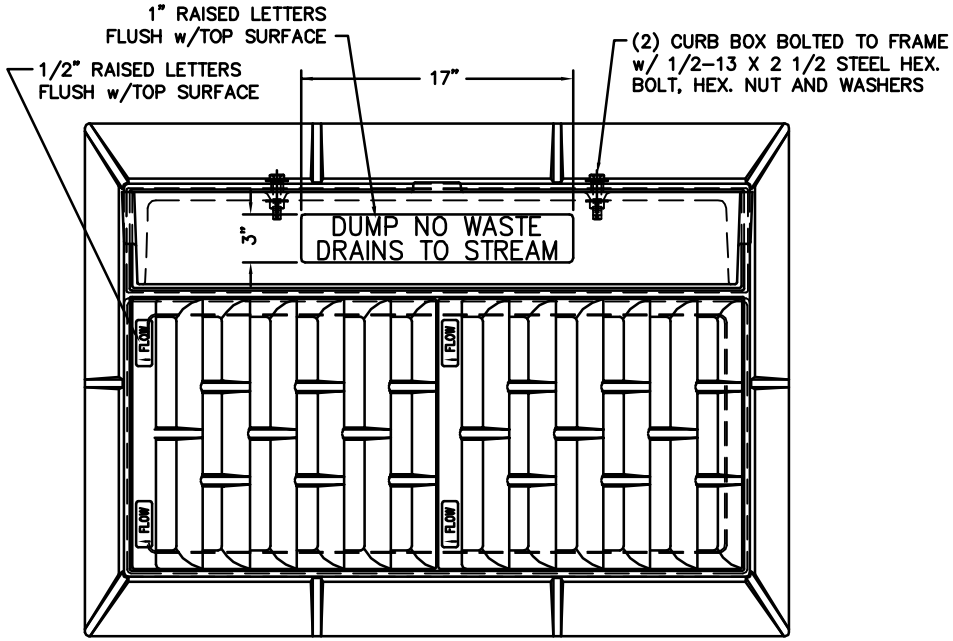



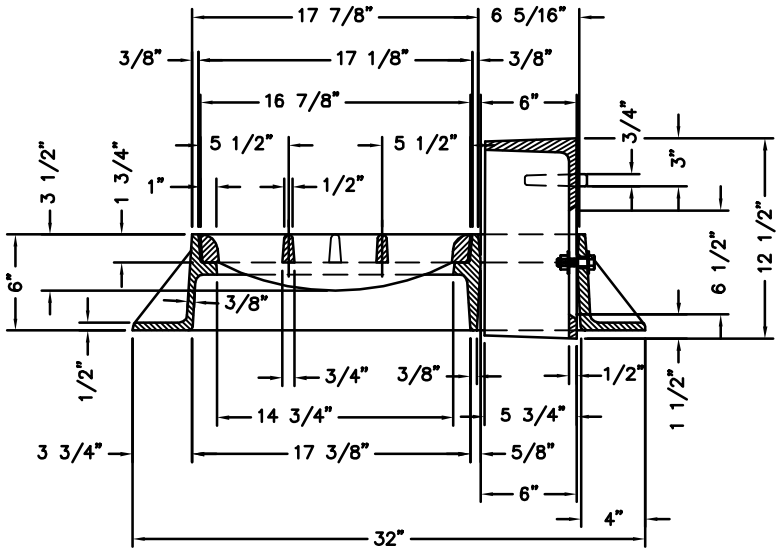

NOTES:

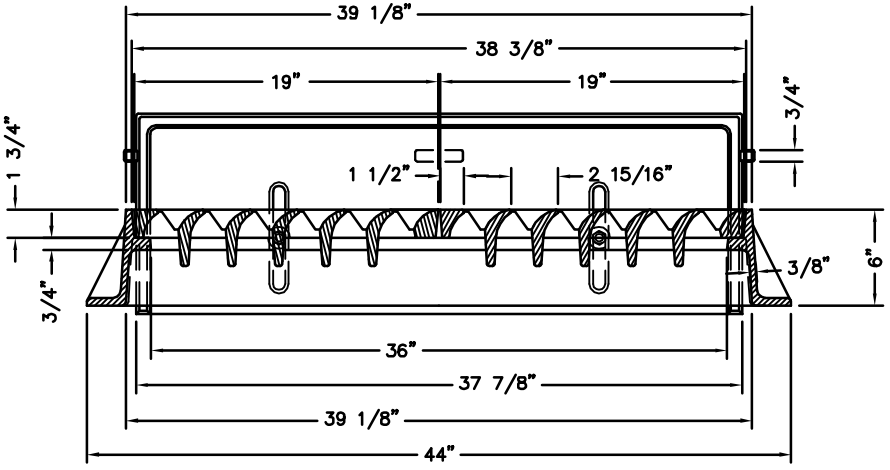
1. Material shall be Gray Iron and meet ASTM A–48 Class 35–B Standards.
2. Design for HS–20 Loading.
3. NEENAH R–3157–2 w/ SPECIAL 6" HIGH FRAME, TYPE "L" VANE GRATE, AND CURB BOX; or approved equal.
4. Curb iron must include either environmental message:
   (1) DUMP NO WASTE...DRAINS TO STREAM
   (2) NO DUMPING...DRAINS TO STREAM
5. Minimum Weights:
   Grate = 100lbs., Frame = 268lbs., Curb Iron = 75lbs

| |
|---|
| CURB CATCH BASIN – SINGLE FRAME AND GRATE TYPE 1–L |
| STANDARD DRAWING NO. DG–02–04 |
| DECEMBER 2012 |

*This is a detail from MSD Standard Drawings dated 9-30-09.




NOTES:

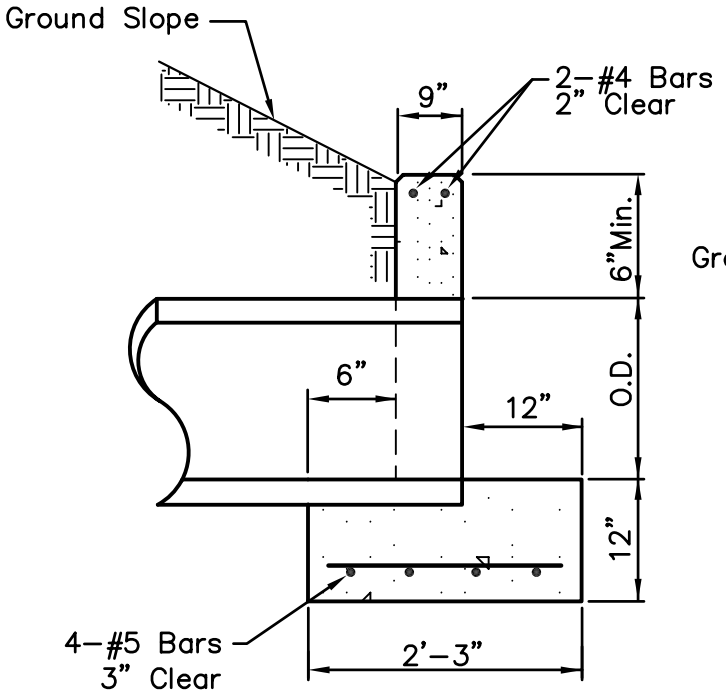
1. Material: Gray Iron ASTM A-48, (Latest Rev.) Class 35-B.
2. Design for H-25 loading.
3. Fits opening size of 2'-0 1/4" x 3'-1".
4. NEENAH R-3157-A w/ SPECIAL 6" HIGH FRAME, TYPE "L" VANE GRATE, AND CURB BOX; or approved equal.
5. Curb iron must include either environmental message:
   (1) DUMP NO WASTE...DRAINS TO STREAM
   (2) NO DUMPING... DRAINS TO STREAM
6. Minimum Weights:
   Grate = 76lbs./ea., Frame = 335lbs., Curb Iron = 115lbs.

# CURB CATCH BASIN - DOUBLE FRAME AND GRATE - TYPE 2-L

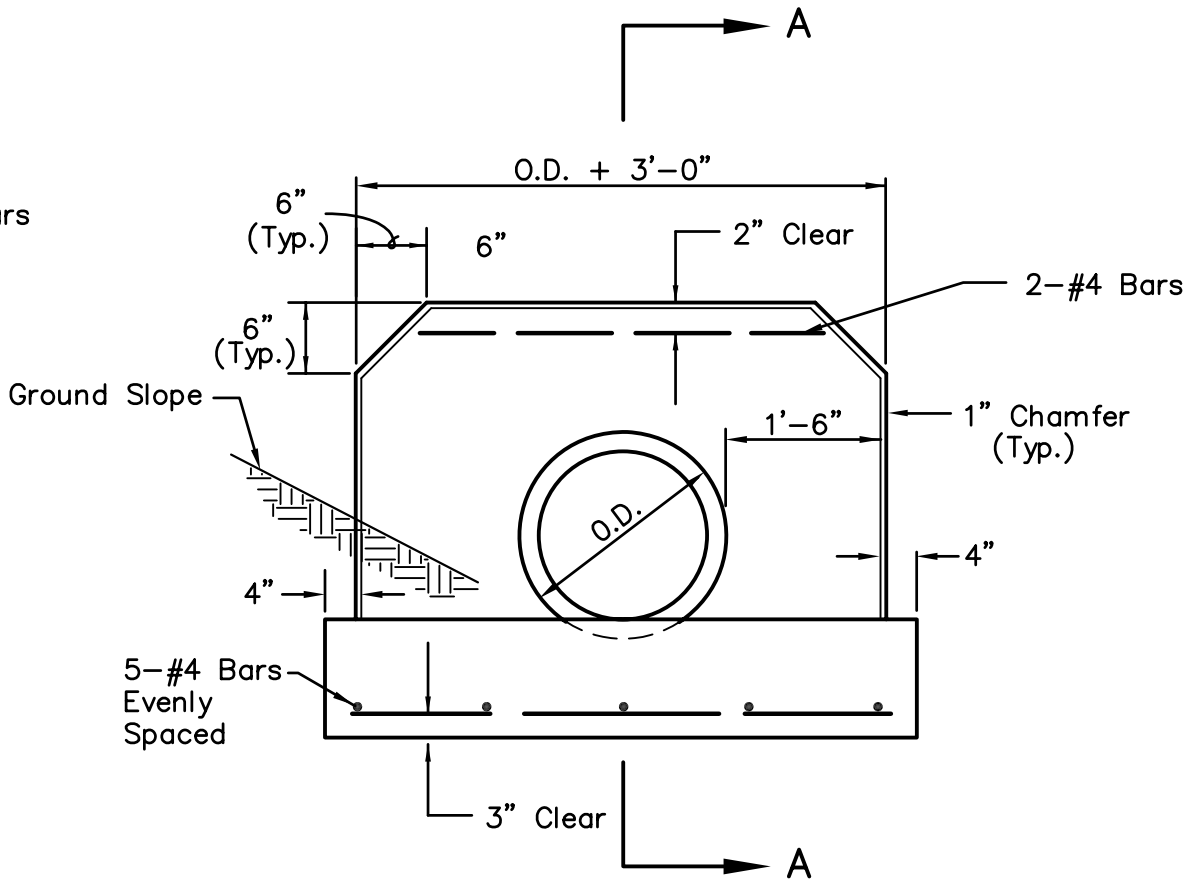
STANDARD DRAWING NO. DG-04-04

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION A–A




ELEVATION

## NOTES:

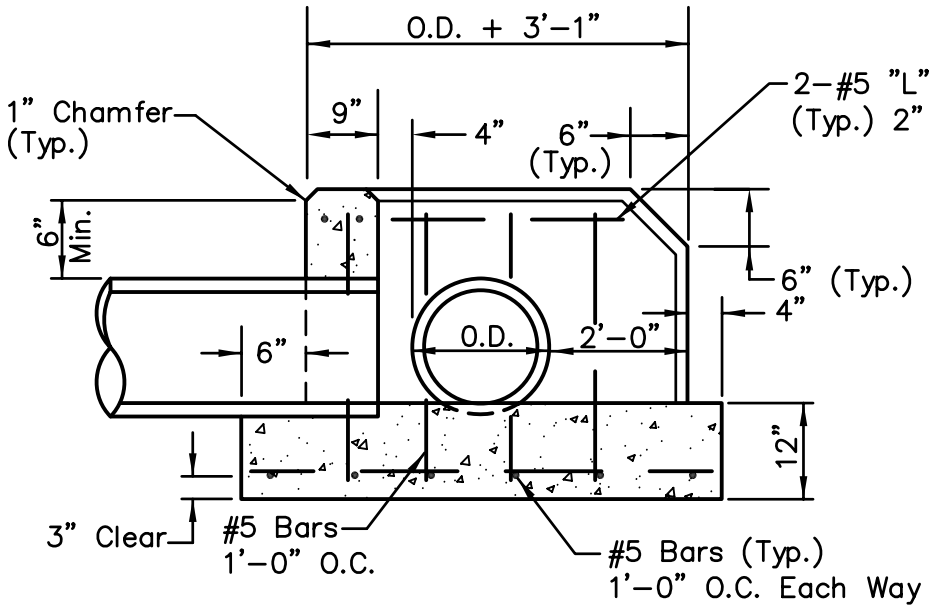
1. Concrete shall be Class "A".
2. Reinforcing steel shall be Grade 60.
3. For use with 24" Pipe or smaller (Circular or Non–circular)

# STANDARD HEADWALL

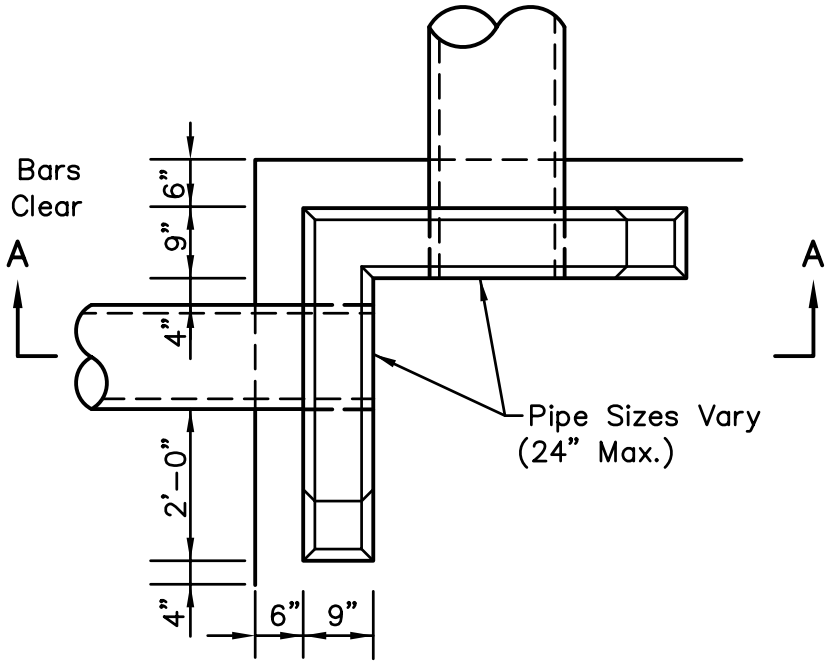
STANDARD DRAWING NO. DH–01–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION A-A




PLAN

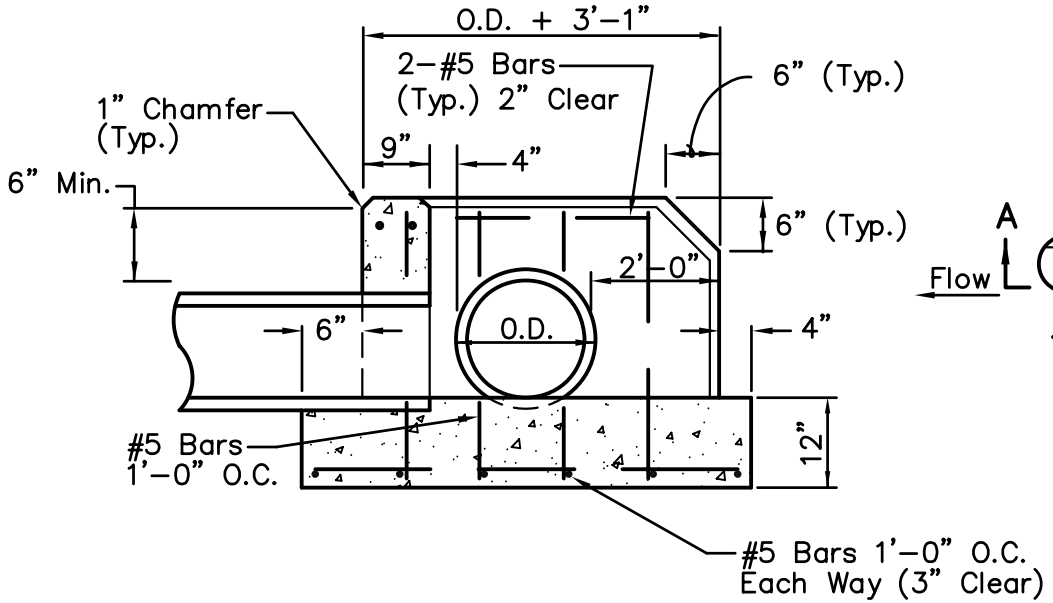
NOTES:
1. All reinforcing steel shall be Grade 60.
2. Concrete shall be Class "A".
3. For use with 24" Pipe or smaller. (Circular or Non-circular)

# ELL HEADWALL

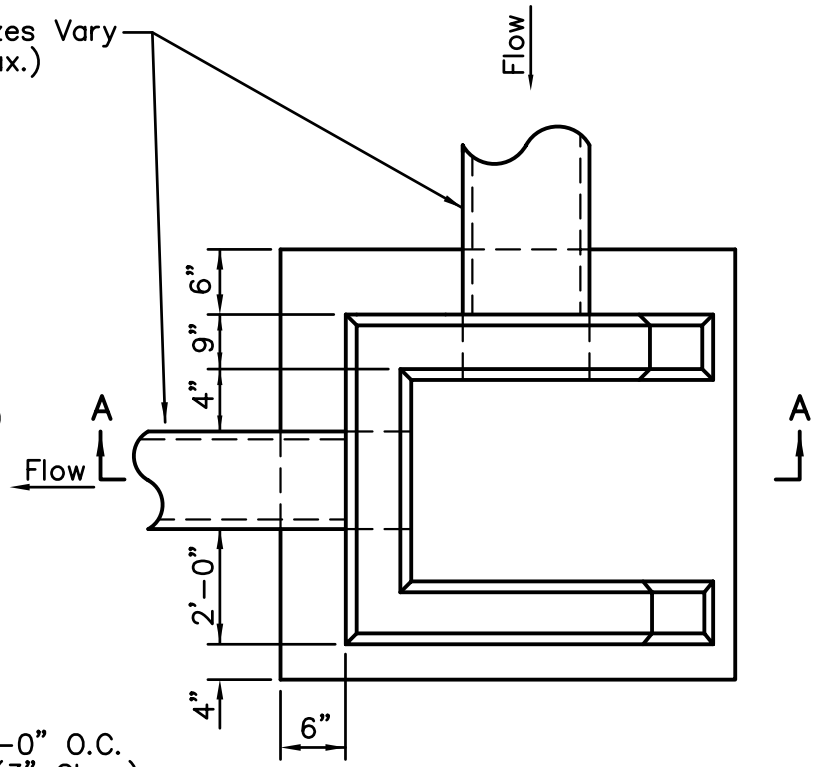
STANDARD DRAWING NO. DH-02-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION A-A




PLAN

**NOTES:**

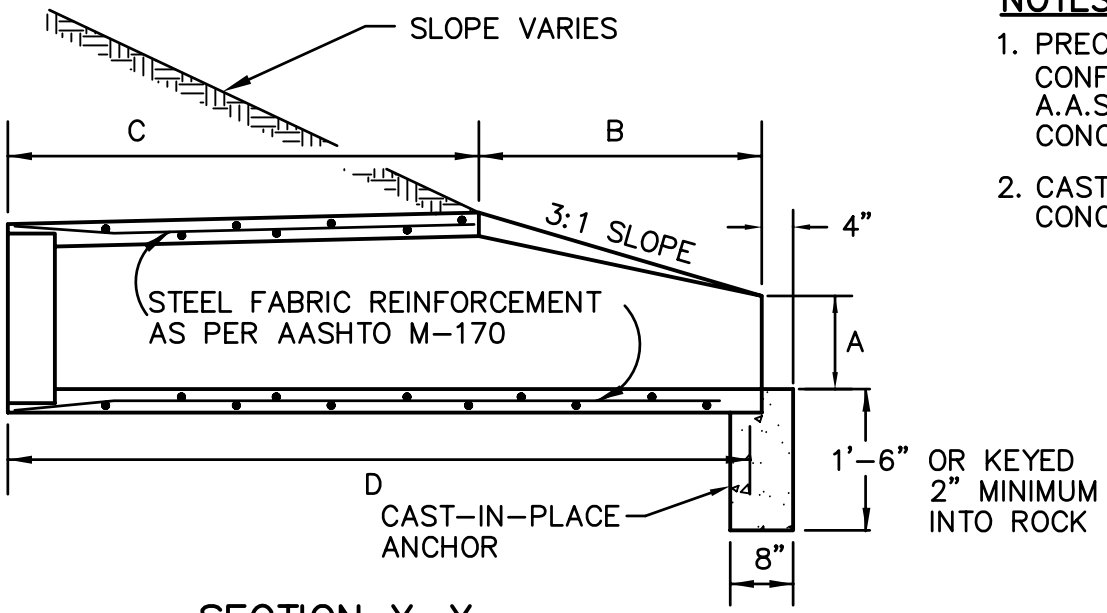
1. All reinforcing steel shall be grade 60.
2. All concrete shall be Class "A".
3. For use with 24" pipe or smaller.
   (Circular or Non-circular)

