

CITY OF WEST LIBERTY, IOWA

DESIGN STANDARDS



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Part 1 – General Information

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1.01 PURPOSE:

The Design Standards Manual has been prepared to implement a policy for design of public improvements, development activities and utility work within the City of West Liberty. Public improvements are defined as meeting any of the following:

1. Designed, constructed, and maintained by the City of West Liberty as a public improvement.
2. Designed and constructed by a private owner/developer

The information in this Manual is the basic criteria for design of public improvements. The standards are organized into sections covering specific areas of design. It will often be necessary to use a number of sections for the design of a single project. For instance, the design of a street may require the use of standards on streets, sidewalks, storm sewers, traffic control signals and erosion control.

These standards are a guide for design, but not a substitute for good engineering. It is the obligation of the designer to use these standards responsibly and professionally to produce designs conforming to commonly accepted engineering practices and the Code of Professional Conduct. If not covered in these standards, refer to the latest version of the Statewide Urban Design and Specifications (SUDAS).

1.02 REVISIONS AND VARIANCES:

The City Engineer shall monitor the effectiveness of the Design Standards and will recommend revisions as needed. Amendments to these standards may be requested by writing the City Engineer with details and justification for an amendment.

It will at times be desirable and/or necessary to vary from the standards in this document to produce a good product. When the need arises, a variance may be requested from the City Engineer. Such a request shall be made in writing and will include the standard to be varied and proposed variation. A written response will be given within seven business days of the request. A variance determination may be appealed to the City Council.

1.03 CONTACTS:

Questions regarding these design standards should be directed to:

City of West Liberty
319-627-2418

Veenstra & Kimm, Inc.
1530 46th Ave. – Suite 2B
Moline, IL 61265
309-797-0171 (phone)
309-797-0996 (fax)

1.04 DEFINITIONS:

City Engineer

The engineer employed by the City that functions as the local engineering authority and enforces the provisions of the Design Standards Manual.

Project Engineer

The person or firm responsible for the design and/or administration of the project.

Inspector

The representative of the City or Owner of the project assigned to observe construction and materials thereof.

Building Sanitary Sewer Service – Private

Conveys wastewater from a single building to a public or private sanitary lateral or trunk sewer. Service is to be privately owned and maintained from the building to the public sewer.

The building sanitary sewer stub is the portion of building sanitary sewer within the public right-of-way or a point beyond the right-of-way line as specified by the City Engineer. Construction must be according to the City plumbing code. A plumbing permit is as required by the City.

Sanitary Sewer Lateral – Private

A sewer constructed on private property to convey wastewater from one or more building sanitary sewers to a public sanitary sewer. This sewer is limited to providing service to one owner or association. This sewer is to be privately

owned and maintained with respective easements by the owner or association. A maintenance agreement and/or permit are as required by the City.

Sanitary Sewer Lateral – Public

Conveys wastewater from one or more building sanitary sewers to another lateral or trunk sanitary sewer. This sewer shall be owned and maintained by the City and shall be constructed on public property or on private property with an easement held by the City. An Iowa Department of Natural Resources or City Permit is required.

Sanitary Sewer Trunk – Public

Receives and conveys wastewater from an area of 160 acres or more to another trunk sewer or interceptor sewer. This sewer shall be owned and maintained by the City and shall be constructed on public property or on private property with an easement held by the City. An IDNR Permit is required.

Sanitary Lift Station – Private

Receives and conveys wastewater from one or more sanitary lateral sewers which cannot be conveyed by gravity flow to the public sewer system. This facility shall be located on private property and shall be maintained by the property owner or association. This facility shall not receive wastewater from sanitary sewers that are owned and maintained by parties other than the lift station owner. A maintenance agreement and/or permit are as required by the City.

Sanitary Lift Station – Public

Conveys wastewater from one or more sanitary sewers which cannot be conveyed by gravity flow to the public sewer system. This facility shall be publicly owned and maintained. This facility shall be constructed on public property or private property with an easement held by the City. An IDNR or City permit is required.

Building Water Service – Private

The water service line includes the piping and fittings including the corporation, installed from the public or private water main to the meter connection of the building served. The service shall be privately owned and maintained from the building to the public main. Construction must be according to the City plumbing code. A permit is as required by the City.

The building water service stub is the portion of building water service line within the public right of way or designated point beyond the right-of-way as specified by the City Engineer.

Water Main – Private

Distributes water to one owner or association. This privately owned and maintained water main shall be constructed on private property. A maintenance agreement and/or permit are as required by the City.

Water Main – Public

A water main to distribute water for domestic, industrial and fire fighting purposes. The main shall be owned by the City, water works or an approved public/private water utility corporation or association. An IDNR or City permit is required.

Building Storm Sewer – Private

Conveys storm water or ground water from a single building to a public or private storm sewer or other open channel. This sewer shall be privately owned and maintained from the building to the public storm sewer main. The building storm sewer stub is the portion of building storm sewer within the public right-of-way.

Storm Sewer – Private

Conveys storm water to a public storm sewer, other open channel, or outlet. Easements shall be obtained when crossing other private property. Drainage areas for private storm sewers on large sites will be reviewed on a case by case basis by the City. This sewer shall be located on private property and privately owned and maintained. City plumbing permit may be required.

Storm Sewer – Public

Conveys storm water to an outlet. This sewer shall be publicly owned and maintained and shall be constructed on public property or on private property with an easement held by the City.

Footing Drain – Private

Conveys ground water to a storm sewer, subdrain, or ditch. This sewer is generally located on private property. An easement is required if the sewer serves more than one property. The sewer shall be privately owned and maintained. The sewer shall be constructed according to City building and plumbing codes.

Subdrain – Public

Conveys ground water from private footing drain sewers or pavement subbase to a public storm sewer or open channel. Subdrain shall be owned and maintained by the City and shall be constructed on public property or on private property with an easement held by the City.

Ditch – Private

A drainageway or channel to convey storm drainage. Private ditches shall only be allowed in basins up to 160 acres where the existing facilities upstream are private with the exception of facilities located in the public right of way. The channel shall be designed to accommodate the overall drainage area needs with adequate easements, and shall be privately maintained.

Ditch – Public

A natural drainageway or constructed channel required by the City as a component of a planned drainage system to convey storm drainage across public property or public easement. Public ditches shall be designed to accommodate the overall City's drainage system's need. Public ditches may include low flow drains. Public ditches shall be owned by the City or shall be located within an easement held by the City.

Stormwater Detention – Private

A basin, parking lot and/or rooftop area used for on-site runoff storage measures to provide off-site protection. The detention facility shall be in conformance with the City's overall stormwater management requirements.

Stormwater Detention – Public

A basin, park and/or other public area used for runoff storage. These facilities shall be designed for flood storage and water quality as required by the City. This detention shall be located on public or private property (with easements) and shall be maintained by the City.

Entrance – Private

Access to an agricultural area, a private residence, a commercial establishment, or an industrial establishment shall be the responsibility of the property owner. Any change in existing property use that requires a modification to the entrances will be the responsibility of the owner to obtain an entrance permit.

Street – Private

A street restricted for use by one owner or association and is available for use by emergency vehicles. This street shall be located on private property and shall be privately owned and maintained.

Street – Public

A street owned and maintained by the City and constructed on dedicated street right-of-way. See Chapter 5, for a detailed description of each roadway system.

1. Major Arterial

A continuous route serving the major centers of activity, the highest traffic volume corridors, and the longest trips on a minimum of mileage. Access to a principal arterial is specifically limited.

2. Minor Arterial

Provides through traffic movement between areas and across the city, and provides limited access to abutting property; subject to control of entrances, exits, and curb use to increase the capacity and improve the safety characteristics of the street.

3. Collector

Provides movement of traffic between arterial routes and local streets, and control of access to abutting property for moderate amounts of medium speed traffic.

4. Local

Serves only as access to abutting property and is planned to be a low speed, low traffic and short trip route.

1.05 SUBMITTAL PROCEDURES:

Improvement Plan Submittal Procedure

1. Adherence to the following procedures will assist in an efficient review of plans and reports. The City reserves the right to modify certain procedures to fit unique situation.
2. Preliminary and final plats, private site plans and public improvements for any subdivision or planned unit development, whether residential, commercial or industrial shall conform to this Manual and City ordinances.
3. City Engineer objective is to complete initial reviews of construction plans and issue comments in ten business days after submittal. The actual time required is a function of the submittal complexity and overall workload of the City Engineer.
4. After the review is completed, the check plans, reports, and comments will be returned to the developer or authorized representative.

5. The project engineer will address all comments and resubmit. Seriously deficient plans may require several reviews prior to acceptance.

6. Revision of Plans and Reports

When submitting revised plans or reports to the City Engineer, the re-submittal must contain:

A. The revised plans for review

B. Check plans from previous reviews. Notations should be made after each comment if the correction was made or justification why a comment is not valid.

If all of the above are not submitted, the re-submittal may be returned without further action until such time as they are included.

7. When plans or reports have been conditionally accepted by the City Engineer, the project engineer shall submit seven copies and an electronic copy of the Improvement plans for approval and distribution by the City.

8. The length of time needed to review revised improvement plans that were previously submitted will normally be five business days depending on the complexity of the project. This time may be extended depending on workload.

Updates to Previously Accepted Plans

1. Engineering documents are approved initially for twelve months. If not constructed during this time period they automatically become void and must be updated to current criteria before any further permits can be issued. The City Engineer may grant a one-year extension provided a) the improvement plans or reports have not substantially changed and b) other conditions affecting the development site have not substantially changed or do not require a modification to approved plans or specifications.

2. Whenever updates or revisions to previously accepted engineering documents are necessary, the project engineer will submit updates or revisions through the normal submittal process. After all City Engineer comments and revisions have been incorporated, the plan sheets containing revisions may be submitted for acceptance.

3. Requests for extensions will be considered only if there are no revisions to the original improvement plans or reports. The City will review the original submittal for compliance with current standards under normal review procedures (requests for extension will be considered re-submittals), and if found in compliance with current standards, the improvement plans will be extended.

Submittal Checklist

1. Improvement Plans for the City of West Liberty shall include the following document submittal for review and acceptance:
 - A. Street plan and profile.
 - B. Storm sewer plan and profile, details for non-standard structures, subdrain shown in plan view.
 - C. Stormwater Management Plan and drainage report.
 - D. Permanent traffic signing and striping plan (as required).
 - E. Pavement design where required with supporting geotechnical report.
 - F. Grading and erosion control plan.
 - G. Sanitary sewer plan and profile and details for non-standard structures.
 - H. Water main plans.
 - I. Traffic control plan during construction.

Final Acceptance

Upon completion of construction of the project the City will accept the improvements into the public system upon submittal of the following.

1. Final plat, easements, and agreements for installed improvements.
2. Maintenance Bonds for improvements.
3. Performance Bonds for uncompleted work.

1.06 DETAILED PLANS OF PUBLIC IMPROVEMENTS:

Public Improvement Plan Sheet Requirements

Detailed plans certified by a Licensed Professional Engineer in the State of Iowa, should be filed with the City for all work involved in Public Improvement Contracts and/or agreements. Detailed plans should conform to the following general requirements.

1. Plan Sheet Size

11"x17" or 22"x 34" sheets.

2. Title Sheet

The following information shall be shown when applicable.

