

**DESIGN CRITERIA
FOR PUBLIC IMPROVEMENT PROJECTS**

**CITY OF GARDNER, KANSAS
NOVEMBER 2022**

TABLE OF CONTENTS
DESIGN CRITERIA

Page

PROCEDURE FOR PUBLIC IMPROVEMENT PROJECT PLAN SUBMITTAL

A. GENERAL.....DC/P-1
B. PUBLIC IMPROVEMENTS FUNDED BY PRIVATE DEVELOPERSDC/P-1

DC1 - GENERAL PLAN REQUIREMENTS FOR PUBLIC IMPROVEMENT
PROJECTS

DC1-001 GENERALDC/1-1
DC1-002 REQUIRED NOTESDC/1-1
DC1-003 APPROVAL BLOCK.....DC/1-8
DC1-004 PRIVATE IMPROVEMENTSDC/1-8

DC2 - DESIGN CRITERIA FOR SANITARY SEWERS AND APPURTENANCES

DC2-001 GENERAL.....DC/2-1
DC2-002 SEWER DESIGNDC/2-1
DC2-003 MAXIMUM SIZEDC/2-1
DC2-004 MINIMUM SIZE.....DC/2-1
DC2-005 PIPE MATERIALDC/2-1
DC2-006 MINIMUM SLOPEDC/2-2
DC2-007 INCREASING PIPE SIZEDC/2-2
DC2-008 HIGH VELOCITY PROTECTIONDC/2-2
DC2-009 ALIGNMENT AND GRADEDC/2-3
DC2-010 MANHOLE LOCATION AND SPACINGDC/2-3
DC2-011 MANHOLESDC/2-3
DC2-012 SEWER LOCATIONSDC/2-4
DC2-013 PROTECTION OF WATER SUPPLIESDC/2-4
DC2-014 UNSEWERED DWELLINGSDC/2-4
DC2-015 MAXIMUM SCOPEDC/2-4
DC2-016 SERVICE LINESDC/2-5
DC2-017 GROUNDWATER BARRIERSDC/2-5
DC2-018 LIFT STATION.....DC/2-5
DC2-019 EASEMENTS.....DC/2-5

DC3 - DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS

DC3-001 GENERAL.....DC/3-1
DC3-002 INTRODUCTIONDC/3-1
DC3-003 DESIGN FLOWSDC/3-1
DC3-004 SITE DESIGNDC/3-1
DC3-005 HYDRAULIC DESIGNDC/3-2
DC3-006 PUMP STATIONDC/3-2
DC3-007 CHECK VALVESDC/3-3
DC3-008 WET WELL SIZINGDC/3-3
DC3-009 CONTROLSDC/3-3

DC3 - DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS
(Continued)

DC3-010 HEATING, VENTILATING, AND AIR CONDITIONING.....	DC/3-5
DC3-011 ELECTRICAL POWER SUPPLY.....	DC/3-5
DC3-012 LIGHTING PROTECTION SYSTEM.....	DC/3-5
DC3-013 EMERGENCY POWER	DC/3-5
DC3-014 VARIABLE FREQUENCY DRIVES.....	DC/3-6
DC3-015 WET WELL AND DISCHARGE MANHOLE LINING	DC/3-6
DC3-016 FLOW MEASUREMENT.....	DC/3-7
DC3-017 FLOW MONITORING OF PRESSURE DISCHARGE PIPE	DC/3-7
DC3-018 EMERGENCY OVERFLOW STORAGE.....	DC/3-7
DC3-019 EMERGENCY BY-PASS PUMPING.....	DC/3-7
DC3-020 PERSONNEL HOIST SYSTEM.....	DC/3-7
DC3-021 ACCESS HATCH	DC/3-7
DC3-022 SITE LIGHTING.....	DC/3-7
DC3-023 FORCE MAIN.....	DC/3-7
DC3-024 TRACER WIRE	DC/3-8
DC3-025 AIR AND VACUUM RELEASE VALVES.....	DC/3-8
DC3-026 TESTING.....	DC/3-8
DC3-027 SUBMITTALS	DC/3-9
DC3-028 OPERATION AND MAINTENANCE MANUALS.....	DC/3-10
DC3-029 TRAINING.....	DC/3-10
DC3-030 DEFINITION OF ACCEPTANCE	DC/3-11

DC4 - DESIGN CRITERIA FOR STREET IMPROVEMENTS

DC4-001 GENERAL.....	DC/4-1
DC4-002 FUNCTIONAL CLASSIFICATION OF STREETS	DC/4-2
DC4-003 RIGHT-OF-WAY GRADING	DC/4-2
DC4-004 TANGENT LENGTH	DC/4-2
DC4-005 OFF-CENTER STREET INTERSECTIONS.....	DC/4-2
DC4-006 CONNECTIONS TO EXISTING PAVEMENTS	DC/4-2
DC4-007 MINIMUM ANGLE OF INTERSECTION.....	DC/4-3
DC4-008 SIDEWALKS	DC/4-3
DC4-009 STORM DRAINAGE.....	DC/4-3
DC4-010 CUL-DE-SACS	DC/4-3
DC4-011 TEMPORARY TURN-AROUNDS	DC/4-3
DC4-012 MONUMENT BOXES.....	DC/4-3
DC4-013 SIGHT DISTANCES.....	DC/4-3
DC4-014 UNDERDRAINS.....	DC/4-4
DC4-015 OPEN CUTTING OF STREETS	DC/4-5
DC4-016 PRIVATE STREETS.....	DC/4-5
DC4-017 BICYCLE PEDESTRIAN TRAIL SYSTEM	DC/4-5
DC4-018 EMERGENCY ACCESS ROADS.....	DC/4-5
DC4-019 DEVELOPMENT ADJACENT TO UNIMPROVED ARTERIAL ROADS.....	DC/4-5

DC5 - DESIGN CRITERIA FOR STORM DRAINAGE FACILITIES

SECTION 5601 ADMINISTRATIVE.....	DC/5-1
SECTION 5607 ENGINEERED CHANNELS.....	DC/5-1
.....SECTION 5608 STORWATER DETENTION AND RETENTION	
5607.2C - EASEMENTS.....	DC/5-1

DC6 - DESIGN CRITERIA FOR WATER LINE CONSTRUCTION

DC6-001 GENERAL..... DC/6-1
DC6-002 LOCATION OF WATER MAINS & APPURTENANCES..... DC/6-1
DC6-003 DEPTH DC/6-1
DC6-004 MATERIALS OF CONSTRUCTION DC/6-1
DC6-005 FIRE HYDRANTS..... DC/6-1
DC6-006 LINE VALVES DC/6-2
DC6-007 CONNECTIONS TO EXISTING WATER MAINS DC/6-2
DC6-008 PROVISIONS FOR FUTURE EXTENSIONS OF WATER
MAINS DC/6-2
DC6-009 THRUST BLOCKING DC/6-2
DC6-010 SEPARATION OF WATERLINES AND SANITARY SEWERS ... DC/6-4
DC6-011 SEPARATION OF WATER MAINS AND OTHER POLLUTION
SOURCES DC/6-4
DC6-012 HIGHWAY AND RAILROAD CROSSINGS DC/6-4
DC6-013 STREET CROSSINGS..... DC/6-5
DC6-014 STREAM CROSSINGS DC/6-5
DC6-015 FIRE FLOW REQUIREMENTS DC/6-5
DC6-016 END OF CUL-DE-SAC DC/6-5
DC6-017 EASEMENTS..... DC/6-5
DC6-018 MINIMUM SEPARATION FROM OTHER UTILITIES..... DC/6-5
DC6-019 PRIVATE FIRE LINES DC/6-5
DC6-020 TRACER WIRE DC/6-6

DC7 - REQUIREMENTS FOR PUBLIC IMPROVEMENT PROJECT PLAN
PREPARATION

DC7-001 INTRODUCTION DC/7-1
DC7-002 GENERAL..... DC/7-1
DC7-003 TITLE SHEET DC/7-1
DC7-004 GENERAL LAYOUT SHEET..... DC/7-2
DC7-005 GRADING AND EROSION CONTROL SHEET..... DC/7-3
DC7-006 ELECTRIC LAYOUT SHEET DC/7-3
DC7-007 DRAINAGE BASIN MAP SHEET DC/7-3
DC7-008 PLAN AND PROFILE SHEETS DC/7-3
DC7-009 INTERSECTION DETAIL SHEETS..... DC/7-5

DC7 - REQUIREMENTS FOR PUBLIC IMPROVEMENT PROJECT PLAN
PREPARATION (Continued)

DC7-010 CROSS-SECTION STREETS..... DC/7-5
DC7-011 PAVEMENT MARKING AND SIGNAGE SHEET..... DC/7-6
DC7-012 TRAFFIC CONTROL PLAN SHEET DC/7-6
DC7-013 STANDARD DETAIL SHEETS DC/7-6
DC7-014 CONSTRUCTION RECORD DRAWINGS..... DC/7-7

DC8 - PRIVATE IMPROVEMENT DESIGN CRITERIA

DC8-001 GENERAL..... DC/8-1
DC8-002 PARKING LOT CONSTRUCTION..... DC/8-1
DC8-003 PRIVATE DRAINAGE FACILITIES DC/8-3

DC8-004 CONVERTING PRIVATELY OWNED INFRASTRUCTURE
TO PUBLICLY OWNED INFRASTRUCTUREDC/8-3

DC9 - PRIVATE IMPROVEMENT PLAN PREPARATION

DC9-001 INTRODUCTIONDC/9-1
DC9-002 GENERAL.....DC/9-1
DC9-003 PARKING LOT PLANSDC/9-1

DC10 - DESIGN CRITERIA FOR STREET LIGHTING CONSTRUCTION

DC10-001 GENERALDC/10-1
DC10-002 CATEGORIES OF STREETS AND PROCEDURES.....DC/10-1
DC10-003 DESIGN PROCESSDC/10-1
DC10-004 DESIGN CONDITIONSDC/10-1
DC10-005 PEDESTRIAN CONFLICT AREA CLASSIFICATIONDC/10-2
DC10-006 ROADWAY FUNCTIONAL CLASSIFICATIONSDC/10-2
DC10-007 RECOMMENDED AVERAGE MAINTAINED
ILLUMINATIONDC/10-2
DC10-008 DESIGN CALCULATIONSDC/10-3
DC10-009 ELECTRICAL SYSTEMDC/10-4

DC11 - DESIGN CRITERIA FOR TRAFFIC SIGNALS

DC11-001 GENERAL.....DC/11-1
DC11-002 DESIGN CRITERIADC/11-1
DC11-003 PLAN REQUIREMENTSDC/11-4

PROCEDURE FOR
PUBLIC IMPROVEMENT PROJECT PLAN SUBMITTAL

- A. General.** All developers and engineering consultants submitting plans for public improvement projects to the city for review are required to follow the procedures outlined in this section. No public improvement projects may be constructed in the City of Gardner without prior approval of the Engineering Division.
- B. Public Improvements.** The plan review process is as follows:
1. The first submittal should contain two sets of plans: one electronic copy and one full-size hard copy. This and all subsequent submittals are dated and recorded in a project status log.
 2. The normal time for review of the first submittal is 15-20 working days. In the case of abnormally large sets of plans (greater than 20 sheets) or of extremely complicated drawings, a longer time may be required for review.
 3. The plans will be routed through the appropriate city departments and/or divisions to obtain a complete review of all facilities which may be affected by the construction. They will also be reviewed for conformance with city standard details and design criteria. Upon completion of city review, a written set of comments will be submitted to the design engineer.
 4. The consultant will be required to make all necessary corrections and/or revisions as noted in the written comments. Upon completion of the corrections and/or revisions the consultant shall submit two new sets of plans, an electronic and full-size hard copy, to the Engineering Division and written responses to comments. Review time is approximately 10-15 working days.
 5. If the plans are close to approval, the final plat showing all proposed easements should be submitted, as well as any necessary application forms such as Kansas Department of Health and Environment sewer and water extension permit, Kansas Department of Transportation permits, Department of Agriculture channel change permit, etc.
 6. Upon completion of the review and approval of the plans by the City Engineer, the following number of sets of approved plans must be submitted for signing and distribution: For Street and Storm Improvements, 4 Sets & Digital Copy (CAD and PDF FORMAT). For Street Lights, 2 Sets & Digital Copy (CAD and PDF FORMAT). For Sanitary Sewer, 4 Sets & Digital Copy (CAD and PDF FORMAT), 1 Half Sized Set and KDHE Application. For Waterline, 4 Sets & Digital Copy (CAD and PDF FORMAT), 1 Half Sized Set and KDHE Application. For Land Disturbance Permit, 1 Copy. The contractor will be required to sign a permit for construction which authorizes the contractor to begin work. A brief preconstruction meeting will be required to be attended by the contractor to discuss specific project issues prior to beginning site work.
 7. Public improvement plans, and engineering reports are approved initially for one year after the date signed on the cover sheet next to the city engineer's signature. After one year, the plans or report shall become null and void and must be re-submitted prior to approval of construction of that project. Such plans and/or reports shall be re-submitted to the Engineering office in accordance with the foregoing outlined procedure and requirements.

DC1 – GENERAL PLAN REQUIREMENTS FOR PUBLIC IMPROVEMENT PROJECTS

DC1-001 **GENERAL.** All plans and reports submitted shall be prepared by, or under the direction of and sealed by a professional engineer licensed in the state of Kansas and shall be reviewed by the city for compliance with the minimum design requirements as established in the Design Criteria Manual for Public Improvement Projects of the City of Gardner and with all other applicable city codes and standards.

Attention is directed to the design engineer that whenever extraordinary or unusual problems are encountered in conjunction with a proposed project, additional information, and analysis beyond the minimum requirements of these standards and criteria will be required.

The City of Gardner is not responsible for the accuracy and the adequacy of the design or dimensions, and elevations as depicted on the plans (which shall be confirmed and correlated at the site of the work). The City of Gardner, through the approval of the plans and/or report, assumes no responsibility for the completeness and/or accuracy of the public improvement plan or report.

DC1-002 **REQUIRED NOTES.** The following general notes will be required as a minimum on all plan submittals for public improvement projects. These notes are not meant to be all-inclusive, and in certain situations the use of additional notes may be required by the City Engineer.

Water Mains

1. Development plans are approved initially for one (1) year after which they automatically become void and must be updated and re-approved by the City Engineer before any construction will be permitted.
2. The City of Gardner plan review is only for general conformance with City of Gardner design criteria and the City code. The City is not responsible for the accuracy and adequacy of the design, or dimensions and elevations. The City of Gardner, through approval of this document, assumes no responsibility other than that stated above for the completeness and/or accuracy of this document.
3. The Contractor shall have one (1) signed copy of the plans (approved by the City of Gardner) with a State approval stamp on the title sheet and one (1) copy of the appropriate Technical Specifications and Design Criteria for Public Improvement Projects at the job site at all times.
4. Construction of the improvements shown or implied by this set of drawings shall not be initiated or any part thereof undertaken until the City Engineer is notified of such intent, and all required and properly executed bonds and contract agreements are received and approved by the City Engineer.
5. The City of Gardner Technical Specifications for Public Improvement Projects, latest edition, shall govern construction of this project.
6. All existing utilities indicated on the drawings are according to the best information

available to the engineer; however, all utilities actually existing may not be shown. Utilities damaged through the negligence of the Contractor to obtain the location of same shall be repaired or replaced by the Contractor at his expense.

7. Backfill within the right-of-way shall be compacted to ninety-five (95) percent of maximum density at optimum moisture. No fill shall be placed in future rights-of-way under a Land Disturbance permit unless approved by the City Engineer.
8. All trench excavation beneath existing and proposed streets shall be backfilled in accordance with Technical Specifications. Alternate backfill materials shall require the approval of the City Engineer.
9. Saturday work shall be as approved by the City Engineer. No work shall be permitted on Sunday or a Holiday.
10. Where available, all water required for the construction of this project shall be purchased from the Public Works Department through the use of a fire hydrant water meter. Meters can be obtained from the Public Works Department, Field Operations Division, for a nominal deposit, refundable upon return of the meter.
11. Relocation of any water line, sewer line or service line required for the construction of this project shall be the responsibility of the Contractor at his expense.
12. The proposed waterline improvements shown by this set of drawings have been designed to provide for the following fire flow requirements as determined by the City of Gardner Fire Chief: GPM. (Note to be placed on development drawings that contain areas zoned for higher densities than R-2).
13. Connections to existing water mains shall not be allowed for new water main extension projects until all testing and disinfection requirements have been met and the connection has been approved by the City Engineer.
14. All structural inspections shall be completed by a professional engineer registered in the State of Kansas.
15. The horizontal separation distance between water lines (service lines) and sanitary sewer lines (service lines), and waterlines (service lines) and sanitary sewer manholes shall be a minimum of 10 ft measured from edge to edge.
16. Waterlines (service lines) must always cross over the force mains (service mains) with a minimum vertical separation distance of 2 ft.

