TECHNICAL STANDARDS MANUAL

The City of Garland, Texas

Adopted May 2015
Revised: January 2019 / February 2020

GARLAND

TEXAS MADE HERE

ENGINEERING ● WATER ● WASTEWATER

TRANSPORTATION ● STORMWATER

This page left blank
intentionally.

Record of Revision

Any revisions to the Technical Standards Manual shall be documented in this section, beginning with the adoption date of May 20, 2015.

REVISION DATE	DESCRIPTION
May 2015	Published and Adopted entire Technical Standards Manual (TSM) with adoption of Garland Development Code (GDC).
January 15, 2019	Published and Adopted new Section 9 regarding Pavement and Subgrade Design Requirements and addition of associated Appendices.
February 01, 2020	Published and Adopted revised sections of the TSM. Necessary revisions to Chapter 31 of the City Ordinance, GDC Amendments to Chapters 1, 3 & 4 and general use of the TSM since 2015 necessitated that the TSM be revised. All Sections of the TSM were revised.

This page left blank intentionally.

Table of Contents

Section 1 – General Requirements
1.01 Short Title 1-3
1.02 Interpretation....1-3
1.03 Enforcement 1-4
1.04 Amendment & Acknowledgment 1-4
1.05 Deviation Requests....1-5
1.06 Applicability....1-5
1.07 Engineering Criteria – Section Descriptions 1-6
1.08 Other Local, State and Federal Environmental Regulations 1-7
1.09 Texas Accessibility Standards (TAS) 1-7
1.10 Record Drawings Request 1-8
1.11 Oversize Reimbursement....1-8
1.12 Reports 1-9

Section 2 – Plan Types, Components, Review Procedures & Construction Requirements
2.1 Plan Submittal Types 2-4
2.2 Private Development Plan Review Process / Steps 2-4
2.3 Schematic Engineering Plan 2-6
2.3.1 Number of Plans to Submit for Schematic Plan Review 2-6
2.3.2 Schematic Plan Sheet General Components 2-7
2.3.3 Plan Submittal Dates and Deadlines....2-8
2.3.4 Fees associated with Schematic Plans 2-8
2.3.5 Schematic Plan Approval 2-8
2.4 Private Site Engineering & Public Works Plan Procedures & Components 2-9
2.4.1 Public Works & Site Engineering Plan General Requirements 2-10
2.4.2 Standard Construction Details 2-11
2.4.3 Technical Specifications 2-11
2.4.4 Digital Data 2-11
2.4.5 Cover Sheet Components & Recommended Plan Sheet Order 2-12
2.4.6 General Plan Sheet Components....2-13
2.4.7 Plan Submittal Dates and Deadlines....2-15
2.4.8 Number of Plans to Submit for Site Permitting Review....2-15
2.4.9 Fees for Public Works & Site Engineering Site Permits & Development....2-15
2.5 Private Development Plan Review Process 2-17
2.5.1 Initial Plan Screening 2-17
2.5.2 Plan Review Cycle Time 2-18
2.5.3 Interdepartmental Compliance Review....2-18
2.5.4 Resubmittal & Comment Response Sheets 2-19
2.5.5 Design Compliance Consultation 2-20
2.6 Additional Permits....2-20
2.7 Final Approval Processing, Site Permitting and Construction....2-22
2.7.1 Approval Letter 2-24
2.7.2 “Release for Construction” stamping....2-24
2.7.3 Submittal of Stamped Plans to Field Operations 2-24
2.7.4 Scheduling Mandatory Pre-Construction Meeting 2-25
2.7.5 Site Permit Requirements and Issuance 2-25
2.7.6 Plan Revisions 2-25
2.7.7 Construction Requirements....2-26

2.7.8 Final Acceptance 2-26
2.7.9 Record Drawings 2-26
2.7.10 Public Utility Survey 2-27
2.8 C.I.P. Engineering Plan Procedures, Components & Construction....2-28
2.8.1 Roadway and Utility Alignment Study or Preliminary Drainage Report....2-28
2.8.2 Design Phase: 2-29
2.8.3 C.I.P. Engineering Construction Procedures....2-31

Section 3 – Survey Requirements
3.01 General....3-3
3.02 Horizontal/Vertical Datums....3-3
3.03 Horizontal Control/Geodetic Monuments....3-4
3.04 Vertical Control/Benchmarks....3-4
3.05 Subdivision Plats 3-5
3.06 Subdivision Monumentation....3-6
3.07 Offsite Easements/Easements By Separate Instrument....3-9
3.08 Right-of-Way & Easement Abandonment....3-9
3.09 License and Real Property Improvement Agreements 3-10
3.10 Capital Improvement Project Mapping & Monumentation....3-11

Section 4 – Drainage Design Requirements
4.01 General....4-3
4.02 Downstream Assessment 4-3
4.03 Schematic Drainage Plan for use with Private Development Projects 4-6
4.04 Schematic Drainage Plan and Capacity Analysis....4-6
4.05 Determining Design Discharge 4-8
4.06 Street Capacity 4-14
4.07 Alley Capacity....4-15
4.08 Valley Gutters 4-15
4.09 Inlet Location and Capacity....4-15
4.10 Design of Enclosed Storm Sewer System....4-24
4.11 Detention/Retention Facility Design 4-35
4.12 Miscellaneous Drainage Requirements....4-40
4.13 Open Channel Design....4-42
4.14 Hydraulic Design of Culverts....4-47
4.15 Bridge Design Hydraulics....4-48
4.16 Energy Dissipators....4-49
4.17 Floodplain Alterations 4-49
4.18 Erosion and Sedimentation Control....4-53
4.19 Drainage Easements 4-53
4.20 Sustainable Development 4-54

Section 5 – Water & Wastewater Design Requirements
5.1 Water and Wastewater System Capacity Analysis....5-3
5.2 Water System - General 5-6
5.2.1 Dead End Water Mains....5-6
5.2.2 Horizontal and Vertical Alignment 5-6
5.2.3 Separation Distance between Water and Wastewater 5-7
5.2.4 Water Main Sizing....5-8
5.2.5 Water Main Materials 5-8
5.2.6 Water Services 5-9

5.2.7 Valves 5-9
5.2.8 Fire Hydrants 5-10
5.2.9 Fire Service Lines 5-11
5.2.10 Connections to Existing Water Mains 5-12
5.2.11 Backflow Prevention 5-12
5.2.12 Automatic Flushing Valve 5-13
5.3 Wastewater System - General 5-13
5.3.1 Wastewater Main Location 5-13
5.3.2 Horizontal and Vertical Alignment 5-13
5.3.3 Separation Distance between Wastewater and Water Mains 5-15
5.3.4 Wastewater Main Sizing 5-15
5.3.5 Wastewater Main Materials 5-16
5.3.6 Wastewater Service Laterals 5-16
5.3.7 Manholes and Cleanouts 5-17
5.3.8 Inverted Siphons 5-19
5.3.9 Wastewater Lift Stations 5-19
5.3.10 Force Mains 5-20
5.4 Easements 5-21
5.5 Thrust Restraint 5-22
5.6 Pavement Cut and Repair 5-22
5.7 Trenchless Construction 5-23
5.8 Crossings 5-23

Section 6 – Stormwater Management Requirements
6.01 General 6-3
6.02 Impervious Area Status Sheet 6-3
6.03 Storm Water Management Plan (SWMP) – Permanent Controls 6-3
6.04 TCEQ Construction General Permit (CGP) 6-4
6.05 Storm Water Pollution Prevention Plan (SW3P) 6-5

Section 7 – Structural Design Requirements
7.01 General 7-3
7.02 Code Requirements 7-3
7.03 Geotechnical Performance Specifications 7-4
7.04 Bridge Design 7-8
7.05 Retaining Wall Design 7-9
7.06 Slope Stability Design Criteria 7-11
7.07 Screening Wall Design Criteria 7-11
7.08 Excavation Support 7-12
7.09 Construction Plans 7-12
7.10 Construction Inspection and Certification. 7-16

Section 8 – Thoroughfare Design Requirements
8.01 General. 8-3
8.02 Street Design 8-3
8.03 Median, Left-Turn Lane, Right-Turn Lane, Deceleration Lane, and Island Design 8-19
8.04 Alley Design 8-24
8.05 Driveway Design 8-28
8.06 Parking Standards 8-37
8.07 Sidewalk Location and Design 8-42
8.08 Sight Line Triangles Requirements 8-44

8.09 Loading Zones / Truck Berths 8-45
8.10 Frontage Road Design 8-48
8.11 Traffic Signal Installation 8-48
8.12 Street Name Signs 8-49
8.13 Traffic Impact Analysis and Mitigation 8-49

Section 9 – Pavement and Subgrade Design Requirements
9.01 General. 9-3
9.02 Existing Surface/Subsurface Investigation 9-5
9.03 Subsurface Design 9-7
9.04 Subgrade Design 9-8
9.05 Pavement Design 9-9

The remainder of this page left blank intentionally.

Appendices

Appendix Section 1:

Reserved

Appendix Section 2:

2A Plan Completeness Checklist
2A.1 Schematic Plan Checklist
2B Cover Sheet General Notes
2C Comment Response Form
2D Capital Improvement Project (C.I.P.) Plan Checklist
2E Public Utility Survey Affirmation Letter
2F Public Utility Survey Coordinates & Vertical Control
2G Permission to Work Letter
2H Engineering First Submittal Form
2I Engineering Fee Summary Sheets

Appendix Section 3:

3A Plat Review Checklist
3B Subdivision Plat Dedication Language
3C Right of Way & Easement Abandonment Forms
3D License Agreement Template
3E Real Property Improvement Authorization Template
3F Request for Verification of Subdivision Monumentation
3G Field Note Guidelines
3H Working Plat Submittal Requirements

Appendix Section 4:

4A Spring Creek Preserve Environmental Boundary
4B Detention Pond Example, Checklist & Operation & Maintenance Manual
4C Single Family Lot Grading Checklist & Exhibit
4D Flood Plain Development Permit Forms
4E No Rise Certification

Appendix Section 5:

5A Water & Wastewater CIP Plan

5B Water & Wastewater Demand Determination Parameters

Appendix Section 6:

6A Impervious Area Status Sheet

Appendix Section 7:

N/A

Appendix Section 8:

N/A

Appendix Section 9:

9A Geotechnical Report for Roadways Checklist

9B Summary of Geotechnical Recommendations Form

The remainder of this page left blank intentionally.

SECTION 1

GENERAL REQUIREMENTS

Section 1 – Index

Section 1 – General Requirements

1.01 Short Title 1-3
1.02 Interpretation 1-3
1.03 Enforcement 1-4
1.04 Amendment & Acknowledgment 1-4
1.05 Deviation Requests 1-5
1.06 Applicability 1-5
1.07 Engineering Criteria – Section Descriptions 1-6
1.08 Other Local, State and Federal Environmental Regulations 1-7
1.09 Texas Accessibility Standards (TAS) 1-7
1.10 Record Drawings Request 1-8
1.11 Oversize Reimbursement 1-8
1.12 Reports 1-9

Section 1 – General Requirements

1.01 Short Title

This Technical Standards Manual (TSM) shall be posted on the City of Garland Engineering Department's website for public viewing and commenting for a period of 30 days prior to adoption. Any comments shall be emailed to the Engineering Department via the link on the webpage. All comments received will be reviewed and responded to. Any necessary changes to the TSM will be incorporated and the TSM shall be adopted in totality. Refer to Section 1.04 for Amendments and Revisions.

These are hereby adopted as a part of the "Technical Standards Manual (TSM)", Sections 1-8 and Appendices, including Technical Specifications and Standard Construction Details which shall be in full force and effective from and after the effective date of adoption of the TSM. The adoption of this Technical Standards Manual shall replace the Public Works Design Guideline from 1996 and the Traffic Management Standards from 1996 in their entirety.

1.02 Interpretation

In the interpretation and application of the provisions of these regulations, it is the intention of the City Council that the principles, standards and requirements provided for herein shall be minimum requirements for the design of both subdivisions and municipal capital projects in the City, and, where other City ordinances or regulations of the City are more restrictive in their requirements, such other ordinances or regulations shall govern.

The Engineer is responsible for understanding and complying with the City's various ordinances and master plans. The City has adopted various ordinances and master plans, which address various requirements not explicitly included in the Technical Standards Manual, including, but not limited to the following:

A. Garland Development Code (GDC) & Code of Ordinances

B. Master Thoroughfare Plan

C. Envision Garland Plan

D. Building Code

E. Water Capacity Improvement Plan

F. Wastewater Capacity Improvement Plan

G. Flood Damage Prevention Ordinance

H. Impact Fee Ordinance

I. International Fire Code

J. Right-of-Way Management Ordinance

K. Catalyst Plans

1.03 Enforcement

The City's Technical Standards are issued by the Engineering Department and are hereby authorized to enforce the provisions of this Technical Standards Manual. The standards and any updates will be available on the City's website.

These Technical Standards shall be in full force and effective immediately upon adoption by the City Council. Projects will be required to comply with all requirements. The City of Garland standards include the various design criteria defined in this TSM, Standard Construction Details, technical specifications, currently adopted North Central Texas Council of Governments (NCTCOG) Specifications for Public Works Construction and the City's supplements to the NCTCOG specifications which are considered **minimum** requirements for the design and construction of adequate public facilities within the City. **The Engineer of record shall bear the sole responsibility for meeting the Engineering standard of care for all aspects of the design and providing a design that's required by the site-specific conditions and intended use of the facilities, while at a minimum meeting the City's design and construction requirements.**

The Department of Engineering has adopted and currently follows the NCTCOG Standard Specifications for Public Works Construction 3rd Edition 1998.

1.04 Amendment & Acknowledgement

The City may amend the Technical Standards Manual. In order to ensure that the Engineer has the City's latest design standards, they are directed to the City's website to acquire the City's most current design standards. The Technical Standards Manual will include a Record of Revisions to identify any revisions to the Technical Standards Manual.

This manual may be revised periodically. Proposed revision will be posted on the City of Garland Engineering Department website for a period of 30 days prior to implementation unless the revision is required to comply with Federal, State, County and City laws, regulations, ordinances or codes. In order to review proposed revisions, go to the following website http://www.garlandtx.gov/252/Engineering. The Appendix consists of checklists and forms pertaining to the Technical Standards Manual and therefore may be revised to correspond to the TSM or City Ordinances without a review period.

At any time if you have a comment or request to modify current design criteria or add new design criteria, a formal request can be submitted to the City for consideration in writing to the Director of Engineering. These comments will be reviewed and responded to.

All proposed revisions will be listed on the website. If proposed revisions are listed, all comments received during the public comment period will be considered and responded to.

We acknowledge and thank the City of Frisco Engineering Services Department for allowing the use of its Technical Standards as a base and model for this document.

1.05 Deviation Requests

All deviations from the requirements included in the TSM are subject to approval by the Director of Engineering. **A grant of an alternative material, design, or method of construction shall not affect nor relieve the Engineer of the obligation and responsibility of such material, design, or method of construction for the intended purposes**.

In the event that specific circumstances dictate requirements not already included in the Technical Standards Manual, it shall be the responsibility of the Engineer to provide the additional information as deemed necessary by the Director of Engineering in writing for review.

1.06 Applicability

The Engineer shall be responsible for the applicability of the information contained in the Technical Standards Manual to the design of their particular project. The Engineer shall also be responsible for the applicability and accuracy of the information furnished in their design. Acceptance by the City of the plans for construction shall not be construed to relieve the Engineer of any responsibility.

The remainder of this page left blank intentionally.

1.07 Engineering Criteria – Section Descriptions

The following is a brief description of the contents of each section.

Section 1 – General Requirements

This section includes an overview and definitions, abbreviations, and acronyms used in the TSM. This section also includes general minimum requirements applicable to all projects, including submittal requirements to the City and to other agencies.

Section 2 – Engineering Plan Procedures, Components & Construction Requirements

This section lists the various types of plans processed by the Engineering Department, minimum components, review and approval procedures along with pre-construction and project acceptance procedures.

Section 3 – Survey Requirements

This section is to address survey requirements.

Section 4 – Drainage Design Requirements

This section includes minimum storm drainage design requirements to be followed in the design of storm drainage facilities, and demonstrates the design procedures to be used on drainage projects within the City. This section also addresses floodplains, bridge hydraulics, erosion control and sustainable development techniques.

Section 5 – Utility Design Requirements

This section includes minimum design requirements for public wastewater facilities, water distribution and transmission system facilities.

Section 6 – Stormwater Management Requirements

This section provides additional requirements and standards to address environmental requirements, including stormwater best management practices.

Section 7 – Structural Design Requirements

This section establishes minimum structural design and geotechnical requirements for various items including bridges, concrete structures, retaining walls, uncontrolled fill mitigation, and screening walls. This section also addresses slope stability analysis.

Section 8 – Thoroughfare Design Requirements

This section includes minimum requirements associated with the City's thoroughfares, including roadway geometry, street lighting, signage and markings, and traffic signals, etc.

1.08 Other Local, State and Federal Environmental Regulations

The list below is not intended to be a complete list and is provided for informational purposes only. Other regulations are specifically mentioned within the various sections of this document.

- Section 404 of the Clean Water Act (33 USC 1344)
- Water Rights: https://www.tceq.texas.gov/permitting/water_rights/wr-permitting
- Migratory Bird Treaty Act: http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtintro.html
- Threatened and Endangered Species:

  http://www.tpwd.state.tx.us/huntwild/wild/species/endang/index.phtml
- The Antiquities Code of Texas: http://www.thc.state.tx.us/project-review/antiquities-code-texas
- Air Quality: https://www.tceq.texas.gov/permitting/air
- TCEQ Dam Requirements

1.09 Texas Accessibility Standards (TAS)

All plans and specifications for the construction or alteration of public buildings and facilities, privately owned buildings and facilities leased or occupied by state agencies, places of public accommodation, pedestrian facilities within public right-of-way, and commercial facilities must be in compliance with the Texas Accessibility Standards (TAS) for individuals with disabilities and must conform to the standards required by regulations issued by the Texas Department of Licensing and Regulation (TDLR), under the Architectural Barriers Act, codified as Article 9102, Texas Civil Statutes (see Architectural Barriers Administrative Rules – Section 68.30 for exemptions). Sidewalks within public Right of Way shall also conform to Title II of the ADA & part 1190 - Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way http://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way.