A. Project title name and location (street names, address, limits, etc.)

B. City name.

C. Vicinity map with north arrow showing project location. Provide scale or state not to scale.

D. Sheet Index

E. File number/Project number (to be filled in by City).

F. Engineer's firm name, address, phone number.

G. Signature line for City authority or leave space for acceptance stamp

SAMPLE:

REVIEWED:

City Authority

Title

Date

H. Sheet number and total of sheets.

I. Engineer's certification, license number and renewal date, and date certified.

J. Legend of symbols and line work (may show on another sheet if cover sheet space is limited).

- K. List of applicable Standard Details (may show on another sheet if cover sheet space is limited).
 - L. Owner/Developer name, address, and phone number.
 - M. Roadway design data, including design speed, functional classification, and estimated ADT.
 - N. List of City, utility and emergency phone numbers.
3. Title Block
- A title block listing the following information:
- A. The name of the project.
 - B. Project Engineer along with sheet title (including address and phone numbers).
 - C. Date
 - D. Sheet number and total number of sheets.
 - E. Space to denote revisions.
 - F. Title block shall go in lower right corner or right edge of each sheet to be read from the bottom or right side.
 - G. Page numbers shall be in the lower right corner of each sheet.
 - H. All persons designing, drafting and checking plans shall legibly place their names or initials in the title block on the title sheet in a space provided for this purpose.
4. Plan Scale - Vertical. scale: 1' = 5'
 Min. horizontal: 1' = 50'
- or 1" = 20' or larger if details for sanitary sewer, storm sewer, paving and/or sidewalks are on same plans. Overall utility plans may be shown at a lesser scale.
- Changes to above scale to be approved by City. A scale bar is required for each plan view.

General Information to Be Shown on Construction Plans

The following shall be shown where applicable.

1. Beginning (B.O.P.) and ending (E.O.P.) of project.
2. Street names.
3. Right-of-Way widths and easement locations and dimensions.
4. Legend as part of title sheet requirements.
5. Adequate witnesses and horizontal and vertical controls so surveyor can lay out project plans. All controls to be shown at actual locations on plans. Bench marks and ties. Horizontal control shall be State Plane Coordinates. Vertical control shall be USGS datum.
6. Lot numbers, subdivision names, and project numbers, as applicable.
7. Lot dimensions (along right-of-way or easement).
8. North arrow up to the right when applicable.
9. Existing and proposed utilities: type, size, and location.
10. Proposed improvement locations, dimensions, and stations.
11. Scale Bar.
12. Existing trees, fences, walks, structures, ditches, pavements, buildings, and utilities that could be impacted by the proposed improvements.
13. Easements, both temporary and permanent.
14. Cross-sections. For subdivisions, existing and proposed finished contours should also be used.
15. Special details and special notes when required (when other than standard details and specifications are used).
16. Plan view and profile. Profile shall line up with plan stations whenever possible.
17. Traffic control signs and markings will follow the latest edition of the Manual on Uniform Traffic Control Devices. When required to maintain traffic during construction, construction staging and traffic control shall be shown on the plans. If required, include signing, street closures and/or detours.

18. Permanent signing.
19. Storm Water Management Plan. Temporary and permanent erosion control measures proposed.
20. Other information deemed necessary for completeness.

Detailed Sewer Plans

1. Stationing, location and type of all manholes, intakes, or other structures.
 - A. Structure designation shall be shown on the plans.
 - B. Location shall be shown on plan and referenced to survey line, centerline, or coordinates.
2. Details shall be shown for all structures that are non-standard.
3. Plan and profiles of all sewer lines and existing ground profile.
4. Subdrain, cleanouts, and stub locations.
5. Size, length, and grade of sewers in profile.
6. Pipe materials and specifications if non-standard.
7. Invert and rim elevations at all intakes, manholes and other structures in profile.
8. Location, size and type of all sewer services. Stub locations shall be referenced to downstream manholes.
9. Estimates shall be included for stubout quantities.
10. Joint details for storm sewer.
11. Manholes shall be identified with numbering system on plan and profile. Structure sizes and casting sizes to be included by schedule or note on the plans.
12. Access easements as necessary for the sewer system.

Detailed Drainageway Plans

1. Stationing and flow line elevations at beginning and end of channel construction.
2. Plan and profile of channel.

3. Typical sections showing ditch dimensions, backslopes, and invert and slope treatment.
4. Invert elevations at all structures.
5. Cross-sections and contours showing existing and proposed grades.
6. Culvert design data.

Detailed Paving Plans

1. Minimum 100 ft. station intervals and centerline stationing of all intersecting streets. Profile elevations at minimum 50-foot intervals on tangents and 25-foot intervals along vertical curves.
2. Street profiles and existing ground elevations shall be shown in the profile view. The curb line shall be shown in plan view. The profile shall show top of slab tangent grades, vertical curve data, and grade break data.
3. Pavement width (back to back).
4. All radii at returns (may be specified in general note if all radii are same).
5. Horizontal curve data shall include centerline PC, PT, PI, delta angle, arc length, degree of curve, tangent length and radius.
6. Typical cross-sections showing referenced profile, subgrade treatment, pavement thickness, jointing, sidewalk, foreslopes, back slopes, cross slopes, ROW line, and dimension of the location of the roadway with the ROW line. A Standard Detail may be referenced in lieu of providing a typical section on the plans.
7. Vertical curve data shall include station and elevation of PI, PC, PT, K-value, low point, high point and length of curve.
8. Intersection details showing drainage and special joint patterns.
9. Location and type of pedestrian ramps.
10. Special subgrade or pavement treatment.
11. Tie to existing pavement, including elevation and grades.
12. Station and offset data for roadway tapers, turn lanes, etc.

Grading and Erosion Control Plans

1. Existing and proposed contours at 1-foot intervals.
2. Stormwater detention facilities.
3. Total grading limits.
4. Stationing as it relates to paving, sewer or drainageway plans.
5. Soils data and soil boring location when applicable. NRCS soil survey or geotechnical report shall be referenced.
6. Type and location of erosion and sediment control measures.
7. Topsoil stockpile and stabilization measures and vegetated areas to be preserved.
8. Temporary and permanent seeding information.
9. Location, height, and details of proposed retaining walls.

Water Mains

The water main plans shall show all appropriate physical features adjacent to the proposed water mains. Other utilities such as sanitary and storm sewers, manholes, etc. shall be shown on the plans with horizontal and vertical separation distances.

1.07 PLANS OF RECORD:

General

As built or construction record information shall be added to the original plan. The Project Engineer is responsible for documenting all changes from the approved plan other than field adjustments. As-built documentation shall be submitted to the City Engineer prior to acceptance of the improvements.

Part 2 – Sidewalks

2.01 GENERAL INFORMATION
2.02 TRAFFIC CONTROL
2.03 WIDTH AND LOCATION
2.04 GRADES
2.05 MATCHING EXISTING WALKS

2.06 MATERIAL AND THICKNESS
2.07 JOINTS AND FINISH
2.08 CURB RAMPS
2.09 SPECIAL CONDITIONS

2.01 GENERAL INFORMATION:

Conditions

1. The design of sidewalks shall conform to the following:
 - A. The Subdivision Ordinance of the City of West Liberty.
 - B. The Design Standards Manual.
 - C. Americans with Disabilities Act (ADA).
2. Project Submittals - All projects are to be submitted to the City for review and comment. On new streets, the sidewalk location and grade shall be included in the improvement plans.

2.02 TRAFFIC CONTROL:

The contractor shall provide lighted barricades to protect pedestrians.

2.03 WIDTH AND LOCATION:

Sidewalk width shall be 4 feet wide, except as noted in Section 2.05.

The back of the walk shall be located 1 foot from the property line, except in areas in which a different offset is required to match existing walks.

Sidewalks are generally required on both sides of all streets.

No sidewalks shall extend to the street perpendicular to the curb except at intersections and designated mid-block crossings. Such existing sidewalks removed for construction or maintenance activities shall not be replaced.

In some cases the City may require the sidewalk width to be 5 feet.

2.04 GRADES:

The cross-slope grade for sidewalks is 2% maximum.

The sidewalk portion that crosses a driveway shall be delineated by expansion joint lines so it is clear where the sidewalk crosses the entrance. Also, depressed sidewalk that is lower than the back of curb elevation will not be allowed.

Sidewalk Longitudinal Grade: The grade of the sidewalk shall follow the street grade except ramps at intersections. Grades greater than street grades shall require special approval.

Parking: The parking grade (between the sidewalk and street) shall be a minimum of 4% unless the City approves a special grade. Parking area grades of up to 10% shall be allowed with submittal of appropriate plan details. Under special circumstances the parking area grade may exceed ten percent, provided sidewalk has a 2-foot wide graded shoulder with maximum 2% cross slope on both sides of the sidewalk. Parking grade may be less than 1/2 inch per foot for narrow border areas.

2.05 MATCHING EXISTING WALKS:

The width and location of a new sidewalk shall be varied to match the width and location of existing sidewalks in the area. However, the sidewalk width shall not be reduced to less than 4 feet.

Sidewalk cross slope may be varied through a gradual transition to match existing adjoining walks. Contact the Engineer if existing adjoining walks vary significantly from existing standards.

2.06 MATERIAL AND THICKNESS:

Sidewalks shall be constructed of Portland cement concrete conforming to the Iowa Department of Transportation C-3 mix. Maximum slump shall be 3 inches.

Sidewalks 4 to 6 feet wide shall have a minimum thickness of 4 inches. Sidewalks greater than 6 feet wide shall have a minimum thickness of 5 inches with fiber mesh reinforcement or 6 inches of non-reinforced concrete. Sidewalks crossing driveways shall be a minimum of 6 inches thick.

2.07 JOINTS AND FINISH:

Sidewalks shall have a uniform texture with a broom finish.

Tooled joints are permissible on sidewalks less than 6 feet in width. Framing is permissible on sidewalks with tooled joints and should match existing adjoining sidewalk. The maximum depth of framing shall be 1/16 inch. The joint depth shall be ¼ the sidewalk thickness. The joint width shall be minimized.

Sawed joints are permissible for all widths of sidewalks. The joint depth shall be ¼ the sidewalk thickness.

Sidewalk joints shall be delineated through driveways.

Sidewalk joints shall be spaced to form square panels.

Preformed expansion joints, ½ inch in width, shall be installed at approximately 100-foot intervals or at property lines in new residential or commercial construction. Preformed expansion joints, ½ inch in width, shall be installed adjacent to all curb ramps.

Stamped imprints indicating the contractor and date of construction are permissible. The size of the imprint shall be limited to less than 4"x6" and the depth to less than ¼".

Apply curing compound immediately following finishing operations or cure with moist burlap for not less than 24 hours. Curing compound on sidewalks is recommended (not required).

2.08 CURB RAMPS:

State law requires pedestrian ramps be installed at all intersections and at some mid-block locations for new or reconstructed curb and sidewalks. The maximum ramp slope shall be 1" in 12". The maximum rise for any run shall be 30 inches. If the distance between ramps on the same intersection quadrant is less than five feet along the arc of the curb, the entire curb between the sidewalks shall be constructed as a large ramp. The area between the sidewalks shall be paved as sidewalk. Sidewalk ramp texture shall conform to ADA requirements.

Ramps shall be located in line with the public sidewalk.

The current standards of the Americans with Disabilities Act (ADA) will govern in all cases.

2.09 SPECIAL CONDITIONS:

1. Retaining Walls: When the sidewalk construction requires the installation of retaining walls for grade adjustments, the detailed plans shall include their design. Unless otherwise approved by the City, all retaining walls shall be located entirely on private property.
2. Obstructions: All obstructions are to be removed or relocated except for those that are impractical to move, ie: utility poles and trees will be considered on a case basis. In new subdivision areas, these items should never occur but in older, built up areas they will have to be addressed. In the case where the sidewalk must be shifted an 8:1 taper (max sharpness) to and away from the obstruction, with a straight section adjacent to the obstruction, shall be provided.
3. Sewers and water main should not be located under the sidewalk wherever possible.

Part 3 – Driveways

3.01 GENERAL INFORMATION

3.02 TRAFFIC CONTROL

3.03 DRIVEWAY MATERIAL, THICKNESS AND FINISH

3.04 CURB REMOVAL

3.05 GENERAL CONDITIONS FOR ALL DRIVEWAYS

3.06 SINGLE FAMILY

3.07 TWO-FAMILY RESIDENCES

3.08 ALL OTHER DRIVEWAYS EXCEPT SINGLE OR TWO FAMILY RESIDENCES

3.09 STATE HIGHWAY AND INDUSTRIAL AREAS (NON-RESIDENTIAL)

3.10 DOUBLE FRONTAGE LOTS – FRONT AND BACK

3.01 GENERAL INFORMATION

An access permit must be obtained before driveway construction or reconstruction not associated with the construction of a new house or business for which a building permit has been obtained. However, the standards set forth in this document apply to all driveway construction. A sketch with dimensions shall be submitted showing the driveway in relation to intersections, side lot lines and other driveways.

