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UNIT III - SANITARY SEWER DESIGN STANDARDS

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CHAPTER 1 - INTRODUCTION

1.1 Purpose

The purpose of these design standards is to provide guidance for the design of sanitary sewer systems and pump stations. These standards set forth minimum criteria for the design and construction of all such facilities within the jurisdiction of the City of Fort Wayne. The Chapters of this Unit outline the general requirements necessary for design. This Unit III shall be used in conjunction with Unit III of the Design Manual. The Design Manual further details design procedures and methods, provides more comprehensive design guidelines and methodology, and contains computation worksheets to assist in sanitary sewer design.

1.2 Description and Use

1.2.1 Compliance with Other Standards

Compliance with this standard does not eliminate the need to comply with other applicable City, County, State and Federal ordinances and regulations. This includes, but is not limited to, the submission and approval of preliminary and final subdivision plats, IDEM permits (IDEM or City issued) for sanitary facilities construction, building and zoning permits, construction inspections, appeals, and similar matters.

1.2.2 Conflicting Standards

The provisions of this document shall be deemed as additional requirements to minimum standards required by other applicable ordinances and standards. In the case of conflicting requirements, the most restrictive shall apply.

1.2.3 Waivers and Variance from Standards

Alternative sanitary sewer methods and materials on occasion may be warranted, and a variance from these standards may be permitted. A written request for variance must be made to Water Resources. The request must be based upon sound engineering practice and judgement, and must be supported by adequate justification and data. If a variance is granted, it will apply only to the specific project for which approval is sought. Variances and waivers granted by the Department of Water Resources shall apply only to the sanitary sewer design standards. Variance from other City, State and Federal regulations and standards can not be granted by Water Resources.

1.3 Definitions and Symbols

1.3.1 Definitions

The following are definitions and symbols commonly used in the design of sanitary sewers and pump stations.

Adjustment Ring – A cylindrical ring, usually comprised of concrete, secured on top of a manhole upon which the frame will rest.

Administering Authority – The designated unit of government given the authority to issue permits
Average Daily Flow – Average 24-hour dry weather flow, including a nominal amount of infiltration, within a sewer.

Backfill – Earth and/or other material used to replace material removed from trenches or other excavations during construction activities. The backfill lies above the pipe bedding.

Bedding – The portion of backfill which encases the sewer pipe to a minimum depth above and below the barrel of the pipe. The bedding serves as the pipe support.

Board – The Board of Public Works for the City of Fort Wayne and any subordinate employee to whom the Board shall specifically delegate the responsibility authorized by these standards.

Building Sewer – Private sewers which connect building plumbing to public sewers. Building sewers normally begin outside the building foundation.

Buoyancy – The act of supporting a floating body, including the tendency to float an empty pipe by exterior hydraulic pressure.

Capacity of Gravity Sanitary Sewer Facility – The maximum flow that can be conveyed or stored in a sanitary sewer or conduit without surcharging.

City Utility Designed Project – Project designed by Fort Wayne in-house staff.

Cleanout – A pipe or some other opening through which a device may be run to unplug a sewer.

Collar – A monolithic concrete encasement for support of a conduit

Collector Sewer – Sewer which is primarily installed to receive wastewater directly from property service connections and convey the wastewater to an interceptor line.

Crown of Pipe – The highest inside part of a pipe or conduit.

Development – Any man-made change to improved or unimproved real estate, including but not limited to, buildings, or other structures, mining, dredging, filling, grading, paving, excavation, substantial improvements, placement of mobile homes, subdivision of land, in-fill or drilling operations.

Effluent – Water or wastewater that flows from a facility such as a pump station or treatment process.

Encasement – The enclosing or surrounding of a conduit with concrete or other suitable material.

Force Main – A pipe under internal pressure created by forces on the discharge side of a pump.

Grade – The inclination or slope of a conduit or natural ground surface usually expressed in terms of the percentage the vertical rise (or fall) bears to the corresponding horizontal distance.

Grease Trap – Device which collects organic substances including fats, vegetable and mineral oils, waxes, fatty acids from soaps, and other hydrocarbons before they enter the sewer system thus reducing the risk of adhesion problems in sewers.

Hydraulic Grade Line – Measure of pressure head available at specific points within a sewer system. The hydraulic grade line is a line connecting the points to which the liquid would rise at various places along any pipe if piezometer tubes were inserted in the liquid.

IDEM – Indiana Department of Environmental Management.

IDNR – Indiana Department of Natural Resources.

INDOT – Indiana Department of Transportation.

Infiltration – Groundwater that enters the sewer system via such means as pipe cracks, joints, connections, or defects in manhole structures.

Inflow – Surface water which enters the sanitary sewer system via an illegal drain connection (foundation drain, roof drain, yard drain, inlet structure, storm sewer cross connection, or sump pump) or from sources such as leaks around manhole covers.

Interceptor Sewer – Principal sewer to which collector sewers are tributary. Interceptor sewers convey the wastewater to treatment or other disposal facilities.

Invert – The bottom or lowest elevation of the internal cross-section of a conduit or sewer.

Inverted Siphon – A sewer line which drops below the hydraulic gradient.

Land Disturbing Activity – Any man-made changes of the land surface including, but not limited to, removing vegetative cover, excavating, filling, transporting and grading of soils, sediment or rock. Agricultural land disturbing activities are excluded.

Lateral – Alternate term for building sewer.

Lift Station – Any arrangement of pumps, piping, valves, and controls which convey wastewater to or over a higher elevation.

Manhole – Sanitary sewer structure through which a person may enter to gain access to an underground sanitary sewer or enclosed structure.

Monolithic – Cast-in-place as one unit.

Non-City Utility Designed Project – Project designed by outside consultant, engineer, developer, etc.

Off-site – Everything not on-site.

On-site – The entire area included in the legal description of the land on which the development or land disturbing activities take place.

Peak Hourly Flow – The largest volume of flow to be received during a continous 24-hour period.

Permanent Easement – A permanent right-of-way to use a described parcel of land for the purposes to construct, operate, control, maintain, reconstruct, or remove a sewer line and appurtenances along, under, and across said easement.

Permit – Written permission to do something from agency with authority to control operation.

Plans – Official drawings or reproductions of drawings pertaining to the work associated with specific project.

Population, Equivalent – A hypothetical number of persons for which flow contributions are calculated.

Population, Saturation – The actual (equivalent) population that exists or would exist when an area is fully developed.

Precast – An item which is formed or molded and distributed by the manufacturer as a complete unit.

Private Sewer – Sewer owned and maintained by a private person or company.

Public Sewer – Sewer to the use of which all owners of abutting property have equal rights to and is controlled and maintained by the City of Fort Wayne or other public authority.

Sanitary Sewer – A pipe or conduit designed to convey wastewater. Storm, surface, and ground waters together with unpolluted industrial wastewaters are not permitted within sanitary sewers.

Service Area – A geographical area served by a public utility or sewage collection system.

Springline of Pipe – The horizontal midpoint of a sewer pipe.

Submersible Pump – A pump capable of being fully placed beneath a water surface.

Surcharge – A condition in which a sewer or conduit does not possess enough capacity to convey the total amount of flow within the system. The amount of surcharge is measured by the volume or rate of excess flow or by the height of the elevated hydraulic grade line.

Stub – Short length of sewer segment tapped into existing system allowing for future connection.

Ten State Standards – "Recommended Standards for Wastewater Facilities of the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers." 1997 Edition.

Temporary Easement – The temporary use of land for the purposes of constructing and placing in operation a sewer and its appurtenances. The temporary sewer easement shall expire a minimum of one year from the date of adoption by the Board of Public Works and Safety, or on the date specified in the easement instrument.

Wastewater – The water supply of a City after is has been fouled by a variety of uses. From the standpoint of sources of generation, wastewater may be defined as a combination of the liquid- or water-carried wastes removed from residences, institutions, and commercial and industrial establishments.

Wet Well – A short-term storage tank containing a pump or pump entrance into which raw wastewater is conveyed.

1.3.2 Symbols

Symbols used throughout these standards include:

Symbols	Definition	Unit
A	cross sectional area	ft^2
cfs	cubic feet per second	cfs
d or D	inside diameter of pipe	ft
ft/s	feet per second	ft/s
g	acceleration due to gravity (32.2)	ft/s^2
gpd	gallons per day	gpd
gpm	gallons per minute	gpm
L	flow length	ft
MGD	million gallons per day	MGD
n	Manning's Roughness Coefficient	-

psi	pounds per square inch	psi
Q	flow within sanitary sewer or conduit	ft^3/s, MGD, gpm
r	radius of pipe	ft
r_H	hydraulic radius (area/wetted perimeter)	ft
s	slope	ft/ft
V or v	velocity	ft/s

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CHAPTER 2 – SUBMITTALS

2.1 Purpose

The purpose of this chapter is to outline the minimum requirements for the submittal of plans for proposed sanitary sewer improvements. The requirements for public sewers, building sewers, and pump stations are all discussed. These submittal requirements are intended to supplement the Design Manual and Chapter 51 of the Fort Wayne Code of Ordinances and the Fort Wayne Water Pollution Control Utility Rules and Regulations.

Submittal requirements shall be discussed with the staff of Water Resources during the preliminary planning phase for all projects. The size and type of submittal typically varies with the size and type of the project and details will be developed with the project manager designated by Water Resources.

Preparation of all project submittals shall be the responsibility of the project designer.

2.2 Public Sewers

2.2.1 Conceptual Approval

2.2.1.1 First Checklist

Conceptual approval will begin with completion of the First Checklist found in Exhibit III-2-1. This checklist addresses planning issues and submittal requirements. The form shall be completed and submitted to Water Resources with an Area Map or Drainage Map, whichever is deemed necessary by the first Checklist.

2.2.1.2 Map Submittal

Two (2) copies a general Area Map or Sanitary Sewer Service Area Map will be required. A general Area Map shall generally include the following:

a. Boundaries of the proposed development

b. Point of connection to existing sewer facilities

c. Intended land use

d. Estimate flow to be generated by the development

An example Area Map is included as Exhibit III-2-2. Sanitary Sewer Service Area Maps, an example of which is found in Exhibit III-2-3, shall be prepared in accordance with Section 3.6. It should be noted that although an Area Map may be acceptable for conceptual approval, a more comprehensive Sanitary Sewer Service Area Map will be required for the actual project design. Accompanying the request for Conceptual Approval and map submittal, shall be a statement of anticipated project start and completion dates.

2.2.1.3 Second Checklist

Development Services will review the submittal and address capacity issues and cost of service concerns using the Second Checklist found in Exhibit III-2-4. Additional Water Resources' Departments and The Board of Public Works will be consulted on an as-needed basis.

2.2.1.4 Developer/Owner Notification

Upon review of the submittal, Development Services will issue a statement addressing the existing system's ability to receive the proposed flow. The statement will include an item expressing the City's acceptance or denial of service to the proposed development and, if relevant, an explanation for the basis of denial.

2.2.2 Construction Plan Approval for Public Sewers

Upon granting of Conceptual Approval, the design engineer or developer shall complete construction plans and specifications for the sanitary sewer project in accordance with all guidelines outlined in this Manual and additional provisions as found in the Design Manual. The checklist found in Exhibit III-2-5 shall serve as the guideline for the submittal of construction plans. The items called for in the Exhibit shall be submitted in order for Development Services to review the plans. The checklist found as Exhibit III-2-6 will be utilized to assess the completeness of the construction plans.

Development Services will review the construction plans and issue written comments on the submittal. Comments received from Development Services shall be addressed by the design engineer or developer and plans shall be appropriately updated. Upon completion of all Water Resource requirements, an approval letter shall be issued.

2.3 Building Sewers

2.3.1 Residential House Taps

Sewer taps for residential connections will require sewer tap permits. Permit requirements shall be in accordance with Section 2.5.1. A fee will be assessed based on service size and connection point. Section 2.5.3 addresses fee requirements.

2.3.2 Industrial and Commercial Taps

In general, the requirements for industrial and commercial taps shall be as described in the following sections. Adherence to all Federal, State, and local regulations, codes, and statutes is also required.

In addition, all requirements of Chapter 51 of the Fort Wayne Code of Ordinances, Sections 51.030 through 51.041, are hereby incorporated into the design standards for commercial and industrial wastes. All submittals shall be transmitted to Water Resources as part of the First Checklist.

2.3.2.1 Conceptual Approval

The need for conceptual approval will be based on the complexity of the particular building sewer connection. It is recommended that Development Services be contacted to discuss specific building sewer submittal requirements on a case-by-case basis. The following sections outline the general, formal submittal process.