Sanitary Sewers

1. Development plans are approved initially for one (1) year, after which they automatically become void and must be updated and re-approved by the City Engineer before any construction will be permitted.
2. The City of Gardner plan review is only for general conformance with City of Gardner

Design Criteria and the City Code. City is not responsible for the accuracy and adequacy of the design, or dimensions and elevations. City of Gardner through approval of this document assumes no responsibility other than as stated above for the completeness and/or accuracy of this document.

3. Contractor shall have one (1) signed copy of the plans (approved by the city of Gardner) with a State approval stamp on the title sheet and one (1) copy of the appropriate Technical Specifications and Design Criteria for Public Improvement Projects at the job site at all times.
4. Construction of the improvements shown or implied by this set of drawings shall not be initiated or any part thereof undertaken until the City Engineer is notified of such intent and all required and properly executed bonds and contract agreements are received and approved by the City Engineer.
5. The City of Gardner Technical Specifications for Public Improvement Projects, latest edition, shall govern construction of this project.
6. All existing utilities indicated on the drawings are according to the best information available to the City Engineer; however, all utilities actually existing may not be shown. Utilities damaged through the negligence of the Contractor to obtain the location of same shall be repaired or replaced by the Contractor at his expense.
7. Backfill within the right-of-way shall be compacted to ninety-five (95) percent of maximum density at optimum moisture. No fill shall be placed in future rights-of-way under a Land Disturbance permit unless approved by the City Engineer.
8. All trench excavation beneath existing and proposed streets shall be backfilled in accordance with Technical Specification Section. Alternate backfill materials shall require the approval of the City Engineer.
9. All service lines shall be laid on a 1.00% minimum grade unless approved by the City Engineer.
10. Accurate elevations of either the first-floor surface or the basement floor surface shall be shown, and identified, for all existing and/or proposed structures for all building sites to be served by the proposed sewer system.
11. Where available, all water required for the construction of this project shall be purchased from the Public Works Department through the use of a fire hydrant water meter. Meters can be obtained from the Public Works Department, Field Operations Division for a nominal deposit, refundable upon the return of the meter.
12. Saturday work shall be as approved by the City Engineer. No work shall be permitted on Sunday or a Holiday.
13. Relocation of any water line, sewer line or service line required for the construction of this project shall be the responsibility of the Contractor and shall be at his expense.

14. The Contractor shall install and properly maintain a mechanical plug at all connection points with existing lines until such time that the proposed line is tested and approved.
15. To prevent damage to main sewer line, all blasting required for laterals stub lines shall be performed during blasting for the main line.
16. A pre-blast survey shall be approved by the Fire Marshall prior to the initiation of blasting operations.
17. All structural inspections shall be completed by a professional engineer registered in the State of Kansas.

Streets and Storm Drainage

1. Development plans and drainage reports are approved initially for one (1) year, after which they automatically become void and must be updated and re-approved by the City Engineer before any construction will be permitted.
2. The City of Gardner plan review is only for general conformance with Gardner design criteria and the City code. City is not responsible for the accuracy and adequacy of the design, or dimensions and elevations. City of Gardner, through approval of this document, assumes no responsibility other than as stated above for the completeness and/or accuracy of this document.
3. Contractor shall have one (1) signed copy of the plans (approved by the city of Gardner) and one (1) copy of the appropriate Technical Specifications and Design Criteria for Public Improvement Projects at the job site at all times.
4. Construction of the improvements shown or implied by this set of drawings shall not be initiated or any part thereof undertaken until the City Engineer is notified of such intent, and all required and properly-executed bonds and contract agreements are received and approved by the City Engineer.
5. The City of Gardner Technical Specifications for Public Improvement Projects, latest edition, shall govern construction of this project.
6. All existing utilities indicated on the drawings are according to the best information available to the City Engineer; however, all utilities actually existing may not be shown. Utilities damaged through the negligence of the Contractor to obtain the location of same shall be repaired or replaced by the Contractor at his expense.
7. Backfill within the right-of-way shall be compacted to ninety-five (95) percent of maximum density at optimum moisture. No fill shall be placed in future rights-of-way under a Land Disturbance permit unless approved by the City Engineer.
8. All trench excavation beneath existing and proposed streets shall be backfilled in accordance with the Technical Specifications. Alternate backfill materials shall require the approval of the City Engineer.

9. Sidewalk locations are shown for informational purposes. Sidewalk and ramp construction shall be required when noted on the plans and/or contained in the summary of quantities.
10. Soil sampling and compaction testing shall be performed by a qualified technician at locations determined by the City Engineer. All sampling and testing expenses shall be paid for by the Contractor.
11. Where available, all water required for the construction of this project shall be purchased from the Public Works Department through the use of a fire hydrant water meter. Meters can be obtained from the Public Works Department, Field Operations Division for a nominal deposit, refundable upon the return of the meter.
12. Saturday work shall be as approved by the City Engineer. No work shall be permitted on Sunday or a Holiday.
13. Relocation of any water line, sewer line or service line required for the construction of this project shall be the responsibility of the Contractor and shall be at his expense.
14. If precast concrete storm sewer structures are to be used on this project, the Contractor shall, subsequent to review by the Design Engineer, submit shop drawings to the City Engineer prior to fabrication of the structures. Failure to do so may be cause for rejection.
15. Monument boxes conforming to all applicable Standard Details shall be installed when the quarter section corners are located within the limits of the new street.
16. Where a new street is to connect to an existing street, all deteriorated or cracked asphalt within five (5) feet of the connection point shall be removed to a depth where sound material is found. If full depth pavement removal is required, the subgrade shall be recompacted to ninety-five (95) percent of maximum density at optimum moisture.
17. All structural inspections shall be completed by a professional engineer registered in the State of Kansas.

Erosion and Sedimentation Control

1. All earth disturbance activities shall proceed in accordance with the following sequence. Each stage shall be completed and immediately stabilized before any subsequent stage is initiated. Clearing, grubbing, and topsoil stripping shall be limited only to those areas described in each stage. No fill shall be placed in future rights-of-way under a Land Disturbance permit unless approved by the City Engineer.
2. The Contractor or Owner shall obtain a Land Disturbance Permit from the City of Gardner. The permit holder must schedule an initial erosion and sediment control inspection prior to any earthmoving on the proposed site as per the approved plan. Scheduling of initial inspections must be made at least twenty four (24) hours in advance.
3. All excavation for utility line installation shall be limited to the amount that can be excavated, installed, backfilled, and stabilized within one working day. All excavated material shall be deposited on the upslope side of the trench. Sediment laden water that

accumulates in the trenches shall be pumped through a filtration device, or equivalent sediment removal facility, or over non-disturbed vegetated areas. Discharge points should be established to provide for maximum distance to active waterways.

4. Before implementing any revisions to the approved erosion and sediment control plan or revisions to other plans, which may affect the effectiveness of the approved Erosion and Sediment control plan, the Contractor must receive approval of the revisions from the City of Gardner.
5. All building materials and wastes must be removed from the site and recycled or disposed of in accordance with the Kansas Department of Health and Environment's regulations. No building materials or wastes or unused building materials shall be burned, buried, dumped, or discharged at the site.
6. Before disposing of soil or receiving borrow for the site, the Contractor must assure that each spoil or borrow area has an Erosion and Sediment Control Plan approved by the City of Gardner and which is being implemented and maintained according to City of Gardner regulations.
7. Any disturbed area on which activity has ceased must be stabilized immediately. During non-germinating periods, mulch must be applied at the recommended rates. Disturbed areas which are not at finished grade, and which will be re-disturbed before winter shall be stabilized in accordance with temporary seeding specifications. Disturbed areas that are either at finished grade or will not be redisturbed before winter must be stabilized with permanent seeding specifications.
8. Planting and seeding dates shall be in accordance with the City of Gardner Technical Specifications for Public Improvement Projects. Interim stabilization will be achieved by mulching.
9. Only limited disturbance will be permitted to construct sediment traps, diversion terraces, etc.
10. At the end of each working day, any sediment tracked or conveyed onto a public roadway will be removed and re-deposited onto the construction site. Removal can be completed through use of mechanical or hand tools, but must never be washed off the road using water.
11. Sediment removal from erosion and sediment controls and facilities shall be disposed of in landscaped areas outside of steep slopes, wetlands, floodplains, or drainage swales and immediately stabilized or placed in topsoil stockpiles.
12. Immediately upon discovering unforeseen circumstances posing the potential for accelerated erosion and/or sediment pollution, the Contractor shall implement appropriate best management practices to eliminate the potential for accelerated erosion and/or sediment pollution.
13. A copy of the approved erosion and sediment control plan and Stormwater Pollution Prevention Plan (SWPPP) must be available at the project site at all times.

14. All pumping of sediment laden water shall be through a sediment removal facility or over undisturbed vegetated areas.
15. Stabilization is defined as a minimum uniform 70% perennial vegetated cover or other permanent non-vegetated cover with a density sufficient to resist accelerated surface erosion and subsurface characteristics sufficient to resist sliding and other movements.
16. An erosion control blanket will be installed on all disturbed slopes steeper than 3:1 and all areas of concentrated flows.
17. Until the site is stabilized, all erosion and sediment control BMPs must be maintained properly. Maintenance must include inspections of all erosion and sediment control BMPs after each runoff event and on a weekly basis. All preventative and remedial maintenance work, including clean out, repair, replacement, regrading, reseeding, mulching, and renetting must be performed immediately. If erosion and sediment control BMPs fail to perform as expected, replacement BMPs, or modifications of those installed will be required.
18. Any sediment removed from BMPs during construction shall be returned to upland areas on site and incorporated into site grading.
19. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and or Contractor shall contact the City for a final inspection.

Traffic and Signaling

1. Existing underground (U/G), overhead (OH) utilities and drainage structures have been plotted from available information and therefore, their locations must be considered approximate only. It is the responsibility of the Contractor to locate each utility prior to construction.
2. All construction methods and traffic signal equipment shall conform to the latest edition of the City of Gardner Standard Specifications for Public Improvement Projects.
3. Contractor shall stake the location of all traffic signal poles, conduit, controllers, service boxes and junction boxes to be installed. Stations and offsets provided are to the center of the traffic signal equipment. The City Engineer shall inspect the staking prior to any excavation and/or construction. Minor relocation of equipment to avoid conflicts may be allowed with the approval of the City Engineer.
4. All existing curb and gutter, sidewalk, pavement, drainage structures or ground damaged during the traffic signal construction shall be replaced by the Contractor at his expense.
5. Conduit entering service boxes, junction boxes and/or pole bases shall be continuous in the service boxes, junction boxes and/or pole base. .
6. Coordinate Signal Turn-On with the City of Public Works Department, Traffic Operations Division.

DC1-003 **APPROVAL BLOCK.** A signature block shall be required on the cover sheet of all plans or reports submitted for review and approval. All plans require the signature of the City Engineer and the date of such signing for formal approval by the city.

The general form of the approval block shall be as follows:

APPROVED	
_____	_____
City Engineer	Date
APPROVED FOR ONE YEAR FROM THIS DATE	

DC1-004 **PRIVATE IMPROVEMENTS.** Private improvements, if any, shown on public improvement plans, shall be clearly defined, and marked as such. These improvements will not be maintained by the City of Gardner and, as such, an appropriate note shall be included on the drawings. These improvements nonetheless shall be designed and constructed to city standards.

DC2 – DESIGN CRITERIA FOR SANITARY SEWERS AND APPURTENANCES

DC2-001 **GENERAL.** Sanitary sewers shall be designed for the ultimate development conditions within the tributary area. The ultimate development conditions shall be estimated using current zoning regulations, land use master plans and approved planning and zoning reports, where applicable. Sewer capacities shall be adequate to convey the anticipated peak flow in accordance with the Design Criteria in this Section.

DC2-002 **SEWER DESIGN.** Sewers shall be designed for the total tributary area using the following minimum criteria. An Equivalent Dwelling Unit (EDU) is a standard quantity of water usage as required for one single family residence. The 25-year design flow rate per EDU shall be as follows:

1 Equivalent Dwelling Unit (EDU) = 300 gpd

Table DC2-002-1 shall be used to determine the total EDUs for an area. Extrapolations to determine design flow rates for industrial zonings, or zonings not listed below in Table DC2-002-1, shall be submitted to, and approved by the City Engineer.

Table DC2-002-1 – 25-Year Design Flow Rates

Type of Development	Gardner Zoning	EDUs per unit	Peaking Factor
Single-Family	R1	1.0 EDU per Living Unit	3.7
Multi-Family	R3, R4	0.8 EDU per Living Unit	3.7
Commercial/Industrial design flows shall be on a case-by-case basis and shall conform to KDHE standards.			

Peak flows can be increased by outside circumstances, such as other watershed contributions into the design watershed, and shall be considered in the design.

Sanitary sewer pipes 18 inches and larger in diameter shall be designed with a maximum flow depth of **three-fourths** of the pipe diameter. Pipes smaller than 18 inches in diameter shall be designed with a maximum depth of flow equal to **two-thirds** of the pipe diameter. All sewers shall be designed to convey the 25-year return interval storm. Design calculations shall be included on the General Layout Sheet of the plans within a table for approval.

DC2-003 **MAXIMUM SIZE.** The diameter of proposed sewers shall not exceed the diameter of the outlet pipe, unless otherwise approved by the City Engineer.

DC2-004 **MINIMUM SIZE.** No public sewer shall be less than eight (8) inches in diameter, and the minimum diameter for service connections shall not be less than six (6) inches.

DC2-005 **PIPE MATERIAL.** Sanitary sewer pipes shall be resistant to or protected from bacterial degradation, acid and alkaline solutions, temperature variation, abrasion, industrial wastes or other materials which may be transmitted by the collection system.

Unless otherwise specified or approved by the City Engineer, the following types of pipe are approved for proposed gravity sanitary sewer systems:

Polyvinyl Chloride Pipe (PVC) with a minimum thickness of SDR of 26

HDPE (gray and de-beaded) with a minimum thickness of DR 13.5

All pipe material shall be in accordance with the City of Gardner *Technical Specifications for Public Improvement Projects*.

DC2-006 **MINIMUM SLOPE.** All sewers shall be designed to provide a minimum velocity of 2.0 feet per second, when flowing one-half full.

All velocity and flow calculations shall be based on the Manning Formula using an N value of 0.013. Table DC2-006-1 outlines the minimum slope based upon pipe diameter.

Table DC2-006-1 – Minimum Design Slope Based Upon Pipe Diameter

	MINIMUM SLOPE IN PERCENT
SEWER SIZE	FULL AND HALF FULL FLOW
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.065
30"	0.058

Exceptions to these minimum slopes shall be made at the upper end of the lateral sewers serving under 30 houses. Said sewers shall have a minimum slope of 0.76 percent. All sewers larger than 30 inches in diameter shall have the slope approved by the city engineer.

Where lateral sewers serve less than 10 houses, the minimum slope shall not be less than 1 percent (1%).

DC2-007 **INCREASING PIPE SIZE.** When a sewer pipe joins a larger pipe, the invert of the larger sewer should be lowered sufficiently to match the crown elevation of the smaller pipe.

DC2-008 **HIGH VELOCITY PROTECTION.** In situations where flow is continuous and grit is a concern, velocities are greater than 10 feet per second or after the first five (5) manholes downstream of a lift station or a low-pressure sewer system, special provisions shall be made to protect against abrasion damage to the pipe and manhole.

Pipe and manhole protection shall be achieved using a protective coating included on the Approved Materials List. The protective lining shall cover all interior surfaces, including the adjustment rings, casting and lid.

Installers of the protective coating must be trained and certified according to the manufacturer's specifications. Installer certification shall be submitted to the City Engineer for approval prior to commencement of any work.

