

CHAPTER 6

SEWER

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6.1 General Information

6.1.1 Purpose

This section provides guidance and minimum design criteria for the modification and construction of wastewater collection and treatment systems constructed within City public rights-of-way or easements. It is intended for general use in the planning, design, and plan preparation processes.

6.1.2 Abbreviations

- A. ADEQ - Arizona Department of Environmental Quality
- B. ADHS - Arizona Department of Health Services
- C. ANSI - American National Standards Institute
- D. ARS - Arizona Revised Statutes
- E. ASTM - American Society for Testing and Materials
- F. AWWA - American Water Works Association
- G. DIP - Ductile Iron Pipe
- H. EPA - Environmental Protection Agency
- I. gpcd - gallons per capita per day
- J. gpd - gallons per day
- K. gpm - gallons per minute
- L. POTW - Publicly Owned Treatment Work
- M. PUE - Public Utility Easement
- N. PVC - Polyvinyl Chloride
- O. MAG - Maricopa Association of Governments
- P. VCP - Vitrified Clay Pipe

6.1.3 Ordinance Requirements

- A. The City requires sewer lines to be installed along the entire length of property line frontage of the property to be developed whenever future extension of the line is possible. The property line frontage is that portion of the property along a public right-of-way. If a parcel to be developed has more than one property line frontage, the City will require a sewer line to be installed along all frontages.
- B. Upon development of property for which City water or sewer service is available, the Developer shall submit a plan, prepared by a Professional Engineer licensed in the State of Arizona, for the sewer system.
- C. The Developer shall install, at his or her expense, all on-site and off-site improvements necessary to serve the development. This includes payment of all required development fees.

- D. The City may require users who have a nonresidential discharge to monitor their discharges and obtain an Industrial Waste Discharge Permit. The permit may be obtained from the City's Community Development counter.
- E. For more specific information on ordinance requirements, review of the Goodyear Revised Code is recommended.

6.1.4 City Policies

- A. Sanitary sewers shall be designed to serve the ultimate population density expected in the tributary area. The design must be in conformance with the current City-approved Wastewater Master Plan, and as such, shall take future connections into consideration.
- B. Sewer lines shall not be privately owned if future connection to said sewer lines will be necessary to serve adjacent parcels.
- C. Private sewer lines shall meet Maricopa County Health Department and City Building Safety Department inspection requirements for approval. Privately owned and maintained sewer lines shall not be located within the street right-of-way or a PUE. On-site sewer collection systems within commercial shopping centers shall be designed as private systems.
- D. Private Sewer Companies
 - 1. Portions of Goodyear's municipal service area are provided sewer service by private sewer companies. Private companies are those defined by the A.R.S.
 - 2. Modifications or construction of sewage collection systems within private sewer company franchise areas shall be reviewed by the City and the subject company. The City shall also review private sewer systems within the City limits. Private sewer systems within the City shall meet current City standards. The applicable review fees shall be paid and a note placed on the drawings delineating operation and maintenance responsibilities. The City cannot provide sewer service within private sewer company franchise areas.
- E. EPA Regulation

The City is required by the U.S. EPA to develop and implement a program to control discharges that might harm the publicly owned treatment work (POTW). The program establishes local discharge

limits for non-residential users and provides for a permitting process based on user discharges and business types. Details of the program and requirements are found in the Goodyear Code of Ordinances. Specific information may be obtained by calling the Engineering Department at 623-882-3110.

6.1.5 Sewer System

- A. All developments are required to connect to the City's sewer system. Onsite disposal systems are not allowed. Exceptions are made only with the written approval of the City Engineer.
- B. The City's sewer system includes 6 classifications of sewer lines which are determined by use. These classifications are:
 - 1. Service Line - In plumbing, the extension from the building drain to the public sewer or other place of disposal; also called house connection.
 - 2. Lateral Sewer - A sewer that discharges into a branch or other sewer and has no other common sewer tributary to it.
 - 3. Branch Sewer - A sewer that receives wastewater from a relatively small area and discharges into a main sewer serving more than one branch sewer area.
 - 4. Submain Sewer - A sewer into which the wastewater from two or more lateral sewers is discharged, and which subsequently discharges into a main, trunk, or other collector.
 - 5. Main Sewer/Trunk Sewer - In larger systems, the principal sewer to which branch sewers and submains are tributary. In small systems, a sewer to which one or more branch sewers are tributary. In plumbing, the public sewer to which the house or building sewer is connected.
 - 6. Interceptor Sewer - A sewer that receives flow from a number of transverse sewers or outlets, and conducts such wastewaters to a point for treatment or disposal.
- C. All developments shall provide for trunk, main, and service lines as required to provide sewer service for not only the individual development, but for the ultimate service area, as deemed necessary by the City Engineer.

