GENERAL:

The City of Lake Ozark operates a sewage collection system and treatment system in accordance with the Missouri Department of Natural Resource (MDNR) regulations. The system is comprised of pressure and gravity sewer lines, grinder stations, lift stations, and a jointly owned regional sewage treatment facility. The plant is managed by the Lake Ozark/Osage Beach Joint Sewer Board. The collection system within Lake Ozark, and from the city to the plant, is owned and operated by the City of Lake Ozark. At the current time, there are a few isolated areas within the city that are not served by the collection system. It is the policy of the city that all occupied facilities within the city will have city sewer service. At the present time, there are over 250 grinder stations, and 29 lift stations.

All referenced material contained in this design guide is taken from Title VII of the City of Lake Ozark Municipal Code (Utilities)

SEWERAGE DESIGN:

1.) Sewage collection system, Modifications of, and additions to, the existing sewage collection system shall be made in accordance with MDNR regulations as supplemented herein.

2.) Any new commercial or industrial construction or connection shall require a Hydraulic design and flow data designed by a registered professional engineer of the state of Missouri, and approved by the Missouri Dept. of Natural Resources. This information shall include: Type, Location, and size of the development, the number of and range in size of lots or buildings to be serviced.

3.) Location and type of gravity or force main system the main will discharge to.

4.) State whether the entire development will be serviced by the proposed phase or if several phases will be involved. State whether other areas outside of the development may be tributary to the pump station.

5.) The Design summary shall consist of: Average Daily Flows (ADF), Peak Daily Flows (PDF), volume for 24 hour detention, or detention volume with back-up generator when required, Total Dynamic Head (TDH), Gallons per Minute (GPM) and efficiency at the pump’s operating point.

6.) All commercial, or industrial pump stations with design flows of 1000 gpd shall utilize Flygt pumps and controls. If the pump station will exceed 3000 gpd the controls shall be designed by Vandevanter Engineering in conjunction with R. E. Pedrotti to include a Siemens Link-2-Site remote monitoring system. This will ensure that the system matches existing city equipment.

7.) All commercial pump stations to be turned over to the city shall require a minimum eight (8’) foot paved apron around the pump structure. The pavement shall be sloped so as to permit surface water to drain AWAY from the station. There shall also be installed a minimum twelve (12’) foot wide paved roadway to the pump station. The maximum allowable gradient will be ten (10%) percent. When asphalt pavement is used there shall be a minimum of two (2”) inches of fine (C type) asphalt laid over a minimum of three (3”) of course (X type) asphalt for a total
pavement thickness of five (5”) inches. Concrete shall be six (6) sack mix, with a four (4) inch slump. When poured concrete is used the access road shall be a minimum of four (4”) inches total thickness. All pavement whether asphalt or concrete shall be constructed on a well compacted crushed limestone base a minimum of four (4”) thick.

8.) Future Development: In designing all components of the pump station and force main, consideration must be given to the potential need to expand or modify the facility to accommodate the future development of areas tributary to the station. As a minimum the following items should be considered:
   a) The valve chamber and wet well shall be sized to accommodate the ultimate pump and valve equipment required.
   b) The ultimate flow should be considered in selection of the pumps.
   c) The ultimate flow should be considered in sizing the force main.
   d) The ultimate storage requirement should be considered in the configuration of the detention pipes to allow for future expansion. Adequate area adjacent to the detention pipes must be provided to allow for this expansion.
   e) Twenty four hour detention is required for all pump stations having a design flow of 3000 gpd or more. The detention chamber shall be installed below ground with an access manhole located at the upstream end. The connection between the detention chamber and wet well wall shall be made with a 12” ductile, or C900 pipe. The detention tank must be a dedicated system; it may not be used as part of the gravity system. The detention tank and connecting line shall be laid with a minimum 1% slope.

