Town of Cicero
Hamilton County, Indiana
Utility & Street Standards

Section 2: Wastewater Collection System

Town of Cicero/Cicero Area
Hamilton County, Indiana
Utility & Street Standards

Section 2: Wastewater Collection System

Part 1 - DEFINITIONS AND TERMS

1.01 Definitions and Terms

A. Abbreviations

B. Definitions

PART 1: DEFINITIONS AND TERMS

1.01 DEFINITIONS AND TERMS

Whenever in these Standards or in any documents or instruments where the Standards govern, the following terms, abbreviations, or definitions are used, the intent and meaning shall be interpreted as follows:

A. ABBREVIATIONS

ASTM	American Society of Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
AWWA	American Water Works Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ACI	American Concrete Institute
AREA	American Railway Engineers Association
NEMA	National Electrical Manufacturers Association
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation
OSHA	Federal Occupational Safety and Health Act
USACOE	United States Army Corps of Engineers
WPCF	Water Pollution Control Federation

B. DEFINITIONS

1. ACCEPTANCE: The formal written acceptance by the Town of Cicero of an entire project which has been completed in all respects in accordance with the approved Plans, Specifications and these Standards including any previously approved modifications thereof.

2. ANNEXATION: The inclusion of additional property into the Corporate Limits by proper legal procedures.

3. BACKFILL: Earth and/or other material used to replace material removed from trenches during construction which is above the pipe bedding.

4. BEDDING: That portion of the trench backfill which encases the sewer pipe to a minimum depth above and below the bell/barrel of the pipe, as provided in the BEDDING section of these Standards, for the purpose of properly supporting the pipe.

5. BUILDING SEWER (LATERAL): The conduit for transporting waste discharged from the building to the public sewer commencing three (3) feet outside the building walls and ending at and exclusive of the wye or tee fitting at the connection to the public sewer.

6. CONTRACTOR: Any Contractor who meets the Town's requirements to perform the work of installing sewers under the Town's jurisdiction.

7. COUNTY: The County of Hamilton, State of Indiana

8. DEVELOPER: Any individual, partnership, firm, corporation or other entity responsible for development of a property.

9. EASEMENT: Easements are areas along the line of all public sanitary sewers which are outside of dedicated sewer or road easements or rights-of-way, and are recorded and dedicated to the Town granting rights along the line of the sanitary sewer. Easements shall be exclusively for sanitary sewers and no other utilities shall be constructed or encroach upon the easement except with the expressed written approval of the Town of Cicero.

10. ENGINEER: The Engineer for the Developer or the Town of Cicero.

11. INFILTRATION/INFLOW: The total quantity of water from both infiltration and inflow (clear water sources) without distinguishing the source.

12. INSPECTOR: A representative of the Town of Cicero assigned to make detailed inspection of any or all portions of the work and materials. The inspector has full authority to reject materials and/or any portion of the work not supplied and installed in accordance with these Standards and to stop work if the work is not proceeding in accordance with these Standards.

13. LIFT STATION: Any arrangement of pumps, valves and controls that lift and/or convey wastewater to a higher elevation.

14. OTHER SPECIFICATIONS AND MATERIALS: Wherever in these Standards other specifications or regulations are mentioned, it shall be understood that the materials and methods mentioned therewith shall conform to all requirements of the latest revision of the specifications so mentioned.

15. OWNER: Any individual, partnership, firm, corporation or other entity who, as property owner, is initiating the work. May also be the Developer.

16. PERMITS: Clearance to perform specific work under specific conditions at specific locations. The Owner/Developer or his duly authorized representative shall furnish to the Town all necessary plans and documents required by the Town to make application for permits.

17. PLANS: Construction plans, including system maps, sewer plans and profiles, cross sections, utility plans, detailed drawings, etc., or reproductions thereof, approved or to be approved by the Town and the Cicero Area Plan Commission, which show location, character, dimensions and details of the work to be done.

18. RECORD DRAWING (AS-BUILTS): Plans certified, signed and dated by a professional engineer registered in the State of Indiana, indicating that the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction and installation details including, but not limited to, key elevations, locations and distances. The certification also indicates that there have been no field modifications that have a determined impact upon the approved design plans. Computer files in Town's current version of AutoCAD are required.

19. RIGHT-OF-WAY: All land or interest therein which by deed, conveyance, agreement, easement, dedication or process of law is reserved for or dedicated to the use of the general public, within which the Town shall have the right to install and maintain sewers.

20. SEWER: A pipe or conduit for carrying wastewater (sanitary sewer), storm water (storm sewer) or a combination of both (combined sewer). Wherever in these Standards the word "sewer" is used without distinguishing type, "sewer" shall mean sanitary sewer. Combination sewers are not allowed in the Town of Cicero collection system.

21. STANDARD DRAWINGS: The drawings of structures, sanitary sewer lines or devices commonly used and referred to on the plans and in these Standards.

22. STANDARDS: The Standards for Design and Construction within the Cicero Area as contained herein and all subsequent additions, deletions or revisions.

23. TEN STATE STANDARDS: Recommended Standards for Wastewater Treatment Facilities, latest edition, developed by the Committee of the Great Lakes - Upper Mississippi River board of State and Provincial Public Health and Environmental Managers.

24. UNIFORM PLUMBING CODE: The Uniform Plumbing code adopted

by the International Association of Plumbing and Mechanical Officials, current edition.

25. WORK: All the work to be done under Town's permit, in accordance with the approved Plans, Specifications, these Standards and permit conditions.

End of Part 1

Town of Cicero/Cicero Area
Hamilton County, Indiana
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Section 2 - Wastewater Collection System

Part 2 - GENERAL RULES AND REGULATIONS

2.01 General

2.02 Building Sewers

PART 2: GENERAL RULES AND REGULATIONS

2.01 GENERAL

This Part provides the general rules and policies accepted and utilized by the Town of Cicero and the Cicero Area Plan Commission.

2.02 BUILDING SEWERS

The following highlights the provisions and requirements pertaining to Building Sewers. Any conflict existing between these regulations and other Ordinances, statutes or requirements shall apply the most stringent requirement.

A. BUILDING SEWER CONNECTION PERMIT

1. Connection Permits

The Town of Cicero/Cicero Area Plan Commission requires connection permits to be issued by the Town for all repairs and/or modifications to or connection of a building sewer to a public sewer or another building utilizing sanitary sewers owned and operated by the Town of Cicero.

2. Minimum Elevations for Gravity Connection

A sanitary sewer connection permit shall not be granted to homes or buildings where the lowest elevation to have gravity sanitary services is less than one (1) foot above the top of the manhole casting elevation of either the first upstream or downstream manhole on the public sewer to which the connection is to be made. If the first upstream and downstream manhole is higher or within this one (1) foot, an alternate connection point or alternate connection method such as an individual private grinder pump lift station will be required..

3. Permit Fee

Connection Fees are established by the Town of Cicero Book of Ordinances. This fee shall cover the costs of mandatory inspection, and any reinspection that may be necessary because of remedial construction. The Town of Cicero may revise the amount of such fees as needed.

End of Part 2

Section 2 - Wastewater Collection System

Part 3 - GENERAL DESIGN STANDARDS

PART 3: GENERAL DESIGN STANDARDS

3.01 GENERAL

Construction permits shall be obtained from the Town for the installation of all sanitary sewer facilities discharging into the sewers owned and operated by the Town of Cicero. Sanitary sewer facilities shall be designed and installed in accordance with these Standards, Ten States Recommended Standards for Wastewater Facilities and 327 IAC 3. All required permits from state and federal agencies shall be the responsibility of the Owner/Developer. Copies of all State and Federal permits required shall be delivered to the Town of Cicero prior to construction commencement.

3.02 GENERAL DESIGN CRITERIA

All sanitary sewers shall be designed to carry the estimated flow from the area ultimately contributing to the respective reach of the sanitary sewer. The required capacity **shall be established and/or approved by the Town.** In no instance shall a gravity sewer, other than a building sewer, be less than eight (8) inches in diameter.

The following design standards for gravity sewers within or contributing to the Cicero Wastewater Collection System have been established:

1. Population Density

   Population density shall be in accordance with the actual count or character of proposed development.

2. Average Family

   For the purposes of design the average family unit is considered to be 3.1 persons per single family home.

3. Design Flow

   The design of all sanitary sewer facilities shall be based on future area population growth and land development characteristics and figures provided by the Town of Cicero including the servicing of existing contiguous developed areas not currently served by sanitary sewers. The values of Average and Peak Flow and Design Population hereby shall be the values which include the future flows and population. The Town reserves the right to review and determine the appropriateness/applicability of the estimated flow volumes provided.

   The following shall be used as a guide but may vary for specific projects:

a. Average Design Flows

(1) Single Family Residential: The average design flow for single family dwellings shall be one hundred (100) gallons per person per day. Typical residences will utilize a flow of 310 gpd.

(2) Commercial/Industrial/Institutional: The average daily design flow for these facilities shall be based on Bulletin S.E. 13 from the Indiana State Board of Health, latest edition and/or 327 IAC-3. Table 4-1 of these Standards itemizes estimated design flows for various non-residential facilities.

This Bulletin shall be used as a general guideline in determining average flow volumes anticipated from a proposed development.

Based upon information submitted by the Owner/Developer, these flow volume guidelines may be modified at the Town's discretion. The Town may require sewers of greater capacity for potential growth.

b. Peak Design Flow

(1) Single Family Residential: The peak design flow for a single family development shall be calculated per Ten States Standards as follows:

$$\text{Peak Flow} = (\text{Avg. Flow}) \ \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where P is equal to the total Design Population in thousands.

(2) Commercial/Industrial/Institutional: The peak design flow from commercial, industrial or institutional developments shall be the average daily flow determined multiplied by at least 4.0. Industrial processes with greater peak flows shall be reviewed on a case-by-case basis.

4. Infiltration: Sanitary sewer design capacity must include an allowance to carry unavoidable amounts of groundwater infiltration or seepage in addition to the peak sanitary flows. Collector and trunk sewers shall be designed to include an allowance of two hundred (200) gallons per day

per inch diameter mile of pipe.

3.03 MINIMUM PIPE SIZES AND STANDARDS

A. PIPE DIAMETER

The required diameter of gravity sewers shall be determined by Manning's formula using a roughness coefficient, "n", of 0.013 or the pipe manufacturer's recommendation, whichever is greater. The minimum pipe diameter for gravity sanitary sewers shall be eight (8) inches.

B. MINIMUM SLOPES AND VELOCITIES

All sanitary collector and trunk sewers shall be designed and constructed to provide a minimum velocity when flowing full of two (2) feet per second. The slope of the sewer pipe shall be such that these minimum velocity requirements are attained. The minimum acceptable slopes for the design and construction of sanitary sewers are as follows:

THESE ARE MINIMUM SLOPES REQUIRED OF THE DESIGN. AS CONSTRUCTED SANITARY SEWERS FOUND TO HAVE LESS THAN THIS MINIMUM SLOPE SHALL NOT BE ACCEPTED.

Pipe Size* (inches)	Minimum Slope* (Feet per 100 Feet, %)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24 and greater	0.08

*4" and 6" are allowed for building sewers only. For details see UPC (Uniform Plumbing Code), latest edition, Indiana Department of Fire Protection and Building Safety.

C. MINIMUM DEPTH

For the protection of the sanitary sewer lines from damage caused by utilities installed after the sanitary sewer has been constructed, the minimum depth to crown of all gravity sanitary sewers shall be 5 feet, and the minimum depth to crown of all force main sanitary sewers shall be 4.0 feet.

D. BUILDING SEWERS

Building sewers shall conform to the latest edition of the Uniform Plumbing Code and to these Standards. Building sewers shall not allow migration of groundwater or any clear water into the system.