Projects with a total estimated construction cost of $50,000 or more are required to submit a full set of construction documents in accordance with Administrative Rule 68.20 to TDLR for registration and review. For Public Right-of-Way projects, the estimated cost for the project shall be based on pedestrian elements only in accordance with Administrative Rule 68.102. If a project's total estimated construction cost is less than $50,000, it is not required to be submitted to TDLR for registration and review; however, the project is still required to comply with TAS. An architect, engineer, interior designer, or landscape architect with overall responsibility for the design of a building or facility subject to subsection 5(j) of the Architectural Barriers Act, shall mail, ship, or hand-deliver the project registration form, review and inspection fees, and construction documents to the TDLR, a registered accessibility specialist, or a contract provider not later than thirty (30) business days after the design professional seals and signs the construction documents. An Architectural Barriers Project Registration form must be completed for each subject building or facility.

1.10 Record Drawings Request

The Engineering Department has record drawings and two foot contour interval topographic maps, along with locators for existing water, sewer, and storm sewer lines. These are available from 8 am to 5 p.m. on a walk-in basis at our office at 800 Main Street on the 3rd floor, for more information call 972-205-2170. There is a small fee for printing each record drawing, topographic map and locator. Plans are not pulled ahead of time and will not be emailed; an Engineering technician will assist the Developer's Engineer with copying drawings.

Record drawings may also be viewed on the City's website using the following tools/steps: (The search website does not work well with Internet Explorer. Turn off any popup blockers and if Select Search Type does not allow you to select the dropdown menu, then under Tools-Compatibility View Settings, add the garlandtx.gov to the compatibility view websites.)

- Look at the subdivision map to obtain subdivision names:
  https://cogmap4.garlandtx.gov/portal/apps/webappviewer/index.html?id=f0c6f6bb10b444bcb46a247cd143480b
  http://www.garlandtx.gov/DocumentCenter/View/790/Subdivision-Map-PDF?bidId=
  Or use the GIS system to lookup subdivision names: http://www.garlandgis.com/
- Then utilize our on-line record locator to pull up as-built PDF's.
  http://www.garlandtx.gov/267/Record-Drawings
  Type in the subdivision name AND include an * at the beginning and end of the subdivision name to pull it up i.e. for Club Creek subdivision, type in *Club Creek*
- For any Capital Improvement Projects or "non-private development" projects, try and search by a street name or descriptive word(s) to pull up drawings under the PROJECT NAME option.

1.11 Oversize Reimbursement

A. The City will, per the GDC Section 3.53, refund oversize water and sanitary sewer main cost within a subdivision larger than 8-inch diameter installed by the subdivision developer, unless the larger size main is required to service the subdivision. The oversize reimbursement is calculated by determining the difference between the cost of the oversized main and what it would have cost to install an 8-inch line using utility bid prices from the proposed development. The City provides reimbursement upon acceptance of the system.

B. For all reimbursement requests, provide the following documents for processing:

1. Development agreement, where applicable
2. Letter requesting reimbursement with eligible mains and lengths identified
3. An itemized breakdown showing the item(s), description, unit, quantity, unit cost, total cost and date installation completed. For water and sewer reimbursement request, provide the unit cost of 8-inch mains installed in the subdivision.
4. Complete vendor application and W-9 form (https://www.irs.gov/forms-pubs/about-form-w-9).
5. Provide a copy of the contract and any applicable invoices justifying the actual cost to construct the main. The City does not reimburse for overhead expenses, engineering, and testing services associated with design or construction.

6. Infrastructure acceptance letter
7. Submittals are processed within two weeks of receipt with a complete submittal of all applicable items referenced above. If the request is reduced an explanation will be provided along with the reimbursement check.

1.12 Reports

Reports shall be typed, legible, and typically prepared on 8 ½ inch by 11 inch paper. Each submitted report must be complete onto itself with all supporting calculations, figures, maps, and tables included. Staple or bind all sheets and exhibits comprising the report. Loose-leaf three ring binders are not acceptable. Provide a cover sheets with engineer seal, date and signature, table of contents with page numbers for lengthy reports having more than 10 pages. Re-submittals shall include the most recent redlined report with the design professional's written response referenced to the comment and page number in the report. A PDF of the final report and all supporting documents shall be submitted for the use of and reproduction by the City of Garland.

The remainder of this page left blank intentionally.

This page left blank intentionally.

SECTION 2

ENGINEERING PLAN PROCEDURES, COMPONENTS AND CONSTRUCTION REQUIREMENTS

Section 2 – Index

Section 2 – Plan Types, Components, Review Procedures & Construction Requirements

2.1 Plan Submittal Types 2-4
2.2 Private Development Plan Review Process / Steps 2-4
2.3 Schematic Engineering Plan 2-6
2.3.1 Number of Plans to Submit for Schematic Plan Review 2-6
2.3.2 Schematic Plan Sheet General Components 2-7
2.3.3 Plan Submittal Dates and Deadlines 2-8
2.3.4 Fees associated with Schematic Plans 2-8
2.3.5 Schematic Plan Approval 2-8
2.4 Private Site Engineering & Public Works Plan Procedures & Components 2-9
2.4.1 Public Works & Site Engineering Plan General Requirements 2-10
2.4.2 Standard Construction Details 2-11
2.4.3 Technical Specifications 2-11
2.4.4 Digital Data 2-11
2.4.5 Cover Sheet Components & Recommended Plan Sheet Order 2-12
2.4.6 General Plan Sheet Components 2-13
2.4.7 Plan Submittal Dates and Deadlines 2-15
2.4.8 Number of Plans to Submit for Site Permitting Review 2-15
2.4.9 Fees for Public Works & Site Engineering Site Permits & Development 2-15
2.5 Private Development Plan Review Process 2-17
2.5.1 Initial Plan Screening 2-17
2.5.2 Plan Review Cycle Time 2-18
2.5.3 Interdepartmental Compliance Review 2-18
2.5.4 Resubmittal & Comment Response Sheets 2-19
2.5.5 Design Compliance Consultation 2-20
2.6 Additional Permits 2-20
2.7 Final Approval Processing, Site Permitting and Construction 2-22
2.7.1 Approval Letter 2-24
2.7.2 “Release for Construction” stamping 2-24
2.7.3 Submittal of Stamped Plans to Field Operations 2-24
2.7.4 Scheduling Mandatory Pre-Construction Meeting 2-25
2.7.5 Site Permit Requirements and Issuance 2-25
2.7.6 Plan Revisions 2-25
2.7.7 Construction Requirements 2-26

2.7.8 Final Acceptance 2-26
2.7.9 Record Drawings 2-26
2.7.10 Public Utility Survey 2-27
2.8 C.I.P. Engineering Plan Procedures, Components & Construction 2-28
2.8.1 Roadway and Utility Alignment Study or Preliminary Drainage Report 2-28
2.8.2 Design Phase: 2-29
2.8.3 C.I.P. Engineering Construction Procedures 2-31

Section 2 – Plan Types, Components, Review Procedures & Construction Requirements

2.1 Plan Submittal Types

The Engineering Department reviews various types of plans. The sections that follow describe these plans, typically required components, the review process and procedure used to review each type along with fees, submittal dates and number of sets to submit. Section references and links are provided to the minimum components plans are required to have. These plans are:

A. Schematic Engineering Plans

B. Public Works & Site Engineering Plans for Private Development Site Permit

C. Capital Improvement Project (C.I.P.) Construction Plans

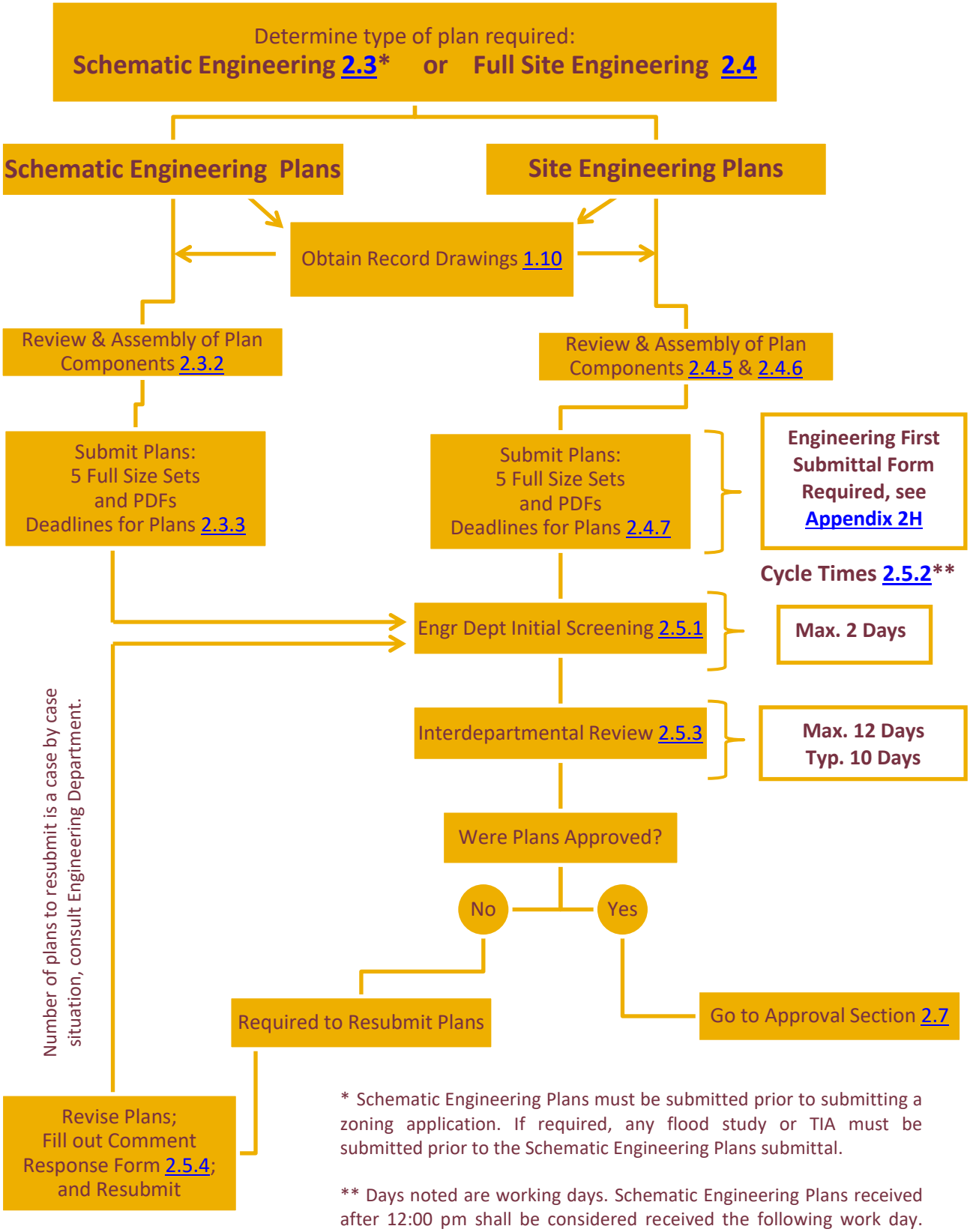
2.2 Private Development Plan Review Process / Steps

Site development plan review is an integral component in the City's administrative process that enforces standards and regulations on private development and land use. Depending on the existing site conditions and the specific elements of your development and your plans, development review can comprise several separate approval processes and can involve as many as ten different City Departments prior to issuance of a Site Permit.

To assist with minimizing the number of private development review cycles, we highly recommend consulting Figure 1: Plan Review Process Summary below, which provides a step by step guide through the major components of the review process. Additionally, the Engineering First Submittal Form in Appendix 2H is required with all first submittals and will ensure all necessary documents and files are provided to the Engineering Department.

The remainder of this page left blank intentionally.

Figure 1. Plan Review Procedure Summary Chart



* Schematic Engineering Plans must be submitted prior to submitting a zoning application. If required, any flood study or TIA must be submitted prior to the Schematic Engineering Plans submittal.

** Days noted are working days. Schematic Engineering Plans received after 12:00 pm shall be considered received the following work day. Site Engineering Plans received after 3:00 pm shall be considered received on the following work day. Allow extra time for submittals that are submitted near and during official City holidays.

2.3 Schematic Engineering Plan

New development projects in the City may be within an existing Planned Development or Downtown District as described in the GDC. Projects within these Districts will likely be required to submit a Detail Plan, Specific Use Provision Site Plan or Downtown Development Plan. Any new development outside of the above Districts described may be required to submit a Preliminary Development Plan.

In order to properly evaluate, review and comment on these plans, Schematic Engineering Drawings and Capacity Analysis of the drainage, water, wastewater, utilities and transportation network servicing the project are typically required. These drawings and analysis are submitted to the Engineering Department and in turn distributed to the City's development review departments. Schematic Engineering Drawings are required per the GDC in conjunction with the following:

1. Detail Plan (per GDC Chapter 2, Section 2.12)
2. Specific Use Provision Site Plan (per GDC Chapter 2, Section 2.19)
3. Downtown Development Plan (per GDC Chapter 7, Section 7.27)
4. Preliminary Development Plan (per GDC Chapter 4, Section 4.02)
5. Schematic Drainage Plan required (per GDC Chapter 3, Section 3.62)

It is important that the above Plans identify and locate existing and proposed rights of way, drainage facilities, flood plains, landscape buffers, utility lines and easements, since these features have a strong influence and often dictate the placement of structures, parking, and other permanent site improvements.

Basically, the schematic plan and analysis shows the project can work with the existing infrastructure or if it cannot, it identifies any needed on- or offsite improvements. The schematics, while not to the level of detail of construction drawings, allows staff the means to assess the project's potential impact on surrounding properties, infrastructure and flood plains. The importance of these plans cannot be overemphasized. Frequently, inadequate schematics are detrimental to all succeeding project phases.

Staff may waive the need for certain aspects of the schematic plans and analysis. This occurs when a development's impact on surrounding infrastructure and other properties are minimal; or when the adequacy of existing infrastructure is not in question.

For further Schematic Drainage Plan requirements refer to GDC Chapter 3 Section 3.62 and TSM Sections 4.02, 4.03, 4.04, and 4.17. For further Schematic Utility Plan requirements refer to TSM Section 5.1. For Schematic Plan Review Procedures, see Section 2.5.

2.3.1 Number of Plans to Submit for Schematic Plan Review

Submit directly to the Engineering Department, 800 Main Street, 3rd floor:

A. For the initial submittal of Schematic Engineering Plans, submit Engineering First Submittal Form (Appendix 2H), five (5) full sized 24"X36" or 22"X34" hard copies and a

vectorized PDF version on a Compact Disk (CD) or USB drive of complete schematic plans and necessary calculations to the Engineering Department.

B. For subsequent submittals, include any requested calculations and Comment Response Form, see Section 2.5.4. If necessary, the Engineering Department's red-line markup will identify the number of plans to re-submit with the next submittal.

2.3.2 Schematic Plan Sheet General Components

A. Schematic / Detail Plan Set Consists of at minimum 4 sheets:

1. Site Plan / Detail Plan (as submitted with the zoning application)
2. Downstream Assessment (see TSM Section 4.02)
3. Drainage Plan and Capacity Analysis (see TSM Section 4.04). When a detention facility is proposed, locate and label the pond's configuration, structures, and easement.
4. Schematic Utility Plan for water and wastewater system

B. Each plan sheet shall, at minimum, have the following components:

1. Either on 24"x36" or 22"x34" sheets
2. Title block including, at a minimum, the following project information:
   a. Project Name & Address
   b. Subdivision, Lot and Block
   c. City's Case Number
   d. Name of plan sheet and sheet number
   e. Design firm, firm registration no. and contact information, including email address
3. Include a legend with drawing symbols used with explanations.
4. Include north arrow and graphic scale (commonly used scales such as 1" = 10', 20', 30', 40', 50', 60', 100', and 200'. Do not use drawing scales such as 1", 1/8", 1/16", etc. Drawing scales are typically 1 inch = 40 feet horizontal for plan views and profiles 1 inch = 4 feet vertical).
5. All instructional text shall be a minimum height of 0.10 inches and maximum solid shading should be less than or equal to 20%. Shading and hatching is allowed only if the design intent, instructions, notes, and details are able to be seen beneath. Instructions and notes must be legible when plans are reduced by 50%.
6. Locate and label landscape buffers where applicable, property boundaries, ownership, right of way, common areas and maintenance entity, and topography on and within 50 feet of the project. Two foot contour interval topographic maps are available from the Engineering Department Records Division for a small fee.
7. Locate and label existing and proposed water, storm, sanitary sewer, and utility lines on and within 50 feet of the project. Identify sizes, alignments, easements with recording information, appurtenances, all non-city utility line alignments and

easements with recording information; note conflicts. Locate and label offsite drainage and utility lines with proposed easements that will be required to service the development. Locate and label all known existing and proposed ground mounted equipment, poles, signs, fences, walls, and floodplains, etcetera located on and within 15 feet of the project that may affect construction.

8. Locate and label future streets, water lines, and storm and sanitary sewer improvements near the development as defined in the City's current Capital Improvement Program, Major Thoroughfare and Master Utility Plans. On the utility plan, reference the City assigned as-built project number(s) for all existing city utilities at any proposed point(s) of connection. Refer to Section 1.10 regarding record drawing requests.

9. A primary and secondary onsite benchmark shall be shown on all plan sheets with elevation information. Contact the City Surveyor prior to beginning topographic work for a list of available benchmarks. Benchmark/Geodetic Control information is also available on the NGS website and City of Garland websites, www.ngs.noaa.gov/cgi-bin/datasheet.prl and www.garlandtx.gov. All benchmarks shall be tied to National Geodetic Survey (NGS) or City of Garland geodetic monuments. Include metadata in descriptions, NAVD88 or (NGVD29 – with conversion to NAVD88 shown) datum with monument identifier when available.

10. When applicable, locate and label phasing limits. Developments requiring phasing, indicate how each phase can exist as a stable independent unit consistent with Code provisions for providing safe access and City services.

2.3.3 Plan Submittal Dates and Deadlines

Submit plans directly to the Engineering Department, at 800 Main Street, 3rd floor prior to the submitting of the zoning application to the Planning Department; typically these projects involve public hearings and follow a formal timeline with strict public notification requirements, see the current Development Application Schedule in the Planning Department for hard deadlines. We recommend applicants submit large and complicated projects well in advance of the Planning Department's Application deadline. If a flood study is required, it shall be submitted at least 10 working days prior to submitting Schematic Engineering Plans to the Engineering Department.

2.3.4 Fees associated with Schematic Plans

There are no Engineering or permit fees associated with the submittal or review of Schematic Engineering Plans.