A permit must be obtained from the Iowa Department of Transportation before placing a driveway within any state highway right-of-way.

3.02 TRAFFIC CONTROL

The contractor doing the work is responsible for all traffic control and work site safety. If construction activities extend onto the street, traffic control shall meet the standards for Work Zone Traffic Control defined in the current edition of the "Manual on Uniform Traffic Control Devices." Traffic control plans may be required.

The contractor shall provide adequate lighted barricades and/or fencing to protect pedestrians.

3.03 DRIVEWAY MATERIAL, THICKNESS AND FINISH:

The driveway slab extending from the street to private property shall be constructed of Portland cement concrete conforming to the specifications of the Iowa Department of Transportation C-3 or M-3 mixes. Maximum slump shall be 3 inches. The concrete driveway slab shall be a minimum of 6 inches thick.

Driveways shall have ½-inch preformed expansion joint material at the front and back of sidewalk. Driveways across from "T" intersections shall have one-inch pre-formed expansion joint material at the front and back of the sidewalk.

The finish shall be a broom finish or astroturf drag.

Apply curing compound immediately following finishing operations or cure with moist burlap for not less than 24 hours. Curing compound on driveways is recommended (not required).

3.04 CURB REMOVAL:

Curb Removal

Curb grinding is preferred for driveway connection. Grinding shall consist of sawcutting the back of curb and milling the curb with a milling machine to provide a smooth uniform joint between the curb line and the driveway apron.

3.05 GENERAL CONDITIONS FOR ALL CLASSIFICATIONS OF DRIVEWAYS:

There shall be a minimum of twenty (20) feet between the end of the radius of a street intersection and the beginning of a driveway curb cut as measured at the curb line in all instances. Additional distance between the radius of a street intersection and the beginning of a driveway curb cut may be required by the City Engineer where deemed necessary because of high traffic volumes or other safety concerns.

A six (6) foot minimum distance between curb cuts at the curb line will be required.

The curb return shall not be constructed closer than three (3) feet to the side property line extended.

3.06 SINGLE FAMILY:

One driveway with maximum dimensions of twenty-four (24) feet measured at the street side of the sidewalk and thirty (30) feet at the curb line will be allowed.

A maximum of two driveways per property will be allowed, regardless of single or double frontage (regular or corner lot).

If two driveways are desired on a single frontage lot, two driveways with maximum dimensions of twelve (12) feet measured at the street side of the sidewalk and eighteen (18) feet at the curb line will be allowed.

If two driveways are desired on a double frontage (corner) lot, one on each frontage, one driveway with maximum dimensions of twenty-four (24) feet measured at the street side of the sidewalk and thirty (30) feet at the curb line and one driveway with maximum dimensions of twelve (12) feet measured at the

street side of the sidewalk and eighteen (18) feet at the curb line will be allowed. The major driveway is required to be located on the lower classified street.

Shared driveways for adjacent single-family residences are encouraged and in some instances may be required. To promote this goal, shared driveway maximum widths of thirty (30) feet at the street side of the sidewalk and thirty-six (36) feet at the curb line will be allowed.

Section 3.05 may be varied by the City Engineer in certain instances in the existing developed areas of the City, as necessary.

3.07 TWO-FAMILY RESIDENCES:

A maximum of one driveway per dwelling unit will be allowed, regardless of single or double frontage (regular or corner lot).

One driveway per dwelling unit with maximum dimensions of twenty-four (24) feet measured at the street side of the sidewalk and thirty (30) feet at the curb line will be allowed, except as noted in 3.06 F.

If garages are constructed on the common lot line, a single driveway with maximum widths of thirty (30) feet at the street side of the sidewalk and thirty-six (36) feet at the curb line will be allowed.

Section 3.05 may be varied by the City Engineer in certain instances in the existing developed areas of the city, as necessary.

3.08 ALL OTHER DRIVEWAYS EXCEPT SINGLE OR TWO FAMILY RESIDENCES:

Single Frontage

One driveway with maximum dimensions of thirty-four (34) feet measured at the street side of the sidewalk and forty-two (42) feet at the curb line will be allowed.

If two driveways are desired, two driveways with maximum dimensions of twenty-four (24) feet measured at the street side of the sidewalk and thirty-two (32) feet at the curb line will be allowed.

If the single frontage length is greater than or equal to one hundred and fifty (150) feet, two driveways with maximum dimensions of thirty-four (34) feet measured at the street side of the sidewalk and forty-two (42) feet at the curb line will be allowed.

Corner Lots

On corner lots, driveways shall be constructed as far away from the intersection as possible and still remain upon the property. In no case shall there be less than twenty (20) feet between the end of the radius of a street intersection and the beginning of a driveway curb cut as measured at the curb line.

In no instance shall more than three driveways be allowed on a double frontage property with no more than two on any single frontage.

One driveway per frontage with maximum dimensions of thirty-four (34) feet measured at the street side of the sidewalk and forty-two (42) feet at the curb line will be allowed.

If one frontage length is greater than or equal to one hundred and fifty (150) feet, two driveways with maximum dimensions of thirty-four (34) feet measured at the street side of the sidewalk and forty-two (42) feet at the curb line will be allowed on the longer frontage.

3.09 STATE HIGHWAY AND INDUSTRIAL AREAS (NON-RESIDENTIAL)

Type A drives are for high traffic volume, joint or common property driveways requiring protection for left turn movements. Type A drives shall be 45 feet wide at the property or sidewalk line. This width contains one 16-foot lane in a 4-foot painted or raised median and two 12-foot lanes out.

Type B drives are for high traffic volume, joint or common property driveways. Type B drives shall be 41 feet wide at the property or sidewalk line. This width contains one 16-foot lane in and two 12-foot lanes out.

Type C drives are for lower volume single property driveways. Type C drives shall be 28 feet wide at the property or sidewalk line. This width contains one 14-foot lane in and one 14-foot lane out.

The maximum radius for all driveways is 25 feet.

3.10 DOUBLE FRONTAGE LOTS – FRONT AND BACK:

Each frontage of lots with frontage on two parallel streets shall comply with the applicable standards for single frontage lots contained in Sections 3.06, 3.07 and 3.08.

Some subdivisions may prohibit access onto the higher classification street. Check the subdivider's agreement in each case.

Part 4 – Alleys

4.01 GENERAL INFORMATION
4.02 ALLEY CLASSIFICATION
4.03 RIGHT-OF-WAY WIDTH
4.04 PAVEMENT WIDTH
4.05 ALLEY GRADES

4.06 ALLEY PAVEMENT CROSS SECTION
4.07 PAVEMENT MATERIAL AND THICKNESS
4.08 SUBGRADE REQUIREMENTS

4.01 GENERAL INFORMATION:

Plans and specifications for public alley improvements must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.

Plans and specifications for public alley improvements must be reviewed and approved by the City Engineer prior to construction.

Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or mylar.

A five-year maintenance bond covering defective materials and workmanship is required for all alley improvements.

4.02 ALLEY CLASSIFICATION:

A **Residential Alley** is a route located between local streets used primarily for access to the rear of residential property.

A **Commercial Alley** is a route located in commercial areas used primarily for access to the rear of commercial property.

4.03 RIGHT-OF-WAY WIDTH:

The right-of-way width shall be 20 feet for all alleys.

4.04 PAVEMENT WIDTH:

Residential alleys shall have a pavement width of 18 feet.

Commercial alleys shall have a pavement width of 20 feet.

4.05 ALLEY GRADES:

The maximum grade for alleys shall be 12% for residential and 10% for commercial alleys. The minimum grade shall be 0.5% for all types of alleys.

4.06 ALLEY PAVEMENT CROSS SECTION:

The pavement shall have a 4% inverted crown cross-section.

4.07 PAVEMENT MATERIAL AND THICKNESS:

The pavement slab may be constructed of the following materials:

1. Non-reinforced Portland cement concrete conforming the IDOT specifications C-3 mix or M-3 mix as applicable.
2. Full depth asphaltic concrete hot mix conforming to the IDOT specifications for Type "B" base and Type "A" surface course.

Minimum alley pavement thickness:

	<u>Residential</u>	<u>Commercial</u>
Portland Cement Concrete	7"	8"
Asphalt Cement Concrete	9"	10"

4.08 SUBGRADE REQUIREMENTS:

The subgrade shall be scarified to a depth of 6 inches below the pavement, and compacted to 90% of Modified Proctor Density.

All fill sections shall be compacted to 90% of Modified Proctor Density.

Part 5 – Streets

5.01 GENERAL INFORMATION	5.11 PAVEMENT CROSS SECTION
5.02 STREET CLASSIFICATION	5.12 CURB AND GUTTER SECTION
5.03 RIGHT-OF-WAY WIDTH	5.13 INTERSECTION CORNER RADIUS
5.04 TRAFFIC LANE WIDTHS & LENGTH	5.14 PAVEMENT MATERIAL AND THICKNESS
5.05 SEPARATE TURNING LANES	5.15 SUBGRADE, BASE, & FILL REQUIREMENTS
5.06 MEDIANS AND BOULEVARDS	5.16 AREA BETWEEN SIDEWALK & CURB
5.07 DESIGN SPEED	
5.08 CLEAR ZONES	
5.09 STREET GRADES	
5.10 CURVE RADIUS	Table 5.1 - Summary of Design Criteria

5.01 GENERAL INFORMATION:

Conditions

1. Plans and specifications for public street improvements must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.
2. The design for roadway facilities shall be in conformance with the latest versions of the following:
 - A. The Design Standards Manual.
 - B. The American Association of State Highway and Transportation Official (AASHTO)-"A Policy on Geometric Design of Highways and Streets" (Green Book.)
 - C. The U.S. Department of Transportation - Federal Highway Administration - "Manual on Uniform Traffic Control Devices" (MUTCD)
 - D. The Institute of Transportation Engineers - "Transportation and Traffic Engineering Handbook".
 - E. Iowa Department of Transportation Manuals Current editions with revisions:
 - Standard Road Plans
 - Road Design Details
 - Road Design Manual
 - Road Design Aids Manual

- F. Iowa Department of Transportation "Urban Design Guides" and "Alternative Urban Design Guides," current edition.
 - G. Iowa Department of Transportation "Standard Specifications for Highway and Bridge Construction", current edition
 - H. In case of a conflict between the above design standards, the City Engineer should be contacted for clarification.
3. Project Submittals
- A. Plans and specifications for public street improvements must be reviewed and approved by the City Engineer prior to construction. Projects affecting IDOT must also be submitted to the Area Transportation Center.
4. Local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.
5. The Engineer of Record is responsible to submit "Record of Construction" drawings to the Engineer on reproducible vellum or mylar.
6. A five-year maintenance bond covering defective materials and workmanship is required for all street improvements.

5.02 STREET CLASSIFICATION:

Streets will be classified according to their functional use as described below. Existing facilities may not fully comply.

Arterial Streets

1. Major Arterial – The major arterial provides continuous routes for the movement of large volumes of all types of through traffic across the City and between the City and outlying areas. The system should be integrated both internally and between major rural connectors. The major arterial system carries most of the trips entering and leaving the area. Frequently, the major arterial carries important interurban as well as intercity bus routes. In urbanized areas, this system provides continuity for all rural arterials. Access to the major arterial is specifically limited in order to provide maximum capacity and through movement mobility.
2. Minor Arterial - The minor arterial street system inter-connects with and augments the major arterial system. It accumulates trips of moderate length at a somewhat lower level of travel mobility than major arterials. This system

places more emphasis on land access but still has specific limits on access points. A minor arterial may carry local bus routes and provide inter-community continuity but ideally does not penetrate identifiable neighborhoods. This system includes urban connections to rural collector roads where connections have not been classified as urban major arterials.

Collector Streets

Collector Streets provide for the movement of traffic between arterial routes and local streets as well as providing limited direct access to abutting property. Moderate amounts (2500 vehicles per day) of low speed (25 MPH) traffic, including bus traffic, may be carried on collector streets.