# "U" - SHAPED HEADWALL

STANDARD DRAWING NO. DH-03-01

DECEMBER 2012

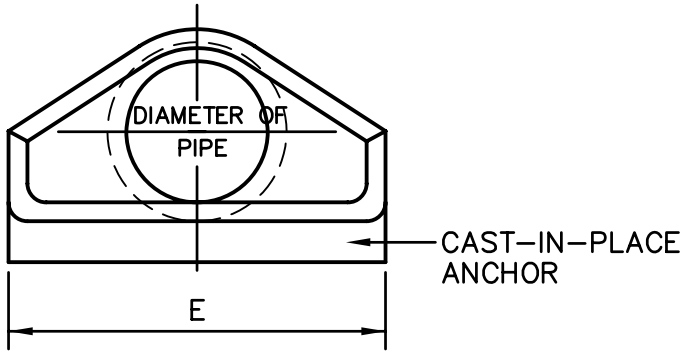
*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION X-X

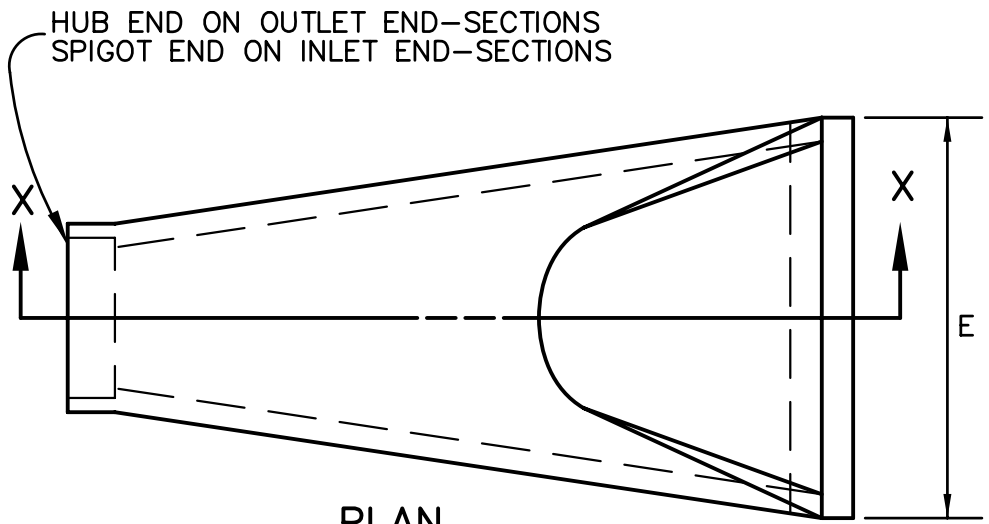
## NOTES

1. PRECAST CONCRETE FLARED END SECTION SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF A.A.S.H.T.O. M-170 CLASS III, WALL B REINFORCED CONCRETE PIPE.
2. CAST-IN-PLACE ANCHOR SHALL BE OF CLASS "A" CONCRETE FOR FULL WIDTH OF FLARED END SECTION.




END VIEW

| END SECTION DIMENSIONS | | | | | |
|---|---|---|---|---|---|
| DIA. | A | B | C | D | E |
| 12" | 4" | 2'-0" | 4'-1" | 6'-1" | 2'-0" |
| 15" | 6" | 2'-3" | 3'-10" | 6'-1" | 2'-6" |
| 18" | 9" | 2'-3" | 3'-10" | 6'-1" | 3'-0" |
| 24" | 10" | 3'-7" | 2'-8" | 6'-3" | 4'-0" |
| 30" | 1'-0" | 4'-6" | 1'-7 3/4" | 6'-1 3/4" | 5'-0" |
| 36" | 1'-3" | 5'-3" | 2'-10 3/4" | 8'-1 3/4" | 6'-0" |
| 42" | 1'-9" | 5'-3" | 2'-11" | 8'-2" | 6'-6" |
| 48" | 2'-0" | 6'-0" | 2'-2" | 8'-2" | 7'-0" |



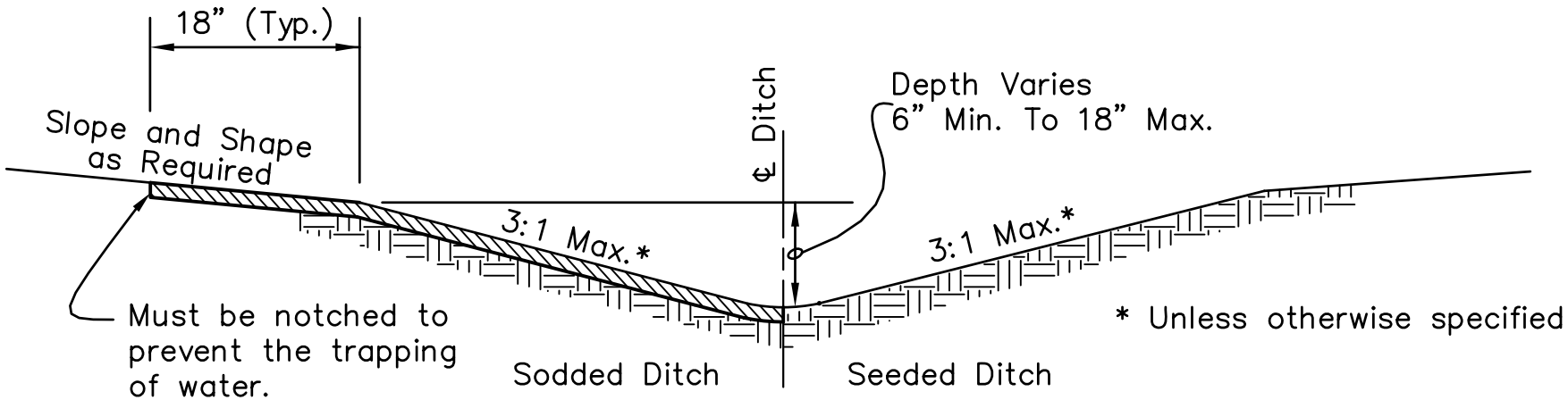

PLAN

FLARED END SECTION
FOR R.C.P.

STANDARD DRAWING NO. DE-01-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




NOTES:

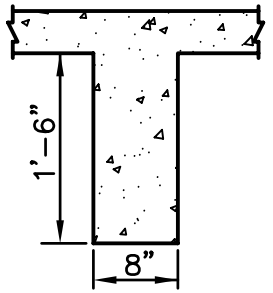
1. Sodded or seeded ditches should not be used where slopes are 10% or greater or where the velocity is greater than 4 feet per second.
2. Sod shall be placed so that ditches shall be free–draining at the edge of all pavements and driveways.
3. Ditch lining shall be designed for full bank flow.

# EARTH "V" DITCH

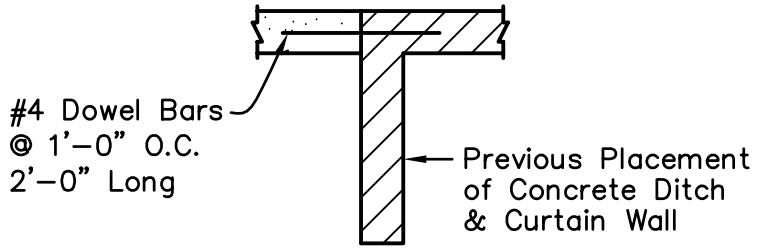
STANDARD DRAWING NO. DD–01–01

DECEMBER 2012

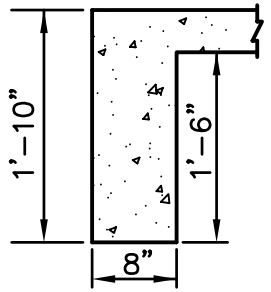
*This is a detail from MSD Standard Drawings dated 9-30-09.



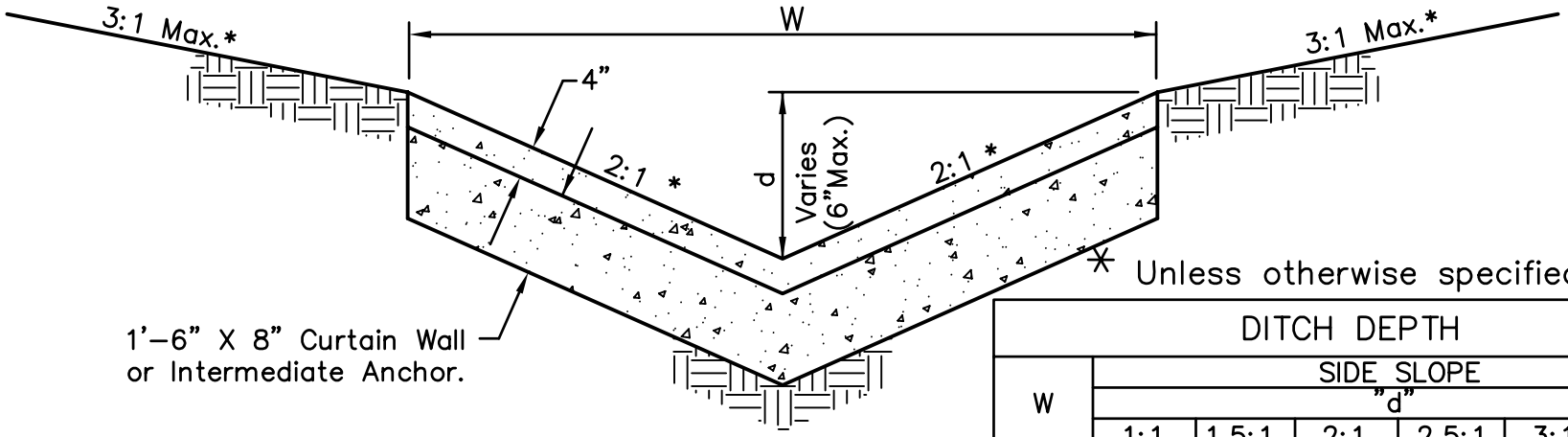

INTERMEDIATE ANCHOR




CONSTRUCTION JOINT




CURTAIN WALL




* Unless otherwise specified

| DITCH DEPTH | | | | | | |
|---|---|---|---|---|---|---|
| W | SIDE SLOPE "d" | | | | | |
| | 1:1 | 1.5:1 | 2:1 | 2.5:1 | 3:1 | 4:1 |
| 1'–0" | 6" | 4" | 3" | 2 3/8" | 2" | 1 1/2" |
| 1'–6" | – | 6" | 4 1/2" | 3 5/8" | 3" | 2 1/4" |
| 2'–0" | – | – | 6" | 5" | 4" | 3" |
| 2'–6" | – | – | – | 6" | 5" | 3 3/4" |
| 3'–0" | – | – | – | – | 6" | 4 1/2" |
| 4'–0" | – | – | – | – | – | 6" |

## NOTES:

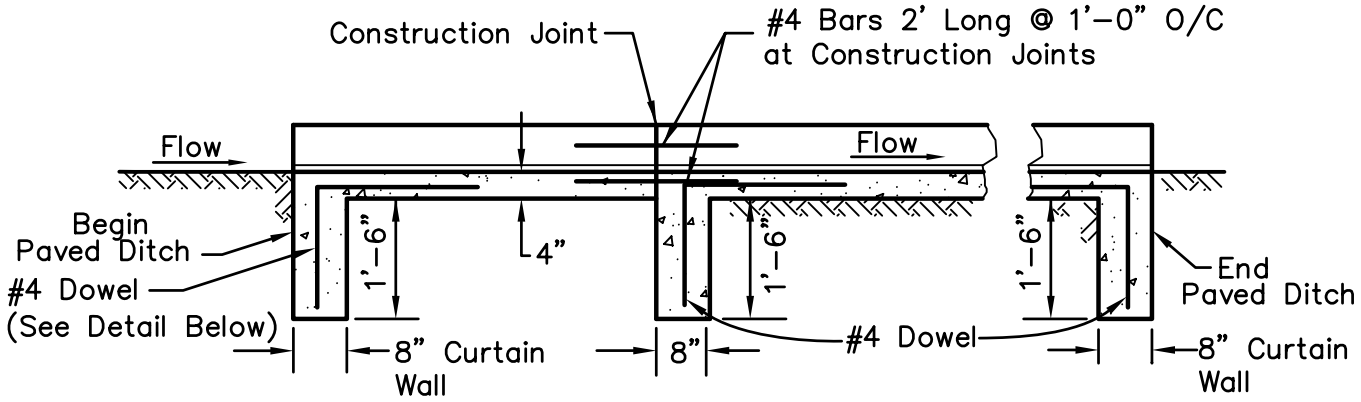
1. Invert may be finished as a radius.
2. Curtain wall shall be constructed at beginning and end of ditch.
3. If a construction joint is used in the placing of the paved ditch, it shall be constructed with a curtain wall as detailed.
4. The ditch shall be Class "A" concrete with polypropylene fiber.
5. Intermediate anchors shall be used on grades 20% or steeper and spaced every 20 feet.
6. Sawed or tooled joints shall be spaced every 20 feet, (max.).
7. Broom finish perpendicular to flow.

# PAVED "V" DITCH

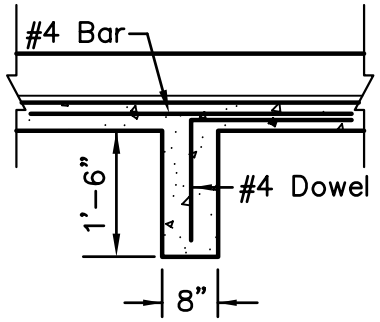
STANDARD DRAWING NO. DD–02–01

DECEMBER 2012

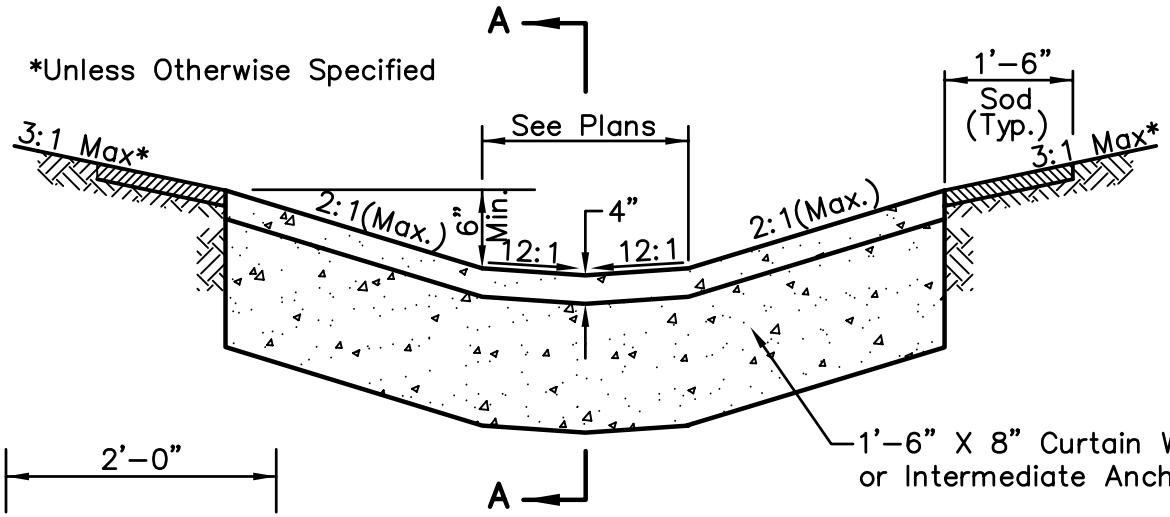
*This is a detail from MSD Standard Drawings dated 9-30-09.



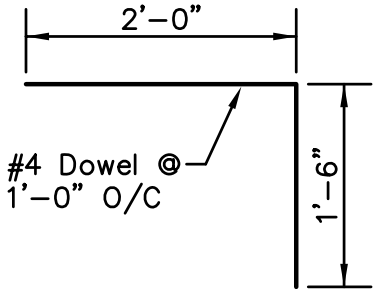

LONGITUDINAL SECTION A–A




INTERMEDIATE ANCHOR




TYPICAL SECTION




DOWEL DETAIL

## NOTES:

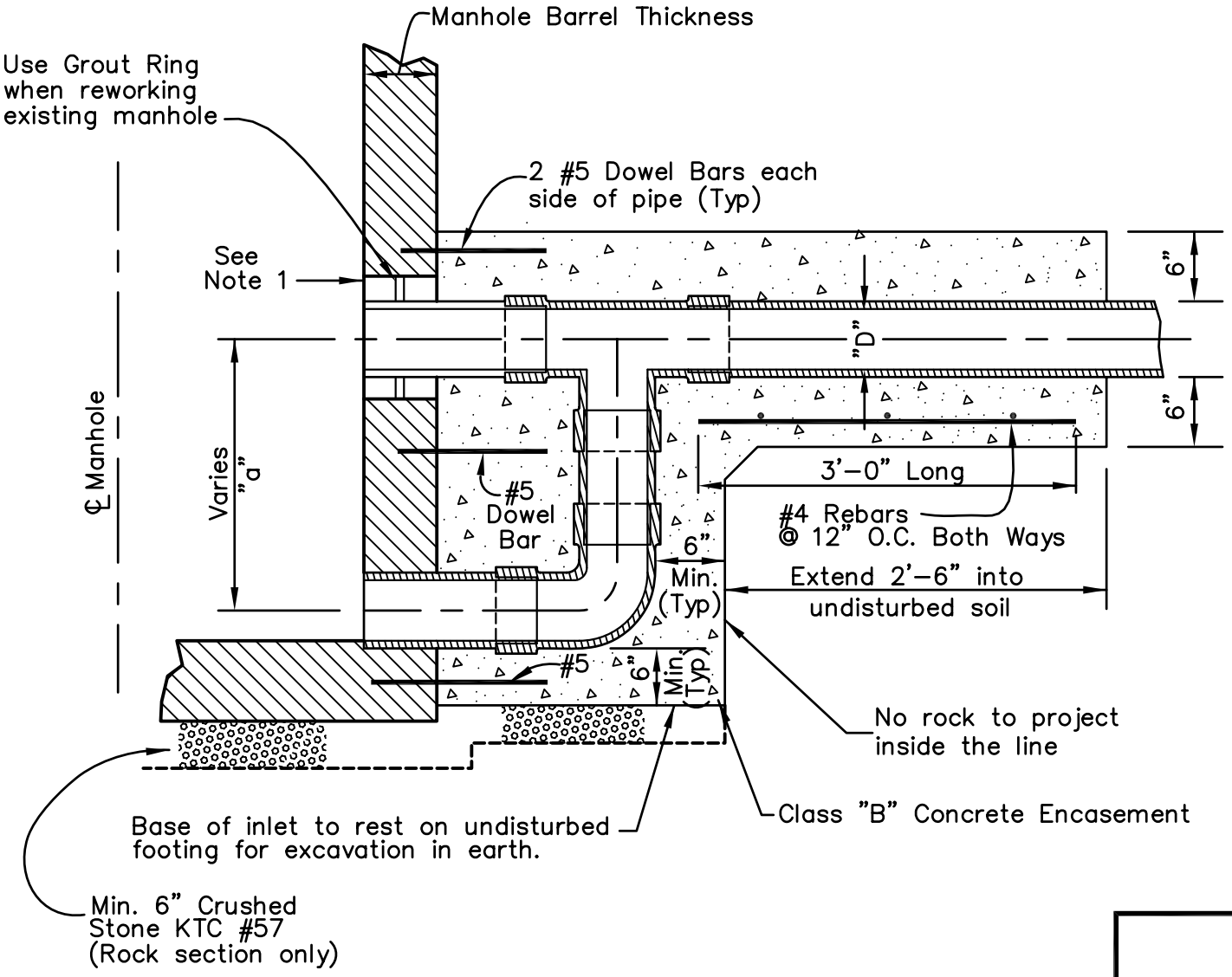
1. Class A Concrete with Polypropylene Fiber.
2. Curtain Wall shall be constructed at Beginning and End of Ditch.
3. If a Construction Joint is used in the placing of the Ditch, it shall be constructed as Detailed.
4. Intermediate Anchors shall be used on Grades 20% or Steeper and spaced every 20 feet.
5. Tooled Joints shall be placed every 20 feet (Max.)
6. Broom finish perpendicular to flow.
7. All Reinforcing Steel shall be Grade 60.