2.3.2.1.1 First Checklist and Map Submittal

Conceptual approval will begin with completion of the First Checklist found in Exhibit III-2-1. The checklist addresses planning issues and submittal requirements. The form shall be completed and submitted to Water Resources with an Area Map. Two copies of the map will be required. The Area Map should be created in accordance with the previous Section 2.2.1.2. Accompanying the request for Conceptual Approval and map submittal, shall be a statement of anticipated project start and completion dates.

2.3.2.1.2 Second Checklist

Water Resources will review the submittal and address capacity issues and cost of service concerns. Water Resources will utilize the Second Checklist found in Exhibit III-2-2 to address relevant issues. Additional Water Resources' Departments and the Board of Public Works will be consulted on an as-needed basis.

2.3.2.1.3 Notification

Upon review of the submittal, Development Services will issue a statement addressing the existing system's ability to receive the proposed flow. The statement will include an item expressing the City's acceptance or denial of service to the proposed commercial or industrial development.

2.3.3 Construction Plan Approval for Building Sewers

Formal construction plans are not required for typical house taps. For all other instances, upon granting of Conceptual Approval, the designer representing the commercial or industrial facility shall complete construction plans and specifications for the building sewer in accordance with all guidelines outlined in Unit I of this manual and all relevant plumbing codes. The checklist found in Exhibit III-2-5 shall serve as the guideline for the submittal of construction plans. All items called for in the Exhibit as well as the completed checklist shall be submitted in order for Water Resources to review the plans. The checklist found as Exhibit III-2-6 shall also accompany the construction plans. This checklist is designed to assess the completeness of the plans.

Development Services will review the construction plans and issue written comments on the submittal. The designer shall address comments received from Water Resources and plans shall be appropriately updated. Upon completion of all Water Resource requirements, an approval letter shall be issued.

2.4 Pump Stations

2.4.1 Conceptual Approval Process

A conceptual design approval process will be required for pump stations. Included within this process is a Concept Design Plan. Unit III, Chapter 5, Sections 5.2.1 and 5.2.1.1 should be referenced for a detailed description of the process and requirements. An Engineering Report shall also accompany the Conceptual Design Plan. The Engineering Report shall be prepared in accordance with Unit III, Chapter 5, Section 5.2.1.2.

2.4.2 Construction Plans

Upon approval of the pump station Concept Design Plan and Engineering Report by Water Resources, construction plans shall be prepared and submitted in accordance with Unit III, Chapter 5, Section 5.2.2. This section shall be referenced for specific requirements.

2.5 Permits, Fees, and Contracts

2.5.1 Local Permits

The local tap permits shall be obtained from the City's New Water and Sewer Permit Office in the City County Building. The said permit shall only be issued to licensed sewer tap contractors. A fee will be assessed based on service size and connection point.

2.5.1.1 Tap Permit to a Sewer Main

A standard tap permit shall be obtained for all connections to a sewer main. Tap permits for new sewers will only be issued when the new sewer main has been accepted by the City or for which prime contractor releases have been granted.

2.5.1.2 Tap Permit to a Sewer Structure

A special permit shall be obtained for any sewer tap connection to a sewer structure other than a pipe. This applies to manholes, junction chambers, etc. Approval from Water Resources will be necessary before permit issuance.

2.5.2 State Permits

2.5.2.1 SPC-15 Permit

An IDEM construction permit must be obtained from IDEM prior to commencement of sanitary sewer or lift station construction. The permit is in

accordance with 327 IAC Article 3. Permit applications may be obtained from the following address:

Facility Construction Section
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015
website: www.in.gov/idem/water/permits

The IDEM permit may be issued by Water Resources using "Local Permitting Authority" in accordance with 327 IAC 8-3-3.1. Standard forms utilized by Water Resources for the local review process are found in Exhibit III-2-7. Water Resources may be consulted for more information regarding the appropriateness, requirements and procedures of using "Local Permitting Authority" with a particular project.

When formal IDEM submittal is chosen as the review route, the permit application and all necessary attachments and plans shall be completed and submitted to Water Resources. Water Resources will attach the required wasteload allocation acceptance letter and forward the application to IDEM.

2.5.3 Fees

2.5.3.1 Permit Application Fees for Local Permits

For the following, fees shall be assessed at the time of application for a sewer tap permit:

- Six-inch (6") tap to a sewer main.
- Six-inch (6") tap such as connection into a sewer structure as opposed to direct connection to a sewer line.
- Service tap larger than six inches (6").

The last two permits will require approval from Water Resources before permit issuance. The cost of all permits shall be per most recent City ordinance.

2.5.3.2 Permit Application Fees for State Permits

Permit application fees for state permits shall be determined by the respective state agency at the time of permit application.

2.5.3.3 Additional Fees

Area connection fees and inspection fees may be assessed by the Board of Public Works. These fees will be determined in the sewer contract issued for the

specific project. In addition, local connection reimbursements as detailed in the project sewer contract may apply on a case-by-case basis.

Unusually long building sewers and private sewer systems are subject to additional inspection fees. These fees will be determined at the time of permit issuance.

2.5.4 Contracts

Whenever a developer extends a public sewer system, he/she will be required to enter into a sewer contract with the City of Fort Wayne. A copy of a standard contract is available from Development Services upon request.

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CHAPTER 3 – PUBLIC SEWERS

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CHAPTER 3 – PUBLIC SEWERS

3.1 Purpose

This chapter focuses on the design elements and basic hydraulic criteria necessary for the proper design of sanitary sewer systems. This chapter establishes the minimum standards and technical design criteria for all sanitary sewer systems within the City of Fort Wayne service area. Known variances from these design standards must be approved by Water Resources prior to commencement of design. Unit III of the Design Manual shall be referenced for additional design detail and methodology.

3.2 General Improvement Location Criteria

Sound engineering judgement shall be utilized when determining locations for sanitary sewers. Existing easements and rights-of-way shall be utilized if at all possible. Service needs of both the present service area and future service areas should be thoroughly evaluated.

3.3 Horizontal Alignment Criteria

3.3.1 General

All sanitary sewers shall be constructed with a straight alignment between manholes. Where sewer depth is ten feet (10') or less, sewer lines and manholes shall be located a minimum of ten feet (10') horizontally from any part of a building structure or its foundation. For sewer depths greater than ten feet (10'), this minimum distance shall be fifteen feet (15').

3.3.2 Placement in Existing Rights-of-Way and Easements

For sanitary sewers located within existing or proposed street right or way, the preferred placement should be as generally defined on the Standard drawings for Recommended Utility Placement as found in the Separations and Backfill section of Unit VI - Standard Drawings. Three drawings, Recommended Utility Placement in Public Right-of-Way, Recommended Utility Placement in Back to Back Easement, and Recommended Utility Placement in Existing Perimeter Easement are presented. These utility locations are applicable to existing right-of-way and easements. In isolated situations, sanitary sewers can be placed in separate easements outside of the existing rights-of-way or easements.

Consideration for allowances for future curb and gutter shall be taken into account when considering the sewer location. In areas with concrete pavement, consideration shall be given to placing the sewer in a location such that one edge of the pavement to be removed would coincide with existing construction joints. This procedure would allow for the sawing and removal of only one side of the pavement. Manhole structures shall be either completely outside the pavement or completely inside the pavement. The existence of curbs or proposals for future curb and gutter shall be taken into account when evaluating the benefit of reducing the number of manholes in curved streets.

3.3.3 Stationing

All sewer stations shall increase upstream. Stationing on manhole structures shall be at the structure centerline. Every effort shall be made to begin the stationing of a sewer with Station 0+00.00 at the downstream end. For sewers not requiring curved sections, the PI stations and deflection angles or interior angles shall be shown on the plans at all changes in alignment.

3.3.4 Minimum Horizontal Separation from Water Lines

Sanitary sewer shall be laid at least ten feet (10’) horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In instances where it is not possible to maintain a ten foot (10’) separation, the authorized agency may allow deviation on a case-by-case basis. This deviation may allow installation of the sanitary sewer closer to the water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches (18”) above the top of the sanitary sewer.

If it is impossible to maintain proper separation as described above, both the water main and sanitary sewer must be constructed of slip-on mechanical joint pipe complying with the water supply standards outlined in Unit IV of this Manual and be pressure tested to 150 psi to assure watertightness before backfilling. In all instances when separation cannot be maintained, Water Resources shall be consulted for guidance and approval.

All sewers shall be constructed with a straight alignment between manholes. Where sewer depth is ten feet (10') or less, sewer lines and manholes shall be located a minimum of ten feet (10') horizontally from any part of a building structure or its foundation. For sewer depths greater than ten feet (10'), this minimum distance shall be 15 feet (15').

3.3.5 Rear Lot Alignment

In certain limited situations, rear lot sewer alignment shall be considered. Written approval from Water Resources for such an alignment will be required. When rear lot alignment is utilized, an exclusive sewer easement shall be required and the sewer shall not be located within drainage swales.

3.3.6 Minimum Distance from Additional Utilities

All plans shall show the location of both underground and overhead utilities. The location of the utilities shall be derived from the best information available. Each of the utilities shall receive a set of plans prior to final submittal on which they may note changes or additions to utility information. The adequacy of the separation of the sanitary sewer line and other utility shall be determined by both the appropriate utility company and the design engineer. Any necessary relocations shall be closely coordinated with the respective utility company.

3.3.7 Location in Relation to Streams and Waterways

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

3.4 Vertical Alignment Criteria

3.4.1 Sewer Depths

Sanitary sewers shall have a minimum cover of four feet (4') as measured from the top of pipe. Exceptions to this requirement will be addressed by Water Resources on a case-by-case basis.

Basement elevations shall also be taken into account. In instances where only a limited number of houses on the sanitary sewer have existing basement facilities, the overall impact on the entire system shall be considered prior to providing gravity basement service. In areas where the lowest building level to be served by gravity sanitary sewer service is less than one foot (1') above the top of the manhole casting elevation of the first upstream manhole on the public sewer to which the connection is made, the Design Engineer shall design for backflow prevention devices to prevent sanitary sewer back-ups.

The sanitary sewer elevation necessary to serve the entire tributary area shall be considered when designing a sanitary sewer line. This design shall include areas beyond the boundary of a design section.

In areas where excessive depths are encountered in the sanitary interceptor sewer, a separate parallel sanitary sewer collector line constructed at a higher elevation shall be considered. The parallel line would end in a drop manhole structure as opposed to individual property service connections to the interceptor line. Approval of a parallel interceptor line must be granted by Water Resources.

3.4.2 Minimum Vertical Separation from Water Lines

A minimum vertical separation of 18 inches (18") between the outside of water main and the outside of the sanitary sewer shall be maintained. The distance shall be measured edge to edge. The crossing shall be arranged such that sewer joints shall be as far as possible from water main joints. Every effort shall be made to construct the sewer below the water main. Where a water main crosses beneath a sewer, structural support and exfiltration testing shall be provided to ensure the integrity of the water main. In instances where it is not possible to maintain an 18-inch (18") vertical separation, the authorized agency may allow deviation on a case-by-case basis. This deviation may allow installation of the sewer closer to the water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at a horizontal separation of at least ten feet (10') as measured edge to edge.

If it is impossible to maintain proper separation as described above, both the water main and sewer must be constructed of slip-on mechanical joint pipe complying with the water supply standards outlined in Unit IV of this Manual and be pressure tested to 150 psi to assure watertightness before backfilling. In all instances when separation cannot be maintained, Water Resources shall be consulted for guidance and approval.

3.4.3 Stream and Waterway Crossings

In instances where a sanitary sewer enters or crosses a stream or other waterway, watertight pipe shall be used for the crossing. A sufficient depth of cover below the natural bottom of the streambed shall be maintained to protect the sewer. In general the following cover requirements must be met:

- One foot (1') of cover where the sewer is embedded in rock.
- Three feet (3') of cover where any other bedding material is encountered.
- In paved stream channels, the top of the sewer line shall be placed below the bottom of the channel pavement.

3.4.4 Sewer Elevations

All sanitary sewer elevations shall be referenced to US national datum. When connecting to or extending existing sewer facilities that were constructed using a datum other than USGS, an elevation equation shall be shown on the plans.

3.4.5 Flooding and Ponding Areas

The top of sanitary manholes shall be a minimum of two feet (2') above existing, proposed, or projected 100-year flood elevations. In instances in which this minimum elevation causes the manhole to be above natural ground creating an obstruction, the top of the manhole may be lowered to the natural ground elevation and a watertight manhole lid and frame shall be specified. Approval from Water Resources is required prior to the lowering of any manhole below the 100-year flood elevations.