Local Streets

Local streets serve as a means of access to abutting property. They are intended to be a low speed (25 MPH) and short trip routes, with usually less than 500 vehicles per day.

Industrial Streets

Industrial streets are intended to carry commercial or industrial traffic.

5.03 RIGHT-OF-WAY WIDTH:

The minimum right-of-way width shall be provided as follows:

1. Major Arterial rights-of-way shall be no less than 100 feet in width,
2. Minor Arterial rights-of-way shall be no less than 85 feet in width,
3. Collector rights-of-way shall be 66 feet,
4. Local rights-of-way shall be 60 feet in width,
5. Cul-de-sac rights-of-way shall be 100 feet in diameter for local and 120 feet in diameter for industrial,
6. Industrial rights-of-way shall be 60 feet.

These widths do not provide for medians or boulevards if they are planned within the right-of-way.

5.04 TRAFFIC LANE WIDTHS AND LENGTH RESTRICTIONS:

1. All street widths shall be measured back-to-back of the curb.
2. The minimum traffic lane width will be 12 feet for arterials.
3. Local and industrial streets will have a minimum pavement width of 29 feet.
4. Arterial and collector streets shall have a minimum pavement width of 34 feet with provisions for bike lanes, except where turning lanes are present or 31 feet where bike lanes are not desired.
5. Cul-de-sacs shall be paved with a 29 foot wide paving. The outer edge of which shall be 10 feet inside the circumference of the right-of-way. The other radius from the stem of the cul-de-sac to the head shall be a minimum of 20 feet. Cul-de-sacs shall have a maximum length of 900 feet from the center of the bulb to the center line of the adjoining street.

5.05 SEPARATE TURNING LANES:

Separate turning lanes may be included on arterial streets but will generally not be included in other street design. Where separate turning lanes are required on the basis of a capacity analysis, use a 12-foot width for arterial streets and an 11-foot width for collector streets.

5.06 MEDIANS AND BOULEVARDS:

Medians or boulevards on arterial streets shall have a minimum width of 16 feet. At intersections, medians may be used to provide for a separate left turn storage lane.

Medians or boulevards which are included as a part of local or collector streets shall have a minimum width of 4 feet if paved or 9 feet if grassed. Paved medians on local and collector streets are discouraged.

5.07 DESIGN SPEED:

A design speed will be used to design the geometric features for arterial streets. The design speed will not be less than 35 miles per hour; however, posted speed limits may be less. The design speed will be used to establish geometric features including sight distance, intersections, etc. to current AASHTO standards.

5.08 CLEAR ZONES:

On streets with curbs, the clear zone shall be 3 feet for streets with a posted speed limit of 25 mph or less and 10 feet for streets with a posted speed limit greater than 25 mph. On streets without curbs, the clear zone shall be 10' for two-lane and four-lane facilities.

Variances to clear zone requirements will be considered for overhead electrical facilities where compliance will significantly impact existing trees. In no case will a clear zone of less than 18 inches be allowed. A clear zone variance must be approved by the City Engineer.

5.09 STREET GRADES:

The maximum street grade for arterial, industrial and cul-de-sac streets shall be 8%, for collector streets 10% and for local streets 12%.

When two streets intersect, the grade of the lower classification street shall be minimized to allow safe stopping and starting in adverse weather.

The minimum grade for streets shall be 0.5%, except around the bulbs of cul-de-sacs where the minimum grade shall be 0.7%.

5.10 CURVE RADIUS:

The minimum center line radius for curves shall be as follows:

- Arterial (major and minor) - 1,000'
- Collector - 350'
- Local - 150'
- Cul-de-sacs - 150'

Under no circumstances will variances be granted for radii less than 75 feet.

5.11 PAVEMENT CROSS SECTION:

All pavements shall have a 2% parabolic crown cross-section.

5.12 CURB AND GUTTER SECTION:

Curbs shall be 6" integral cast Portland cement concrete. There shall be no separation between the curb and gutter section and the pavement. Roll curbs are not allowed.

5.13 INTERSECTION CORNER RADIUS:

The corner radius at intersections will depend on the functional classification of the intersecting streets. These are the minimum criteria:

- arterial - arterial 50 feet
- arterial - collector 30 feet
- arterial - local 25 feet
- collector - collector 25 feet
- collector - local 25 feet
- local - local 25 feet
- industrial 50 feet
- alley - all Maximum allowable that will remain in the street R.O.W. (not more than 20')

Corner radiuses may be enlarged on routes that will have significant truck or bus traffic.

5.14 PAVEMENT MATERIAL AND THICKNESS:

The pavement slab shall be constructed of non-reinforced Portland cement concrete conforming the IDOT specifications C-3 mix or M-3 mix.

The minimum required pavement thicknesses are as follows:

<u>Street Class</u>	<u>Portland Cement Concrete</u>
Arterial	9 inches minimum
Collector and Industrial	8 inches
Residential	7 inches

Pavement thickness requirements are intended as a guide. Arterial street projects shall be designed on the basis of soil conditions and projected traffic loadings.

5.15 SUBGRADE, BASE, AND FILL SECTION REQUIREMENTS:

The subgrade shall have 18 inches of subsurface below the pavement and be compacted to 90% of Modified Proctor Density.

All fill sections shall be compacted to IDOT Type A limits.

All pavement construction will require a minimum 6" thick aggregate drainable base and tile system constructed to IDOT standards. Pavement tile systems may be used for sump pump discharge tiles required by Part 9, Storm Sewers and

Stormwater Management Facilities. Tile shall be 6" diameter when used in conjunction with sump pump discharges.

5.16 AREA BETWEEN THE SIDEWALK AND THE CURB (PARKWAY):

The parkway shall slope to the street at a rate of ½ of an inch vertical per horizontal foot.

In residential areas, the parkway shall be grassed except in such areas that the parkway is so narrow that grass does not grow well. In these narrow areas, the alternate materials described below may be used upon approval of the Engineer.

In commercial areas, alternate materials may be used in the parkway upon approval of the City Engineer. These materials include exposed aggregate concrete, asphalt and bricks or concrete pavers on an asphalt or concrete base.

TABLE 5.1

Summary of Design Criteria

DESIGN STANDARD	ARTERIAL	COLLECTOR	LOCAL	CUL-DE-SACS	INDUSTRIAL
Minimum right-of-way width	100' (major) 85' (minor)	66'	60'	60'	60'
Minimum lane width	12'	11'			
Minimum pavement width	34'*/31'	34'*/31'	29'	29'	29'
Maximum grade	8%	10%	12%	8%	8%
Minimum grade	0.5%	0.5%	0.5%	0.7%	0.5%
Minimum curve radius	1,000'	350'	150'	150'	150'
Minimum pavement thickness	9**	8	7	7	8

*With bike lanes. **See 5.14.

Part 6 – Utility Work and other Construction in the Public Right-of-Way

6.01 GENERAL INFORMATION

6.02 TRAFFIC CONTROL

**6.03 MISCELLANEOUS
CONSTRUCTION**

6.04 CLEAR ZONES

6.05 EXCAVATION AND BACKFILL

6.06 WORK AROUND TREES

**6.07 RESTORATION OF BRICK
STREET SURFACE**

**6.08 RESTORATION OF ASPHALT
OVERLAY ON BRICK STREETS**

**6.09 RESTORATION OF ASPHALT
OVERLAY ON CONCRETE STREETS**

**6.10 RESTORATION OF CONCRETE
STREETS**

6.11 OTHER SURFACES

6.12 MAINTENANCE

6.01 GENERAL INFORMATION:

A right-of-way construction permit is required to work within the public rights-of-way. Permits may be obtained from the City Manager. Permits for utility work must be obtained by the owner of the utility. A right-of-way construction permit is not required for sidewalk, driveway, or mail box construction. See Parts 2 and 3 for the construction of sidewalks and driveways and Section 6.03 for the construction of mailboxes.

6.02 TRAFFIC CONTROL:

The permittee is responsible for all traffic control and work site safety. Traffic control shall meet the standards for Work Zone Traffic Control as defined in the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. A traffic control plan may be required by the City Engineer.

The permittee shall provide adequate lighted barricades and/or fencing to protect pedestrians. All excavations shall be fenced when the contractor is not at the site.

There may be situations where the traffic load or site conditions will allow only a portion of the street to be closed at one time. On collector and arterial streets, contractors may be required to bore and jack to place a new utility beneath the street surface.

6.03 MISCELLANEOUS CONSTRUCTION:

Mail Boxes

The base of all mail boxes shall be a minimum of 12 inches from the edge of the pavement. Brick or other masonry support structures are allowed. The property

owner will be required to sign a masonry mailbox waiver available at City Hall. Contact the local post office for current regulations regarding the height and offset of the face of the box.

Retaining Walls

Private retaining walls are not allowed within the public right-of-way without an agreement for temporary use of public right-of-way approved by the City Council.

Monitoring Wells

Monitoring wells are allowed in the public right-of-way only when it can be shown that the wells cannot be located on private property. Monitoring wells are subject to special permit conditions.

6.04 CLEAR ZONES:

On streets with curbs, the clear zone shall be 10' for four-lane facilities and 3' for two-lane facilities. On streets without curbs, the clear zone shall be 10' for two-lane and four-lane facilities.

Variances to clear zone requirements will be considered for overhead electrical facilities where compliance will significantly impact existing trees. In no case will a clear zone of less than 18 inches be allowed. A clear zone variance must be approved by the City Engineer.

6.05 EXCAVATION AND BACKFILL:

Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in one foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted; however, sand may be used as utility bedding.

In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density. Backfill outside of right-of-way will not be the City's responsibility to monitor.

6.06 WORKS AROUND TREES:

Use care to prevent work within the drip line of trees. When work falls within the drip line of trees, contact the City Engineer or City Forester.

6.07 RESTORATION OF BRICK STREET SURFACE:

Use care to salvage bricks during excavation.

Construct a 7 inch thick base of IDOT M-3 concrete. Allow enough depth for installation of brick on a sand cushion.

Brick shall be placed on a sand cushion making sure the pattern and elevation match the surrounding street.

A 50% sand and 50% Portland cement mixture shall be swept into the brick joints and fogged with a mist of water to insure seating of the brick.

6.08 RESTORATION OF ASPHALT OVERLAY ON BRICK STREETS:

Construct a 7 inch thick base of IDOT M-3 concrete flush with the top of the surrounding bricks.

Tack and place IDOT Type A mix asphalt and compact to the proper elevation.

6.09 RESTORATION OF ASPHALT OVERLAY ON PORTLAND CEMENT CONCRETE STREETS:

Construct a concrete base of the same thickness as was removed using M-3 mix. An IDOT type BT-3 joint shall be used to joint the base to existing concrete. Use #5 epoxy coated bars, 24 inches in length, spaced 30 inches on center drilled and grouted 9 inches into the existing slab. The concrete base shall be flush with the existing concrete.

Tack and place 3/8-inch Type A asphalt and compact to the proper elevation.

6.10 RESTORATION OF PORTLAND CEMENT CONCRETE STREETS:

Concrete shall be removed to the nearest longitudinal joint and a minimum of half the panel between transverse joints. Only full or half panels may be removed. Full panels must be removed if the portion to remain is cracked or settled.

Concrete shall be sawn to insure a clean break at the joints.

An IDOT type BT-3 joint shall be used to joint to existing concrete. Use #5 epoxy coated bars, 24 inches in length, spaced 30 inches on center drilled and grouted 9 inches into the existing slab.

Place new concrete of the same thickness as was removed using IDOT M-3 mix.

All joints shall be sawn and sealed according to IDOT detail RH-51.

6.11 OTHER SURFACES:

All areas outside the paving which are disturbed shall be restored to their original condition.

When approved by the governing authority, unimproved streets (rock or rock and oil, seal coated streets, or asphaltic concrete surfaced streets) may be repaired or restored with Bituminous Seal Coat consisting of one or more applications of Binder Bitumen with one or more successive applications of cover aggregate. Materials, Equipment and Construction methods shall be in general conformity with Section 2307 of the current Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction.