- D. Sewer lines shall be sized to accommodate their ultimate service area. Reference shall be made to the City's Wastewater Master Plan for the sizes and locations of sewer mains within the City. The minimum size line for a public main is 8-inch diameter.
- E. Public Sewage Lift Stations

The City Wastewater Master Plan has estimated wastewater generation from the entire City. Refer to this plan for information regarding the approved location for public sewage lift stations. Public lift stations in size and location other than those identified in the City Wastewater Master Plan will not be permitted.
- F. At a minimum, Preliminary and Final Wastewater Reports shall be prepared by a Civil Engineer registered to practice in the State of Arizona for each development within the City. The cost of said reports shall be the responsibility of the Developer. These reports shall be designed per the requirements of this manual and the City Wastewater Master Plan.
- G. Information provided in the City Wastewater Master Plan has been developed based upon the zoning land uses existing at the time of completion. If a proposed development changes the land use of an area in such a manner that it significantly impacts the functionality of the City Wastewater Master Plan, the Developer will be financially responsible to update the City Wastewater Model prior to obtaining permits for construction.
- H. ADHS Bulletin 11 shall apply to all City sewer lines.

6.2 Plan Preparation

6.2.1 Reports

A. Preliminary Wastewater Information

Preliminary information regarding the wastewater system for a development shall be provided for in all General Plan Amendment, Rezone, and PAD applications. The preliminary information provided within these documents shall at a minimum show and discuss the location and sizes of existing and proposed sewer mains within and adjacent to the site. The text shall also identify the wastewater treatment facility that will be accepting flows, and provide information regarding the current capacity of the facility and any scheduled CIP improvements or Developer-financed improvements to be constructed at the facility prior to construction of the proposed project. When a site is planned to be constructed in phases, a Master Wastewater Report shall be completed at

the time of rezone or PAD application, or at the time of preliminary plat or site plan submittal if the property does not go through the rezone / PAD process.

B. Master Wastewater Reports

A Master Water Report shall be developed for each project in which the project is to be designed and constructed in a phased succession. The Master Wastewater Report will provide a governing design by which all Preliminary and Final wastewater reports will be based for each phased portion of a development. A Master Wastewater Report shall be prepared in accordance with these Design Standards by a Registered Professional Engineer who is licensed to practice in the State of Arizona. The Master Report shall at a minimum address the following:

1. The Master Wastewater Report will become the basis for a Water and Wastewater Service Agreement between the Developer and the City of Goodyear when such agreement is required by the City. This agreement will specify terms and requirements for water and wastewater service to the development. The introduction to the report should include the above underlined sentence as a statement.
2. All development projects shall be responsible for determining their specific wastewater system needs. Services for proposed developments shall not be provided at the expense of existing customers. The Wastewater Master Plan shall state this in the introduction.
3. Adequate sewer line capacity shall be shown for the development. In addition, sewer system calculations or a sewer model shall be used to identify the size of on-site and off-site facilities such as sewer lines, and if necessary lift stations and force mains, required to serve the project. It is understood that plans are conceptual in this stage, and it is customary to show a general layout within a property rather than a detailed layout through a street system.
 - a. If no change in zoning is proposed, the wastewater system for the project must be analyzed to the point of discharge to an existing sewer which has been identified in the Wastewater Master Plan as having sufficient capacity to serve the project.
 - b. If a property is desired to be rezoned, or a PAD is sought which would result in increased line sizes within or

- downstream of the property or would otherwise significantly alter the sewer main alignments as shown in the City's current Wastewater Master Plan, a Master Report shall be prepared and shall provide all text, calculations, and other documentation appropriate to support the proposed changes, as required by the City Engineering Department.
- c. Changes in land use sought for in a property, in conjunction with a rezone or PAD application, that significantly modify the density or developable area from what is identified in the current City Wastewater Master Plan, will require an update to the City Master Wastewater Model as determined by the City Engineering department. The Developer will be financially responsible to update the City Wastewater Master Model and / or Wastewater Master Plan prior to obtaining construction permits.
 - d. Calculations should be based on Manning's equations using a Manning's "n" of 0.013, as well as the invert elevations and pipe diameters of all existing and proposed pipes.
 - e. Wastewater flows generated within the development shall be calculated as specified in the Design Flows section of this chapter.
 - f. Off-site calculations shall be based on a sewer sub-basin which shall be shown on an accompanying map. The sub-basin shall include all areas upstream of the development and downstream of the development to the next interceptor sewer. An interceptor sewer shall be defined as 15-inch diameter or larger. Refer to the City Wastewater Master Plan for the identification of areas which will impact the capacity of lines within the development being designed.
 - g. Off-site wastewater flows shall be as specified in the City's current Wastewater Master Plan unless newer information is provided to the City.
 - h. A computer disk containing all calculations shall be submitted along with the Master Plan Report. Common spreadsheet formats compatible with Microsoft Excel are acceptable.

4. Compliance with the current City Wastewater Master Plan for the respective area:
 - a. Each Master Plan must include a map showing the following:
 - (1). All proposed on-site and off-site facilities; these include but are not limited to interceptors, sewer lift stations, and force mains.
 - (2). Proposed street locations, parcel boundaries, and proposed lots within each parcel.
 - (3). Contour lines at 2-foot intervals showing the elevation of the land surface shall be provided. If drainage requirements will require extensive grading, then finished grades should also be shown. Sufficient information must be provided to evaluate pipe cover.
 - b. A separate area location map shall be provided showing existing and proposed streets, as well as existing parcels surrounding the project to a distance of not less than 1 mile from the exterior boundaries of the project. The County Assessor's maps can provide the information required to prepare these composite maps.
 - c. The scale of all maps must be sufficient to show all required information clearly.
5. When a Preliminary or Final Report is submitted for a portion of a development that has a Master Report, and the Preliminary or Final report significantly changes the design or layout of the system, the Master Report will be required to be revised at the expense of the Developer requesting the change prior to approval of the preliminary or final report.