3.5 General Procedures

The design flow for each sewer segment within the system shall be determined as follows:

a. Prepare a Sanitary Sewer Service Area Map that defines the areas tributary to each element of the sewer. A Sanitary Sewer Service Area Map will be required for ALL projects unless waived by Water Resources.

b. Examine each tributary area to determine existing population and future potential land use and equivalent population.

c. Determine the average daily flow based on existing population and future equivalent population.

d. Determine the design peak flow based on average daily flow and the appropriate peaking factor.

The following sections discuss in detail the procedures outlined in this section.

3.6 Sanitary Sewer Service Area Map

A Sanitary Sewer Service Area Map shall be prepared to thoroughly describe the project. Information to be clearly shown on the map includes actual area to be served by the project, the location of the sewers, portions of the area tributary to each sewer segment, and any connections or points of inflow from adjacent areas. Adjacent future contributing areas shall also be shown in entirety on the Sanitary Sewer Service Area Map.

A sample Sanitary Sewer Service Area Map is included as Exhibit III-2-3 in the previous Chapter. The purpose of the Sanitary Sewer Service Area Map is to graphically depict the basis for the design flow calculations. Information which must be present on the map includes, but is not limited to:

a. A general location map showing all areas which contribute flow to the proposed sanitary system. Major streets shall be referenced.

b. A general layout of the proposed system with the drainage areas tributary to each major element of the system clearly defined.

c. The basis for determining both the number of existing and future users together with the equivalent population for each area. For example, the number of single-family and multi-family residential units or the type and size of all industrial, commercial, and institutional facilities should be clearly stated.

d. A use designation such as residential, commercial, or industrial, for each drainage area.

e. A designation for each sewer segment.

f. A designation for manholes. This designation shall be carried through to computation sheets.

g. All proposed sewer sizes.

h. All proposed sewer slopes.

i. The location of estimated or actual flow entering the system for outside areas. These areas shall include the same information required for the proposed service area.

j. An adequate number of spot elevations and/or contours in undeveloped areas to depict the natural drainage of the area.

k. The connection point of the proposed sewer system to an existing system.

When required, the Sanitary Sewer Service Area Map and design calculations shall be submitted for review during Conceptual Approval. It should be noted that Area Maps are acceptable in certain situations.

3.7 Design Flow

3.7.1 General

In general, sewers shall be designed to accommodate the peak hourly flow within the sewer system.

3.7.2 Collector Sewers

Collector sewers are primarily constructed to receive wastewater directly from property service connections. Due to changes in land use within a tributary area which may significantly affect a collector system's ability to transport flow, the collector sewer shall be designed to transport (flowing full) the peak hourly flow for saturation (build out) development which may reasonably be expected during the service life of the sewer. Near term flows, those flows anticipated before the sewer reaches its intended design flow (i.e. flows during project phasing which would not allow the sewer to experience adequate cleansing velocities, etc.), expected within the collector lines shall be investigated to address maintenance concerns during periods of low flow.

3.7.3 Interceptor Sewers

An interceptor sewer is a principal sewer to which collector sewers are tributary. All interceptor lines shall be designed (flowing full) to transport the peak hourly flow for saturation development unless specific permission is granted by Water Resources.

3.7.4 Average Daily Flow (ADF)

The design of all sanitary sewer facilities shall take into account both existing and projected future developments.

3.7.4.1 Development Flows

Single Family Residential: The average design flow for single family dwellings shall be 100 gallons per person per day. A single-family residence shall be assumed to contain 3.1 persons.

Commercial/Industrial/Institutional: The Indiana State Board of Health Bulletin S.E. 13 (1988 or most recent version) should be referenced for detailed flow estimations for commercial, industrial, and institutional facilities. The Bulletin shall be used as a general guideline in determining average flows anticipated for a development. Exhibit III-3-1 contains excerpts from the State Bulletin and presents flows for common developments. The Exhibit should be referenced to compute average daily flows. The number of defined units shall be multiplied by the average gallons/unit/day to obtain the average daily flow.

3.7.4.2 Undeveloped Land For Future Flows

Exhibit III-3-1 also contains land use categories for currently undeveloped land with a flow per acre given. Projected land uses shall be utilized to compute saturation flow within the design areas.

3.7.5 Peak Design Flow (PDF)

The peak hourly design flow shall be computed by multiplying the average daily flow by a peaking factor. The peaking factor may be taken directly from Exhibit III-3-2. To obtain the equivalent population required for the graph, commercial, industrial, and institutional flows and undeveloped area anticipated flows should be divided by 100 gallons/person/day to obtain an equivalent population figure. This equivalent population figure shall be combined with the population figure for single family residential to obtain the total population required for peaking factor computation. The peaking factor may also be computed using the following formula:

$$\text{Peaking Factor} = (18 + (P)^{1/2}) / (4 + (P)^{1/2})$$

Where P = population in thousands

3.7.6 Flow Metering

When actual flow metering data is available, the monitored flows shall be utilized for design purposes.

3.8 Hydraulic Design Criteria

3.8.1 General

Manning's Equation shall be utilized to determine the required pipe size and slope. Manning's equation is as follows:

$$Q = \frac{1.49}{n} (A) (r_H)^{2/3} / S^{1/2}$$

Design shall be for full flow at saturation conditions with the following characteristics:

a. Roughness coefficient, n = 0.013

b. Minimum velocity, v = 2.0 ft/sec

c. Minimum pipe size, D = eight inches (8")

d. Minimum allowable slopes – See Exhibit III-3-3.

3.8.2 Hydraulic Grade Line

The hydraulic grade line for peak flows shall not rise above the crown of the pipe. If velocity entering a manhole is above critical, the hydraulic grade line must be computed to ensure that service connections will not experience surcharging that causes back-ups. In critical instances or when requested by Water Resources, the hydraulic grade line shall be computed to show its elevation at manholes, transition structures, and junction points. The calculations shall provide for losses at structures and elevation differences. When necessary, the pipe exiting the manhole must be adjusted in elevation to ensure that the energy gradient remains constant across the manhole.

Water Resources shall be consulted when either hydraulic grade line or energy grade line calculations are required.

3.8.3 Velocity

The minimum velocity allowed in sanitary sewer pipes under design flow conditions shall be two (2.0) ft/sec. The maximum allowable velocity shall be 15 ft/sec.

In instances where severe topographic constraints or other unusual conditions result in a design velocity which must be greater than 15 ft/sec, Water Resources must be consulted during design. Special provisions shall be made to protect against displacement by erosion and impact. Specific, written approval will be required for the special provisions as well as for hydraulic design and the pipe material selection.

3.8.4 Slopes

Exhibit III-3-3 defines the minimum allowable slopes for various pipe sizes. These minimum slopes shall be required during design. As-built sewers with slopes less than those defined which result in velocity of flow being less than two (2.0) ft/sec may not be accepted by the City of Fort Wayne.

3.9.4.1 Slope Between Manholes

Sewers shall be laid with uniform slope between manholes or other junction structures.

3.8.5 Changes in Sewer Size

Sewer size changes are only allowed at manholes and junction chamber structures. The energy gradient must be maintained at these changes. An approximate method for achieving this is to place the 0.8 depth point of both sewers at the same elevation. Another alternate method utilized involves matching of pipe crown elevations. Additional general criteria used in Fort Wayne is as follows:

a. Pipes Less than or Equal to 24-inch (24”) Diameter

1. When increasing pipe diameter by six inches (6”) or less, crown elevations at the centerline of the manhole shall match.

2. When increasing pipe diameter by more than six inches (6”), the springlines of the pipes at the centerline of the manhole shall match.

b. Pipes Greater than 27-inch (27”) Diameter

The junction shall first be designed by matching crowns at the centerline of the junction chamber. The energy grade line shall then be evaluated in both the upstream and downstream segments. The grade line shall not increase in the downstream segment. If the energy grade line of the downstream segment lies below the energy grade line of the upstream segment, the downstream sewer may

be raised by two-thirds of the difference between the upstream and downstream grade lines.

3.8.6 Minimization of Solids Deposition

The pipe diameter and slope shall be selected to obtain the greatest practical flow velocities to minimize settling problems. Sewers shall not be oversized to allow for construction on a flatter slope. If the proposed slope is less than the minimum slope of the smallest pipe which can properly accommodate the peak hourly design flow, the actual depths and velocities at minimum, average, and design maximum day and peak hourly flow for each design section of sewer shall be calculated and submitted to Water Resources for review.

3.9 Hydraulic Computations

(Exhibit II-3-5 of the Design Manual contains a spreadsheet for completing hydraulic calculations associated with sanitary sewer design.)

All hydraulic calculations shall be submitted to Development Services for review during project design. In general, the calculations shall include, but not be limited to, the following:

- Service area designation
- Average daily flow
- Peak daily flow
- Identification of any intermediate flows
- Sewer sizing and slope calculations
- Sewer velocity calculations

3.10 Sewer Pipe

a. The minimum allowable inside diameter for sewer pipe, with the exception of building sewer connections, shall be eight inches (8”). All building sewer connections shall have a minimum inside diameter of six inches (6”). Commercial and industrial connections shall be discussed on a case-by-case basis.

b. Pipe materials shall be in accordance with Water Resource standards.

c. Pipe testing and bedding requirements shall be in accordance with Water Resources standards unless special circumstances warrant otherwise. Exceptions may be approved by Water Resources.

d. Backfill classifications, materials, and methods of compaction shall be in accordance with Water Resource standards unless special circumstances warrant otherwise. Exceptions may be approved by Water Resources.

e. All sanitary sewers shall be designed to prevent damage from applied loads both during and after construction. Load allowance shall be based upon trench width and depth. In instances in which standard strength pipe is not sufficient, extra strength pipe or special

construction methods shall be specified. In these special circumstances, calculations addressing both live and dead loads shall be submitted to Water Resources for review. All loading requirements must be taken into account when considering material selection and installation methods.

f. Sewers sixty inches (60") in diameter and larger shall be designed using the "D" loading method as specified in the latest edition of the "Concrete Design Manual" published by the American Concrete Pipe Association. The "D" load design shall be limited to increments of 200 feet or more and shall not vary between manholes unless permission is granted from Water Resources. The "D" load design shall be based on a trench width approved by Water Resource prior to design.

3.11 Manholes

3.11.1 General

No sewer laterals or building sewer connections shall be allowed to be connected directly to a manhole structure.

3.11.2 Manhole Locations

Manholes shall be located at the following locations:

- Changes in sewer grades or alignment.
- Sewer junctions.
- Pipe diameter changes.
- Material changes.
- Where spacing requirements justify placement.

3.11.3 Manhole Spacing

Manholes shall be placed at the following intervals:

Pipe Diameter	Maximum Distance Between Manholes
8" to 15"	400'
18" to 30"	500'
33" and greater	600'

Under special circumstances, manhole spacing may be increased. Water Resources will review such instances on a case-by-case basis.

3.11.4 Manhole Diameter

The following table provides general criteria for the maximum pipe size that can connect to a specific diameter manhole structure. The designer shall use this table as a guideline. Existing conditions may dictate variance. The table assumes the following:

- For pipe sizes less than 30 inches (30”), a compression connector or resilient connector per ASTM C923 is installed.

- For pipe sizes 30 inches (30”) and larger, seep ring and non-shrink grout is installed.

Minimum Manhole Diameter	Maximum Pipe Size Straight Through and up to 45° angle			Maximum Pipe Size 45° to 90° angle		
	RCP	HDPE	PVC	RCP	HDPE	PVC
48”	18”	18”	24”	18”	18”	24”
60”	36”	36”	36”	24”	24”	27”
72”	42”	42”	48”	36”	36”	42”
84”	54”	54”	60”	42”	42”	48”
96”	60”	60”	66”	48”	48”	54”

Changes in direction of flow (internal angles between pipes) at manhole junctions of less than 90 degrees (90°) are not recommended due to hydraulic losses.

A minimum access diameter of 24 inches (24”) shall be provided. All manholes must have sufficient wall between pipe openings to meet the following criteria:

- For circular structures, the minimum distance allowed between precast holes shall be six inches (6”).

- For rectangular structures such as junction chambers, where pipe is to be installed in adjacent walls, a minimum of six inches (6”) of wall as 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.

3.11.5 Flow Channel

For all manholes with equal diameter influent and effluent pipes, a minimum 0.10 foot (0.10’) drop between the inverts of the influent and effluent pipes shall be maintained to offset losses experienced at manhole structures.

The flow channel through a manhole shall be made to conform in shape, and slope to that of connecting sewers. The channel walls shall be shaped or formed to the full height of the springline of the outlet sewer so that maintenance, inspection, and flow in the manhole are not obstructed.

3.11.6 Bench

A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench shall be sloped no less than one-half (½) inch per foot (four percent).

3.11.7 Watertight Bolt-Down Construction

Watertight manholes and covers shall be used in all areas where flooding by street runoff or anticipated high water levels are expected.