6.12 MAINTENANCE:

Seeding or sodding of disturbed areas shall be maintained until watering is no longer required for self-sustaining growth.

The owner of the utility will be responsible for repair or maintenance of settled areas within the right-of-way and pavement repairs for a period of five years from the date the work is completed.

Part 7 – Water Distribution System

7.01 GENERAL INFORMATION

7.02 DESIGN RESOURCES

7.03 DEFINITIONS

7.04 CONSTRUCTION SPECIFICATIONS

7.05 SYSTEM DESIGN

7.06 MATERIALS

7.07 BEDDING AND BACKFILL

7.08 PERFORMANCE AND TESTING

7.09 LOCATION OF EASEMENTS

7.01 GENERAL INFORMATION:

Plans and specifications for public water distribution facilities must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.

Plans and specifications for public water distribution facilities must be reviewed and approved by the City Engineer prior to construction.

Plans and specifications for public water distribution facilities must be reviewed and approved by the Iowa Department of Natural Resources prior to construction. Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or mylar.

A two-year maintenance bond covering defective materials and workmanship is required for all water main improvements.

7.02 DESIGN RESOURCES:

The design for water distribution facilities shall be in conformance with the following:

1. Requirements and Standards of the Iowa Department of Natural Resources.
2. City's Construction Specifications.
3. City's Plumbing Code.

In case of a conflict between the above design standards, the most restrictive requirement shall apply.

7.03 DEFINITIONS:

Distribution Main

A water pipe owned, operated or maintained by the City which is used for the purpose of distribution of water and from which service connections are made.

Private Service Pipe

A water pipe installed, owned, operated and maintained by the private consumer. Service pipes are often 1 inch in size for residential and may be 2 to 6 inch in size for commercial or 8 to 12 inch for large industrial applications.

Private Fire Hydrant

One which is located on privately owned property, or on streets not dedicated to public use unless the water main is within a public easement. Private fire hydrants must be served by a minimum of a 6-inch pipe. A private fire hydrant is the responsibility of the property owner and is to be used for fire protection only. Where it is the owner's intention that these hydrants be used by the City Fire Department, these hydrants shall conform to the Department of Public Works specifications for fire hydrants. The City has the right to utilize the hydrants for flushing purposes.

7.04 CONSTRUCTION SPECIFICATIONS:

Construction must comply with the City's standard construction specifications for water distribution facilities.

7.05 SYSTEM DESIGN:

Minimum Design Period Requirements

Water mains shall have a minimum size based on a hydraulic analysis utilizing 20-year design for a specified water demand. The specified water demand will depend on the area to be serviced and the type of water main (transmission, arterial or distribution) and must be confirmed by the City Engineer.

Minimum Pressure Requirements

The minimum static pressure required at all fire hydrants is 35 psi or higher at peak hour conditions on the day of maximum demand. The City may require stricter requirements in specific situations. The residual pressure required under fire flow conditions should not drop below 20 psi at any hydrant or any point in

the system. When static pressure exceeds 100 psi, individual pressure reducing devices may be required

Flow Considerations

1. Design Flows - The water main system must be able to meet the following flow requirements:
 - A. Peak day demands plus fire flow demands.
 - B. Instantaneous peak demands for water mains from source treatment and/or storage facilities. Peak day demands plus fire flow demands must also be met.
2. Peak Day Demands
 - A. General

The peak day demand is the average rate of consumption on the maximum day. The maximum day is the 24-hour period during which the highest consumption total is recorded in the latest 3-year period. High consumption that will not occur again due to changes in the system, or that was caused by unusual operations, will not be considered.

When no actual figure for maximum daily consumption is available it will be estimated on the basis of consumption in other similar service areas. Such estimates will be at least 2.0 times greater than the average daily demand for more than 500 people and 2.5 times greater for 500 people or less. When a system is in two or more service levels, consider the total maximum daily consumption that must pass through the service level being reviewed.

- B. Average Day Demand (Minimum)

Equation 1: Area x Area Density x Rate = Average Daily Demand

Equation 2: Number of Units x Unit Density x Rate = Average Daily Demand

Density Table:

LAND USE	AREA DENSITY	UNIT DENSITY	RATE
Low Density (Single Family) Residential	10 people/Ac.	3.3 people/unit	100 gpcd
Medium Density (Multi-family) Residential	12 to 15 people/Ac.	3.3 people/unit 6.0 people/duplex	100 gpcd
High Density (Multi-family) Residential	20 to 75 people/Ac.	2.5 people/unit	100 gpcd

If the Project Engineer uses values different than the above table, approval by the City Engineer is required.

Office & Institutional Special Design Density

Commercial Special Design Density

Industrial Special Design Density

Special design densities shall be subject to approval by the City Engineer based on methodology provided by the Project Engineer.

3. Instantaneous Peak Demands

Based on the assumption that the instantaneous peak flows for water supply should be greater than the extreme peak wastewater flow the following has been set as the Instantaneous Peaking Factor:

A. 220 people or less = Average day demand (gpm) x 9.0.

B. more than 220 people = Average day demand (gpm) x $7/P^{0.167}$

P = design year population in thousands.

If major water users exist in the system, the peak may be greater than those listed above.

4. Fire Flows

Fire flows shall be in accordance with Uniform Fire Code Appendix III-A or International Fire Code Appendix B depending upon adopted code of City. The Project Engineer must confirm which code the City currently has adopted.

A. Hydrant Distribution

Hydrant distribution shall be in accordance with the Uniform Fire Code Appendix III-B or International Fire Code Appendix B depending upon adopted code of City. The Project Engineer must confirm what code the City currently has adopted.

Size

All mains shall be a minimum of 6 inches in diameter. A larger size may be required by the City Engineer, depending upon water demand and fire flows.

Depth

Water main shall be installed with a minimum depth of cover of 5½ feet. Generally, the maximum depth shall not exceed 7 feet.

Alignment

All mains shall be looped if possible and practical, except for short runs to serve cul-de-sacs where the distance is less than 500 feet.

Water mains shall be constructed such that no services shall be extended beneath the paving of the circular turnaround on cul-de-sacs.

Water distribution mains will be extended to and through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect water mains to serve future adjacent undeveloped land. This will be evaluated on a case-by-case basis.

Water mains will be located so the front of each property has access for a service connection.

Changes in Alignment

Thrust restraints are required at all changes in alignment exceeding 10-degrees, at all dead ends and on fire hydrants. Wrap pipes and fittings in plastic before pouring thrust blocks.

The maximum deflection at joints shall not exceed the pipe manufacturer's recommendations.

Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used. PVC water main materials shall not be bent.

Separation from Sewers

There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.

Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.

Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, one full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.

Water mains shall be separated from sewer force mains by a horizontal distance of at least 10 feet unless:

1. the force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Sections 8.2 and 8.4 of these standards, and;
2. the water main is laid at least four linear feet from the sewer force main.

Location of Valves

Four-way connections will have 3 valves. On looped systems, valves will generally be on the main line. Four valves may be required in specific instances.

Three-way connections will have 2 valves. On looped systems, valves will generally be on the main line. Three valves may be required in specific instances.

Maximum valves spacing will be 800 feet in residential areas or 400 feet in commercial areas. Maximum spacing of 400 feet will apply to mains bordering both residential and commercial areas.

A valve shall be placed within 10-feet of dead-ends to allow the extension of the pipe without shutting off the existing system. Taps within the final 10-feet are not allowed. Valves within driveways are to be avoided.

Auxiliary valves shall be provided for all fire hydrants.

Valves shall be located as close as possible to tees and crosses.

Valves should not be located within paving whenever possible.

Location of Fire Hydrants

Fire hydrant spacing will be on an average distance of 400 feet. This average spacing will generally mean one hydrant for every block in residential, commercial and industrial areas. A fire hydrant will be required at the end of every cul-de-sac regardless of the proximity of a hydrant on the intersecting through street. A fire hydrant will be required at the end of all dead end lines.

The location of fire hydrants may be modified at the request of the local jurisdiction's fire department.

Service Pipes

Every building, including each unit of zero-lot-line residences, shall have a direct service connection to a public water main. Separate services are required for each platted lot (not building).

No water consumer shall construct water service pipes across lots or buildings to adjoining premises, but all service pipe shall be laid on streets, alleys or public ground to the premises to be served, and enter at the front or rear of the building nearest the main.

Such service pipe shall be laid in a straight line at right angles to the water main, and connection made within two lines drawn parallel to the sides of the building to be served or not more than three feet outside of these sides.

Multiple stop boxes shall be permanently marked to identify the correct individual metered services.

7.06 MATERIALS:

Ductile-Iron Pipe

Thickness design shall conform to AWWA C150.

Manufacture shall conform to AWWA C151.

Thickness class, unless otherwise indicated or specified, shall be Class 52.

Cement mortar lining shall conform to AWWA C104.

All ductile iron pipe 12" in diameter and larger shall be wrapped with a 8 mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5 installation methods.

Use single rubber-gasket push-on joints or mechanical joints conforming to ANSI/AWWA C111/A21.11. Furnish with all necessary hardware and gaskets.

All Bell-and-spigot pipe joints shall be conforming to ANSI A21.6 or ANSI A21.8.

For bolted/restrained mechanical joint, use Griffin Bolt-Lok restrained joint or approved equal.

For unbolted/restrained mechanical joint, use Griffin Snap-Lok restrained joint or approved equal.

Do not use drilled & tapped retainer glands.

The plain end of a push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting gaskets.

Polyvinyl Chloride (PVC) Pipe

PVC pipe design shall conform to AWWA C900 and all pipe shall have the same outside dimensions as ductile-iron pipe.

Thickness class shall be DR 18 (Class 150).

PVC pipe materials shall not be used in any area where there is likelihood the pipe will be exposed to significant concentrations of pollutants comprised of low-molecular-weight petroleum products or organic solvents or their vapors.

PVC pipe materials shall not be used around cul-de-sacs or other small radius curves.

PVC water main shall be marked with insulated solid #12 wire for the entire length to make electronic location possible.

1. The insulation shall be protected to prevent accidental grounding. Make few splices, and where necessary, wrap the bare wire with electrical tape.
2. The wire shall be installed continuously as the pipe is backfilled. The wire shall be fixed to the side of the pipe at a position of 2 o'clock or 10 o'clock and attached with duct tape every 5 feet.
3. Bring the wire to the ground surface at each fire hydrant. Leave 18 inches of wire exposed. If there is no fire hydrant within 500 feet, bring the wire to the surface in a valve box and mark the drawings appropriately.

Where there is evidence there will be considerable underground construction or several large diameter service taps or connections, ductile iron pipe materials will be used.

Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used. PVC water main materials may not be deflected. PVC water main joint deflections shall be limited to manufacturer's recommendations.

Fittings

All fittings shall conform to ANSI/AWWA C110/A21.10, with pressure rating of Class 250.

Mechanical-joint fittings shall be ductile iron compact C153/A21.53 or ductile standard C110/A21.10. Large fittings, 12-inch through 20-inch shall be ductile iron standard C110.A21. Swivel tees shall be ductile iron standard C110.A21.10. Where ductile iron is not available (i.e., offsets), cast iron standard C110.A2 shall be provided.

All fittings shall be Class 250, shall be bituminous coating inside and outside, shall be furnished complete with necessary accessories including plain rubber gaskets, ductile iron glands, bolts and nuts. Verify the gasket seats are not made irregular by improper application of the lining materials.

Valves & Valve Boxes

Gate valves shall conform to AWWA C509. Use full line size gate valves with epoxy or polymer lining. Use Clow, Mueller or Kennedy valves, or an approved equal with 200 psi working pressure and gaskets rated at 250 psi. The waterway must be a full sized waterway. Valves shall be capable of being repacked or replacing O-rings under pressure.

Butterfly valves shall conform to AWWA C504. Use Pratt, M&H or Mueller valves, or an approved equal.

Valves shall open left and be furnished with a 2" square operating nut. Use Cor-Ten steel.

An operator extension stem with a centering device on the upper end unit shall be used to bring the operating nut to a point 1' below the surface of the ground and/or box cover. The extension stem shall be steel and shall be complete with a 2" square wrench nut on top end and 2" square socket on the bottom.