DC2-009 **ALIGNMENT AND GRADE.** All sewers shall be laid with straight horizontal alignment, with no deflections in vertical grade between manholes.

DC2-010 **MANHOLE LOCATION AND SPACING.** Manholes shall be installed at the end of each line, all changes in grade, size or alignment and all main line intersections. The maximum spacing between manholes shall be less than four hundred (400) feet for sewers eighteen (18) inches or less in diameter, and not greater than six hundred (600) feet for larger sewers.

DC2-011 **MANHOLES.** Manholes shall conform to the applicable Standard Details and the City of Gardner *Technical Specifications for Public Improvement Projects*. The maximum depth of any manhole shall not exceed eighteen (18) feet unless approved by the City Engineer.

The minimum horizontal clearance between pipes within the barrel of standard manholes should not be less than four (4) feet. Manholes with two or more connecting pipe diameters greater than eighteen (18) inches shall have a minimum inside clear dimension of five (5) feet. Manholes with three or more connecting pipe diameters of twenty-four (24) inches or greater shall have a minimum inside clear dimension of six (6) feet.

Drop manholes should be avoided as much as possible. However, an outside drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four (24) inches or more above the manhole invert. The outside drop pipe shall conform to the applicable Standard Detail.

Without utilizing drop manholes, the difference in elevation between the invert of any incoming sewer and the invert of the outgoing sewer shall be less than twenty-four (24) inches, except where required to match crown elevations. When a sewer joins a larger sewer connection, the crown of the smaller sewer shall not be lower than the crown of the larger pipe. The minimum drop through manholes shall be 0.2 feet for manholes with greater than 45° turns, and 0.1 feet for up to 45° turns.

Manholes located in close proximity to streets shall have the top of the manhole elevation set within the following tolerances:

Minimum Elevation	1/4" per foot rise above top back of curb
Maximum Elevation	1/2" per foot rise above top back of curb

Manholes located in unimproved areas and stream corridors shall have the top elevation of manholes set one (1) foot above the existing ground elevation or one (1) foot above the 100-year floodplain, (gasket and locking) anchored to grade rings whichever is greater. The maximum top of manhole elevation shall not be more than three (3) feet above finish grade.

Any variation from the above top of manhole criteria is subject to approval by the City Engineer.

The invert of dead-end manholes shall be constructed shaped and sloped to match anticipated extensions and/or service lines in the future. All connections shall meet requirements of this Section and all stubs shall be properly plugged to prevent any groundwater from entering the manhole. No service line connections to existing manholes shall be allowed.

DC2-012 **SEWER LOCATIONS.** Sanitary sewers shall be located within sewer or utility easements dedicated to the City of Gardner or street or alley rights-of-way. When the sewer is located in easements on private property, access shall be provided to all manholes. A manhole shall be provided at each street or alley crossing. End lines shall be extended to provide access from street or alley rights-of-way where possible. Street and alley crossing shall have a minimum overburden depth of eight (8) feet. The minimum overburden depth for sanitary sewer outside the right-of-way shall be five (5) feet, unless otherwise approved by the City Engineer. All trenches shall be backfilled in accordance with the City of Gardner *Technical Specifications for Public Improvement Projects*.

Sanitary sewer mains shall be extended to property lines. A manhole shall also be provided at the edge of the property line to accommodate future main extensions.

DC2-013 **PROTECTION OF WATER SUPPLIES.** There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

When potable water pipes and sanitary sewer systems, including gravity mains, force mains and manholes, are installed parallel to each other, the minimum horizontal separation shall be ten (10) feet, measured from the nearest points. Sanitary sewer pipes and waterlines shall not be installed in the same trench, regardless of the width of the trench. In cases where it is not practical to provide ten (10) feet of separation, alternate designs which provide equivalent protection shall be submitted to the City Engineer and KDHE for approval.

The minimum vertical clearance between waterlines and gravity sanitary sewer pipes shall be two (2) feet. Crossings with less than two (2) feet of vertical separation shall be in accordance the material and jointing requirements of B.1 of Chapter VIII of KDHE's *Policies, General Considerations And Design Requirements for Public Water Supply Systems In Kansas* and pressure tested to assure water tightness pursuant to the most recent revision of KDHE's *Minimum Standards of Design of Water Pollution Control Facilities*. If concrete encasement is the selected alternative when two (2) feet of vertical separation between the gravity sanitary sewer and the waterline, the encasement for the sanitary sewer shall have a minimum thickness of six (6) inches and extend a minimum of 10 feet on each side of the crossing.

The vertical clearance between waterlines and sanitary sewer force mains shall be a minimum of two (2) feet and the waterline shall always cross above the sanitary sewer force main.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

DC2-014 **UNSEWERED DWELLINGS.** All existing dwellings without sewer service shall be provided access to the sanitary sewer.

DC2-015 **MAXIMUM SLOPE.** All sewers which are designed to flow at seven (7) feet per second or greater shall be reviewed and approved by the City Engineer.

DC2-016 **SERVICE LINES.** Services shall not be permitted in manholes.

Wyes shall be installed in sewer mains for all private service lines. The service line shall be extended from the wye at the main's using a 45-degree riser and shall be extended to the edge of the utility easement or right-of-way, whichever extends furthest onto the property to be served. The service line shall be installed to provide a minimum slope in the service line of 1%, taking into account at least a three (3) feet Minimum Serviceable Floor Elevation (MSFE) at the structure to be served.

All service lines provided for future connection shall be plugged and marked by placing a 2"x4" wood post with metal cap or #4 rebar directly over the end of the service. Markers shall extend vertically from the end of service to one foot (1') below existing grade for the purpose of locating the stub line upon future connection.

DC2-017 **GROUNDWATER BARRIERS.** Groundwater barriers shall be provided to impede the conveyance of groundwater along the pipe at approximately the midpoint of the pipe when the distance between manholes exceeds 280 feet.

DC2-018 **LIFT STATIONS.** All lift stations shall be manufactured by Smith and Loveless, Inc. (classic style) and shall be wetwell mounted. The lift station must meet firm pumping capacity and shall be designed in accordance with the design criteria as specified under Sewer Design. Any variation from the specified lift station or design must be approved by the city engineer.

DC2-019 **EASEMENTS.** Permanent easements must be provided for all sanitary sewer mains. Permanent easements for sanitary sewer mains shall be centered on the main. The minimum easement width shall be 15 feet; however, easement widths may be increased depending upon the depth of the sewer main.

DC3 – DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS

DC3-001 **GENERAL.** The following discusses the minimum requirements for the contents of the Engineer’s Design Memorandum and Technical Specifications for Lift Stations and Force Mains. The Design Memorandum must be submitted and approved prior to plans and specifications being submitted to the City for approval.

The Memorandum and Specifications must be prepared and stamped by a professional engineer, licensed in the State of Kansas. These criteria are meant as a guide to quality and design of equipment and systems that are acceptable to the City. Any variances from these criteria will require significant backup calculations and data and will be reviewed upon submittal of the complete Design Memorandum.

DC3-002 **INTRODUCTION.** Describe in general the watershed(s) that are included in the service area, the estimated, ultimate growth population or population equivalents served and the type of development. Indicate the projected construction schedule (phasing) for the entire project.

DC3-003 **DESIGN FLOWS.** Present the calculations of the Average Daily Flow and Peak Flows based upon the highest flows/acre wastewater contribution. The table below should be used to establish the Peak Flow for a project. Low density residential shall be considered as up to and including 3.5 residences/acre. Above that value will be considered high density residential. Extrapolations to determine the Peak Flow/Acre may be made for the specific size of the development (acres).

Peak Flows for Design

Area (acres)	Residential		Commercial/Industrial (cfs/acre)
	High Density (cfs/acre)	Low Density (cfs/acre)	
Up to 100	0.022	0.019	0.0175
200	0.021	0.018	0.0165
500	0.017	0.014	0.0125
1000	0.014	0.0118	0.01
1500	0.0135	0.0108	0.009
2000	0.013	0.01	0.008

Peak Flows can be increased by outside circumstances such as other watershed contributions flowing by gravity or being pumped into the design watershed. If this is the case, the system design shall include these external factors.

DC3-004 **SITE DESIGN.** Submit:

- A general location map to indicate the relative position of the project within the City and its proximity to other watersheds.
- An overall system map that includes the gravity and pressure systems shall be provided. This system map should be of a scale that allows the reviewer to see the entire system on one sheet.
- No sheets should be larger than 24” x 36” and are best presented labeled and folded into pockets in the body of the Memorandum.

- One sheet that should be dedicated solely to the proximity of the site to the 100-year Flood Plain.
- Lift Station site Drawing that shall include the coordinates of the Lift Station and other major equipment items. A minimum of 1" = 50' scale shall be used. The Site Drawing shall show all equipment in plan view. Items to include are: Final grade contours, Lift Station, Detention Systems, Standby Generators, Valve Vaults, Measuring Manholes, Quick-disconnect stations for City to pump system (during emergency situations), Davit-Arm Bases, Fencing, Lighting and Paved Access Roads. Some of these items included in this drawing will require typical plan and elevation, sections and detailed drawings in order to illustrate their relative function. A separate electrical power and control drawing should illustrate the equipment selected and its connection to the mechanical equipment proposed.
- Plan and Profile drawing(s) shall be included for the Force Main that includes air release valves, minimum depths, valve pits and valves and connections to other gravity or pressure systems.
- If exhibits for this Design Memorandum are being developed from the Construction Drawings, they shall be simplified by removing layers, such as landscaping, etc., that do not apply to the systems design, in order to clarify the exhibits.
- The Design Memorandum shall also include the Maximum Velocity which shall not exceed 8 feet per second, unless otherwise approved, and the Minimum Velocity shall not be less than 2.5 feet per second, unless otherwise approved. Minimum and Maximum pumping pressures shall be determined and presented. Test pressure for Force Mains shall be 150 psi.

DC3-005 **HYDRAULIC DESIGN.** The Hydraulic Design data will include data from the Measuring Manhole through the entire system to the discharge connection of the Force Main. Minimal exhibits and calculations that will require presentation in the Design Memorandum shall include:

- System Curve(s), indicating operating range with maximum and minimum loads.
- Certified pump curves.
- Static and Dynamic Head Calculations.
- System Losses including all fittings, suction, and discharge points from the pump suction to the discharge connection of the Force Main.
- Hydraulic Grade Line of the Pumps and Force Main.

DC3-006 **PUMP STATION.** Pump stations shall be designed to provide firm pumping capacity to pump a 25-year storm event based on ultimate development. The difference of the design pumping rate and the 50-year storm event shall be detained on site.

The following pumping systems (type and model included in the Design Memorandum) shall be acceptable:

- Wet Well Mounted Lift Stations, manufactured by Smith and Loveless, Inc. for applications less than 18 ft. suction head. The suction pipes, installed by the Contractor, shall be PVC Schedule 80 (IPS), conforming to ASTM D 1785. The pump end of the suction pipe shall be connected using Van Stone Flanges/Slip (Gasket Type) and Grade 304 Stainless Steel hex bolts and nuts conforming to ASTM F593 2002.
- Submersible Pump Lift Stations are recommended for permanent applications, and 18 ft. and greater suction head, where pumps are approved by Department.

- Submittals shall include pump curves with operating points and pump and motor efficiencies. A design target should be to select a pump with a 60% efficiency, or greater. A target for minimum wire to water efficiency is a minimum of 60%.

DC3-007 **CHECK VALVES.** All lift station check valves shall be Swing Flex Check Valves.

DC3-008 **WET WELL SIZING.** Pump start/stop shall be designed according to the following:

- Motors, 30 Horsepower, or less – 10 start/stops (or less) per hour.
- Motors, greater than 30 Horsepower – 6 start/stops (or less) per hour.
- Minimum wet well diameter of 6 ft.

DC3-009 **CONTROLS.** The pump station control panel shall be part of the system that controls all features of the pump station and associated panel or field-mounted instrumentation. The design engineer shall specify a Mission Mydro 850 Monitoring System. The contractor shall have the overall responsibility for the complete system which shall include:

- Design, supply, delivery, installation, certification, calibration and adjustment, software configuration, testing and startup, City personnel training, warranty and routine future field services, of a complete coordinated system.
- All services and hardware to ensure proper communications are established with off-site remote locations that are to be monitored and controlled.

The design engineer shall review and coordinate system technical information submitted by Contractor for software; operating system, database, control strategies and the graphical user interface, specifically: report and log formats, graphics, trends, alarming, and other items.

Component specifications requirements are:

- Functions and features of all equipment of the system meet the requirements of the SCADA system.
- Control panel enclosure shall be NEMA TYPE 4X for outdoor location.
- Controls shall operate from a source of 120 volts, 1 phase, 60 Hz. All controls shall be protected from lightning or other transient voltages by a power arrestor.
- Condensation protection shall be provided. Enclosure shall have a heater which operates continuously to prevent condensation build-up. A freeze protective heater and thermostat shall also be provided.
- All DC power supplies required for operation shall be provided.
- Wiring shall meet all NEC, NEMA, and local electrical codes.
- PLC shall be an Allen-Bradley. Four additional I/O modules shall be provided, where PLC is specified.
- An uninterruptible power supply (UPS) shall be furnished to supply continuously a reliable source of power to the PLC's, computer and peripherals. The UPS shall provide no-break sine wave power, lightning and surge protection, isolation per FIP Standard 94, voltage regulation and be switch-mode power supply rated. The UPS shall utilize sealed, maintenance-free batteries to provide a minimum of 30 minutes of backup power at full load in the event of a failure of the normal AC source.
- All panels and all field modifications shall be in conformance with UL-508. Contractor shall certify that panels have retained their UL labeling or third party certification.

- Programming and documentation software shall run under the latest issue of Microsoft Windows operating system. The system supplier shall program the pump station PLC to operate and monitor its local I/O. The system supplier shall program the master PLC software to incorporate the lift station into the existing SCADA system, if required.

Minimum component requirements for the Mission MyDro 850 Monitoring System (including 8 digital and 2 analog) are:

- Standard package alarms
- Power Failure “built in”
- High Water (transducer is analog) (floats are digital) Back-up System
- Amp Meter (analog)
- Generator Failure (digital)
- Communication “built in”
- Pump Failure (digital) – Can have all combined to one alarm
- Excess Pump Starts “built in”
- Flow Monitoring (as applicable) (Flow meter rate “flow of day” analog)
- Rain Gage (as required) is a pulse counter that is added when purchased
- Seal Failure (as required) (digital) – “can all be combined in one alarm”
- Fuel (analog) – “can be digital if only a low lever alarm is wanted”
- Temperature Monitoring (Motor temperature is digital) (Outside temperature is analog)

The Allen-Bradley PLC Control panel shall monitor the following I/O (list could be different for each lift station):

Discrete Inputs

1. Pump No. 1 – Running
2. Pump No. 1 – In Remote
3. Pump No. 1 – Fail
4. Pump No. 2 – Running
5. Pump No. 2 – In Remote
6. Pump No. 2 – Fail
7. Wet well High Level Float Switch Alarm
8. Wet Well Low Level Float Switch Alarm
9. Power Failure
10. High/High Level Alarm (for systems with Containment)
11. Motor Moisture Alarm (submersible only)
12. Generator running and Generator Failure (set in PLC).

Discrete Outputs

1. Pump Station Enable
2. Remote Generator Test

Analog Inputs (4 to 20 milliamps)

1. Wet Well Level (Ultrasonic transducers with float switches as back-up)
2. Flow Rate
3. VFD Speed Indication (where VFD is used)
4. Force Main Pressure

Analog Outputs

1. VFD Speed Control (where VFD is used)

When an alarm occurs, the following sequence shall be provided:

1. The alarm shall be added to the Event Log.
2. Mission Communications, MyDro 850 System shall be provided.
3. Alarming requirement to be finalized at a coordination meeting with the City and design engineer.

DC3-010 **HEATING, VENTILATING AND AIR CONDITIONING.** Include recommendations for HVAC systems, other than standard equipment (as recommended by the manufacturer) depending upon the complexity of the location and environment.