The building sewer shall connect to the public sewer at a mainline fitting. Connections to manholes shall only be allowed at upstream terminating manholes. Inside drop connections to manholes are not allowable.

Building sewers within the right-of-way or easement shall be a minimum of six (6) inches in diameter. Building sewers shall have a wye cleanout located within three (3) feet of the building's exterior wall and extended to grade.

Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes or extended flush with paving with approved materials and be adequately protected. All cleanouts will have water tight covers or caps to eliminate any Clearwater migration into the system.

Building sewers installed for future connections shall be terminated at the right-of-way or easement and plugged to ensure 100 percent water tightness. A one-half (1/2) inch metal locator rod or a magnetic locator tape shall be installed at the end of the plugged line to within three (3) feet of the finished grade.

3.04 SEWER STRUCTURES

A. MANHOLES

1. General

Manholes shall be installed at the end of each line; at all changes in grade, size, materials or alignment; at all sewer intersections and at the following intervals:

Pipe Diameter (inches)	Maximum Interval Between Manholes (feet)
Less than 15	400
15 and less than 30	500
Greater than 30	600

The minimum inside diameter of manholes shall be as stated in Part 4 of this Section.

Flow channels shall be shaped and formed in each manhole to provide a smooth transition of flow from all inlets to the outlet. The bench wall shall be formed to the crown of the inlet and outlet pipes to form a "U" as shown in the Standard Details in these Standards.

At changes in sewer alignment and/or sizes, the energy gradient elevation shall not increase. This shall be accomplished by keeping the crown elevation continuous where possible for changes in sewer sizes.

Manholes proposed to be installed in unpaved areas shall be designed and constructed such that the top of the casting is a minimum of three (3) inches above the finished grade in yard areas and one (1) inch in paved areas to prevent ponding of water over the casting. Positive drainage away from the manhole shall be provided.

2. Outside Drop Connections

Outside drop pipe connections shall be provided for all sanitary sewers entering a manhole at an elevation greater than twenty four (24) inches above the invert of the manhole.

In areas where future residential, commercial and/or industrial growth can occur, all new manholes 15 feet deep or deeper shall be equipped with up to two (2) precast outside drop connections of a size and at an elevation to be determined by the Town at the time of design to allow for future connections at these points. The drops shall extend from the base to within 10 feet of the final graded surface elevation.

B. LIFT STATIONS

A construction permit shall not be issued for a sanitary sewer lift station unless prior approval is obtained from the Town.

3.05 EASEMENTS

Whenever possible, sanitary sewers shall be constructed within the public right-of-way. Should the construction be outside the limits of the public right-of-way, sewer easements shall be acquired, dedicated and recorded solely for the benefit of the Town of Cicero. Easement boundaries shall be so shown on the plans and specifications as "Sanitary Sewer and Water Easement" in lieu of "Utility Easement."

The minimum permanent easement widths to be dedicated to the Town are as follows:

Depth of Sewer from Finished Grade	Minimum Easement (ft.)
up to 15 feet	20
> 15 feet to 25 feet	25
greater than 25 feet	30

A minimum 40 foot by 40 foot easement shall be provided for all submersible lift stations with wet wells up to 30 feet deep. Easements for lift stations with wet wells greater than 30 foot deep and/or wet well/dry pit lift stations shall be handled on a case by case basis.

The sewer easements shall be exclusively under the discretion and control of the Town. Ingress and egress shall be available to the Town's crew at all times. No utility companies are allowed to use the Town easements for installation of their utility lines without the expressed written permission of the Town. All plan sheets shall clearly identify the sanitary sewer easement and the location of all other proposed utilities. The horizontal and vertical plans shall identify all utilities proposed to cross the sanitary sewer easement.

3.06 RECORD DRAWINGS

Sanitary sewer plans submitted as record ("as-built") drawings shall have all laterals shown on the plan view with their locations properly scaled. Lateral measurements shall be indicated by their distance from the downstream manhole in the form of stationing. Lateral stationing shall begin at 0+00 at each downstream manhole. All sheets shall have the phrase "as-built" or "record drawing" boldly printed on them with the date, and shall be stamped and signed by a professional engineer registered in the state of Indiana. "As-Built" drawings shall be delivered on reproducible media (3 copies) and electronics files in the Town’s current version of AutoCAD.

3.07 PROTECTION OF WATER SUPPLIES

There shall be no physical connections between a public or private water supply system and a sanitary sewer or appurtenances thereto which would permit the passage of any polluted water into the potable supply. Sanitary sewers shall be laid at least ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured from edge of pipe to edge of pipe. In cases where it is not practical to maintain a ten (10) foot separation, the appropriate reviewing agency may allow deviation on a case-by-case basis if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a water main provided that the water main is in a separate trench or on an undisturbed earth shelf located to one side of the sewer pressure class pipe is used, and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer. Deviations must be approved in writing by the Town of

Cicero.

Sanitary sewers crossing water mains shall be laid to provide a minimum vertical separation distance of 18 inches between the outside of water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Adequate structural support shall be provided to prevent damage to the lower pipe. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe, and shall be pressure tested to assure water tightness prior to backfilling.

3.08 EXISTING UTILITY STRUCTURES AND FACILITIES

The plans shall show the location of overhead and underground utility lines and existing sewers according to the best information presented and available. In addition to field surveys, plans shall be submitted to the individual utilities and shall have indicated to the best of their records the locations of their facilities and the route of the proposed sewer.

3.09 UTILITY COORDINATION

It is the responsibility of the Owner/Developer of his authorized representative to coordinate with and get approval from the various utilities. Further, it is the responsibility of the Owner/Developer to get authorization to encroach upon any other utilities easement and secure such recorded encroachment as a requirement for dedication of the sanitary sewer system.

3.10 SANITARY SEWERS CROSSING DRAINAGE WAYS

Sanitary sewers shall be constructed of ductile iron pipe or shall be encased in a minimum of 12" of concrete wherever the sanitary sewer crosses under a naturally occurring drainage way (i.e. creeks, river, streams, etc.). A minimum cover of 3’-0” is required below the stream bed. Wherever applicable, the sanitary sewer crossing the drainage way shall be pressure tested to assure 100% water tightness prior to backfilling. All applicable permits from the Indiana Department of Natural Resources (IDNR), IDEM, and the Army Corp. of Engineers shall be the Owner's/Developer’s responsibility. No construction will be allowed without permit acquisition.

End of Part 3

Table 2-1: Wastewater Flow Table

Type of Establishment*			Gallon Per Person of Wastewater Per Day Unless Otherwise Noted
1.	Institutions other than hospitals		180-120
2.	Schools (without gym and showers)		15
3.	Schools (with gyms and showers)		25
4.	Organization camps only		
	a.	With showers and handwashing facilities	20+
	b.	With toilets, showers and handwashing facilities + Cooking or central food service included	40+
5.	Campgrounds		
	a.	With individual sewer connections (per site)	100
	b.	With community building only (per site)	50
6.	Mobile home parks (per mobile home park space)		200
7.	Motels and hotels (per room)		100
8.	Restaurants along an interstate or major highway; 24 hour operation (per seat)		70
9.	Restaurants; 24 hour operation (per seat)		50
10.	Restaurants; less than 24 hour operation (per seat)		35
11.	Bars and cocktail lounges (per seat)		35
12.	Bowling alleys (per alley)		125

Table 4-1: Wastewater Flow Table
(continued)

Type of Establishment*	Gallons Per Person of Wastewater Per Day Unless Otherwise Noted
13. Places of employment (does not include industrial waste, per employee per shift)	35
14. Day workers at offices	20
15. Picnic parks and areas	5
16. Drive-in theatres (per car space)	5
17. Service stations (per vehicle served)	10
18. Swimming pool bathhouse (per person)	10
19. Private dwelling (per dwelling)	310
20. Apartments	
a. One bedroom (per apartment)	200
b. Two bedroom (per apartment)	300
21. Shopping center (where stores are not known) per square foot building area	0.45
22. Churches	
a. Without kitchen (per sanctuary seat)	3
b. With kitchen (per sanctuary seat)	5
*Additional flows if daycare or school program.	
23. Beauty salon (per customer)	35
24. Day care center	20

* The flows listed indicate a reasonable approach for the type of establishment referred to. Additional considerations will be necessary in some cases. Values listed are from Indiana State Board of Health Bulletin S.E. 13-1983 and/or 327 IAC 3. For uses not mentioned in this table, flow estimates should be submitted for preliminary design review and possible approval prior to proceeding with final plans.

Section 2: Wastewater Collection System

Part 4 - MATERIALS

4.01 Introduction

4.02 Gravity Sanitary Sewers

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- B. Gravity Sanitary

4.03 Sanitary Sewer Force Mains

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- B. Anchorage
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4.04 Sanitary Sewer Manholes

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- C. Monolithic (Cast-in-Place) Manholes
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4.05 Building Sewers

PART 4: MATERIALS

4.01 INTRODUCTION

The following Part provides a description of materials acceptable for the construction of gravity sanitary sewers, force mains, manholes and their appurtenances within the Town of Cicero's collection system. Use of other materials not specified herein will be allowed only with the written approval and authorization of the Town Officials.

4.02 GRAVITY SANITARY SEWERS

A. GENERAL

The Town of Cicero currently allows the use of the following pipe materials meeting or exceeding the minimum requirements/specifications set forth herein for the construction of gravity sanitary sewers:

Polyvinyl Chloride Pipe (PVC)
Ductile Iron Pipe (DIP)

VITRIFIED CLAY PIPE (VCP) is NOT an approved material for the construction of sanitary sewers discharging to the Cicero Sewer System.

In general, all gravity sanitary sewer pipe shall be the bell and spigot type with elastomeric seal joints and smooth interior walls meeting or exceeding all requirements set forth in the latest ASTM Standard referenced herein.

THE TOWN DOES NOT ALLOW THE USE OF SOLVENT CEMENT JOINT FOR GRAVITY SANITARY SEWERS.

Each length of pipe shall be marked per the requirements of the respective ASTM Standard. Upon request, the Contractor at his own expense shall furnish the town with copies of all material tests required by applicable ASTM standards.

B. GRAVITY SANITARY SEWER MATERIALS

Each pipe material acceptable for gravity sanitary sewer construction is separated into its own subsection for ease of revision and/or updating as follows:

1. POLYVINYL CHLORIDE PIPE

a. Pipe: Polyvinyl chloride (PVC) gravity sanitary sewer pipe shall be the integral wall bell and spigot type with elastomeric seal joints and smoother inner walls meeting or exceeding all of the requirements set forth in

ASTM D-3034 for pipe diameters 15-inches or less and meeting or exceeding all of the requirements set forth in ASTM F-679 for pipe diameters greater than 15-inches.

For diameters 15-inches or less, the pipe shall have a minimum cell classification of 12454-B or 12454-C and for diameters greater than 15-inches, the pipe shall have a minimum cell classification of 12454-C; with all pipe having a minimum tensile strength of 34.50 MPa as defined in ASTM D-1784.

PVC sanitary sewer pipe shall have a minimum pipe stiffness of 46 psi for each diameter when measured at 5% vertical ring deflection and tested in accordance with ASTM D-2412.

b. Joints: Flexible gasketed joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a watertight seal. The assembly of joints shall be in accordance with the pipe manufacturer's recommendations and ASTM D-3212. The gaskets sealing the joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to the requirements of ASTM F-477.

   All field-cutting of pipe shall be done in a neat, trim manner using a hand or power saw, and the cut end shall be beveled using a file or wheel to produce a smooth bevel of approximately 15 degrees and be a minimum depth of one-third the pipe wall thickness. Field cut pipe will only be allowed to be installed at manholes, at prefabricated tees and wyes, and at the connection of new sanitary sewer to existing sanitary sewer.