Valve Boxes shall be 2-piece slip type Tyler Series 6855 Item 668-A, or approved equal range 62" to 82". Use lids marked "water".

Tapping valves shall be 175 psi minimum working pressure, mechanical joint manufactured by Mueller or Clow.

Hydrants

- Specification standard: AWWA Standard C502
- Acceptable manufacturers and model: Mueller SuperCenturion 250 or Waterous Pacer WB-67-250
- Type of shutoff: Compression
- Type of construction: Break flange or break bolt
- Main valve opening: 4½" minimum
- Nozzle arrangement and size: 3 nozzle: Two 2½-inch hose nozzles and one 4½-inch pumper nozzle. The 4½" pumper nozzle is to face the street, or at an intersection, face the higher classification street.
- Nozzle thread: National Standard Hose Threads
- Type of inlet connection: Mechanical Joint
- Size of inlet connection: 6 inch
- Depth of bury: Distance from ground line to top of connecting pipe shall be 5½ feet
- Direction of opening: Open to left (counter-clockwise)
- Packing: Conventional or O-Ring
- Size and shape of operating nut: 1½ inch, standard pentagon
- Working pressure: 150 psi
- Color: Red

Special Fittings

Special pipe fittings must be approved by the City Engineer.

Special fittings must be the same diameter, thickness and pressure class as standard fittings.

Special fittings shall be manufactured to meet requirements of same specifications as standard fittings except for laying length and types of end connection.

Swivel fitting shall be Tyler 5-198 or approved equal. Retaining spools may be used.

Cast iron tapping sleeves shall be Mueller or Clow.

Stainless steel tapping sleeves shall be epoxy coated with ductile-iron flange and shall be compatible with Mueller or Clow tapping valves. Sleeves shall be Ford FAST, Smith-Blair 662 and 663 or Romac SST.

Tapping sleeves for 12" or 16" shall be ductile iron or CASI. The outlet of the tap shall not be greater than $\frac{1}{2}$ of the diameter of the pipe tapped.

Sleeve Type Couplings

Standard solid black sleeves shall be Tyler 5-144L or approved equal. Bolted straight coupling shall be Smith-Blair 441 or Romac Style 501, 6 bolt, 6" long, or approved equal.

Gaskets, Bolts, and Nuts

Mechanical joints made with:

1. Bolts: 3/4 inch Cor-ten steel.
2. Bolt studs with nut on each end.

All thread rod used to restrain fittings shall be stainless steel and 3/4" diameter.

7.07 BEDDING AND BACKFILL:

All mains shall be bedded in crushed stone to a depth of one-half the pipe diameter. See construction specifications for type of crushed stone.

All other pipe shall be bedded in accordance with manufacturer's recommendations.

Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in one foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. See construction specifications

for type of crushed stone. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.

In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

7.08 PERFORMANCE AND TESTING:

Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C601. A minimum free residual chlorine concentration of 10mg/l shall be maintained for the 24-hour disinfection period. The contractor shall provide documentation of bacterial tests from a certified laboratory.

Pressure and leakage test in accordance with AWWA C600.

Valves shall be located and tested to verify operation.

Fire hydrants shall be tested to verify operation.

Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

7.09 LOCATION OF EASEMENTS:

All public water mains should be located within the public right-of-way. In rare exceptions, dedicated easements may be used for location of water main outside of public right-of-way.

To limit damage to structures in the event of a main break, water mains shall be placed a minimum distance of 1.5 times the depth from building setback lines. Greater separations are desirable.

All water mains outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.0 times the pipe depth rounded up to the nearest 5 feet.

The minimum easement width is 10 feet.

Part 8 – Sanitary Sewer

8.01 GENERAL INFORMATION	8.07 MANHOLE STANDARDS
8.02 DESIGN RESOURCES AND REFERENCES	8.08 PROTECTION OF WATER SUPPLIES
8.03 PERMITTED FLOWS AND CONNECTIONS	8.09 CREEK CROSSINGS
8.04 DESIGN FLOWS AND CAPACITY	8.10 BACKFILL AND BEDDING
8.05 SERVICE CONNECTIONS	8.11 PERFORMANCE & TESTING
8.06 PIPE STANDARDS AND STRENGTH DESIGN	8.12 SEWER LOCATION AND EASEMENTS
	8.13 LIFT STATIONS & FORCE MAINS

8.01 GENERAL INFORMATION:

Plans and specifications for public sanitary sewer facilities must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.

Plans and specifications for public sanitary sewer facilities must be reviewed and approved by the City Engineer prior to construction.

Plans and specifications for public sanitary sewer facilities must be reviewed and approved by the Iowa Department of Natural Resources prior to construction. Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or mylar, and shall include the horizontal locations of services.

A two-year maintenance bond covering defective materials and workmanship is required for all sanitary sewer facilities.

8.02 DESIGN RESOURCES AND REFERENCES:

The design for sanitary facilities shall be in conformance with the following:

Requirements and Standards of the Iowa Department of Natural Resources.

8.03 PERMITTED FLOWS AND CONNECTIONS:

No combined sewers shall be constructed. Sanitary and storm sewers shall be kept separate.

Only sewage shall be permitted in the sanitary sewers. Footing drains, downspouts, sump pumps, etc., conveying clear water will not be allowed to discharge into the sewer system. Air conditioning condensation water may be allowed in the sanitary sewer.

Flows from commercial car washes must be discharged to the sanitary sewer after passing through approved oil and sediment traps.

Each platted lot shall have a direct connection to a public sewer.

8.04 DESIGN FLOWS AND CAPACITY:

Peak rates will be taken as approximately 2.5 times the normal flow. Infiltration will be calculated by the addition of 100 gallons per capita per day.

The peak wet weather flows for various land usage are as follows:

1. Single Family Dwellings
(100 gal/cap/day) x 2.5 (peak factor) +
1200 gal/acre day (infiltration) = 250 gpcd + infiltration
Assume 3.5 people/home
2. Mobile Homes
(50 gal/cap/day) x 2.5 (peak factor) +
1200 gal/acre day (infiltration) = 125 gpcd + infiltration
Assume 2.5 people/home
3. Multi Family Dwellings
(75 gal/cap/day) x 2.5 (peak factor) +
1200 gal/acre day (infiltration) = 187 gpcd + infiltration
Assume 1.5 people/bedroom
4. Motels and Hotels
(50 gal/cap/day) x 2.5 (peak factor) +
1200 gal/acre day (infiltration) = 125 gpcd + infiltration
Assume 1.5 people/room
5. Schools, without cafeteria or showers
(10 gal/cap/day) x 2.5 (peak factor) +
1200 gal/acre day (infiltration) = 25 gpcd + infiltration

6. Schools, with cafeteria or showers
 (20 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 50 gpcd + infiltration

7. Office Buildings
 (10 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 25 gpcd + infiltration
 Assume 1 person/200 sq. ft.

8. Light Industrial
 (14,000 gal/acre/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 36,200 gpad

gpcpd = gallons per capita per day
 gpad = gallons per acre per day

If a proposed sewer is to serve a predominantly wet area or an area prone to excessive infiltration and inflow, special design information should be obtained from the City Engineer. If no information is available, the designer should use a minimum of 1000 gpcpd for infiltration.

All sanitary sewers shall be a minimum of 8 inches in diameter.

Pipes will be sized to carry peak rates with the pipe flowing at no more than 0.67 of the pipe diameter for pipes 15" and smaller and 0.75 of the pipe diameter for pipes larger than 15" in diameter.

All sewers shall have a slope which will give a mean velocity when flowing full of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013.

Minimum pipe slope shall be the greater of the below table value or slope that provides a minimum 2 fps peak flow velocity for the upstream service area.

Sewer Size:	Minimum Slope (ft./100 ft.)
8"	0.400
10"	0.300
12"	0.220
15"	0.150
18"	0.120
21"	0.100
24"	0.090
27"	0.080
30"	0.080
36"	0.080

Where velocities greater than 15 feet per second are calculated, special provisions shall be made to protect against displacement, erosion or shock.

Sanitary sewers shall be sufficiently deep so as to receive sewage by gravity from basements and to prevent freezing.

8.05 SERVICE CONNECTIONS:

A sanitary service pipe will be provided for every platted lot or location where construction of a building is likely. A 4-inch sanitary service pipe will be used for single-family residential. Pipes for multi-family residential, commercial, or industrial, will be sized as required.

Sanitary service pipes will be extended from the main to the right-of-way line or outer utility easement line, whichever is further.

Two sanitary services may be located in the same trench provided they terminate at the right-of-way line adjacent to the parcel they will serve (services crossing lot lines are not permitted).

The end of all sanitary services shall be marked with a treated 2x4 or 2" plastic pipe extending from the service line to 3 feet above finished grade.

Service taps in manholes are allowed only in extreme conditions and with the approval of the City Engineer. If permitted, service connections to manholes must be between 6" and 12" above the invert elevation of the outlet. Sewer flow channels in the manhole bottom must be provided for all services. Internal drops for service connections may be permitted on manholes deeper than 12 feet upon approval of the City Engineer. Internal drops shall be constructed of SDR 23.5 PVC with stainless steel bands and fasteners spaced at a maximum of 4 feet.

8.06 PIPE STANDARDS AND STRENGTH DESIGN:

Reinforced Concrete Pipe

Reinforced concrete pipe manufactured in accordance with ASTM C-76 and meeting the following standards may be used for pipe 12 inches in diameter or larger. Reinforced concrete pipe shall be subject to approval of the City Engineer.

1. All joints will be confined O-ring gasket meeting ASTM C443. All pipe 36-inch diameter and smaller will have bell and spigot joints. Pipe larger than 36-inch diameter may have tongue and groove joints.
2. Minimum wall thickness will be B-wall as defined in ASTM C 76.

3. The required pipe strength and bedding requirements shall be calculated on a case-by-case basis. The minimum pipe strength shall be Class III as defined in ASTM C 76.
4. All pipe shall be marked with the date of manufacture and ASTM class. If quadrant reinforcement is used, the top shall be marked on the outside of the pipe.
5. No lift holes.
6. Hydrogen sulfide shall be considered in the design of concrete pipe sewers downstream from lift stations.

Vitrified Clay Pipe

Vitrified clay pipe manufactured in accordance with ASTM C700 and meeting the following standards may be used for pipe 8 inches through 36 inches in diameter.

1. Shop drawing of gasket installation and joint assembly, subject to approval of the City Engineer.
2. All pipe shall be "extra strength" as defined by ASTM C700.

Ductile Iron Pipe

Ductile iron pipe manufactured in accordance with ANSI/AWWA-C150/A21.50 and ANSI/AWWA-C151/A21.5A and meeting the following standards may be used.

1. Use push on gasketed joints.
2. Use Class 52 ANSI standard unless a thicker wall is required because of depth.
3. Lining and Coating:
 - A. Inside of pipe and fittings: Double thickness cement lining and bituminous seal coat conforming to ANSI/AWWA-C104/A21.4.
 - B. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANSI Standard.

PVC Truss Pipe

PVC truss pipe manufactured in accordance with ASTM D2680 and meeting the following standards may be used for pipe 8 inches through 12 inches in diameter.

1. All PVC truss pipe shall be made of PVC compound having a minimum cell classification of 11432 as defined in ASTM D4396.
2. Gaskets shall comply with requirements in ASTM F477 and F913. Joint shall meet the requirements of ASTM D3212.
3. Pipe shall have a minimum pipe stiffness of 200 lb./inch/inch at 5% deflection.

Poly vinyl chloride (PVC)

Poly vinyl chloride (PVC) manufactured in accordance with ASTM D3034-88 and meeting the following standards may be used for 4 inch and 6-inch services.

1. ASTM D3212 gasketed joints.
2. All 4" and 6" services shall be SDR 23.5 or 26

The designer shall specify pipe material, bedding and trench width to withstand anticipated dead and live loads.

PVC A-2000

PVC A-2000 manufactured in accordance with ASTM F949 and meeting the following standards may be used for pipe diameters 15 inches and up.