DC3-011 **ELECTRICAL POWER SUPPLY.** The fundamental requirements of the electrical power supply are:

- 3-phase power supply from the utility
- Emergency disconnect mounted on pole outside the pump station, on a post
- Utility power meter located outside fenced area
- Transfer switch for a 3-phase generator

DC3-012 **LIGHTNING PROTECTION SYSTEM.** A protection system shall consist of air terminals, antennas, grounding electrodes and interconnecting conductors. The motor control center shall include transient voltage surge suppressor. The design of the system shall be prepared by a professional designer certified by the Lighting Protection Institute (LPI). The system shall be installed by a master installer certified by LPI.

Equipment furnished shall meet the following for design, construction and testing: ANSI/NFPA 780-Lightning Protection Code, ANSI/UL 96-Lightning Protection Components, and LPI 175-Lightning Protection Institute Standard Practice. System components shall conform to NFPA 780 Class 1 or 2 and shall be fabricated from the following metals:

Conductors:	Copper
Air Terminals:	Copper and Bronze
Grounding Electrodes:	Copper clad steel
Fasteners:	Copper or bronze
Bimetallic Fasteners:	Bronze and aluminum

All material for the system shall bear the UL inspection label.

DC3-013 **EMERGENCY POWER.** Emergency power may be required and will be reviewed on a case by case basis. Connections for portable power shall be included for all pump stations where permanent stand by power units are not required. Approved generator sets are Caterpillar, or Cummins/Onan. Fuel storage shall provide a minimum of 24-hour supply of diesel. The generator sets shall be furnished and installed in an enclosed outdoor power unit. The system shall meet the following requirements:

- The unit shall consist of a one-piece, seamless fiberglass-reinforced plastic enclosure for weather protection and sound attenuation. The maximum sound additive level shall be 72 dB(A) at 23 feet distance.
- The FRP enclosure shall be able to withstand a wind load of 120 MPH and the roof capable of supporting 30 lbs per square foot loading.
- 150 KW generators and smaller shall require a tip-up style FRP enclosure with gas spring lift assist.
- Generators larger than 150 KW must be provided with a walk-in, seamless FRP enclosure.
- Acceptable fuels are natural gas and propane.
- Controls shall include a terminal strip with alarm and monitoring contacts for connection to the City's telemetry system.
- The generator, automatic transfer switch, environmental systems, fuel tank (where applicable) and ancillary equipment shall be skid-mounted, pre-installed, and tested as an integrated system by the manufacturer. Individual component testing is not acceptable. The manufacturer shall be responsible for system equipment and testing.
- The generator and automatic transfer switch shall be covered by a 5-year, or 1,500 hour warranty.

DC3-014 **VARIABLE FREQUENCY DRIVES.** Soft Starts are preferred but Variable frequency drives (VFD) may be considered in some situations. Because this benefit varies depending on system variables such as pump size, load profile, amount of static head, and friction, it is important to calculate benefits for each application before specifying a VFD. If a VFD is proposed, harmonic distortion needs to be evaluated and an isolation transformer provided, if required. By-pass contactors need to be installed for emergency power operations if VFDs are used.

Approved VFD manufacturers: ABB, Toshiba, Yaskawa

DC3-015 **WET WELL AND DISCHARGE MANHOLE LINING.** At a minimum, the wet well and the discharge manhole at the end of the force main shall be lined with a protective coating. The new concrete in these manholes shall be cured prior to application of the protective coating (minimum of 28 days). The lining shall cover all interior surfaces from the bottom to the top including any adjustment rings and underside frame and cover.

Approved manufacturers are:

- Raven Lining systems, Inc, 405 Coating System, Tulsa, OK. This is a 100% solids, solvent-free epoxy grout that can be troweled or sprayed.
- Protective Liner systems, PLS-650 Perpetu Wall Liner System. This is a two-part, 100% solids, epoxy system reinforced with fiberglass.
- Zebron[®], Zebron Corporation, Newport Beach, CA. This is a 100% solids, hybrid polyurethane containing no solvents.
- Castagra Ecodur, Castagra Products, Inc., Reno, NV.

Installers of these materials must be trained and certified according to the manufacturer's specifications. Installer certification shall be submitted to the City for review and approval prior to commencement of any work.

DC3-016 **FLOW MEASUREMENT.** Flow measurement shall be provided to measure influent flow to the wet well of the lift station from the upstream gravity sewer system. The primary element of the flow measurement device recommended is a Parshall flume to be designed so as to be on the lift station site but not so close to the wet well that downstream flow will submerge the flume and result in erroneous readings. An ultrasonic level device shall be used to measure the upstream and downstream levels through the flume. These readings that are converted to flow shall be integrated into the control system.

DC3-017 **FLOW MONITORING OF PRESSURE DISCHARGE PIPE.** Using electromagnetic meter and integration into the control system.

Approved meter manufacture: Siemens.

DC3-018 **EMERGENCY OVERFLOW STORAGE.** The difference of the design pumping rate and the 50-year storm event shall be detained on site as emergency overflow storage.

DC3-019 **EMERGENCY BY-PASS PUMPING.** Six (6) inch suction and discharge connections (Bauer connections), above ground, are required. This design shall include the proper joint restraints as well as a concrete vault to provide access to the valve. The asphalt or concrete road into and out of the site shall accommodate the City truck and trailer that will respond to emergency situations. The access road shall be designed to allow along-side access of the trailer to by-pass piping. The road configuration shall be such that the vehicle can drive through on a loop road or maneuver the road configuration under the following conditions: 30 ft. turning radius.

DC3-020 **PERSONAL HOIST SYSTEM.** Adavit-arm hoist is required within five (5) feet of the wet well and/or valve vault for use of confined space entry. The sleeves shall mount to a horizontal concrete or steel structure.

DC3-021 **ACCESS HATCH.** Access to manholes or wet wells shall be through an aluminum hatch designed for pedestrian access rated for a minimum live load of 300 psf with deflection not to exceed 1/150th of the span. Aluminum material shall be used for the bars, angles, extrusions and diamond plate. Stainless steel material shall be used for all hardware. Each hatch shall be supplied with an exposed padlock clip. Nominal opening dimensions shall be a minimum of 24" x 30". Each hatch shall be supplied with a safety grille. Approved equipment are "FLE" access hatch as manufactured by ITT Flygt Corp. or "EC" access hatch as manufactured by Syracuse Castings.

DC3-022 **SITE LIGHTING.** Site lighting shall be required to provide lighting controlled by a photo-electric cell. Manual off/on switch shall also be provided. Intensity of lighting shall be designed to provide safe maintenance at night but not be of the intensity and direction to cause problems with adjacent property owners.

DC3-023 **FORCE MAIN.** As a minimum, the design of the Force Main shall include plan and profile drawings of the route indicating the minimum cover, connection to the receiving system with details if required, air release valve pit location and details, and any required valves (plug valves required) and details.

The Force Main shall be PVC pipe, ANSI/AWWA C900 or C905 with dimension ratios corresponding to working pressures of (150 psi minimum). PVC to PVC joints shall be

ANSI/AWWA C900 or C905, push-on type, with elastomeric synthetic rubber gaskets. PVC to Cast Iron joints shall be ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. All cast iron or ductile iron fittings on PVC pipe shall be properly encased with polyethylene.

Thrust prevention shall be provided with Restrained Joints and distances in both directions from the fittings indicated.

DC3-024 **TRACER WIRE.** Tracer wire for sewer pipeline and discharge piping shall be a (12 AWG) extra-high-strength copper-clad steel conductor (EHS-CCS), insulated with a 45 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. EHS-CCS conductor must be a 21% conductivity for locating purposes, Break load will be 1150lbs minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be Copperhead Soloshot Extra High Strength, EHS-CCS HDPE 45 mil insulation or equal. The tracer wire shall be installed no more than six inches (6”) above the top of the force main. Tracer wire shall be installed continuously along the new facility route with access points placed every 300 hundred feet maximum. Tracer wire should be brought to the ground surface at the access points. Access points may include valve boxes, handholes, manholes, vaults or other covered access devices. Access point covers shall be clearly marked with the type of facility. Splices in the tracer wire should be avoided and connected by means of a Snake Bite Dryconn Direct Bury Lug by Copperhead Industries Direct Bury Kits to ensure continuity. The contractor shall perform continuity tests on the tracer wire after installation. If the tracer wire fails the continuity test, the Contractor shall repair the wire at no additional cost to the Owner.

DC3-025 **AIR AND VACUUM RELEASE VALVES.** Air and vacuum release valve assemblies shall be installed in the locations indicated on the drawings. Each valve assembly shall be installed complete with appurtenant piping and valve as specified.

The air/vacuum valve assemblies shall be fully automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry.

DC3-026 **TESTING.** The contractor shall be responsible for coordinating the testing of all systems. Prior to testing, the contractor shall furnish all required operation and maintenance manuals to the City of Gardner. All special testing materials and equipment shall be provided by the contractor. The contractor shall coordinate and schedule all of his testing and startup work with the City. Testing shall be witnessed by the City and the requirements are as follows:

- All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly. The manufacturer’s representative performing the test shall furnish a copy to the City of the certified check list that indicates test values measured for proper functioning parts and systems.
- The Manufacturer shall also perform factory-certified tests that shall use the latest test code of the Hydraulic Institute to determine head vs. capacity and kilowatt draw. The results of the factory-certified tests shall be furnished in the operation and maintenance manuals.

- Witnessed field tests shall be performed on the complete system. Each function shall be demonstrated to the satisfaction of the Utilities Department and Design Engineer. These tests shall include:
 1. Megger stator and power cables.
 2. Check seal lubrication.
 3. Check for proper rotation.
 4. Check power supply voltage.
 5. Measure motor operating load and no load current.
 6. Check level control operation and sequence.
 7. Insure that the check valve is closing properly at shut down of the system.
- Each test shall be witnessed and signed off by the Manufacturer upon satisfactory completion. The Contractor shall provide all required operation and maintenance manuals and notify the City at least one (1) week prior to the commencement date of the field tests.

DC3-027 **SUBMITTALS.** Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, the Contractor shall review for conformance with the specifications and then shall furnish to the Design Engineer for his review six (6) copies of submittal documents. Coincident with review and mark-up by the Design Engineer the submittals shall be sent to the Utilities Department Manager for review.

Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. The Contractor shall submit the following materials:

1. Operational description of each system showing all major components and their interconnections and interrelationships. Where appropriate, provide block diagrams. Label each diagram and specify all external power and communications interfaces.
2. Drawings of equipment to be supplied shall include, as a minimum: Overall dimension details for each item and arrangement of items included in each unit. Wiring diagrams of equipment including field device connection shall be included and specific installation/wiring requirements identified.
3. Operational description shall include the principal functions/capabilities.
4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.

Software Submittals

1. Provide complete user manual for all supplier configured software and firmware. For ancillary software such as operating systems and spreadsheets being supplied under this contract, only a listing of the manual which will be included with the Operations and Maintenance documentation is required.
2. Sample communication and control database programs for project in hardcopy form. As a minimum, hardcopy form shall be fully documented, including code, comments, addressing data and cross-references. Every line or section of code shall be accompanied by a comment describing its function.
3. Provide initial graphic display and report format layouts. List and briefly describe all operator interface functions provided at the PC, including: Alarm annunciation and acknowledgment, status displays, control capabilities, report generation, event logging, charting and trending.

Spare Parts - The contractor shall provide a list of recommended spare parts and expendable items. The list shall be exclusive of any spare parts furnished under this contract. A total purchase cost of the recommended list shall be provided in addition to the unit cost of each item.

DC3-028 **OPERATION AND MAINTENANCE MANUALS.** Adequate operation and maintenance (O & M) information shall be supplied for all equipment requiring maintenance or other attention. As a minimum, O & M manuals shall be supplied for pumps/motors, variable frequency drives, valves, flow measurement devices, generator sets, odor control systems, lightning protection systems, and control systems including instrumentation panels.

- The contractor shall provide two (2) complete sets of hard-covered, ring bound, loose-leaf and digital O & M manuals. In addition to “as-built” system drawings, the manual shall include operating and maintenance literature for all units and components provided for the whole system. Data furnished shall include internal wiring diagrams.
- The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.
- O & M manuals shall include copies of all PLC programs written to accomplish the monitoring and control functions specified. Programs shall be updated after startup is complete, with the programs provided digitally to the City.
- The O & M manuals shall be organized as follows:
 1. System Equipment/Installation
 2. System software
 3. Operation
 4. Maintenance and Troubleshooting
- Topics required are:
 1. Equipment function, normal operating characteristics, and limiting conditions.
 2. Assembly, installation, alignment, adjustment, and checking instructions.
 3. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 4. Lubrication and maintenance instructions.
 5. Guide to troubleshooting.
 6. Parts list and predicted life of parts subject to wear.
 7. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
 8. Test data and performance curves, where applicable.
 9. Warranties and warranty contact information including names, phone numbers and email addresses.

DC3-029 **TRAINING.** Training shall be provided for each major component or system that requires maintenance (generally furnish training for all equipment that requires an O & M Manual).

The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of a minimum of one (1), 8-hour day, including time for demonstration in the field. At least two (2) weeks prior to the requested start of the program, the proposed dates of training shall be submitted to the Utilities Department and Design Engineer for

approval.

It shall be the responsibility of the Contractor to coordinate and organize the suppliers for the training program. The suppliers shall provide all instructional course material, equipment, and manuals to conduct the training program. The City shall provide the facilities for the training.

DC3-030 **DEFINITION OF ACCEPTANCE.** System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

- All O & M documentation has been submitted, reviewed, and approved.
- The complete controls system and instrumentation have successfully completed all testing requirements and have successfully been started up.
- All City personnel training programs have been completed.
- The Design Engineers and Utilities Department both sign a document indicating the controls system has formally been accepted.

DC4 - DESIGN CRITERIA FOR STREET IMPROVEMENTS

DC4-001 **GENERAL.** Proposed street improvements within the City shall conform to the criteria established in the Gardner Comprehensive Plan as well as this Section and the City of Gardner *Technical Specifications for Public Improvements*.

Street improvements within the City of Gardner shall be designed to conform to all applicable codes, regulations, and ordinances as established by the City. Plans for said improvements containing all information specified or requested shall be submitted to the City Engineer for approval.

DC4-002 **FUNCTIONAL CLASSIFICATION OF STREETS.** The City defines geometric design standards for streets and highways which result in adequate traffic mobility and suitable access to abutting property.

The street design standards included in this section are based upon the street functional classifications outlined in the Access Management Code, latest edition.

Typical cross-sections of these classifications are shown on applicable Standard Details.

Table DC4-002-1 – Design Criteria for Functional Street Classifications

Designation	Arterial	Collector	Local ⁷	Reference Documents
Number of Traffic Lanes ²	2-6	2-3	2	Land Development Code
Width of Traffic Lanes ²	12' - 14' ³	12' - 14' ³	12'	Land Development Code
Left Turn Lanes	Double at Signals ⁴	As needed from TIS	N/A	Access Management Code Traffic Impact Study
Right Turn Lanes	Yes	Yes	As needed from TIS	Access Management Code Traffic Impact Study
Bike Lanes	As Shown in TMP	As Shown in TMP	N/A	Land Development Code
Minimum R/W Width ⁵	120'	60' - 80'	50'	
Minimum Design Speed	50 MPH	40 MPH	30 MPH ⁷	
Posted Speed	40-45 MPH	30-35 MPH	25 MPH ⁷	
Stopping Site Distance	425'	305'	200' ⁷	
K Value ⁶ (Crest / Sag)	84 / 96	44 / 64	19 / 37 ⁷	
Minimum Radii Horizontal Curve ⁷	750'	250'	175' ⁷	
Sidewalks/Multi-use paths	5' Sidewalk + 10' SP	5' Sidewalk - Both Sides	5' Sidewalk - Both Sides in Multi-Family	Municipal Code
On Street Parking	Prohibited	Permitted	Permitted	Land Development Code
Min./Max. Grade	0.8%/6%	1%/8%	1%/10%	Access Management Code
Curb Radii	25-30'	10-20'	5-15'	Municipal Code
¹ Denotes fully improved condition				
² Denotes width of outside lane with no shoulder or bike lane				
³ Double at Arterial/Arterial intersections, all other intersections as defined in TIS				
⁴ See Technical Specifications and Standard Details for R/W width at intersections				
⁵ Per AASHTO Green Book Table 3.34				
⁶ Multi-Family Local Street minimum design speed may be reduced to 15 MPH				
⁷ TIS = Traffic Impact Study				

DC4-003 RIGHT-OF-WAY GRADING. Within the limits of the right-of-way, the finished grade shall slope toward the curb with grades varying from two (2) percent to four (4) percent. These gradients may be varied only upon written approval of the City Engineer.