SLOPED BOTTOM
PAVED DITCH

STANDARD DRAWING NO. DD–03–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




## P.V.C. DROP INLET CHART

| Minimum Dimensions ℄ to ℄ "a" | "D" I.D. of Pipe & Drop Inlet |
|---|---|
| 16" | 4" |
| 20" | 6" |
| 24" | 8" |
| 26" | 9" |
| 27" | 10" |
| 31" | 12" |
| 37" | 15" |
| 47" | 18" |
| 51" | 21" |
| 64" | 24" |
| 73" | 27" |

NOTE

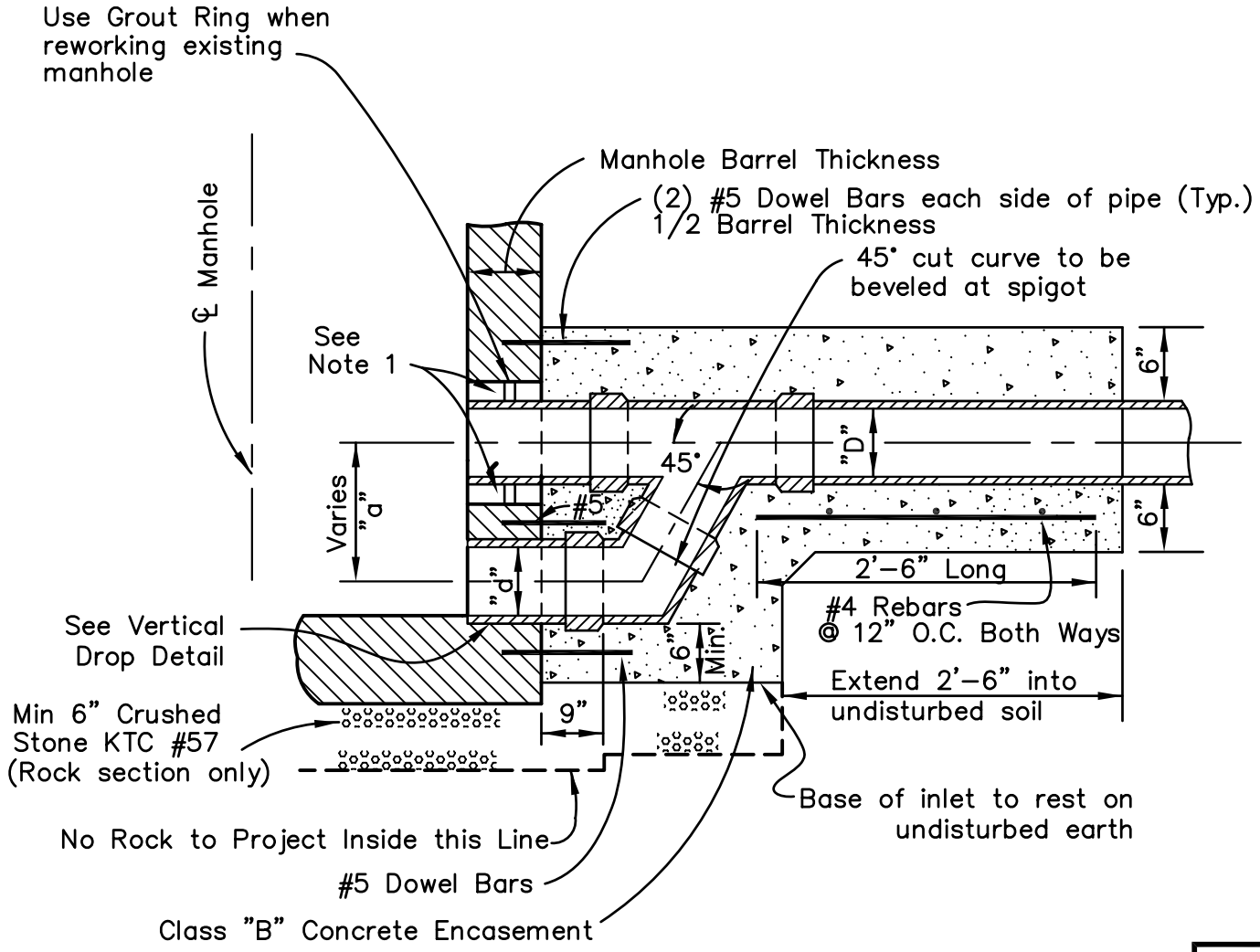
1. Sewer Pipe Connection to precast manhole with Positive Seal Gasketing System(A.S.T.M. C–923). Gasket shall be as manufactured by the Press Seal Gasket Co., A–Lok or Kor–N–Seal manhole pipe connectors or approved equal for sanitary sewers.

# P.V.C. VERTICAL DROP INLET

STANDARD DRAWING NO. SD–01–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




## P.V.C. DROP INLET CHART

| Minimum Dimensions ℄ to ℄ "a" | "D" I.D. of Pipe & Drop Inlet |
|---|---|
| 16" | 4" |
| 20" | 6" |
| 24" | 8" |
| 26" | 9" |
| 27" | 10" |
| 31" | 12" |
| 37" | 15" |
| 47" | 18" |
| 51" | 21" |
| 64" | 24" |
| 73" | 27" |

NOTE:

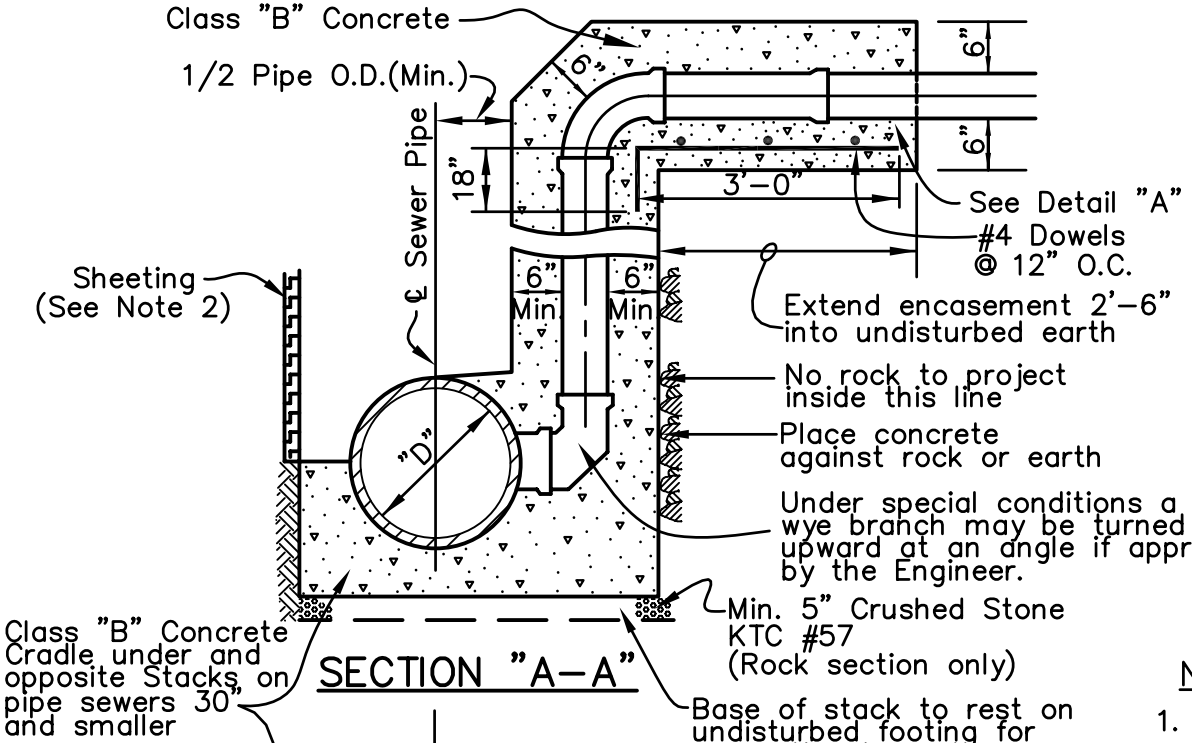
1.Sewer pipe connection to precast manhole with Positive Seal Gasketing System(A.S.T.M. C–923). Gasket shall be as manufactured A–lok or Kor–N–Seal Manhole pipe connectors or approved equal for sanitary sewers

# P.V.C. SLANTING DROP INLET

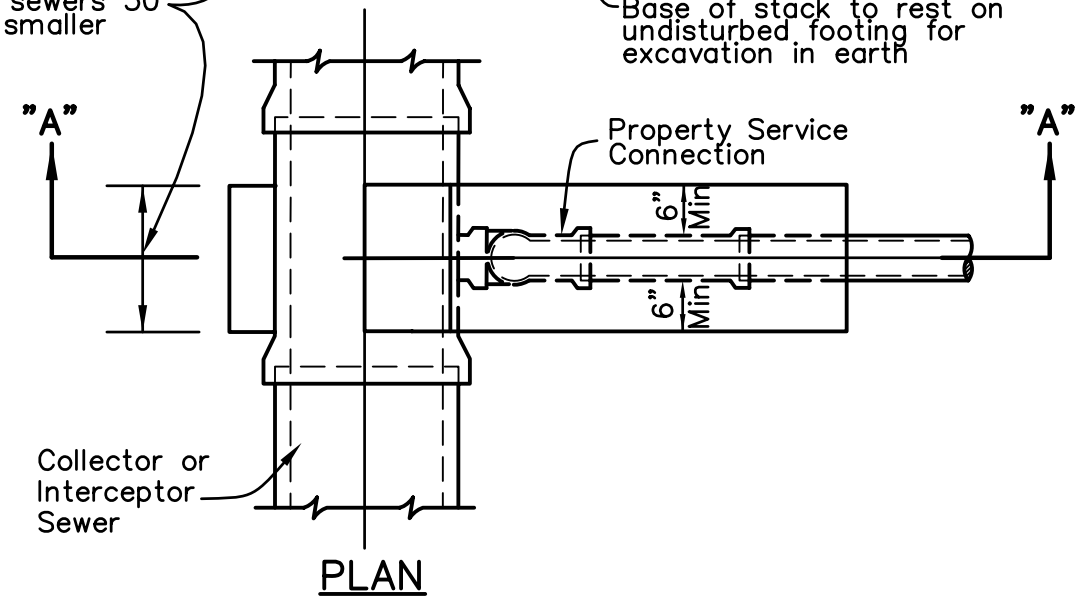
STANDARD DRAWING NO. SD–02–01

DECEMBER 2012

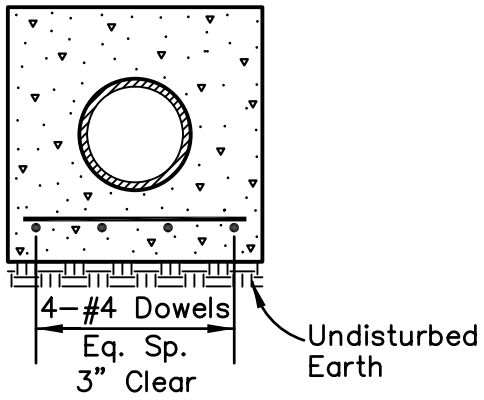
*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION "A-A"




PLAN




DETAIL "A"

NOTES:

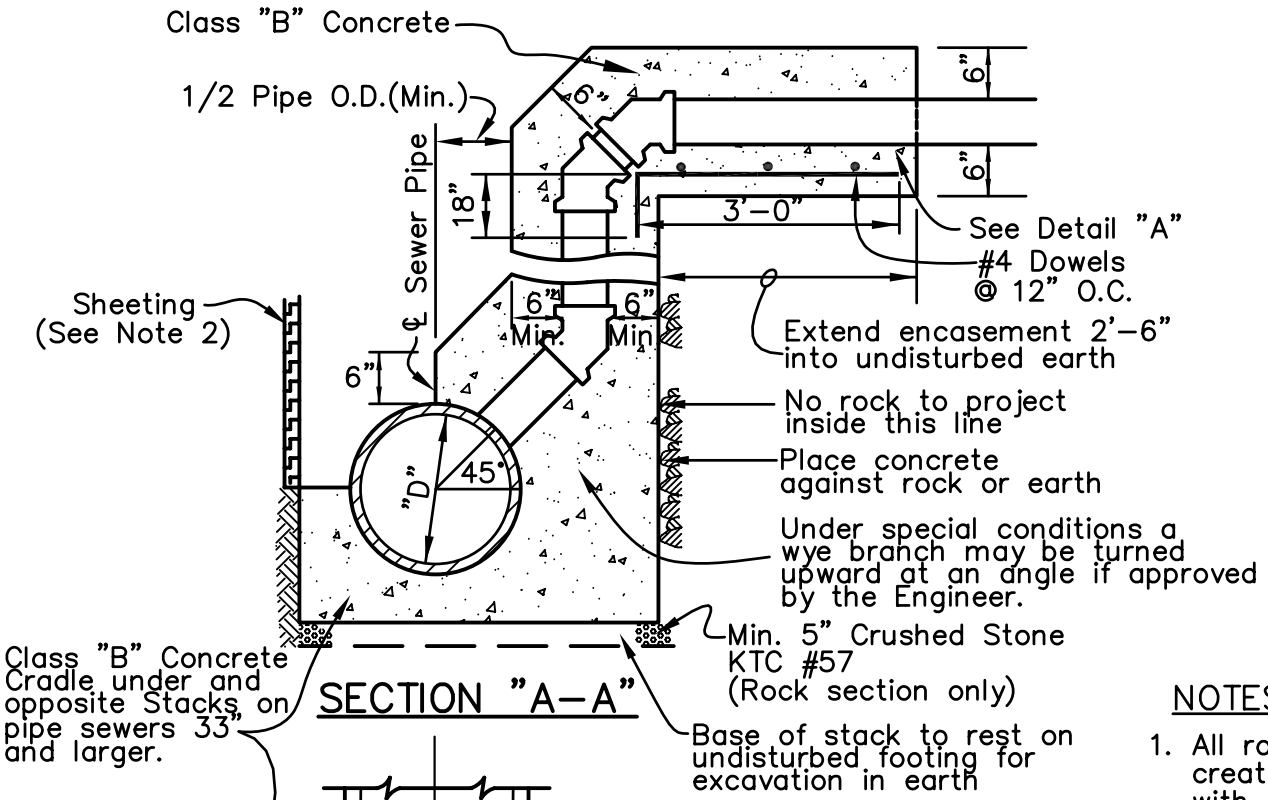
1. All rock loosened, shall be removed; voids created by such removal shall be refilled with crushed stone KTC #57.
2. Where concrete is poured against the sheeting or trench box, tarred or other suitable paper shall first be attached to the sheeting. The sheeting will not be allowed to be removed until the concrete has sufficiently cured.

# STACK CONNECTION TO 30" OR SMALLER PIPE

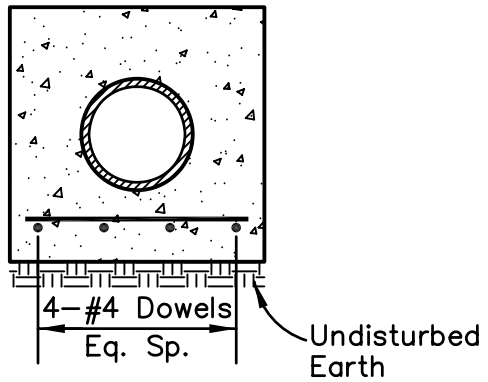
STANDARD DRAWING NO. SS-01-01

DECEMBER 2012

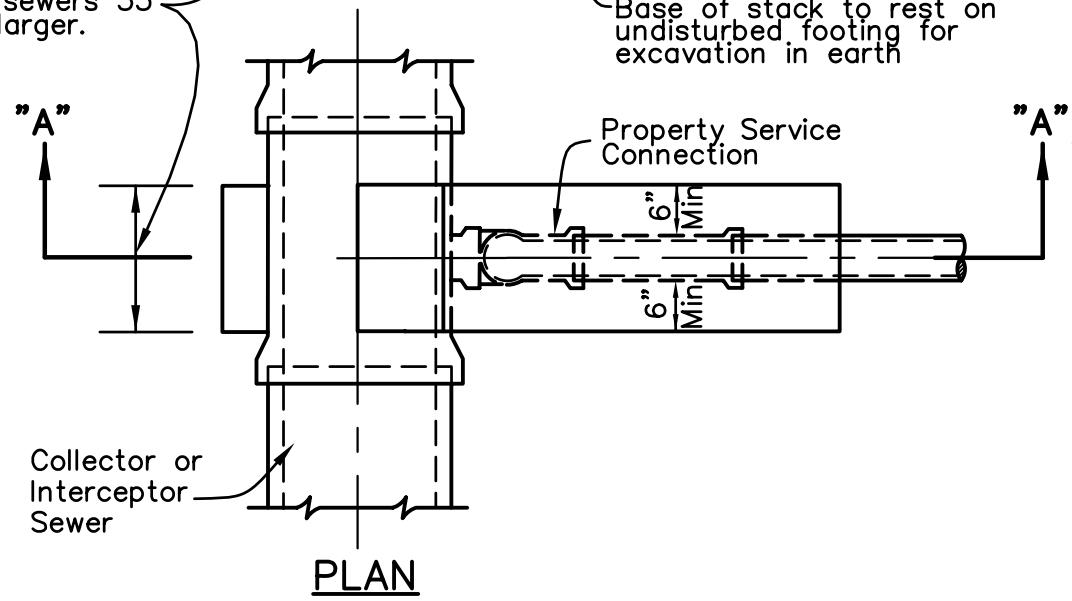
*This is a detail from MSD Standard Drawings dated 9-30-09.




SECTION "A-A"




DETAIL "A"




PLAN

NOTES:

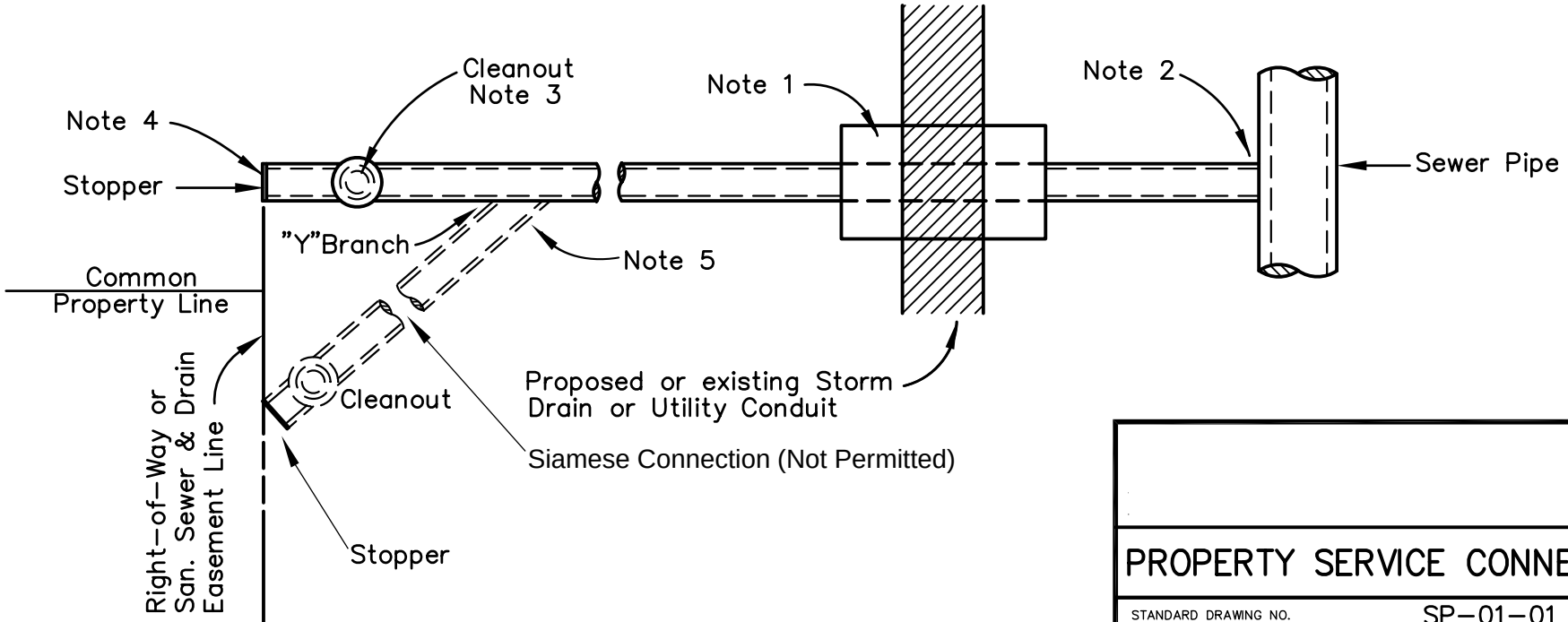
1. All rock loosened, shall be removed; voids created by such removal shall be refilled with crushed stone KTC #57.
2. Where concrete is poured against the sheeting or trench box, tarred or other suitable paper shall first be attached to the sheeting. The sheeting will not be allowed to be removed until the concrete has sufficiently cured.

| |
|---|
| STACK CONNECTION TO 33" OR LARGER PIPE |
| STANDARD DRAWING NO. SS-02-01 |
| DECEMBER 2012 |

*This is a detail from MSD Standard Drawings dated 9-30-09.