1. All PVC A-2000 pipe shall be made of extruded PVC with resin cell class 1245 as defined in ASTM D 1784.
2. Gaskets shall comply with requirements in ASTM F477. Joints shall meet the requirements of ASTM D3212.
3. Pipe shall have a minimum pipe stiffness of 50 psi in accordance with ASTM D2412 at 60 percent flattening.

PVC Vylon Profile Wall Sewer Pipe

PVC Vylon Profile Wall Sewer pipe manufactured in accordance with ASTM F794 and meeting the following standards may be used for pipe diameters 24 inches and up.

1. All Vylon Profile wall pipe shall be made from PVC compounds which comply with the requirements for a minimum cell classification of 12364A as defined by ASTM D1784.
2. Gaskets shall comply with requirements in ASTM F477. Joints shall meet the requirements of ASTM D3212.
3. Pipe shall have a minimum pipe stiffness of 46 psi in accordance with ASTM D2412.

TABLE 8.1

PIPE MATERIAL	SIZE	JOINT	MINIMUM STRENGTH	MINIMUM BEDDING
<u>Sanitary Sewers</u>				
Reinforced Concrete	12" & up	See Reinforced Concrete Pipe Sec.	Class III, B wall	Class B
Vitrified Clay	8"-36"	Gasket	Extra strength	Class B
PVC Truss	8"-12"	Gasket		Crushed stone encasement
Ductile Iron	8" & up	Gasket, push	Class 52	Encasement Class B
<u>Sanitary Service</u>				
PVC	4" & 6"	Gasket	SDR 23.5	Crushed stone
DIP	4" & 6"	Gasket	Class 52	Encasement Class B

8.07 MANHOLE STANDARDS:

Manholes shall be located as follows:

1. At the end of each line.
2. At all changes in grade, size, or alignment.
3. At all intersections of pipes.

4. At distances not greater than 400 feet for sewers 15 inches or less in diameter and 500 feet for sewers 18 inches to 30 inches in diameter. Greater spacing may be permitted in larger sewers.

Drop Connections

An external drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

Minimum Drop Across Manholes

1. For the same size pipe with a change in alignment of 45 or less, no drop is required.
2. For the same size pipe with a change in alignment of greater than 45, or junction of two inflow pipes, a 0.2' drop is required.
3. For the same size pipe with a junction of three or more inflow pipes, a 0.3' drop is required.
4. When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to match the 0.8 depth point of both sewers at the same elevation.

Bedding

All manholes shall be placed on a minimum of 6 inches of crushed stone bedding.

Materials

1. Joints: All joints will be confined O-ring gasket meeting ASTM C443.
2. No lift holes through the entire wall.
3. Mark date of manufacture.
4. Inverts: Precast and cast-in-place inverts must provide a channel at least one-half the depth of the pipe and match the full cross-sectional area of the pipe. All junctions and changes in directions of inverts shall be smooth and rounded to the maximum extent possible to supplement flow through the manholes.

5. Diameter: The minimum diameter for manholes is 48 inches for pipe 21 inches in diameter and smaller, and 60 inches for pipe greater than 21 inches in diameter.
6. Castings shall be Neenah R-1670 non-rocking self-sealing or approved equal and "sanitary sewer" shall be cast in the cover.

All manholes shall be marked with two metal fence posts to remain in place until landscaping is complete. In subdivisions, the posts shall remain in place until landscaping has been completed by the lot owner.

If a manhole is in an area subject to surface water inundation, the casting shall be bolted to the cone section with stainless steel anchors. In addition, an exterior Cretex manhole chimney seal (or approved equal) shall be installed that spans from the casting ring to the cone section.

Manholes in paving shall have an interior Cretex manhole chimney seal (or approved equal) that spans from the casting ring to the cone section.

Concrete spacer rings, metal shims and bricks shall be the only materials utilized to adjust manhole frame elevations. Mastic or grout must be used to bond and seal materials used for adjustment.

8.08 PROTECTION OF WATER SUPPLIES:

There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.

Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.

Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, one full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and

have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.

8.09 CREEK CROSSINGS:

Sanitary sewers crossing creeks shall be Class 52 D.I.P. encased in reinforced concrete or 3/8" thick steel carrier pipe.

Rip rap all disturbed creek banks and bottom after construction.

8.10 BACKFILL AND BEDDING:

Within right-of-way - backfill shall consist of Class A crushed stone placed in one foot lifts and compacted to 90% modified proctor density or suitable job excavated material placed in one foot lifts and compacted to 90% Modified Proctor Density. If Class A crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.

In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

The gradation of bedding material shall be compatible with surrounding soils to prevent migration of fines.

See Table 8.1 for pipe bedding requirements.

8.11 PERFORMANCE & TESTING:

All sewers and manholes will be lamped and visually checked for leakage prior to acceptance.

All sanitary sewers, including service pipes, will be air-tested using current ASTM standards prior to acceptance.

All tests will be completed after backfill is complete.

Polyvinyl Chloride Truss Pipe and PVC Pipe shall have a deflection test conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5%. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the inside diameter of the pipe and the tests shall be performed without mechanical pulling devices.

8.12 SEWER LOCATION AND EASEMENTS:

Manholes in street right-of-way must be located in areas which allow direct access by maintenance vehicles. Manholes in areas outside the street right-of-way shall be subject to the approval of the City Engineer in which case access to the manhole shall be along a route in which the transverse slope does not exceed 4% and longitudinal slope does not exceed 12%. Placement of sewers in front yards outside of the right-of-way is discouraged.

Sewers shall be placed a minimum horizontal distance of 1.5 times the depth from potential or existing building sites. Greater separations are desirable.

All sanitary sewers outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.0 times the sewer depth rounded up to the nearest 5 feet.

The minimum easement width is 15 feet.

8.13 LIFT STATIONS & FORCE MAINS:

It is the City's intention and preference to have all extensions or additions to the sanitary sewer collection system be gravity sewer systems. If gravity sewer is not feasible, lift stations shall be designed to have regional service areas.

Telemetered alarm systems are required.

Provisions for the connection of standby power or auxiliary pumping are required.

Part 9 – Storm Sewers and Stormwater Management Facilities

9.01 GENERAL INFORMATION	9.08 MANHOLE AND INTAKE STANDARDS
9.02 PERMITTED FLOWS	9.09 PROTECTION OF WATER SUPPLIES
9.03 DESIGN FLOWS AND CAPACITY	9.10 MINIMUM COVER AND BACKFILL AND BEDDING
9.04 OPEN CHANNEL FLOW	9.11 PERFORMANCE & TESTING
9.05 SUBSURFACE DRAINAGE	9.12 SEWER LOCATION AND EASEMENTS
9.06 INTAKES AND DRAINAGE OF STREETS	9.13 STORMWATER MANAGEMENT FACILITIES
9.07 PIPE STANDARDS AND STRENGTH DESIGN	

9.01 GENERAL INFORMATION:

Plans and specifications for public storm sewer and stormwater management facilities must be certified by a professional engineer registered in the State of Iowa and utilizes the NGVD of 1929.

Plans and specifications for public facilities must be reviewed and approved by the City Engineer prior to construction.

Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible velum or mylar, and shall include the horizontal locations of services.

Five-year maintenance bond covering defective materials and workmanship is required for all storm sewer and stormwater management facilities to be dedicated to the city.

9.02 PERMITTED FLOWS:

No sanitary sewers, sanitary sewer services or septic tanks shall be discharged into storm sewers.

No flows from commercial car washes shall be discharged into storm sewers.

Sump pump discharge of ground and surface water is permitted.

Only ground water is permitted in sump pump discharge tiles less than 12 inches in diameter. No surface water or roof drains are permitted in these systems.

9.03 DESIGN FLOWS AND CAPACITY:

Storm sewer systems consist of pipe and overland flow routes to convey stormwater. All storm sewer designs shall contain both components.

Storm sewer pipes shall be designed to convey the five-year return frequency flow except for pipe used to discharge water from stormwater management facilities (see 9.12).

If the five-year return frequency flow exceeds the capacity of a 48-inch pipe, open channel flow may be used in lieu of an enclosed system upon approval of the City Engineer. Generally, this will be approved only where a stream or creek exists.

The overland flow route shall be designed to convey the 100-year return frequency flow assuming the pipe is inoperative. Such routes shall be designed to convey the flows without damage to property and shall be clearly designated on the construction drawings and final plat or site plan.

All design flows shall be calculated using commonly accepted engineering practices appropriate for the size of the drainage area under consideration. All designs shall consider existing and fully developed conditions and use the larger of the two flows.

The minimum size for any storm sewer receiving surface water is 12 inches in diameter, excluding stormwater management control structures. The minimum size for subsurface drainage pipes receiving only ground water and stormwater management control structures is 6 inches in diameter.

All storm sewer pipes shall have a slope which will give a mean velocity when flowing full of not less than 2.0 feet per second based on Manning's formula using a minimum "n" value of 0.013.

Where velocities in a pipe are greater than 15 feet per second are calculated, special provisions shall be made to protect against displacement, abrasion or shock.

All area intakes (excluding street intakes) shall include trash racks and be designed assuming 25% blockage by debris.

The maximum slope for storm sewer outlet lines shall be 10%.

- If RCP is utilized for outlet lines having a slope greater than or equal to 8%, all joints must be tied together.
 - The flared end section and last two pipe joints shall be tied together in all instances.

9.04 OPEN CHANNEL FLOW:

The erosion potential of the soil shall be evaluated with regard to anticipated velocities. Appropriate measures shall be taken to protect the soil and/or reduce velocities to prevent erosion.

The channel capacity in conjunction with possible over-bank flow shall be designed to safely convey the 100 year return frequency flow. If over-bank flow is considered, its impact must be evaluated and area of conveyance protected by easement.

9.05 SUBSURFACE DRAINAGE:

In predominantly wet areas, areas containing hydric soils and other such areas designated by the City Engineer, a subsurface drainage system shall be provided to receive the discharge from sump pumps.

A 2" service connection manufactured specifically for the pipe being used and approved by the City Engineer shall be provided for each lot abutting the subsurface drainage system.

The end of all sump pump services shall be marked with a metal post or #4 reinforcing steel at least 24" in length buried to within one foot of the finished grade.

9.06 INTAKES AND DRAINAGE OF STREETS:

All intakes on public streets will be designed to the IDOT Type RA standards.

DOT RA-16 intakes are allowed on storm sewer laterals.

Intakes shall be spaced so that for a five (5) year storm, arterial streets shall have two traffic lanes free of excess water at all times. Local and collector streets shall be designed to have one twelve (12) foot traffic lane free of water. Storm water shall not cross an intersection but can follow a curb around its radius.

For a one hundred (100) year storm, the ponding of surface water on local, collector, and arterial streets must not exceed a depth of one (1) foot at the gutter. Water exceeding one (1) foot shall be designed to overflow into an overland flow route. This applies to temporary ponding from local drainage only.

Streets in flood plains designated on the FEMA Flood Insurance Maps shall be elevated at their lowest point to the 100-year flood elevation.

Minimum drop through intake structures shall be the same as required for manholes (see 9.08).

9.07 PIPE STANDARDS AND STRENGTH DESIGN:

Reinforced Concrete Pipe

Reinforced concrete pipe meeting the following standards may be used for pipe 12 inches in diameter or larger.

1. Joints
 - A. Circular pipe: All joints will be confined O-ring gasket meeting ASTM C443. All pipe 36-inch diameter and smaller will have bell and spigot joints. Pipe larger than 36-inch diameter may have tongue and groove joints. If the hydraulic grade line is less than 6 inches above the top of the pipe during the 100-year event, O ring gaskets may be omitted, provided each joint is wrapped with 24 inches of approved filter fabric.
 - B. Low head pipe: All joints will be sealed using an approved mastic material and each joint shall be wrapped with 24 inches of approved filter fabric. If the Hydraulic grade line is less than 6 inches above the top of the pipe during the 100-year event, mastic joint material may be omitted.
2. Wall Thickness: Minimum wall thickness will be B-wall as defined in ASTM C 76.
3. The required pipe strength and bedding requirements shall be calculated on a case-by-case basis. The minimum pipe strength shall be Class III as defined in ASTM C 76.
4. Pipe Markings: All pipe shall be marked with the date of manufacture and ASTM class. If quadrant reinforcement is used, the top shall be marked on the outside of the pipe.