   NO SOLVENT CEMENT JOINTS SHALL BE ALLOWED.

   NOTE: Only smooth exterior pipe shall be used at manhole connections.

c. Fittings: Only manufactured fittings made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in ASTM D-1784 shall be used.

   SADDLE CONNECTIONS SHALL NOT BE ALLOWED FOR NEW CONSTRUCTION.

d. Design: The minimum wall thickness for PVC sewer pipe and lateral sewer pipe 15-inches or less in diameter shall conform to SDR-35 Type PSM as specified in ASTM D-3034. The minimum wall thickness for PVC sewer pipe greater than 15-inches in diameter shall conform to T-1 as specified in ASTM F-679

e. Marking: The date of manufacture, class of pipe, specification designation, size of pipe, name or trademark of manufacturer, and identification of plant/location shall be legibly marked on the outside of each pipe section in accordance with the ASTM D-3034.

f. Certification: The Contractor shall upon request furnish the Town with manufacturer's certification stating that the pipe supplied meets or exceeds all requirements of the applicable ASTM standards and these Standards.

2. DUCTILE IRON PIPE

a. Material: Ductile Iron Pipe in diameters from eight (8) inches through thirty six (36) inches shall be centrifugally cast and shall conform to ANSI/AWWA A21.51/C-151 and ASTM A746, latest revision. The minimum pipe wall thickness shall be Thickness Class 51 or 52. Pipe shall be provided in minimum laying lengths of twenty (20) feet. The outside surface of the pipe and fittings shall be bituminous-coated complying with ANSI/AWWA A21.51/C151 and ANSI/AWWA A21.10/C110. The inside surface of all pipe, fittings and adapters shall be lined with factory applied Protecto 401 ceramic epoxy lining, or approved equal.

b. Fittings: Fittings shall be standardized for the type of pipe and joint specified and shall comply with ANSI A-21.10, AWWA C-110.

c. Joints: Mechanical joints, slip, or flanged joints shall be provided. Mechanical joints and accessories shall conform to AWWA Standard C-111, ANSI A-21.11. The bolts and nuts shall be corrosion resistant high strength alloy steel. The O-ring gaskets sealing the slip joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacturer of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater; and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to the requirements of AWWA C-111 (ANSI A-2111).

d. Weights and Marking: Weights of pipe fittings shall conform strictly to

the requirements of ANSI Specifications. The class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each joint of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each joint of pipe and each fitting after the exterior coating has hardened.

e. Certification: The Contractor shall upon request furnish the Town with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable ANSI Specifications and these Standards for each.

4.03 SANITARY SEWER FORCE MAINS

A. GENERAL

The Town of Cicero currently allows the use of the following pipe materials, meeting or exceeding the minimum requirements set forth herein, for the construction of sanitary sewer force mains:

Polyvinyl Chloride Pipe (PVC)
Ductile Iron Pipe (DIP)
High Density Polyethylene (HDPE)

The Town reserves the right to reduce material options on a project specific basis.

Each pipe segment shall be clearly marked per the requirement of the respective ASTM, AWWA and/or ANSI Standard.

B. ANCHORAGE

Force mains shall be anchored to resist thrusts that develop at bends, angles, tees, etc. in the force main pipe. The magnitude of the forces to be resisted shall be calculated and provided as part of the Engineer's design submittal. The required anchorage shall be attained by installing mechanically restrained pipe joints as indicated in the Town details. Anchorage design at force main fittings shall be based on pipeline pressures of at least 50 percent greater than the maximum pump design shut off head plus a water hammer allowance with an appropriate factor of safety.

C. AIR/VACUUM RELIEF VALVES

Sanitary sewer force mains shall be designed to avoid the need for air or vacuum release lines. If possible, force mains shall be designed without high points and with the top of the force main below the hydraulic grade line at the minimum

pumping rate so that relief valves will not be needed.

If high points in the force main cannot be eliminated, a combination air release valve or approved equal shall be installed at each significant high point where air could become trapped. The air release valve shall be installed in a manhole structure in accordance with the requirements of these Standards, and provisions shall be required for draining the structure. A high point shall be considered significant if it is 2 feet or more above the minimum hydraulic grade line, or, when pumping is intermittent, above the static head line.

D. FORCE MAIN MATERIALS

Each pipe material acceptable for force main construction is described in the following individual subsections for ease of discussion and revisions:

1. POLYVINYL CHLORIDE (PVC) FORCE MAIN

a. Pipes: PVC force main pipe shall conform to ASTM Specification D-2241, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDRPR). The material used shall conform to ASTM Specification D-1784, Standard Specification of Rigid Polyvinyl Chloride and Chlorinated Polyvinyl Chloride compounds, class 12454-B (PVC 1120). The minimum pressure class/SDR rating acceptable shall be Class 200/SDR 21.

The pipe fittings shall be pressure rated in accordance with recommendations of the Plastic Pipe Institute. Pressure class and standard dimension ratios (SDR) shall be as follows:

Class 200:	SDR 21
Class 250:	SDR 17
Class 315:	SDR 13.5

All plastic pipe and couplings shall bear identification markings in accordance with AWWA C-900-75, which shall include the National Sanitation Foundation (NSF) seal of approval. In addition, the plain end of each pipe length shall have two (2) rings, one (1) inch apart, painted around the pipe at the proper location to allow field checking of the correct setting depth of the pipe in the bell or coupling.

b. Joints: Joints shall be bell end or coupling push-on type. The push-on joint and joint components shall meet the requirements for ASTM Specification D-3139, Joint for the Plastic Pressure Pipe, using Flexible Elastomeric Seals. The joint shall be designed so as to provide for the thermal expansion and contraction experienced with a total temperature change of seventy-five (75) degrees F in each joint of pipe. Details of the joint design and assembly shall be in accordance with joint manufacturer's standard practice.

The lubricant shall have no deteriorating effects on the gasket or the pipe. The lubricant containers shall be labeled with manufacturer's name. Gaskets shall meet all applicable requirements of ANSI Standard A-21.11.

c. Fittings: Fittings shall be restrained joint D.I.M.J. fittings as identified in Part 2.b of this section.

d. Installation: The installation shall conform to the requirements of the manufacturer, the AWWA Standard and as indicated on the plans and specified herein.

e. Marking and Certification: Marking and certification requirements – see Section "Gravity Sanitary Sewer Materials", B.1.e. and f.

2. DUCTILE IRON FORCE MAIN PIPE

All provisions of Section 4.02 for Ductile Iron Pipe Gravity Sanitary Sewer shall be the minimum criteria for materials, specifications and installations of Ductile Iron Force Main Pipe. Section 4.02 is reiterated herein.

a. Material: Ductile Iron Pipe in diameters from eight (8) inches through thirty six (36) inches shall be centrifugally cast and shall conform to ANSI Specifications A21.51 and AWWA C-151, latest revision. Ductile Iron Pipe shall be Pressure Class 350 and provided in minimum laying lengths of eighteen (18) feet.

b. Fittings: Fittings shall be standardized for the type of pipe and joint specified and shall comply with ANSI A-21.10, AWWA C-110 or compact AWWA C-153 / ANSI A 21.53.

c. Joints: Mechanical joints, slip or flanged joints shall be provided. Mechanical joints and accessories shall conform to AWWA Standard C-111, ANSI A-21.11. The bolts and nuts shall be corrosive resistant high strength alloy steel.

Slip joints with rubber O-ring gaskets shall comply with AWWA Standard C-111 (ANSI A-2111). Flanged joints shall be manufactured with laying dimensions, facing and flanges detailed in accordance with AWWA Standard C-115 (ANSI A-21.15) Class 125.

Restraints shall be as manufactured by EBBA Iron Sales, Inc. or approved equal:

EBBA Iron Series		
Pipe Material	Joint Type	
	MJ	Pipe Bell
PVC	2000PV	1600, 2800
DIP	1100	1700

Bell joint ductile iron pipe may also utilize Field Lok 350 lock gaskets as manufactured by US Filter or approved equal.

d. Weights and Marking: Weights of pipe and fittings shall conform strictly to the requirements of ANSI Specifications. The class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each joint of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each joint of pipe and each fitting after the exterior coating has hardened.

e. Certification: The Contractor shall upon request furnish the Town with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable ANSI Specifications for each.

3. HIGH DENSITY POLYETHYLENE (HDPE) FORCE MAIN PIPE

a. Material: HDPE forcemain pipe shall conform to ASTM Specification D-3035. The material used shall conform to ASTM Specification D-3350, Class 345464E. The minimum pressure class/SDR rating acceptable shall be Class 160/SDR 11. The pipe shall be DIPS and shall have an interior diameter no less than the piping that it is connected to. The pipe fittings shall be pressure rated in accordance with recommendations of the Plastic Pipe Institute. Pressure class and standard dimension ratios (SDR) shall be as follows:

Class 200: DR 9

Class 160: DR 11

b. Joints: Joints shall be of a heat fusion joining system. Pipe and fittings shall be thermal butt fusion, saddle fusion, or socket fusion according to manufacturer recommended procedures. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall match the outside diameter and minimum wall thickness specifications of ASTM F-714 for the same size pipe. The manufacturer shall provide fusion training. The Contractor and the onsite joint inspector shall be trained by the manufacturer or manufacturer's authorized representative. The fusion equipment and operator shall be required to demonstrate successful field experience. Regarding fusion over 36" capability, the fusion unit shall be field tested for a

period of five years and the fusion operator shall have pipe size experience of the same size pipe on this project for five years or longer.

c. Fittings: All fitting shall be provided as indicated on the plans. HDPE Fittings shall be of the same material and class as the pipe and shall be manufactured by the manufacturer of the pipe. HDPE Elbows, tees, and wyes shall be manufactured by mitered fabrication. The manufacturer shall have a written specification for all standard mitered fittings, which establishes Quality Control criteria and tolerances. The manufacturer may be required to demonstrate its ability to produce product required by this specification. Mechanical joint anchor fittings (MJ Adapter or Harvey Adapter) shall be used to transition from ductile iron to HDPE and from HDPE to PVC. The fitting shall be stronger than the pipe in that when it is subjected to tensile stress the pipe will pull apart before the fitting will pull out and the pipe will blow before the fitting will rupture under pressure. The MJ Adapter shall have a pre-installed stainless steel stiffener, in accordance with Plastic Pipe Institute (PPI) recommendations, to neutralize point-loading, ACQ, creep and loss of gasket seal due to diameter contraction. The stiffener shall be engineered sufficiently thick to avoid redial buckling due to gasket pressure. The MJ Adapter requires longer bolts and shall be sold with the modified longer bolt kit to avoid construction crew delays or improper installation with too short bolts. All fittings for force mains or pressure rated fittings shall be rated according to the manufacturer's written specifications, and clearly labeled on the fittings as such.

d. Installation: The installation shall conform to the requirements of the manufacturer, the AWWA Standard, and as indicated on the plans and specified herein.

e. Marking and Certification: Each length of HDPE sanitary sewer shall be clearly marked with the Manufacturer's Name, Tradename or Trademark, Nominal pipe size, Pipe Stiffness, Production Code/Extrusion Code, Material Cell Class Designation and ASTM number. The pipe manufacturer shall provide certification that the stress regression testing has been performed on the specific product. The said certification shall include a stress live curve per ASTM D-2837. The stress regression testing shall have been performed in accordance with ASTM D-2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis of 1,600 psi as determined by ASTM D-2837. This certification shall also state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used and its source.

4.04 SANITARY SEWER MANHOLES

A. GENERAL

Sanitary sewer manholes shall be installed at the end of each line segment; at all changes in grade, size, materials and/or alignment; at all intersections; and at distances not greater than 400 feet for sewers less than fifteen (15) inches in diameter, 500 feet for sewers equal to or greater then fifteen (15) inches and less than thirty (30) inches in diameter, and 600 feet for sewers equal to or greater than thirty (30) inches in diameter.