DC4-004 TANGENT LENGTH. The minimum tangent length between reverse curves shall be fifty (50) feet for local streets. No tangent will be required for radii longer than five hundred (500) feet.

DC4-005 OFF-CENTER STREET INTERSECTIONS. Off-center street intersections shall be separated by a minimum centerline to centerline dimension of one hundred-fifty (150) feet.

DC4-006 CONNECTIONS TO EXISTING PAVEMENTS. Where new street construction connects to an existing street, a minimum of five (5) feet of the existing pavement shall be saw cut and removed to subgrade. The exposed subgrade shall be re-compacted or replaced with aggregate base in accordance with the Standard Details, and repaved with the new construction.

DC4-007 MINIMUM ANGLE OF INTERSECTION. All intersections shall meet at a 90-degree

angle, unless otherwise approved by the City Engineer. The minimum acceptable angle for driveways that serve two-way traffic is 80 degrees. Driveways that serve one-way traffic may have an acute angular placement from 60 to 90 degrees.

- DC4-008** **SIDEWALKS.** Sidewalk construction shall typically follow the requirements in the Standard Details. Temporary sidewalks on unimproved streets may be required to facilitate pedestrian ingress/egress. Construction of temporary sidewalks shall be funded by the developer.
- DC4-009** **STORM DRAINAGE.** All storm drainage facilities constructed in connection with street improvements shall be designed in accordance with the City of Gardner *Design Criteria for Storm Drainage Facilities*.
- DC4-010** **CUL-DE-SACS.** At locations where streets are to be terminated and a vehicular connection between adjacent streets is not required, a cul-de-sac shall be constructed. Such cul-de-sac shall be constructed with a length no greater than 800 feet and the minimum radius shall be 39 feet.
- DC4-011** **TEMPORARY TURN-AROUNDS.** At locations where streets are to be temporarily terminated which will be extended at a later date, and said street extends beyond the intersection of an adjacent street more than one hundred-fifty (150) feet measured from the edge of pavement, a temporary cul-de-sac shall be constructed with a minimum radius of thirty-five (35) feet. The temporary cul-de-sac shall be constructed of asphaltic concrete with a minimum thickness of six (6) inches. Curb and gutter are not required. The cul-de-sac shall be constructed within the limits of a permanent construction easement.
- DC4-012** **MONUMENT BOXES.** Monument boxes conforming to applicable Standard Details shall be installed at all quarter section corners during street construction.
- DC4-013** **SIGHT DISTANCES.** Sight distance is the length of roadway ahead visible to the driver. The minimum sight distance available on a roadway should be sufficiently long to enable a vehicle driving at the design speed to stop before reaching a stationary object in its path.
- A. **Stopping Sight Distance**--Stopping sight distance represents the sum of the brake reaction distance and the braking distance. These distances are measured from the height of the driver's eye to the height of the object, 3.5 feet and 2.0 feet above the road surface, respectively. Design controls for stopping sight distances vary slightly for crest vertical curves and sag vertical curves, and are dependent on the algebraic difference in the grades as well as the design speed. Refer to American Association of State Highway and Transportation Officials' (AASHTO) "A Policy on Geometric Design of Highways and Streets", 2001 or latest version for the minimum stopping sight distances to be used in design of roadways.
- B. **Intersection Sight Distance**-- Sight distances at intersections vary from stopping sight distance. The intersection sight distance should be sufficient to permit a vehicle on the minor leg of the intersection to cross the traveled way without requiring the approaching through traffic to slow down. To achieve this, an area free of visual obstruction is required at every corner of an intersection.

An obstruction to vision shall be defined as an obstacle (i.e., a parked vehicle, a wall or commercial sign, bush or hedge, guardrail, or fence, etc.) which forms a restriction

to an assumed line of sight measured from the driver's eye height to a target some distance along the cross street.

Every effort shall be made to select intersection locations which maximize the sight distance. The location of intersections shall always consider the grade changes along the adjacent street in terms of possible sight obstructions.

- C. Sight Triangle--Sight triangle requirements vary based on the type of intersecting streets and are summarized in Table DC4-014-1. All measurements are taken from the point of intersection of the extended curb lines of each intersecting street. The values in the table are dependent on the travel speed of the vehicles on the intersecting street and on the typical vehicle which will approach the intersection. The standard assumed height of the driver's eye for a passenger vehicle is 3.5 feet above the roadway surface (7.6 feet above the pavement for a single unit truck or large semi). This relates to the line of sight required to detect an approaching vehicle on the cross street (regarded as a point 3.5 feet above the roadway surface). See City of Gardner Access Management Code for additional details.

Table DC4-014-1 – Clear Sight Distance

Design Speed of Intersecting Street	Intersection Sight Distance (measured along centerline of intersecting street)
15 mph	105'
20 mph	125'
25 mph	150'
30 mph	200'
35 mph	225' – 250'
40 mph	275' – 325'
45 mph	325' – 400'

All corner lots within the City of Gardner (except those in the Central Business District) shall have a sight triangle free of visual obstructions from a point twenty-five (25) feet back along the minor leg as measured from the point of intersection of the extended curb lines of each intersecting street to a point that varies with the street type and is stated in Table DC4-014-1. This area shall remain free of visual obstructions higher than three (3) feet and lower than ten (10) feet above the roadway surface. Within the Central

Business District, the sight distance triangle shall conform as closely as possible to the above specification, as approved by the City Engineer.

- DC4-014** UNDERDRAIN. In areas that have known subsurface moisture problems, underdrains will be required. They shall be built as shown in the Standard Details.

If during construction it does becomes apparent that there is a need for underdrain in a location that was not previously designed for underdrain, the City Engineer can require that the consultant submit a revised plan including underdrains that will provide for subsurface drainage. The standard detail is a minimum. Upon approval of the City Engineer, alternate details for increased capacity may be allowed.

- DC4-015** **OPEN CUTTING OF STREETS.** No open cutting of streets for utilities shall be allowed unless approved by the City Engineer. If an open cut is approved by the City Engineer, a traffic plan in accordance with MUTCD guidelines will be required to be submitted and approved prior to construction. One lane shall remain open at all times or flashing signboards provided at appropriate locations informing drivers of detours. The signboards must be placed at the site at least 5 days in advance of construction.
- DC4-016** **PRIVATE STREETS.** All streets and roadways within any development which are classified as "Private Streets" shall conform to the standards and specifications for public streets, as stipulated in the Technical Specifications and Design Criteria for Public Improvement Projects for the City of Gardner.
- DC4-017** **BICYCLE PEDESTRIAN TRAIL SYSTEM.** The design engineer shall contact the Parks and Recreation Department, Public Works, and/or Planning Department to determine whether any portion of the proposed construction will involve the City of Gardner's Trail System. Multi-use paths constructed as part of this system shall be 10 feet in width with a 25' wide pedestrian easement.
- DC4-018** **EMERGENCY ACCESS ROADS.** Emergency access roads connecting to public streets shall only be permitted at locations approved by the City Engineer.
- DC4-019** **DEVELOPMENT ADJACENT TO UNIMPROVED ARTERIAL ROADS.** A vertical profile, horizontal limits of future arterial roadway improvements and elevations at the future right of way shall be established for all developments adjacent to an unimproved arterial roadway. The elevation of the proposed development shall match the elevation at the future right of way. An unimproved arterial road shall be defined as an arterial road which has not been constructed to its ultimate typical section as defined by the Major Street Map or as required by the City Engineer.

During these improvements, an interim stage for safety improvements will be needed. These improvements include proper grading, drainage, storm sewer, roadway signage, sidewalk improvements, and shoulder modifications.

DC5 - DESIGN CRITERIA FOR STORM DRAINAGE FACILITIES

The City of Gardner design criteria shall conform to American Public Works Association (APWA) *Section 5600 – Storm Drainage Systems & Facilities*, latest edition, with the following amendments and modifications:

SECTION 5601 ADMINISTRATIVE

5601.1 Introduction

This section shall be modified to include the following paragraph:

The City Engineer reserves the right to modify the criteria set forth in this Section in order to accommodate unique or innovative projects, such as low impact developments, conservation developments and redevelopment projects.

5601.3 General Requirements and Applicability

This section shall be modified to include the following paragraph:

All proposed projects shall submit a stormwater management system design in accordance with Section 14.01.400 of the Gardner Municipal Code.

A minimum of 2 percent grade is required for positive drainage for all lot-to-lot developments. Due to the relatively flat topography in the City of Gardner, inlets shall be placed in subdivisions per design as determined by the City Engineer. Runoff from adjacent upstream properties shall be directed into swales or inlets as directed by the City Engineer.

SECTION 5607 ENGINEERED CHANNELS

5607.2B-Roadside Channels shall be modified to include the following statement:

Permanent easements for roadside drainage swales shall extend from the right-of-way to 10-feet beyond the outside bank of the swale.

The following sub-section shall be added to Section 5607.2-Easements:

5607.2C - Permanent easements shall be dedicated to the City of Gardner for operation and maintenance of swales that will be publicly maintained. The minimum width of permanent easements for overflow swales shall be the calculated 100-year flow width, with a minimum width of ten feet (10').

SECTION 5608 STORMWATER DETENTION AND RETENTION

5608.4C – Release Rates – This subsection shall be replaced with the following:

Table 5608.4-1 - Allowable Release Rates from Detention Facilities

Design Storm	Allowable Post Development Release Rate
1-Year	Pre-developed 1-year storm
10-Year	Pre-developed 10-year storm
100-Year	Pre-developed 100-year storm

Stormwater detention requirements may be waived for infill sites if approved by the City Engineer. Prior to approval of a waiver, a Stormwater Management Plan shall be submitted and approved by the City Engineer.

DC6 – DESIGN CRITERIA FOR WATER LINE CONSTRUCTION

DC6-001 **GENERAL.** Proposed extensions of the water distribution system shall, in general, follow the pattern of constructing 12-inch water lines along all section lines and 8-inch water lines along all half-section lines. Deviations from this general policy may be deemed necessary by the city engineer should the provision of adequate service to prospective customers or fire protection needs, existing or anticipated, in the area to be served warrant said deviations.

Hydraulic calculations shall be submitted for review with all commercial and industrial plans. Upon request by the City Engineer, hydraulic calculations shall be submitted for residential plans. Typically, these calculations shall be shown on a drawing sheet included in the plans.

All commercial and industrial water lines shall be designed with a minimum of two (2) feed lines (looped system). Dead end lines will not be allowed without approval from the City Engineer.

No public water line shall be constructed less than six (6) inches in diameter. Where water lines less than six (6) inches exist, it shall be upgraded to a minimum diameter of six (6) inches, unless otherwise approved by the City Engineer.

DC6-002 **LOCATION OF WATER MAINS AND APPURTENANCES.** Proposed water mains shall be located in a dedicated ten (10) foot water line easement adjacent to the right of way, in a fifteen (15) foot stand-alone water line easement or, with the City Engineer's approval, within the street right-of-way. Street grades and elevations of proposed main shall be taken into consideration so relocation of the water line will not be required.

Combination air release valves are required at high points of water transmission mains where no services exist or are planned. The profile of the water main shall be designed to limit high points in the line where practical, particularly where mains are installed within the right-of-way.

DC6-003 **DEPTH.** All water mains shall have a minimum cover of forty-two (42) inches.

DC6-004 **MATERIALS OF CONSTRUCTION.** Polyvinyl chloride (PVC) or High-density Polyethylene (HDPE) shall be used for all mains constructed in the City of Gardner, unless approved otherwise by the City Engineer.

HDPE water mains shall conform to AWWA C906. The HDPE pipe shall be Ductile Iron Pipe Size (DIPS) with a minimum Dimension Ratio (DR) of 11. HDPE pipe shall be NSF 61 product certified.

The PVC pipe shall conform to ASTM D1784, ANSI/AWWA C900. Pipe wall thickness shall be DR-18 for pressure class 150 or DR-14 for pressure class 200.

DC6-005 **FIRE HYDRANTS.** Fire hydrants shall conform to AWWA C502.

Hydrants shall be traffic models with breakaway flanges and shall have one 4-1/2 inch pumper nozzle and two 2-1/2 inch nozzles. All hydrants shall be furnished with a six (6) inch auxiliary gate valves.

Hydrants shall be placed at or near street intersections, at the end of dead-end lines and at intermediate points when block lengths exceed 500 feet. Under no circumstances shall the spacing of fire hydrants exceed 500 feet in residential areas or 300 feet in commercial areas. Fire hydrant spacing in industrial areas shall be determined by the Fire Marshal.

Tapping of extended fire hydrant lines for water service lines, irrigation lines and private fire lines in commercial and industrial areas will require the approval of the City Engineer. An additional gate valve will be required at the fire hydrant when tapping has been approved.

Fire hydrant installations shall conform to all applicable Standard Details.

DC6-006 **LINE VALVES.** Gate valves shall be of the resilient-seated configuration and shall conform to the applicable requirements of AWWA C509 and C515.

Gate valves shall be used in all water mains less than sixteen (16) inches in diameter. Butterfly valves shall conform to AWWA C504 and shall be used in all mains sixteen (16) inches and larger in diameter.

Valves shall be placed in all straight runs of pipe at intervals not to exceed 500 feet. Where two lines intersect, a valve should be placed in each pipe on each side of the intersection. Valves should be so placed that any pipe two (2) blocks long can be cut out of the general circulation without interrupting service in the rest of the system.

DC6-007 **CONNECTIONS TO EXISTING WATER MAINS.** Connections to existing water mains shall be made in such a manner as to provide the least amount of interruption to water service. In the event closing of valves to make a connection will affect a customer who requires continuous service, temporary tap(s) shall be scheduled and made for temporary service. Temporary water service shall not be permitted from a fire hydrant. Where possible, connections to existing mains shall be made using tapping sleeves and valves as approved in the City of Gardner *Technical Specifications for Public Improvement Projects*.

All existing ductile iron dead end line assemblies shall be removed prior to the continuation/extensions of waterlines.

When connections are made to an existing system under normal conditions, the exposed pipe and fitting interiors shall be wetted with a 500 mg/L chlorine solution before closure. In emergency situations the exposed interiors of the pipe and fittings are to be swabbed with a 1% chlorine solution.

Wetting and or swabbing are not considered effective methods of disinfection when there is a potential for significant contamination of the main, i.e., sewage is detected in the trench during repairs.

DC6-008 **PROVISIONS FOR FUTURE EXTENSIONS OF WATER MAINS.** At the termination of all water mains or at locations as specified by the City Engineer, a fire hydrant in accordance with Standard Details shall be provided.

DC6-009 **THRUST BLOCKING.** All fittings shall be restrained joint unless approved by the City

Engineer. All piping within the designed distance of fittings shall be restrained joint in accordance with Table 1. The engineer shall determine, and the plans reflect the locations and distances required for the installation of restrained joint piping.

**TABLE 1
THRUST RESTRAINT FOR PVC MAINS AND
FITTINGS FAST GRIP GASKETS**

THE THRUST RESTRAINT TABLES ARE BASED UPON THE FOLLOWING CRITERIA:

1. HORIZONTAL FITTINGS ONLY
2. TYPE NO. 2 LAYING CONDITIONS
FLAT BOTTOM TRENCH, BACKFILL LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE.
3. CLAY NO. 1 SOIL CONDITIONS
CLAY OF MEDIUM TO LOW PLASTICITY
4. DEPTH OF COVER 3.5 FEET
5. DESIGN PRESSURE 180 PSI
6. SAFETY FACTOR OF 1.5 TIMES PLEASE

NOTE:

ANY TRENCH, SOIL DEPTH OR PRESSURE CONDITIONS WHICH DEVIATE FROM THE ABOVE LISTED CRITERIA SHOULD BE REVIEWED BY THE CITY ENGINEER FOR AN ALTERNATIVE SOLUTION.