3.11.8 External Drop Inlets

An external vertical drop shall be provided for any pipe invert entering a manhole at an elevation greater than two feet (2') above the pipe invert exiting the manhole.

3.11.9 Adjustment Rings

In general, acceptable adjustment ring sizes are two, four, and six-inch (2", 4"and 6"). A six-inch (6") adjustment ring shall be used when lowering of a manhole rim is not anticipated. If future lowering is a possibility, a 12 inch (12") ring shall be specified.

3.12 Stubs

Stubs may be provided at the end of all sewers. When provided, stubs shall be one foot (1') long as measured from outside of the manhole barrel for PVC or PE pipe or one foot (1') pipe length for concrete.

3.13 Siphons

Design and construction of siphon structures requires written approval from Water Resources prior to commencement of the design process.

Siphon structures shall have a minimum of two (2) barrels. Minimum allowable barrel diameter shall be six inches (6"). Design of the structure shall provide sufficient head and appropriate pipe sizes to secure a minimum velocity of 3.0 ft/sec for average design flows. The structure's inlet and outlet shall be designed such that the average design flow is diverted to one siphon barrel therefore allowing for either barrel to be taken out of service for cleaning and/or repair.

3.14 Flotation

All sewers and sewer structures to be constructed shall be protected against flotation and excessive pipe flexing in areas where high groundwater conditions exist or flooding of the trench is anticipated.

3.15 Anchors

Sewers constructed on 20 percent slopes or greater shall be anchored securely with concrete or other acceptable material. Anchors shall be spaced as follows:

- A maximum of 36 feet (36') center to center for grades of 20 percent up to 35 percent.
- A maximum of 24 feet (24') center to center for grades of 35 percent up to 50 percent.
- A maximum of 16 feet (16') center to center on grades of 50 percent and greater.

All design methods for anchors shall be approved by Water Resources prior to construction.

3.16 Concrete Encasements

Concrete encasements may be utilized in the following instances:

- When it is necessary to prevent flotation.
- When crossing streams, ditches, or existing storm drains.
- Where soil conditions indicate the possibility of heavy erosion.
- In areas where less than the desired cover is provided.

The concrete encasement shall extend a minimum length of two feet (2') beyond the point where a four foot (4') depth of cover is reached or to a point five feet (5') beyond the tops of banks when crossing a ditch or stream.

The encasement of flexible pipes shall not be allowed except when the encasement is completed from structure to structure.

3.17 Railroad Crossings

When any railroad is crossed, the specifications and precautionary measures required by the respective railroad officials shall be followed. The developer shall supply Water Resources with a copy of the railroad crossing application and proof of approval from the respective railroad entity. In the absence of specific railroad requirements, the following general criteria shall apply.

3.17.1 Criteria

The following criteria shall apply to instances in which sanitary sewer construction affects railroad rights-of-way and facilities. In those instances, the more stringent standard shall be utilized.

a. Sanitary sewers shall cross tracks at an angle as close as possible to 90 degrees (90^o). The crossing angle shall never be less than 45 degrees (45^o).

b. Sanitary sewer lines crossing beneath railroad tracks shall be constructed in four-flange liner plate tunnels or bored and jacked casings.

c. Tunnels or casing pipe under railroad tracks and across railroad rights-of-way shall extend to a point a minimum distance of 25 feet (25') from the centerline of the outside track or to right-of-way line, whichever occurs first and a minimum of five feet (5') beyond the top of ditch bank within the railroad right-of-way.

d. Tunnel liner plates and bored and jacked crossings shall have grout holes at a minimum of ten feet (10') on center. The grout holes shall be staggered on each side of the centerline of the sanitary sewer.

e. Sanitary sewer lines laid longitudinally along railroad rights-of-way shall be located as far as practical from the tracks. If the sewer is located within 25 feet

(25') of the centerline of any track, the sewer shall be encased or shall be of a special design as approved by Water Resources.

f. A minimum depth of cover of four feet (4') shall be provided for any sanitary sewer within a railroad right-of-way.

g. A minimum depth of cover of three feet (3') shall be maintained between all ditch flowline surface elevations and the top of tunnel linings or casings.

h. Tunnels or casings under tracks and across railroad rights-of-way shall be a minimum of four feet (4') deep as measured from the bottom of the track rail to the top of the tunnel liner or casing pipe.

3.17.2 Railroad Conflict Drawings

(Exhibit III-3-7 of the Design Manual shall be referenced for an example Railroad Conflict Drawing.)

A railroad conflict drawing shall be prepared and address the following:

a. Both a plan and profile view shall be provided.

b. The following items shall be included on the drawing: relationship between the proposed sewer and the railroad, angle of crossing, location of utilities, original survey station of the railroad (when available), right-of-way lines, limits of tunnel boring or casing liner, topography, and general layout. The profile shall clearly show the sewer in relation to both the tracks and existing ground elevations. Boring or tunneling limits by station, sewer line soundings and borings, and other pertinent information shall be included on the drawings.

c. The conflict drawing and project plans shall be submitted to both Water Resources and the appropriate railroad company for review and approval.

In certain instances, the requirements of specific railroad companies may be more stringent than these standards. In those instances, the more stringent standard shall be utilized.

3.18 Highway Crossings

When any highway is crossed, the specifications and precautionary measures required by the respective highway officials shall be followed. The developer shall supply Water Resources with a copy of the highway crossing application and proof of approval from the respective highway entity. In the absence of specific highway requirements, the following general criteria shall apply.

a. Sanitary sewers shall cross the roadway at an angle as close as possible to 90 degrees (90^{o}). The crossing angle shall never be less than 45 degrees (45^{o}).

b. Sewers shall not be placed under roadway bridges where the possibility of restricting the required waterway area or where a possibility of compromising the structural integrity of bridge foundations exists.

c. Tunnels crossing beneath roadway shall be four-flanged liner plates or equal.

d. Tunnels or borings under roadways shall have a minimum depth of cover of three feet (3') as measured from the surface elevation to the top of the tunnel or boring. The top of the tunnel lining shall not be above the invert of existing or proposed ditches.

e. Tunnels or borings under roadways shall extend a minimum of ten feet (10') (measured perpendicularly) outside the outer edge of existing pavement or to the toe of slope when the roadway is on fill and the toe of slope exceeds the ten foot (10') outside of pavement requirement.

f. Sanitary sewer lines laid longitudinally along highway rights-of-way shall be located a sufficient distance outside of the edge of pavement to ensure worker and motorist safety during construction.

g. Sanitary sewer lines laid outside of pavement but inside of roadway right-of-way shall have a minimum depth of cover of four feet (4').

3.19 Casing Pipe and Tunnel Liners

3.19.1 Tunnel Liners

Tunnel liners shall adhere to the following criteria.

a. In tunnel excavation, the tunnel liner shall have a minimum outside diameter of 48 inches. The carrier pipe for all gravity installations shall rest on a four inch (4") pad of Class B concrete. A minimum distance of eight inches (8") shall be maintained between the top of the carrier pipe and the bottom of the tunnel liner. For pressurized pipes, appropriate restraining blocks shall be designed. All calculations shall be submitted to Water Resources for approval.

b. Tunnel liner plates and joints shall be watertight and capable of withstanding E80 loading for railroads and H25 loading for roadways.

c. Liner plates shall have a minimum yield strength of 28,000 psi.

3.19.2 Pipe Casing

Pipe casing shall adhere to the following criteria:

a. Steel casing pipe for pipe diameters less than 30 inches (30") in diameter shall have a casing diameter 12 inches (12") larger than the outside diameter of the carrier pipe. The casing pipe shall have a minimum yield strength of 35,000 psi. Exceptions may be approved by Water Resources on a case by case basis.

b. Steel casing pipe for pipe diameters equal to or greater than 30 inches (30") in diameter shall have a casing diameter six inches (6") larger than the outside diameter of the carrier pipe. The casing pipe shall have a minimum yield strength of 35,000 psi. Exceptions may be approved by Water Resources on a case by case basis.

c. In boring excavation, the carrier pipe shall be encased in a ductile steel casing pipe of sufficient size to provide clearance for installation of the sewer pipe. The inside diameter of the casing pipe shall be a minimum of twelve inches (12") larger than the largest outside diameter of the carrier pipe, joints, or couplings, thus providing a minimum of eight inches (8") between the carrier pipe and the casing pipe.

END CHAPTER 3

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CHAPTER 4 – BUILDING SEWERS

CHAPTER 4 – BUILDING SEWERS

4.1 Purpose

The purpose of this chapter is to outline the requirements for building sewers. This chapter establishes the technical design criteria for all building sewers within the City of Fort Wayne jurisdiction. Any variances from these standards must be approved by Water Resources.

4.2 Prohibition Against Clear Water Discharges

No building sewer with any of the following sources of clear water connected to it shall be connected to the City's sewer system:

- Foundation or footing drains.
- Yard drains
- Heat pump discharges
- Storm drain connections
- Roof drains / downspouts
- Sump pump discharges
- Cooling water discharges
- Any other sources of surface runoff or groundwater

4.3 Buildings Served

4.3.1 Maximum Number of Buildings Served

A separate and independent building sewer shall be provided for every building, except where one building stands at the rear of another on an interior lot and where no private sewer is available or can be constructed to the rear building through an adjoining alley, courtyard, or driveway. The building sewer from the front building may be extended to the rear building and the whole considered as one building sewer. Calculations supporting sizing must be provided to Water Resources. Prior permission for such configuration and sizing must be granted by Water Resources.

4.3.2 Gravity Sewer Service

It is recommended that gravity building sewer connections only be constructed for homes or buildings where the lowest elevation to have sanitary services is one foot (1') or more above the top of the manhole casting elevation of the first upstream manhole on the public sewer to which the connection is proposed to be made. In instances where this one foot distance is not achievable and in areas susceptible to back-ups, proper backflow prevention shall be designed. If the first upstream manhole is at a higher elevation due to the natural topography of the area, an alternate method may be selected by Water Resources for the purpose of determining the feasibility of gravity connection.

4.3.3 Non-Gravity Sewer Service

A gravity building sewer connection will NOT be allowed for homes or buildings where the lowest elevation to have gravity sanitary services is less than one foot (1') above the top of the manhole casting elevation of the first upstream manhole on the public sewer to

which the connection is proposed to be made. If the first upstream manhole is at a higher elevation due to the natural topography of the area, an alternate method may be selected by Water Resources for the purpose of determining the feasibility of gravity connection. In instances in which gravity flow is not permitted, sanitary sewage carried by building sewers shall be lifted by an approved means (i.e. grinder pumps) and subsequently discharged to the public sewer.

4.4 Connection Permits and Building Sewer Inspection

4.4.1 Connection Permits

No unauthorized person shall uncover, make any connection with or opening into, use, alter, or disturb any public sewer or appurtenance thereof without first obtaining a written permit from the New Water and Sewer Permit Office in the City–County Building. The owner must satisfy all obligations to pay all assessments, reimbursements, and pro rata shares of sewer extension costs laid against that property for public sewers which serve it. A sewer tap permit given in error shall not operate to nullify any such obligation that has been duly recorded nor stop the City from charging and collecting such costs at any subsequent time. Chapter 2 of this Unit details permit and fee requirements, respectively.

4.4.2 Building Sewer Inspection

After making each sewer tap and building sewer installation, the tap contractor or property owner shall notify the New Water and Sewer Permit Office at (219) 427-1161 of such connections so that an inspection may be made by the City prior to backfilling the said sewer installation. Inspections will be conducted during normal business hours. A minimum three (3) hour notice will be required in order for the New Water and Sewer Permit Office to arrange the inspection. No calls for inspection will be accepted after 3:00 p.m.

No person shall make use of a sewer tap or backfill or otherwise conceal a sewer installation unless and until the same has been inspected and approved by Water Resources. In addition to other measures, Water Resources may call for the excavation and exposure of the sewer installation, may terminate the connection, and may require the owner to reimburse the City for its costs and expenses in such excavation, exposure, termination, reconnection, and restoration. Such costs and expenses shall be considered charges for sewerage treatment services and may be collected in accordance with the provisions of Indiana Code 36-9-23-31 through 36-9-23-34 and Chapter 51.

4.5 Building Sewer Responsibility

All costs and expenses incidental to the installation and connection of the building sewer and all necessary appurtenances shall be borne by the owner. In addition, the continued maintenance and upkeep of the building sewer system to continue proper operation shall be the sole responsibility of the owner. The owner shall indemnify the City for any loss or damage directly or indirectly occasioned by the installation of the building sewer, including backwater damages from the public sewer.

4.6 Hydraulic Design Criteria

4.6.1 Plumbing Codes

Building sewers shall conform to the latest adopted version of the Uniform Plumbing Code. As an alternative to plumbing codes, an engineer licensed in the state of Indiana may design a building sewer.