C. Preliminary Wastewater Reports

1. A Preliminary or Final Report shall be provided along with every site plan or preliminary plat application.
2. When a Master Wastewater Report has previously been approved by the City for an overall development, the Preliminary Wastewater Report should follow the Master Report as closely as possible.

3. The Preliminary Wastewater Report shall follow the same development protocol as identified in the Master Wastewater Report section of this chapter with the following exceptions:
 - a. The Preliminary Wastewater Report shall provide a more detailed layout of the wastewater system than is typically provided with the Master Report. Where applicable, additional detail regarding the system shall be provided as well.
 - b. The Preliminary Wastewater Report will not be the basis of a Water Services Agreement.

D. Final Wastewater Reports

1. A Final Wastewater Report shall be required at the time of construction plan submittal. The Final Wastewater Report shall closely follow the approved Wastewater Master Report (if applicable) and approved Preliminary Wastewater Report. The Final Wastewater Report shall be developed as follows:
 - a. The objective of the Final Wastewater Report is to provide a document that finalizes the wastewater system design for a development according to all applicable comments and changes made during the site plan / preliminary plat and construction plan reviews processes.
 - b. The Final Wastewater Report must show compliance with the Goodyear Code of Ordinances regarding the construction of sewer lines within City right-of-way as identified in the City's Wastewater Master Plan and this document.
2. A construction schedule shall be included in table format for all wastewater-related construction required to serve the development, per signed zoning or other agreements.

6.2.2 Site Plans and Preliminary Plats

- A. All site plans and preliminary plats shall provide a full-sized (24-inch x 36-inch) exhibit that shows and labels the following:
 1. All existing wastewater lines, line sizes, and line material types. Lift stations and associated force mains shall also be shown and labeled. It is encouraged that a separate plan sheet be provided to show all of the public wet utilities. Existing

information shall be shown in dashed screened black line types.

2. All proposed improvements such as wastewater lines, lift stations, and force main lines shall be shown in dark lines.
3. The service provider for the area.
4. All existing and proposed wastewater line easements.

6.2.3 Construction Plan Requirements

A. Reviews and Approvals

1. All improvement plans which include work within the City shall be submitted for review and approval by City Staff. Plan review submittals are made to the Engineering Department.
2. Maricopa County Department of Environmental Services approval is required prior to City approval.

B. Review Guidelines

No permits for public sewer installation will be issued until the Owner / Developer has provided the necessary easements and rights-of-way. The instruments of dedication must be approved by the City and recorded at the Maricopa County Recorder's Office. The following paragraphs highlight construction plan requirements pertaining to the preparation of sewer improvement plans which are to be submitted to the City for approval:

1. Plans shall be prepared per the guidelines in Chapter 2 of this manual.
2. General Construction Notes and Sewer Construction Notes which apply to construction of the City of Goodyear's sewer system are required on each set of construction plans which include work on the City's sewer system or a sewer system which is to be dedicated to the City. These notes are provided in Chapter 1 of this manual.
3. Sewer line stationing shall be along the pipe, monument, or roadway centerline.
4. Concrete encasement shall be shown in both plan and profile. The beginning and ending stations of the encasement shall be called out.

5. If a line is to be connected to an existing system, the following note shall be placed on the plans: “Contractor shall verify the location of the existing sewer line before proceeding with trenching.”
6. Both slope and elevation shall be shown on all proposed sewer main stubs. A profile is required for lines larger than 12 inches.
7. Where sewer lines cross water lines, storm drains, reclaimed water lines or drainage culverts, the relationship shall be shown in both plan and profile and actual separations shall be called out.
8. For permitting purposes, quantities for all items of work within public rights-of-way and public easements shall be included on the cover sheet of the plans.
9. Sewer line invert elevations shall be called out for all plans showing sewer line construction.
10. The drawings shall show all utility locations, sizes, material types, easements, rights-of-way, and other structural features of the sewer for current and future building construction.
11. Lift station details shall show all invert elevations, structural elevations, existing and finished grades, control setting elevations, structural design of wet wells and dry wells, valves and piping, surge control devices, pump suction, discharge details, and any other details which will provide a clear understanding of the design.
12. Plans and profiles of force mains shall show size, invert and grade elevations, materials of construction, utility location, and any other details which define the force main construction requirements.
13. Private sewer lines shall be noted as such on plans. The responsibility for operation and maintenance should also be called out.
14. Easements of record shall be noted and shown in plan view, including docket and page numbers and / or the Maricopa County Recorder’s number.
15. All plan documents for sewers and / or wastewater treatment works shall be prepared by a Registered Professional Engineer

licensed in the State of Arizona under the provisions of A.R.S. 32:141-145.