9.) There shall be an appropriate gate constructed at the entrance road

10.) Gravity sewer design shall conform to the applicable Missouri Dept. of Natural Resources regulations and as specified herein. The peak hourly flow shall be determined and the gravity line sized accordingly with the following additions:
   A) Gravity sewer laterals from structures to grinder stations or mains:
      1) Shall not be less than four (4) inch pipe.
      2) Shall have a cleanout located within five (5) feet of the structure being serviced and at all vertical 45 or 90 degree and horizontal bends; a sanitary tee within five (5) feet of the grinder station or main; and a backflow valve adjacent to the grinder station or main.
      3) Shall not exceed one hundred fifty feet (150) in length. Service lines over 150 feet in length shall be treated as sewer mains.
      4) Shall be SCH 40 with SCH 40 fittings or ASTM D3034 DR 26 PVC with sanitary sewer DR26 PVC or ductile iron fittings.
      5) All bends shall be long radius bends. Short radius 90 degree bends are specifically prohibited.
   B) Gravity Sewer mains:
1) Sewer mains shall be designed for the peak hourly flow, and shall not be less than six (6) inch pipe.

2) Gravity sewer pipe shall be:
   A) ASTM 2241 DR 21 class 200 with approved fittings.
   B) PVC, ASTM D3034, SDR 26 class 150 pipe with SDR 26 PVC Sanitary fittings.
   C) SCH 40 PVC with SCH 40 fittings.
   D) ASTM D3034, SDR 35 with SDR 35 fittings where maximum depth of cover is six (6) feet or less.

3) Manholes shall be constructed at the end of main lines and at changes in horizontal and vertical alignment, or not more than every 300 feet.

4) When service line will exceed one hundred fifty feet (150), a manhole shall be constructed with a 4 inch service line to the structure and a minimum (6") six inch main to the remainder of the system.

5) All bends shall be long radius bends. Short radius 90 degree bends are specifically prohibited.

C) Connections to sewer mains shall be made using a sanitary wye tapping fitting

D) Connections to grinder pump basins:
   1) Shall be installed using cast iron inlet hub of appropriate diameter and shall be bolted to the grinder basin with stainless steel hardware and sealed with an approved silicone sealant. In some cases a PVC backflow valve (check valve) shall be installed within two (2) feet of the basin.
   2) Inlet pipes shall be installed a minimum of four (4) feet above the bottom of the grinder basin and not less than eighteen (32) inches below the top of the basin.

E) Bedding:
   1) Shall be installed around the pipe from 3 inches below to 12 inches above the pipe. Bedding shall be nominal ½ inch or 3/8 inch crushed rock.

F) Detectable Marking tape and toning wire:
   1) Metallic detectable marking tape, type III shall be placed in the trench above all sewers, gravity and pressure, one foot above the pipe.
   2) No. 12 solid copper toning wire shall be located three inches above the sewer line and shall be continuous from terminus to terminus and shall include all city owned sewers.

G) Minimum grades for gravity sewer:
   1) 4 inch sewer shall not be less than 1.00%
   2) 6 inch sewer shall not be less than 0.67%
   3) 8 inch sewer shall not be less than 0.50%
   4) 10 inch sewer shall not be less than 0.33%

H) Minimum depth of cover for gravity sewers:
   1) Shall be not less than 32 inches above the top of pipe. Maximum depth of cover eight (8) feet unless authorized in writing by the City Inspector, Public works Director, city engineer, or their designee.

I) Manholes:
1) Shall be installed in accordance with the design drawings, and as approved by the Missouri Department of Natural Resources and the City of Lake Ozark
2) Or as approved by a registered professional engineer and MDNR.

J) Valve boxes:
   1) Shall be an adjustable Buffalo type with cast iron lid marked “sewer”

K) Leak testing for gravity sewer:
   1) Gravity sewer lines may be tested by air or water method.
      A) Water Test: Gravity sewer lines shall be plugged at the bottom end and filled with water to the top of the next upstream manhole; or if no manhole, to the top of the farthest upstream cleanout, and left for twenty four (24) hours. The allowable leakage shall be one gallon or less per 100 feet of line tested.
      B) Air testing: Test lines between manholes with low-pressure air. Safety requires a regulator or relief valve on pressurizing equipment, set at 8 psi. No one will be allowed in manholes while there is air pressure against test plugs.
         1) Test pressure shall not be less than 4 psi, but no more than 6 psi
         2) Supply air into the line until test pressure is obtained. Allow at least 5 minutes for air temperature in the test section to stabilize.
         3) Re-establish the test pressure and start a stop watch. Determine the time required for pressure to drop .5 psi
         4) If the pressure does not drop during the stabilization period, and no additional air has been added, the section undergoing test will have passed without further testing.
         5) The duration of the air pressure test shall be 10 minutes
   2) Manholes shall be tested by water method
      A) Water Method: Manholes shall be tested by plugging the inlet and outlet pipes and filling the manhole with water to the top of the manhole cover ring and letting it set for twenty four (24) hours. The maximum leakage shall be a drop in water level of three (3) inches.