4.6.2 Minimum Slopes

Building sewers shall be laid on a minimum slope of 2.08% (1/4" per foot). Any exception to this must be approved by Water Resources.

4.7 Building Sewer Connection to Public Sewer

The building sewer shall connect to the public sewer at a mainline fitting. The building sewer shall not protrude into the main line.

Connections to manholes must receive prior approval from Water Resources. Inside drop connections to the manhole will not be permitted. When connections are made to manhole structures, rubber water stop joints or mortared rubber gaskets (boots) poured in place shall be specified for water tightness between the pipe and the manhole. When new holes into manholes are required, core drilling of the new hole shall be specified.

Building sewer installed for future connections shall be terminated at the street right-of- way or easement and shall be properly plugged with a manufactured plug to ensure a watertight seal. A one-half inch ferrous locator rod or a magnetic locator tape shall be installed at the plugged line to within one foot (1') of the finished grade.

4.8 Building Sewer Structures

4.8.1 Cleanouts

A cleanout shall be provided adjacent to all building structures. The maximum distance between the exterior building wall and the cleanout wye shall be seven feet (7').

4.8.2 Grease and Sand Traps

Any building sewer which will have or has the potential of discharging waste containing grease, oil, sand, or similar substances, having quantity and characteristics above that of a normal single family residence waste, shall have a grease and/or sand trap installed in a manner to provide, at all times, the effective removal of grease, oil, sand, and/or similar substances before discharge to the public sewer.

Installation of a grease and/or sand trap will be required within a building sewer when any one of the following conditions exist:

- Abnormal maintenance of the sewer has been required to prevent the occurrence of blockages, back-ups, etc., resulting in property damage; and evidence indicates that

the cause of this abnormal maintenance is the result of the discharge of prohibited wastes and/or wastes in excess of limitations set out in the Fort Wayne Municipal Code.

- There exists a concentration of persons discharging prohibited wastes into a public sewer without the benefit of any grease and/or sand trap.

- The results of laboratory analysis have demonstrated that the strength of wastes being discharged into the public sewer are in excess of the limitations set out by the Fort Wayne Municipal Code.

Water Resources will notify, in writing, any person who has been identified to be in violation of any of the above-mentioned conditions and shall require such person or persons to install a grease and/or sand trap. The grease and/or sand trap must be installed within one hundred and twenty (120) days of written notification. Sole responsibility and cost of installation shall lie with the property owner or utility user.

4.8.3 Inspection Manholes

When required by Water Resources, an inspection manhole shall be included in the building sewer design. Inspection manholes will be considered on a case-by-case basis.

4.9 Building Sewer Pipe

a. The minimum allowable inside diameter for building sewers shall be six inches (6”). Commercial and industrial connections shall be discussed on a case-by-case basis.

b. Pipe materials shall be in accordance with Water Resource standards.

c. Pipe testing and bedding requirements shall be in accordance with Water Resources standards unless special circumstances warrant otherwise. Exceptions may be approved by Water Resources.

d. Backfill classifications, materials, and methods of compaction shall be in accordance with Water Resource standards unless special circumstances warrant otherwise. Exceptions may be approved by Water Resources.

e. All sewers shall be designed to prevent damage from applied loads both during and after construction. Load allowance shall be based upon trench width and depth. In instances in which standard strength pipe is not sufficient, extra strength pipe or special construction methods shall be specified. All loading requirements must be taken into account when considering material selection and installation methods.

END CHAPTER 4

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CHAPTER 5 – PUMP STATIONS

CHAPTER 5 – PUMP STATIONS

5.1 Purpose

This chapter discusses the requirements for the design and construction of small wastewater pumping stations. More specifically, the chapter:

- Outlines submittal requirements as defined by the Department of Water Resources
- Identifies the planning and design approach to be used for pump stations
- Defines specific criteria by which pump stations will be designed
- Discusses life cycle cost analysis

The chapter is designed to give general guidelines to be adhered to during pump station design. Water Resources shall be consulted before actual design to discuss features that may be required on a case-by-case basis.

5.2 Submittal Requirements

Submittals for pump stations shall consist of a Concept Design Plan, an Engineering Report, and Final Design Plans. Approval by Water Resources will be required prior to authorization of any succeeding design phase.

5.2.1 Conceptual Approval Process

The Conceptual Approval process shall consist of Concept Design Plan and Engineering Report formulation. The following sections outline specific requirements.

5.2.1.1 Concept Design Plan

The purpose of a Concept Design Plan is to provide Water Resources with preliminary design data for proposed pump stations and related appurtenances such as force mains. The preliminary data will allow Water Resources to determine compatibility with existing systems and will provide the foundation for justification of a pump station alternative.

The Concept Design Plan shall include the following:

A. A location plan which clearly shows the following information:

- Ultimate tributary area with corresponding land use categories as defined by the City
- Municipal boundaries
- Phase boundaries

- Preliminary pump station location
- Preliminary force main location
- Pertinent flood elevations

The location plan may be hand drawn on existing City topographic maps or USGS maps.

Three (3) copies of all of the information required for the Concept Design Plan shall be submitted to Water Resources for review and approval.

5.2.1.2 Engineering Report

Accompanying the Concept Design Plan, will be an Engineering Report. The report shall follow the following format:

A. Data Collection and Review

- Discuss proposed development phasing (flows, timing, etc.)
- Obtain and review existing mapping, utility information, and other available data
- Conduct a field reconnaissance of the area
- Conduct a preliminary design field survey for verification of critical elevations, if needed

B. Analysis and Solutions

1. Compute design flow calculations which include:

- Finalized flow projections
- A chart or table showing development phase and phase completion date
- Projected cumulative average and peak flows for each phase of development
- Estimate total dynamic head (TDH)
- A system head loss versus flow rate chart, typically graphical, with proposed manufacturer's pump curves for the selected pumps superimposed over the chart
- A chart showing the minimum and maximum cycle times for each phase of development; The maximum time between cycles shall be based on average daily flows.

- A chart showing the minimum and maximum number of cycles/pump/hour for each phase. The maximum number of starts per hour shall be based on peak flows

2. Determine the ultimate peak flow's impact on the existing collection system. Water Resources shall be consulted for this information.

3. Determine preliminary development and location of the pumping station and force main system. The development shall be broken down by phase and shall be completed for saturation development.

4. Determine alarm needs as defined by Water Resources.

5. Outline provisions for operation of the pump station during power outages.

6. Outline provisions for protection of the pump station facility against flooding.

7. Discuss access to the pump station during adverse conditions.

8. Discuss protection of personnel while working on electrical components during adverse conditions.

9. Determine pump station lighting needs as required by Water Resources.

C. Recommendations and Report

- Briefly describe all alternatives explored. The possibility of gravity service must be addressed.

- Recommend a specific solution.

- Complete a life cycle cost effective analysis.

- Prepare a brief Engineering Report documenting the analysis and recommendations.

- Discuss how the lift station could be modified as future phases develop.

Three (3) copies of the Engineering Report shall be submitted to Water Resources for review and approval.

5.2.2 Final Design Requirements

Unit III, Chapter 5, Section 5.5.2 shall be referenced for additional requirements when designing pump stations for Fort Wayne Utility projects.)

Upon completion of the Conceptual Approval process, Final Design Documents shall be prepared. The following paragraphs outline requirements of the Final Design phase.

A. Field Survey and Subsurface Investigation

- Complete final design field survey as required to define topography and surface features, tie station to the centerline of nearby roadways, locate above and below ground utilities, and tie the proposed project alignment into existing monumentation of record.
- Reduce field survey information and provide existing condition drawings and electronic files, if available.
- Complete subsurface investigation as needed to identify the geotechnical properties and subsurface conditions.

B. Design

- Complete hydraulic, structural and other computations to define the final pump station improvements.
- Complete wet well calculations.
- Complete force main calculations.
- Compute pump curve/system curve in feet of total dynamic head versus flow in gallons per minute with the following labels: Pump Curve; Single Pump Operation Curve; Two-Pump Operating Curve; Three-Pump Operating Curve (if applicable); Design Point(s); Operation Points; and Operating Envelope.
- Determine total dynamic efficiency at the operating point(s).
- Determine pump cycle time.
- Determine valve configuration.
- Complete float setting calculations.
- Complete buoyancy calculations.
- Determine force main pressure and, for larger stations, complete water hammer calculations.
- Determine need for air-release and/or combination air/vacuum release valves.
- Complete odor control calculations or make and document assumptions.
- Complete electrical calculations and/or power requirements.

- Complete materials and product selections in accordance with City design standards.

- Determine the location of the proposed improvements and temporary or permanent right-of-way needs.

C. Prepare Preliminary Construction Documents

- Develop plan and profile drawings for the project. The drawings should be developed in accordance with all provisions of Unit I – General Requirements.

- Conduct a field review of the proposed layout to identify any constraints not readily identified during surveying.

- Meet with City staff to discuss and review comments.

Three (3) copies of the Final Design Plans and Documentation shall be submitted to Water Resources.

5.3 Design Approach

5.3.1 Approvals

Prior to construction or expansion of any sanitary pump stations, the design documents must be approved by both Water Resources and IDEM or the local IDEM review entities. IDEM may be contacted directly at the following address to determine required submittals and associated fees:

Facility Construction Section
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015
website: www.in.gov/idem/water/permits

All submittals must be signed and sealed by a Professional Engineer registered in the State of Indiana.

5.3.2 Service Level

Guidelines presented in this Manual shall govern the planning and design of small pump stations with maximum peak flow not exceeding 700 gallons per minute and/or total dynamic head not exceeding 80 feet (80').

For proposed construction or expansion of pump stations exceeding the above-mentioned ranges, Water Resources shall be consulted for additional design requirements.

5.3.3 Justification

(Unit III, Chapter 5, Section 5.3.3.1 of the Design Manual shall be referenced for cost effective analysis computations.)

The need for a sanitary pump station must be justified according to one or more of the following criteria:

a. The pump station is recommended by Water Resources.

b. The elevation of a proposed service area is too low to be served by an existing, on- or off-site, gravity sewer.

c. The proposed sanitary pump station has been determined to be a cost-effective alternative to an on- or off-site gravity sewer.

5.4 Design Criteria

(Unit III, Chapter 5 of the Design Manual shall be referenced for typical pump station drawings and additional design methodology information.)

5.4.1 General

Pump stations shall be of the wet well type with submersible pumps. The stations shall operate automatically under normal conditions but shall be capable of manual control.

5.4.1.1 Protection Against Flooding

Wastewater pumping stations should remain fully operational and accessible during the 25-year flood. In addition, pump station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood.

5.4.1.2 Parking Requirements

Adequate space for the off-street parking of two vehicles shall be provided. The entrance to the parking area shall be a minimum of ten feet (10') wide. The parking area must be constructed of #53 or #57 stone or other approved material.

5.4.1.3 Compliance with OSHA Safety Requirements

Provisions shall be made to protect maintenance personnel from safety hazards. If applicable, equipment for confined space entry shall be provided in accordance with IOSHA and regulatory agency requirements. All pertinent IOSHA regulations are hereby incorporated by reference.

5.4.2 Process

5.4.2.1 Wet Well

(Unit III, Chapter 5, Section 5.4.2.1 of the Design Manual shall be referenced for a detailed discussion of wet well volume calculations.)

Precast concrete or cast-in-place wet wells are acceptable. All interior surfaces shall be resistant to deterioration caused by hydrogen sulfide. Prior to wet well design, subsurface soil and groundwater conditions shall be thoroughly evaluated.

All wet wells shall be designed for ultimate peak flow. The number of pump starts per hour shall generally not exceed five (5) starts per hour. The maximum detention time in the wet well shall average no more than thirty (30) minutes.

Detention times shall be computed for both initial average flow and ultimate average flow.

The wet well volume should be based on a maximum drawdown range of four feet (4').

The high water alarm shall be at or below the flowline of the inlet pipe. Pipes shall not be used for storage during normal pump station operation. The inlet pipe shall be located between the pumps and on the wall opposite the discharge pipe(s). When possible, it is preferred that influent flows not be dropped into the wet well to prevent entrained air from entering a pump suction.

If backup power (i.e. second power source or transfer switch for generator, etc.) is not provided, the design of the pump station shall provide for a minimum four (4) hour emergency response storage volume. The emergency volume shall be considered volume above the alarm level. The emergency storage volume may be provided in the wet well, gravity sewer, and, if necessary, a surge tank. The maximum storage volume elevation shall be carefully checked against upstream connections and floor elevations to ensure that surcharging and back-ups do not occur. The upper limit of emergency storage shall be a minimum of one foot (1') below the lowest upstream floor or manhole rim elevation. Any deviations from the minimum emergency storage requirements shall be approved by Water Resources.