16. There are additional requirements for the preparation of improvement plans in the City. The additional requirements are presented in Section 2.1 of this manual.

6.2.4 As-Built Drawings

A City-approved set of as-built drawings are required for all sewer system improvements constructed in the City prior to acceptance of the system and start of the 2-year warranty period. As-built plans shall be signed and sealed by a qualified professional registered in the State of Arizona. See Chapter 10 of this manual for applicable As-Built standards.

6.3 Technical Design Requirements

6.3.1 Sewer Lines

A. Materials and Details

In selecting pipe material for sewers, consideration shall be given to the chemical characteristics of the wastewater (especially in industrial waste flow areas), the possibility of septicity, exclusion of infiltration, external and internal pressures, abrasion, and similar problems encountered with the established grades.

1. Approved DIP, PVC, or VCP may be used for main lines and service lines, between 4 and 15 inches. DIP and VCP may be used for 15- to 24-inch sewer lines in the rights-of-way. Materials and details for trunk sewer mains of 24-inch diameter or larger will be reviewed on a case-by-case basis.
2. No public sewers other than service lines shall be less than 8 inches in diameter unless permission is received in writing from the City Engineering Department.
3. Pipe material shall not change between manholes.
4. Where standard-strength pipe is not structurally sufficient, or when sufficient cover cannot be maintained, additional strength must be obtained by using higher class pipe, special bedding specifications, and / or special construction methods.

5. All types of pipe materials used in design shall have established ASTM, ANSI, or NSF standards of manufacture or seals of approval, and shall be designated for use as sewer pipe.
6. Pavement replacement type and compaction type shall be indicated per City Standard Details, this manual, and MAG standards, and shall be identified on each sheet.

B. Hydraulic Design

1. For sewer lines 10 inches in diameter and smaller, slopes shall be sufficient to maintain a velocity of 2 fps; for sewer mains larger than 10 inches in diameter, slopes shall be sufficient to maintain a velocity of 2.5 fps. These calculations are to be based upon Manning's Formula, using an "n" value of 0.013. To prevent abrasion and erosion of the pipe material, the maximum velocity shall not exceed 9 fps for lines 10 inches and smaller, and 10 fps for pipes larger than 10 inches.
2. Hydrogen sulfide problems must be analyzed in the Design Report and be provided for in the design of the system where required.
3. All velocities should be analyzed under peak flow conditions.
4. The following table indicates the minimum and maximum slopes generally considered necessary to obtain desired velocities. Exceptions require the written approval of the City Engineer:

TABLE 6.3-1 - Slopes for Sanitary Sewers (n = 0.013)

Pipe Size (inches)	Minimum Slope <i>2.0 fps</i> (ft/ft)	Maximum Slope <i>9.0 fps</i> (ft/ft)
4	0.0084	0.1703
6	0.0049	0.0992
8	0.0033	0.0676
10	0.0025	0.0502
12	0.0019	0.0394
15	0.0014	0.0292
18	0.0011	0.0229
24	0.00077	0.0156

C. Location within the Right-of-Way

1. All public sanitary sewer lines shall be located within a street right-of way or easement dedicated to the City.
2. Sewer lines shall be located per City Standard Details.
3. Sewer lines in arterial and collector roads shall be located on the street side as shown in the City standard details. Sewer lines in local residential streets shall typically not cross street centerline, unless approved by the City Engineering Department.
4. Centerline of the sewer line shall not be closer than 5 feet to the lip of gutter.
5. The center of manhole shall be located at least 3 feet from the street centerline.
6. All sewer lines shall be aligned parallel to the property lines or the street centerlines, or as close to parallel as possible.

7. Sewer mains shall not be located within a street median unless otherwise approved by the City Engineering Department.

D. Easement Requirements

1. No sewer line shall be installed in an easement unless the Engineering department has approved the placement of the line in an easement and the property owner has dedicated the necessary easements and rights-of-way.
2. If approved, sewer lines outside of public rights-of-way shall be placed in easements not less than 20 feet wide. A 30-foot wide easement is required for lines larger than 8 inches and deeper than 10 feet; for pipes with diameters greater than 20 inches the Developer shall contact the City Engineering department to determine required easement width. Sewer lines shall be accessible from a public right-of-way or other accessible public easement at all times.
3. Easements larger than 20 feet in width may be required if other utilities are also co-located in the easement or if additional area is needed for maintenance and equipment access due to the size and/or depth of the lines.
4. Easements shall be free of obstructions, shall not be located in a fenced area, and shall at all times be accessible to City service equipment such as trucks, backhoes, etc.
5. Easements shall be dedicated prior to obtaining any sewer construction permit.

E. Pipe Locations and Separations

1. Service Lateral Locations

Service lines shall not be located under driveways or driveway wings with the following exceptions:

- a. A service line may be located beneath a driveway wing of a residential lot, if the narrowness of the lot does not permit an alternative location.
- b. The engineering plans shall contain the following statement: "If a sewer service falls under a driveway during the construction of a home, it shall be relocated or a MAG 440-2 cleanout shall be installed at the outside PUE line, at the City's discretion".