TABLE OF PIPE FOOTAGES REQUIRED TO RESTRAIN FITTINGS BY SIZE					
RESTRAINT FOOTAGE IS FOR EACH SIDE OF FITTING					
FITTING	4"	6"	8"	12"	16"
11 1/4 BEND	5'	7'	9'	13'	17'
22 1/2 BEND	9'	13'	18'	26'	33'
45 BEND	20'	28'	37'	53'	70'
90 BEND	47'	68'	89'	129'	168'
DEAD END	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR TEES					
(RESTRAINT IS ON THE BRANCH ONLY)					
BRANCH SIZE	4"	6"	8"	12"	16"
RESTRAINT LENGTH	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR REDUCERS BY SIZE				
REDUCER-SMALL END	12"	8"	6"	4"
LARGE END				
16"	57'/75'	98'/188'	113'/285'	124'/450'
12"	-	54'/79'	74'/142'	88'/245'
8"	-	-	29'/38'	50'/95'
6"	-	-	-	27'/39'

Example: 16" x 12" reducer requires the following: 57'75'
Length of restrained joint piping for the large side of reducer 57 feet

NOTE: If the straight run of pipe on the small side of reducer exceeds 75 feet then no restrained joints are necessary.

DC6-010 **SEPARATION OF WATERLINES AND SANITARY SEWERS.** There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

When potable water pipes and sanitary sewer systems, including gravity mains, force mains and manholes, are installed parallel to each other, the minimum horizontal separation shall be ten (10) feet. Waterlines and sanitary sewer pipes shall not be installed in the same trench, regardless of the width of the trench. In cases where it is not practical to maintain a ten (10) foot separation, alternate designs which provide equivalent protection shall be submitted to the City Engineer and KDHE for approval.

The minimum vertical clearance between waterlines and gravity sanitary sewer pipes shall be two (2) feet. Crossings with less than two (2) feet of vertical separation shall be in accordance the material and jointing requirements of B.1 of Chapter VIII of KDHE's *Policies, General Considerations And Design Requirements for Public Water Supply Systems In Kansas* and pressure tested to assure water tightness pursuant to the most recent revision of KDHE's *Minimum Standards of Design of Water Pollution Control Facilities*. If concrete encasement is the selected alternative when two (2) feet of vertical separation between the gravity sanitary sewer and the waterline, the encasement for the sanitary sewer shall have a minimum thickness of six (6) inches and extend a minimum of 10 feet on each side of the crossing.

The vertical clearance between waterlines and sanitary sewer force mains shall be a minimum of two (2) feet and the waterline shall always cross above the sanitary sewer force main.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

DC6-011 **SEPARATION OF WATER MAINS AND OTHER POLLUTION SOURCES.** It is of the utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where septic tanks, absorption fields, waste stabilization ponds, feedlots, or other sources of pollution are encountered.

- a. A minimum distance of 25 ft. (7.6 m) shall be maintained between all potable water lines and all pollution sources, e.g., septic tanks, septic tank absorption fields, waste stabilization ponds, sewage contamination, wastewater, landfill leachate, and all CAFO facilities.
- b. Under no circumstances shall a water line be extended through an area that is a real or potential source of contamination to the water line or water supply.

Under no conditions shall the encasement of a water line be considered as adequate protection of a water line or a water supply for the purpose of extending the water line through a real or potential source of contamination.

DC6-012 **HIGHWAY AND RAILROAD CROSSINGS.** All crossings of highways or railroads shall be made by boring or tunneling. Casing pipe shall be greater than or equal to the strength and integrity of the carrier pipe (casing pipe shall conform to the City of Gardner

Technical Specifications for Public Improvement Projects. The installation shall comply with all federal, state and local regulations. The work shall be in conformance with all requirements and regulations of the entity having jurisdiction of the right-of-way.

- DC6-013** **STREET CROSSINGS.** Open cutting of streets shall be allowed only where permitted by the City Engineer. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. All work and materials shall be in accordance with the requirements of the City of Gardner *Technical Specifications for Public Improvement Projects.*
- DC6-014** **STREAM CROSSINGS.** Waterlines crossing navigable streams, as determined by the US Army Corps of Engineers, are to be buried at a minimum depth of seven (7) feet beneath the streambed. Waterlines crossing non-navigable streams are to be buried at a minimum depth of five (5) feet beneath the streambed.
- DC6-015** **FIRE FLOW REQUIREMENTS.** Public improvement plans for water line projects serving development sites other than single family or duplex sub-divisions shall be reviewed for fire protection sufficiency by the Fire Marshal. The Fire Marshal shall determine the required rate of flow for fire protection based on I.S.O. guidelines. The Design Engineer shall obtain the flow requirements and then determine if the existing and proposed water lines can provide the minimum flow rate. Calculations verifying the flows shall accompany the drawings when submitted for approval.
- DC6-016** **END OF CUL-DE-SAC.** All waterlines terminating within cul-de-sacs shall be designed in conformance with the applicable Standard Details. The waterline shall be extended to a point where water service lines will not be located under the cul-de-sac bulb.
- DC6-017** **EASEMENTS.** Permanent easements must be provided for all water mains. Permanent easements shall be centered on the main. The minimum easement width shall be 10 feet; however, easement widths may be increased depending upon the size of the water main.
- DC6-018** **MINIMUM SEPARATION FROM OTHER UTILITIES.** Water mains in proximity to sanitary sewer mains must meet the minimum horizontal and vertical separation requirements stated in the City of Gardner's Design Criteria for Sanitary Sewer and Appurtenances. A minimum horizontal separation of 5 feet shall be provided between the outer wall of water mains and all other utilities. The separation between the outside walls of water mains and all other utilities that are within 10 feet of each other must be labeled on the plans. The utilities shall not be placed in a common trench. In addition, the utilities shall be separated by a minimum of 3' of unfinished soil.
- DC6-019** **PRIVATE FIRE LINES.** A private fire line shall be defined as a fire protection main which only has connections to private on-site fire hydrants and/or building fire sprinkler systems. All water lines and hydrants within a development which are classified as a "private fire line" shall conform to the design and specifications of water mains, as stipulated in the *Technical Specifications and Design Criteria for Public Improvement Projects* for the City of Gardner.

Construction of all private water lines requires installation of an isolation valve and a double check detector assembly (DCDA). The DCDA shall be located at the point of connection to the main. Variances from this policy shall be approved by the City Engineer. Maintenance of the backflow prevention device and private water line shall be responsibility of the property owner.

Public water service lines shall not be connected to private water lines. Private fire lines are for fire protection only and are considered non-potable.

Cross connections between a private water line used for fire protection and a public water main shall be prohibited.

DC6-020 **TRACER WIRE.** Underground tracer wire shall be installed to enable detection of all watermains and sanitary sewer forcemains.

Tracer wire used in open cut excavation and horizontal directional drilling applications shall be 12 AWG extra-high-strength copper-clad steel conductor (EHS-CCS). EHS-CCS conductor must be a 21% conductivity for locating purposes and shall have a minimum break load of 1,150 lbs.

Tracer wire used in horizontal drilling and pipe busting applications shall be 3/16” stainless steel, stranded, annealed (HDD). HDD conductor must be a 21% conductivity for locating purposes and shall have a minimum break load of 3,700 lbs.

Tracer wire shall be insulated with a 45 mil, high-density, high-molecular weight polyethylene (HDPE) insulation, rated for direct burial use at 30 volts. HDPE insulation color shall meet the APWA color code standard for identification of buried utilities.

The tracer wire system must be installed as a continuous single wire. Looping of the tracer wire is not allowed. The tracer wire shall be attached to the side of the main with tape or tie-wraps.

All mainline tracer wires must be interconnected where tees and crosses are installed along the main. Connectors in the approved materials list shall be used at these locations and where any other splicing is allowed. Splicing is not allowed on the main line for directional drilling and pipe bursting applications.

The tracer wire shall be brought to the ground surface at access point test stations, water meter pits for service connections, and air release structures. Enough tracer wire is required in each test station or meter pit to extend the wire a minimum of two feet above finished grade. Test stations will be required along the main at a maximum spacing of 800 feet, at intersections (tees and crosses), and at dead-ends. A single tracer wire will extend from the intersection to the test station at the fire hydrant.

All main dead-ends shall be grounded with an approved drive-in magnesium anode rod buried at the same depth as the tracer wire. Extended fire hydrant lines greater than 5 feet from tee, fire hydrants at cul-de-sacs, and forcemain discharge locations are considered dead-ends. Test stations will be installed at locations where grounding is required.

The Contractor will perform a post-construction locate to verify the tracer wire is working as intended. This will be done prior acceptance and the issuance of the Project Completion Certificate.

In addition, electronic locate markers shall be attached to all meter service line connections

to the main and meet the APWA standard color for buried utilities with a minimum frequency of 145.7 KHZ.

DC7 – REQUIREMENTS FOR PUBLIC IMPROVEMENT PROJECT PLAN PREPARATION

DC7-001 **INTRODUCTION.** The following criteria is established to provide a uniform system of plan preparation that will aid the engineer in preparing plans for work within the City of Gardner.

DC7-002 **GENERAL.** All plans and specifications for public improvement construction shall be sealed by a professional engineer licensed in the state of Kansas and submitted to the office of the City Engineer for review. Subsequent to the review, the engineer will be notified of the approval of the plans as submitted, or of any necessary changes. (Refer to the section "Public Improvement Project Plan Submittal" for plan review procedures.)

Upon completion of the review and approval of the plans by the City Engineer, 2 sets of full size plan sets, 2 set of half size plan sets, 1 copy of the electric layout sheet, and 1 electronic copy of the plans in AutoCAD must be submitted for signing and distribution.

The suggested plan sheet size is 22" x 34" or 24" x 36" with all sheets in each set of plans being of the same size. Plan and profile shall be drawn on double or single plan and profile sheets to scales of one inch (1") equals fifty feet (50') horizontal by one inch (1") equals ten feet (10') vertical, unless otherwise approved by the city engineer for special cases.

The plans shall consist of:

1. Title Sheet
2. General Layout Sheet
3. Grading and Erosion Control Sheet
4. Electric Layout Sheet
5. Drainage Basin Map Sheet
6. Plan and Profile Sheets
7. Intersection Detail Sheets
8. Cross Section Sheets (Street Improvement Plans only unless otherwise required by the City Engineer.)
9. Standard Detail Sheets
10. Pavement Marking and Signage Sheet (as necessary)
11. Traffic Control Plan (as necessary)

Each sheet should contain a sheet number, including the individual sheet number and the total number of sheets, the engineer's seal, proper project identification and date.

DC7-003 **TITLE SHEET.** The following items shall be included on the title sheet:

1. Name of project
2. City project number
3. Index of sheets
4. A location map adequately showing project location in relation to major streets
5. A summary of plan quantities of principal items, such as:
 - Pipe sizes, number of manholes, etc. (sanitary sewers)
 - Length of curb and gutter, square yardage or tonnage of asphaltic concrete pavement, etc. (streets)
 - Pipe sizes, number of inlets, etc. (storm sewers)

- Pipe sizes and lengths, number of valves, etc. (water lines)
6. The location of the project benchmark per the Johnson County Horizontal and Vertical Control Network.
 7. Name, address and telephone number of the Design Engineer and owner/developer.
 8. List containing the name and telephone number of each utility company.
 9. Zoning
 10. Signature and stamp of Professional Engineer registered in the State of Kansas

DC7-004 GENERAL LAYOUT SHEET. The following items shall be included on the general layout sheet for all improvement projects:

1. A legend of symbols which shall apply to all sheets.
2. North arrow and scale. Scale of the general layout map shall be one (1) inch equals one hundred (100) feet, unless otherwise approved by the City Engineer.
3. Names of subdivision, block designation, lot designation, all street names, and an accurate tie to at least one quarter section corner. An unplatted tract shall have an accurate tie to at least one quarter section corner.
4. Project boundary, survey control and reference ties.
5. A list of general notes to the contractor to include at least those notes included in this Section.
6. Layout of sidewalks and access ramps.
7. Utility and street light layout.
8. Construction plan quantities.

In addition, the following items shall be included on the general layout sheet for the type of improvement shown:

Storm Drainage

Drainage calculation summary table containing the following information:

1. Pipe size and slope.
2. Pipe capacity.
3. Velocity.
4. Time of concentration.
5. Runoff coefficient.
6. Incremental tributary acreage.
7. Cumulative acreage.
8. Rainfall intensity.
9. Rainfall runoff.
10. Engineered swales and shear stress calculations for erosion protection.

Sanitary Sewer and Waterline

1. Location of all existing sanitary sewer and waterlines properly designated within or adjacent to the project area (list the City project name and number).
2. Connection point or points to existing facilities (tied to a known point on existing facility) and the type of connection to be utilized.
3. Location of all proposed sanitary sewer and waterlines and appurtenances with designation and sheet number on which they appear in plan and profile.
4. Preblast survey limits.

DC7-005 GRADING AND EROSION CONTROL SHEET. The grading and erosion control sheet shall be drawn at a scale of 1"=max 100' (1"=20', 1"=50', or 1"=100' are acceptable) with match lines for multiple sheets when necessary. The following items shall be included on the grading and erosion control sheet:

1. Existing topographic features – trees, hedges, brush, buildings, pavement, utilities, fences, curbs, drives, sidewalks, inlets, manholes, valves, and other manmade objects - shown in ½ tone.
2. The current physical features (both natural and manmade) of the property and adjacent land within 50', including contours at vertical intervals of not more than 5' where the slope is greater than 10% and not more than 2' where the slope is less than 10%.
3. Proposed contours shown at the same contour interval as the existing contours.
4. Lot and subdivision lines with lots and blocks numbered per the plat of the subject subdivision.
5. Street centerline alignment with edge of pavement lines, edge of sidewalk lines, and back of curb lines.
6. North arrow and bar scale.
7. Street names, R/W lines, existing and proposed easements (show centerline and limits of the easements).
8. 2% minimum grading is required for positive drainage.
9. 100-year floodplain and stream buffers (if applicable).
10. Appropriate erosion control measures and applicable notes (may be shown on separate sheet).
11. The consultant shall also submit a copy of the application for an NPDES permit.
12. Limits of construction.

DC7-006 ELECTRIC LAYOUT SHEET. For subdivision plans, the Electric Division for the City of Gardner will provide the design engineer with a schematic of the electric and street lighting layout to be included in the plans. The plans shall include street crossings, proposed street lighting layout, proposed conduit, and proposed layout of feedthrough cabinets, transformers, etc. This sheet will be used by the Electric Division to install the electric infrastructure once plans are approved.

DC7-007 DRAINAGE BASIN MAP SHEET. The drainage basin map sheet shall be drawn to such a scale as to fit on one sheet where possible, but shall not exceed 1"=1000', and shall include the following information:

1. A plan view of the project.
2. A layout of all pipe systems with the structures numbered.
3. Boundaries of all basins (there should be a sub-basin for each inlet) shall be shown, and each basin and sub-basin shall be labeled.
4. A data table providing stormwater calculations (K, C, I, Q, Q_{total}, t_c, HGL, etc.) and pipe data (length, slope, diameter, full pipe velocity, etc.). The data table should also include 100-year calculations for emergency overflows.

DC7-008 PLAN AND PROFILE SHEETS. The following items shall be included on the plan and profile sheets for all improvement projects.

1. North arrows and scale.
2. Existing and proposed streets with names and widths.

3. Existing and proposed property lines, lot numbers, block numbers and subdivision names.
4. All existing and proposed utilities such as power, gas, oil, water, telephone, sewer, streetlights, traffic signals and other items. The locations shall be in conformance with the best information available from the utility provider and/or field survey.
5. All existing and proposed improvements within seventy-five (75) feet each side of the center line. This shall include paved streets, curbs and gutters, driveways, culverts, fire hydrants, utility poles, trees, shrubs, fences, walls, houses, and other such items, and shall be identified as to type, size, material, etc.
6. All existing easement and right-of-way information recorded with the Johnson County Records and Tax Administration.
7. Minor construction notes shall appear on the proper plan and profile sheets.
8. Locations and widths of existing and proposed sidewalks and ramps.

In addition, the following items shall be included on the general layout sheet for the type of improvement shown:

Street

1. Horizontal curve data, vertical curve data, stopping sight distances, K values and design speed.
2. Gradient between vertical curves.
3. Center line stations.
4. Stations and grade at curb returns (at ¼ points).
5. Profile with the existing grade shown as a dashed line and proposed grades shown by solid lines.
6. Location of monument boxes.
7. Sight triangles.