3) Pressure Sewer design shall conform to MDNR requirements and as supplemented herein. The design of additions to the city sewer system shall minimize the need for pressure sewer to the maximum extent practicable in order to reduce the number of lift or grinder stations to the minimum required. Pressure sewers shall conform to the following criteria:
   A) Pressure sewers shall be designed for flow rates between 2.0 fps and a maximum of 7.0 fps. The minimum diameter of pipe used shall be 1 ½ inches.
   B) Pressure pipe:
1) Less than four inches shall be SCH 40 PVC, or blue poly CTS ASTM D-2737 with FORD brass fittings.
2) A combination of brass and galvanized fittings is strictly prohibited, only brass fittings alone may be used with blue poly CTS.
3) Four inches and larger shall be: AWWA C151 class 350 ductile iron, or AWWA C900 DR 18 class 150 PVC.

C) Joints /Fittings:
   A) For SCH 40 pipe shall be SCH 40 or SCH 80 solvent welded
   B) For other pipe shall be mechanical joint, or anchor type with mega lug restraints or as approved by an engineer and MDNR.
   C) Changes in direction shall consist of multiple fittings. The use of short radius 90 degree bends is strictly prohibited.

L) The minimum cover for pressure sewer shall be 32 inches.
M) The maximum depth of cover for pressure sewer is six (6) feet, unless specifically authorized by the City Inspector or Public Works Director.
N) Bedding shall be installed around the pipe from 4 inches below the pipe to 12 inches above the pipe. Bedding shall be nominal ½ inch or 3/8 inch crushed rock or lime fines.
O) Detectable Marking tape and Toning wire:
   1) A metallic detectable Marking tape, type III Marked “sewer below” shall be placed in the trench 12 – 18 inches above all pressure sewer pipe.
   2) A No. 12 solid copper toning wire shall be installed 3 inches above the pressure sewer and shall extend from terminus to terminus and shall extend up into all valve stacks.

P) The check valve shall be FORD brass body, or for force mains (4”) four inches and larger Valvematic Surgebuster single flap style.
Q) The inlet connection hub shall be cast iron inlet hub bolted to the basin. The back of the hub shall be sealed to the basin using approved silicone sealant. Appropriate inlet hubs are stocked by the pump supplier.
R) An isolation valve shall be installed at the connection to the sewer main. The valve shall be brass body, globe valve of the same nominal size as the pressure sewer, shall be installed at the connection to the sewer force main. The valve should be located so as to be outside roadways or other similar traffic areas. The valve shall be placed upon a concrete or approved masonry pedestal to prevent settlement, shall be covered with a buffalo type valve box and cover extended to one inch above the finished surface. If the finished surface is concrete or asphalt pavement in which case the cover shall be flush with the paved surface. Valve box covers on pressure sewers shall be marked “sewer”. The markings shall be cast into the cover.
S) The tapping saddle shall be brass. The tapping saddle shall be sealed to the pipe by means of a rubber “O” ring seal to provide a connection suitable for a working pressure of 200 psi.
Tapping saddles shall have flanged and threaded outlets conforming to ANSI B16.1. If at all possible, all tapping saddles shall be in the horizontal position. Under no circumstances shall anyone make a wet tap without approval and authorization of the Public Works Director or the Utility Superintendent.

T) Leakage Test: The pressure shall be filled with water from the isolation valve to the grinder station shut-off valves and shall be fitted with a testing connection such that the line can be pressurized and refilled with water. The line shall be brought to a pressure of 125 psi and held at that pressure for 1 hour. Air or vacuum test will not be allowed.