2. Separation of Water and Sewer Lines

Caution should be taken in the design and construction of sewer lines to protect all water supplies from wastewater contamination. To minimize the potential of contamination, the Engineer shall design the horizontal and vertical separation of water and sewer lines in accordance with MAG Standard Specifications and City Standard Details.

3. Separation from Gas Lines

The minimum horizontal distance from a sewer line to a gas line shall be 6 feet, from nearest edge to nearest edge.

4. Separation from Storm Drains and Culverts

a. Sewer lines crossing less than two feet below a storm drain or culvert, or under large structures such as box culverts and bridges, shall require additional protection such as the use of DIP or encasement.

b. Sewers crossing over storm drains and culverts must be a minimum of one foot above, as measured from nearest edge to nearest edge.

F. Cover and Depth

1. All private service lines shall have a minimum of 4 feet of cover, as measured from finished ground at the property line or easement line. In no case shall a sewer service line be installed with less than 4 feet of cover over the top of the pipe. Refer to the City Standard Details.

2. All sewer trunks, mains, or branches shall be designed and constructed at a sufficient depth to serve the ultimate drainage area. A minimum cover of 6 feet, as measured from finished grade to the top of the sewer line, shall be maintained for all public sewer lines.

3. When a sewer line passes under an irrigation ditch, at least 4 feet of cover between the flow line of the ditch and the crown of the sewer shall be maintained. If this condition cannot be met, the crossing shall be made according to the directions of the City Engineer.

4. Where cover is less than three feet due to topography (e.g. canals, washes, etc.), a 6-inch thick concrete cap shall be

constructed in-place over the sewer line. This cap shall extend not less than two feet on either side of the sewer pipe, and shall extend not less than 5 feet beyond the limits of the canal, wash, etc. This is allowed only with the written approval of the City Engineer.

5. All sewer lines that extend across designated floodways shall be installed with ductile iron pipe material with 401 protector and shall be constructed 2-feet below the 100-year scour limit as described in the Arizona Administrative Code Title 18, Chapter 9, Subsection (D)(2)(c).
6. Sewer lines constructed in designated floodways shall have their crowns at least 2 feet below the 100-year storm scour depth and shall be constructed with DIP. The DIP shall extend a minimum of 10 feet each side of the 100-year storm scouring area.
7. Sewers shall be installed at a depth sufficient to ensure gravity drainage of wastes from each service. Sewer design shall ensure adequate drainage from the ultimate drainage area, and shall allow for the future extension of service to adjacent parcels.
8. All sewers shall be designed to absorb superimposed live loads and backfill overburden without damage to the pipe material, and without adversely affecting the hydraulic characteristics of the pipe. The Engineer shall specify minimum depths of cover to be provided during the construction of roadways or other facilities affecting cover over the sewer line.

G. Intersecting Lines

1. When the diameter of a sewer line changes within a manhole, the inside crown elevations of the two pipes shall match.
2. Manholes with the through-line having a change in direction greater than 30 degrees shall have a minimum 0.10-foot drop through the manhole.
3. For manholes with a line intersecting the through-line, the intersection line invert shall be 0.10 feet above the flow line of the through-line. The sewer lines shall intersect at no greater than a 90 degree angle.

H. Curved Sewers

Horizontal curvilinear sewers will not be accepted.

I. Tie-in to Existing System

Construction plans shall call for the Contractor to tie-in new work to the existing, active system only after completion of the new work, and with specific approval of the Engineering Inspector to make the tie-in.

J. Design Flows

Domestic sewage systems shall be designed in accordance with the following:

1. Sewer lines 8 to 12 inches in diameter:
 - a. Shall be designed with peak capacities of not less than 1000 gpcd when flowing full.
2. Sewer mains larger than 12 inches in diameter:
 - a. Shall be designed using the criteria identified in the City's Wastewater Master Plan. The current master plan can be downloaded from the City's Engineering website.
 - b. The Maximum Day wastewater generation rate used to determine line size capacities shall equal 2.89 times the Average Day generation rate.
 - c. Table 6.3-1 below lists the wastewater generation rates identified in the current Master Plan. Refer to the Master Plan for additional information regarding the implementation and use of these generation rates.

TABLE 6.3-2 – Average Day Wastewater Generation Rates

Land Use	WW Generation (gpdu)	WW Generation (gpad)
Agricultural Preservation - 1 DU per acre	176	
Residential < 2 DU per acre	160	
Residential - 2 to 4 DU per acre	144	
Residential - 4 to 6 DU per acre	129	
Residential - 6 to 10 DU per acre	128	
Residential - 10 to 20 DU per acre	124	
Residential - 20+ DU per acre	110	
Community Commercial		951
Regional Commercial		1,087
Luke-Compatible Land Use		1,087
City Center		5,776
Ball Park Village		3,851
Light Industrial		815
General Industrial		1,087
Public / Quasi Public		1,019
Prison		1,699
Airport		170

Generation Rates per City’s Wastewater Master Plan,
Black & Veatch, June 2008

6.3.2 Manholes

A. Materials and Details

All manholes shall be 5 feet in diameter and per MAG Standard Details and Specifications. Manhole frames and covers shall be Class 35, and their weights and dimensions shall be in accordance with details shown in MAG Standard Detail 424. Manholes used in the City wastewater system will not contain built-in steps. The interior of all manholes shall be coated with a City-approved corrosion resistant coating. See the City Approved Materials List for Wastewater.