NOTES

1. Property service connections crossing under (over) the storm drain or utility conduit proposed or existing with less than (2) feet of clearance shall be capped (cradled) with 6" Class "B" Concrete in accordance with the typical concrete cap (concrete cradle) detail. The minimum clearance is 6–inches for all utilities and storm drains and 18–inches for water lines.
2. The contractor may install "T" Branches in lieu of "Y" Branches for connecting property service connections to the sewer. The contractor shall use "spurs" in the "T" Branches on all Reinforced Concrete Pipe sanitary sewers.
3. **A two-way cleanout will be required on individual connections placed as near as possible to the intersection of the common property line and the R.O.W. or sanitary sewer and drain easement line as shown.**
4. The invert of a property service connection at end shall not be lower than crown of sewer pipe, unless approved by the engineer.
5. **Siamese Connections are not permitted.**
6. **Detectable marking tape shall be installed.**

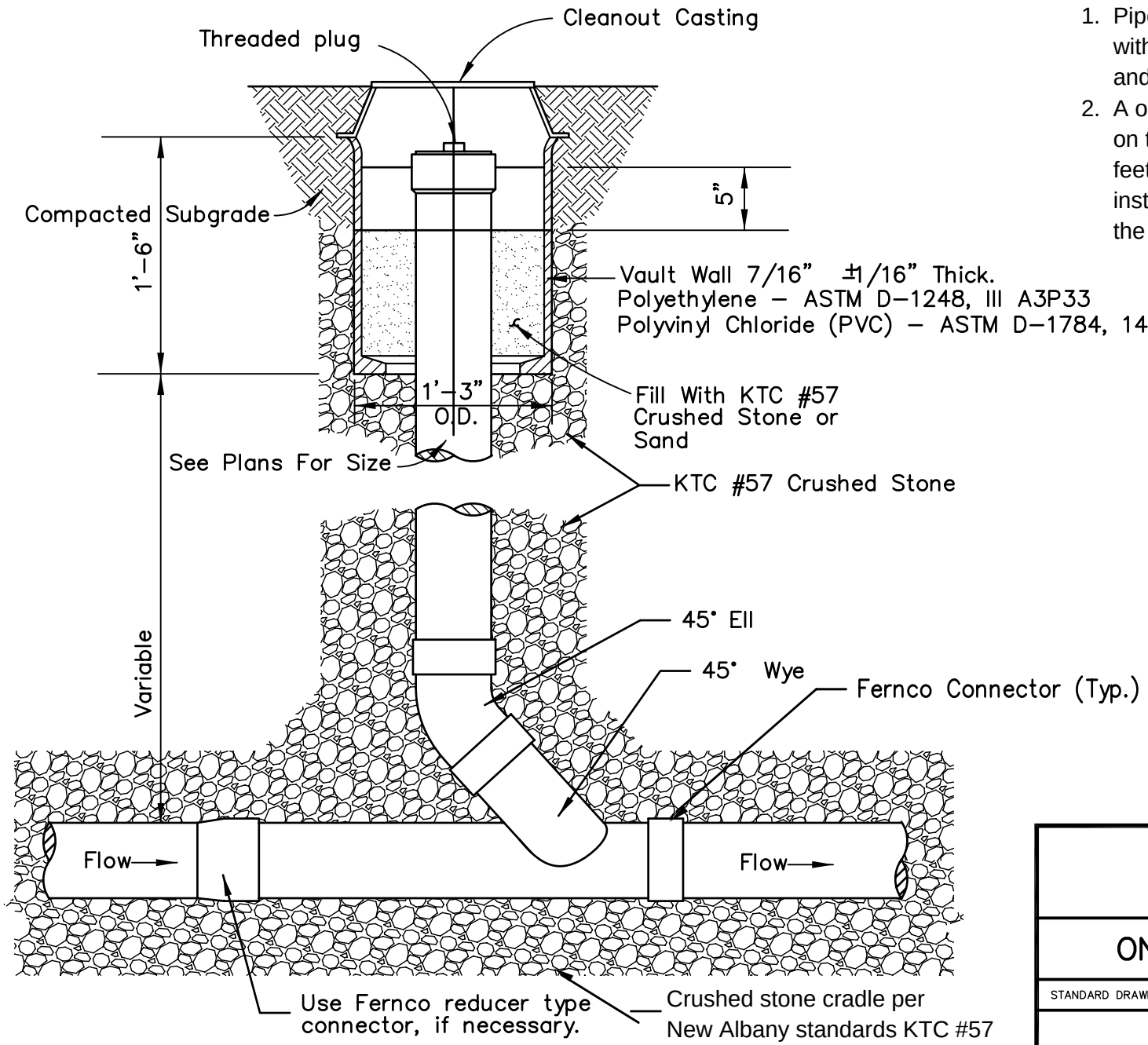



# PROPERTY SERVICE CONNECTION

STANDARD DRAWING NO. SP–01–01

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




Notes:

1. Pipe Shall Be DR 32.5 HDPE with a 6" inside diameter (IPS) and 0.2" wall thickness.
2. A one-way cleanout is required on the property service line within 10 feet of the exterior wall and shall be installed to open in the direction of the flow.

# ONE WAY CLEANOUT

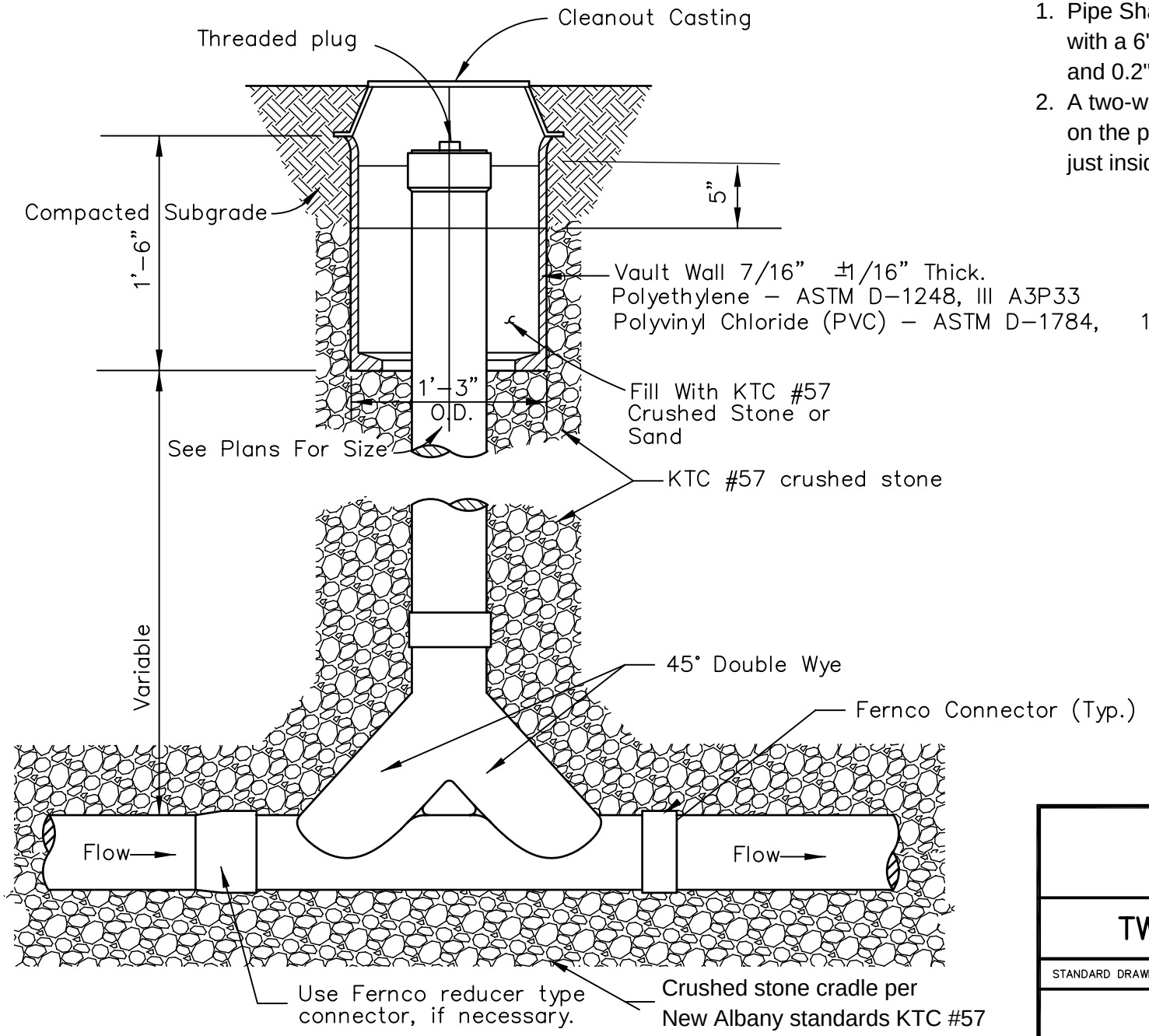
STANDARD DRAWING NO. SC-01-02

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.

Notes:

1. Pipe Shall Be DR 32.5 HDPE with a 6" inside diameter (IPS) and 0.2" wall thickness.
2. A two-way cleanout is required on the property service connection just inside the R/W or easement line.

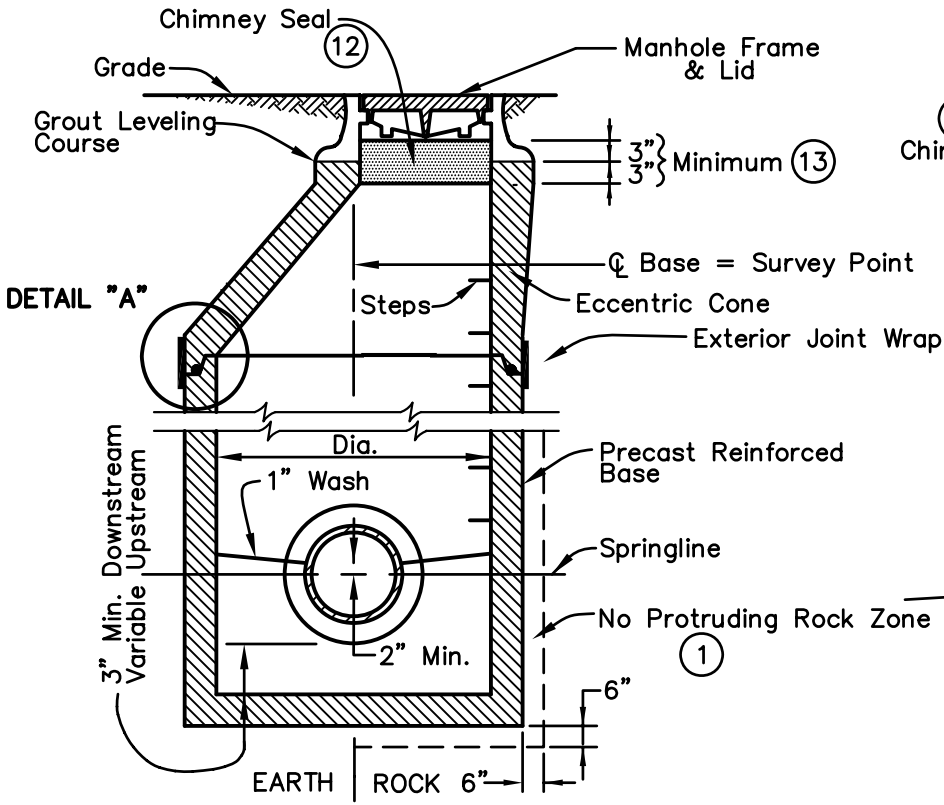


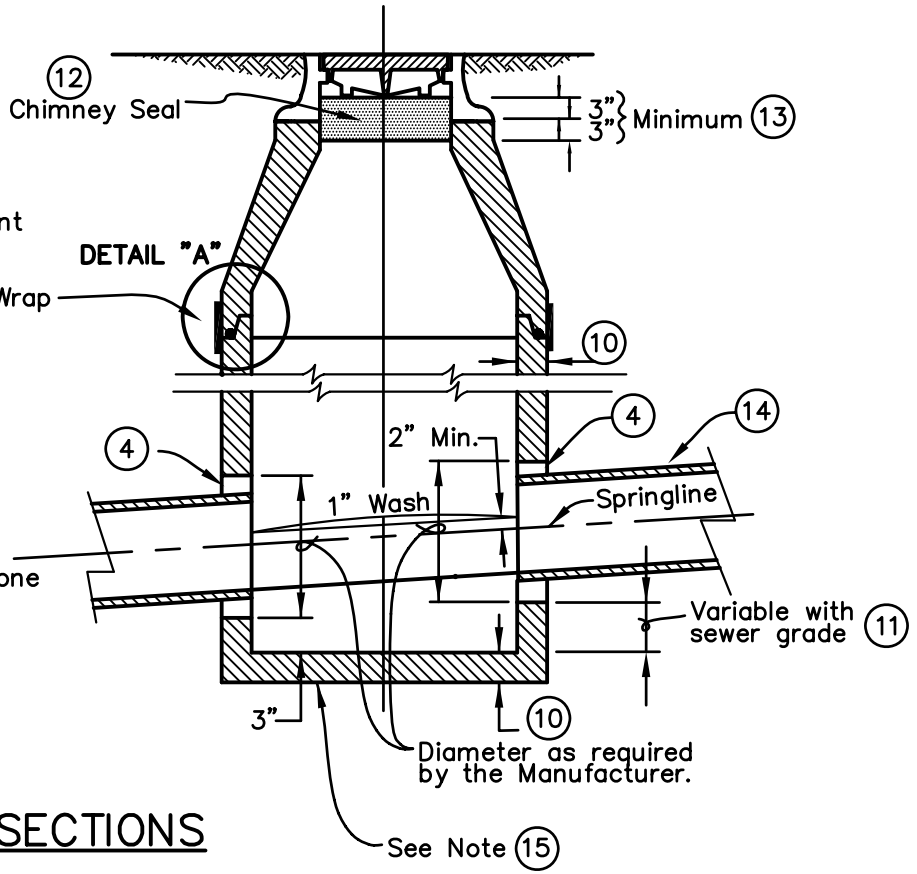

# TWO WAY CLEANOUT

STANDARD DRAWING NO. SC-02-02

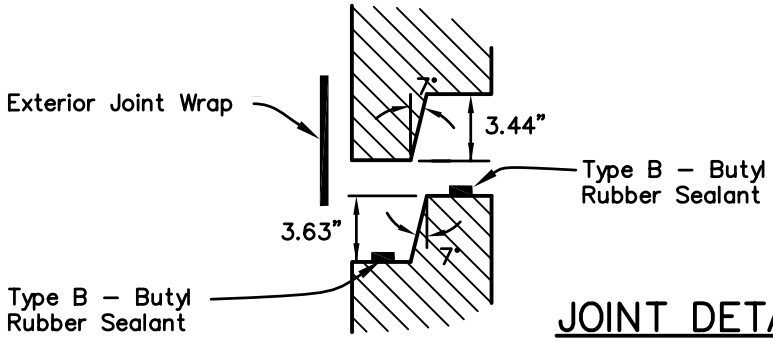
APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




## TYPICAL SECTIONS




## JOINT DETAIL "A"

FOR NOTES SEE STANDARD DRAWING GM–01–04 Page 2 of 2

# PRECAST MANHOLE – TYPE 1

STANDARD DRAWING NO. GM–01–04 Page 1 of 2

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

## NOTES

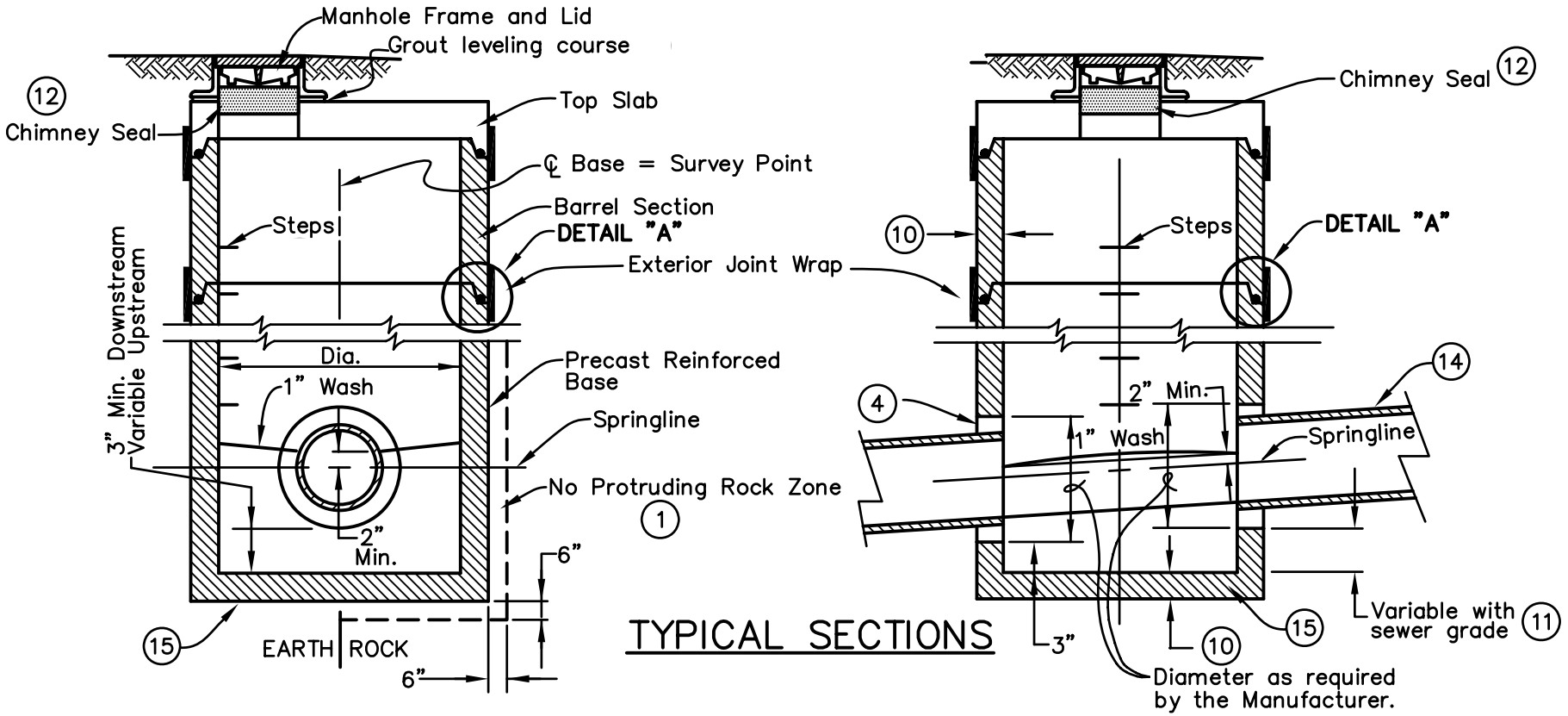
1. All rock loosened, shall be removed. Voids created by such removal shall be refilled with Crushed Stone KTC #57.
2. **Chimney seals and exterior joint wraps are not required for New Albany storm manholes.**
3. In lieu of poured Class "A" concrete inverts, precast inverts may be substituted.
4. Sewer pipe connection to precast manhole with positive seal gasketing system (ASTM. C–923). Gasket shall be as manufactured by the Press Seal Gasket Co., A–lok, Kor–N–Seal or equal with stainless steel banded manhole pipe connectors for sanitary sewers.
5. **Not used.**
6. No rock fragments will be allowed within 6–inches of structure.
7. Manhole shall meet all of the requirements of ASTM. C478, C913.
8. **Backfill according to New Albany Standard Specifications.**
9. Total height of all collars shall not exceed 12 inches.
10. 5" for 48" diameter, 6" for 60" diameter and 7" for 72" diameter.
11. Manhole inverts shall have a minimum of 0.10' fall through the structure unlees any line exceeds 10%, at which point the "variable with sewer grade" note applies.
12. **Internal mechanical Chimney seals are required on all New Albany sanitary manholes. Chemical bonding for chimney seals is to be used only for rehabilitation and only in non-paved areas. At a minimum, the seal will extend from a point 3 inches above the base of the manhole frame, to a point 3 inches below the top of the concrete cone or top slab. If grade adjustments collars are used, the seal height will increase proportionally to the collar height.**
13. The top of the concrete cone or top slab must have a minimum 3 inch vertical surface that is smooth and free of any form offsets or excessive honeycomb.
14. Install flexible push–on joint 3 feet from manhole to allow for settlement and reduce bending moments.
15. All base sections shall be monolithic.
16. **Not used.**