2.3.5 Schematic Plan Approval

Schematic Plans will be approved once all reviewing departments have signed off on the plans. The Engineering Department shall inform the applicant and Planning Department once approval has been granted. The approval allows the application for the plans listed in TSM Section 2.3 to move forward in the City's land development approval process according to the requirements set forth in the GDC and by the Planning Department.

2.4 Private Site Engineering & Public Works Plan Procedures & Components

Construction plans shall be prepared in conjunction with the preparation of land for onsite and offsite construction of public and private improvements. These plans may include, but are not limited to, paving, grading, drainage improvements, drainage area maps, landscaping, irrigation, erosion control and water and sewer lines by private developers including connections to existing City lines and facilities.

At the conclusion of the review and approval process, plans are stamped "Released for Construction" and a Site Permit is issued by the Engineering Department.

A. Definition of Site Permit: A permit that is issued under GDC Chapter 4, Section 4.08 that authorizes site preparatory activities other than construction or placement of a structure on the land and, upon approval, authorizes the property owner to apply for a building permit.

B. Purpose of a Site Permit: A Site Permit allows work to begin on the site including the construction of public improvements which are generally located outside of the building pad or footprint. Such site work is generally authorized prior to work on the actual building(s). Prior to installing a connection on a public utility main, a Site Permit must be obtained which requires submittal of Site Engineering Drawings and approval.

For private development projects Public Works & Site Engineering Plans and a Site Permit are typically required in conjunction with the following (except, a Working Plat can be submitted unaccompanied, see TSM Section 3.05):

1. Working Plat (per GDC Chapter 3, Section 3.08)
2. Preliminary Plat (per GDC Chapter 3, Section 3.08)
3. Final Plat or Re-plat (per GDC Chapter 3, Section 3.15)
4. Minor Plat & Amending Plat (per GDC Chapter 3, Section 3.24)
5. Grading & Drainage projects (per GDC Chapter 3, Section 3.85)
6. General Requirements (per GDC Chapter 3, Section 3.95)

Development review staff focuses primarily on factors that have the greatest impact on:

- Public health, safety, and welfare;
- Long-term maintenance of public infrastructure;
- Ensuring sound engineering principles are used;
- Impact and compatibility with neighboring properties; and
- Compliance with applicable City ordinances and standards

We have found that construction plan reviews minimize field changes and faulty construction, saving time and expense for both the City and Developer. Multiple plan re-submittals for City review typically equal delays in the project schedule, which will, in turn require additional cost and effort.

In an effort to minimize re-submittals and streamline the plan review and approval process, standard procedures for indicating and responding to comments has been established, see Section 2.5 for Plan Review Procedures. It is our hope that these procedures will lead to Developers getting Site and Building Permit plan approval quickly and ultimately, a certificate of occupancy.

The Engineer of record shall bear the sole responsibility for meeting the Engineering standard of care for all aspects of the design and providing a design that's required by the site-specific conditions and intended use of the facilities, while at a minimum meeting the City's design and construction requirements.

2.4.1 Public Works & Site Engineering Plan General Requirements

Specific information required for submittals can be found within this document and in the plan checklists located in Appendix 2A. The City reserves the right to specify additional requirements as necessary. All plans shall meet the general requirements defined below:

A. All improvements shall be designed in accordance with the City design criteria, specifications, and standard construction details referenced as part of the Technical Standards Manual.

B. ALL PLANS MUST be to a level of detail sufficient to show that the site has:

1. Adequate fire protection;
2. Adequate ingress / egress to a public right of way;
3. Water and sanitary sewer service can be provided;
4. Existing and proposed drainage and grading defined and the design must demonstrate that the proposed improvements are reasonably safe from flooding along with showing no adverse impacts to neighboring properties and rights of way;
5. Existing and proposed utility and drainage easements defined;
6. Traffic circulation and right of way dedications defined;
7. Provisions for stormwater detention where required; and
8. Erosion / Sediment control / Storm Water Pollution Prevention Plan Narrative where required;

C. Where special construction procedures or structures are required, special detail drawings are required.

1. All detail drawings shall be drawn to scale in order to allow the ability to see spatial relationships of the various elements in the detail.
2. Special detail drawings shall contain adequate dimensions, sections, views, notes, and instructions to construct the structure, or permit preparation of detailed shop drawings by a fabricator when necessary.

Review Pre-submittal meeting notes for specific requirements prior to submittal to the Engineering Department. Using the checklists in Appendix 2A will minimize redline comments on plans that are submitted for Site Permitting. The checklists are not meant to be totally inclusive of all possible items that may be needed for the review but depicts ordinance requirements and other commonly requested items.

Plan approval, and ultimately issuing of the Site Permit depends on compliance with the comments made on the check prints and the checklist. The Engineer of record shall satisfy themselves of the completeness and accuracy of the design by consulting the checklists. The City may use a modified form of the checklists to indicate where submittals are inadequate rather than providing a detailed redline plan.

2.4.2 Standard Construction Details

All projects shall be constructed in accordance with the City's standard construction details which are available through the City web site. The City's standard details do not have to be included in the plan set, just referenced as needed as the contractor and inspector are required to have the entire set of construction details on site. It is the responsibility of the engineer to use the most current detail, as the details are subject to change. If a necessary standard detail is not available from the City, TxDOT details are generally acceptable except for utility construction. For utility work, a standard detail may be selected from the NCTCOG Public Works Construction Standards, see Section 1.03 for currently adopted edition. It is the responsibility of the Design Engineer to provide a detail in the plans if a standard City detail is not available for review and approval.

2.4.3 Technical Specifications

All projects shall be constructed in accordance with the most current version of the City specifications which are available in the Engineering Department, adopted NCTCOG, or TxDOT specifications. It is the responsibility of the Design Engineer to use the most current and applicable specification, as the specifications are subject to change. If a necessary specification is not available from the City or TxDOT, then one may be selected from the NCTCOG Public Works Construction Standards, see Section 1.03 for currently adopted edition.

2.4.4 Digital Data

The Engineering Department is the custodian of all public works and private subdivision improvement plans in perpetuity. As the City moves to archiving plans digitally it is important that some degree of uniformity is maintained. The objective of the plan set up requirements is to provide uniformity and standardization of plan submittals while allowing the design engineer flexibility on how information is presented. Standardization of information along with uniformity in setup allows the review process to occur in a more orderly and timely fashion leading to quicker plan approvals.

Public works and site engineering construction plans shall be digitally drawn. North should be to the top or right of the sheet, and stationing left to right unless the sheet orientation with respect to North will not permit. Where modifications to existing roads and utilities are proposed, "screened or ghost lined" existing features. Use heavy bold lines to indicated new improvements with appropriate notes and symbols. Locate and label the type, size, and

location of all underground utilities along with easement alignment, dimension and description.

For projects with extensive public infrastructure improvements, our preference is to have separate files for sanitary sewer, water and storm sewer systems.

Digital files shall be either MicroStation (.dgn) or AutoCAD (.dwg) format for input into the City's GIS database. All files must use Texas State Plane coordinates and elevations shall be based on NAVD 88 vertical datum. **Assumed coordinate systems are not accepted.**

When setting up files please keep in mind the following general guidelines:

1. Files names should make sense to a viewer who may not be familiar with the consulting firms naming conventions and be indicative of the contents of the file.
2. All pertinent drawing elements will reside in the primary drawing file. There shall be no cells, nodes, blocks, or reference files attached to the drawing.
3. Separate layers for structures, pipes, annotation etc. with a logical description of each layer.
4. All easements within the property shall be represented and drawn as closed polylines representing aggregate areas.
5. Graphically represent all off-site easements, adjacent right of way, lot lines, etc… encompassing or intersecting infrastructure improvements.
6. Infrastructure line work must be continuous polylines with a beginning and ending at a structure insertion point, connecting only two structures per line. Lines must be drawn with the direction of flow. Remove extraneous line work and annotation.

2.4.5 Cover Sheet Components & Recommended Plan Sheet Order

A. The Engineer shall provide the following certification on the cover sheet of the plans:

These construction plans have been reviewed by the City of Garland. The City has determined that they are in general compliance with the Garland Development Code, City's Master Plans and Technical Standards Manual. The City's review and release of these plans does not represent that the City has re-engineered or verified the engineering of the proposed improvements. The Design Engineer is responsible for all engineering and recognizes that specific site circumstances or conditions may require improvements constructed to exceed minimum standards contained in the City's Technical Standards. The Design Engineer is responsible for the applicability and accuracy of the plans and specifications contained herein. _____, P.E., Firm Registration # _____.

B. The latest version of the City's Cover Sheet General Notes shall be included on the cover sheet of the Construction Plans for all projects and can be found in Appendix 2B.

C. The cover sheet should also include, at a minimum, the following:

1. Title block as indicated in Section 2.4.6 below

2. Recorded subdivision name, lot and block prominently shown
3. Project Name and Project Address
4. Sheet Index
5. Case number
6. Vicinity Map with north arrow
7. Design firm(s) name, registration number, and contact information including email address
8. Owner/Developer's name and contact information including email address

D. Public Works & Site Engineering construction drawings must be complete and typically include the following sheets. We recommend the following plan order of the sheets in the set:

- Cover Sheet
- Plat (include copy of filed plat or a draft version of the working plat)
- Site Improvement Survey
- Demolition Plan, *as applicable*
- Site Plan / Dimension Control (for non-residential developments)
- Paving Plan
- Utility Plan
- Grading Plan
- Drainage Area Maps (existing and proposed)
- Drainage Plan, *as applicable*
- Stormwater Pollution Prevention Plan / Erosion Control Plan, see Section 6.04 for downloadable template
- Special Construction Details, *as applicable*
- Tree Survey / Mitigation Plan, *as applicable*
- Landscape Plan, *as applicable*
- Irrigation Plan, *as applicable*
- Screening & Retaining Wall Plans, *as applicable*

2.4.6 General Plan Sheet Components

A. Each construction plan sheet shall bear the seal and signature of the Licensed Professional Engineer in the State of Texas who prepared the plans. If references to standard construction details are made in the construction plan submittal, the Engineer shall provide the following certification on the title sheet of the plans:

I, the project Engineer, acknowledge by reference that I have reviewed the standard City of Garland details for applicability to this project and all details are applicable unless specifically noted otherwise. The additional non-City of Garland standard details specifically identified in this set of construction plans [or specifically included in these bidding/contract documents] have been selected by me or under my direct responsible supervision as being applicable to this project. _____, P.E., Firm Registration # _____

B. Each construction plan sheet shall, at minimum, have the following components:

1. Either on 24”x36” or 22”x34” sheet

2. Title block including, at a minimum, the following project information:

   a. Project Name & Address
   b. Subdivision, Lot and Block
   c. City’s Case Number
   d. Name of plan sheet and sheet number
   e. Design firm, firm registration no. and contact information, including email address

3. Include a legend with drawing symbols used with explanations.

4. Include north arrow and graphic scale (commonly used scales such as 1” = 10’, 20’, 30’, 40’, 50’, 60’, 100’, and 200’. Do not use drawing scales such as 1”, 1/8”, 1/16”, etc. Drawing scales are typically 1 inch = 40 feet horizontal for plan views and profiles 1 inch = 4 feet vertical).

5. All text shall be a minimum height of 0.10 inches and maximum solid shading should be less than or equal to 20%. Shading and hatching is allowed only if the design intent, instructions, notes, and details are able to be seen beneath. Instructions and notes must be legible when plans are reduced by 50%.

6. Locate and label landscape buffers where applicable, property boundaries, ownership, right of way, common areas and maintenance entity, and topography on and within 50 feet of the project. Two foot contour interval topographic maps are available from the Engineering Department Records Division for a small fee. Use heavy line weight for Property lines, label bearings, distances, radii, and area in acres or square feet.

7. Locate and label existing and proposed water, storm, and sanitary sewer lines on and within 50 feet of the project. Identify sizes, alignments, easements with recording information, appurtenances, all non-city utility line alignments and easements with recording information; note conflicts. Locate and label offsite drainage and utility lines with proposed easements that will be required to service the development. Locate and label all known existing and proposed ground mounted equipment, poles, signs, fences, walls, FEMA floodplains, etcetera located on and within 15 feet of the project that may affect construction. When the design engineer determines it necessary, provide Subsurface Utility Engineering information where a conflict likely exists with critical facilities. Provide distance from the center of nearest street intersection to property corner.

8. Locate and label future streets, water lines, and storm and sanitary sewer improvements near the development as defined in the City’s current Capital Improvement Program, Major Thoroughfare and Master Utility Plans.

9. A primary and secondary onsite benchmark shall be shown on all plan sheets with elevation information. Contact the City Surveyor prior to beginning topographic work for a list of available benchmarks. Refer to Section 3 for additional information.

10. Development requiring phasing, indicate how each phase can exist as a stable independent unit consistent with Code provisions for providing safe access and City services.

2.4.7 Plan Submittal Dates and Deadlines

Submit directly to the Engineering Department, 800 Main Street, 3rd floor:

A. For projects required to Plat or Re-plat: Plat / Re-plat shall be submitted in Working Plat format in conjunction with Public Work & Site Engineering Plans. See Working Plat Submittal Requirements checklist in Appendix 3H.

B. For projects not requiring Zoning, Platting or Re-plating, submit plans at any time.

C. For projects requiring zoning approval, the applicant is encouraged to obtain City Council approval prior to submitting construction plans for a Site Permit.

2.4.8 Number of Plans to Submit for Site Permitting Review

A. For the initial submittal (Public Works and Site Engineering Plans): submit Engineering First Submittal Form (Appendix 2H), five (5) full size 24" x 36" or 22" x 34" copies of complete construction plans, special construction details, and necessary calculations to the Engineering Department. Refer to Section 2.4.5 and 2.4.6 above for components to be shown on the plans. With the initial submittal, be sure to include an Impervious Area Status Sheet, refer to TSM Section 6 and Appendix 6A.

B. For subsequent submittals: Include any requested calculations, Comment Response Form (refer to Section 2.5.4 and Appendix 2C), and redline markups of the plans. The Engineering Department's red-line markup will identify the number of plans to re-submit.

2.4.9 Fees for Public Works & Site Engineering Site Permits & Development

A. Engineering Review and Inspection Fee

1. A non-refundable Engineering Review and Inspection fee will be assessed per section 1.51 of the GDC and due prior to issuance of a Site Permit. As of October 1, 2013, the fee is 4% and is subject to change; check the City's website for the current rate. All improvements and appurtenances placed in public rights of way and easements needing future City maintenance are assessed including but not limited to, street paving, alley paving, traffic signals, storm sewers, wastewater mains and taps, lift stations, water mains, valves, taps, meters, fire hydrants, drainage structures, and channels. Do not include sidewalks, driveways, private storm and wastewater lines, private service lines, fire lines, Fire Department Connections and lines, backflow prevention devices, fire lane and on-site pavement, earthwork, screening walls, and retaining walls in the assessment. There is a $100 minimum charge.

2. Prior to plan approval, the Engineer shall provide the Development Engineering Group with copies of itemized paving, drainage and utility construction bid tabulations or an Engineer's estimate of probable construction cost defining item, unit, quantity, unit cost, and total cost. Our preference is that you present the

information on the Summary of Public Improvement Items and Quantities forms provided in Appendix 2I.

3. Fees are typically collected at the pre-construction meeting, make checks payable to the City of Garland. Visa, Discover and Master Card are also accepted.

4. Prior to final acceptance, the probable estimate of construction cost will be compared with information submitted for the maintenance bonds. If significantly different (≥10%) additional monies will be collected prior to final acceptance.

B. Additional Site Permit Fees

1. Developer installed screening wall or a detention pond that is to be publicly maintained shall have a maintenance fee assessed. Consult the Engineering Department for additional details.

2. As part of the Site Permit, the Building Inspection Department will include the following fees, where applicable. Contact the Building Inspection Department directly for the actual amounts and / or percentages:

   a. Paving
   b. Grading
   c. Driveway Approach
   d. Sidewalk
   e. Screening Wall**
   f. Retaining Wall >=4'**
   g. Processing Fee

   **This fee is included with the Site Permit; an additional paper Application and Permit must be obtained from Building Inspections Department prior to beginning construction. Consult the Building Inspection Department for information on the additional permits and fees required.

3. Tree Mitigation fees must be paid prior to issuance of a Site Permit, contact the Planning Department for details.

C. Pro-Rata Charges

1. Refer to the GDC Chapter 3, Section 3.50 for additional explanation. In short, a pro-rata fee is a charge made to repay the cost of public water and sewer mains put in by an earlier Developer or the City. The money is used to reimburse the Developer(s) or the City who installed these improvements. The fee is collected when properties adjacent to these mains are platted. Pro-rata fees are assessed on water and sanitary sewer lines that are less than or equal to twenty (20) years old per foot of frontage to the line. It is normally assessed on unplatted parcels. Fees are due prior to issuance of the Site Permit and are typically collected at the pre-construction meeting. Make checks payable to the City of Garland, credit cards are accepted.

2. Rates are re-calculated every year by October 1st. Contact any member of the Development Engineering Group within the Engineering Department for current rates.

D. Sidewalk Escrow

1. The GDC Section 3.93, requires that in instances where a request for sidewalk waiver is approved by Plan Commission, that the applicant pay the City an amount equal to the estimated cost of constructing a standard width sidewalk on straight and level terrain equal to the linear footage waived. The Engineering Department uses the unit cost from the City's annual concrete contract to calculate sidewalk escrow. Sidewalk escrow must be paid prior to approval of a plat.

2.5 Private Development Plan Review Process

To assist with minimizing the number of private development review cycles, we highly recommend consulting Figure 1: Plan Review Process Summary, which provides a step by step guide through the major components of the review process.

2.5.1 Initial Plan Screening

The Engineering Department coordinates the City's interdepartmental reviews for a Site Permit.

Prior to distribution of plans to the City review departments, the Engineering Department staff conducts an initial plan screening. This is a quick check, to determine if the submittal contains the minimal information necessary to facilitate a comprehensive City wide interdepartmental review.

A. In order for the timely approval of a project it is critical that all submitted items be 100% complete at the time of the submittal. Plans submitted for review should be to a construction level of detail, i.e. ready to be constructed.