5.4.2.2 Valves and Valve Vaults

All plug and check valves shall be installed horizontally in a shallow concrete valve vault next to the wet well. The arrangement shall provide for easy access to the equipment for maintenance purposes.

Suitable shutoff and check valves shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump. Check valves shall be suitable for the material being handled and shall be placed

on the horizontal portion of the discharge piping. The check valves shall be equipped with an external lever and weight.

All valves shall be capable of withstanding normal pressure and water hammer and shall be accessible for maintenance. Provisions shall be made to drain or remove accumulated water from the valve pit. A two-inch (2") drain line leading to the wet well, provided that wet well liquid cannot enter the valve vault, is acceptable. The two-inch (2") line shall be equipped with a backflow preventer and P-trap.

5.4.2.3 Force Mains

5.4.2.3.1 General

The following criteria shall apply to force mains:

a. Velocities in force mains shall be kept between three (3) and eight (8) ft/s.

b. Minimum acceptable diameter shall be four inches (4").

c. Minimum acceptable diameter shall be two inches (2") for grinder pumps.

d. Force mains shall not drain between pumping cycles.

e. Force mains shall be designed to resist hydraulic forces.

f. Force mains shall be designed to prevent water hammers.

g. Force mains shall be designed to enter the gravity sewer system at a point not more than two feet (2') above the flow line of the receiving manhole.

h. Tracing wire shall be specified for all force mains.

5.4.2.3.2 Air and Vacuum Relief Valves

An air valve or vacuum release shall be placed at high points in the force main to prevent air locking. Long, horizontal runs and changes in slope may require air/vacuum and/or air release valves. The location of both air release and vacuum release valves shall be discussed with Water Resources prior to design.

5.4.2.3.3 Friction Losses in Force Mains

(Unit III, Chapter 5, Section 5.4.2.3.3 of the Design Manual shall be referenced for a detailed discussion of the Hazen Williams friction loss calculation.)

Friction losses in force mains shall be evaluated utilizing the Hazen Williams formula for friction loss. The value for C shall be 100 for unlined iron or steel pipe design. For other smooth pipe material such as PVC, polyethylene, lined ductile iron, etc., a higher "C" value may be utilized. In no instance should the "C" value exceed 120.

Other formulas for friction loss calculation such as the Darcy-Weisbach and Manning equation may be utilized for friction loss computation provided that prior approval from Water Resources is granted.

5.4.2.4 System Head Curve

Selection of pump size shall be based on static and dynamic head.

Fittings and valves shall be converted to an equivalent length of force main to compute friction losses.

The total dynamic head (TDH) is computed by taking the total static head plus the friction loss.

$$TDH = h_s + h_f$$

The TDH shall be calculated for the design roughness coefficient. A system curve shall be submitted to Water Resources.

5.4.2.5 Buoyancy

(Unit III, Chapter 5, Section 5.4.2.5 of the Design Manual shall be referenced for a detailed discussion of buoyancy calculations.)

Buoyancy shall be analyzed on the wet well to determine whether additional methods of restraint are necessary. Mechanical equipment, water weight, and other temporary loads shall not be included in the analysis. A minimum safety factor of 2.0 shall be utilized.

If the factor of safety is not $\geq$ 2.0, restraint measures will need to be employed. Water Resources shall be consulted in these instances.

5.4.2.6 Force Main Pressure and Water Hammer

(Unit III, Chapter 5, Section 5.4.2.6 of the Design Manual shall be referenced for a detailed discussion of force main pressure and water hammer calculations.)

Force main pressure and water hammer shall be thoroughly analyzed. The total pressure must be less than the rated pressure, including surge allowance, of the pipe.

5.4.2.7 Odor Control

The Engineer shall consider the need for odor control. When odor control is warranted, Water Resources shall be consulted prior to odor control measure specification and design.

5.5 Pumps

5.5.1 General

All pumps shall be submersible type for handling raw, unscreened sewage. The pump type, number, and configuration shall be consistent with flows and accessibility. Pumps and their respective control systems shall be compatible. Multiple pumps shall be provided. In instances in which only two pumps are provided, the units shall be of equal size. Units shall have capacity such that, with any unit out of service, the remaining units will have capacity to handle the design peak hourly flow.

5.5.2 Pump Openings

Pumps handling raw wastewater shall, at a minimum, be capable of passing spheres three inches (3") in diameter. Pump suction and discharge openings shall be at least four inches (4") in diameter.

5.5.3 Intake

Each pump shall have an individual intake. Wet well and intake design shall be such as to avoid turbulence near the intake and to prevent vortex formation.

5.5.4 Pump Guide Rail System

A guide rail system shall be provided for the easy removal of the pump and motor assembly for inspection and service. The system shall not require a person to enter the wet well to remove the pump and motor assembly. Two (2) rails of corrosion resistant stainless steel, or other approved material, shall be provided for each pump. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame. One (1) intermediate stainless steel guide rail support is required for each 20 feet (20') of guide rail length.

All pumps shall be equipped with sliding brackets or rail guides. A stainless steel lifting chain of adequate length for the wet well depth shall be provided for each pump. The rails and rail guides shall allow the complete weight of the pump unit to be lifted on dead center without binding and stressing the pump housing. The system shall allow the pump to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump.

5.5.5 Required Pump Information

The following information shall be provided to Water Resources by the project Contractor for each pump prior to installation:

- Pump type
- Make and model number
- Pump capacity in gpm
- Total dynamic head
- Operating RPM
- Motor horsepower
- Motor phase, voltage, and cycle
- System head versus capacity curve showing any interim flows together with the design minimum, average, and peak flows
- Pump warranty information

Approval from Water Resources must be given prior to installation.

5.6 Electrical

5.6.1 General

All pump stations shall be wired in strict accordance with the latest edition of the National Electric Code. Pumps and equipment shall be designed to operate from a 460 volt, three-phase power source. No single-phase to three-phase converters will be allowed. 230 volt, three phase power may be used if 460 volt is not available. Additional requirements for single-phase pump stations include the following:

- Capacitor start motors
- Power transformers will not be required to facilitate auxiliary equipment when 120 volts are available from the utility.
- All motor starters and controls shall be located above ground level in a shop-assembled control cabinet. The bottom of the control cabinet shall sit a minimum of four feet (4') above ground elevation.

All conductors shall be THWN, stranded, copper wire rated at 600 volts.

Fusible disconnect switches shall be provided and rated for use as service entrance equipment and shall be housed in a NEMA 4X enclosure.

Pump control cabinets shall be stainless steel, housed in a NEMA 4X enclosure with padlock capability, have a three-point latching handle to provide watertight service, and shall be mounted on non-maintenance aluminum or stainless steel pedestals. The cabinet shall have a hinged door containing all operator control and status-indicating devices, and must be appropriately sized for the application. Auxiliary and telemetry enclosures shall be stainless steel, NEMA 4X rated. Both enclosure cabinets shall be located so as to provide safe access to the panels while the wet well hatch doors are opened (panel doors

must open away from station's wet well hatch). The bottom of the control cabinet shall sit a minimum of four feet (4') above ground elevation.

Reduced-voltage staring, if required, shall utilize solid-state motor starters with bypass contactors. The solid-state starters shall be used to start and stop the pumps with a bypass contactor utilized for full pump speed.

At a minimum, the following key issues must be addressed in the design with supporting calculations and or NEC references to verify:

a. Service size

b. Feeder/service conductor size

c. Ground conductor size

d. Feeder/service disconnect size

e. Branch circuit conductor size

f. Branch circuit type of protection

g. Branch circuit over-current protection rating

h. Motor controller size and overload protection rating

i. Pump control system transformer over-current protection

j. Available fault current

k. Spare capacity for future growth, if applicable

l. Feeder/service over-current protection

m. Ground fault protection, if required

The motor control center shall be located outside of the wet well, be readily accessible, and be protected by a conduit seal or other appropriate measures meeting the requirements of the National Electric Code to prevent the conditions of the wet well from interfering with the functions of the control center.

5.6.2 Applicable Standards and Codes

All pump station electrical designs shall meet or exceed the latest issue of the following codes or standards:

- Indiana Building Code (IBC)
- National Electric Code (NEC)
- Underwriters Laboratories, Inc. (UL)
- Factory Mutual System (FM)

- National Fire Protection Association (NFPA)
- National Electrical Manufacturers Association (NEMA)
- Occupational Safety and Health Administration (OSHA)

5.6.3 Pump Control

5.6.3.1 Automatic Sequence Operation

The pump controls shall operate the pumps and shall perform automatic alteration and duplexing for two (2) pumps or triplexing for three (3) pumps. The alternator shall alternate the lead pump once the wet well level has been pumped down to the stop elevation. The alternator shall also provide for energizing the other pump as a backup or lag pump if needed. Provisions shall be made for overriding the alternator by manually selecting the pump sequence.

A step control or variable level scheme shall be used for pump control. These schemes shall establish the following sequence operations:

a. Constant speed pumps – The lead pump shall start when the wet well volume from the pump's "off elevation" to the lead pump "start elevation" is equal to the volume derived in Section 5.4.2.1. The minimum separation between these elevations shall be one foot (1').

   If the influent sewage flowrate into the wet well exceeds the capacity of one pump, the second, third, etc., pumps shall start at predetermined levels and continue to run until the wet well water liquid level is pumped down to a predetermined stop elevation for all pumps.

b. Variable speed pumps shall be considered on a case-by-case basis by Water Resources.

5.6.3.2 Pump Control Panel

(Unit III, Chapter 5, Exhibit III-5-6 shall be referenced for a typical control panel.)

The standard submersible pump control panel shall be housed in a lockable NEMA 4X enclosure and powered by three-phase, 60 hertz, 230/460 voltage supply. The controls shall include the following features:

a. Individual circuit breaker for each pump with operator for door interlock and a normally open/normally closed (NO/NC) contact is available for remote indication of circuit breaker trip)

b. NEMA rated starters; IEC style are not acceptable. The preferred starters are Cutler-Hammer Advantage starters.

c. Pump alternator

d. HOA switch for each pump

e. Pump run and pump stop Light Emitting Diodes (LEDs); The preferred LEDs are Allen-Bradley model #800-N320A with proper lens color; A red color shall signify stop, a yellow color shall signify fail, and a green color shall signify run.

f. Power monitor and surge arrestor

g. Condensate heater

h. Delay on start timer

i. Elapse timer meter for each pump and for both pumps running (three (3) total); If the station has more than two pumps, the number of meter shall be equal to the total number of pumps plus one (1).

j. Manual restart after thermal shutdown

k. Control power failure remote indication (dry contact)

l. Pump seal leak indication and motor temperature indication (shut down on either indication)

m. Alarm light top mounted to indicate high level (alarm – light glows full bright) with pilot light on panel door and a dry contact for remote monitoring

n. Transformer; primary transformer at service voltage (460v or 230v, 3-phase), secondary transformer 120 volt

o. Two (2) fifteen (15) amp circuit breakers; one (1) for GFI duplex receptacle and one (1) for future use

p. Pump fail indication by light on inner door

q. Auxiliary contacts for telemetry system

r. Lockable NEMA 4X enclosure with dead front door

s. Multitrode Float Stick System (Model #MT2PC with appropriate stick for wet well depth

Any changes or additions to the Fort Wayne standard control panel shall be discussed with and approved by Water Resources.

5.6.3.3 Control Settings

All pumps shall stop at the wet well level equal to the minimum level recommended by the manufacturer of the proposed pumps. A minimum drawdown range of at least 3 feet (3') but not greater than four feet (4') is desirable between the high level alarm and the pump "stop elevation". The

increment in levels between the multi-pump start points shall be minimum of one foot (1'). All pumps shall shut off a minimum of one foot (1') below the last pump start elevation. The high water alarm level shall be at or below the invert of the lowest influent pipe invert and at least one foot (1') above the last pump start elevation.

5.6.3.4 Level Detection

Flygt float sticks shall be the preferred method of level detection. The float stick shall be incorporated into all pumping station operations.

Other methods of level detection such as ultrasonic sensors, bubbler systems, and submersible level sensors may be utilized upon approval by Water Resources.