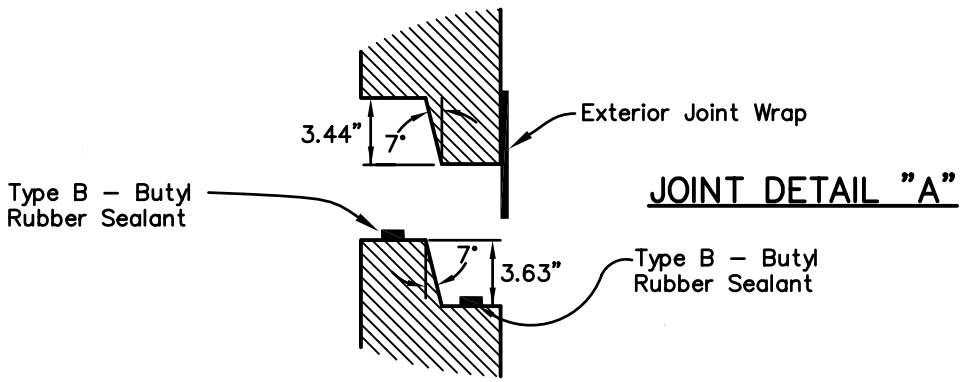
# PRECAST MANHOLE – TYPE 1

STANDARD DRAWING NO. GM–01–04 Page 2 of 2

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




JOINT DETAIL "A"

FOR NOTES SEE STANDARD DRAWINGS
GM–02–04 Page 2 of 2

# PRECAST MANHOLE – TYPE 2

STANDARD DRAWING NO. GM–02–04 Page 1 of 2

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

## NOTES

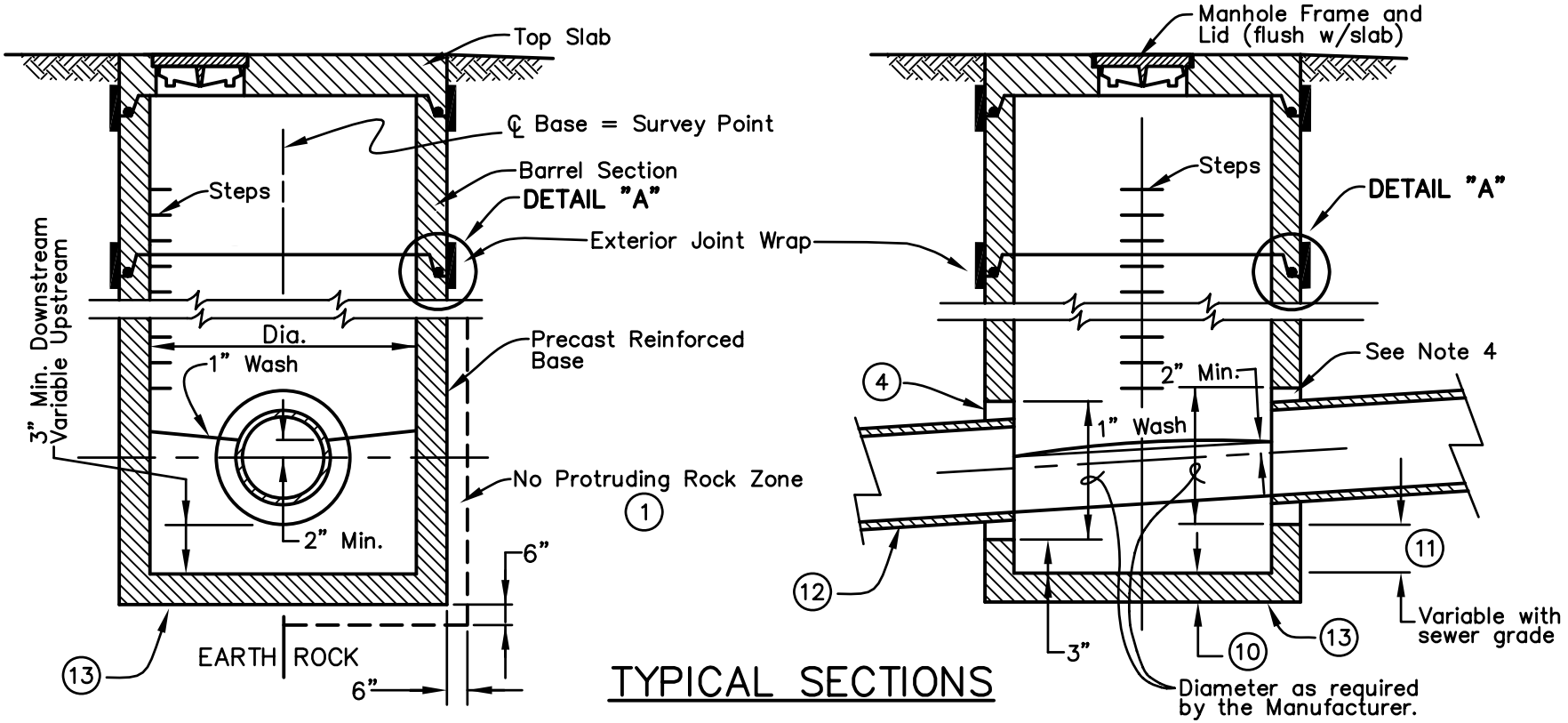
1. All rock loosened, shall be removed. Voids created by such removal shall be refilled with Crushed Stone KTC #57.
2. **Chimney seals and exterior joint wraps are not required for New Albany storm manholes.**
3. In lieu of poured Class "A" concrete inverts, precast inverts may be substituted.
4. Sewer pipe connection to precast manhole with positive seal gasketing system (ASTM. C–923). Gasket shall be as manufactured by the Press Seal Gasket Co., A–lok, Kor–N–Seal or equal with stainless steel banded manhole pipe connectors for sanitary sewers.
5. Not used.
6. No rock fragments will be allowed within 6–inches of structure.
7. Manhole shall meet all of the requirements of ASTM. C478, C913.
8. Backfill according to New Albany Standard Specifications.
9. Total height of all collars shall not exceed 12 inches.
10. 5" for 48" diameter, 6" for 60" diameter and 7" for 72" diameter.
11. Manhole inverts shall have a minimum of 0.10' fall through the structure unlees any line exceeds 10%, at which point the "variable with sewer grade" note applies.
12. **Chimney seals, either internally mechanical or chemical, will be required on all new New Albany sanitary manholes. At a minimum, the seal will extend from a point 3 inches above the base of the manhole frame, to a point 3 inches below the top of the concrete cone or top slab. If grade adjustments collars are used, the seal height will increase proportionally to the collar height.**
13. The top of the concrete cone or top slab must have a minimum 3 inch vertical surface that is smooth and free of any form offsets or excessive honeycomb.
14. Install flexible push–on joint 3 feet from manhole to allow for settlement and reduce bending moments.
15. All base sections shall be monolithic.
16. Not used.

# PRECAST MANHOLE – TYPE 2

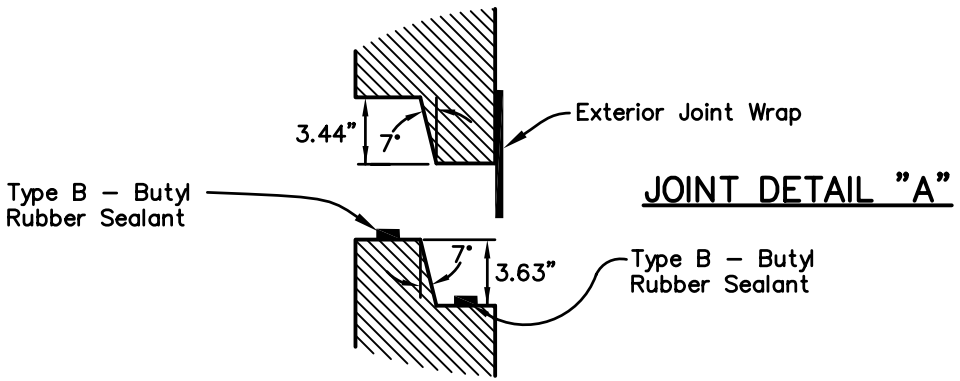
STANDARD DRAWING NO. GM–02–04 Page 2 of 2

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




## TYPICAL SECTIONS




## JOINT DETAIL "A"

FOR NOTES SEE STANDARD DRAWINGS
GM–03–04 Page 2 of 2

# PRECAST MANHOLE – TYPE 3

STANDARD DRAWING NO. GM–03–04 Page 1 of 2

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

## NOTES

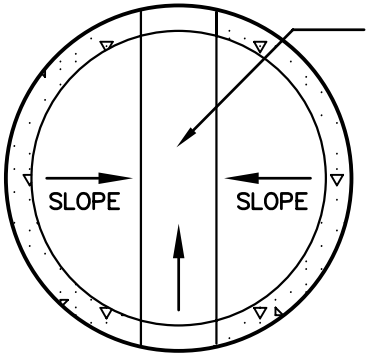
1. All rock loosened, shall be removed. Voids created by such removal shall be refilled with Crushed Stone KTC #57.
2. **Exterior joint wraps are not required for New Albany storm manholes.**
3. In lieu of poured Class "A" concrete inverts, precast inverts may be substituted.
4. Sewer pipe connection to precast manhole with positive seal gasketing system (ASTM. C–923). Gasket shall be as manufactured by the Press Seal Gasket Co., A–lok, Kor–N–Seal or equal with stainless steel banded manhole pipe connectors for sanitary sewers.
5. **Not used.**
6. No rock fragments will be allowed within 6–inches of structure.
7. Manhole shall meet all of the requirements of ASTM. C478, C913.
8. **Backfill according to New Albany Standard Specifications.**
9. Total height of all collars shall not exceed 12 inches.
10. 5" for 48" **Not used.**
11. Manhole inverts shall have 0.10' of fall through the structure unlees any line exceeds 10%, at which point the "variable with sewer grade" note applies.
12. Install flexible push–on joint 3 feet from manhole to allow for settlement and reduce bending moments.
13. All base sections shall be monolithic.
14. **Not used.**

# PRECAST MANHOLE – TYPE 3

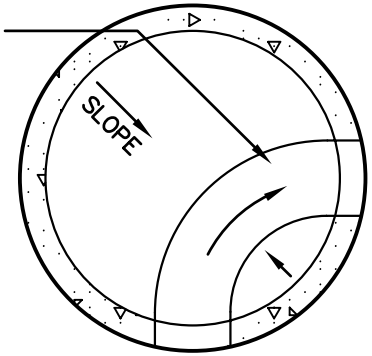
STANDARD DRAWING NO. GM–03–04 Page 2 of 2

APRIL 2015

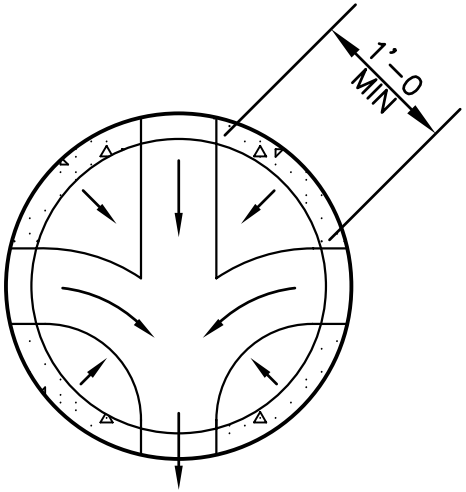
*This is a detail from MSD Standard Drawings dated 9-30-09.



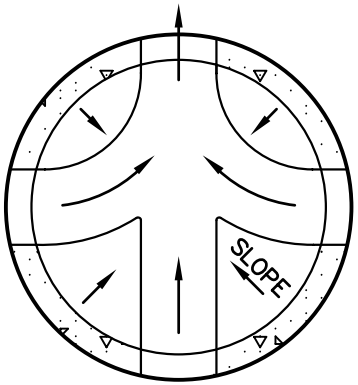

TYPICAL STRAIGHT FLOW



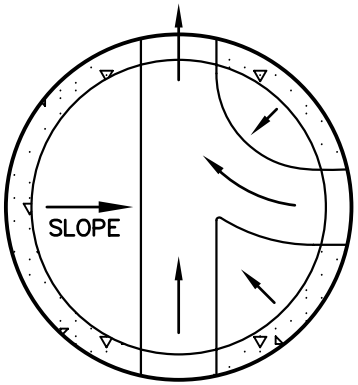

TYPICAL CURVE FLOW




MINIMUM DISTANCE BETWEEN
OPENING FOR PIPE

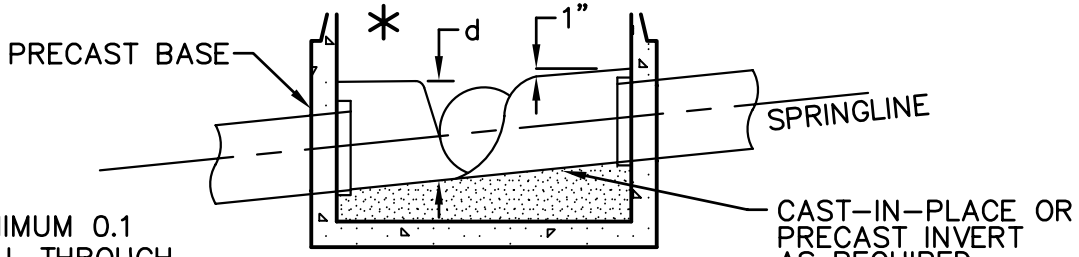



TYPICAL 4-WAY FLOW




TYPICAL 3-WAY FLOW

## TYPICAL CHANNELIZATION DETAILS FOR SANITARY SEWERS




* MINIMUM 0.1
FALL THROUGH
MANHOLE

TYPICAL CROSS SECTION

d = 1.1 x pipe diameter

# MANHOLE CHANNELIZATION

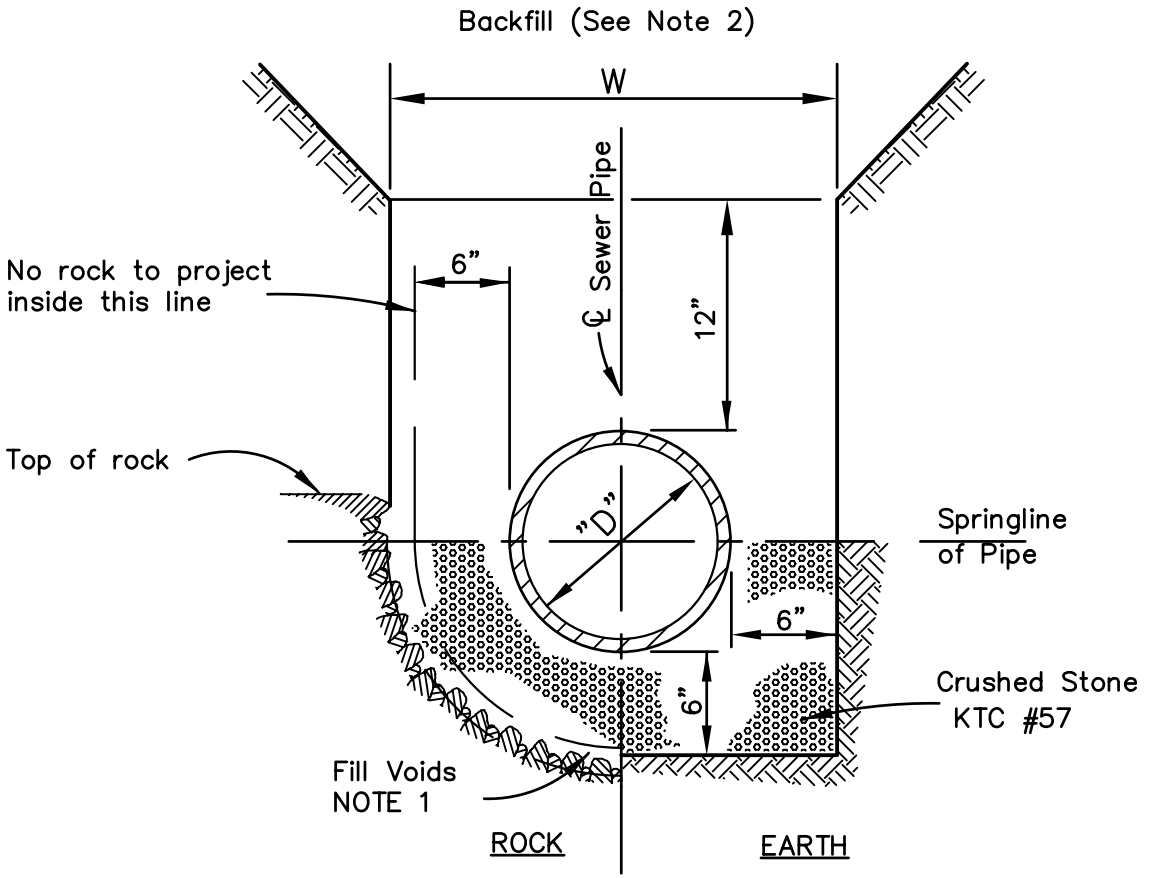
STANDARD DRAWING NO. GM-04-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

| Maximum Allowable Trench Width 12" Above Outside Top of Pipe "W" | Inside Diameter of Pipe "D" |
|---|---|
| 2'–6" | 4" |
| 2'–8" | 6" |
| 2'–10" | 8" |
| 3'–0" | 10" |
| 3'–5" | 12" |
| 3'–9" | 15" |
| 4'–1" | 18" |
| 4'–4" | 21" |
| 4'–8" | 24" |
| 5'–1" | 27" |
| 5'–5" | 30" |
| 5'–10" | 33" |
| 6'–2" | 36" |
| 6'–8" | 39" |
| 6'–11" | 42" |
| 7'–6" | 48" |
| D+2t+2'-8" | over 48" |

If "W" is exceeded, a Concrete Cradle shall be placed at such locations at the Contractor's expense. Applies to excavations in rock or earth.




NOTES:

1. All rock loosened shall be removed; voids created by such removal shall be refilled with Crushed Stone KTC #57.
2. Backfill shall be as noted on the drawings.
3. Remove stone for pipe bells to provide full contact of bedding.