Design of Grinder Pumps And Lift Stations

The design of grinder pump installation shall be certified by a Registered Professional Engineer and shall conform to MDNR and City of Lake Ozark requirements. In order to reduce maintenance and operational cost, the city has selected Myers for its residential applications or Flygt equipment for commercial or industrial applications as their standard. Accordingly all grinder and lift stations shall be designed using Myers or Flygt equipment. The size, type, and capacity of the grinder pump, or lift station shall be based upon the hydraulic loading and gradient necessary to pump sewage from the source to an appropriate location.

1) Hydraulic design shall consist of:
   a) Average daily flow (ADF)
   b) Peak Hourly Flow (PHF)

2) A professional engineer shall design what horse power pump is needed and their respective capabilities (i.e. pumping rate, head capabilities, gallons per minute, etc.)

3) The minimum diameter for simplex wet wells is 36 inches

4) The minimum diameter for duplex wet wells is 60 inches

5) The maximum total depth of the wet well from the lid to the bottom is 10 feet

6) Select the pump model and horsepower from the Myers/Flygt pump curves.

7) Select the pressure line type and size as discussed under “pressure sewers” herein.

A) Additional limitations or Specifications for Grinder pumps.

1) No more than two residences may be served by a simplex grinder station.

2) No more than fifteen (15) single-family residences, or their equivalent, may be served by a single duplex grinder station. This is subject to the review of the City Engineer, and Public Works Director.

3) In instances where a commercial facility has an average daily flow of less than 16 gpm, and no further development or additional capacity is contemplated, a simplex pump and controls maybe installed in a duplex basin.

4) Triplex package units or custom-built lift stations are subject to the review and approval of the City Engineer and Public Works Director.
5) Each grinder pump station shall include a Myers or Flygt pumps fiberglass basin package including internal piping, pump base and guide rail and Myers or Flygt control panel as described in their perspective specifications.

A) The basin will be a Myers or Flygt basin and either simplex or duplex as required. All internal piping shall be SCH 80 PVC, and guide rails shall be stainless steel. The basin shall have an anti-floatation ring. The basin cover (lid) shall be aluminum with a minimum thickness of ¼ inch. The lid shall be fully bolted and/or hinged secured

B) All grinder stations of 5.4 HP or less shall have internal discharge piping of 1 ½ or 2 inch SCH 80 PVC.

C) All grinder stations of more than 5.4 HP shall have SCH 80 PVC piping of minimum 2 inch or as approved by the City Inspector or Public Works Director.

D) All grinder stations shall have a brass-bodied globe valve installed in each discharge line within the grinder station at a location approved by the Public Works Director.

E) The minimum distance from the top of the grinder basin cover to the top of the inlet pipe shall be 24 inches.

F) The minimum distance from the top of grinder basin to the discharge piping shall be 36 inches, but not more than 48 inches.

G) The maximum depth of the grinder station basin shall be 10 feet.

B) Electrical service for sewage lift stations and grinder stations

1) Ameren UE is the provider for electrical service. The owner, developer, or contractor shall make arrangements with Ameren UE for electrical service to the grinder station. Electrical energy shall be provided on a direct individually metered service of the appropriate capacity for the facility to be served.

2) The use of “add-a-phase” or other artificial phasing devices is prohibited. When three phase service is required the owner or developer shall make all necessary arrangements with Ameren UE to provide the required service.

Grinder Station Electrical Panel: Myer/Flygt Electric Control Company shall provide the standard panel for the prescribed equipment. The control panel shall be fully and completely compatible and parts interchangeable with existing city owned units or as directed by the Public works Director. It shall be mounted on an appropriate stand at a height of approximately five (5) feet above finished grade. Each control panel shall have a wiring diagram, or schematic, attached to the inside of the outer door of the control panel box. All exterior wiring shall be run in gray carlon PVC electrical conduit. All work should be done in accordance with the National Electric Code and all material should be UL approved. Electric service wires, pump service wires, and float control wires, shall be run in minimum two (2) inch conduit. All bends and fittings shall be long radius bends. An explosion proof wye fitting shall be installed six (6) inches below the control panel. No splice or junction boxes will be permitted in the grinder pump basin.