5. No lift holes.
6. All RCP shall be manufactured by an IDOT certified facility.

Ductile Iron Pipe

Ductile iron pipe meeting the following standards may be used.

1. Joints: Use push on gasketed joints.
2. Thickness: Use Pressure Class 350 standard unless a thicker wall is required because of depth.
3. Lining and Coating:
 - A. Inside of pipe and fittings: Double thickness cement lining and bituminous seal coat conforming to ANS A21.4.
 - B. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate AN Standard.

Corrugated PVC

Corrugated PVC with a smooth interior wall meeting the following standards may be used only under the conditions specified below:

1. The pipe shall meet the standards of ASTM F949-90 constructed of resins meeting the requirements of ASTM D1784, cell class 12454B.
2. Size: 12" through 18".
3. Joints: Gasketed.
4. Perforated PVC pipe meeting the standards of paragraph 1 and 2 above may be used provided the pipe is surrounded by a freely draining aggregate or fabric sock.
5. Manhole connections shall be approved by the City Engineer.
6. No corrugated PVC pipe shall be used within public right-of-way or with easements shared with other utilities except for subsurface drainage pipes.

Subsurface Drainage Pipes

Subsurface Drainage Pipes meeting the following specifications may be used for subsurface drainage systems:

1. Corrugated PVC with a smooth interior wall meeting the standards of ASTM F949-90 constructed of resins meeting the requirements of ASTM D1784, cell class 12454B may be used for 6", 8" and 10" diameters.
2. Corrugated HDPE with a smooth interior wall from a manufacturer approved by the City Engineer may be used for 6" diameter.
3. All subsurface drainage pipes shall be perforated and shall be protected by a fabric sock or freely draining aggregate placed around the pipe. Subsurface drainage pipes serving as pavement subdrains shall be surrounded by a freely draining aggregate that extends up to and contiguous with the aggregate base of the pavement.

The designer shall specify pipe material, bedding and trench width to withstand anticipated dead and live loads. Minimum pipe bedding shall be Class B.

HDPE (ADS N-12) 4"-36". Gasketed joints and crushed stone encasement. Allowed for culverts within right-of-way. Not allowed for storm sewer under or within 5 feet of streets.

9.08 MANHOLE AND INTAKE STANDARDS:

Manholes or intakes shall be located as follows:

1. At the end of each line.
2. At all changes in grade, size, or alignment.
3. At all intersections of pipes.
4. At distances not greater than 400 feet for sewers 15 inches or less in diameter and 500 feet for sewers 18 inches to 30 inches in diameter. Greater spacing may be permitted in larger sewers.
5. Flared end sections are required at all storm sewer line outlets.

Minimum Drop Access Manholes

1. For the same size pipe with a change in alignment of 45° or less, no drop is required.

2. For the same size pipe with a change in alignment of greater than 45°, or junction of two pipes, a 0.2' drop is required.
3. For the same size pipe with a junction of three or more pipes, a 0.3' drop is required.
4. When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to match the 0.8 depth point of both sewers at the same elevation.

Bedding

All precast manhole bases shall be placed on a minimum of 6 inches of crushed stone bedding.

Materials

1. Joints: All joints will be confined O-ring gasket meeting ASTM C443.
2. No lift holes through the entire wall.
3. Mark Class and date of manufacture.
4. Inverts: Precast and cast-in-place inverts must provide a channel at least one-half the depth of the pipe and match the full cross-sectional area of the pipe. All junctions and changes in directions of inverts shall be smooth and rounded to the maximum extent possible to supplement flow through the manholes.
5. Diameter: The minimum diameter for manholes is 48 inches for pipe 24 inches in diameter and smaller, and 60 inches for pipe greater than 24 inches in diameter. 72" diameter manholes may be required for pipes greater than 36" in diameter. Reducers may be used above the chamber section of 60" and 72" manholes. Precast T's may be used on pipes 48" and larger in diameter.
6. Castings shall be Neenah R-1670 non-rocking self-sealing or approved equal and shall have "storm sewer" cast in the cover.

Standard manholes, step details, and risers are the same as for sanitary sewers, except cretch chimney seals are not required.

All manholes shall be marked with two metal fence posts to remain in place until landscaping is complete. In subdivisions, the posts shall remain in place until landscaping has been completed by the lot owner.

Manholes in paving shall have an interior Cretex manhole chimney seal (or approved equal).

Concrete spacer rings, metal shims and bricks shall be the only materials utilized to adjust manhole frame elevations. Mastic or grout must be used to bond and seal materials used for adjustment.

9.09 PROTECTION OF WATER SUPPLIES:

There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.

Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.

Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, one full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.

9.10 MINIMUM COVER AND BACKFILL AND BEDDING:

The minimum cover for storm sewers shall be 1' below the bottom of pavements and 2' below the surface on non-paved areas. All shallow pipe shall be designed to withstand anticipated live loads.

Within public right-of-way, backfill shall consist of crushed stone placed in one foot lifts and compacted to 90% modified proctor density or suitable job excavated material placed in one foot lifts and compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall

consist of suitable job excavated materials. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.

All other areas - backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

9.11 PERFORMANCE & TESTING:

All sewers and manholes will be lamped and visually checked prior to acceptance.

All tests will be completed after backfill is complete.

9.12 SEWER LOCATION AND EASEMENTS:

Manholes in street right-of-way must be located in areas which allow direct access by maintenance vehicles. Manholes in areas outside the street right-of-way shall be subject to the approval of the City Engineer in which case access to the manhole shall be along a route in which the transverse slope does not exceed 4% and longitudinal slope does not exceed 12%.

Sewers shall be placed a minimum horizontal distance of 1.5 times the depth from potential or existing building sites. Greater separations are desirable.

All storm sewers outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.5 times the sewer depth rounded up to the nearest 5 feet.

The minimum easement width is 10 feet.

Drainageway easements for overland flow shall be of sufficient width to contain the 100-year flow and as a minimum shall include the bottom width and side slopes of the drainageway and any necessary overbank areas.

9.13 STORMWATER MANAGEMENT FACILITIES:

Thresholds:

1. Stormwater management will be required for all new subdivisions and resubdivisions of residential developments larger than 3 acres in size and for commercial and industrial developments larger than 3 acres in size.
2. In developments where the natural drainage is divided into more than one watershed, the individual watershed drainage areas must meet the criteria mentioned in 1 above before stormwater management is required. However, the designer has to account for the stormwater runoff, which may include

easements from downgrade property owners, to ensure public safety and not create property damage.

Detention Requirements:

1. New developments which require stormwater management shall be required to detain the difference in the volume between the five-year undeveloped storm and the 100-year developed storm events for their development site. For redevelopment of a site that does not presently have stormwater management. The undeveloped condition shall be calculated assuming pasture conditions.
2. The maximum release rate for detention calculations shall be the five-year undeveloped storm.

Methodology:

1. The SCS TR-20 computerized runoff volume program or other technically proven method shall be used to determine the volume of runoff which must be detained.
2. The results of these calculations shall be submitted on a standardized form which shall include all of the individual parameters that the designer inputs into the program.

Locational Criteria:

1. Stormwater detention is not encouraged within any front or side yard setbacks required by building code, or within 25 feet from the estimated back building line. Location is subject to approval by the City.

Design Requirements, Dry-bottomed Detention Facilities:

1. Dry-bottomed detention facilities shall be oversized by 10% to help offset anticipated sedimentation prior to total watershed development.
2. Maximum side slopes of dry bottom facilities shall not exceed 4:1.
3. Low flow pipes are required to convey low flows from storm sewer outlets to the detention facility outlet structure. Low flow pipes shall be a minimum of 12 inches in diameter unless it can be shown that the bottom of the detention facility will remain dry. Low flow pipes shall be slotted and bedded in freely draining aggregate. Alternate methods of subsurface drainage may be proposed.

Design Requirements, Wet Detention Facilities:

1. Maximum side slopes from the point of normal water level to a point 20 feet land side and 20 feet water side shall be 8:1. If riprap is provided around the pond normal water level perimeter, the maximum riprap slope may be increased to 3:1.
2. Pond outlet shall be three stage:
 - Stage one outlet shall consist of orifice, weir, or pipe to retain the volume of $\frac{1}{2}$ inch times the pond drainage basin area. Outlet device shall be designed to drawdown this volume in not less than 24 or more than 48 hours. Provisions shall be made for protection of the outlet device from debris buildup and clogging.
 - Stage two outlet shall control the 100-year developed maximum release rate to no more than the 5-year undeveloped maximum rate.
 - Stage three shall be an overflow spillway to the designated 100-year overflow route.

Part 10 – Erosion Control

10.01 GENERAL REQUIREMENTS
10.02 THRESHOLDS

10.03 REQUIREMENTS
10.04 METHODS

10.01 GENERAL REQUIREMENTS

Erosion control plans must be certified by a professional engineer registered in the State of Iowa.

Erosion control plans must be reviewed and approved by the City Engineer.

Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

10.02 THRESHOLDS

Residential developments consisting of subdivisions and resubdivisions larger than one acre in size will require an erosion control plan.

Commercial and industrial developments greater than one acre in size will require an erosion control plan.

10.03 REQUIREMENTS

Erosion control plans shall be designed with the following general goals in mind:

- To protect the site from the significant loss of soil and top soil due to erosion.
- To protect downstream properties and facilities from the deposition of sediments.
- To protect onsite facilities and public improvements from damages due to erosion.
- To protect water quality.

The erosion control plans will designate an individual, including name, title, address and phone number, to be responsible for the following duties throughout the duration of the project:

- Initial installation of the erosion control measures specified by the erosion control plan.
- Site inspections on a weekly basis and after rains greater than ¼" to assess the effectiveness of existing erosion control measures and to direct installation of additional erosion control measures in response to problems noted during said inspections. The designated individual will keep a log of the inspections and any corrective measures taken. No inspections are required while the ground is frozen or there is snow cover. Inspections will resume when the snow begins to melt. Inspections will continue until adequate ground cover is established to control erosion.

10.04 METHODS

Methods of erosion control shall be consistent with those outlined in the Iowa Construction Site Erosion Control Manual or other commonly accepted engineering practices.

The plan shall include provisions for responding to unanticipated erosion problems as they arise during the construction process.

Special care shall be taken to prevent erosion behind the curbs and beneath the pavement of streets.

Part 11 – Traffic Control Signals

11.01 GENERAL REQUIREMENTS

11.02 DESIGN

11.01 GENERAL REQUIREMENTS

Plans and specifications for traffic control signals must be certified by a professional engineer registered in the State of Iowa.

Plans and specifications for traffic control signals must be reviewed and approved by the City Engineer prior to construction.

Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.

The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or mylar.

A two-year maintenance bond covering defective materials and workmanship is required for all traffic control signals

11.02 DESIGN

Warrants for traffic control signals shall be as defined in the "Manual on Uniform Traffic Control Devices", current edition.

Design of traffic control signals shall comply with the requirements of the "Manual on Uniform Traffic Control Devices", current edition, except as noted below.

The minimum lens size shall be 12 inches.

Part 12 – Roadway Lighting

12.01 REQUIRED LUMEN OUTPUT

12.02 LIGHT SOURCE MATERIAL

12.03 LOCATIONAL CRITERIA

12.01 REQUIRED LUMEN OUTPUT

The required lumen output and mounting height is as follows:

<u>Roadway Classification</u>	<u>Luminaire</u>
Local	8,500 lumen ASA Type III
Collector	14,500 lumen ASA Type III
Arterial	23,000 lumen ASA Type III

12.02 LIGHT SOURCE MATERIAL

The light source shall be high pressure sodium or metal halide.

12.03 LOCATIONAL CRITERIA

The general criteria for the location of street lights are as follows:

- A street light at all intersections.
- Street lights at mid-block locations if the blocks are more than 600 feet in length.
- Closer spacing of street lights in problem areas such as major arterials or high pedestrian areas, as determined by an engineering study.