Cleanouts shall not be substituted for manholes.

In unpaved/grassy areas manholes shall be designed and installed such that they extend a minimum of three (3) inches above finished lawn grade or one (1) inch above roadway surface grade to prevent water ponding. Positive drainage away from the manhole shall be provided.

B. TYPES OF MANHOLE CONSTRUCTION

The Town will accept/allow either Monolithic (Cast-in-Place) and/or Precast manholes conforming to the specifications herein.

C. MONOLITHIC (CAST-IN-PLACE) MANHOLES

Should a Contractor elect to build monolithic manholes, shop drawings showing at a minimum the concrete mix, steel reinforcement details, pipe connections and manhole dimensions shall be submitted to the Town for approval of each structure to be built. The shop drawings shall have been reviewed and certified by a Professional Engineer registered in the State of Indiana prior to submittal to the Town. Verification of pipe sizes and depths as well as grade shall be the Contractor's responsibility prior to manufacture of structures.

D. PRECAST MANHOLES

Precast reinforced concrete manholes including bases, risers/barrels, cones and flat slabs shall be constructed of either wet or dry cast Class A concrete meeting or exceeding the requirements of ASTM C-478, latest revision.

Precast reinforced concrete manholes shall be manufactured, tested and marked in accordance with ASTM C-478.

Precast manholes shall be constructed with the base and the first riser section as one complete precast unit.

Where used, precast manhole cones shall be the eccentric cone type.

No "see through" lift holes shall be allowed on precast concrete manholes 48 inches in diameter or less. All lift holes shall be thoroughly wetted and completely filled with non-shrink mortar or epoxy gout; then smoothed and covered, both inside and out, with a trowelable grade butyl rubber base backplaster material to ensure water tightness.

All joints between precast manhole elements shall be made with an approved rubber gasket in accordance with ASTM C-443, latest edition, and a 1/2-inch diameter non-asphaltic mastic (Kent Seal or approved equal) conforming to AASHTO M-198 and Federal Specifications SS-521-A.

All manhole sections shall be steam or heat-and-water-mist cured and shall not be installed until at least five (5) days after they are cast.

The CONTRACTOR shall field apply a butyl-rubber or approved asphaltic backplaster to the entire exterior surface of all sanitary manhole structures prior to backfill. Factory applied waterproof coatings may be accepted by the ENGINEER, but the CONTRACTOR shall physically seal the joints and any damaged coating areas following the placement of the structure with the butyl-rubber or approved asphaltic backplaster.

E. MANHOLE BASES, INVERTS AND FLOW CHANNELS/BENCH WALLS

Monolithic or precast manhole bases shall be of 6" minimum thickness for 4' diameter and 8" minimum thickness for larger diameters, and shall be constructed of Class A concrete having a minimum compressive strength of 4,000 psi, in accordance with ASTM C-478. All structures shall be designed for H_2O and backfill loadings with groundwater at the ground surface.

The bottom invert of all pipe entering a manhole shall be at least three (3) inches above the top of the base slab so that the finished sewer channel may be installed and shaped. The installation of the final sewer channel may be done at the point of fabrication of the precast base or cast-in-place.

The flow channels within manholes shall be an integral part of the precast base. The channels shall be shaped and formed for a clean transition with proper hydraulics to allow the smooth conveyance of flow through the manhole. The bench wall shall be formed to the crown of the inlet and outlet pipes to form a "U" shaped channel as shown in Details in these Standards. The bench wall shall slope back from the crown at minimum 1/2-inch per foot to the manhole wall.

For connections to existing manholes, flow channels shall be required and shaped as if it were a new manhole.

F. ADJUSTING RINGS

No brick or block shall be used in the construction of a manhole or to adjust the elevation of the frame and cover

Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the frame and cover shall only be accomplished by the use of precast concrete adjusting rings conforming to ASTM C-478.

Rings shall be of a nominal thickness of not less than four (4) inches and not more than twelve (12) inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to required elevation.

A watertight seal shall be provided between the cone and riser ring, each adjoining riser ring, and riser ring and casting by the use of two (2) rows of 1/2-inch extrudable preformed gasket material. Adjusting rings shall be manufactured with a keyway to prevent lateral movement.

As an alternative to adjusting rings, a cast-in-place section may be used.

G. CASTING, FRAME AND COVER

The type of frame and cover to be used shall be Neenah R-1712-B-SP, Model 1022-1AGSMD as manufactured by East Jordan Iron Works, or equal with machined bearing surface and Type F concealed pickhole.

All castings shall conform to the following requirements:

1. Casting shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion or other defects. They shall be smooth and well cleaned by shot blasting or other approved method.

2. Casting shall be imprinted with the words “SANITARY SEWER” on the lid of each sanitary sewer manhole. Minimum letter height shall be two (2) inches for words in the lids.

3. All casting lids shall be provided with watertight, concealed pickholes. Casting lids with open pickholes will not be accepted for any sanitary sewer manhole applications.

4. All sanitary sewer manhole casting frames and lids shall be provided with a “Self-Sealing” application.

H. EXTRUDABLE PREFORMED GASKET MATERIAL

A nominal 1/2-inch size butyl rubber base gasket material, conforming to AASHTO M-198 and Federal Specification SS-S-210A, shall be used for adjusting ring grooves; between adjusting ring and cone; between adjusting ring and casting; and in joint of precast manhole sections. The gasket material shall be as manufactured by Hamilton Kent-Seal, RUB'R-NEK-L-T-M by K.T. Snyder Company or an approved equal. A compatible primer or solvent as recommended by manufacturer of butyl base material shall be used to prepare surfaces prior to application of butyl base material.

I. TROWELABLE BUTYL RUBBER BACKPLASTER

Per Sanitary Manhole Details, the exterior of the manhole from two (2) inches below the bottom riser ring on the cone section to and covering the base of the casting, including the voids on the outside joints of the riser rings shall be sealed with a trowelable grade butyl rubber base exterior backplaster material, 1/4 inch minimum thickness when dry.

J. SPECIAL TYPES OF MANHOLES

1. Outside Drop Connection

No inside drop manhole connections shall be allowed for new sewer construction. Inside drop connections to existing manholes shall only be allowed upon written approval of the Town.

Where a sanitary sewer or sanitary sewer lateral enters a manhole 24 inches or more above the invert of the outgoing sewer, the incoming sewer shall be connected to the manhole by means of an outside drop connection. All new sanitary sewers requiring a drop connection shall be constructed with an outside drop connection per Drop Manhole Detail. Outside drop connections may be either precast or monolithically poured.

Base for Manhole with outside Drop Connection - The footing for the portion of the manhole under the drop shall be connected to the manhole base. A minimum of three (3) ½-inch diameter reinforcing rods shall be placed as dowels into the manhole base. These rods shall be tied to the reinforcements. The rods shall be tied to the reinforcement as specified in ACI Building Code Requirements. The rods shall be extended as the vertical part of the drop is constructed. In addition, the drop shall be tied into each joint of precast concrete manhole with a minimum 3/8 inch rod to prevent any separation of the drop from the precast manhole.

Detailed drawings shall be submitted for approval for all field fabricated drop connections.

2. Special Flood Protected Manholes

In areas susceptible to flooding, the top of the manhole shall be above the 100 year flood elevation. The Engineer shall identify the flood elevation on the plans and design the manhole to preclude the submergence of the manhole. No alternatives may be used without approval of the Town.

K. MANHOLE DIAMETERS

The following are minimum manhole diameters for sanitary sewers entering/exiting a manhole at the following range of angles:

MANHOLE DIAMETERS

Manhole Dia.	Sewer Dia.	Sewer Pipe Turns
48”	≤18”	Greater than 45°, up to 90°
48”	≤24”	Straight Through and up to 45°
60”	21”-33”	Greater than 45°, up to 90°
60”	27”-36”	Straight Through and up to 45°
72”	36”	Greater than 45°, up to 90°
72”	42”-48”	Straight Through and up to 45°
84”	42”	Greater than 45°, up to 90°
96”	48”	Greater than 45°, up to 90°
96”	54”	Straight Through and up to 45°
102”	72”	Straight Through and up to 45°

L. STEPS

Manhole steps shall be polypropylene, polypropylene coated steel reinforcing or approved non-corrosive fiberglass material. Copolymer polypropylene shall meet ASTM D-4101 reinforced with deformed 3/8” steel meeting ASTM A-615, grade 60. Steps shall be twelve (12) inches on center maximum.

M. SEWER PIPE TO MANHOLE CONNECTIONS

To connect a sanitary sewer to a manhole, either a flexible boot KOR-N-SEAL 1 or 2, flexible connector, cast-in-place Dura-Seal gasket, "A"-lock gasket or an approved equal shall be used. Connections to an existing manhole shall be a flexible boot KOR-N-SEAL or approved equal.

If the flexible boot connection is used, it shall be placed in the reinforced concrete manhole base and secured to the pipe by a stainless steel clamp. Flexible connectors shall conform to ASTM C-923.

The cast-in-place inflatable gasket shall conform to ASTM C-923.

All connections shall provide for a watertight seal between the pipe and manhole. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole.

The rubber for the connector shall comply with ASTM C-923 and shall be resistant to ozone, weather elements, chemicals, including acids and alkalis, animal and vegetable fats, oils and petroleum products.

The stainless steel elements of the connector shall be totally non-magnetic Series 304 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the responsibility of the Contractor to submit details of the proposed connection to the Town for approval. Connections not approved by the Town shall be subject to removal and replacement with an approved adapter.

N. REJECTION OF PRECAST MANHOLE SECTIONS

Precast reinforced concrete manholes, risers and tops shall be subject to rejection for failure to conform to any of the following specification requirements:

1. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint.
2. Defects that indicate imperfect proportioning, mixing and molding.
3. Surface defects indicating honeycombed or open texture.
4. Damaged ends, where such damage would prevent making a satisfactory joint.
5. Infiltration into manhole exceeding allowed limits.
6. The internal diameter of the manhole section shall not vary more than one (1) percent from the nominal diameter.
7. Not installed in conformance with Part 5.
8. Not clearly marked date of manufacturer, trade name, size designation part number, and ASTM number.
9. Having a deviation more than 1/4" from the straight edge at any point across the top of manhole cone section or riser ring.
10. Having any visible steel bars along inside or outside surface of the manhole except for reinforcement stirrups or spacers used to position the cage during manufacture.
11. Other defects deemed significant by the Town Representative.

4.05 BUILDING SEWERS

Building sewers shall be SDR 35, Schedule 80 PVC pipe conforming to ASTM D2241. Joints shall be flexible gasket push-on compression type assembled in accordance with the manufacturer's recommendations.

VITRIFIED CLAY PIPE (VCP) shall NOT be permitted for building sewer construction.

End of Section 4

Section 2: Wastewater Collection System

Part 5 - INSTALLATION

5.01 General

5.02 Workmanship

- A. Line and Grade
- B. Installation of Sanitary Sewers
- C. Point of Commencement and Direction of Laying
- D. Construction Bulkheads
- E. Laying Of Pipe In Cold Weather
- F. Abandoned Sewers

5.03 Dewatering and Control of Surface Water

5.04 Trenching

5.05 Bedding and Backfill - Sanitary Sewers

- A. Bedding - Sanitary Sewers
- B. Backfilling Sanitary Sewers

5.06 Trench Box Pulling and Sheeting

5.07 Sanitary Sewer Manholes Installation

- A. Preparation of Base
- B. Placement of Manhole Sections
- C. Pipe Connections to Manholes
- D. Backfilling of Manholes
- E. Placement of Adjusting Rings
- F. Manhole Waterproofing
- G. Connection for Future Sewers

5.08 Installation of Building Sewers (Laterals)

PART 5: INSTALLATION

5.01 GENERAL

The following Part addresses the minimum requirements for the installation of sanitary sewers discharging to the Town of Cicero collection system.