1. All manholes and rings shall be constructed of concrete as specified by MAG; brick substitutes will not be permitted.
2. Reinforced concrete adjusting rings shall have a total height of no more than 18 inches but no less than 6 inches.
3. Sewer manholes shall be tested per ASTM C-1244-93 as per the ARS R18-9-E301.D.3.f.ii.
4. The flow channel through the manhole shall be steel-trowel finished to conform in shape and slope to that of the sewer lines. The manhole shelf shall be brush or broom finished, with a slope of one inch per foot. The manhole bottom should be filleted to prevent solid depositions, and channeled to ensure satisfactory flow to the lower invert.
5. Manholes should be protected from storm drainage and flooding conditions whenever possible. Sewers shall typically not be allowed in washes or drainage areas where avoidable.
6. If a design specifies that manholes shall be located in a wash or drainage area, bolted water-tight manhole covers or water-tight manhole inserts shall be used to prevent inflow. The manhole shall be a monolithically-poured structure, designed such that infiltration or exfiltration cannot occur. Providing for the elimination of infiltration and/or exfiltration in washes is the Engineer's responsibility in the design of the system.

B. Spacing

1. Manholes are required at all changes in grade or pipe size, at all changes in alignment, and at locations necessary to ensure the sewer line does not cross the street centerline. The

horizontal angle formed between the two lines shall not be less than 90 degrees in the direction of flow.

2. Maximum manhole spacing shall be:
 - a. 400 feet for 8-inch to 15-inch sewer lines.
 - b. 500 feet for all sewer lines 18 inches or greater.
3. Manholes in City streets must be located near the center of a traffic lane, rather than on or near the line separating traffic lanes. Manholes should not be located in bike trails, equestrian trails, sidewalks, or crosswalks.
4. Cleanouts are not allowed in the City of Goodyear public right-of-way or dedicated easement. If there are services between the last manhole and the end of the line, a manhole shall be required at the end of the line.
5. Manholes on boundaries of the subdivision or improvement district shall have stubs with shaped inverts in appropriate directions for future connections.
6. Centerline stations and offsets shall be shown on all manholes.
7. A sewer manhole shall be required at the upstream end of a cul-de-sac. All manholes shall be located in such a manner as to provide easy access for the City's cleaning equipment.

C. Intersecting Lines Within Manholes

1. Manholes with lines intersecting at angles more than 30 degrees shall have a minimum 0.10-foot drop across the manhole.
2. When sewer lines of differing sizes enter the same manhole, the crown of the downstream pipe shall be lower than the crown of the upstream pipe.
3. In large trunk lines, inverts at junctions should be designed to maintain the energy gradient across the junction and prevent backflow.

D. Drop Manholes

Manholes with drop connections that are less than 2.5 feet shall not have a difference of manhole inflow and outflow invert elevations

that is greater than 12 inches. All drop connections greater than 2.5 feet shall be per MAG Standard Detail, No. 426.

MAG Type “A” drop sewer connections shall have a poured invert as required for Type “B” installations.

E. Monitoring Manholes

1. The City shall determine whether or not a sewer service will be required to have a monitoring manhole to test the flow and composition of their sewage. As a general rule, sewer users with a projected water consumption of 25,000 gpd or greater, sewer discharges of a categorical industrial nature, or other situations as deemed necessary by the City’s Public Works Department, shall be required to have a monitoring manhole.
2. On sewer service lines with diameters smaller than 6 inches, monitoring manholes shall be constructed per MAG Standard Details 420-1, 420-2, and 421. These are to have straight channels, with no taps or bends for two pipe lengths upstream and one pipe length downstream.
3. Design details for monitoring manholes on sewer service lines 6 inches or larger, or with a peak flow greater than 40 gpm, shall be approved by the City.
4. Monitoring manholes shall be located in a minimum 20-foot wide PUE which extends from a 20-foot radius around the manhole to the existing public sewer. The monitoring manhole shall be accessible at all times to monitoring crews and vehicles.

F. Manholes Vector Spraying

All sewer manholes installed in the City limits shall be treated with an insecticide approved by the City and identified in the City Approved Materials List for Wastewater Collection Systems.

1. The two year warranty for the insecticide application shall run concurrently with the two year sewer system warranty.
2. A record of the insecticide applications and warranty information shall be provided to the City Environmental Services Division and the necessary regulatory agencies.

3. The insecticide shall be applied to a depth of 12 feet with an average coverage of 140 square feet per manhole. Sewer outlets and inlets to manholes shall also be treated.
4. The product and coating shall be applied per the manufacturer's label rate and EPA labels.
5. Each manhole that has been treated shall be marked with an identifying color or number as determined by the City Environmental Services department.
6. Only qualified and state-licensed personnel shall be permitted to perform the work of applying the insecticide.

6.3.3 Service Lines

A. Materials and Details

All service lines, whether into a line or into a manhole, shall be constructed by a licensed Contractor at the expense of the Developer. Prior to the construction of any service line, the Contractor shall contact the City's Engineering Inspections Division (623-882-3110) and Environmental Services division (623-932-3010) for inspection services not less than 24 hours prior to tapping.