5.6.3.5 Operator Interface

Control interface devices shall be provided for the following:

a. Automatic alternation of the lead pump with a three (3) position switch to control the following:

Position	Operation
No. 1	Pump #1 shall be lead pump
No. 2	Pump #2 shall be lead pump
ALT	The lead pump shall change automatically after each stop of the lead pump

For stations with more than two (2) pumps, more positions may be necessary.

b. Pump Motor Control Switches – Three (3) position switches shall provide the following:

Position	Operation
Hand	Starts pump motor which continues to run until position changes
Off	Pump motor will not run
Automatic	Pump motor is controlled by the previously discussed operation scheme

c. A red LED for each pump to indicate that the pump is operating

d. Red LEDs for each pump to indicate pump overheat and seal leak

e. A momentary push button for manually resetting alarms

f. AC voltmeter and ammeter to monitor the incoming service; The meters shall indicate volts/amps on a circular scale rated from 0 to some full scale value. The ammeter shall have a three (3) position selector switch to monitor the line current on any phase.

g. Elapsed time meters for each pump to indicate run times; The meter shall be not be reset capable and shall be capable of registering elapsed time up to 99,999.9 hours.

5.6.3.6 Pump Interlock

Sensors and control hardware shall be provided to allow monitoring of the following conditions:

a. Motor-stator over-temperature

b. Seal leakage

c. Loss-of-phase, phase reversal, or lack of voltage

d. Electrical overload (solid-state, temperature compensated)

All of these conditions shall cut power to the appropriate pump(s) with the exception of seal leakage which shall be evaluated on a case-by-case basis. Capability for stator over-temperature and electrical overload manual reset shall be provided at the control panel.

The stator over-temperature circuitry shall be re-enabled automatically after a power outage.

Loss-of-phase, phase reversal, or lack of voltage condition shall cut power to all pumps. The monitor for these conditions shall reset automatically once the problem parameter falls within its appropriate range. If after the monitor has reset, the control system calls for more than one pump, the additional pump(s) shall be energized after a time delay(s).

5.6.4 Alarm System

5.6.4.1 Local Alarms

The local alarm system may be housed in the pump control panel or may be placed in a separate enclosure. When in a separate enclosure, the station shall be provided with a local alarm system housed in a stainless steel, NEMA 4X enclosure. The alarm system shall be powered by a 12-volt maintenance free battery with a solid state charger. The battery shall be capable of continuously powering the station alarm light for a minimum of five (5) hours without recharging. The battery charger shall be capable of providing maximum charging current to the battery during alarm operation. The following local alarm conditions shall be provided:

a. High wet well level

b. Power failure

These alarms shall activate a red flashing light at the station itself. The light shall de-energize automatically upon reset of the listed alarm conditions.

5.6.4.2 Telemetry Alarms

(Unit III, Chapter 5, Exhibits III-5-7, III-5-8, and III-5-9 shall be referenced for Fort Wayne lift station telemetry specifications, antenna mountings, and panels and interfaces.)

All telemetry requirements shall be in accordance with the latest version of the City of Fort Wayne, Water Pollution Control Utility's Standard Specifications for Lift Station Telemetry Systems. In addition to the Utility specifications, all local codes relating to antenna height requirements, aircraft flight paths, and other pertinent issues must be adhered to.

In general, the telemetry system shall be set up to indicate the following conditions:

a. Pump run status

b. Pump failure

c. Wet well high level

d. Power failure

e. Personnel at station

5.6.5 Emergency Power

Emergency pumping capability shall be considered on a case-by-case basis in consultation with Water Resources. At a minimum, one of the following methods shall be employed:

- The preferred method shall be connection of the station to two (2) independent power sources. Two independent substations shall be identified.
- Installation of permanently in-place internal combustion engine-powered generator with properly sized automatic transfer switch; Natural gas shall be the preferred generator type with diesel and other types evaluated on a case-by-case basis.
- Installation of properly sized manual transfer switch and generator receptacle for connection to available generator
- Portable pumping connection

All emergency equipment shall have sufficient capacity to startup and maintain the total rated capacity of the pump station.

5.7 Metering and Sample Points

All contract customers will be required to install meters and sampling points. These installations will be addressed on a case-by-case basis. Water Resources shall be consulted for requirements.

END CHAPTER 5

	City Utilities Department Of Water Resources	Exhibit III-2-1 First Checklist
		Created: January 1, 2002 Revised:

Project: _____

Contact: _____

Phone #: _____

Board Order #: _____

Engineering Representative: _____

SUBMITTAL REQUIREMENTS

1. Will the sewer constructed to serve this development serve any other areas? ☐ yes ☐ no
2. Will any sewers larger than 8" be constructed as part of this project? ☐ yes ☐ no
3. Will a public lift station be built to serve this development? ☐ yes ☐ no
4. Will any sewers be designed at less than minimum slope? ☐ yes ☐ no

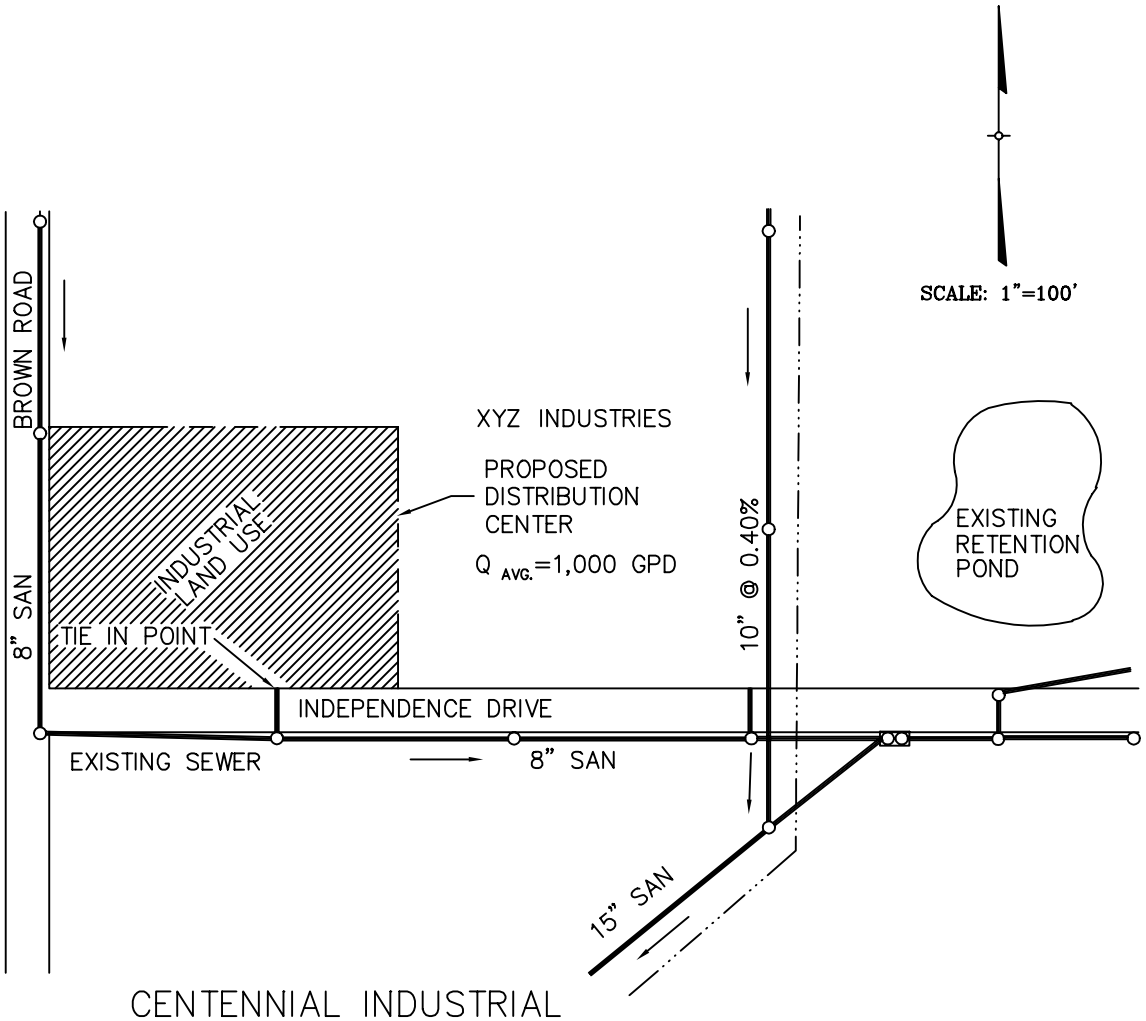
An Area Map may be submitted if the answer to all these questions is NO. A Drainage Map is required if the answer to any of these questions is YES. (Note that although an Area Map may be acceptable for Conceptual Approval, a Drainage Map will be required for Construction Plan Approval.)

COMMERCIAL AND INDUSTRIAL WASTES AND DISCHARGES

1. Is the user federally categorized? ☐ yes ☐ no

   If yes, FIC Code _____

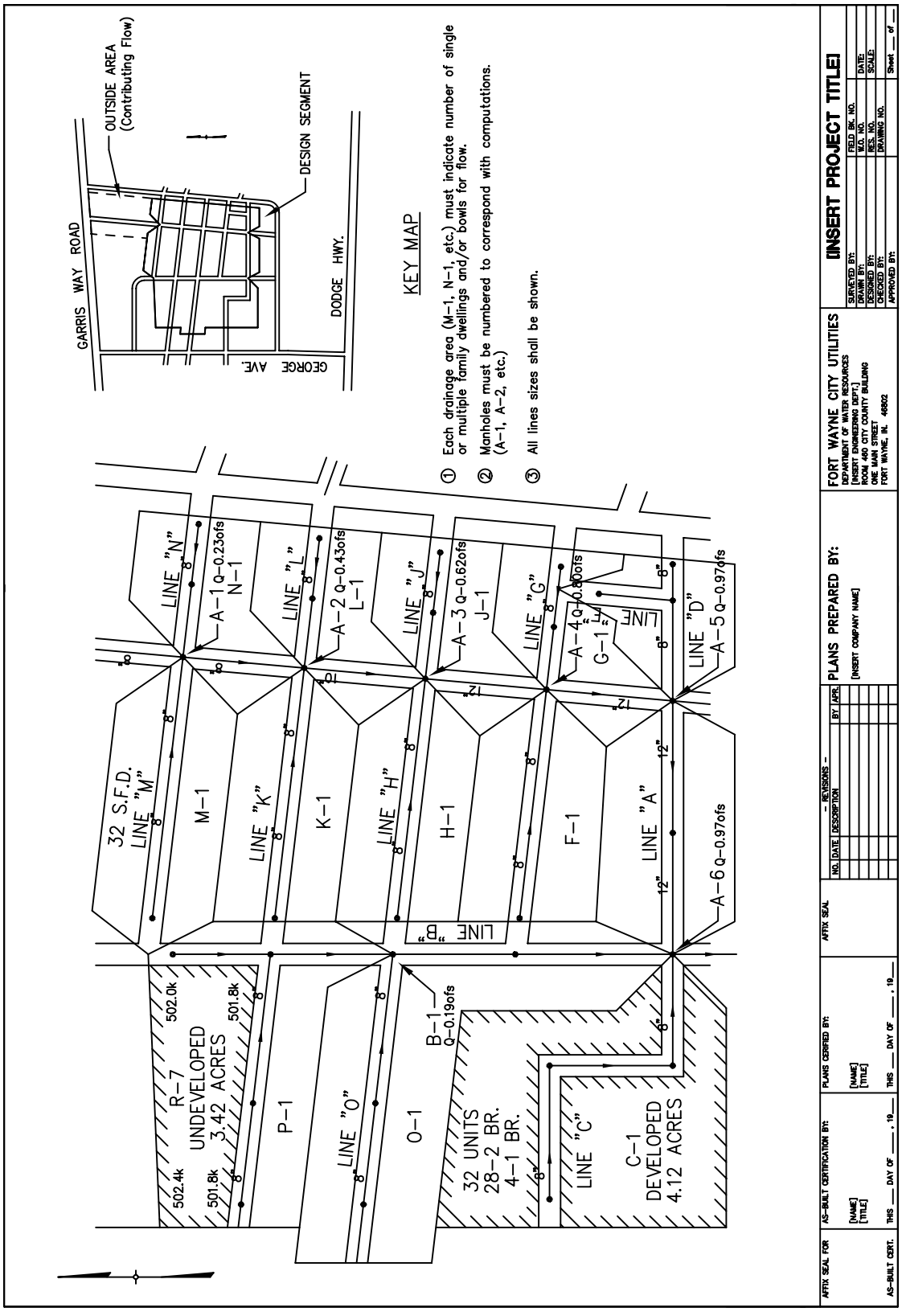
	City Utilities Department of Water Resources	Exhibit III-2-2 Area Map
		Created: January 1, 2002 Revised:



CENTENNIAL INDUSTRIAL PARK SECTION VIII

(NOTE: If road is not nearby, give distance to nearest landmark.)