B. Submittals with significant omissions and lacking in details may result in the entire submittal being considered incomplete and returned to the design professional within 2 days not reviewed. Omissions that will result in a finding of incomplete plans are:

1. Insufficient number of plan sets for a complete interdepartmental routing;
2. Incomplete set of plans (sheets missing);
3. Failure to provide completed comment response sheets and redline plans from previous submittal;
4. Submittals lacking the required submittal of vector based PDF(s) of the plan set;
5. Lack or insufficient calculations for on- and offsite drainage;
6. Incomplete water and sanitary sewer system layout;
7. Established development criteria and prior stipulations not addressed;
8. Failure to adequately address previously identified deficiencies;
9. If applicable, the omission of Landscaping and Irrigation Plans.

2.5.2 Plan Review Cycle Time

Plan review cycle time for initial plan intake for schematic plans is 1 working day. Inter-departmental routing and review takes 7 working days. For Public Works & Site Engineering Plans initial plan intake is up to 2 working days. Inter-departmental routing and review typically takes 10 working days with a maximum of 12 working days. Allow extra time for submittals that are submitted near and during official City holidays. Please remember: Processing times given are approximate.

Schematic Plans received after 12:00 pm shall be considered received the following work day. Public Works & Site Engineering Plans received after 3pm shall be considered received on the following work day.

The time required for plan approval and permitting depends on the design professional time frame for re-submitting plans, responsiveness to comments, and the complexity of the project. Staff can significantly speed up approvals, when applicants provide thorough responses, research as-built conditions, adjacent plat and easements, ensure drawing layers are turned on, correct typographical mistakes and obtain any necessary clarification prior to submitting or re-submitting plans. Applicants are encouraged to review all applicable sections on the Plan Completeness Checklist in Appendix 2A, prior to submitting plans.

If City comments are not addressed or alternate engineering solutions provided with resubmitted plans, comments will be repeated and plans returned unapproved.

Protracted negotiations involving road modifications and offsite utilities and easement acquisitions could delay final plan approval and permitting. Other causes for delay may occur if the project design changes substantially mid-way through the review. Please limit phone calls and emails inquiring about plan review status as it takes time away from staff completing reviews and only delays the approval process.

2.5.3 Interdepartmental Compliance Review

The primary review departments are:

DEPARTMENT	Code
Building Inspection	BI
Electric	GPL
Engineering	E
Fire	F
Health	H
Parks and Recreation	PARD
Planning	P
Solid Waste	SWT
Stormwater	SMW
Surveyor	S
Transportation	T
Wastewater	WW
Water	W

Each department will indicate comments directly on the plans and / or on attached comment sheets and reports. This can include both sketches and written notations. As comments are made, the departmental reviewers will indicate their Comment Code and the sequential number of the comment. Comments for each department will start with "1".

For example:

Comment/Mark-up	Code and Number	Explanation
W1. Add a valve	Water Dept 1st Comment	It relates to the need for an additional valve.
W2. Move service	Water Dept 2nd Comment	It relates to the need for a service line to be relocated.
F1. Indicate Fire Lane	Fire Dept 1st Comment	Indicate fire lane.

This method will be used for the first and all subsequent submittals.

Once the number of comments reaches 20 or more on any sheet in the plan set, the City reviewer reserves the right to stop the review and return plans to the design professional for being incomplete and non-responsive. Reviewing departments may provide additional comments on re-submittals that were not identified on the previous submittal due to the incompleteness of the submittals.

2.5.4 Resubmittal & Comment Response Sheets

A. In the past, resubmitted plans frequently had comments that were not adequately addressed or were completely ignored. In an effort to minimize these occurrences and avoid long and protracted negotiations regarding comments, we have instituted a policy of requiring a written or typed response to redlined comments to be submitted with returned plans on the comment response sheet in Appendix 2C.

As a general rule:

1. Repeating comments from sheet to sheet need only be responded to once;
2. Provide explanations for items that are not readily apparent as to how a particular comment was addressed; or
3. Why a comment was addressed differently than requested; and
4. Why a particular comment or request couldn't be done.

B. Resubmit corrected plans along with a vector based PDF of all plan sheets, the previous redline plans, comment response forms and any supported documents. The re-submittals will follow the same plan review procedure until plans are approved, see Section 2.7.

C. Any modifications to the plans as a result of addressing a review comment from the City shall be documented within the Comment Response Sheet per Section 2.5.4.A. **For any modification within the plans that are not a result of a previous review comment, the design professional shall submit written documentation notating the modification to the City.**

If modifications are made without providing written documentation, this modification shall be disallowed and rejected without formal notation from the City and the design professional and developer shall assume all risk and responsibility to revise the plans and, as necessary, reconstruct improvements in conformance with previous acceptable submittals, the Technical Standards Manual, and the Standard Construction Details.

2.5.5 Design Compliance Consultation

To reduce the number of re-submittals and save time, the City may schedule a design compliance consultation with the Developer and / or the design professional and all affected City departments to address significant omissions, comments and / or conflicting responses. The Design Compliance Consultation is set up by appointment, not on a walk-in basis. The applicant can also request the meeting from any member of the interdepartmental review team. The purpose of this meeting is for the applicant to be given the opportunity to review plan review comments with interdepartmental plan reviewers. This meeting should help the applicant make all necessary corrections with the first re-submission rather than having multiple revisions and multiple re-submittals.

Applicants are encouraged to summarize the results of the meeting in writing and e-mail action items, conclusions, etcetera to the staff members at the meeting.

Because of the nature of the process, re-submittals will have additional or modified information and comments. Efforts will be made to limit additional and unnecessary comments, however, it also should be understood that comments may be made regarding the new or modified information.

The design professional and Developer should feel free to contact any reviewer for clarification regarding comments.

2.6 Additional Permits

Other permits that may be required but not limited to are:

A. Right of way work permit, required prior to any work in City right of way or easements, issued by the Engineering Department Field Operations Group. Contractors must register with the City. Contact the Right of Way Administrator for further information at (972) 205-3622 or see City Right of Way Management Website. The Developer must contact and coordinate service and permitting for other utilities such as, gas, telephone, cable television, etc..

B. A separate Building Permit is required to initiate work on structures including screening and retaining walls greater or equal to 4’ or any other element not included in the Site Permit. Contact the Building Inspection Department at 972-205-2300 for Building Permit requirements.

C. Sidewalk and driveway approach permit required when work is in City right of way. This permit is issued by the Building Inspection Department.

D. Permits from the Texas Department of Transportation (TxDOT) are required for any work within State right of way. The Developer's Engineer shall coordinate with the TxDOT Dallas County Area Office for preliminary approval for any proposed driveways or drainage connections within TxDOT rights of way during the zoning phase or at the beginning stages of the project design. For zoning to proceed, the Engineer shall provide documentation of TxDOT's preliminary approval to the City. Once the Engineer receives notification from the City that the construction plans are sufficient, the Developer's Engineer shall prepare the appropriate TxDOT Permit application and submit to the City Engineering Department. The City Engineering Department representative will sign and return the permit application to the Developer's Engineer, then the Engineer shall schedule a meeting with the TxDOT representative to review their permit application and receive TxDOT approval and Permit **prior to the City stamping the plans for the Site Permit**.

E. Flood plain development permit required when work is proposed in or adjacent to Special Flood Hazard Areas as shown on the effective Flood Insurance Rate Map for the City of Garland, refer Section 4.17.H for information and forms. In addition, refer to Section 4.17 for Conditional Letters of Map Revision (CLOMR) and Letters of Map Revision (LOMR) requirements.

F. Provide evidence showing compliance with the US Army Corps of Engineers Wetlands and Waters of the US regulations. The US Army Corps of Engineers (Corps) and the US Environmental Protection Agency jointly administer Section 404 of the Clean Water Act (CWA). The CWA regulates the discharge of dredged or fill material into creeks, streams, lakes, certain man-made canals, and other waters of the United States, including wetlands. In addition, the US Fish and Wildlife Service and the Texas Commission of Environmental Quality have important advisory roles. See http://www.spl.usace.army.mil/ and click on Regulatory, then Permit Process within the State, for specific information.

Individual permits may be required for projects with potentially significant impacts and require public notice. Nationwide permits (currently 44 activity-specific permits) may be authorized for activities with minimal environmental impact and undergo a streamlined process.

G. Keep in mind that State, Federal, and other agencies may also require permits when development encroaches upon their facilities or easements, particularly those maintained by the State, North Texas Tollway Authority, North Texas Municipal Water District, Waters of the U.S., Texas Commission on Environmental Quality, floodplains, and properties with probable wetlands or landfills. It is critically important that you contact these outside agencies early in the planning stage of your project so their requirements can be incorporated into your plans and schedule. While staff will attempt to identify which State and /or Federal permits may be required, it is ultimately your responsibility to comply with all State and Federal regulations. When applicable, approval letters and / or permits are required from the following agencies, prior to stamping of plans and release for Site Permitting.

1. City of Dallas (Lake Ray Hubbard Take Area)

2. Dallas Area Rapid Transit (DART) License Agreement or Railroad permit,
3. North Texas Tollway Authority,
4. North Texas Municipal Water District, and
5. US Army Corps of Engineers
6. Texas Commission on Environmental Quality (TCEQ) for material alterations to a sewage system.

H. If the project requires off-site improvements, work or access on adjacent properties, a completed "Permission to Perform Work on Property Letter" must be submitted to the City. See Appendix 2G for an acceptable letter.

2.7 Final Approval Processing, Site Permitting and Construction

Refer to Figure 2: Site Permit Approval/Issuance Process Flow Chart below for a guidance summary of the Site Permit issuance, pre-construction and construction process.

This page left blank intentionally.

Figure 2. Site Permit Approval/Issuance Process

Plan Review Approval Received
See Figure 1, Section 2.2 for plan approval

↓

Approval Letter issued by Engineering Department
Section 2.7.1

↓

Correct any outstanding items as listed on Approval Letter

↓

Submit one final full size, sealed and signed set of construction plans to Engr. Dept.
Section 2.7.2

↓

City's "Release for Construction" stamp placed on plans by Engr. Dept. and returned to applicant
Section 2.7.2

↓

Applicant submits necessary copies & PDFs of stamped plans to Field Engr. Office
Section 2.7.3

↓

Schedule mandatory Pre-Construction Meeting with Field Engr.
Section 2.7.4

↓

Pay Site Permit Fees & Attend Pre-Con Meeting
Section 2.7.5

↓

Site Permit Issued & Begin Construction
per Field Engineering requirements

2.7.1 Approval Letter

Upon completion of the plan review process and a determination of plan completeness by all City reviewing departments, the design professional will receive an Approval Letter from the Engineering Department describing the remaining steps needed to obtain the Site Permit.

This letter will also identify any outstanding items required on the plans prior to the Engineering Department stamping the plans with the City's "Release for Construction" stamp. The Approval Letter will also include the calculated permit fees and Site Permit Application.

The Approval Letter does not authorize any construction activities. Construction is only allowed after a Site Permit is issued; see next steps for obtaining a Site Permit.

Per GDC Section 3.100, plan approval shall be null and void if a Site Permit is not obtained within 1 year from the date plans are stamped released for construction.

The following sections describe the remaining steps required after receiving an Approval Letter to complete the pre-construction and construction process.

2.7.2 "Release for Construction" stamping

- The applicant shall submit one (1) full size original set of the approved public works and site engineering plans on bond paper to the Engineering Department with any outstanding items corrected along with vector based PDFs of all plan sheets to be stamped for the City's record. The engineer of record must sign and seal all applicable sheets per Texas Engineering Practice Act and Rules, Chapter 137 Subchapter B.

  For any modification to the approved plans prior to stamping, the design professional shall submit written documentation notating the modification to the City for review. If modifications are made without providing written documentation, this modification shall be disallowed and rejected without formal notation from the City and the design professional and developer shall assume all risk and responsibility to revise the plans and, as necessary, reconstruct improvements in conformance with previous acceptable submittals, the Technical Standards Manual, and the Standard Construction Details.

- The Engineering Department will stamp the plans with the City's official "Release for Construction" stamp. Typically, plans are stamped within 48 hours of receipt. We will notify you when the stamped plan set is ready for pickup. This set will be used for you to reproduce the plans required for the City and your use. For time sensitive projects, however, once the original set is checked and verified by staff, the applicant can stamp the plans themselves using the City's official "Release for Construction" stamp. Plans must be stamped in the Engineering Department's office.

2.7.3 Submittal of Stamped Plans to Field Operations

- Using the official stamped plans from Section 2.7.2 above, make five (5) full size copies of the official stamped plans and a PDF scan on a CD or DVD of the official stamped plans. The PDF scan must be optimized to print to the original size. The

scanned PDFs shall be for each individual sheet with the PDF file name matching the sheet number and name of the plan sheet per the cover sheet page index.

- Deliver the six copies and CD/DVD to the Field Operations Inspection Supervisor, at 800 Main Street, 2nd Floor.

2.7.4 Scheduling Mandatory Pre-Construction Meeting

- You may contact the Field Engineering Inspection Supervisor at 972-205-2113 two days after delivery of the plans to Field Engineering to schedule the mandatory pre-construction meeting.
- The developer / owner and general contractor must attend the mandatory site permit pre-construction meeting. In the event they cannot attend, each is responsible for assigning an authorized representative to attend in their place. Authorized representatives must have decision-making authority for the project. If any of the parties mentioned are not present at the meeting, the meeting will be cancelled and the site permit will not be issued. Construction activity will not be allowed on the project without a valid site permit.
- Pre-construction meetings are held on Tuesday and Thursday mornings with representatives from the Engineering Department's Field Operations group, inspection and final acceptance procedures are discussed. A City Inspector will be assigned to the project, specific project requirements are reviewed and inspection checklists distributed.

2.7.5 Site Permit Requirements and Issuance

- The Site Permit will be issued after the completion of the Pre-Construction meeting and after all applicable fees are paid. Fees may be paid at or prior to the pre-construction meeting. A Site Permit, along with approved stamped plans, authorizes work on the project's non-vertical elements such as grading, drainage, utility and paving improvements. Per GDC Section 4.10, the Site Permit shall expire if work on the site improvements have not commenced within 1 year following the Site Permit date of issuance.
- **During work on the project, A Site Permit Placard and the most current version of the approved stamped plans shall be on the job site at all times.**

2.7.6 Plan Revisions

The City reserves the right to require corrections to plans that have been released for Site Permit with actual field conditions that are found to be contrary to the plan, and for omitted or conflicting instructions. The Engineer of Record shall, either upon his/her own initiative or upon the request from the Engineering Department, furnish revised drawings as may be necessary. When such a request is made, the changes must be reviewed and re-approved by the City before construction of the work covered by them is undertaken.

A. Any proposed modification or revision to the plans shall be coordinated with the City Inspector. The Engineer shall discuss and review the proposed change with the Senior

Field Engineer for a determination if the proposed change may be reflected on the Record Drawings or as an official "Plan Revision" to the construction drawings. If a Plan Revision is warranted, the Engineer shall provide the proposed revision to the Engineering Department's Development Engineering Group for processing as defined below.

B. The revised plan must be sealed with the Engineer of Record seal, signature and date.

C. If the revision is significant and/or affects multiple plan sheets, submit (5) hard copies and vector based PDFs of all plan sheets labeled as they are on the cover sheet to the Engineering Department for review. If the revision is minor and/or affects one to three sheets, you can email a vector based PDF of the plan sheet(s) to Engineering for review.

D. Cloud the information and area with the change and note the number of the revision within a triangle Δ. Provide a description of the change near the title block.

2.7.7 Construction Requirements

For current construction requirements, please contact the Field Engineering Department at 972-205-2170.

2.7.8 Final Acceptance

Upon substantial completion of the work, coordinate project acceptance with the assigned Engineering Department Inspector. Project acceptance will not occur until record drawings, digital CAD files, Public Utility Survey, Monumentation Verification, and maintenance bonds are received and verified by the Inspector. It is recommended that one month prior to requesting Engineering Final Acceptance of the project, all finals and paper work should be completed and submitted to Field Engineering for review.

2.7.9 Record Drawings

Record drawings are a final record of what was actually installed, and include all deviations or changes from the approved plan. Record drawings are required to reflect the same degree of precision and detail as the original plans. Record drawings are necessary as a basis to plan and design future projects in the same location and to make repairs to damaged components or other non-working facilities. They are required to show all changes that occurred during construction, including changes in materials, distances, lengths, locations, elevations, slopes, volumes, etc.

During the construction phase of the project, the Contractor/Developer for the project shall maintain one set of full size plans for record drawings. The Contractor's superintendent or authorized representative, together with the City's construction inspector, shall update the plans with record information on an as needed basis. Record information includes the final locations of all new materials incorporated into the work and all existing improvements encountered during construction. See Public Utility Survey requirements below.

Upon completion of construction, the record information will be provided to the Engineer / Surveyor and together with the survey of the as-built conditions, shall be the basis for the record drawing submittal. As-built changes to text: invert elevations, dimensions, notes, etc. will be lined out with the record drawing text placed near it. Do not alter, modify or erase

original approved construction drawing text. Any design changes should be drawn electronically, not hand drawn changes.

Submit the record drawings noted as RECORD DRAWINGS with any as-built changes noted, signed and sealed by the Engineer of record. Submit PDFs and digital files of the approved record drawings in either MicroStation (.dgn) or AutoCAD (.dwg) format for input into the City's GIS database to the City Inspector. The CAD file shall include all utility linework in one drawing, on State Plane coordinates and with no xrefs. Refer to Section 2.4.4 for Digital Data Requirements. The PDF file shall be scanned from the original final sealed Record Drawings. The page size shall be identical to the printed paper copy with a minimum resolution 300 dpi. The PDF's must be free from objectionable background, rotated properly and stored in a separate folder on the CD or USB device. Conversion of a CAD file to a PDF file is not acceptable. PDF file names shall match the sheet number and name of the plan sheet.

2.7.10 Public Utility Survey

Per GDC Section 3.111, the City shall not accept dedication of required public improvements until the applicant's surveyor has stated to the Director of Engineering, through an affirmation letter and submission of a Public Utility Survey establishing that the visible public utility improvements have been installed within the approved Final Plat dedicated easements and right of ways as reflected in the approved and "Release for Construction" Site Permit Public Works and Site Engineering Construction Plans. See Appendix 2E for an example affirmation letter that should accompany the Public Utility Survey.

The Public Utility Survey shall be completed by a Texas R.P.L.S. per TSM Section 3.01. The survey must conform to the Coordinates and Vertical Control as indicated in Appendix 2F. Any survey not complying with Appendix 2F will be rejected.