1. New sewer service lines shall be per the City Standard Details and MAG Standard Details and specifications.
2. The maximum number of service lines into manholes shall be three into a manhole in a cul-de-sac, and two into a manhole in all other situations. However, no service lines are allowed into a manhole against incoming flow through the manhole.
3. When a sewer service line connects to a manhole the invert elevation shall not be:
 - a. Located below the crown of the outflow pipe
 - b. Located more than 1.5 feet above the crown of the outflow pipe.
4. A three-foot minimum separation between service service lines is required.
5. All service lines shall be dimensioned and stationed using the closest downstream manhole as Station 0 + 00. Typical dimensions to water service lines shall be shown.

6. Service lines installed for future connection shall be marked.
7. When installed, all service lines must be perpendicular to the lateral. Service lines may be at an angle only if inserted into a manhole, but the flow line of the sewer service line shall not be more than 4 inches below the crown of the line to be tapped.
8. No service lines will be made directly into sewers 6 inches or greater in diameter. Such service lines must be into an existing manhole, or the Developer shall install a new manhole at his or her own expense.
9. Plans shall be reviewed by the Design Engineer for backflow prevention valves. These are required where finished floor elevations are below both upstream and downstream manhole rim elevations.
10. Grease, oil, or sand interceptors which are acceptable to the City and approved by the City Engineer shall be provided for laundries, restaurants, automobile service facilities, and other facilities when, in the opinion of the City, they are necessary for the proper handling of liquid wastes. Interceptors shall be supplied and maintained by the Owner.
11. No sewer service lines will be allowed between the sewer trunk and the odor control manhole.

B. Sizes

1. Tap sizes for private single family residential developments shall be 4 inches. A 4-inch diameter tap shall be provided for each platted lot.
2. Commercial lots with buildings shall have 6-inch minimum private service lines and shall provide service adequate for discharge.
3. Commercial lots without buildings shall have no service lines unless requested by owners; then only 6-inch or larger service lines shall be allowed.
4. Multi-family developments shall have a minimum 6-inch tap.
5. All service lines larger than 6 inches require the installation of a manhole.

C. Location

1. Service lines shall be located so as to avoid conflicts with driveway locations.
2. Proposed tap locations shall be shown on all plans.
3. Because water lines are located behind the curb in many locations, conflicts with sewer service lines are possible. In order to minimize potential health hazards, sewer lines should be designed to allow sewer service lines to pass under water mains behind the curb with a minimum clearance of 12 inches.
4. When it is not possible to maintain sufficient clearance, or if the sewer service will pass over the water main, the sewer service must be DIP or must be encased in concrete. Concrete encasement shall have a minimum thickness of 6 inches, and both options must extend at least three feet from each side of the crossing.

D. Construction Details

All construction shall be per this manual and MAG Standard Details and Specifications.

E. Televised Inspection

All newly installed sewers shall be inspected by closed-circuit television methods acceptable to the City. Any defects discovered during televised inspection shall be corrected at no cost to the City. After correction of defects has been completed, affected sewer sections shall be re-televised at no cost to the City. Two DVDs containing video of all televised inspections shall be provided to the City prior to final acceptance of the sewer. All DVD's shall be formatted for playing on a standard DVD player without any special hardware or software.

F. Sewer System Testing

1. Sewer lines and services shall be pressure tested per MAG specifications
2. Manholes shall be vacuum tested per MAG specifications.

6.4 Sewage Lift Stations

6.4.1 Site Selection

- A. In selecting a site for a sewage pumping facility, consideration should be given to:
 - 1. Accessibility
 - 2. Drainage Characteristics
 - 3. Visual Impact
 - 4. Function and Design Constraints
- B. The potential for flooding should be considered when selecting a pump station location. The station's equipment shall be protected from damage and remain operable during a 100-year flood event.

6.4.2 Lift Station Design

- A. Sewage lift station requirements are provided by ADEQ and are published in their Engineering Bulletin No. 11. Additional requirements specific to the City can be obtained from the Engineering department and Environmental Services division before beginning design. At a minimum, telemetry, dual pumps, generator, three-phase power, and odor control will be required.
- B. It is recommended that, prior to the preparation of construction drawings, a Preliminary or Basis of Design Report be prepared and submitted to the City for acceptance. The Preliminary Report should outline the type of equipment and controls proposed for the station. A Final Design Report, prepared by a Registered Professional Engineer licensed in the State of Arizona, must accompany all lift station design drawings.

6.4.3 Sewer Lift Station Design Standards

- A. There shall be a minimum of two pumps at each site. Pumps shall be capable of passing 2-1/2-inch solids, and shall be equipped with stainless steel motor shafts.
- B. Check valves shall be silent closing type and located in a separate vault.
- C. Three-phase 480-Volt power shall be used where available.