Storm Drainage

1. Detailed alignment of the storm sewer, appurtenances, pipe size, capacity, and other details relating to the storm drainage system including inlet station, top elevation and invert elevation.
2. Proper ties to existing permanent facilities.
3. Distances between the storm sewer and other existing or future utilities in the right-of-way or drainage easement.
4. Drainage channel, slope and cross sections.
5. Existing and proposed street grades.
6. Proper elevations, slopes and lining for existing outfall ditches.
7. Locations of all bends and appurtenances.
8. Size, slope and material of each pipe on the profile.
9. Hydraulic grade line for design storm.
10. Location, cross-section, and capacity of overflow swales, including the velocity in the swale and erosion protection where necessary.
11. Property owner information for all properties directly adjacent to development.

Sanitary Sewer

1. Detailed alignment of the proposed sewer with ties to property corners or station and angle callouts at each manhole.
2. The channel center line of waterways within fifty (50) feet of the sanitary sewer lines.

3. All manholes with manhole designation, station, and invert elevations. Drop, shallow and special manholes shall be designated as such. Invert elevations shown shall be the invert of the pipe in and out of the manhole. The proposed top elevation of the manhole shall be shown. Distance between manholes shall be shown as well as the gradient, pipe size and pipe material.
4. Results of all rock borings.
5. Accurate elevations of lowest floor for all existing and/or proposed structures. Include minimum serviceable floor elevation (MSFE).
6. A uniform system of line and manhole designation as required by the City Engineer.
7. Station, slope, and length of each service line.
8. Profile of existing grade as a dashed line and the proposed grade by solid lines. The flow line of any drainage channel, either improved or unimproved, within fifty (50) feet of the sewer line shall also be included and properly identified. The proposed sewer shall be shown as double solid lines properly showing the height and flow line of the pipe.
9. All utility crossings with approximate elevations provided in the profile.

Water Lines

1. Alignment of the proposed water line dimensioned from curb lines or right-of-way lines.
2. Designation by station of all fire hydrants, line valves, tees, bends, and crosses.
3. Pipe material, size, and location of required restraint.
4. Results of all rock borings.
5. All utility crossings with approximate elevations provided in the profile.

DC7-009 **INTERSECTION DETAIL SHEETS.** The intersection detail sheets shall show the intersections at 1"=20' or 1"=10'. The following items shall be included on the intersection detail sheets:

1. North arrow and bar scale.
2. Back of curb and face of curb lines and edge of pavement line.
3. Radius line for curb returns with length of radius labeled.
4. Storm inlets, manholes, other proposed items.
5. Plus station for start/stop of tapers, turn lanes, curb returns—with offsets where appropriate.
6. Top of curb elevations and stations every 25' with plus station, elevations and offsets at curb returns and at midpoint of curb returns.
7. Horizontal alignment data (same as Plan and Profiles).
8. Location of sidewalks, handicap ramps, with dimensions for sidewalks.
9. Street lighting poles, etc.

DC7-010 **CROSS-SECTION SHEETS.** The following items shall be included on the cross-section sheets. Cross Section Sheets are not required for privately financed projects unless requested by the City Engineer.

1. Street cross-section at each station showing existing grade as a dashed line and proposed grade as a solid line. Cross-sections shall include existing grade lines a minimum of ten (10) feet beyond right-of-way lines. Show cut and/or fill quantities at each cross-section.

2. Center line elevation at top of pavement.
3. Cross-sections at all intersecting streets and driveways.
4. Channel cross-sections for all drainage channel improvements.
5. Additional cross-sections as required to clearly describe the extent of the grading operations.

DC7-011 PAVEMENT MARKING AND SIGNAGE SHEET. The pavement marking and signage sheet shall be typically drawn to scale at 1"=50'. The following items shall be included on the pavement marking and signage sheet:

1. North arrow and bar scale.
2. Legend.
3. Existing topographic features – trees, hedges, brush, buildings, pavement, utilities, fences, curbs, drives, sidewalks, inlets, manholes, valves, and other man-made objects—screened to 65%.
4. Horizontal alignment of the proposed streets, including centerline and stationing.
5. Proposed drainage structures and other proposed structures.
6. Proposed edges of pavement and sidewalk, and back of curb lines.
7. Station equation at all proposed intersections (including an intersection of a proposed street with an existing street).
8. Street names.
9. Proposed and existing right-of-way.
10. Construction limits.
11. Easements of all types, existing and proposed.
12. Proposed and existing street light poles.
13. Stationing of all proposed pavement markings.
14. Lane width dimensions.
15. Stationing and MUTCD number for all proposed signs.
16. General Notes that include but are not limited to:

All markings shall be in accordance with the latest edition of the MUTCD.

All existing markings that conflict with the proposed markings shall be completely removed.

The contractor shall maintain ALL existing signs not shown on the plans as to be removed.

DC7-012 TRAFFIC CONTROL PLAN SHEET. The traffic control plan sheet shall be provided as necessary. This plan shall be prepared by a certified traffic control consultant and shall be reviewed and approved by the City Engineer. The traffic control plan sheet shall include construction sequencing and overall phasing plan, work areas identified by shading and/or line patterns, construction notes describing each phase of construction, a detour plan (if applicable), etc.

DC7-013 STANDARD DETAIL SHEETS. Detail sheets shall be included to show all details of appurtenances, materials, and construction whether or not covered by the Gardner, Kansas, standards. Details shall conform to the City of Gardner standards and are to be drawn clearly and neatly with proper identifications, dimensions, materials, and other information necessary to ensure the desired construction.

DC7-014 CONSTRUCTION RECORD DRAWINGS. Construction Record Drawings shall be submitted to the City Engineer upon completion of the project and prior to final acceptance of the project by the City of Gardner. The Design Engineer shall provide the City with prints for all public improvement projects corrected to show the project as constructed and shall accurately and completely denote all changes made during the course of the work. Each sheet within the plans shall be clearly marked as "Record Drawings" and shall include the revision date and certifications by the Design Engineer. The horizontal and vertical location of the storm sewer structures and pipe, sanitary sewer structures and pipe and all lot corners provided on the Record Drawings shall be based upon field survey data. Listed below are the required sets of construction record drawings.

Construction Record Drawings:

Street and Storm Improvements	1 Sets & Digital Copy (CAD & PDF FORMAT)
Street Lights	1 Sets & Digital Copy (CAD & PDF FORMAT)
Sanitary Sewer	1 Sets & Digital Copy (CAD & PDF FORMAT)
Waterline	1 Sets & Digital Copy (CAD & PDF FORMAT)
Grading	1 Full Set & Digital Copy (CAD & PDF FORMAT)

DC8 – PRIVATE IMPROVEMENT DESIGN CRITERIA

DC8-001 GENERAL. Private improvement construction in the City of Gardner shall conform to all applicable codes, regulations and ordinances as established by the City of Gardner. The design and construction of private improvements including streets, storm sewers, sanitary sewers, waterlines, streetlights and related construction shall conform to the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects*.

Plans for private improvements associated with building construction shall be submitted to the Fire Department, Building Codes Division. Plans for private improvements not associated with new building construction or an addition to an existing building shall be submitted for review and approval to the Infrastructure Department, Engineering Division.

DC8-002 PARKING LOT CONSTRUCTION. Parking lot construction shall conform to the following design criteria and all City of Gardner ordinances:

A. Materials for Construction

The acceptable materials and thicknesses for parking lot pavement sections are outlined in Table DC8-002-1.

Table DC8-002-1 -Parking Lot Pavement Material and Minimum Thickness

Material	Minimum Thickness
Full Depth Asphaltic Concrete Section	
Asphalt Surface (BM-2)	2
Asphalt Base (BM-2B)	4
Asphaltic Concrete with Aggregate Base	
Asphalt Surface (BM-2)	4
Aggregate Base (AB-3 OP Modified)	6
Portland Cement Concrete Pavement	
Portland Cement Concrete Pavement ¹	5

¹ Portland Cement Concrete Pavement shall be air-entrained KCMMB with 10 gauge welded wire mesh on six (6) inch centers each way and embedded two (2) inches from the bottom of the slab

² Subgrade shall be compacted to 95% of the maximum density

Driveway entrances and concrete curbs within the right-of-way shall meet the requirements of the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects*. Parking lot curbs shall be air-entrained with a minimum 28-day compressive strength of 4,000 psi.

B. Curb and Gutter

Concrete curbing shall be provided along the perimeter of parking areas and along drives connecting parking areas with public streets. Curbing shall have a six-inch vertical face above the surface of the pavement and be in accordance with the Standard Details, unless otherwise approved by the City Engineer.

All work within public right-of-way shall conform to applicable City of Gardner *Technical Specifications for Public Improvement Projects* and applicable Standard Details. Transitions to existing curb and gutter shall be made at saw joints in existing curb or at existing expansion joints. Expansion joints shall be placed where new curbing abuts existing curbing.

C. Drainage Facilities

All parking areas shall be provided with adequate drainage facilities as approved by the City Engineer. Enclosed storm sewers shall be used to collect and convey drainage to the public storm sewer system. Stormwater runoff exiting through driveway entrances shall not be allowed unless otherwise approved by the City Engineer. If the flow exceeds the capacity of the gutter, it shall be collected by a curb inlet prior to entering public right-of-way.

A Stormwater Management Plan shall be submitted to the City Engineer for review and approval in accordance with the City of Gardner Design Criteria for Storm Drainage Facilities.

D. Driveway Entrances

All driveway entrances within the public right-of-way shall be constructed in accordance with the Standard Details and the City of Gardner Access Management Code. In addition to the above design criteria, Table DC8-007-2 outlines geometric design criteria for commercial driveways. Private driveways shall adhere to the City of Gardner Access Management Code and applicable Technical Specifications.

Table DC8-002-2 -Driveway Widths and Radii per Driveway Type

Driveway Type	Maximum Width¹ (ft)	Minimum Width¹ (ft)	Minimum Radii² (ft)
Commercial			
2-Way without median	35	28	25
2-Way with median ³	52	32	25
1-Way In-bound	20	16	25
1-Way Out-bound	24	20	25

¹ Width shall be measured at the property line, parallel to the roadway

² As requested by the City Engineer, the Design Engineer shall provide turning movement diagrams to verify the adequacy of the curb radii

³ Minimum width of median shall be 4 feet

ADA detectable warning devices shall be installed at all traffic signal controlled commercial drives in accordance with the Standard Details.

Driveways which are shared by adjacent property owners require an access easement be recorded at the Johnson County Records and Tax Administration office.

All construction within right-of-way under the control or jurisdiction of the State of Kansas shall be reviewed and approved by the appropriate state agency prior to submitting plans to the City of Gardner. Plans submitted to the City of Gardner for review shall reflect all changes or corrections as required by that state agency as outlined on the approved state permit.

DC8-003 PRIVATE DRAINAGE FACILITIES. When a public storm sewer system is located adjacent to the lot, the private drainage facility shall be extended to the public system by the property owner. All other private drainage facilities, including inlets, sump pumps, outfalls, end sections, pop-up drains or other discharge devices, shall be located a minimum of four (4) feet from all property lines, including the Right-of-Way (ROW). If the private drainage facilities cause a hazardous condition to surrounding lawns, sidewalks or other improvements, the line shall be relocated to a location designated by the City Engineer, at the private drainage facility owner’s expense.

DC8-004 CONVERTING PRIVATELY OWNED INFRASTRUCTURE TO PUBLICLY OWNED INFRASTRUCTURE. Requests for converting privately owned infrastructure to public owned infrastructure shall be made in writing to the City Engineer. Privately owned infrastructure must comply with the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects*. All costs associated with evaluating the suitability of privately owned infrastructure shall be the responsibility of the requestor.

DC9 – PRIVATE IMPROVEMENT PLAN PREPARATION

DC9-001 INTRODUCTION. The following criteria have been established to provide a uniform system of plan preparation for work within the City of Gardner related to private improvements. The plan preparation criteria should be used for plans being developed for parking lot expansion permits and Land Disturbance applications.

DC9-002 GENERAL. All plans for private improvements shall be prepared by a Professional Engineer licensed in the State of Kansas and submitted to the Public Works, Engineering Division for review. Subsequent to the review, the Design Engineer will be notified of the approval of the plans as submitted, or of any necessary changes.

Private improvement plans that involve public water lines, sanitary sewer lines, storm sewer lines or street construction shall be prepared in accordance with the plan preparation requirements detailed in Section 1 of the Design Criteria.

Private improvements involving parking lot construction shall meet the requirements outlined in the Design Criteria.

Three (3) sets of private improvement plans shall be submitted to the Public Works, Engineering Division. Typically, the plans will be reviewed within ten to fifteen (10-15) working days from the date received; however, large or complicated projects may require longer review times. Once the plans are approved, one set of plans stamped Approved by the Public Works, Engineering Division, will be returned and will serve as the permit for construction.

DC9-003 PARKING LOT PLANS. The following items shall be provided on the plans submitted for the construction of a new parking lot or an addition to an existing parking lot.

- A. A location map, with north arrow, adequately showing project location in relation to major streets.
- B. General site layout to include:
 - Building location (if applicable)
 - Street names, lot and block designation
 - Parking lot setback dimension from property lines
 - An accurate tie to at least one quarter section corner. Unplatted tracts shall have an accurate tie to at least one quarter section corner.
 - Landscaping
 - Lighting
 - Erosion control
- C. All existing property lines, lot lines, street right-of-way lines and temporary and permanent easement lines shall be shown at their proper location. Street right-of-way lines and existing driveways shall be shown on both sides of the street adjacent to the perimeter of the lot.
- D. All existing and proposed utilities such as electric, gas, oil, water, telephone, sanitary sewer, storm sewer, and other applicable items shall be shown in conformance with the best information available from the owner of such facilities, or by field surveyed location.

The plan shall identify the size, material and type of construction.

- E. Existing and proposed site contours for the site shall be shown. Proposed contours shall be supplemented with spot elevations at critical locations.
- F. Limits of paving, perimeter curbing and parking stalls, including handicapped parking, and all dimensions shall be shown, including radii and other significant geometric details.
- G. A legend for the site layout detail and a sheet(s) that includes both Standard Details and project specific details. The project specific details shall include a profile view of the proposed curb(s), a section through the proposed pavement detailing pavement composition, a driveway entrance detail in accordance with the Standard Details, proposed drainage structures and any other appropriate details as required by the City Engineer.
- H. Storm drainage facilities in both plan and profile view. These views shall show inlet and pipe locations, size, material, gauge, slope of pipe, design storm hydraulic grade line and all invert and top of structure elevations. The plan sheets shall include a drainage calculation summary table identifying the pipe size and slope, pipe capacity, velocities, time of concentration, runoff coefficient, incremental and accumulated tributary acreage, rainfall intensity, and the total rainfall runoff.
- I. General construction notes as required.
- J. Erosion control designed in accordance with the latest edition of the City of Gardner's *Technical Specifications Section and Design Criteria for Public Improvement Projects*.
- K. Parking lot lighting designed in accordance with the latest edition of the Gardner Municipal Code.
- L. Landscape plans designed in accordance with the latest edition of the City of Gardner's Land Development Code.
- M. A land disturbance permit for all parking lot improvements greater than five thousand (5,000) square feet.

DC10 – DESIGN CRITERIA FOR STREET LIGHTING CONSTRUCTION

DC10-001 GENERAL. Proposed street lighting construction in the City of Gardner shall conform to the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects* and all applicable Standard Details. Plans shall be submitted electronically to the Infrastructure Department, Engineering Division, for approval and shall include all required information as outlined in this Section. Street Light plans shall be submitted concurrently with the Street plans as a standalone plan set bearing the same City of Gardner project number.

DC10-002 CATEGORIES OF STREETS AND PROCEDURES. For all street classifications, street lights shall be installed in accordance with Chapter 17.04.010 of the City of Gardner Municipal Code, unless otherwise approved by the City Engineer.

DC10-003 DESIGN PROCESS.

The illumination design process involves the selection of the proper lighting equipment and the establishment of the geometry of the system in order to provide the most effective lighting system. The major steps of the design process are outlined as follows:

- **Existing Conditions**-Determination of roadway facility and land use area classifications.
- **Selection of Illumination Level** - The recommended average intensity of horizontal illumination shall be determined based upon the classifications of roadway facility and area type.
- **System Characterization** - Detailed calculations using selected light source types and sizes and luminaire mounting height and spacing locations are utilized in order to determine the average intensity of horizontal illumination. Based upon the selected equipment and geometrics, an isocandle diagram or computer program equivalent is utilized to determine the minimum illumination level. The uniformity of illumination is checked by comparing the ratio of average maintained illumination to minimum maintained illumination, commonly referred to as the uniformity ratio, with the recommended criteria in order to determine optimal effectiveness of lighting system.