The Public Utility Survey shall only include the following:

The survey shall include the surveyor's R.P.L.S. #, contact information, north arrow, graphical scale and subdivision, lot and block information for all lots shown. For areas of the project where visible public improvements were installed, the survey shall show all property lines for lots containing or adjacent to public easements, all Rights of Way and all easements as shown on the Final Plat for the property. The survey shall also include all publicly maintained ground mounted utility, drainage and street improvements within the easements and Rights of Way. The survey shall include the following items located in public easements and Rights of Way that were installed with the project:

Water Items:
- fire hydrants
- valve lids
- meter boxes/vaults
- flushing/blow off valves

Sanitary Sewer Items:
- manholes
- cleanouts
- lift stations
- air release valves

Storm Sewer/Drainage Items:
- manholes
- grates
- junction boxes
- lined channels (outer edges & limits)
- flumes
- curb inlets (each end of inlet at back of curb line)

● detention pond outlet structure ● point at outfall pipe flowline
● headwalls (minimum two points at each end of headwall and wingwall)
● paved positive overflow path (center line at beginning, end and P.I.s)
(For boxes, grates, inlets & outlet structures, a minimum of three corners shall be provided)

And include any special structures not listed, as defined by the Field Engineering Inspector.

The survey points shall, at a minimum, contain point node, point number and description accurately describing the improvement/monumentation.

Submit a PDF and digital file of the Public Utility Survey in either MicroStation (.dgn) or AutoCAD (.dwg) format for input into the City's GIS database to the City Inspector. The digital file shall be in State Plane coordinates. Submit the PDF and digital file on CD or USB device. Refer to Section 2.4.4 for Digital Data Requirements. The page size shall be 22"x34" or 24"x36" with a minimum resolution 300 dpi. The PDF's must be free from objectionable background, rotated properly and only include the above mentioned items.

Per the GDC Section 3.111, if improvements are installed outside of the dedicated easements, at the discretion of the Director of Engineering, the improvements shall be reconstructed within the utility easements or additional easement(s) by separate instrument shall be provided and recorded along with a subsequent Amending Plat or Replat of the property at the developer's expense. A letter of acceptance shall not be issued until the approved recorded separate instrument is received by the Director of Engineering.

2.8 C.I.P. Engineering Plan Procedures, Components & Construction

2.8.1 Roadway and Utility Alignment Study or Preliminary Drainage Report the Engineer shall:

A. Arrange and attend preliminary conferences with interested parties regarding the project including, but not limited to Water, Wastewater, PARD, Engineering, Transportation, IT, GISD, Atmos Energy, ONCOR Electric, AT&T, Verizon, Garland Power and Light, North Texas Municipal Water District and Time Warner and obtain their existing improvement records and proposed improvement plans. Contact the Engineering and Design Records Supervisor at 972-205-2170 to obtain record drawings relevant to the project. The Engineer is responsible for contacting TXDOT, NTTA, Dallas County, adjoining Cities or other City Departments to obtain all record documents, including rights-of-way and easements for the project. Review record construction plans, land records, or other pertinent documents obtained from the City and other appropriate agencies.

B. Collect field survey data which is necessary to prepare the Roadway or Utility Alignment Study and Preliminary Drainage Reports. The Engineer will clarify the level of survey required with the Engineering Department prior to beginning said survey. Reference TSM Section 3 for Survey requirements.

C. Prepare in an approved MicroStation or AutoCAD format the project study/report. Each project is unique; therefore, site conditions and project elements will determine the specific items requiring investigation. The following is a general list of items that could require investigation on a project. The study/report will show alignment options, existing

streets, existing alleys, existing driveways, existing sidewalks, existing paving materials, existing trees, existing shrubs, existing utilities, existing drainage facilities, existing property lines, existing easements, property owners, proposed curbs, proposed sidewalks, typical sections, potential wall locations, proposed utilities, proposed drainage improvements, proposed property dedications investigation and analysis of all federal and state permits, and maintenance of traffic flow or other City services during construction. Include a preliminary drainage area map showing drainage areas, run-off coefficients in accordance with the future City zoning, major points of concentration, size of area in acres, and the calculated quantity of run-off at each point of concentration. The study/report shall also include an Opinion of Probable Construction Cost for each option presented. The Preliminary Drainage Report will include an introduction generally describing each Alternative, detailed discussion paragraphs describing the drainage patterns for each alternative and a summary of the facts, pros and cons for each option with a design recommendation.

D. Prepare and submit two (2) paper copies and a PDF file of the study/report on such a scale where all items are legible, each utility is labeled, drainage is labeled, all above ground features are labeled, property lines are labeled, easements are labeled and there is a clear definition between the existing and proposed improvements. If the documents are not legible or properly labeled the submittal will not be reviewed and returned for corrections.

2.8.2 Design Phase:

For the design phase of the project, Engineer shall:

A. Establish the scope of any soil foundation investigations, Subsurface Utility Exploration (SUE), Environmental Investigations or other surveys/ tests which, in the opinion of the Engineer, may be required for a proper design of the project. The City will contract with the sub-consultants and arrange for such work to be done. The Engineer will provide the scope for the required investigations, review the preliminary report, provide comments as necessary to finalize the report and apply the results to the project design.

B. Furnish to the City the engineering data necessary for applications for routine permits by local, state, and federal authorities (as distinguished from detailed applications and supporting documents for government grant-in-aid or for planning advances).

C. Prepare detailed specifications and contract drawings for the project. This may include, but shall not be limited to, separate sheets for the following:

1. Title Sheet with Index & Project Location (see Engr. Dept. for standard cover sheet)

2. Project Layout

3. Right of Way (R.O.W.) Map indicating all existing and proposed R.O.W. & prepare a right-of-way deed map showing the existing right-of-way, lot numbers, subdivision names, volume and page of recorded instruments, street names, and existing proposed rights-of-way and easements for the project.

4. Typical Sections

5. Prepare Control/Geometric Layout indicating monuments found and set, the relationship of the project baseline or centerline to the monuments, and the benchmarks used and/or set.
6. Demolition Plan
7. Bid Item Quantities listed by sheet number and project total
8. Earthwork Summary
9. Paving Plan & Profile
10. Intersection Layouts
11. Signing and Barricading Plans
12. Construction Sequencing and Traffic Control (Utilities)
13. Construction Sequencing and Traffic Control (Paving)
14. Pavement Markings, conduit and signing layout
15. Stormwater Pollution Prevention or Erosion Control Plans
16. Water Line Plan; and Profile (12" or larger)
17. Sanitary Sewer Plan and Profile
18. Drainage Area Map (Existing and Proposed)
19. Run-off Computations
20. Inlet and Storm Sewer Computations
21. Storm Sewer Plan & Profile, Storm Lateral Profiles
22. Drainage Details
23. Signalizations Plans (if required)
24. Landscape Plans (if required)
25. Technical Specifications and/or Special Provisions for the project
26. Roadway Cross-Sections at 50 feet intervals and the centerline of driveways
27. Utility Plan and Profiles for ductbanks or other proposed utilities. (if required)
28. Construction Details not covered in the City or TXDOT Standard Detail sheets.

Final contract drawings shall be submitted on 24" x 36" plots and PDF files. The Engineer shall correlate pay items on drawings with City of Garland Standard pay items in the contract proposal.

D. During development of specifications, the Engineer shall place primary reliance on the Standard Specifications for Public Works Construction -North Central Texas - issued by the North Central Texas Council of Governments most currently adopted version by City of Garland, and the City's "Technical Standards Manual". During development of contract drawings, the Engineer shall place primary reliance on City approved standard drawings and bid items, (copies of which are available at the Engineering Department, the Texas Manual on Uniform Traffic Control Devices, and the Stormwater Quality Best Management Practices for Construction Activities as supplied by the North Central Texas Council of Governments). The Engineer shall develop the specifications and contract drawings in accordance with all Federal, State, or City specifications or regulations. The City of Garland standards shall supersede all aforementioned specifications and regulations.

E. Submit three (3) full size sets and one (1) half-size set of plans and one PDF file to the City for review.

F. Prepare and include in plans detailed construction signing and barricade plans for traffic control and safety (if needed). Primary reliance shall be placed in the Texas Manual for Uniform Traffic Control Devices. Provisions for construction phasing shall be included.

G. Prepare and Include Stormwater Pollution Prevention Plan (SWPPP) in accordance with the "Stormwater Quality Best Management Practices for Construction Activities" Manual as distributed by the North Central Texas Council of Governments and TSM.

H. Include appropriate provisions for trench safety as determined by a soil investigation report prepared by separate geotechnical engineers.

I. Revise and resubmit as needed upon review and comment by the City.

J. Provide an updated detailed Opinion of Probable Cost with each submittal.

K. Submit all necessary documentation for review/approval required by any agency for submittal to the City for any permits that may be required. The City of Garland shall submit to the applicable agencies.

2.8.3 C.I.P. Engineering Construction Procedures

For the construction phase of the project, Engineer shall:

A. Attend the Pre-Bid meeting and assist with answering questions and preparing Addenda's during the bidding phase,

B. Attend the Preconstruction conference and assist with answering questions during the construction phase.

C. Provide complete horizontal and vertical control, which, in the opinion of the City, is adequate for the eventual contractor to re-establish the horizontal and vertical control network for the project.

D. Provide limited construction phase engineering assistance. When requested by the City, the Engineer will visit the site and consult with the City and the contractor to resolve unusual or unexpected construction problems. The Engineer shall conduct a final project

inspection with the City and prepare recommendations concerning items that the Engineer observes during the final inspection that require additional work or adjustment. Provide written responses to request for information on clarifications.

E. Review the contractor's shop drawings and related submittals for compliance with City specifications and design adequacy to provide complete details acceptable for construction.

F. Prepare Record Drawings based upon mark-ups and information provided by the City Inspector. Submit one set of hardcopy, PDF and AutoCAD or MicroStation files of the Record Drawings with the as-built changes noted and the date and signature of the Engineer to the City Inspector. The page size shall be 22” x 34” with a minimum resolution of 300 dpi. The files must be free from objectionable background, rotated properly and stored in a separate folder on a CD/DVD.

This page left blank intentionally.

SECTION 3

SURVEY REQUIREMENTS

Section 3 – Survey Requirements

3.01 General 3-3
3.02 Horizontal/Vertical Datums 3-3
3.03 Horizontal Control/Geodetic Monuments 3-4
3.04 Vertical Control/Benchmarks 3-4
3.05 Subdivision Plats 3-5
3.06 Subdivision Monumentation 3-6
3.07 Offsite Easements/Easements By Separate Instrument 3-9
3.08 Right-of-Way & Easement Abandonment 3-9
3.09 License and Real Property Improvement Agreements 3-10
3.10 Capital Improvement Project Mapping & Monumentation 3-11

Section 3 – Survey Requirements

3.01 General

In the interpretation and application of the provisions in these survey requirements, it is the intention of the City that the principals, standards and requirements provided herein and the General Rules of Procedures and Practices of the Texas Board of Professional Engineers and Land Surveyors (TBPELS), shall be minimum standards for the projects involving survey, and where other Ordinances of the City are more restrictive, such Ordinances shall control, as they exist or may be amended. Professional Surveying is defined by the State of Texas Occupations Code, Sec. 1071.002 thusly; "Professional surveying" means the practice of land, boundary, or property surveying or other similar professional practices. The term includes:

A. performing any service or work the adequate performance of which involves applying special knowledge of the principles of geodesy, mathematics, related applied and physical sciences, and relevant laws to the measurement or location of sites, points, lines, angles, elevations, natural features, and existing man-made works in the air, on the earth's surface, within underground workings, and on the beds of bodies of water to determine areas and volumes for:

   1. locating real property boundaries;

   2. platting and laying out land and subdivisions of land; or

   3. preparing and perpetuating maps, record plats, field note records, easements, and real property descriptions that represent those surveys; and

B. consulting, investigating, evaluating, analyzing, planning, providing an expert surveying opinion or testimony, acquiring survey data, preparing technical reports, and mapping to the extent those acts are performed in connection with acts described by this section.

All work products submitted to the City of Garland for requirements outlined herein, must be signed and sealed by a Registered Professional Land Surveyor registered with the TBPELS.

3.02 Horizontal/Vertical Datums

The City of Garland **Geodetic Control Network** is published on the Texas Coordinate System of 1983 (as codified in the Texas Natural Resources Code) and the equivalent North American Datum of 1983 (NAD83) and on the North American Vertical Datum of 1988 (NAVD88). Unless specified otherwise or approved by the City Surveyor, the datum for capital improvement projects and private development projects must be NAD83 for horizontal datum and NAVD88 for vertical datum. Refer to the Garland Geodetic Network for monument information.

A. Garland Geodetic Monument Map

B. Garland Geodetic Monument Data Sheets

3.03 Horizontal Control/Geodetic Monuments

All projects, public and private, shall be tied to the Texas Coordinate System of 1983(NAD83), with sufficient (subject to review and approval by the City Surveyor) number of State Plane Coordinate pairs to enable retracement. Scaled coordinates, surface coordinates, or other datums shall not be accepted and revisions shall be required if attempted, unless approved by the City Surveyor. When identifying State Plane Coordinates on any project, the Registered Professional Land Surveyor ("RPLS") shall:

A. Provide a metadata statement (see example in Section 3.06.C to include a reference to the datum, properly cited as the "Texas Coordinate System of 1983, North Central Zone", as stated in Title 2, Subtitle B, Chap. 21, Subchapter D, Sec. 21.075 (b) of the Texas Natural Resources Code, and the following items;

B. Statement of the method by which the coordinates were obtained;

   1. Conventional ties to City of Garland Geodetic Monuments (state which monuments were used and their coordinates, and City of Garland datum year);

   2. Via OPUS;

   3. Via static post-processed data;

   4. Via RTK ties to City of Garland Geodetic Monuments (state which monuments were used and their coordinates, and City of Garland datum year);

   5. Via VRS-RTK (identify VRS network).

For Subdivision Monumentation requirements, see Section 3.06. For Capital Improvement Project monumentation requirements, see Section 3.10.

3.04 Vertical Control/Benchmarks

All projects, public and private shall have, at a minimum, a primary/source and secondary/onsite benchmark shown, along with a written locative description and elevation, on all plan sheets. Benchmark/Geodetic Control information is also available on the City of Garland and National Geodetic Survey (NGS) websites at, Garland Geodetic Network and https://geodesy.noaa.gov/NGSDataExplorer/. All benchmarks shall be tied to City of Garland or NGS geodetic monuments. Include metadata in descriptions, citing NAVD88 datum with monument identifier, if any. The vertical datum (benchmarks, geodetic monuments) used for topographic surveying and civil engineering design must be approved by the City Surveyor. Significant plan revision may be required if the vertical datum is not approved. Therefore, it is incumbent upon the applicant to contact the City Surveyor prior to topographic surveying or civil engineering design. Contact the City Surveyor for questions regarding benchmarks.

3.05 Subdivision Plats

A plat is the legal document and graphic presentation of one (1) or more lots or tracts of land, or of a subdivision, resubdivision, combination or recombination of lots or tracts. It typically includes a drawing and written description of property boundaries, easement and right-of-way dedications, owner's certificate, approval statements and signatures. Platting is the process for subdividing land and allowing public infrastructure to be planned in a comprehensive manner. Platting is required to divide a lot or tract into two or more parcels for purposes of transfer of ownership or development of the parcels. Although a conveyance of property may be accomplished through a metes and bounds description without the necessity of platting, the conveyance will not be recognized as a building site, nor will the lines of ownership be recognized for the purpose of determining development rights on the conveyed parcel. The plat becomes part of the public record through recordation in the applicable County Clerk's office. It is the policy of the City of Garland to subject the subdivision, platting and replatting of land to the control of the City pursuant to the City charter, state law, and all other rules, regulations, and policies the City may adopt. Consult the Working Plat Submittal Requirements document for required items for Working Plat submittal. Once Working Plat has achieved Acceptable Status, contact the Planning Department for Plat Application requirements.

Properties must be platted in order to obtain a Site or Building Permit in the City of Garland. When these permits are required submit five complete sets of public works and site engineering construction drawings that include a copy of the Working Plat as defined herein and in Section 2.4 to the Engineering Department.

The Plat Submittal Process is comprised of two (2) components or steps:

1. Working Plat Submittal
    a. Neither a plat application, nor fee is required for a Working Plat submittal.
    b. The Working Plat is required to be submitted with, and placed in, public works and site engineering construction plans, if any.
    c. Shall achieve "Acceptable Status" to proceed to step two (2)

2. Plat Application Submittal
    a. "Acceptable Status" notification from Engineering Department required
    b. Submittal shall be made to Planning Department
    c. Completed Plat Application form required
    d. Plat Application fee required

For specific information on plat types, see GDC Chapter 3, Article 2.

The term "*Working Plat"* is simply a temporary designation assigned to any type of plat (i.e. - final, replat, amending, minor, etc.) which is under review by City Staff. The temporary designation "Working Plat" shall be placed above the type of plat specified in the title block. The Working plat is reviewed by staff for technical compliance with GDC, TSM, and Plat Checklist requirements. Once all technical requirements have been met and staff comments have been addressed, including any technical comments or requirements that may be included in the public works and site engineering construction drawings (if any), the Working Plat is considered to have achieved *"Acceptable Status"* and will be eligible for a Plat Application submittal to the Planning Department. After achieving *"Acceptable Status"*,

notification from the Engineering Department will be sent to the developer's identified contact.

Final approval of construction plans is not necessary in order for a plat to be considered for placement on the Plan Commission Agenda for approval, but the exact alignment and dimensions for all rights-of-way, utility, drainage and detention easements to be dedicated must be established and approved by departments providing technical review.

Since a plat is recorded with the County Clerk and becomes a legal document,revisions to it require amending or replatting depending upon the nature of the revision, and can be very time consuming. To avoid replatting and unexpected delays, ensure accuracy by thoroughly checking all metes and bounds descriptions. Furthermore, thoroughly review the current City of Garland Plat Review Checklist, in Appendix 3A and ensure all City Surveyor's requirements are met. **The Plat Review Checklist outlines all technical requirements, such as sheets size, text size, plat elements, etc.** Additionally, use the appropriate dedication forms shown in Appendix 3B. From time to time, plat dedication forms may be revised by the City. Additionally, plat dedication forms may be modified for a particular plat at the direction of the City Surveyor or City Attorney's Office.

The Developer's Surveyor or Engineer is responsible for ensuring that the plat matches the proposed easements shown on the public works and site engineering construction plans. Compare utility, drainage and street construction plans with the plat and ensure all easements are properly reflected.