5.02 WORKMANSHIP

A. LINE AND GRADE

The Contractor shall furnish and set all line and grade stakes (HUB) and stakes for bench marks. The bench marks shall be set in strategic locations of the project in order to facilitate the Contractor's installation of the line and grade stakes (HUB) for each pipeline. Only the laser method shall be used to set the grade of the pipeline. The Contractor shall constantly check line and grade of the laser beam and the pipe.

B. INSTALLATION OF SANITARY SEWERS

Suitable tools and equipment shall be used for the safe and convenient handling and laying of pipe. Great care shall be taken to prevent pipe coatings or wrappings from being damaged. Lower pipe, fittings, and valves into the trench by hand, by means of hoists or ropes, or by other suitable tools or equipment that will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench. Carefully examine all pipe for cracks and other defects. No pipe or fittings shall be laid which are known to be defective. If pipe or fittings are discovered to be cracked, broken or defective after being laid, they shall be removed and replaced with sound material. Thoroughly clean all pipe and fittings before installation. All pipe and appurtenances should be kept clean until accepted as completed work.

C. POINT OF COMMENCEMENT AND DIRECTION OF LAYING

The point of commencement for laying of sewer pipe shall be the lowest point in the proposed sewer line. Lay the pipe with the bell end of bell and spigot pipe or with the receiving groove end of tongue and groove pipe pointing upgrade. Any other procedure shall be followed only with permission of the Town.

Lay each pipe on an even firm bed as specified so that no uneven strain will come to any part of the pipe. Particular care shall be exercised to prevent the pipes from bearing on the sockets. Dig all bell holes for bell and spigot pipe.

Completely shove home all pipe (to the assembly mark). On pipe of the tongue and groove type thirty (30) inches and larger in diameter, pressure must be

applied to the center of each pipe as it is laid by a winch and cable or other mechanical means. All connection fittings shall be sealed with a watertight stopper.

The Contractor shall extend the building wye lateral to the Right-of-Way line and shall place a one (1) inch cast iron locator rod or magnetic locator tape above the end of the pipe to within three (3) feet of the ground surface. The purpose is to provide for ease of location of the wye stub.

D. CONSTRUCTION BULKHEADS

Before extending a sanitary sewer, the Contractor shall provide a watertight bulkhead in the existing sewer immediately downstream of the point of connection. This bulkhead shall be left in place until the new sanitary sewer has been cleaned of all accumulated water and debris and accepted by the Town.

During all intermissions in construction of the sanitary sewer pipe, the open face of the last pipe laid shall be plugged, covered or bulkheaded so as to prevent sand, water, earth or other materials from entering the pipe.

Whenever pipe and special castings are required to be cut, the cutting shall be done by skilled workmen in such manner as to leave a smooth end at right angles to the axis of the pipe without damage to the pipe casting or cement lining. Cutting torches shall not be used.

E. LAYING OF PIPE IN COLD WEATHER

The Town reserves the right to order pipe installation discontinued whenever, in its opinion, there is danger of the quality of work being impaired because of cold weather. The Contractor shall be responsible for heating the pipe and jointing material so as to prevent freezing of joints. **Do not lay any pipe on frozen ground.** No flexible or semi-rigid pipe shall be laid when the air temperature is less than 32 degrees F unless proper precautions per the manufacturer's recommendations are taken by the Contractor and the method is approved by the Engineer and Town.

When pipes with rubber gaskets or resilient-type joints are to be laid in cold weather, sufficiently warm the gasket or joint material so as to facilitate making a proper joint.

F. ABANDONED SEWERS

Sewers and storm water drains which are to be abandoned shall be bulkheaded with mortar and an eight (8) inch thick brick wall. Sewers, storm water drains, and sewer structures which are to be abandoned in place shall be filled with sand or Cellular Concrete and plugged, unless otherwise indicated on the Plans.

Service shall be maintained in such sewers and drains until the Town shall order bulkheads placed. No timber bulkheads shall be allowed. All castings on such abandoned structures are the property of the Town and shall be salvaged by the Contractor and delivered as directed. Unless otherwise specified, all abandoned manholes, catch basins and inlets shall be removed to a depth of three (3) feet below the proposed or established grade or existing street grade, whichever is lower.

5.03 DEWATERING AND CONTROL OF SURFACE WATER

Where groundwater is encountered, the Contractor shall make every effort necessary to secure a dry trench bottom before laying pipe. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose, piping, wellpoints, etc., necessary to depress and maintain the groundwater level below the base of the excavation. If the Contractor is unable to remove the standing water in the trench, the Contractor, the Contracator shall over-excavate the proposed bottom grade of the sewer bedding, and place not less than three (3) inches of Class No. 2 crushed stone (Indiana Department of Highway aggregate Classification) in the over-excavated area.

The Contractor and/or Owner/Developer shall be liable for all lawsuits which may arise as a result of the Contractor's dewatering efforts.

The Contractor shall keep the site free of surface water at all times and shall install drainage ditches, dikes, pumps, and perform other work necessary to divert or remove rainfall and other accumulation of surface water from excavations. The diversion and removal of surface and/or groundwater shall be performed in a manner which will prevent the accumulation of water within the construction area.

Discharge of groundwater dewatering devices shall be treated to mitigate erosion and insure water quality.

UNDER NO CIRCUMSTANCES SHALL SURFACE WATER AND/OR GROUNDWATER BE DISCHARGED TO, DISPOSED OF OR ALLOWED TO FLOW INTO THE TOWN'S SANITARY SEWER SYSTEM.

5.04 TRENCHING

The width of the trench at and below the top of the sanitary sewer shall be only as wide as is necessary for proper installation and backfilling, and consistent with safety requirements. The minimum width of trench for sanitary sewers, including force mains, 42-inches in diameter and less shall be 1.25 times the outside diameter (O.D) plus 12-inches (See Sanitary Sewer Details):

Minimum Trench Width (inches) = 1.25 (O.E.) + 12

The design plans and specifications submitted to the Town for review, approval and issuance of a construction permit shall include a detailed trench drawing.

The design of the sewer pipe and structures is predicated upon the width of trench indicated above and, should these limits be exceeded, the Contractor shall be responsible for the provision and installation of such remedial measures as may be required by the Engineer and/or the Town.

Bell holes shall be excavated for bell and spigot pipe and mechanical joint pipe, so that the entire barrel of the pipe shall rest on the bedding.

The pipe trench shall not be excavated more than one hundred (100) feet in advance of pipe laying.

Whenever pipe trenches are excavated below the designed bedding bottom, the Contractor shall fill the over-excavation with mechanically compacted No. 8 (1/4-inch to 3/4-inch) crushed stone or No. 8 fractured face aggregate.

All rock, boulders and stones 6-inches in diameter and larger encountered in trenches shall be removed. Boulders or rocks are not to be used for trench backfill.

In cases where material is deposited along open trenches, the material shall be placed so that no damage will result to the work or adjacent property as a result of rain or other surface wash.

If the bottom of the trench is of undesirable material, an additional six (6) inches of trench bottom shall be excavated and filled with Class 2 crushed stone and compacted using a hand held mechanical tamper. Where the distance to stable ground is excessive, the Engineer shall order in writing other types of foundation as he deems necessary subject to the approval of the Town.

Remove any rock encountered within six (6) inches below the barrel surface of the pipe, replace with No. 8 crushed stone or No. 8 fractured face aggregate and compact.

5.05 BEDDING AND BACKFILL - SANITARY SEWERS

The following Part provides the minimum requirements for the bedding of pipe and the backfilling of the trench.

Sanitary Sewer Pipe Bedding Detail provides the bedding requirements for PVC, HDPE, and PVC Composite; and Ductile Iron.

A. BEDDING - SANITARY SEWERS

Bedding material shall be compacted No. 8 crushed stone or No. 8 fractured face aggregate and shall be placed in the trench bottom such that after the pipe has been placed thereon, imbedded to grade and aligned, there remains a 4-inch minimum depth of material below the pipe barrel and a minimum of 3-inches below the bell.

The bell holes shall be excavated so that the entire pipe barrel rests on the bedding. Pipes shall be bedded with No. 8 crushed stone or No. 8 fractured face aggregate shall be placed around the sides of the pipe up to the sides of the pipe to the springline (1/2 the Outside Diameter). This material shall be shovel sliced or otherwise carefully placed and "walked" or hand tamped in to ensure compaction of the haunch area and complete filling of all voids. From the springline to twelve (12) inches above the crown of the pipe, bedding shall be added in six (6) lifts "walked" in for compaction. Backfilling of the remainder of the trench shall be as specified in this Part.

B. BACKFILLING SANITARY SEWERS

1. Backfill Materials

The following materials shall be used to backfill the trenches in accordance with and in the manner indicated by the requirements specified herein:

Class I	Angular, six (6) to forty (40) millimeters (1/4 to 1-1/2 inch) graded stone such as crushed stone.
Class II	Coarse sands and gravels with maximum particle size forty (40) millimeters (1-1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.
Class III	Fine sand and clay gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil types GM GC, SM and SC are included in this class.
Class IV	Silt, silty clays and clays, including organic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding.

Backfill Around Pipe (Bedding): Bedding and backfill materials shall be agreed upon prior to construction by the Engineer and the Contractor.

Samples will be obtained and kept at the Engineer's office. No significant

deviation from this material will be permitted for use without authorization by the Engineer and the Town.

The term "Select Fill" shall mean the use of Class II or III backfill materials as described above.

The trench shall be backfilled per the following:

2. Areas Subject to Vehicular Traffic

In areas under proposed or existing paved roads or under or within five feet of pavement, sidewalks, curbs, gutters or similar structures, granular backfill material complying with the requirements of the Indiana Department of Transportation Standard Specifications shall be used.

The material shall be placed in uniform layers not exceeding six (6) inches, loose measurement. Within three (3) feet of the sanitary sewer pipe the backfill material shall be thoroughly and uniformly compacted with hand held mechanical tampers. The remaining backfill material shall be compacted with mechanical tampers. A minimum compaction of 95 percent Standard Proctor Density shall be achieved within the backfill material.

Jetting or flooding of the backfill or other alternative compaction methods and materials shall NOT be used without the approval of the Town or Indiana Department of Transportation, dependent upon jurisdictional authority.

3. Areas NOT Subject to Vehicular Traffic

In areas five (5) feet or more from the paved surfaces provided in 5.05, the trench shall be carefully backfilled with clean fill material free of rocks larger than 6-inches in diameter, frozen lumps of soil, wood or other extraneous material.

5.06 TRENCH BOX PULLING AND SHEETING

When required by the Occupational Safety and Health Act (OSHA) to protect life, property, or the work, sheet and brace all open cut trenches in accordance with CFR 1926 and any other applicable requirements. Upon completion of the work, all temporary forms, shores, and bracing shall be removed. All vacancies or voids left by the sheeting, while being withdrawn, shall be carefully filled with bedding material. The Contractor is completely and solely responsible for all trench and construction safety procedures and equipment.

The Contractor shall employ adequate safeguards to prevent movement of the pipe joint. If any movement should occur, the Contractor shall reinstall the pipe.

Any damage to pavement or other structures due to sheeting, shoring, or bracing shall be repaired by the Contractor at his own expense.

Sheeting and bracing which is to remain in place shall be cut off at the elevation of 1.5 feet above the top of the sewer pipe.

5.07 SANITARY SEWER MANHOLES INSTALLATION

Part 5.04 provides information regarding the design of manholes.