3) Grounding rod shall be copper clad grounding rod ½ inch by eight (8) feet in length. The rod shall be driven vertically into the ground or as directed by the Public Works Director.

4) Electric meter, meter base, disconnect, and panel shall comply with Ameren UE service manual, section 5.3.1 (bypass requirements).
REQUIRED INSPECTIONS, TESTING, AND STARTUP PROCEDURES

1) Construction drawings are required for all gravity and pressure sewers and all grinder or sewage lift stations. Such drawings shall be designed and sealed by a Registered Professional Engineer in the State of Missouri.

2) All materials and equipment shall conform to the City of Lake Ozark Design Guidelines.

3) All gravity and pressure sewers shall be inspected by the Public Works Director, or the Utility Superintendent, or the City Engineer.

4) All gravity and pressure sewers, manholes, and wetwells shall be tested for leakage as specified herein. All testing shall be performed in the presence of City personnel.

5) Grinder and sewage lift stations shall be fully tested for performance and operation in the presence of the Public Works Director or the Utility Superintendent. Such testing shall include pumping rates, pumping cycle test including emergency alarm and startup of standby equipment (if so equipped), electrical current and voltage checks. The contractor/developer shall provide the services of a manufacturers factory representatives to be present during the tests.

6) Upon completion of all testing and startup procedures the Public Works Department will issue a certificate of approval. The system will not be connected to the city service or approved by the city until all equipment meets the design requirements. If the system can not be approved no building occupancy permit will be issued.

As constructed drawings and maintenance documents

The Developer/Contractor shall provide the Public Works Department with not less than two full sized “As Constructed” drawings certified as being correct record drawings by a Registered Professional Engineer.

The developer or contractor shall provide not less than two copies of a certified and recorded utility easement for all sewer lines and grinder or lift station sites to be turned over to the city. Easements shall be prepared and sealed by a Registered Land Surveyor in the State of Missouri.

SEWER DESIGN – PUBLIC INFORMATION PACKET

Applicants for a building or zoning permits will be provided with a “Sewer information packet” which reflects the requirements contained in this design manual and pertinent city ordinances. Such packet shall be considered as an approved part of the City of Lake Ozark Design Guidelines.

Septic Tank Systems
City Code Section 700.150 requires that any facility constructed within 300 feet of an existing city sewer must connect to such sewer. There are a few locations within the city where city sewer is not available. In those cases the owner may be authorized by the City Inspector to construct or repair a septic system.

**REQUIREMENTS FOR AUTHORIZED PRIVATE SEWAGE DISPOSAL SYSTEMS**

A construction and or excavation permit from the City Inspector is required prior to construction. Approved soil morphology, permeability tests and soil percolation tests, site topography, septic tank and absorption system, design by a registered professional engineer are required for the permit.

1) The system must be designed by a Registered professional engineer in accordance with Missouri Department of Health Regulations 710.025 through 710.059, Missouri Laws for on site Sewage Disposal Systems, and 19 CSR 20-3.060 Minimum Standards for On Site Sewage Disposal Systems.

2) Soil morphology tests shall be made by a registered professional engineer or state certified soil scientist. Test and reports shall be in accordance with 19 CSR 20-3, para (2) Site Elevation.

3) The Minimum Setback Distances shown in 19 CSR 20-3, Table 1 Minimum Setback Distances shall be strictly followed.

4) Flow rates or volumes shall be computed on the basis of 120 gallons per day per bedroom or 60 gallons per day per person, the minimum flow from a residence shall be 240 gallons.

5) The minimum septic tank capacity shall be 1250 gallons. Septic tanks shall be constructed in strict conformance to 19 CSR 20-3, Para. (4).

6) Absorption Systems shall be in accordance with 19 CSR 20-3 Para. (6) Absorption systems.

7) All drain field, leach field and tank connections are to be inspected by city personnel before backfill

A construction and or excavation permit form the City Inspector is required prior to construction. Approved soil morphology, site topography, septic tank and absorption system, design by a registered professional engineer are required for the permit.