# CRUSHED STONE CRADLE

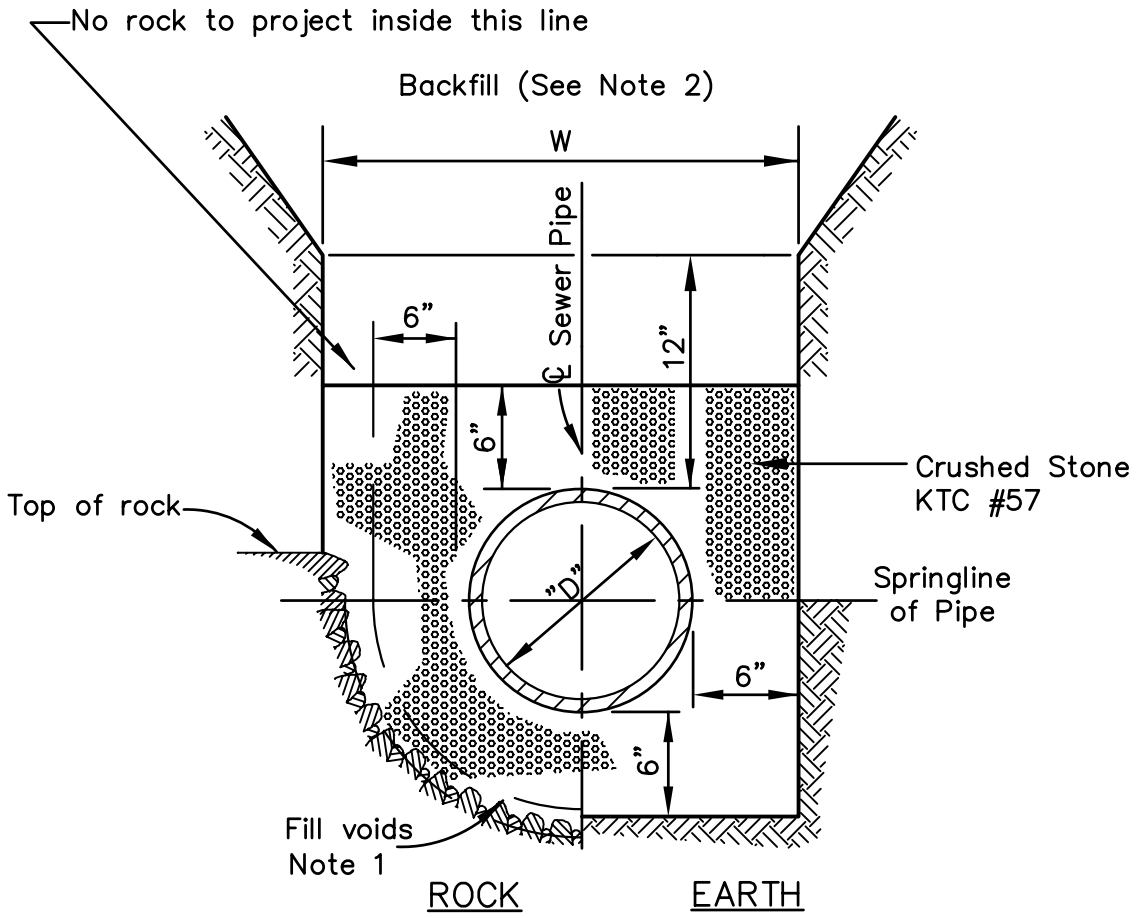
STANDARD DRAWING NO. GC–01–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

| Maximum Allowable Trench Width 12" Above Outside Top of Pipe "W" | Inside Diameter of Pipe "D" |
|---|---|
| 2'–6" | 4" |
| 2'–8" | 6" |
| 2'–10" | 8" |
| 3'–0" | 10" |
| 3'–5" | 12" |
| 3'–9" | 15" |
| 4'–1" | 18" |
| 4'–4" | 21" |
| 4'–8" | 24" |
| 5'–1" | 27" |
| 5'–5" | 30" |
| 5'–10" | 33" |
| 6'–2" | 36" |
| 6'–8" | 39" |
| 6'–11" | 42" |
| 7'–6" | 48" |
| D+2t+2'-8" | over 48" |

If "W" is exceeded, a Concrete Cradle shall be placed at such locations at the Contractor's expense. Applies to excavations in rock or earth.




NOTES:

1. All rock loosened shall be removed; voids created by such removal shall be refilled with Crushed STone KTC #57.
2. Backfill shall ne noted on the drawings.
3. Remove stone for pipe bells to provide full contact of bedding.

# CRUSHED STONE ENCASEMENT

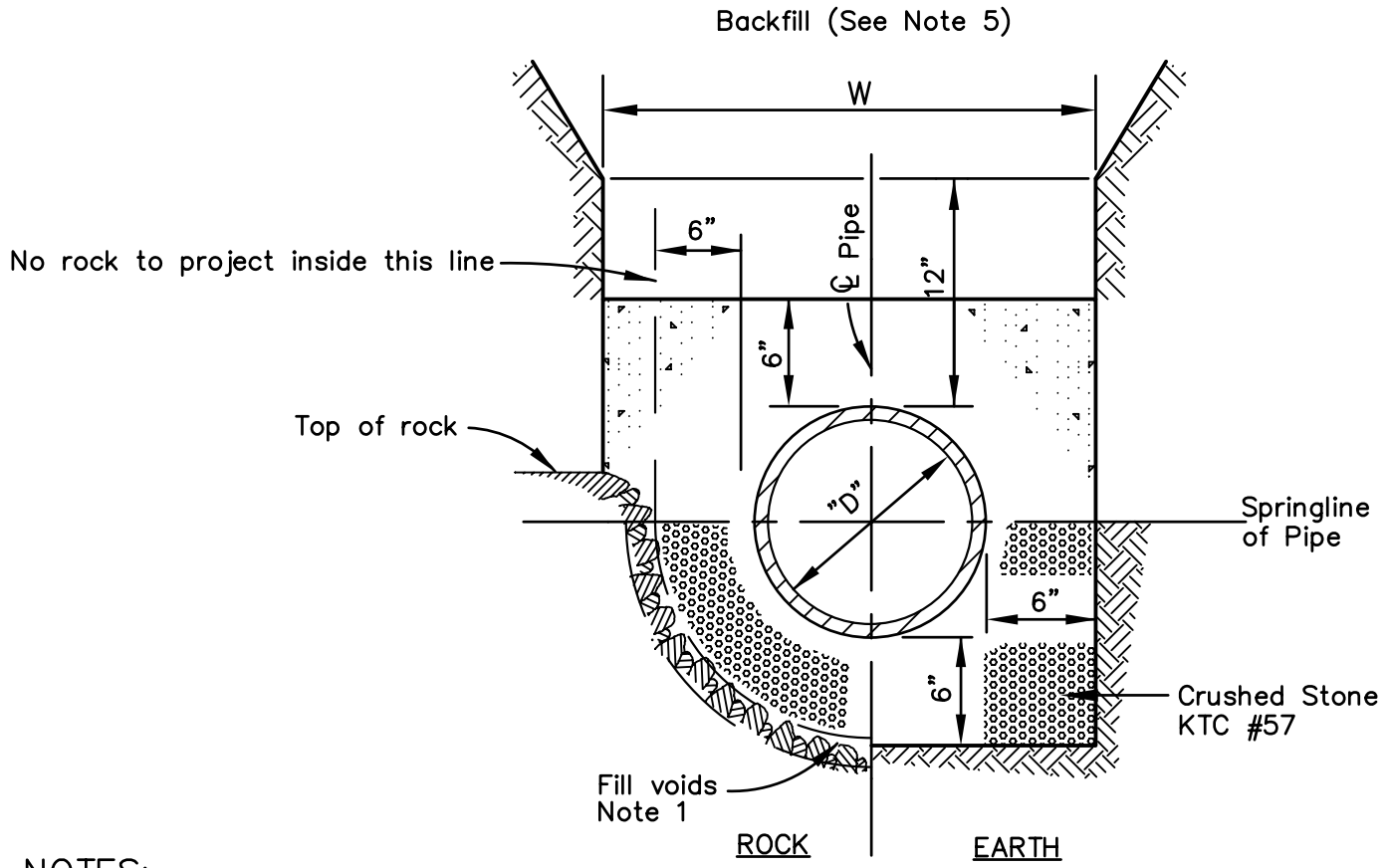
STANDARD DRAWING NO. GC–02–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

| Maximum Allowable Trench Width 12" Above Outside Top of Pipe "W" | Inside Diameter of Pipe "D" |
|---|---|
| 2'–6" | 4" |
| 2'–8" | 6" |
| 2'–10" | 8" |
| 3'–0" | 10" |
| 3'–5" | 12" |
| 3'–9" | 15" |
| 4'–1" | 18" |
| 4'–4" | 21" |
| 4'–8" | 24" |
| 5'–1" | 27" |
| 5'–5" | 30" |
| 5'–10" | 33" |
| 6'–2" | 36" |
| 6'–8" | 39" |
| 6'–11" | 42" |
| 7'–6" | 48" |
| D+2t+ 2'-8" | over 48" |

If "W" is exceeded, a Concrete Cradle shall be placed at such locations at the Contractor's expense. Applies to excavations in rock or earth.




NOTES:

1. All rock loosened shall be removed; voids created by such removal shall be refilled with Crushed Stone KTC #57.
2. If concrete is placed against sheeting, tarred or other suitable paper shall be first attached to the sheeting. The sheeting will not be allowed to be removed until the concrete has sufficiently cured.
3. The concrete cap may be placed against rock, if approved by the engineer.
4. Class "B" concrete shall be used.
5. Backfill shall be as noted on the drawing.
6. Remove stone for pipe bells to provide full contact of bedding.

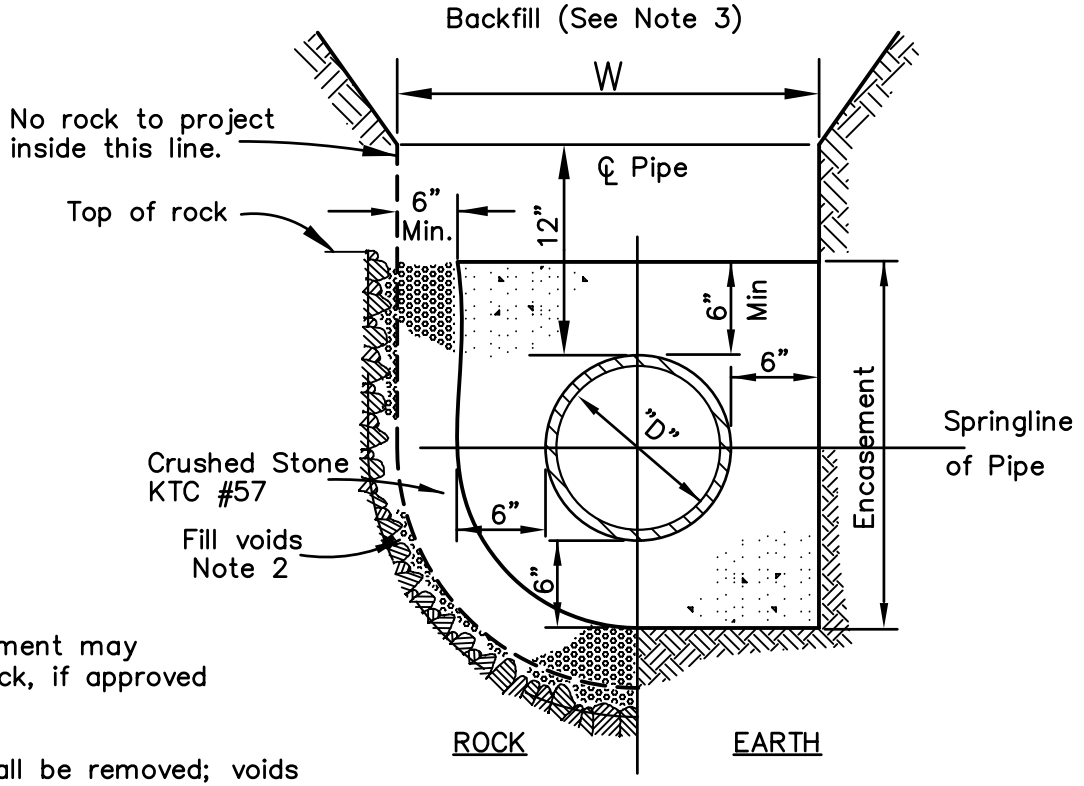
# CONCRETE CAP

STANDARD DRAWING NO. GC–03–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.

| Maximum Allowable Trench Width 12" Above Outside Top of Pipe "W" | Inside Diameter of Pipe "D" |
|---|---|
| 2'–6" | 4" |
| 2'–8" | 6" |
| 2'–10" | 8" |
| 3'–0" | 10" |
| 3'–5" | 12" |
| 3'–9" | 15" |
| 4'–1" | 18" |
| 4'–4" | 21" |
| 4'–8" | 24" |
| 5'–1" | 27" |
| 5'–5" | 30" |
| 5'–10" | 33" |
| 6'–2" | 36" |
| 6'–8" | 39" |
| 6'–11" | 42" |
| 7'–6" | 48" |
| D+2t+ 2'-8" | over 48" |




NOTES:

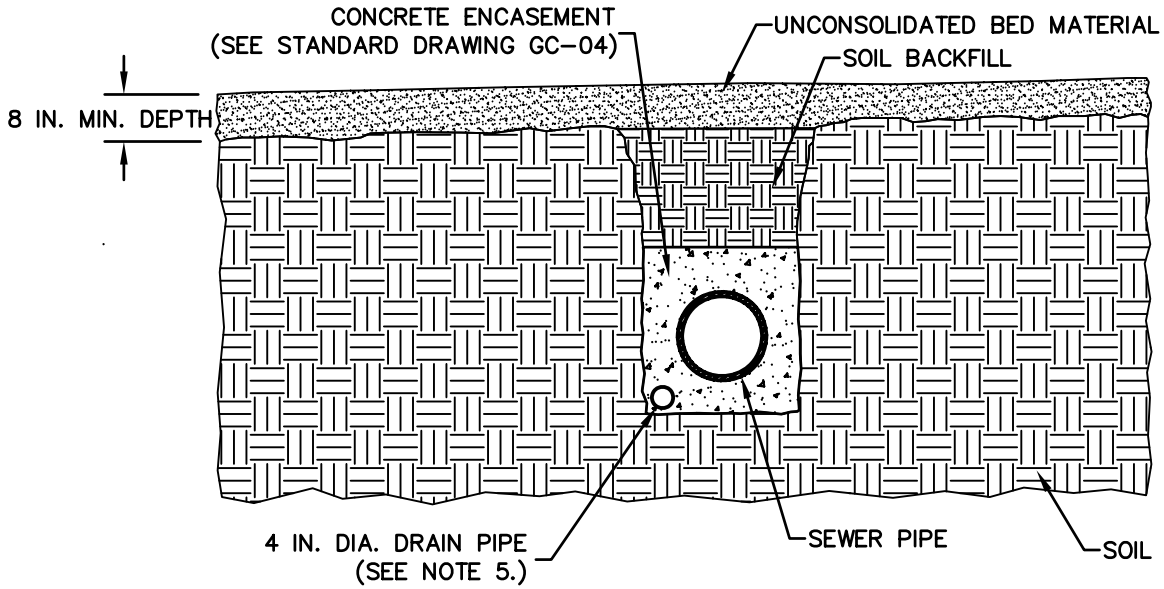
1. The concrete encasement may be placed against rock, if approved by the engineer.
2. All rock loosened shall be removed; voids created by such removal shall be filled with Crushed Stone KTC #57.
3. Backfill shall be as noted on the drawings.
4. Contractor shall encase pipe a minimum of 6–inches above the pipe or to existing rock line, as shown on drawings.
5. Contractor shall keep pipe from floating during the placement of concrete.
6. If concrete is placed against sheeting, tarred or other suitable paper shall be first attached to the sheeting. The sheeting will not be allowed to be removed until the concrete has sufficiently cured.
7. Class "B" concrete shall be used.

# CONCRETE ENCASEMENT

STANDARD DRAWING NO. GC–04–01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




CROSS SECTION

## NOTES

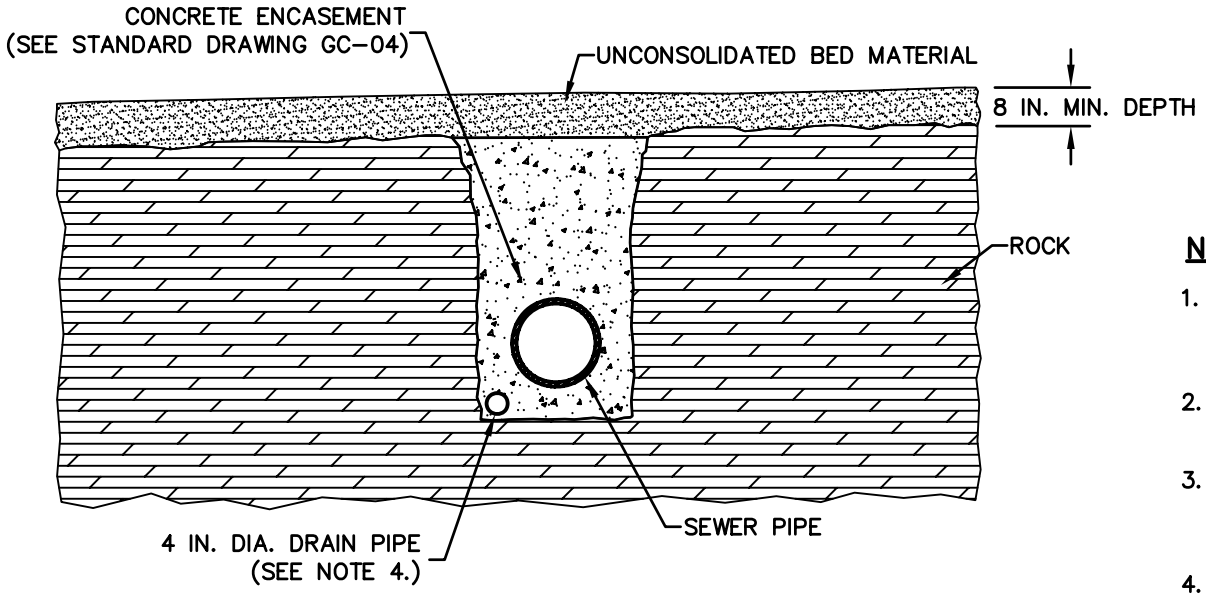
1. UNCONSOLIDATED MATERIAL IS LOOSE STONE, GRAVEL, SAND, SOIL, OR MUCK NATURALLY DEPOSITED IN THE STREAM BED.
2. STOCKPILE BED MATERIAL AND SOIL IN SEPARATE STOCKPILES.
3. SOIL BACKFILL AND UNCONSOLIDATED BED MATERIAL SHALL BE SAME MATERIAL AS THAT REMOVED DURING EXCAVATION.
4. SOIL BACKFILL SHALL BE COMPACTED TO 95% OF STANDARD PROCTOR DENSITY.
5. EXTEND EACH END OF DRAIN PIPE TO A MINIMUM OF 24 INCHES INTO CRUSHED STONE ENCASEMENT.
6. 4" DRAIN IS OPTIONAL BASED ON SITE CONDITIONS.

# RESTORATION OF CHANNELS WITH UNCONSOLIDATED BEDS OVER SOIL

STANDARD DRAWING NO. EC-01-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




CROSS SECTION

## NOTES

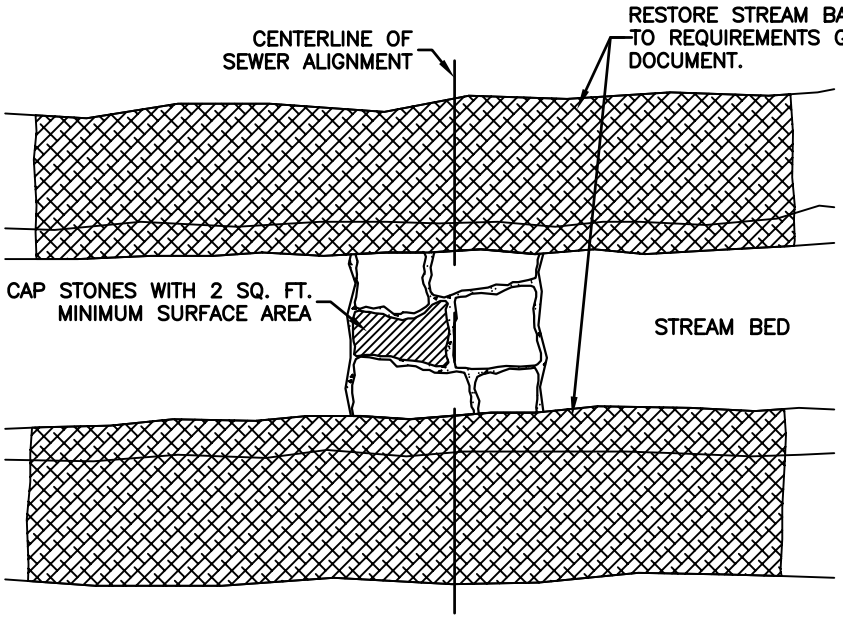
1. UNCONSOLIDATED MATERIAL IS LOOSE STONE, GRAVEL, SAND, SOIL, OR MUCK NATURALLY DEPOSITED IN THE STREAM BED.
2. STOCKPILE BED MATERIAL SEPARATE FROM SPOIL MATERIAL.
3. UNCONSOLIDATED BED MATERIAL SHALL BE SAME MATERIAL AS THAT REMOVED DURING EXCAVATION.
4. EXTEND EACH END OF DRAIN PIPE TO A MINIMUM OF 24 INCHES INTO CRUSHED STONE ENCASEMENT.
5. 4" DRAIN IS OPTIONAL BASED ON SITE CONDITIONS.