A. PREPARATION OF BASE

The bottom of the excavation/trench for the manhole shall be filled with a minimum of six (6) inches of No. 8 crushed stone mechanically compacted to form a stable base. Where poor or unstable soil conditions exist or over excavation has occurred, additional No. 2 crushed stone or Class B concrete shall be used to form a stable base.

B. PLACEMENT OF MANHOLE SECTIONS

Precast manhole sections shall be placed and aligned to provide vertical sides. The completed manhole shall be rigid, true to dimensions and watertight.

The joints between manhole sections shall be made with an approved rubber O-ring in accordance with ASTM C-443 and a 1/2-inch diameter non-asphaltic mastic (Kent Seal or equal) conforming to AASHTO M-198 and Federal Specifications SS-521-A.

C. PIPE CONNECTIONS TO MANHOLES

Connections to new or existing manholes shall be per Part 4.04. Connections to existing manholes shall require the installation of flow channels and bench walls per Part 4.04.

Where the Contractor connects to an existing manhole, that manhole shall be rehabilitated to current standards of the Town. This requirement shall include rehabilitating flow channel, as well as prescribed measures to reduce the amount of infiltration and inflow to required levels.

D. BACKFILLING OF MANHOLES

Manhole backfilling and compaction shall comply with the requirements as

specified for the adjacent sanitary sewer.

E. PLACEMENT OF ADJUSTING RINGS

Per Part 4.04, seal all joints; 1) between the casting and adjusting ring/chimney, 2) between adjusting rings with one (1) one half (1/2) inch diameter cord of extrudable preformed gasket material, and 3) between the adjusting rings and precast cone section with a minimum of two (2) one half (1/2) inch diameter cords of extrudable preformed gasket material. Between adjusting rings, the extrudable gasket material shall be placed in the keyways and be of sufficient quantity to completely fill the joint cavity.

F. MANHOLE WATERPROOFING

Per Part 4.04, the exterior of the manhole from the top of the adjusting rings to and covering the base of the structure, including the adjusting rings, shall be coated and the voids shall be filled with a trowelable grade butyl rubber base backplaster material.

G. CONNECTION FOR FUTURE SEWERS

All sewer structures shall be designed based on the future estimated growth. In areas where future residential or industrial growth can occur, manholes over fifteen (15) feet in depth shall be equipped with up to two (2) outside drop connections installed per Part 4. Future or unused connection pipes shall be bulkheaded with a watertight stopper.

5.08 INSTALLATION OF BUILDING SEWERS (LATERALS)

A connection permit issued by the Town shall be obtained prior to the installation of a building sewer.

Only materials listed in Part 4 shall be used for laterals

Lateral size shall be a minimum of six (6) inches in diameter and installed at a minimum slope of two (2) percent and shall meet the requirements per the latest edition of the Uniform Plumbing Code.

All building sewers shall have a cleanout located within three (3) feet of the exterior building wall and shall be installed per Sanitary Sewer Details.

Connections to new sanitary sewers shall only be made at the manufactured fitting. No saddle connections shall be allowed if a manufactured fitting exists based upon approved as-built plans. The point of commencement for laying of the building sewer pipe shall be at the connection to the main sewer and shall be laid with the bell end pointing upgrade.

Bedding per the specification of PVC flexible pipe shall be required.

Connections to sanitary manholes shall not be made without the written approval of the Town and only at terminating manholes for newly constructed sewers. Building sewers shall connect to the manhole, when approved, at an elevation of not more than 42 inches above the base of the manhole. No inside drop connections shall be allowed without written approval of the Town.

End of Part 5

Section 2: Wastewater Collection System

Part 6 - LIFT STATIONS

PART 6: LIFT STATIONS

6.01 GENERAL

This Part pertains to the requirements for the design and construction of submersible type lift stations, which are the primary type constructed as part of private development.

Any proposed alteration of the lift station dimensions, equipment, controls, etc. from the standards set forth herein will be approved only upon the submittal of plans and specifications of the proposed changes to the Town, and upon the Town's written approval.

Lift Stations, in general, shall be submersible type including a minimum of two (2) pumps and motors of minimum pumping capacity of 100 gpm (subject to Town and IDEM approval and sound engineering design) under site operating conditions, wet well, separate valve pit, valves, piping, hatches, guide rails, pump removal components, control center, float switches, remote monitor package, interconnecting electrical wiring, incoming power and radio alarm supply, and all other features regularly and normally required as a part of a complete and functional facility. All work shall be in accordance with site requirements, details in the Plans, these Standards and the manufacturer's recommendations.

All Lift Stations shall be designed for and operate on three (3) phase power. No deviation from this requirement shall be permitted without the express prior written approval of the Town. The Owner/Developer shall coordinate with the power utility and pay all costs to provide the three (3) phase power to the station.

6.02 GENERAL REQUIREMENTS

A. All of the mechanical and electrical equipment shall be an integral package supplied by the pump manufacturer with local representation so as to provide undivided responsibility. The package shall be equal in construction and performance to Hydromatic Pump equipment and other specific requirements set forth herein and in the approved plans.

B. The Contractor shall submit to the Town for review and approval five (5) sets of shop drawings, detailed specifications, pump warranty and performance characteristics for all of the equipment and fixtures to be furnished and installed. The Town will retain three (3) copies of each submittal. The Shop Drawings and equipment data shall be submitted with a cover letter or Contractor's stamp of approval, indicating that the data submitted has been reviewed, checked and approved. The Town will review the submittal and render a decision in writing as to the acceptability of the equipment. Without prior written Town approval, the item of work will not be accepted.

C. Any exceptions to this Standard or associated approved Plans shall be submitted in writing and clearly stated. The exceptions must be approved by the Engineer and the Town prior to proceeding with the work.

D. All components of the lift station that are exposed to weather and to open wastewater shall be constructed of material that is resistant to corrosion and will not require surface protection throughout the expected life of the lift station. In general, these materials are stainless steel, aluminum, fiberglass reinforced polyester (FRP) and ultraviolet stabilized PVC.

E. All valves and piping coming in contact with sewage or installed in the pump or valve chambers shall be coated with 14 mil coal tar epoxy.

6.03 OPERATING CONDITIONS

The characteristics and operating conditions of the lift station and pumps shall be provided in detail as part of the DESIGN ENGINEER'S design and submitted for approval to the Town.

Prior to installation the Contractor shall submit the following information for each pump to the Town for review and approval:

A. Pump capacity in gallons per minute;
B. Total dynamic head (TDH) and operating RPM;
C. Motor Horsepower;
D. Motor rpm;
E. Motor voltage, phase and cycle;
F. Make and model number;
G. Pump curves for the pumps to be provided; and
H. System lead calculations and curves

6.04 PUMPING EQUIPMENT

A. Pumps shall be of the submersible type for handling raw unscreened sewage. Pump volute, motor and seal housing are to be high quality gray cast iron. Impeller shall be either cast iron or cast bronze of a non-clog design capable of handling a minimum three (3) inch sphere solids, fibrous material, heavy sludge, and other matter found in normal sewage applications. The pump shall reserve a minimum service factor of 1.20. Impeller shall have pump out vanes on the front and back shroud of the impeller to keep pumped material away from the seal area and increase operating life. Impeller shall be either slip fit or taper fit with key to securely lock the impeller of the driving shaft. The pump volute shall be fit with a replaceable bronze wear ring to minimize wear on the impeller and help achieve longer balance operating life. All fasteners shall be of 300 series stainless steel.

The pump/motor shall be non-overloading throughout the entire performance range. The pump volute, motor, and seal housing shall be high-quality gray cast iron, ASTM A-48 Class 30.

B. All mating surfaces where watertight sealing is required shall be machined and fitted with Buna-N rubber O-rings. Sealing shall be accomplished when metal-to-metal contact is made, resulting in controlled compression of the rubber O-rings without requirement of a specific torque limit.

C. The pump shall be provided with a mechanical John Crane Type 21 rotating shaft seal system running in an oil reservoir having separate, constantly lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall consist of one (1) ceramic stationary seat and one (1) carbon rotating ring. The lower seal shall be removable without disassembling the seal chamber. The upper seal between the motor and the seal chamber shall be of the same design. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The shaft sealing system shall be capable of operating submerged to pressures equivalent to two hundred (200) feet. No seal damage shall result from operating the pump unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication.

The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor is to be connected to an alarm in the control panel to indicate lower seal failure.

D. The stator winding, rotor and bearings are to be mounted in a sealed submersible type housing. Insulation utilized in the stator windings shall be Class F with maximum temperature capability of 155 degrees Celsius. Motor housing shall be filled with a high dielectric oil NEMA B design to give superior heat transfer and allow the bearing to run in a clean, well lubricated environment or the housing shall be air filled with grease lubricated bearing. The pump and motor are to be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Stator shall be securely held in place with removable end ring and threaded fasteners so that it may be easily removed in the field without use of heat or press.

Shaft shall be of solid 303 stainless steel and supported by ball bearings. Motor shall be provided with heat sensing units attached to the motor windings which shall be connected to the control panel to shut down pump if overheating occurs. The controls shall re-energize the pump automatically in the pump sequence when the over-temperature condition is corrected. Bearings shall be designed for a B-10 life of 25,000 hours at the pump design point.

E. Pump motor cable and heat sensor/seal failure sensor cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend

permanently embossed on the cable. Power cables shall be STW-A, water resistant, 600 V, 60°C, UL and CSA approved. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Cable of the proper length shall be provided to eliminate need for splices or junction boxes between pump and "control center". The cable shall enter the motor through a cord cap assembly which is double sealed allowing disassembly and disconnect of the wires and the motor and still not damage the sealed characteristics of the motor housing. Each individual conductor shall be color coded in accordance with generally accepted industry standards. The color coding shall designate the application of the conductor.

F. The pump mounting base shall include adjustable guide rail supports and a discharge connection with a one hundred twenty-five (125) pound standard flange. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or approved equal.

G. A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly. Two (2) rails of minimum two (2) inch diameter Schedule 40, 309 stainless steel pipe or one rail of fiberglass reinforced plastic (FRP) I-Beam 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 guide rail support is required for each ten (10) feet of guide rail length for stainless steel pipe and one for each nine (9) feet of guide rail length for FRP I-Beam rail.

H. The pumps shall be equipped with sliding brackets or rail guides. To insure easy removal of the pumps, the rail guides attached to each pump shall not encircle the rails. A stainless steel lifting chain or alternate manufacturer's pump removal system subject to Town approval of adequate length for the basin depth shall be provided for each pump. Each pump shall be equipped with a permanent, stationary lifting handle with a minimum clearance of 12" between the top of pump and bottom of handle.

I. The rails and the rail guides shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable. The actual sealing of the discharge interface must be of the hydraulically sealing diaphragm type assembly with removable Buna-N diaphragm as supplied in Hydromatic Pumps Aurora Pump Co or approved equal.

J. Pump warranty shall be provided by pump manufacturer and shall warrant the units being supplied to the Owner/Developer against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units. A copy of the warranty statement shall be submitted with the approval drawings. All components of the lift station system shall be warranted and bonded for three (3) years after acceptance.

6.05 WET WELL, VALVE PIT AND ACCESSORIES

A. The basin and valve pit are to be constructed of precast concrete meeting the requirements of ASTM C-478. Cast-in-place monolithic structures may be substituted with the prior written approval of the Town. Minimum valve vault and wet well diameter shall be 6'-0". The actual arrangement of the structures are to be as shown in the approved Plans. The wet well basin top shall be provided with a four (4) inch PVC vent having a downward pointing inlet and stainless steel screen over the inlet opening. General layouts are given in Details 2-6 and 2-7 of these Standards. A three (3) inch diameter drain pipe shall be installed to the station wet well and shall include a red valve Tideflex check valve or approved equal.