- D. Field prints shall include all electrical information.
- E. Phase protection shall be provided for all three-phase motors and pumps.
- F. An hour meter shall be provided for each pump.
- G. Pump failure indicator lights shall be provided on the control panel and the exterior of the station.
- H. An access hatch and permanent ladder shall be installed in the wet well. The ladder shall be Type 304 stainless steel or greater.
- I. All lift station control panels shall be designed for future installation of a telemetry system.
- J. Only submersible pumps shall be used.
- K. Approved submersible pump stations shall be supplied per manufacture and model identified in the Wastewater Approved Materials List found on the City's website.
- L. A minimum of three sets of the operation and maintenance manuals shall be prepared and provided to the Environmental Services division prior to the final inspection.
- M. Force main shall be identified as such with magnetic marking tape one foot above the pipe.
- N. Cleanouts shall be installed per section 6.3.4.D.
- O. Lift station shall be located a minimum distance of 100 feet from the nearest home. A block wall shall be constructed around the perimeter of the lift station site.
- P. Odor control measures must be identified in the Design Concept Report and incorporated into the design.
- Q. The interior of all lift stations shall be coated with a corrosion-resistant coating as identified in the City Approved Materials List for Wastewater.
- R. Provide spare parts as recommended by the manufacturers.
- S. Electrical specifications information is to be provided on field prints as follows:
 - 1. Electrical specifications

2. Size and type of conduits
3. Size and type of over-current protection for all disconnects
4. Phase protection for all three-phase motors and pumps
5. Floats shall be used for all controls and alarms.
6. Failure indicator lights on control panel
7. Hour meter totalizer for each pump
8. Flashing light to warn of pump failure
9. Alarm circuitry to one terminal board for telemetry
10. No electrical connections in wet well
11. All lift station equipment shall conform to the City's current SCADA standards.
12. NOTE: It is recommended that designers coordinate their pump station design with the City Engineering department and the Environmental Services division prior to final plan preparation.

6.4.4 Force Mains

A. Velocity Requirements

The velocity of flow in the force main shall be between 4 fps and 6 fps.

B. Materials of Construction

1. All types of pipe materials used in design of force mains shall be DIP with a ceramic epoxy lining. The DIP and epoxy lining shall meet established ASTM, ANSI, AWWA, and NSF standards of manufacture or seals of approval and shall be designated as pressure sewer pipe.
2. The epoxy lining shall be provided as identified in the City Approved Materials List for Wastewater.
3. All cut ends or damaged epoxy-sealed DIP shall be repaired or sealed per the epoxy manufacturer's requirements.

4. Force mains shall be identified as such with magnetic marking tape one foot above the pipe.

C. Air Release Valves

Approved air release valves designed for sewage shall be provided on force mains at all peaks in elevation. See the City Standard Details for air release valve requirements and the Approved Materials List for approved models.

D. Cleanouts and Manholes

1. Two-way cleanouts shall be provided every 800 feet or one-way cleanouts every 400 feet. See the City Standard Details.
2. For details regarding force main discharge into a manhole, refer to the City Standard Details.

E. Water Line Separation

1. For details regarding force main discharge into a manhole, refer to the City Standard Details.
2. The minimum separation between force mains and water lines shall be 2 feet vertical and 6 feet horizontal, all as measured from nearest wall to nearest wall.

F. Testing

1. Prior to issuance of a Certificate to Operate, all force mains shall be pressure tested. Preparatory to testing, the section of the pipeline to be tested shall be filled with water and placed under a slight pressure for at least 48 hours. The pipeline shall then be brought up to working pressure plus 50 psi, or to 125% of working class pressure, whichever is greater. This pressure shall be maintained on the section under test for a period of not less than 4 hours.
2. Accurate means shall be provided for measuring the quantity of water required to maintain full test pressure on the line for the test period. Maximum allowable leakage is to be determined by the following formula:

$$L = [JD \sqrt{(Pt)}]/4500$$

Where:

- a. L = Maximum allowable leakage in gallons per hour for the section of pipeline tested
- b. J = number of joints in length tested
- c. D = diameter of pipe in inches
- d. Pt = test pressure in psi

6.5 Wastewater Treatment

6.5.1 Treatment Plants

The subject of wastewater treatment plant design is beyond the scope of this design manual. The Engineer shall contact the Maricopa County Environmental Services department, the City of Goodyear Engineering department, and the City of Goodyear Environmental Services division for further information pertaining to the development of wastewater treatment facilities within the City.

6.5.2 Septic Systems

- A. When sewer service is not available, a temporary septic system may be allowed with the approval of both the City and the Maricopa County Environmental Services Department.
- B. A “dry” sewer line shall be installed along the entire length of the property line frontage. The property line frontage is that portion of the property along a public right-of-way. If a parcel to be developed has more than one property line frontage, the City will require a sewer line to be installed along all frontages.
- C. The operation and maintenance of septic systems are the responsibility of the Owner. The City will not accept any septic system for operation and maintenance.

6.5.3 Reclaimed Water

Wastewater Reclamation and Advanced Treatment:

The City's current Wastewater Master Plan calls for the development of regional wastewater reclamation facilities. Reclaimed water is to be used to satisfy the demand for water to irrigate golf courses and parks. Reclaimed water in excess of the irrigation demand shall be treated and stored underground for subsequent recovery. Refer to Section 5.2 of this manual for the requirements of reclaimed water systems.