City Utilities Department of Water Resources	Exhibit III-2-3 Sample Sanitary Sewer Service Area Map
	Created: January 1, 2002 Revised:



	City Utilities Department Of Water Resources	Exhibit III-2-4 Second Checklist
		Created: January 1, 2002 Revised:

Project:_____

Contact:_____

Phone #:_____

Board Order #:_____

CAPACITY

1. Is this development served by an interceptor in a red zone? ☐ yes ☐ no
   a. If yes, is an SPC-15 permit required? ☐ yes ☐ no
   b. If yes, does the flow from the proposed tap have a significant effect on the sewer system? ☐ yes ☐ no
2. Can the pipes shown handle the flow shown? ☐ yes ☐ no
3. Are the design velocities greater than 2 ft/s? ☐ yes ☐ no
   a. If not, are all pipes minimum size and slope? ☐ yes ☐ no

COST OF SERVICE

1. Is a lift station or other high maintenance facility planned with this development? ☐ yes ☐ no
2. Is the City being asked to pay oversizing? ☐ yes ☐ no
3. What is the City's payback period for its investment?

COMMERCIAL AND INDUSTRIAL WASTES

1. Have all submittal requirements been met? ☐ yes ☐ no
2. Have all Federal and State codes and regulations been adhered to? ☐ yes ☐ no

This "Conceptual Approval" request is being sent to the Board of Public Works because:

[ ] Capacity Issues:

_____

_____

_____

[ ] Cost of Service Issues:

_____

_____

_____

Forwarded by:

_____

	City Utilities Department Of Water Resources	Exhibit III-2-5 Sanitary Sewer Facilities Review Checklist
		Created: January 1, 2002 Revised:

Project Name:_____ Date:_____

Project Number:_____ Submitted by:_____

The Applicant shall check each item submitted. If any item is not applicable, indicate with a N/A in the space provided.

1. _____ Two sets of plans with accurately depicted roadways in areas of the utility.
2. _____ Specifications (include Special Provisions for sewers) or general notes on plans.
3. _____ Minimum construction plan requirements checklist (Exhibit III-2-6).
4. _____ Service area map and design computations.
5. _____ Legal description of property served by the proposed sewers.
6. _____ Proposed easement location and, when complete, copy of easement plats certified and sealed by a Land Surveyor registered in the State of Indiana. Plats shall be pursuant to minimum standards for land surveying in Indiana.
7. _____ Copy of approved primary plat (recorded or unrecorded).
8. _____ Copy of roadway plans, if not previously submitted.
9. _____ Documentation showing that potential conflicts with existing utilities have been addressed to the satisfaction of the utility company.
10. _____ Copy of all required permits or permit applications.

Date Submitted:_____

	City Utilities Department Of Water Resources	Exhibit III-2-6 Minimum Construction Plan Requirements Checklist Created: January 1, 2002 Revised:

Project Name: _____ Date: _____

Project Number: _____ Submitted by: _____

_____

Engineering Representative:_____

Dates:

Received: _____

Returned: _____

Approved: _____

The Engineering Representative shall check each item to indicate it has been shown or addressed on the construction plans. If an item is not applicable or not required, indicate with a N/A in the space provided:

____Backfill type
____Basement elevation
____Bench marks
____Bench mark datum
____Blueline stream crossing
____Concrete cap or encasement
____Construction limits shown
____Developer name/address/ phone number
____Drop inlets
____Easements labeled
____Easement plat
____Electric lines, existing
____Engineer's seal & signature
____Existing ground
____Existing sewers
____Existing utility crossings
  ____Water lines
  ____Telephone lines
  ____Cable TV
  ____Electric
  ____Gas lines
____Flow arrows
____Geotechnical information
____Horizontal location information for new pipe installation (i.e. bearing and distance or distance and offset)
____House/lot number
____Invert elevation
____Legend
____Line designation
____Location map
____Lot lines
____Manhole designations
____Manhole stations
____Meets minimum standards for land surveying
____North arrow
____Pavement cut limits
____Pipe type
____P.I. station & angle
____Plan date
____Proposed grade (of ground)
____Proposed street grades
____Railroad lines, existing
____Resurfacing limits
____Rights-of-way, existing
____Rim elevation (M.H.)
____Scale/graphic scale
____Sewer grades
____Sewer sizes
____Soil borings
____Special construction notes
____Special details
____Standard notes
____Station equations (equalities as required)
____Stationing
____Storm drains, existing
____Street names
____Stubs
____Survey baseline
____Surveyor's seal & signature
____Surveyor's certification
____Tie-in point to existing system
____Title block/sheet
____Topo, existing
____Tree protection indicated as required
____Tunnels/bores/sections

	City Utilities Department Of Water Resources	Exhibit III-2-7 IDEM Local Permitting Forms, Page 1
		Created: January 1, 2001 Revised:

LOCAL UNIT CONSTRUCTION PERMIT APPLICATION

Fort Wayne City Utilities
Development Services

1. Name of Project	
2. Location of project (nearest public intersection)	
(quarter section, section, township and range of the approximate center of the development)	
3. Brief description of project	
4. Maximum number of proposed service connections to the water main(s)	
5. Numerical count of type of connections to the main(s) (A) Residential (B) Commercial (C) Industrial	
6. Certification by Design Engineer I hereby certify that I am familiar with the information contained in this application and that to the best of my knowledge and belief, such information is true, complete and accurate. Signature of Engineer _____	
7. Date Signed	11. PE Seal
8. Name of Engineering Firm	
9. Telephone Number	
10. Address of Engineering Firm	

	City Utilities Department Of Water Resources	Exhibit III-2-7 IDEM Local Permitting Forms, Page 2
		Created: January 1, 2002 Revised:

SEWER PERMIT APPROVAL LETTER INFORMATION

PROJECT NAME

#CONT.

DATE OF APPLICATION

DATE OF APPROVAL

DESIGN CONSULTANT (individual and firm)

NEAREST INTERSECTION

QUARTER SECTION, SECTION, TOWNSHIP AND RANGE

NUMBER OF SERVICE CONNECTIONS

RESIDENTIAL

COMMERCIAL

INDUSTRIAL

AVERAGE FLOW IN GALLONS PER DAY

LENGTH AND TYPE OF SEWER

ENGINEER

ADDRESS

DEVELOPER/OWNER/CONTRIBUTOR (May have more than one) AND ADDRESS

CONTRACTOR

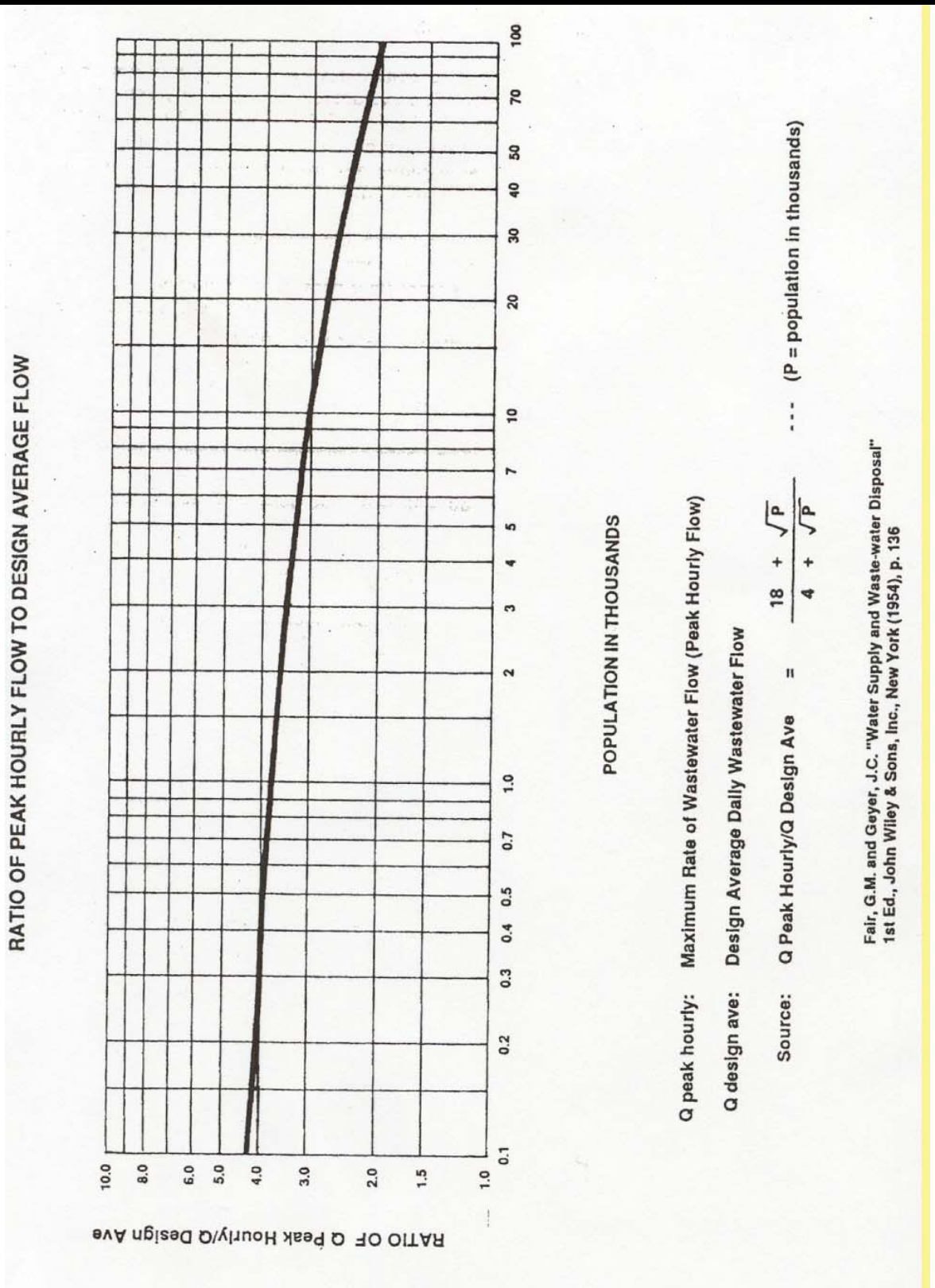
ADDRESS

	City Utilities Department Of Water Resources	Exhibit III-3-1 Wastewater Flows* Created: January 1, 2002 Revised:

Development	Unit	Average Gal/Unit/Day
Airport		
a. Passenger	Passenger	3
b. employee	Employee	20
Apartment		
a. one-bedroom	Apartment	200
b. two-bedroom	Apartment	300
c. three-bedroom	Apartment	350
Church		
a. with kitchen	Sanctuary seat	5
b. without kitchen	Sanctuary seat	3
Condominiums		
a. one-bedroom	Condominium	200
b. two-bedroom	Condominium	300
c. three-bedroom	Condominium	310
Factory		
a. with showers	Employee	35
b. without showers	Employee	20
Food Service Operations		
a. Restaurant (not 24-hour)	Seat	35
b. Restaurant (24 hour)	Seat	50
c. Tavern / Bar	Seat	35
Hospital / Medical Facilities	Bed	200
Hotels / Motels	Room	100
Laundromat	Machine	500
Mobile Home Park	Lot	200
Nursing Home	Bed	100
Office Building	Employee	20
School		
a. Elementary	Student	15
b. Secondary	Student	25
Shopping Center		
a. floor space	Square foot of floor	0.10
b. employee	Employee	20
Single Family Dwelling	Dwelling	310
Two Family Dwelling	Dwelling	620
FUTURE LAND USE		
Fill-in Residential	Acre	600
Subdivision Residential	Acre	400
Industrial	Acre	850
Commercial	Acre	600

*Partially Excerpted from Indiana State Board of Health Bulletin S.E. 13 (Reference No. 5)

	City Utilities Department Of Water Resources	Exhibit III-3-2 Peaking Factors
		Created: January 1, 2002 Revised:



	City Utilities Department Of Water Resources	Exhibit III-3-3 Minimum Allowable Slopes
		Created: January 1, 2002 Revised:

Manning's "n" = 0.013

PIPE DIAMETER (inches)	SLOPE (ft/ft)	VELOCITY FULL (ft/sec)
8	0.0040	2.2
10	0.0028	2.1
12	0.0022	2.1
15	0.0015	2.0
18	0.0012	2.0
21	0.0010	2.1
24	0.0008	2.0
27	0.00067	2.0
30	0.00058	2.0
33	0.00052	2.0
36	0.00046	2.0
42	0.00037	2.0
48	0.00030	2.0
54	0.00026	2.0
60	0.00026	2.0
68	0.00026	2.3
72	0.00026	2.4
78	0.00026	2.6
84	0.00026	2.7
96	0.00026	3.0
108	0.00026	3.2
120	0.00026	3.4
132	0.00026	3.6
144	0.00026	3.8