B. The basin, valve pit, flat tops and base slabs are to be constructed of precast reinforced concrete manhole sections conforming to ASTM C-478. All joints between precast sections shall be made with an approved rubber O-Ring in accordance with ASTM C-443 and a ½-inch diameter non-asphaltic mastic conforming to AASHTO M-198 and Federal Specification SS-521-A. In addition, the outside wall below grade is to be coated with bituminous waterproofing material. The top and bottom of the chambers shall be precast or may be poured in place concrete if approved by the Engineer and the Town.

C. The wet well pump basin and the valve pit chamber shall be enclosed at grade level with a reinforced concrete pad rectangular in shape and extending a minimum of 1'-6" from the chambers outside dimension. The top elevation will be above surrounding grade to prevent surface water flows over the station.

D. The Lift Station shall be provided with an access drive to the nearest public right-of-way conforming to the minimum Town asphalt drive requirements.

E. The pump supplier shall provide aluminum door access hatch frame and door assemblies to be installed in the concrete basin top. The door assemblies shall provide access for removal of the pumps and shall support the guide rails. Door dimensions shall be large enough to accommodate the next largest pump model installation and removal. The doors shall be provided with lifting handle, safety latch to hold door in the open position and a hasp suitable for padlock. The doors shall have a nonskid finish and be designed for light, medium or heavy duty,

depending on the location of the pumping station. Doors shall be designed and rated for 150 lb/ft^2 loads.

F. An aluminum single door access hatch frame and door assembly similar to the one described above shall be provided for use as entry to the valve pit. Minimum opening for the valve box entry shall be thirty-six (36) inch by thirty-six (36) inch.

G. A swing check valve with external swing arm and an eccentric plug valve shall be installed in the valve pit in each pump's discharge piping. A minimum clearance of twelve (12) inches shall be allowed from the bottom of the valves to floor of the pit. A drain pipe and Tideflex (or approved equal) check valve shall be installed to drain the valve pit back to the wet well, but not allow the wet well liquid to enter the valve pit. In addition, emergency suction and discharge connections with camlock connectors for Town-operated stand-by pumps will be required.

6.06 DISCONNECT SWITCH

A. A single main fusible or breaker disconnect switch of adequate size to provide power for the "control center" and its related components shall be provided by the Contractor.

B. The disconnect switch shall be housed in a NEMA 4X 316 stainless steel enclosure with an external operation handle capable of being locked in the ON or OFF position.

6.07 CONTROL CENTER

A. The control center shall be built in a NEMA 4X, 316 stainless steel enclosure and shall be suitable for the specified horsepower and voltage for the pumping equipment. The outer door of the panel shall be a hinged dead front with provisions for a lockable hasp and a single-handle latching system. The enclosure shall have a minimum size of 36-inch x 42-inch x 11-inch and sized appropriately to house the programmable logic controller, back-up battery power supply, pump monitoring equipment and any other equipment or controls. The enclosure shall include a drip shield, and be of 14 gauge stainless steel (minimum), welded construction. The outer door of the panel shall be hinged dead front with provisions for locking with a padlock. Inside shall be a separate hinged panel to protect all electrical components. H-O-A switches, run lights, circuit breakers, etc. shall be mounted such that only the faces protrude through the inside swing panel and no wiring is connected to the back side of the inside swing panel. The panel doors shall include a 3-point, single latch locking system.

The control panel shall provide the following front panel mounted devices:

1. "Hand-Off-Automatic" switch for each pump (hand mode wired for manual operation).
2. "Pump Run" indicating light (green) fro each pump (labeled as Pump "x" Run) lit when pump is ON.
3. "Seal/Failure" indicating light (red) for each pump (labeled as such).
4. "Motor High Temperature" indicating light for each pump (labeled as such).
5. Accumulative type elapsed "Run Time" meter for each pump. The meters shall be a non-resettable type in one-tenth ($1/10^{th}$) hour increments up to 99999.9 hours before repeating. The meter shall be enclosed in a dust and moisture-proof molded plastic case.
6. "Test-Auto" test switch shall be mounted on the control enclosure dead panel for testing all alarm lights (labeled as such).
7. "Manual/Auto" switch for operation of each pump.
8. "Start/Stop" pushbuttons for manual operation.
9. "Manual/Auto" switch for pump sequence.
10. "Pump Manual Sequence Selection" switch for manual selection of pump sequence.
11. "Level Transducer/Backup Float Level Control Reset" switch.

All switches, indicating lights and pushbuttons mounted on the pump control panel shall have engraved plastic legend nameplates (black with white letters) – secured with screws – indicating its function.

An internal panel light, with switch shall be installed in the electrical enclosure.

B. A main breaker shall be provided for incoming power within the pump panel. A second main breaker shall be provided for emergency generator feed, and interlocked with the normal main breaker with a slide bar to allow for only one breaker "On" at a time.

A circuit breaker and magnetic starter with three (3) leg overload protection and manual reset shall be provided for each pump. Circuit breaker operators shall be accessible without opening the dead-front "operator's door".

Separate 20 amp branch breakers (minimum) shall be supplied, and, as follows: One for the control circuit, one for a duplex GFI receptacle (See requirements this section), one for condensate heater, one for telemetry, one for a site light (may be required with installation) and one spare.

The disconnect and overload functions shall be provided by a magnetic- hydraulic or thermal magnetic, ambient temperature compensated circuit breaker, calibrated and factory sealed with the proper trip setting. The devices shall have a minimum interrupting rating of 10,000 RMS symmetrical.

D. The control center shall incorporate connections for heat sensors which are installed in the pumps. The connection shall disconnect the starter upon high temperature signal and will automatically reconnect when condition has been corrected.

E. The control center shall incorporate connections for seal failure sensors which are installed in the pumps. The panel will have a seal failure alarm light for each pump. This alarm indicates failure of the lower mechanical seal in the pump. This will be an alarm light only and will not shut down the pump.

F. An externally mounted NEMA 4X red-flashing globe-type alarm light, with a lexan-type cover and wire shield shall be installed on the control panel and be visible from the road. The light shall be activated upon a high or low wet well level, seal/thermal alarm and normal power failure.

An externally mounted alarm horn shall be required to be mounted near the alarm light. A push to test horn and light button; as well as, a push to silence horn button shall be provided and mounted on the side of the enclosure.

All alarms shall be equipped with a battery back-up system with a minimum operational life of six (6) hours at full system load. All alarms shall be equipped with built in test capabilities and normally be powered by a 120 VAC circuit. All alarms shall automatically reset when alarm condition(s) has cleared. An adjustable 0-15 minute time delay relay shall be reactivated and timed-out prior to transmitting the high wet well level condition.

G. The control center shall include an adjustable thermostatic controlled 120V AC heater sized to maintain panel internal temperature of a minimum of 55° F and shall include a low temperature switch, set at 40° F within the enclosure to alarm failure of heater. The heater shall be placed so as not to damage any other component or wiring in the control center. The panel shall also include an appropriate air conditioning system if variable frequency drives (VFDs) are included.

H. The control center shall include lightning protection and a phase monitor relay to shut down the control circuit and protect the equipment due to loss of phase or phase reversal. Lightning and surge protection shall be Liebert, or approved equal, rated at 80K per node, at main breaker. The three phase sequence voltage relay shall be of the 8-pin connector type.

I. A 120 volt, 20 amp GFI receptacle with weatherproof enclosure shall also be installed on the outside of the control panel with an on/off switch inside the control panel.

J. A separate single main fusible or breaker disconnect switch of adequate size to

provide power for the 'Control Center' and its related components shall be provided by the Contractor.

The disconnect switch shall be housed in a NEMA 4X 316 stainless steel lockable enclosure with an external operation handle capable of being locked in the ON or OFF position.

K. The control center shall include terminal blocks for incoming power, pump power conductors, level sensors, float switches, leak detectors, motor thermal sensors, control wiring, flowmeter (where required) and telemetry.

L. The control center shall include a voltage transformer to reduce supply to 120 volt, single (1) phase to be used for all control functions and other functions as specified herein, except the float circuit and associated relays which shall be provided with 24 volt control voltage requiring an additional transformer.

The low volt power supply and interface system suitable for operation of the float switches shall be in an intrinsically (explosion proof) safe mode.

M. The control center shall be suitable for connection to include an "Omni Site" alarm package to function with the existing system. The main control must include the following interconnection capability:

Install unit within the pump control panel with adequate space for operation and access. CONTRACTOR shall confirm cell coverage with Town's typical provider.

Power to the unit shall be 120 Volts AC from the pump control panel. Provide automatic alarm notification on loss of AC power. Provide PLC outputs and interposing relays as necessary for remote monitoring via the alarm monitoring system.

Furnish all conduit and wiring as necessary. Wire all inputs and outputs to the system including the following:

<u>Discrete Inputs:</u>

1. Utility power fail
2. High wet well level (from PLC and from high level float switch and/or level transducer)
3. Pump #1 run status
4. Pump #1 failure
5. Pump #2 run status
6. Pump #2 failure

Pump operation on float switches (from float switch control circuit)
Backup battery failure alarm

Analog Inputs:

1. Wet well level (from level transmitter)

Provide full configuration of the lift station web site. Include the following information:

1. Individual pump runtime indication
2. Current station discharge flow rate
3. Current lift station wet well level
4. Total lift station discharge flow since last reset. The user shall be able to reset the flow counter through the web page.

N. A minimum four (4) inch PVC schedule 80 wall conduit shall be provided from the wet well basin to the control center which will allow the pump power cables, sensor cables and float switch cables to be pulled through without difficulty and allow the use of one (1) piece cables from the pumps and float switches to the control center. The conduit shall be sealed at the control center to avoid entrance of sewer gases into the control panel.

JUNCTION BOXES SHALL NOT BE USED.

O. The control center and associated components shall be mounted on a non-maintenance type pedestal or mounting stand constructed of aluminum or 316 stainless steel. The control center shall be located so as to provide safe access to the panel while wet well hatch doors are opened, and shall be positioned so as not to be between the access drive and the wet well.

P. All components of the control center shall be American made and available from local sources. In particular, items such as circuit breakers, overload protection, relays, etc. shall be available and in stock by local sources.

In order to maintain unit responsibility and warranty on the pumping equipment and control center, the control center must be accepted in writing by the pump manufacturer, as suitable for operation with the pumping equipment.

The control panel and various components of the pump station controller shall be UL listed.

Each electrical panel shall be wired as per the wiring schematic and labeled with wire markers. All internally mounted electrical components and terminal points shall be clearly labeled.

Q. An automatically resetting phase monitor shall be installed in the electrical enclosure. Status contact from the phase monitor shall be wired to the pump control panel. An electrical surge protection device shall be placed in the controls, for each pump control circuit.

R. A manual transfer switch in a NEMA 4X stainless steel, lockable enclosure with utility power connected to one side through the main disconnect shall be provided. A plug for the Town's portable generator in a lockable Nema 4X stainless steel panel should also be provided.

S. The equipment in the pump control panel shall be designed to operate on 24V DC. The automatic back-up battery power supply with charger shall be provided to allow operation of the PLC and telemetry equipment on loss of 120V AS power. The unit shall be sized to operate the controls for a period to be no shorter than six (6) continuous hours at full system load.

T. Motor starters shall be NEMA-rated magnetic type with a 120 volt control coil and three thermal overload relays for three phase and one for single phase services with a minimum size of NEMA 1. Where required by the Town, variable frequency drives (VFD's) shall be provided. VFD's shall be as manufactured by ABB Automation, Dan Foss, G.E. or approved equal.

U. Automatic pump operation, automatic pump lead-lag alteration and all control logic commands shall be carried out by the PLC. The PLC shall be Digital Control Corporation's Duplex Analog Pump Controller; model number 11928-5.