# RESTORATION OF CHANNELS WITH UNCONSOLIDATED BEDS OVER ROCK

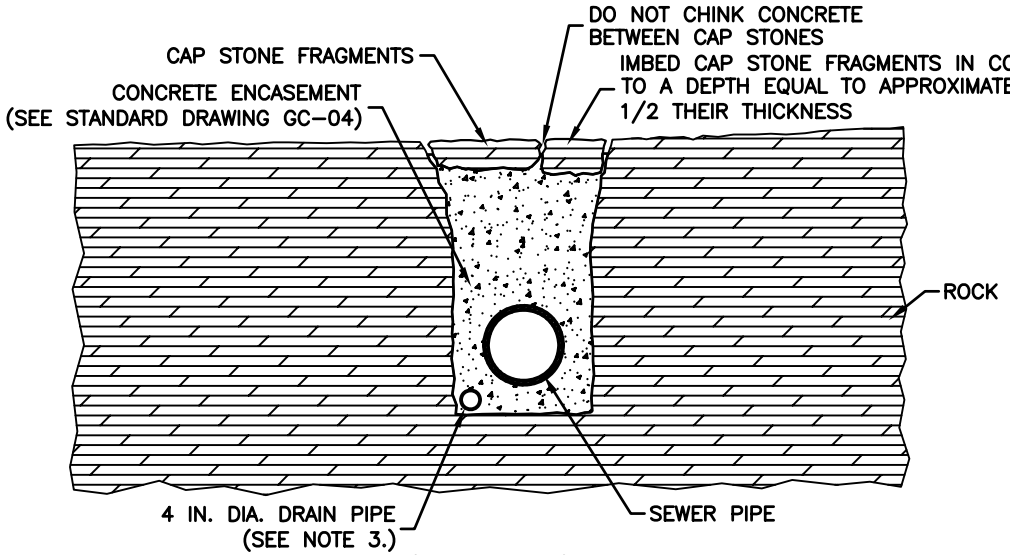
STANDARD DRAWING NO. EC-02-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




PLAN




CROSS SECTION

## NOTES

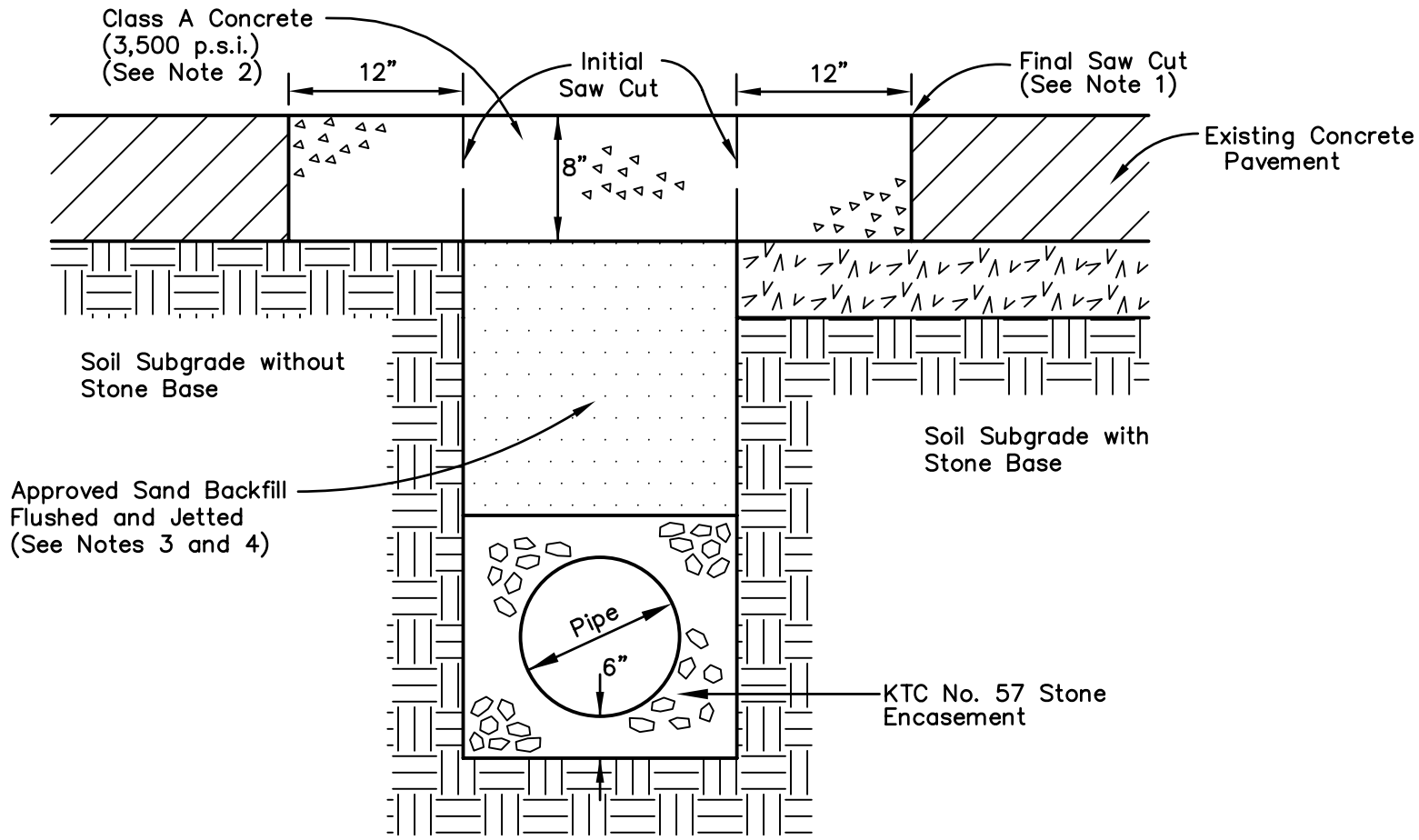
1. USE THIS RESTORATION METHOD ON EXPOSED MONOLITHIC ROCK BEDS AND THOSE WITH LESS THAN 4 INCHES OF UNCONSOLIDATED BED MATERIAL DEPOSITED OVER A MONOLITHIC ROCK BED.
2. MINIMUM THICKNESS OF CAP STONE SHALL BE 8 INCHES.
3. EXTEND EACH END OF DRAIN PIPE A MINIMUM OF 24 INCHES INTO CRUSHED STONE ENCASEMENT.
4. 4" DRAIN IS OPTIONAL BASED ON SITE CONDITIONS.

# RESTORATION OF CHANNELS WITH ROCK BED

STANDARD DRAWING NO. EC-03-01

DECEMBER 2012

*This is a detail from MSD Standard Drawings dated 9-30-09.




## NOTES

1. The final saw cut shall be made a distance of 12 inches beyond the trench, after trench excavation and backfill are complete, and immediately prior to placing concrete. If the distance from the edge of the trench to an existing break or joint is less than 4 feet, the final saw cut shall be located at the existing break or joint.
2. Concrete cap to be 8 inches. If the existing pavement section is less than 8 inches thick, excavation of underlying stone base or soil subgrade will be required to provide the specified thickness.
3. Use of compacted KTC No. 57 stone in lieu of sand backfill may be allowed on a case by case basis with prior approval from **New Albany.**
4. In roadway embankment situations when sand backfill is utilized, compacted earth shall be placed in this zone within 5 feet (horizontal distance) of the embankment slope.
5. The Contractor shall be responsible during the ensuing 5 years for proper backfilling and replacement of the surface. During the 5 year period any pavement settlement shall be immediately repaired by the Contractor at the expense of the Contractor.

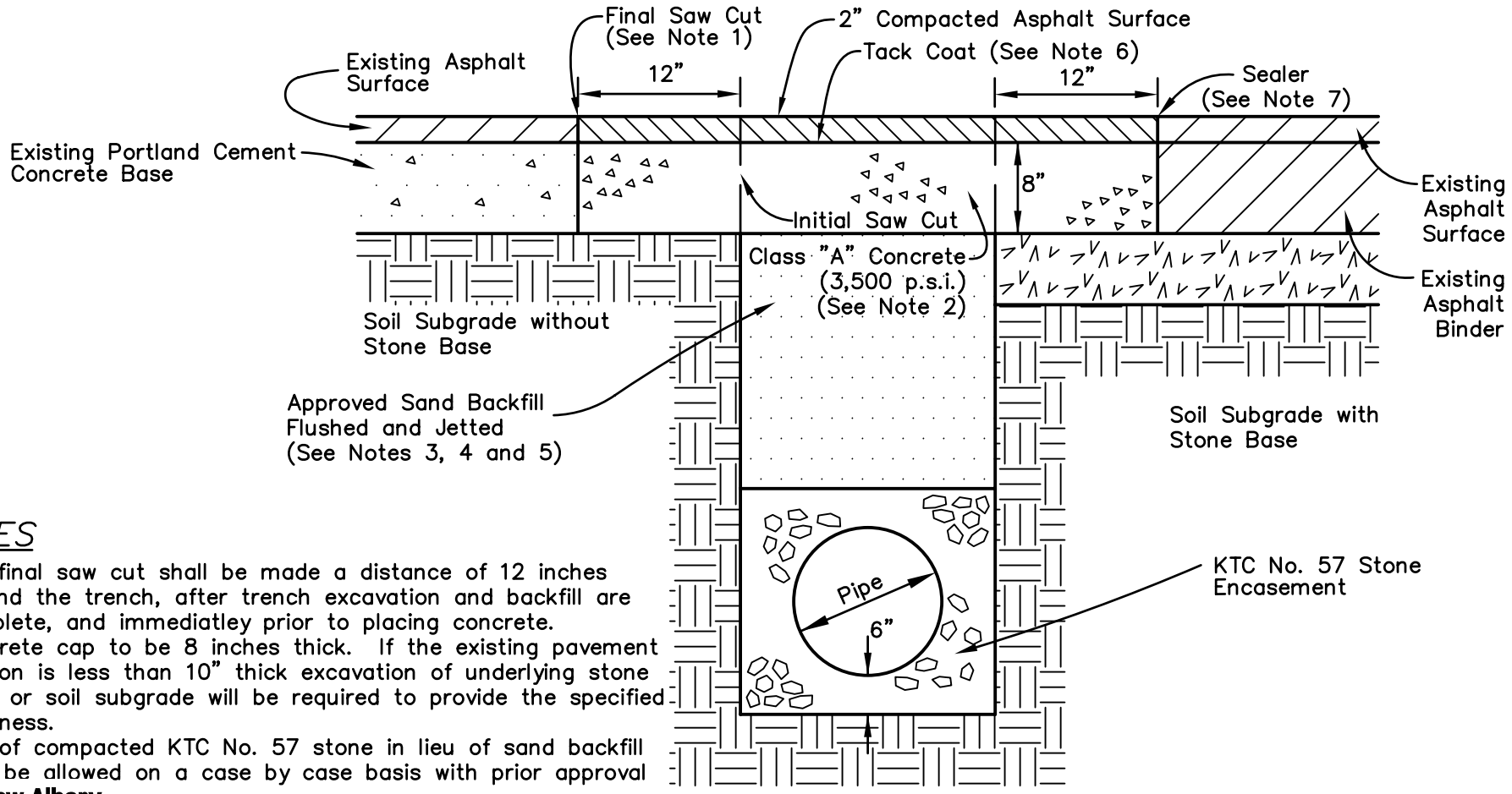
NEW ALBANY

CONCRETE
PAVEMENT RESTORATION

STANDARD DRAWING NO. PR–01–01

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




## NOTES

1. The final saw cut shall be made a distance of 12 inches beyond the trench, after trench excavation and backfill are complete, and immediatley prior to placing concrete.
2. Concrete cap to be 8 inches thick. If the existing pavement section is less than 10" thick excavation of underlying stone base or soil subgrade will be required to provide the specified thickness.
3. Use of compacted KTC No. 57 stone in lieu of sand backfill may be allowed on a case by case basis with prior approval of **New Albany.**
4. **Use of processed coal bottom ash that meets the requirements for Type 1A backfill, as described in the New Albany and Floyd County Sanitary Sewer and Stormwater Design Manual, in lieu of sand may be allowed on a case by case basis with prior approval of New Albany.**
5. In roadway embankment situations, when sand backfill is utilized, compacted earth shall be placed in this zone within 5 feet (horizontal distance) of the embankment slope.
6. Tack material consisting of emulsified asphalt SS–1h shall be placed on the surface of the concrete cap at the rate of 0.1 gallon per square yard, and allowed to "break" prior to the placement of the asphalt surface.
7. Pavement joints shall be sealed with an approved joint sealant after placement of asphalt surface.
8. The Contractor shall be responsible during the ensuing 5 years for proper backfilling and replacement of the surface. During the 5 year period any pavement settlement shall be immediately repaired by the Contractor at the expense of the Contractor.

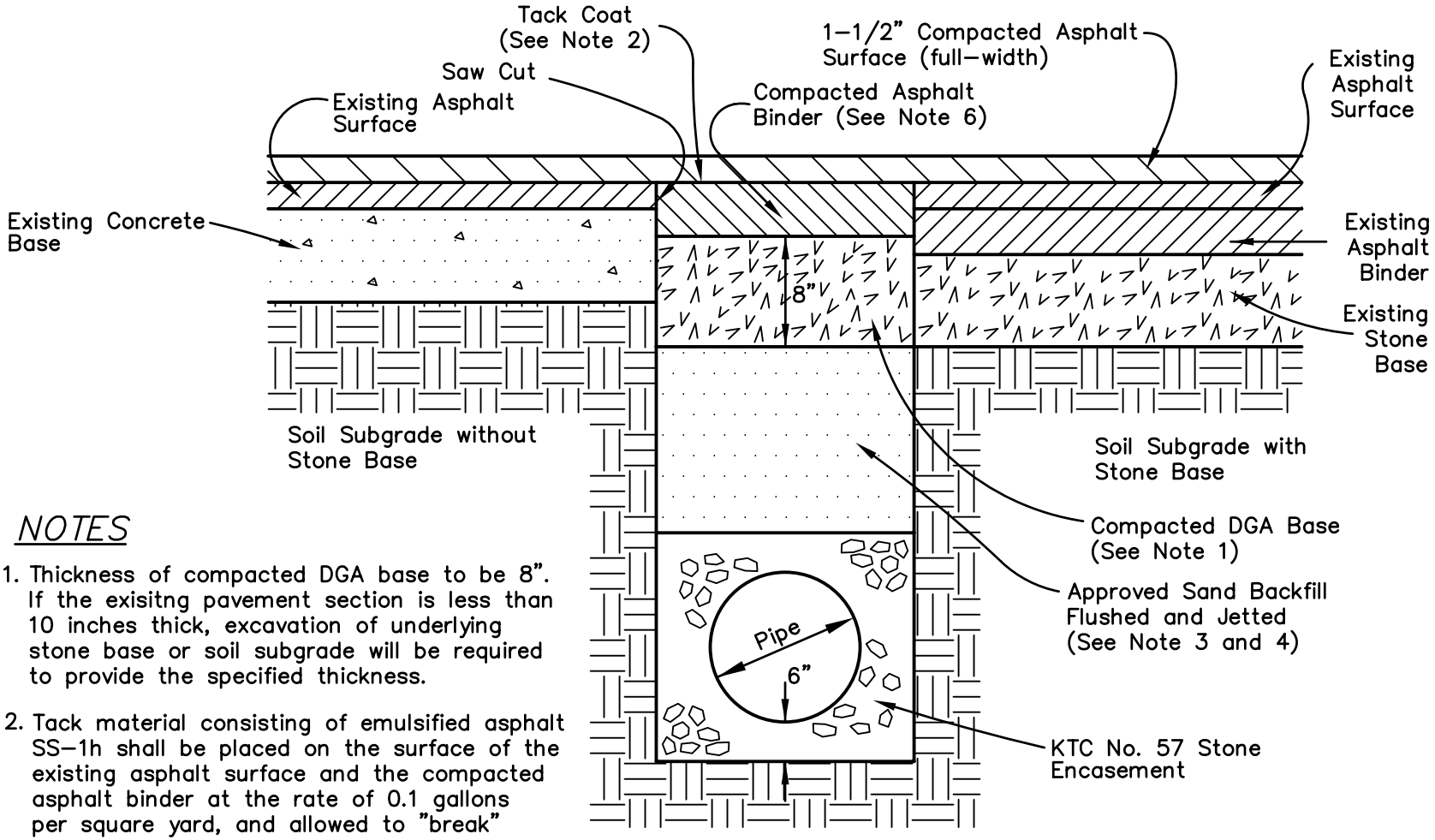
NEW ALBANY

ASPHALT
PAVEMENT RESTORATION

STANDARD DRAWING NO. PR–02–02

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




## NOTES

1. Thickness of compacted DGA base to be 8". If the exisitng pavement section is less than 10 inches thick, excavation of underlying stone base or soil subgrade will be required to provide the specified thickness.
2. Tack material consisting of emulsified asphalt SS–1h shall be placed on the surface of the existing asphalt surface and the compacted asphalt binder at the rate of 0.1 gallons per square yard, and allowed to "break" prior to placement of the full width asphalt surface.
3. Use of compacted KTC No. 57 stone in lieu of sand backfill may be allowed on a case by case basis with prior approval of **New Albany.**
4. Use of processed coal bottom ash that meets the requirements for Type 1A backfill, as **described in the New Albany and Floyd County Sanitary Sewer and Stormwater Design Manual, in lieu of sand may be allowed on a case by case basis with prior approval of New Albany.**
5. The Contractor shall be responsible during the ensuing 5 years for proper backfilling and replacement of the surface. During the 5 year period any pavement settlement shall be immediately repaired by the Contractor at the expense of the Contractor.
6. Use 2 inch thick binder on Subdivision streets.

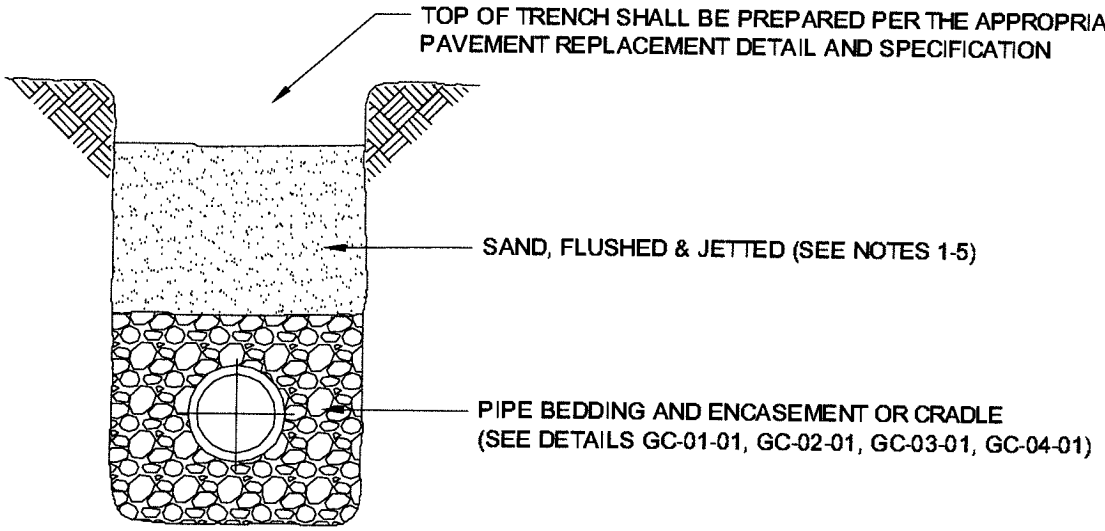
NEW ALBANY

ASPHALT PAVEMENT
RESTORATION WITH OVERLAY

STANDARD DRAWING NO. PR–03–02

APRIL 2015

*This is a detail from MSD Standard Drawings dated 9-30-09.




## TYPE I-A BACKFILL
## SAND FLUSHED & JETTED
## WITHIN LIMITS OF EXISTING OR PROPOSED PAVED SURFACES

NOT TO SCALE

NOTES:

1. WATER TO BE USED FOR FLUSHING AND JETTING SHALL BE SUPPLIED THROUGH HOSES AND PIPES HAVING MINIMUM DIAMETER OF 2 INCHES. THE JET PIPE SHALL HAVE A MINIMUM DIAMETER OF 1.5 INCHES.