DC10-004 DESIGN CONDITIONS.

The number of luminaires shall be minimized and shall be located behind sidewalks, unless otherwise approved by the City Engineer. Breakaway pole bases are required for Collector, Industrial/Service and Arterial Street installations.

Determination of light source size, type, mounting height and spacing shall at least conform to the requirements outlined below based upon the required illuminance levels when the luminaires are at their lowest output. This condition occurs just prior to lamp replacement and luminaire washing. Therefore, formulas calculating average illuminance shall include light loss factors relating lamp lumen depreciation and luminaire dirt depreciation.

Local Streets:

- Luminaires will be located at intersections of local residential streets, equally spaced along cul-de-sacs longer than 200 feet, at changes of alignment of 60° or more which are 200 feet or more from an intersection, and/or a minimum number of mid-block lights such that the spacing between lights is approximately 200 ft.
- LED luminaires
- Post-top luminaries in accordance with the City of Gardner Approved Materials List
- Spun aluminum poles for 14' mounting heights

Collector and Industrial/Service Streets:

- LED luminaires
- In conformance with the City of Gardner Approved Materials List
- 30' round, spun aluminum poles
- The collector standard streetlights shall be used at the intersection of collector and residential streets.

Arterial Streets:

- LED Luminaires
- In accordance with the City of Gardner Approved Materials List
- 40' round, spun aluminum poles, black in color

DC10-005 PEDESTRIAN CONFLICT AREA CLASSIFICATION.

The classification of urbanized areas shall be generally defined as follows:

- **High.** High pedestrian use areas are generally densely developed business districts, which attract a heavy volume of nighttime vehicular and/or pedestrian traffic.
- **Medium.** Medium pedestrian use areas are characterized by multi-family residential and commercial land uses, such as libraries, recreation centers and neighborhood retail buildings.
- **Low.** Low pedestrian use areas are generally single family and duplex residential developments with minimal nighttime pedestrian traffic.

DC10-006 ROADWAY FUNCTIONAL CLASSIFICATION.

The functional classification of roadways is defined in American National Standards Institute (ANSI) Illuminating Engineering Society (IES) RP-8.

DC10-007 RECOMMENDED AVERAGE MAINTAINED ILLUMINATION.

The average illumination design criteria for roadways and intersections are outlined in Table DC10-007-1 and DC10-007-2, respectively.

Table DC10-007-1 -Illuminance Requirements for Roadways

Roadway Functional Classification	Average Maintained Illumination at Pavement, fc			Illuminance Ratio ¹
	Pedestrian Use Classification			
	High	Medium	Low	
Freeway	0.6	0.6	0.6	3
Expressway	1.4	1.2	0.9	3.0
Arterial	1.7	1.3	0.9	3.0
Collector and Industrial/Service	1.2	0.9	0.6	4.0
Local	0.9	0.7	0.6	6.0
Alley	0.6	0.4	0.4	6.0

¹ Illumination Ratio equals Average Illuminance divided by Minimum Illuminance

Table DC10-007-2 -Illuminance Requirements for Intersections

Intersection Type	Average Maintained Illumination at Pavement, fc			Uniformity Ratio ¹
	Pedestrian Use Classification			
	High	Medium	Low	
Arterial/Arterial	3.4	2.6	1.8	3.0
Arterial/Collector	2.9	2.2	1.5	3.0
Arterial/Local	2.6	2.0	1.3	3.0
Collector/Collector	2.4	1.8	1.2	4.0
Collector/Local	2.1	1.6	1.0	4.0
Local/Local	1.8	1.4	0.8	6.0

¹ Illumination Ratio equals Average Illuminance divided by Minimum Illuminance

DC10-008 DESIGN CALCULATIONS.

All calculations shall conform to the standard practice of the Illuminating Engineering Society of North America and shall be included with the plan submittal. The required calculations are summarized below.

- **Spacing** - The spacing between the luminaires is the longitudinal distance if spaced in staggered or one-sided arrangement. This distance is one-half the longitudinal distance if luminaires are arranged in opposite spacing.
- **Light Loss** - The light loss factor represents the luminaire conditions at their lowest output level. The total factor is based upon the contribution of individual light loss factors such as lamp lumen depreciation, luminaire dirt depreciation, ambient temperature, in-service voltage, ballast, lumen component depreciation, physical surroundings and burnouts. The light loss factor can be determined by tables from the equipment manufacturer for the given luminaire type.
- **Coefficient of Utilization** - The coefficient of utilization is equal to the total of street side and house side coefficients of utilization as determined from the equipment manufacturer coefficient of utilization curves for the given luminaire type, placement and mounting height.
- **Minimum Illumination** - Minimum illumination is determined from the isofootcandle diagram or computer program equivalent from the equipment manufacturer for the given luminaire type, placement and mounting height.

- **Uniformity Ratio** – The uniformity ratio shall not exceed 4:1 and preferably not exceed 3:1, except on residential streets where 6:1 may be acceptable.
- **Cutoff** - The control of candlepower distribution shall be a true 90° cutoff.

DC10-009 ELECTRICAL SYSTEM.

The electrical system shall comply with the American National Standard Practice for Roadway Lighting, the National Electrical Code (NEC) and the National Electrical Safety Code (NESC) as summarized below:

- At signalized intersections, a 200- amp switch load street light cabinet shall be installed on the same concrete pad as the traffic signal cabinet, in accordance with the City of Gardner Approved Materials List and applicable Standard Details.
- Conduits and junction boxes for streetlight and traffic signals shall remain separate except for streetlights located on traffic signal poles.
- Wiring for streetlights shall be copper. Aluminum wire will not be permitted.

DC11 – DESIGN CRITERIA FOR TRAFFIC SIGNALS

DC11-001 GENERAL. These criteria are established to provide uniform procedures to aid the Design Engineer in preparing traffic signal improvement plans for projects in the City of Gardner. The traffic signal system shall consist of the signal controller, signal poles, signal heads, cable, conduit, vehicle detectors and any other appurtenances required to provide a complete, operable traffic signal system. Components of the system shall conform to the City of Gardner *Technical Specifications for Public Improvement Projects*.

DC11-002 DESIGN CRITERIA. In addition to the following requirements, all work shall conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

Standard Phasing:

The following standard phasing shall be utilized, unless otherwise approved by the City Engineer:

- Phase 1 – eastbound left
- Phase 2 – westbound through
- Phase 3 – southbound left
- Phase 4 – northbound through
- Phase 5 – westbound left
- Phase 6 – eastbound through
- Phase 7 – northbound left
- Phase 8 – southbound through

Signal Heads:

Traffic signal heads shall be placed in accordance with the MUTCD. Additional guidelines are provided below to standardize the placement of signal heads:

1. A standard three-section head should be centered over each exiting lane for all through lanes of traffic.
2. When a left-turn lane is provided without left-turn phasing, no separate signal head should be provided for the left-turn movement.
3. When protected left-turn phasing is specified, the three-section head shall be centered over the left-turn lane. When dual left-turn movements are specified, a separate indication should be centered over each left-turn lane.
4. When protected/permissive left-turn phasing is specified, a four-section head should be centered over the left-turn lane. The head shall be accompanied by a LEFT TURN YIELD ON symbolic flashing yellow arrow.

All traffic signal and pedestrian indications shall be LED displays. In addition, backplates shall be provided for all traffic signal heads that are mounted to the mast arm. Signal heads that are mounted to the signal pole should not be equipped with backplates.

Emergency Preemption:

Opticom emergency preemption equipment shall be installed on the signal mast arm for all directions of traffic.

Street Lighting:

Streetlights shall be coordinated with the City Engineer to determine the need for combination mast-arm street lights at new or modified signal installations. Luminaire placement shall be in accordance with the City of Gardner *Technical Specifications and Design Criteria for Public Improvement Projects*. All clearances shall be coordinated with overhead utility providers.

Service Boxes:

Service boxes shall be provided whenever conduit changes direction and adjacent to signal poles and controllers. Use type IV double lid junction box on controller corner. Junction boxes shall be used adjacent to detector loop locations for the splicing of loop wire to the lead-in cable. Type I junction boxes shall be used where one or two conduit runs enter/exit the box. Type II junction boxes shall be used where more than two conduit runs enter/exit the box. Service and junction boxes shall be installed at least 2 feet from the back of curb to the center of the box and no closer than 2 feet to any pole. The distance between service and/or junction boxes shall not exceed 200 feet to facilitate the pulling of cable.

Conduit:

All conduit for traffic signal installations shall be high density polyethylene (HDPE) SDR9. Signal conduit that extends from signal poles to adjacent service boxes shall be two (2) 3-inch conduit while signal conduit that extends from the signal controller to the adjacent service box shall consist of four (4) 3-inch conduits. Signal conduit that extends from service box to service box shall be two (2) 3-inch conduits. In all cases, the cables shall not exceed 40 percent of the conduit cross-sectional area. Signal conduit for advance detectors or signal interconnect/fiberoptic cable shall be two (2)-inch conduit.

Street lighting cable is permitted in signal conduit runs and boxes only if the streetlight is attached to the traffic signal pole. The conduit sizes above are typical applications and shall be verified by the Design Engineer to ensure that no more than 40 percent of the conduit cross sectional area is filled by the cables.

Secondary Service:

The Design Engineer shall coordinate and verify the location of the proposed secondary service point with the appropriate utility company to ensure availability of service. A three (3) inch conduit with secondary service wire shall extend from the controller to the secondary service point (EVERGY only). A three (3) inch conduit with a pull string shall extend from the controller to the secondary service point (EVERGY only).

Signal Poles:

Signal poles shall be located a minimum of 6 feet from the back of curb to the center of the pole. When pedestrian signal heads are used, signal poles with push buttons shall be placed in accordance with ADA Guidelines. Pedestrian poles may be utilized to facilitate ADA compliant pedestrian access needs. Signal and pedestal poles shall be powder coated black per the City of Gardner *Technical Specifications for Public Improvement Projects* at designated intersections as determined by the City Engineer.

Controller Cabinet:

Controller cabinets shall be located adjacent to and behind the sidewalk. In locations where no curb exists, the controller shall be placed as far from the edge of pavement as practical but shall be a minimum of ten (10) feet from the edge of pavement, unless otherwise approved by the City Engineer. The controller cabinet shall not be placed on the lowest elevation corner of the intersection, unless otherwise approved by the City Engineer.

Wiring:

The number of conductors required for the various types of traffic signal equipment is summarized below:

Cable for both vehicle signal heads and pedestrian heads shall be 7-conductor cable conforming to International Municipal Signal Association (IMSA) Specification 19-1. One (1) 21-conductor cable shall be installed per mastarm pole for the vehicle signal heads regardless of the quantity of heads on the mast arm. Typical intersection would require four (4) 21 conductor cables. A spare 7-conductor shall be installed with the 21 conductors. One (1) 2-conductor cable per pushbutton shall be provided, from the controller with no splicing.

Detector lead-in cable shall be 4-conductor shielded cable. Detector loop wire shall be single conductor PVC/nylon with tube jacket.

Street lighting distribution cable shall be two (2) 1-conductor No. 8 AWG. Pole and bracket cable shall be No. 10 Thermoplastic High Heat-resistant Nylon-coated (THHN) 2-conductor stranded copper conforming to IMSA Specification 19-1. Street lighting cable for luminaires on signal poles should be spliced inside the signal pole, not the service box adjacent to the pole.

Microwave Detection:

When microwave detection is used, the detection system shall be Wavetronix/Matrix. The microwave detector shall be mounted to the mast arm that is attached to the traffic signal pole. The plans shall include notes requiring coordination with the manufacturer for the proper placement and configuration of the microwave detection system.

Overhead Signs:

Overhead street name signs shall be mounted to the mast arms using Sky-Brackets. There shall be a minimum of two (2) brackets per sign placed no more than three 3 feet apart with a maximum of one (1) foot from the edge of the sign. The overhead street name signs shall be placed between the signal pole and the first vehicle signal head. Lighted signs are required. The power feed shall be continuous from controller to sign.

Traffic Signal Interconnect:

At locations specified by the City Engineer, interconnection of the traffic signals through fiber optics may be required. Fiber optic cable shall be separate from copper signal conductors. A Fiber Optic Pull Box shall be placed outside of the traffic signal cabinet. One

hundred (100) feet of spare fiber shall be coiled in each pull box. Fiber Optic boxes shall be installed at least 2 feet from the back of curb to the center of the box and no closer than 2 feet to any pole. The distance between fiber optic boxes shall not exceed five hundred (500) feet to facilitate the pulling of cable.

DC11-003 PLAN REQUIREMENTS

This section governs the preparation of traffic signal improvement plans.

General:

The improvement plans shall include all information necessary to construct and verify the design of a traffic signal system. For private development projects, the plans shall be submitted as a separate set, which clearly shows other public street and stormwater drainage improvements (and utilities, if applicable) in a de-emphasized manner and shall include appropriate quantity sheets for Contractor provided equipment. The plans shall be arranged as required by the City Engineer. All plan sheets shall be signed and sealed by the Kansas Registered Professional Engineer responsible for preparing the plans. The signed and sealed plans shall be submitted to the Infrastructure Department, Engineering Division for review and approval prior to construction.

Private Improvements:

If any private improvements are shown on the public improvement plans, they shall be clearly differentiated from the public improvements. An appropriate note shall be included on the drawings stating that these private improvements will not be maintained by the City of Gardner.

Sheet Size:

The suggested sheet size for improvement plans is twenty-four inches by thirty-six inches (24" x 36") although sheets twenty-two inches by thirty-four inches (22" x 34") may be used. All sheets in a given set shall be the same size.

Types of Sheets in Plans:

The improvement plans shall consist of the following:

- Title Sheet
- Traffic Signal Plan Sheet
- Signal Interconnect Plan Sheet(s) (If Required)
- Wiring Detail and Timing Plan Sheet
- Summary of Quantities Sheet
- Standard Detail Sheets
- Pavement Marking and Signing Plan and Detail Sheets
- Traffic Control Detail Sheet

Each sheet shall contain proper project identification, the type of sheet, a sheet number, including the individual sheet number and the total number of sheets, and dates of when the plans were originally prepared and all revisions. Copies of the approved standard detail sheets can be obtained from the Infrastructure Department, Traffic Operations Center or at

Street centerline stations shall be marked at one hundred (100) foot intervals and at other pertinent points.

The plans shall clearly show the proposed placement of all traffic signal equipment including, poles, heads, Opticom equipment, cameras, signs, streetlights, junction and service boxes, conduit, loops and control centers. The items to be constructed or installed for the project shall be legibly noted and located by station and offset. Distances from proposed improvements to the back of curb shall also be provided.

A signal phasing diagram shall be displayed and shall follow the City's standard phasing.

A list of general notes shall include at least the following:

1. Existing underground (U/G), overhead (OH) utilities and drainage structures have been plotted from available information and therefore, their locations must be considered approximate only. It is the responsibility of the individual contractors to exactly locate each utility before actual construction.
2. All construction methods and traffic signal equipment shall conform to the latest edition of the City of Gardner Technical Specifications.
3. Contractor shall stake the location of all traffic signal poles, conduit, controllers, service boxes and junction boxes to be installed. The stations and offsets provided are to the center of the traffic signal equipment. Traffic Signal staff shall inspect the staking prior to any excavation and/or construction. Minor relocation of equipment to avoid conflicts may be allowed with the approval of the City's Traffic Signal Staff.
4. All existing curb and gutter, sidewalk, pavement, drainage structures or ground damaged during the traffic signal construction shall be replaced to match existing. This work will be considered SUBSIDIARY to the "Traffic Signal Installation" bid item.
5. Conduit entering service boxes, junction boxes and/or pole bases shall be continuous in the service boxes, junction boxes and/or pole base.
6. Coordinate Signal Turn-On with the City of Gardner.
7. All traffic signal indicators shall be Light Emitting Diode (L.E.D.).
8. All poles and cabinets shall be painted black.