The PLC is composed of two circuit cards, the computer card and the display card. It includes the following functions:

1. Four relays for driving the high and low alarm, and the two pumps.
2. A 4-20 ma. current transmitter for wet well level output.
3. A power supply for system power.
4. A control panel for display and setpoint entry.
5. A MC68HC11 microcomputer.
6. An RS-232 serial interface for program loading and SCADA interface.
7. One 4-20 ma. analog input port for the external transducer.
8. Two contact inputs for pump disable signals.

The Pump Controller System has four relays which have the following functions:

1. Two for pump control. Each of these relays shall meet the following specifications:

Contact rating	15 amps at 125 VAC 10 amps at 250 VAC 70 amps inrush
Breakdown voltage	1,000 Volts RMS

Life 1,000,000 minimum cycles

2. One relay for high alarm. This alarm will close if a high alarm condition exists. This relay has the same specifications as the water pump relays above.
3. One relay for the low alarm output. This relay will close if a low alarm condition exists. This relay is a 10 amp 125 VAC standard form C relay.

The System has a 4-20 milliamp current loop output for transmitting wet well level. It is a non-isolated transmitter with a total compliance of 12 volts D.C.

The system shall have eight input pins for connection to external pump disable switches and float switches. Inputs signals shall be as follows:

1. Disable Pump 1
2. Disable Pump 2
3. High alarm float switch input
4. Lag float switch input
5. Lead float switch input
6. Pumps off float switch input
7. Low alarm float switch input
8. Disable floats input

PLC shall be designed to operate with an external 12 Volt transformer.

Input Voltage 12 VAC + 50% - 10%
Input Current 2 amps max

Input power shall be transient protected and current limited. Transient protection shall be a metal oxide varistor.

The PLC shall be controlled by a Motorola MC68HC711E9 microcontroller. All programs and setpoints are stored in non-volatile memory so that no information can be lost during a power loss.

The control module display card shall include all the controls and displays required to enter or check setpoints and monitor system status as well as a 40 segment LED bargraph to display wet well level.

Adjustable System Setpoints - The following setpoints shall be adjustable from the local operator interface:

1. Pump off level
2. Lead pump start level
3. Lag pump start level

4. High wet well level alarm
5. Low wet well level alarm
6. Current pump sequence – lead/lag

Pump fault logic shall be provided to sense discrepancy between pump required output being turned on and no pump run signal being received. System shall be configured to generate fault on any condition including motor overload, motor over temperature, seal failure or power disconnect.

Time delay on pump required outputs, initially set at 10 seconds and 20 seconds to prevent simultaneous pump restart on restoration of control power shall be provided.

When alarm conditions have cleared all alarms shall automatically reset. An adjustable 0-15 minute time delay relay shall be reactivated and timed-out prior to transmitting the high wet well level condition. All alarms shall be recorded and stored for future access and system evaluation.

6.08 LEVEL CONTROL

A. FLOAT SWITCHES

Sealed float type mercury switches shall be supplied to control sump level and alarm signal. The float shall be constructed of a durable ABS material that is leak proof, shock proof and impact resistant. The level sensors shall be rated for low volt operation at milliwatt levels. Floats shall operate at a maximum of 24 volt control voltage.

Floats shall be mercury-free type meeting the requirements for Class1, Division 1, Group C & D or “intrinsically safe” fro installation in an explosion hazard environment. Floats shall be manufactured by Anchor Scientific, Ind., Long Lake, MN or approved equal.

Each level sensor shall be furnished complete with sufficient cable length to run to the terminal box below the pump station controller and leave slack for future level adjustments. The support wire shall have a heavy Neoprene jacket and a weight shall be attached to the cord above the float to hold the float in place in the sump.

The CONTRACTOR shall furnish a stainless steel bracket mounted in the hatch opening for hanging the sensor cables and provide a stainless steel chain with anchors for connecting floats to chain.

Three position level sensor test switches (one for each float switches shall simulate liquid level “high” and “low” and shall be spring loaded to the “normal” position for normal operation).

Stainless steel, submersible level transducers may be required at the Town's discretion

B. SUBMERSIBLE LEVEL TRANSDUCERS

The level transducers shall be of the submersible hydrostatic pressure sensing type including the following features:

0.25% accuracy full scale with long term stability of 0.2% scale per year

-40 F to 185 F temperature range

9-30 VDC loop power excitation source.

4:20 mA output

316 stainless steel with flexible Teflon coated diaphragm

Heavy duty polyethylene cable with vent tube and shielded 18 AWG conductors

FM and CSA Intrinsically safe Class I, Div. I, Groups A, B, C, D

Transducers shall be supported on factory installed stainless steel chain and weights as shown on the plans.

The Contractor shall install the upper assembly where shown on the plans. The transducer controls and electronic components shall be housed within the pump control panel. The transducer, upper assembly, interconnection cable, and support pipe shall be provided as a complete unit as manufactured by KPSI Series 750 Submersible Level Transmitter or approved equal.

6.09 SYSTEM OPERATION

A. Pump Control:

1. The pump panel shall provide both manual and automatic control of the lift station pumps.
2. PLC operation of the pumps shall require the operation selector switch mounted on the Control Panel to be in the Automatic mode of control.
3. Manual operation of the lift station pumps shall be selected by the operator using the Pump 1 Manual / Auto Selection, Pump 2 Manual / Auto

Selection. Pumps must be placed into the manual mode of control before manual control of pumps is allowed.

a. Manual pump control shall be done using Pump 1, 2 Manual Start and Pump 1, 2 Manual Stop "pushbuttons" at the panel. Manual controls shall mimic 3-wire pump control, thus preventing restart of pump once shut off until the Start "pushbutton" is once again activated. Interlocks and alarms to manual pump operation shall be the same as those listed below for automatic pump control.

b. Program pump operation to allow "bumpless transfer" of operation when switching from manual mode of control to PLC automatic mode of control, or when switching from auto mode of control to manual mode of control.

1) Pump running in the manual mode of control shall remain running in the PLC auto mode of control until automatic control sequence turns pump off.
2) Pump not running in the manual mode of control shall remain off in the PLC auto mode of control until automatic control sequence turns pump on.
3) Pump running in the auto mode of control shall remain running in the manual mode of control until stopped by operator, or turned off by pump interlock.
4) Pump not running in the auto mode of control shall remain off in the manual mode of control until started by operator.

4. PLC automatic operation of the pumps shall be selected by the operator using the Pump 1 Manual / Auto Selection, Pump 2 Manual / Auto Selection. Pumps must be placed into the PLC automatic mode of control before automatic control of pumps is allowed. The operation sequence will be modified if VFD's are required.

a. Automatic starting and stopping:

1) Automatic Level Control of pumps shall require manual / automatic selection for a given pump to be placed in the automatic mode. Pumps in the manual mode of control shall be skipped in the pumping sequence.
2) The automatic control system shall utilize the level transducer (or float switches if transducer not required by the Town) setpoints to start and stop the pumps and alarm. Level setpoints shall be readily adjustable in the PLC.

b. Pump Sequence Control:

1) When the pumps are controlled in the automatic mode, pump sequence shall be controlled automatically by the PLC (automatic sequence control). The operator at the control panel shall make selection of manual or automatic pump sequencing using Pump Sequence Manual / Auto Selection.
2) In the Automatic mode Pump sequence shall be rotated through a predetermined sequence list on shutdown of lead pump. Sequence list shall be (lead pump to lag pump in sequence) 1-2, and 2-1. The backup pump can be changed via the operator interface.
3) In the Manual mode of operation, operator shall select sequence from list above via the control panel using Pump Manual Sequence Selection.
4) Failure or unavailability of pump due to placement in the manual mode of control or presence of an interlock preventing pump operation shall override pump sequence controls. Failed or unavailable pump shall automatically be skipped in sequence.

5. The following pump interlocks shall prevent operation of pump in both the automatic and manual modes of pump control. Pump shall be shutdown until automatically reset for high temperature failure. The pump will not be shut down for seal failure.

a. Pump winding high temperature.
b. Pump upper seal failure.
c. Pump fail to start.

In both manual and automatic control modes, only one pump shall be allowed to run at any one time to prevent hydraulically overloading the downstream sewer system. The panel and controls shall be setup to easily eliminate this restriction.

B. Provide pump backspin protection timers to prevent restart of pump after shutdown until timer has timed out. Timers shall be active in both the manual and automatic modes of control. Initial timer settings shall be 60 seconds.

C. Where level transducer is required by the Town, the backup floats shall be wired to energize and stage the pumps up and down when the PLC fails/level transducer fails and the High level float switch is made. Once the system is initiated, the panel will require personnel to manually select a switch to reset to the normal level transducer operation.

6.10 PUMP STARTUP AND TESTING

Lift station pump tests will be witnessed by the Town Engineer during final inspection. Tests at maximum speed, minimum speed, and varying speeds shall be conducted. Any costs associated with the test shall be the Contractor's responsibility.

Manufacturer's Start-Up

Prior to the Engineer's final inspection of the lift station equipment, the Contractor shall be responsible for coordinating start-up activities with the pump manufacturer's representative in accordance with the manufacturer's requirements. The Engineer's representative must be present at the time of manufacturer's start-up.

The manufacturer's representative shall completely inspect and certify the station's installation complete control panel, amp draw, and pump capacity tests at various VFD speeds (if applicable) shall be conducted by the Manufacturer's Representative. Written tabulation and acceptance of all findings shall be submitted through the Contractor for acceptance. Any deficiencies in equipment and/or workmanship noted during the manufacturer's start-up shall be remedied by the Contractor prior to final inspection.

Upon successful completion of the manufacturer's start-up, the manufacturer shall deliver to the Contractor:

A. Three (3) copies of the completed, witnessed inspection reports and certification with cover letter certifying that all pumping and electrical equipment has been installed and is operating in accordance with manufacturer's requirements.

The manufacturer's representative shall provide at least one (1) day on site to inspect and certify to the Engineer and Town that the installation is complete and in accordance with the specifications and all manufacturer's recommendations and ready for start up and operation. An additional trip and 1 day minimum shall be provided for proper training for Town personnel. The training session shall be provided on a separate day from start-up and shall be scheduled in advance with Town personnel.

6.11 OPERATION AND MAINTENANCE MANUALS

A. Four (4) operation and maintenance manuals shall be submitted to the Town.

B. Manuals shall include, at a minimum:

1. Operation instructions;
2. Maintenance instructions;
3. Recommended spare parts list;
4. Lubrication schedules;

5. Structural diagrams;
6. As-built wiring diagrams;
7. Bill of materials; and
8. Any field installation modifications made.

6.12 SPARE PARTS

A. The Contractor shall supply one set of spare parts for each pump model and size at each station, including at a minimum the following:

1. Impeller;
2. Upper seal assembly;
3. Lower seal assembly;
4. Upper bearing assembly;
5. Lower bearing assembly;
6. Wear rings; and
7. O-Rings and gaskets (two (2) sets).

6.13 NOTES TO DESIGN ENGINEER

A. SIZING OF WET WELL

1. The wet well storage below the lowest inlet shall be a minimum of 5'0" and shall also meet the following criteria:

a. Off level to be set at the pump manufacturer's recommended level but no less than 1'0" from the bottom of the wet well.
b. The distance between the off level and the lead pump on level shall be set to provide storage capacity at least equal to:

$$\frac{5 \times \text{RATED PUMP GPM}}{}$$ (i.e. 15 minute cycle minimum)

c. The lag pump on level shall be set a minimum of 6" above the lead pump on level and a minimum of 6" below the lowest inlet invert.
d. The high water alarm level shall be set a minimum of 6" above the lag pump on level and a minimum of 6" below the lowest inlet invert.
e. All level switches shall be set below the lowest inlet invert.

B. STATION WARRANTY

Station warranty shall be three (3) years from the date of acceptance per Town maintenance bond requirements.

End of Part 6