3.06 Subdivision Monumentation

Survey Monumentation for all subdivisions shall conform to the following requirements unless alternate monumentation is proposed in writing to, and approved by the City Surveyor:

• PERIMETER OF PLATTED BOUNDARY – not withstanding additional requirements outlined in subsection A, all angle points, points of curve, and points of tangency shall be monumented with a three & one-quarter inch (3 1/4") metallic cap disk attached to metal pipe or rod and imprinted with inscriptions shown herein

• BLOCK CORNERS - atwo inch (2") metallic cap attached to metal pipe or rod and imprinted with "RPLS" or "firm" and appropriate registration number of the surveyor or firm

• LOT CORNERS – a five-eighths (5/8") inch diameter metal pipe or rod with cap imprinted with "rpls" or "firm" and appropriate registration number of the surveyor or firm

A. Install new subdivision monuments on at least (2) two corners of the boundary (if monumentation is not found) of the proposed subdivision in unobstructed areas if possible, or at alternate locations proposed in writing to, and approved by the City Surveyor. Visibility between monuments or from a third random traverse point before and after the subdivision is constructed is preferred. Monument specifications (available from Berntsen International. Inc. 1-800-356-7388 or at www.berntsen.com) are as follows:

1. Berntsen RBD5325 - 3 1/4” Domed cap for 5/8” Rebar (Aluminum) set flush with natural ground within 6” PVC sleeve as described in subsection 3 below.

2. 3-1/4” Domed cap engraved "Subdivision Monument" including the subdivision name and year set, (i.e. - "Joe Q. Public Estates - 2019", and “Do Not Disturb”). Berntsen item # RBD5325: Cap, domed top 3-1/4" for 3/4" aluminum. Example:

   Top outer circle- SUBDIVISION MONUMENT
   Top inner circle- JOE Q. PUBLIC ESTATES
   Lower inner circle- -2019
   Lower outer circle- DO NOT DISTURB

3. 6” schedule 40 PVC sleeve, 3 feet long housing for monument - 6" x 36".

4. Berntsen Bench Mark access cover with engraving " Subdivision Monument" including the subdivision name and year set, (i.e. - "Joe Q. Public Estates - 2019"). Berntsen item # BMAC6 for 6" PVC with engraving.

5. Adhesive for access cover - Berntsen item # E6800: E6800 adhesive for BMAC clear with UV protection.

B. Provide horizontal data, including metadata, on plat for each new monument (unless otherwise directed by City Surveyor) including:

   1. Texas Coordinate System of 1983, North Central Zone (4202) State Plane Coordinates (surface or scaled coordinates are not State Plane and are not acceptable) in feet.

   2. Appropriate metadata (see example in Item C below).

If monumentation on the boundary of the subdivision is found at time of platting, alternate locations within the subdivision (i.e. – block corners, lot corners, etc.) must be used for subdivision monuments, the locations of which may be specified by the City Surveyor.

C. ALL SUBDIVISION PLATS, REGARDLESS OF THE TYPE OF MONUMENTATION REQUIRED HEREIN, MUST HAVE STATE PLANE COORDINATES (referenced as “Texas Coordinate System of 1983, North Central Zone (4202)” as set forth in the Texas Natural Resources Code) SHOWN ON THE FACE OF THE PLAT ON AT LEAST TWO (2) CORNERS OF THE SUBDIVISION BOUNDARY INCLUDING METADATA NOTE. IF THE COORDINATES ARE OBTAINED INDEPENDENT OF THE CITY’S GEODETIC CONTROL, VIA OPUS, STATIC POST-PROCESSED, OR VRS-RTK METHODS, STATE SUCH. IF CITY GEODETIC MONUMENTS WERE USED (MUST TIE TO MINIMUM OF TWO), LIST METHOD OF TIE (CONVENTIONAL, RTK, STATIC, ETC.). A METADATA NOTE SIMILAR TO THE ONE BELOW MUST BE ON THE SUBDIVISION PLAT.

EXAMPLE METADATA STATEMENT, DO NOT COPY THE NUMERIC VALUES IN THIS EXAMPLE:

*COORDINATES (*insert "AND BEARINGS" here if used for basis of bearings also) SHOWN HEREON ARE NAD83 (CORS??, EPOCH *????) TIED TO THE TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE (4202) USING CITY OF GARLAND GEODETIC CONTROL MONUMENTS 24 AND 25 (state which specific monuments were used);*

GPS24 - N=7021483.019	*GPS25 – N=7023392.672*
E=2538741.969	*E=2545208.193*
Z=554.14	*Z=526.18*

D. Unless otherwise indicated herein, all lot corners shall be monumented with a 5/8" iron rod or larger, with a cap stamped with the responsible RPLS Registration number (i.e.- RPLS 9999), Firm name or TBPELS Firm number of the surveyor of record that is traceable to the registrant. Lot monumentation size, material, cap color and inscription shall be noted on the plat. More substantial materials, such as aluminum, bronze, or brass caps are recommended.

E. Placement of monumentation on and within the boundary of property being platted in which areas are to be dedicated to the public;

1. Monumentation shall be installed on the boundary of such property being platted at all corners, angle points, and points of curvature and tangency, except those points falling within areas to be dedicated. In areas to be dedicated, all points on new right-of-way lines shall be monumented. Monumentation shall be installed within the boundary of such property being platted at the following points:

   a. All corners of parks, squares, or other portions intended for public use.

   b. All block corners.

   c. On the right-of-way lines of all alleys and public and private streets at all points of intersection, angle points, and points of curvature and tangency.

F. If new construction will damage, destroy, or alter existing survey markers, monuments, or property corners, they must be re-set prior to final acceptance of the subdivision by the City of Garland Engineering Department. Prior to acceptance of subdivision improvements by the City, a letter titled "REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION" (for sample letter see Appendix 3F) from the responsible Registered Professional Land Surveyor shall be submitted to the City Surveyor stating request for a field inspection and verification of subdivision monumentation and for the release of the subdivision monumentation hold by the Engineering Department. A copy of the recorded subdivision plat shall accompany the request letter. All monumentation shall be flagged and marked for field inspection.

G. Prior to acceptance of subdivision improvements by the City, a Public Utility Survey shall be completed as part of the as-built process. See Section 2.7.10 of the TSM for more information.

3.07 Offsite Easements/Easements by Separate Instrument

When an offsite easement or easement by separate instrument is required, provide exhibit(s), containing graphic drawing and metes and bounds description with your initial plan submittal. For property needing a Building or Site Permit, City Utility Easements by separate instrument can be no greater than 150-feet in length, otherwise the property shall be replatted. Plan ahead, securing and coordinating approval of offsite easements is a time consuming process and may cause delays. Descriptions and drawings for all offsite easements or easements by separate instrument shall substantially conform to the **City of Garland Field Note Guidelines** (see Appendix 3G). All offsite easements/easements by separate instrument required for development shall be filed of record (by the applicant) with the Dallas County Clerk (or the appropriate county), a copy provided to the Engineering Department, and the recording information shown on the plat **prior to approval by staff and Plan Commission consideration**. Final plats are not allowed on the Plan Commission agenda without recording information for offsite easements/easements by separate instrument or abandonments. Whether or not a plat is involved, the required documents must be filed of record (by the applicant) and a filed copy provided to the Engineering Department.

Contact City Surveyor's Office easement form language.

3.08 Right-of-Way & Easement Abandonment

Rights–of-way and easements are dedicated to the City and are held in trust for public use for the purpose intended. Public right-of-way and easement abandonment is the process by which the City releases the public's interest, if any, in rights-of-way or easements. Public rights-of-way or easements may have been acquired through various dedications, including by plat, deed, or separate instruments. Typically, the easement would need to be abandoned in the manner in which it was dedicated. That is to say, if the easement was created by plat, it would need to be abandoned by replat, or if created by separate instrument, then it would need to be abandoned by a separate instrument. Only the City council can formally abandon City of Garland's interests, if any, in rights-of-way or easements. Additionally, some form of consideration may be required for abandoned rights of way and easements, which shall be determined at the time of application review.

Areas to be abandoned (if acquired by separate instrument) within the platted area shall be processed by separate document/instrument and recording data, ordinance or resolution numbers shall be noted on the plat prior to approval by staff and Plan Commission consideration. Abandonment requests require a completed abandonment application (see Appendix 3C), unless waived by the Director of Engineering, and are subject to approval by City Council. A pre-submittal meeting may also be required. Any letters of agreement from other entities including, but not limited to, City of Garland Parks Department., T.M.P.A., N.T.M.W.D., etc. shall be provided to the Engineering Department. Franchise utility contact information and a sample letter is available from the Engineering Department. It is the applicant's responsibility to obtain current contact information for franchise utilities if the provided list has changed.

See Appendix 3C for Application for the Abandonment/Vacation of a Public Easement, Street or Alley Right-of-way form.

In certain cases, a License Agreement or Real Property Agreement may be more appropriate if the request only involves minor encroachments as defined below in Section 3.09. Sidewalk escrow, right of way and easement abandonment are processed in conjunction with, or prior to platting, all of which are administrated by the Engineering Department. See 2.4.9.D for sidewalk escrow information.

The following documents are required for easement or right of way abandonment:

A. Letter to the Director of Engineering requesting the abandonment of a City right of way or easement, and the subsequent purpose for which the property shall be used. Please reference the City case number (assigned by the Planning Dept.) on all correspondence and submittals.

B. Application for the Abandonment of a Public Easement, Street or Alley Right of Way form ("Abandonment Application"), see Appendix 3C. The application shall include, but not be limited to;

   1. A boundary survey with metes and bounds description and graphical depiction of the area to be abandoned depicting all existing easements of record, both signed and sealed by a registered professional land surveyor in the State of Texas;

   2. Provide a separate improvement survey drawing, locating and labeling on the ground locations of all adjacent, contiguous and intersecting public and private utility lines, structures, or other facilities within the abandonment area;

   3. Approval signatures in Abandonment Application or letters of consent from all public/franchise utility companies (if applicable);

   4. Approval signatures in Abandonment Application or letter of consent from all abutting property owners (if applicable).

   5. In certain cases, the existing instrument of record to be abandoned may be used as the exhibit, labeled at the top of each page as "Exhibit 'A'", or other letter, as directed by City Surveyor or City Attorney's Office in lieu of Item No. B(1) described above.

3.09 License and Real Property Improvement Agreements

The Director of Engineering may allow a minor or temporary encroachment into a City right of way or easement. A License Agreement (Appendix 3D) grants the applicant the right to limited use of City owned right of way for a designated purpose. A Real Property Improvement Authorization (Appendix 3E) grants the applicant the limited use of a City easement for a designated purpose. For the purpose of this section, a minor or temporary encroachment means any use that will not;

A. Significantly affect the public interest,

B. Unreasonably interfere with the paramount and primary purpose, for which the street, alley, easement or other property interest exists,

C. Unreasonably interferes with existing uses within the area of the proposed license.

The owner must complete the appropriate form, sign and notarize it and submit the original signed documents to the Engineering Department for filing with the applicable County Clerk's office. The applicant is responsible for the cost of the filing fee; consult County Clerk's office for current rates and other requirements regarding filing documents. Make checks payable to the **Dallas County Clerk's** office (or the appropriate county). When the completed agreement is submitted the Director of Engineering will sign it, and send it to the applicable County for filing. Once the filed copy is received from the County, a copy can be provided for your records upon request.

3.10 Capital Improvement Project Mapping & Monumentation

A. Surveying Phase for Design and Construction:

In preparing and executing surveys for the design and construction of the project, the Surveyor shall:

1. Establish permanent monumentation for horizontal and vertical project control. The project shall be tied to the Texas Coordinate System of 1983, North Central Zone (4202)(cite current NGS reference frame).. North American Vertical Datum of 1988 (NAVD88) datum shall be utilized for vertical control. Regardless of method of connection (i.e.- static, RTK, VRS, conventional, etc.) to the Texas Coordinate System of 1983, North Central Zone (4202) and NAVD88 datums, both published and measured coordinates (N,E,Z) on a minimum of two (2) City Geodetic Control Monuments shall be shown. Approval is at the discretion of the City Surveyor.

    a. Locate right-of-way lines and corners, property lines and corners, buildings, fence lines, trees 3 inches in diameter and larger, edges of pavement and all other visible surface features with respect to the project control baseline. Existing utility structures, signs and appurtenances shall be located and referenced by utility name (e.g. ONCOR Electric, TXU Gas, Frontier, Etc.)

    b. Vertical topographic information tying pavement, curbs, drives, walls, manholes (top and inverts), storm drain inlets (top and inverts), and other physical features as needed within the project areas for the design. .

2. Research City, County, State, or other entities for applicable record documents as necessary, and establish the location of existing boundary lines and easements for the project. Furnish copies of all real estate documents to the City.

3. In cooperation with the City and other franchised utilities, determine the locations and elevations of existing underground utilities. In particular, locations of major underground franchise facilities shall be shown in all profiles.

4. Incorporate aerial, topographic, and planimetric survey data provided by the City.

B. Design Phase:

For the design phase of the project, a Registered Professional Land Surveyor shall:

1. Prepare, seal and sign the project Right-Of-Way Map(s) with a certification stating that the survey conforms to the minimum standards set forth by the TBPELS. All monuments located within the project corridor during the course of the survey must

be illustrated on the right-of-way map with a project station and offset or coordinates that relate to the project control, whether or not such monuments are used for analysis and/or construction of the project Right-Of-Way. All monuments placed or perpetuating found objects must be reported to the minimum technical standards of the TBPELS.

2. Prepare all necessary property descriptions and 8 1/2 X 11-inch exhibits needed for additional right-of-way and easement acquisition. All descriptions and exhibits must conform to the minimum technical standards of the TBPELS and the requirements of the City Surveyor. Right-of-way and easements shall be delineated on and cross-referenced to the appropriate plans and profile sheets. The plan and profile sheets shall clearly indicate all private property that is in conflict with the proposed construction. Two (2) copies of each exhibit document sealed by a Texas Registered Professional Land Surveyor shall be submitted.

C. Construction Phase:

For the construction phase of the project, a Registered Professional Land Surveyor (RPLS) shall:

1. Provide complete horizontal and vertical control, which, in the opinion of the City, is adequate for the eventual contractor to re-establish the horizontal and vertical control network for the project.

2. After final acceptance of construction by the City, and at the discretion of the City, the Engineer shall require an RPLS to:

   a. Establish “permanent” survey monumentation for control throughout the project

   b. Establish right-of-way corridor permanent monumentation at all control points, points of intersection or deflection, points of curvature, points of tangency and intersecting street/block corners.

   Definitions:

   i. “Permanent” survey monumentation is described as a 3-1/4” aluminum domed top disc for 5/8” rebar (Berntsen #RBD5325) set in concrete per City specifications or alternate approved by the City Surveyor.
   ii. Project control monumentation shall bear the inscription “CONTROL”.
   iii. Right-of-Way monumentation shall bear the inscription ”CITY OF GARLAND ROW”.
   iv. Parcel Description ROW monumentation shall be, at a minimum, a 5/8” x 18” rebar marked in a way that is traceable to the registrant unless it is a part of the final ROW corridor monumentation, which shall then conform to Section 3.06 (A), or unless alternate is approved by the City Surveyor.

D. Special Services/ Right-Of-Way Monumentation:

If required by the Engineering Department for the project, a Registered Professional Land Surveyor shall:

1. As a result of the creation of new right-of-way, establish and monument new right-of-way corridor geometry and new Parcel Description property corners for adjoining parcels upon completion of project in accordance with the minimum technical standards of the TBPELS, and the specifications in subsection 3(i) and 3(iii) below. A Registered Professional Land Surveyor must certify the following on the face of the project As-Built ROW Map

2. *A survey has been completed for the additional ROW shown on the accompanying map; and as of [insert completion date of survey here], all monuments found or placed defining the ROW geometry or ROW parcels have been field verified as to their existence and location as originally found or have been reset (if unstable/disturbed or destroyed) in accordance with the minimum technical standards of the TBPELS.* On projects where no new right-of-way is acquired, upon completion of the project the surveyor shall, verify existence of, or reset, found right-of-way monumentation and property corners for adjoining parcels. Where monumentation must be reset, it shall conform to the minimum technical standards of the TBPELS and specifications in subsection 3(i) and 3(iii) below. A Registered Professional Land Surveyor must certify the following on the face of the project "As-Built" Right-Of-Way Map:

   A retracement survey has been completed of the right-of-way shown on the accompanying map; and as of [insert completion date of survey here], all monuments found or placed defining the right-of-way geometry or existing adjoining parcels have been field verified as to their existence and location as originally found or have been reset (if unstable/disturbed or destroyed) in accordance with the minimum technical standards of the Texas Board of Professional Engineers and Land Surveyors.

3. Definitions:

   i. "Permanent" survey monumentation is described as a 3-1/4" aluminum domed top disc for 5/8" rebar (Berntsen #RBD5325) set in concrete per City specifications or alternate approved by the City Surveyor.
   ii. Project Control monumentation shall bear the inscription "CONTROL".
   iii. ROW corridor monumentation shall bear the inscription "CITY OF GARLAND ROW".
   iv. Parcel Description ROW monumentation shall be, at a minimum, a 5/8" x 18" rebar marked in a way that is traceable to the registrant unless it is a part of the final *ROW corridor monumentation described in Section 2(D) 5.c.i.1.*, or unless alternate is approved by the City Surveyor.

This page left blank intentionally.

SECTION 4

DRAINAGE DESIGN REQUIREMENTS

Section 4 – Index

Section 4 – Drainage Design Requirements

4.01 General 4-3
4.02 Downstream Assessment 4-3
4.03 Schematic Drainage Plan for use with Private Development Projects 4-6
4.04 Schematic Drainage Plan and Capacity Analysis 4-6
4.05 Determining Design Discharge 4-8
4.06 Street Capacity 4-14
4.07 Alley Capacity 4-15
4.08 Valley Gutters 4-15
4.09 Inlet Location and Capacity 4-15
4.10 Design of Enclosed Storm Sewer System 4-24
4.11 Detention/Retention Facility Design 4-35
4.12 Miscellaneous Drainage Requirements 4-40
4.13 Open Channel Design 4-42
4.14 Hydraulic Design of Culverts 4-47
4.15 Bridge Design Hydraulics 4-48
4.16 Energy Dissipators 4-49
4.17 Floodplain Alterations 4-49
4.18 Erosion and Sedimentation Control 4-53
4.19 Drainage Easements 4-53
4.20 Sustainable Development 4-54

Section 4 – Drainage Design Requirements

4.01 General

A. This section contains the minimum storm drainage design criteria to be followed in the design of storm drainage facilities and demonstrates the design procedures to be used on drainage projects in the City of Garland.