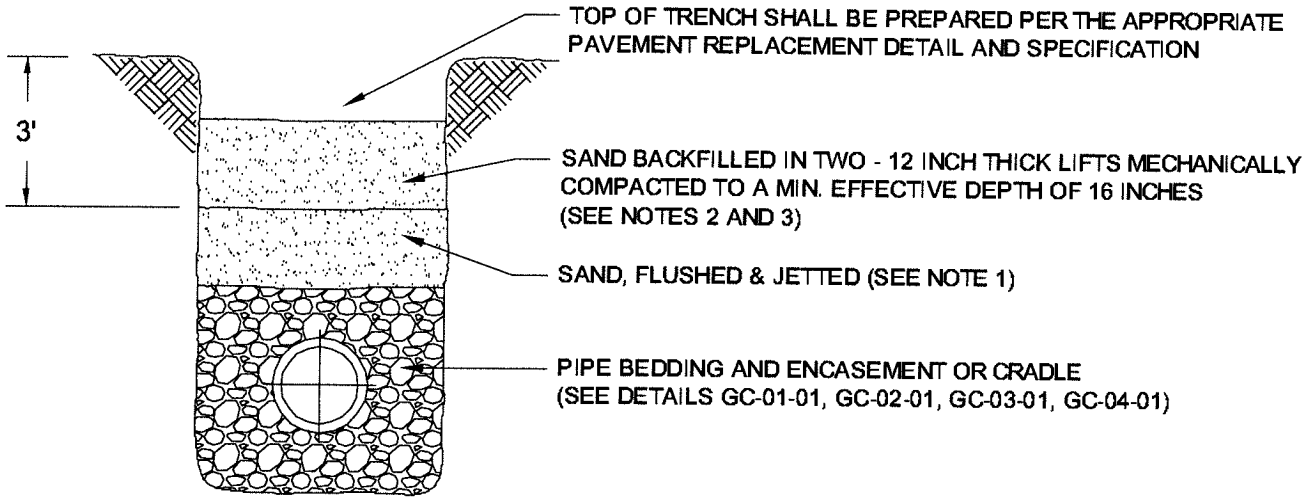
2. THE JET PIPE SHALL BE INSERTED INTO THE SAND BACKFILL BEGINNING AT THE DOWNSTREAM END OF THE TRENCH AND PROCEEDING UPSTREAM AT A MAXIMUM SPACING ALONG THE TRENCH OF 6 FEET AND THE SPACING SHALL BE STAGGERED ALONG THE TRENCH AREA.

3. THE JET PIPE SHALL PENETRATE THE SAND BACKFILL TO WITHIN 12 INCHES OF THE CRUSHED STONE ENCASEMENT.

4. THE PIPE SHALL REMAIN IN PLACE UNTIL WATER IS OBSERVED RISING ABOVE THE BACKFILL THROUGHOUT THE FULL WIDTH OF THE TRENCH AND OVER A LENGTH OF TRENCH EQUAL TO ONE HALF THE DISTANCE BETWEEN ADJACENT JET INSTALLATIONS.

5. FOLLOWING FLUSHING AND JETTING AND PRIOR TO PAVEMENT CONSTRUCTION, THE SURFACE OF THE SAND SUBGRADE SHALL BE THOROUGHLY COMPACTED FOLLOWING THE PROCEDURES DESCRIBED IN THE TYPE I-B BACKFILL DETAIL.

| |
|---|
| TYPE I–A BACKFILL |
| STANDARD DRAWING NO. NA–I–A |
| APRIL 2015 |




## TYPE I-B BACKFILL
## SAND FLUSHED & JETTED AND MECHANICALLY COMPACTED WITHIN LIMITS OF EXISTING OR PROPOSED PAVED SURFACES

NOT TO SCALE

NOTES:

1. TRENCH SHALL BE COMPLETELY BACKFILLED WITH SAND AND DENSIFIED BY FLUSHING AND JETTING WITH WATER. FLUSHING AND JETTING PROCEDURES SHALL BE AS DESCRIBED IN THE TYPE I-A BACKFILL DETAIL. THE SAND BACKFILL SHALL BE REMOVED TO A DEPTH OF 3 FEET BELOW THE PAVEMENT SURFACE AND STOCKPILED FOR LATER MECHANICAL COMPACTION. THE EXPOSED SURFACE SHALL THEN BE THOROUGHLY COMPACTED.

2. FOR COMPACTION, THE CONTRACTOR SHALL SUPPLY A VIBRATORY PLATE COMPACTOR OR SMOOTH DRUM VIBRATORY ROLLER CAPABLE OF COMPACTING SANDS TO A MINIMUM EFFECTIVE DEPTH OF 16 INCHES.

3. THE REQUIRED NUMBER OF PASSES OF THE ROLLER OR PLATE SHALL BE ESTABLISHED AT THE BEGINNING OF COMPACTION OPERATIONS FOR THE PROJECT BY TAKING NUCLEAR DENSITY TESTS TO MONITOR THE DENSITY INCREASE WITH INCREASED PASSES OF THE ROLLER OR PLATE. THE REQUIRED NUMBER OF PASSES SHALL BE SET WHEN NO FURTHER INCREASE IN SAND BACKFILL DENSITY IS MEASURED.

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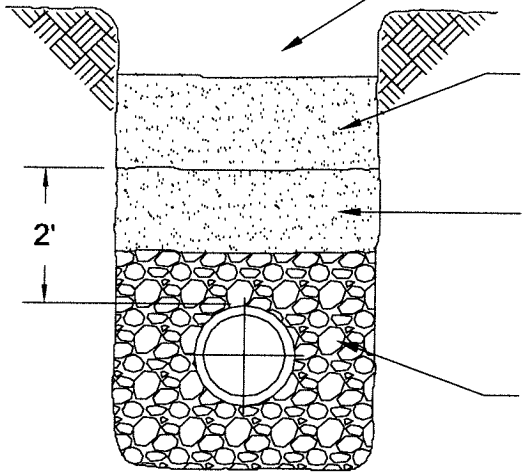
| TYPE I–B BACKFILL |
| STANDARD DRAWING NO. NA–I–B |
| APRIL 2015 |




TOP OF TRENCH SHALL BE PREPARED PER THE APPROPRIATE PAVEMENT REPLACEMENT DETAIL AND SPECIFICATION

EARTH BACKFILL PLACED IN 12 INCH LIFTS MECHANICALLY COMPACTED TO A MIN. 95% OF THE STANDARD PROCTOR DENSITY AND A MOISTURE CONTENT BETWEEN +2% AND -4% OF THE OPTIMUM MOISTURE CONTENT (SEE NOTES 1 AND 2)

EARTH BACKFILL PLACED IN 6 INCH LIFTS MECHANICALLY COMPACTED TO A MIN. 95% OF THE STANDARD PROCTOR DENSITY AND A MOISTURE CONTENT BETWEEN +2% AND -4% OF THE OPTIMUM MOISTURE CONTENT (SEE NOTES 1 AND 2)

PIPE BEDDING AND ENCASEMENT OR CRADLE (SEE DETAILS GC-01-01, GC-02-01, GC-03-01, GC-04-01)

## TYPE III-A BACKFILL
## EARTH MATERIAL MECHANICALLY COMPACTED WITHIN LIMITS OF EXISTING OR PROPOSED PAVED SURFACES

NOT TO SCALE

NOTES:

1. EARTH BACKFILL SHALL CONSIST OF SELECTED EXCAVATED MATERIALS OR APPROVED BORROW MATERIALS CONTAINING NO ROCK FRAGMENTS WITH A MAXIMUM DIMENSION LARGER THAN 4 INCHES.

2. EACH LAYER SHALL BE PROPERLY COMPACTED BEFORE THE NEXT SUCCEEDING LAYER IS PLACED. ANY LIFT OF FILL WHICH PUMPS UNDER WEIGHT OF THE COMPACTION EQUIPMENT SHALL BE REJECTED, REGARDLESS OF THE FIELD DENSITY TEST RESULTS.

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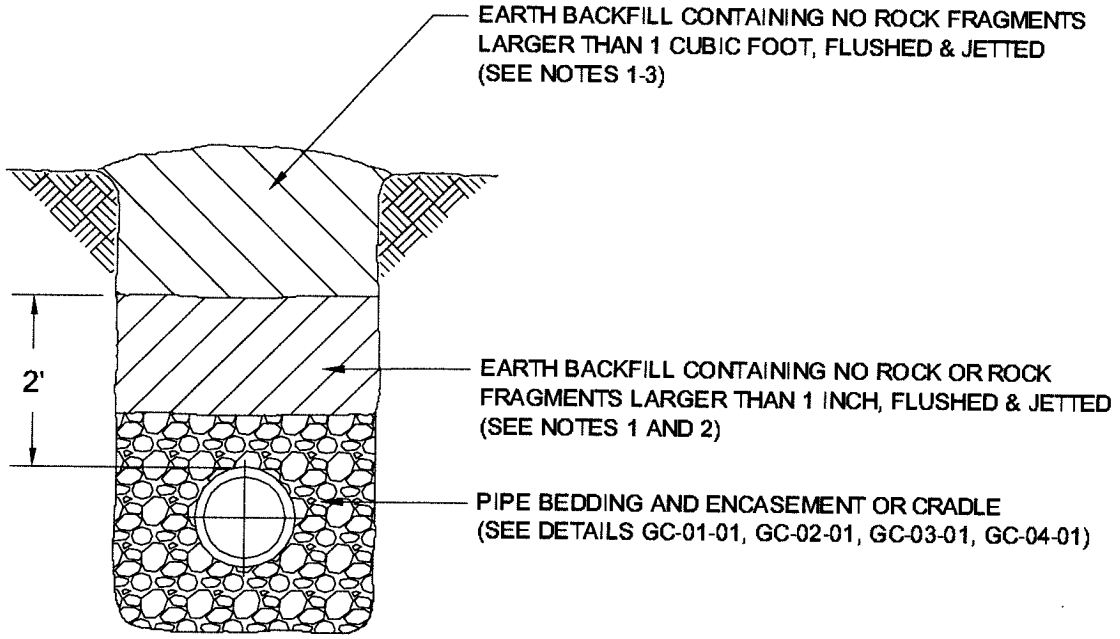
| TYPE III–A BACKFILL |
| STANDARD DRAWING NO. NA–III–A |
| APRIL 2015 |




## TYPE II BACKFILL
## EARTH MATERIAL FLUSHED & JETTED
## OUTSIDE LIMITS OF EXISTING OR PROPOSED PAVED SURFACES

NOT TO SCALE

NOTES:

1. AFTER THE TRENCH HAS BEEN COMPLETELY BACKFILLED WITH SELECTED EXCAVATED MATERIALS OR APPROVED BORROW MATERIALS, THE BACKFILL SHALL BE DENSIFIED BY FLUSHING AND JETTING WITH WATER BEGINNING AT THE DOWNSTREAM END OF THE TRENCH AND PROCEEDING UPSTREAM. FLUSHING AND JETTING PROCEDURES SHALL BE AS DESCRIBED IN THE TYPE I-A BACKFILL DETAIL.

2. FLUSHING AND JETTING SHALL STOP ONCE THE BACKFILL IS COMPLETELY SATURATED AND NO FURTHER SETTLEMENT IS OBSERVED.

3. AFTER THE BACKFILL IN THE TRENCH HAS SUBSTANTIALLY DRIED AND COMPLETED ANY ADDITIONAL SETTLEMENT, ANY SETTLEMENT BELOW THE FINISH GRADE SHALL BE BACKFILLED WITH ADDITIONAL EARTH AND COMPACTED IN ACCORDANCE WITH TYPE III-B BACKFILL.

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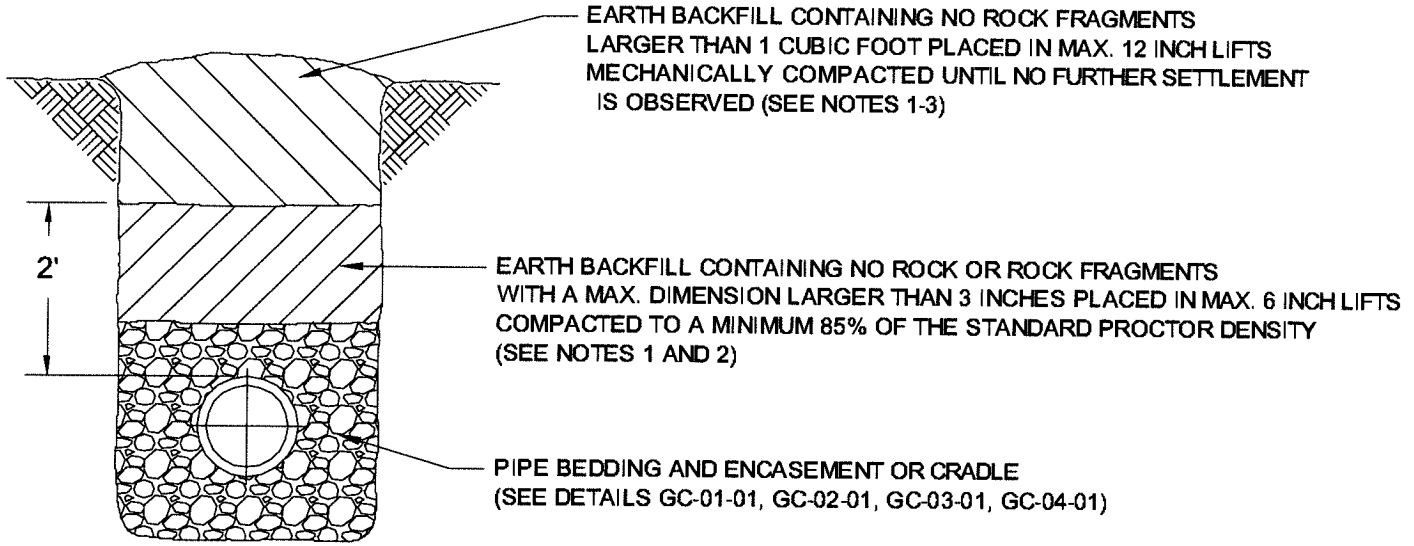
| TYPE II BACKFILL |
| STANDARD DRAWING NO. NA–II |
| APRIL 2015 |



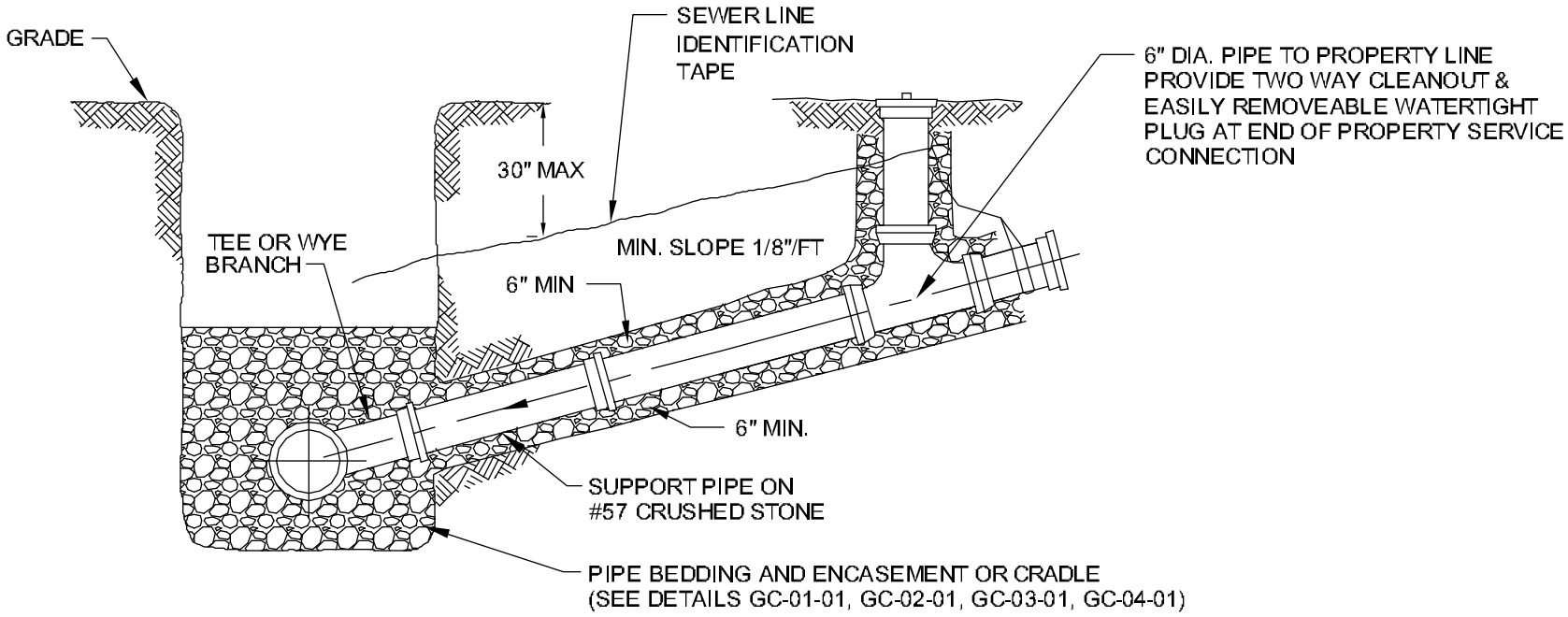

# TYPE III-B BACKFILL
## EARTH MATERIAL MECHANICALLY COMPACTED
## OUTSIDE LIMITS OF EXISTING OR PROPOSED PAVED SURFACES

NOT TO SCALE

NOTES:

1. EARTH BACKFILL SHALL CONSIST OF SELECTED EXCAVATED MATERIALS OR APPROVED BORROW MATERIALS CONTAINING NO ROCK FRAGMENTS GREATER THAN THE DIMENSIONS LISTED ABOVE.
2. EACH LAYER SHALL BE THOROUGHLY COMPACTED BEFORE THE NEXT SUCCEEDING LAYER IS PLACED. ANY LIFT OF FILL WHICH PUMPS UNDER THE WEIGHT OF THE COMPACTION EQUIPMENT SHALL BE REJECTED, REGARDLESS OF THE FIELD DENSITY TEST RESULTS.
3. EACH LAYER SHALL BE COMPACTED WITH A DOZER OR OTHER HEAVY, EARTH-MOVING EQUIPMENT TRAVELING BACK AND FORTH OVER THE MATERIAL UNTIL NO FURTHER SETTLEMENT IS OBSERVED.

| |
|---|
| TYPE III–B BACKFILL |
| STANDARD DRAWING NO. NA–III–B |
| APRIL 2015 |




NOTE:
1. THIS DETAIL IS FOR SHALLOW PROPERTY SERVICE CONNECTIONS IN ROCK OR EARTHEN TRENCH.

# PROPERTY SERVICE CONNECTION FOR SHALLOW SEWER

STANDARD DRAWING NO. NA–SPSC

APRIL 2015

# Appendix B

# Criteria for Precast Structures

# APPENDIX B

## CRITERIA FOR PRECAST STRUCTURES

1. Any use of precast structures must be so noted on the plans, including a typical detail for each type of structure for the project.

2. Structures which require specially designed footings, cut-off walls, etc., will not be allowed as precast.

3. Openings in precast structures for pipes shall be the outside diameter of the pipe plus maximum of 6 inches. In order to use non-shrink grout, the opening shall be the outside diameter of pipe plus 3 inches. (Outside diameter of pipe plus 4 1/2 inches is permissible when tapered hole forms are utilized.)

4. For precast structures (other than those with knockout panels), the opening around the pipe shall either be filled with non-shrink grout for the wall thickness of the structure or the pipe shall be encased with a minimum 6-inch collar of concrete from the inside face of the wall to 1'-0" outside the outer face of the wall. The pipe shall be adequately supported to prevent settling while the grout or the concrete encasement is setting up. The inside face of the structure walls shall be finished with a trowel and wet brush finish.

5. For circular structures, the following applies as to the maximum inside diameter (or horizontal dimension) of pipe to be used with a given size of manhole.

| Diameter of Structure | Maximum Size of Pipe* |
|---|---|
| 4'-0" | 24 inches |
| 5'-0" | 36 inches |
| 6'-0" | 48 inches |

*Outside diameter may be considered on a case-by-case basis for flexible pipe.

6. For circular structures, the minimum distance allowed between precast holes for the pipes shall be 12 inches.

7. For circular structures and rectangular structures (other than those with knockout panels), the minimum vertical distance from the holes for the pipes to the top of the structure wall shall be 4 inches. If this vertical distance is less than 12 inches, then additional reinforcing steel shall be furnished for this section. The top slab must be designed for HS-20 loading.

8. For precast structures with knockout panels, holes for the pipe shall not be cut into the structural members (i.e., top beams and corner columns) and non-shrink grout shall not be allowed to be placed around the pipes. The pipes shall be encased with concrete a minimum 6-inch collar around the outside of pipe or a minimum of 3 inches beyond the hole knocked in the wall, whichever is greater. Also, the concrete encasement shall extend from the inside face of the wall to 1'-0" outside the outer face of the wall.

9. Precast structures with knockout panels shall not be used with more than 2 feet of earth cover unless load calculations are supplied.

10. For rectangular structures where pipe will be installed in adjacent walls (other than those with knockout panels), at least 6 inches of wall (measured from the interior corner)is required on each side of the pipe beyond the precast opening for the pipe. This rule is not applicable for structures which have pipe installed in opposite walls or where one outlet pipe is utilized.

11. A wash is required in the bottom of catch basins to provide positive drainage (sloped toward outlet).