B. The design factors, formulas, graphs and procedures described are intended to serve as guidelines. Responsibility for the actual design remains with the Engineer. Deviation from the requirements of these standards shall be approved by the Director of Engineering.

C. The Engineer shall prepare the design plans in accordance with the standard design checklist, see Appendix 2A.

D. It is the responsibility of the Engineer to provide all necessary calculations and designs described herein. The Engineer shall provide the City the data, calculations, and designs necessary to demonstrate the design does not adversely impact the surrounding or downstream property and meet local, state, and federal rules, regulations, and requirements.

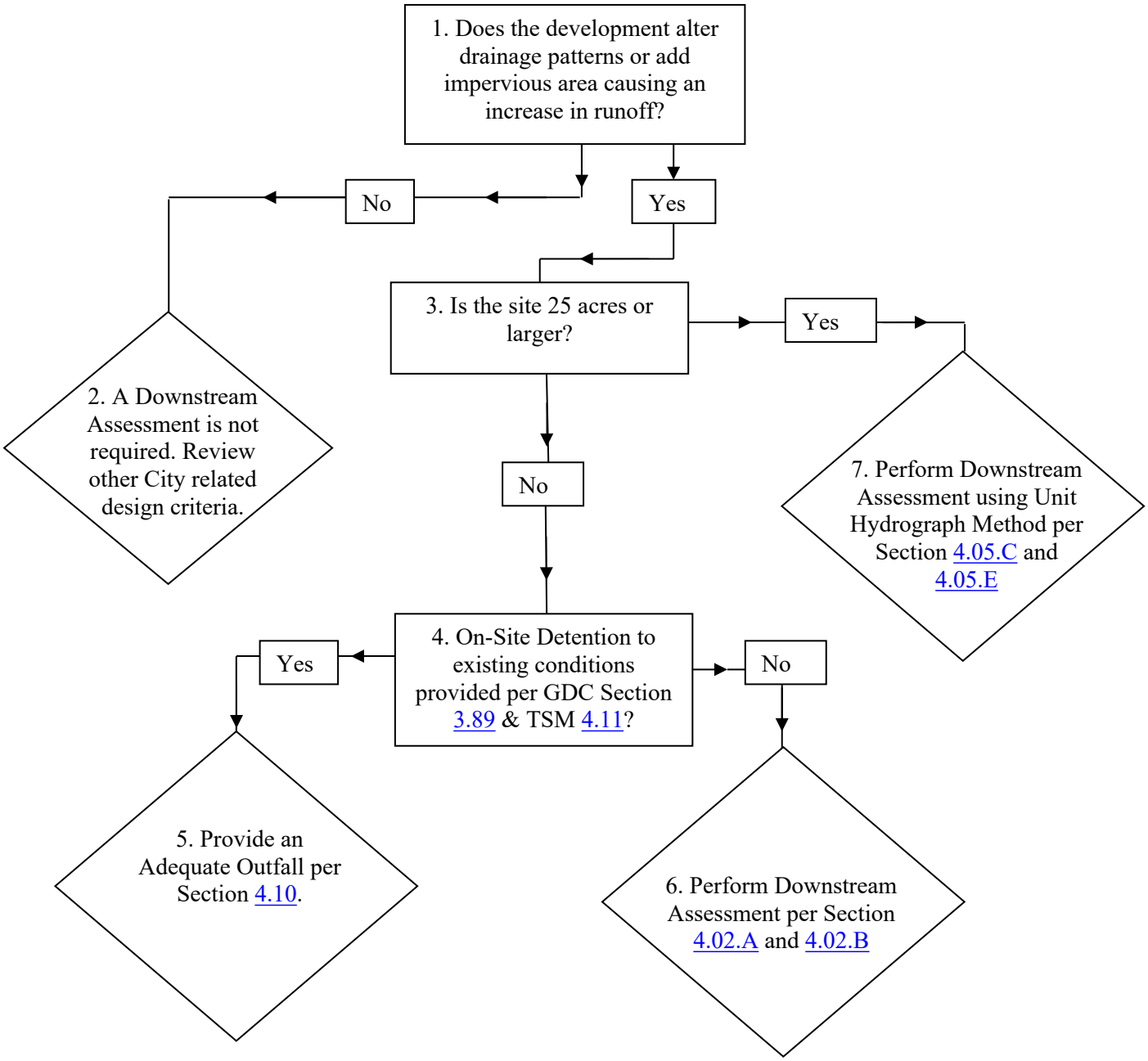
E. The Engineer shall use the city's base models for development along floodplain areas. If a model is not available, the Engineer shall be required to provide a floodplain model in accordance with city standards and guidelines.

F. The proposed project must be designed to minimize exposure of subdivisions and surrounding property to flood damage and provide adequate utility service as required by Chapter 31 of the City of Garland's Code of Ordinance and Garland Development Code (GDC). Although staff reviews plans for these issues, the project Engineer is ultimately responsible for the accuracy, completeness and conformance with City ordinances, policies and standards. The City's review is limited to the facts as presented on the submitted plans. The City has no project engineering responsibility and will not provide any specific design instructions. The Engineer sealing the plans is responsible for the accuracy and completeness of the documents submitted for review. The City reserves the right to require corrections for actual field conditions which are found to be different or information omitted on the plans.

4.02 Downstream Assessment

A. The design of a storm drain facility must account for the offsite flows that are routed through the development, flows generated by the development, and the impacts of the development and the drainage system on downstream facilities. The storm water discharge from the development shall not cause adverse impacts to adjacent or downstream properties or facilities. In order to determine the impacts to the downstream properties or facilities, a Downstream Assessment may be required. The following summarizes the process for a Downstream Assessment.

Figure 1: Downstream Assessment Flow Chart



B. Where applicable, a Downstream Assessment shall be prepared and submitted to the City with the schematic drainage plans described in Section 4.03. The study shall demonstrate the development will produce no adverse impacts. No adverse impacts may include, but are not limited to:

1. No new or increased flooding of existing insurable (FEMA) structures (habitable buildings).

2. No increases in water surface elevations for the 2-, 25-, and 100-year storm events unless contained in an existing channel (with a minimum 1-foot of freeboard), roadway, drainage easement, or ROW. Dry lane and gutter capacity requirements set forth in Section 4.06 shall also be met.

3. Post-development channel velocities shall not be increased by more than 5% above pre-development velocities. Exceptions to these criteria may require a certified geotechnical/geomorphologic study that provides documentation that a higher velocity will not increase erosion.

4. No increases in downstream discharges caused by the proposed development that, in combination with existing discharges, exceeds the existing capacity of the downstream storm drainage system.

5. When a storm sewer analysis has determined the existing downstream system does not have capacity for fully developed conditions and the total increase in unrestricted post-developed Q-100 leaving the site is less than or equal to 5.0 cfs versus pre-developed Q-100, then onsite flow regulation methods may be used to decrease the post-developed Q-100 to be equal to or lower than the pre-developed Q-100 leaving the site. If the unrestricted post-developed Q-100 is greater than the pre-developed Q-100 by more than 5.0 cfs, then detention of stormwater runoff or off-site improvements to the undersized storm sewer system are required. Alternatively, if the proposed development is adjacent to a FEMA mapped floodplain and a detailed analysis demonstrates the peak of the runoff hydrograph from the development will beat the peak of the nearest downstream receiving stream's hydrograph, then the Engineering Department will evaluate whether a detention exemption is applicable.

6. The Downstream Assessment shall extend to a point downstream where the proposed development creates no adverse impacts. The downstream point is known as the Zone of Influence. The Engineer shall determine how far downstream the analysis for the Downstream Assessment shall extend. For properties less than 25 acres, the Downstream Assessment may use the 10% rule to determine the Zone of Influence. For all other properties, the Zone of Influence will be defined by a detailed hydrologic and hydraulic modeling analysis.

7. The 10% rule states the Zone of Influence can be considered to be the point where the drainage area controlled by the drainage facility comprises 10% of the total drainage area. As an example, if a structural control drains 10 acres, the Zone of Influence ends at a point where the total drainage area is at least 100 acres.

8. If a portion of a larger property is being developed, the Zone of Influence shall be determined based on the entire property.

C. Separate analysis is required for each major outfall from the proposed development. Once the analysis is complete, the designer must answer the following three questions at each determined junction downstream:

1. Are the post-development discharges greater than the pre-development discharges?

2. Are the post-development velocities greater than the pre-development velocities?

3. Are the post-development velocities greater than the velocities allowed for the receiving system?

These questions shall be answered for each of the three storm events. The answers to these questions will determine the necessity, type, and size of non-structural and structural controls to be placed on-site or downstream of the proposed development.

4.03 Schematic Drainage Plan for use with Private Development Projects

A. It is important that the Schematic Drainage Plan identify and locate existing and proposed rights of way, drainage facilities, floodplains, landscape buffers, utility lines and easements, since these features have a strong influence and often dictate the placement of structures, parking, and other permanent site improvements. Basically, the schematics show the project can work with the existing infrastructure or if it cannot, it identifies any needed on- or off-site improvements. The schematics, while not to the level of detail of construction drawings, allows staff the means to assess the project's potential impact on surrounding properties, infrastructure and floodplains. The importance of these plans cannot be overemphasized. Frequently, inadequate schematics are detrimental to all succeeding project phases.

B. Staff may waive the need for certain aspects of the schematic plans. This occurs when a development's impact on surrounding infrastructure and other properties are minimal; or when the adequacy of existing infrastructure is not in question.

C. See Section 2.3 for additional plan requirements.

4.04 Schematic Drainage Plan and Capacity Analysis

A. Include an engineer-scaled drawing showing the topography of the property on and within 50 feet of the development, along with all other applicable information defined in this section. Two foot contour interval topographic maps are available from the Engineering Department's Records Division for a small fee.

B. Provide a drainage area map for pre- and post-developed conditions; where applicable include offsite contributing areas.

C. Locate and identify existing and proposed drainage patterns, storm sewer layout, sizes, inlets, streams, swales, stream crossings, retaining walls, total additional imperviousness, boundaries of wooded areas and tree clusters, 100-year runoff entering and leaving the site and disposition of the stormwater runoff before and after

development. Where applicable, label public and private storm sewer segments; refer to Section 4.19 B for more information.

D. Define how the existing system will function under the new loading and any sustainable features that are proposed.

E. Where required by the downstream assessment analysis, show the location and preliminary sizing of offsite improvement required to connect to the public drainage system, including any easement needs.

F. Locate and label any amenity, retention and detention pond(s), easement(s), and outlet structure(s), include preliminary sizing calculations. Define water quality enhancement feature and probable location; provide dimensional control from property lines.

G. Environmental feature assessments shall include a delineation of onsite floodplains, creeks, seeps, springs, steep slopes, significant tree clusters, landfills, underground storage tanks, archaeological features, wetlands and Waters of the U.S. This information does not need to be on a separate sheet.

H. Plot and label the FEMA effective 100-year floodplain and floodway, reclamation areas, ditches, creeks, ponds, wetlands, and mitigation areas on and within 100 feet of the development. For development along Rowlett and Spring Creek, use the 100-year fully developed floodplain per the1988 Rowlett and Spring Creek Flood Plain Management Study.

I. If floodplain reclamation is proposed, provide bound copies and a PDF of the complete report along with a compact disk of the effective, pre- and post-project computer models along with all supporting information including but not limited to cross sections, profiles, and work maps see Section 4.17 for requirements. The analysis must show that the development will be reasonably safe from flooding during the 100-year storm.

   1. Be advised the City of Garland requires changes to be made to the effective FIRM maps and Flood Insurance Study (FIS) documents if any of the following occurs as a result of the proposed work in a designated 100-year floodplain:

      a. A change in water surface elevation
      b. A change in the floodplain boundaries
      c. A physical change to the hydraulic model (e.g. fill or excavation, roadway, structures).

J. Keep in mind, State and Federal permits may be required when developing property particularly when development occurs within the floodplain, along Waters of the U.S. or on property containing wetlands. Define whether State or Federal permits are expected. It is critically important that you contact State and Federal agencies early in the process so their requirements can be incorporated into your development plan and schedule. While staff will attempt to inform you what permits may be required it is your responsibility to comply with all State and Federal regulations.

4.05 Determining Design Discharge

The Rational Method may be used to determine the runoff generated from a property when a contributing drainage area is less than 200 acres. A unit hydrograph method shall be used to determine the runoff generated from a property with a contributing drainage area greater than 200 acres. The Director of Engineering may require developments with contributing drainage areas less than 200 acres to use a unit hydrograph method if the hydrologic results of the contributing drainage area or components within the drainage area more accurately reflect a unit hydrograph.

A. Rational Formula (Drainage Areas < 200 acres)

The Rational Formula for computing peak runoff rates is as follows:

$$Q = C * I * A$$

Q = runoff rate (cfs)
C = runoff coefficient (dimensionless)
I = rainfall intensity (in/hr)
A = drainage area (ac)

B. Runoff Coefficient (C)

1. Runoff coefficients shall be based on the future land use plan, which is included in the Envision Garland Comprehensive Plan available on the City's website under the Planning Department tab. Runoff coefficients reflecting other conditions may be used based on the guidelines set forth in Section 4.05.F.

2. Table 4.1 below provides guidelines for runoff coefficients for typical land use within the city; however, a weighted runoff coefficient may be used for the design if it is more representative of the site conditions.

Table 4.1 Runoff Coefficients and Inlet Time Guidelines

Land Use	Runoff Coefficient "C"	Inlet Time (Minutes)
Single Family Residential	0.50	15
Two Family, Patio Home, Town Home	0.70	10
Multiple Family	0.80	10
Non-Residential Uses	0.90	10
Park Area	0.35	20
School	0.70	10
Church	0.80	10
Undeveloped	0.30	20
Hospital	0.90	10
Streets	0.90	10

3. A lower runoff coefficient may be used if sustainable elements are included in the design. The Engineer shall notify the Engineering Department of the design intent and provide the necessary data, calculations and design to support the desired runoff coefficient. All sustainable designs are subject to approval by the Engineering Department (refer to Section 4.20 for sustainable design options).

C. Time of Concentration (Tc)

SCS methodology shall be used to determine the time of concentration (Tc). This method separates the flow through the drainage area into sheet flow, shallow concentrated flow, and open channel flow. **The Tc is the sum of travel times for sheet flow, shallow concentrated flow and open channel flow**. The time of concentration flow path and sheet flow path shall be made available to the City upon request.

1. Sheet Flow: The maximum allowable length for sheet flow is 300 feet for undeveloped drainage areas and 100 feet for developed areas. When selecting n for sheet flow, consider cover to a height of about 0.1 foot. This is the only part of the plant cover that will obstruct sheet flow. The T_t in minutes for sheet flow is determined using the following equation:

$$T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,S^{0.4}}$$

T_t = travel time (hr)
n = Manning's roughness coefficient (Table 4.2)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall, 3.6"
S = slope of hydraulic grade line (land slope, ft/ft)

Table 4.2 Sheet Flow 'n' Values

Surface Description	n
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	**0.011**
Fallow (no residue)	**0.05**
Cultivated soils	
Residue cover less than 20%	**0.06**
Residue cover greater than 20%	**0.17**
Grass:	
Short Prairie Grass	**0.15**
Dense grasses	**0.24**
Range (natural)	**0.13**
Woods:	
Light underbrush	**0.40**
Dense underbrush	**0.80**

2. Shallow Concentrated Flow

Shallow concentrated flow begins where sheet flow ends. A projected slope should be established along the flow line for the shallow concentrated flow length. The T_t in minutes for shallow concentrated flow is determined by the following equation:

$$T_t = \frac{L}{3600V}$$

T_t = travel time (hr)
L = flow length (ft)
V = velocity (fps):
Unpaved = 16.1345*(S)^0.5
Paved = 20.3282*(S)^0.5

3. Open Channel Flow

Open Channel Flow is where the runoff is located within a defined channel or in some cases, closed storm systems. The T_t for open channel flow is determined using the following equation:

$$T_t = \frac{L}{3600V}$$

$$V = \frac{1.486\left(R^{2/3}\right)\left(S^{1/2}\right)}{n}$$

T_t = travel time (hr)
V = average velocity (ft/s)
R = hydraulic radius (ft) (R = A / WP)
A = cross sectional flow (ft^2)
WP = wetted perimeter (ft)
S = slope of the hydraulic grade line (channel slope, ft/ft)
n = Manning's roughness coefficient

The Engineer shall compare the calculated total time (sheet plus shallow concentrated plus open channel) to the time listed in Table 4.1. If the calculated Tc differs from the value in Table 4.1, the Engineer shall provide information to justify the Tc calculations.

D. Rainfall Intensity (I)

The rainfall intensity (I), shall be based on the National Weather Service Rainfall Frequency Data presented in Technical Memorandum NWS Hydro-35, dated June 1977 (2 to 100 year), U.S. Geologic Survey Frequency Data presented in Water Resources Investigations Report 98-4044, dated 1998 (500 year) and iSWM Technical Manual. The intensity for a particular duration can be obtained using the coefficients from Table 4.3 below. If the calculated inlet time differs from the value in Table 4.1, the Engineer

shall provide information to justify the inlet time calculations. The equation used to determine the intensity values for various storm events and durations is provided below.

$$I = \frac{b}{(Tc + d)^e}$$

Refer to Table 4.3 below for b, d, and e values. Incremental rainfall intensities for Dallas County from 5 minutes to 24 hours with 1, 2, 5, 10, 25, 50 and 100 year return periods are also shown, from the April 2010 (Revised 9/2014) iSWM Technical Manual-Hydrology.

The remainder of this page left blank intentionally.

Table 4.3

Table 4.3 Dallas County Rainfall Data

		Return Period (Years)						
	Coefficients	1	2	5	10	25	50	100
	e	0.83258	0.81545	0.80449	0.79827	0.78187	0.77019	0.75870
	b	47.679	55.179	70.024	79.931	87.970	94.058	100.079
	d	9	10	12	13	13	13	13
Hours	Minutes	Rainfall Intensity (inches per hour)						
0.083	5	5.30	6.06	7.17	7.96	9.18	10.15	11.17
	6	5.00	5.75	6.85	7.62	8.80	9.74	10.72
	7	4.74	5.48	6.55	7.31	8.45	9.36	10.31
	8	4.51	5.23	6.29	7.03	8.14	9.02	9.94
	9	4.30	5.00	6.05	6.78	7.85	8.70	9.59
	10	4.11	4.80	5.82	6.54	7.58	8.41	9.27
	11	3.94	4.61	5.62	6.32	7.33	8.14	8.98
	12	3.78	4.44	5.43	6.12	7.10	7.88	8.70
	13	3.64	4.28	5.26	5.93	6.89	7.65	8.45
	14	3.50	4.13	5.09	5.76	6.69	7.43	8.21
0.250	15	3.38	4.00	4.94	5.59	6.50	7.22	7.99
	16	3.27	3.87	4.80	5.44	6.32	7.03	7.78
	17	3.16	3.75	4.66	5.29	6.16	6.85	7.58
	18	3.07	3.64	4.54	5.15	6.00	6.68	7.39
	19	2.97	3.54	4.42	5.03	5.85	6.52	7.22
	20	2.89	3.45	4.31	4.90	5.72	6.37	7.05
	21	2.81	3.35	4.20	4.79	5.58	6.22	6.89
	22	2.73	3.27	4.10	4.68	5.46	6.08	6.74
	23	2.66	3.19	4.01	4.57	5.34	5.95	6.60
	24	2.59	3.11	3.92	4.48	5.23	5.83	6.46
	25	2.53	3.04	3.83	4.38	5.12	5.71	6.34
	26	2.47	2.97	3.75	4.29	5.02	5.60	6.21
	27	2.41	2.90	3.68	4.21	4.92	5.49	6.09
	28	2.36	2.84	3.60	4.12	4.82	5.39	5.98
	29	2.31	2.78	3.53	4.05	4.73	5.29	5.87
0.500	30	2.26	2.73	3.46	3.97	4.65	5.19	5.77
	31	2.21	2.67	3.40	3.90	4.56	5.10	5.67
	32	2.17	2.62	3.34	3.83	4.48	5.01	5.57
	33	2.12	2.57	3.28	3.76	4.41	4.93	5.48
	34	2.08	2.52	3.22	3.70	4.33	4.85	5.39
	35	2.04	2.48	3.16	3.64	4.26	4.77	5.31
	36	2.00	2.43	3.11	3.58	4.20	4.69	5.22
	37	1.97	2.39	3.06	3.52	4.13	4.62	5.14
	38	1.93	2.35	3.01	3.46	4.07	4.55	5.07
	39	1.90	2.31	2.96	3.41	4.01	4.48	4.99
	40	1.87	2.27	2.92	3.36	3.95	4.42	4.92
	41	1.84	2.24	2.87	3.31	3.89	4.36	4.85
	42	1.81	2.20	2.83	3.26	3.83	4.30	4.79
	43	1.78	2.17	2.79	3.22	3.78	4.24	4.72
	44	1.75	2.13	2.75	3.17	3.73	4.18	4.66
0.750	45	1.72	2.10	2.71	3.13	3.68	4.12	4.60
	46	1.70	2.07	2.67	3.08	3.63	4.07	4.54
	47	1.67	2.04	2.63	3.04	3.58	4.02	4.48
	48	1.65	2.01	2.60	3.00	3.54	3.97	4.42
	49	1.62	1.98	2.56	2.96	3.49	3.92	4.37
	50	1.60	1.96	2.53	2.93	3.45	3.87	4.32
	51	1.58	1.93	2.50	2.89	3.41	3.82	4.27
	52	1.56	1.91	2.47	2.85	3.36	3.78	4.22
	53	1.53	1.88	2.44	2.82	3.32	3.73	4.17
	54	1.51	1.86	2.41	2.79	3.29	3.69	4.12
	55	1.49	1.83	2.38	2.75	3.25	3.65	4.07
	56	1.48	1.81	2.35	2.72	3.21	3.61	4.03
	57	1.46	1.79	2.32	2.69	3.17	3.57	3.99
	58	1.44	1.77	2.30	2.66	3.14	3.53	3.94
	59	1.42	1.75	2.27	2.63	3.11	3.49	3.90
1	60	1.40	1.73	2.24	2.60	3.07	3.45	3.86
2	120	0.83	1.04	1.38	1.61	1.92	2.18	2.45
3	180	0.61	0.76	1.02	1.20	1.44	1.63	1.85
6	360	0.35	0.44	0.60	0.71	0.86	0.98	1.12
12	720	0.20	0.26	0.35	0.41	0.51	0.58	0.67
24	1440	0.11	0.15	0.20	0.24	0.30	0.35	0.40

E. Unit Hydrograph Method (Drainage Areas > 200 acres)

1. The use of a unit hydrograph method shall be based upon standard and accepted engineering principles normally used in the profession subject to the approval of the Engineering Department. Acceptable methods include the Soil Conservation Services (SCS) Technical Release Number 55 (TR-55) for drainage areas 200 acres to 2,000 acres and SCS's Technical Release Number 20 (TR-20), or the United States Army Corps of Engineers HEC-HMS models for drainage areas 200 acres or more.

2. The post development unit hydrograph method shall be based upon fully developed watershed conditions assuming no effects from upstream or on-site detention facilities, unless the requirements set forth in Section 4.02.B are met, or as directed by the Engineering Department. The Engineer should discuss the approach method with the Engineering Department prior to design.

3. Circumstances that may require the use of a unit hydrograph method include open channels, reclaiming floodplains, creating lakes, regional detention/retention facilities or building other types of drainage related facilities on major drainage courses. The city requires fully developed watershed conditions be used for all modeling. FEMA's flows shall not be used as the flows are generally based upon existing watershed conditions.

4. Coincident peak flows can also be considered using Table 4.4.

Table 4.4: Frequencies for Coincidental Occurrences

Area Ratio	100 year design	
	Main Stream	Tributary
10000:1	2	100
	100	2
1000:1	10	100
	100	10
100:1	25	100
	100	25
10:1	50	100
	100	50
1:1	100	100
	100	100

5. Modeling Requirements

   HEC-HMS shall be used in developing all hydrologic models. Other hydrologic models may be used upon approval from the Engineering Department. The following criteria should be used:

   a. HEC-HMS Frequency-based hypothetical storm options or 24 hour storm duration using SCS Type II distribution.

   b. Rainfall values calculated using coefficients provided in Table 4.3.

c. The SCS Curve Number (CN) method shall be used to determine the loss rate. CN values shall be taken from TR-55.

d. Tc values shall be calculated as shown in Section 4.05.C.

e. Muskingum Cunge method shall be used for routing of the Unit Hydrograph through the drainage system. The Engineering Department may request other routing methods, such as the Modified Puls Routing Method, to be used if the method is more characteristic of the hydrologic and hydraulic conditions in the watershed.

F. Runoff from Off-Site Developments

1. Off-site Flows for Developed Upstream Watershed

The Engineer may take the effects of upstream detention into account if the hydrologic and hydraulic information for the existing upstream ponds are shown on the construction plans and the information can be verified by record drawings or a record survey. An emergency overflow path between the existing detention ponds and the proposed site shall be identified and clearly indicated on the construction plans. The Engineer shall confirm the hydrologic and hydraulic effects of upstream facilities in accordance with Section 4.11.

2. Off-site Flows for Undeveloped Upstream Watershed

If an undeveloped upstream property exists, the Engineer shall assume fully developed conditions without detention for the off-site area unless a Downstream Assessment shows the downstream facilities cannot convey the fully developed peak flows.

4.06 Street Capacity

A. Straight Crown Streets:

1. Minimum grade of public streets and alleys shall be 0.60%.

2. All straight crown street capacities shall be hydraulically designed using Manning's equation:

$$Q = \left(\frac{1.486}{n}\right) A \left(R^{2/3}\right)\left(S^{1/2}\right)$$

Q = Gutter flow (cfs)
n = Manning's roughness coefficient, (0.0175 for concrete street)
A = Cross section flow area (ft^2)
R = Hydraulic radius of the conduit in feet, which is the area of the flow divided by the wetted perimeter (R = A / WP)
WP = Wetted perimeter (ft)
S = Slope of the hydraulic gradient (ft/ft)

3. The City requires a minimum of 9 foot of pavement in each direction shall remain dry during the 100-year event for any divided thoroughfare per the Master Thoroughfare Plan.

4. The dry lane criteria shall be met in both the interim and future conditions.

B. Parabolic Crown Streets

1. All parabolic crown street capacities shall be hydraulically designed using Manning's equation.

2. During a 100 year storm event, the gutter depth on Type F (residential) and G thoroughfares are required not to exceed 6" or top of curb, whichever is less.

3. For any streets that are not a Type F, G or a divided thoroughfare, then a 9 foot pavement section along the centerline of the street shall remain dry during the 100-year event.

4.07 Alley Capacity

A. All alley capacities shall be hydraulically designed using Manning's equation.

B. The 100 year storm event shall be contained within the edge of pavement.

C. In residential areas where the standard alley section capacity is exceeded, storm sewer systems with inlets shall be provided.

D. Inlets shall be located in alleys upstream from an intersection and where necessary to prevent water from entering intersections in amounts exceeding allowed street capacity.

4.08 Valley Gutters

A. The use of valley gutters to convey storm water across a street intersection is subject to the following criteria:

1. Valley gutters shall not cross Type A, B, C, D1, D2, D3 and E thoroughfares as shown on the Master Thoroughfare Plan.

2. At any intersection, valley gutters perpendicular to the main street will not be permitted; and valley gutters parallel to the main street may only cross a lower classified street.

4.09 Inlet Location and Capacity

A. Gutter Flow

Curb inlets shall be designed for the 100-year storm event using fully developed conditions and placed to ensure that the 100-year flow in a street does not exceed the dry lane requirements for straight crown streets and top-of-curb elevation for parabolic crown streets as per Section 4.06. On drainage area maps, provide a subarea for all curb inlets and any inlets in parking lots and/or adjacent to public ROW. Drainage area subarea designations shall match the inlet sizing chart and compute flow to each inlet using the following form of the Manning's equation should be used to evaluate gutter flow hydraulics:

$$Q = \left[\frac{0.56}{n}\right] Sx^{5/3} S^{1/2} T^{8/3}$$

Q = Gutter flow rate (cfs)
S_x = Pavement cross slope (ft/ft)
S = Longitudinal slope (ft/ft)
T = Width of flow in roadway (ft)
n = Manning's roughness coefficient

Depth of flow in the gutter can be calculated using the following modified form of the equation above:

$$y_o = z\left(\frac{QnS_x}{S^{1/2}}\right)^{3/8}$$

y_o = depth of water in the curb and gutter cross section (ft or m)
Z = 1.24

If the flow in the gutter is still excessive, the storm sewer shall be extended to a point where the gutter flow can be effectively intercepted by curb inlets.

B. Grated Catch Basins & Combination Inlets

1. Combination grate inlets and grated catch basins are typically not to be used in public Right-of-Way (ROW) and easements. They may be allowed on a case by case bases where site and flow conditions dictate with the approval of the Director of Engineering.

2. Grated catch basins and inlets may be used on private storm sewer systems but shall be designed assuming 40% blockage. Calculations shall be provided in plans to insure buildings do not flood and that excess runoff does not enter into public ROW. Vane grates are allowed in public alleys.

C. Capacity of Curb Inlet on Grade

To determine the capacity of a curb inlet on grade, first determine the ratio of the flow in the locally depressed gutter section to the total flow in the road.

$$E_0 = 1/\left\{1 + \frac{S_w}{S_X}\left[\left(1 + \frac{S_w/S_x}{(T/W) - 1}\right)^{2.67} - 1\right]^{-1}\right\}$$

E_0 = Ratio of flow in the depressed gutter to the total flow
S_W = Gutter cross slope (ft/ft)
S_x = Roadway cross slope (ft/ft)
T = Width of flow in roadway (ft)
W = Width of depressed gutter section (ft)

Then calculate the equivalent cross slope at the depressed curb inlet opening.

$$S_e = S_x + \frac{a}{w} E_0$$

S_e = Equivalent cross slope (ft/ft)
S_x = Roadway cross slope (ft/ft)
a = Gutter Depression Depth (ft)
W = Width of depressed gutter section (ft)
E_0 = Ratio of flow in the depressed gutter to the total flow

Then calculate the inlet length required to capture 100% of the gutter flow.

$$L_T = 0.60 Q^{0.42} S^{0.3} \left(\frac{1}{nS_e}\right)^{0.6}$$

L_T = Required length of inlet (ft)
Q = Total flow in the roadway (cfs)
S = Roadway longitudinal slope (ft/ft)
n = Manning's roughness coefficient
S_e = Equivalent cross slope (ft/ft)

The efficiency of a curb inlet opening shorter than L_T is:

$$E = 1 - \left(1 - \frac{L}{L_T}\right)^{1.8}$$

E = Inlet efficiency
L = Length of the curb inlet opening (ft)
L_T = Required length of inlet to capture 100% of the roadway flow (ft)

The total flow captured by the curb inlet is:

$$Q_i = EQ$$

Q_i = Flow capture by inlet (cfs)
E = Inlet efficiency
Q = Total flow in the roadway (cfs)

D. Capacity of Curb Inlets in Sag

The capacity of a curb inlet in sag depends on the water depth at the curb opening and the height of the curb opening. The inlet operates as a weir to a depth equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage and the capacity should be based on the lesser of the computed weir and orifice capacities.

1. If the depth of flow in the gutter (d) is less than or equal to 1.4 times the inlet opening height (h), (d≤1.4H), determine the length of inlet required considering weir control. Calculate the capacity of the inlet when operating under weir conditions with the following equation:

$$Q = C_W(L + 1.8W)d^{1.5}$$

2. Rearrange above equation to produce the following relation for curb inlet length required:

$$L = \left(\frac{Q}{C_w y_o^{1.5}}\right) - 1.8W$$

Q = total flow reaching inlet (cfs)
C_w = weir coefficient (3.0)
y_o = head at inlet opening (ft)
L = length of curb inlet opening (ft)
W = lateral width of depression (ft)

$$y_o = z\left(\frac{QnS_x}{S^{1/2}}\right)^{3/8}$$

y_o = depth of water in the curb and gutter cross section (ft or m)
Q = gutter flow rate (cfs)
n = Manning's roughness coefficient
S = longitudinal slope (ft/ft)
S_X = pavement cross slope (ft/ft)
Z = 1.24

3. If the depth of flow in the gutter is greater than the inlet opening height (d>h), determine the length of inlet required considering orifice control. The equation for interception capacity of a curb opening as an orifice follows:

$$Q = C_0 hL\sqrt{2gd_e}$$

Q = total flow reaching inlet (cfs)
C_0 = orifice coefficient = 0.70

h = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = length of curb opening inlet (ft.)
g = acceleration due to gravity = 32.2 ft/s^2
d_e = effective head at the centroid of the orifice (ft) d_e=d - h/2

Rearranging equation allows a direct solution for required length:

$$L = \frac{Q}{C_0 h \sqrt{2 g d_e}}$$

4. If both steps 1 and 2 were performed (i.e., h<d≤1.4h), choose the larger of the two computed lengths as being the required length.

5. Select a standard inlet length that is greater than the required length.

E. Capacity of "Y" Inlets

$$\frac{Q}{P} = 3.1 y^{3/2}$$

Q = flow (cfs)
P = perimeter of opening (ft)
y = head/depth (ft)

"Y" (drop) inlets shall be located to collect water on non-paved areas where it is not practical to use a headwall. No double "Y" inlets shall be allowed.

F. Curb Inlet Placement

1. Placing several curb inlets at a single location is only permitted in areas with steep grades (4% or greater) to prevent flooding and avoid exceeding street capacity in flatter reaches downstream.

2. No more than 20 feet of inlet shall be constructed at one location along one curb line.

3. Curb inlets shall be placed upstream from right angle turns and street intersections. Curb inlets shall be placed a minimum of 10 feet from the end of street and commercial driveway curb returns.

4. Curb inlet depth shall not be less than 4.5' from top of curb for all public improvements, unless approved by Director of Engineering.

5. Recessed inlets are required on collectors and arterials streets.

6. Inlets are required at the low point of a super-elevation to prevent flow across the roadway.

7. Multiple sag inlets shall be located no closer than 300 feet.

8. Curb inlets shall not be located directly above storm drain lines.

9. Any discharge of concentrated flow into streets shall be limited to less than or equal to 5 cfs per Section 4.12.A. Flumes are not allowed.

10. Capacity calculations for inlets located on a non-residential private drainage system shall be provided by the design engineer and approved by the City.

11. Data shown for each inlet shall include paving or storm sewer stationing at centerline of the inlet, size and type of inlet along with top of curb or grate inlet elevation and flow line elevation. Flow to be intercepted by the inlet and bypass flow, if applicable, shall be shown to each inlet on the storm sewer plan.

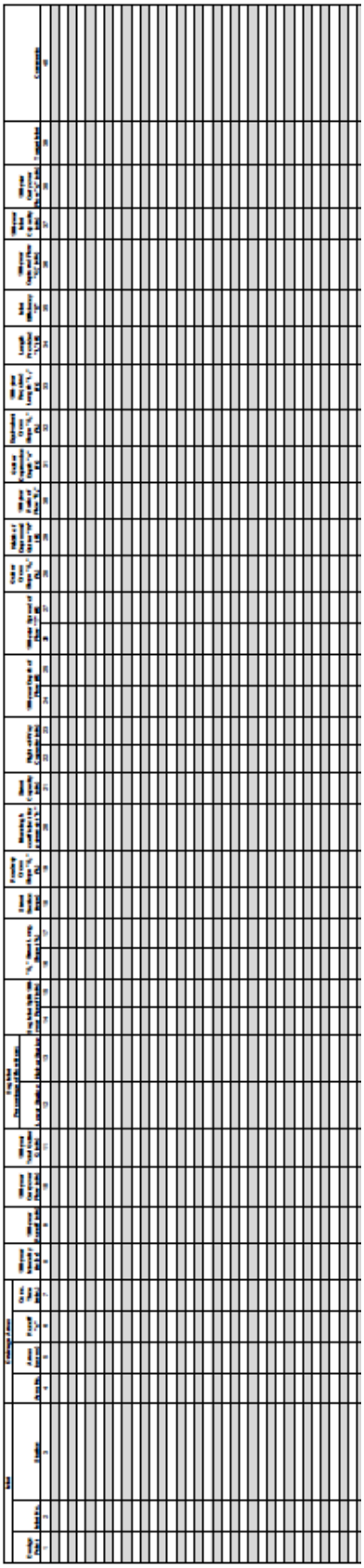
12. A paved emergency overflow path shall be provided and located on the plans for sag locations. An emergency overflow path is the path the storm water will take if the drainage facility becomes clogged or ceases to function as designed. The emergency overflow path must be located within public ROW or drainage easement per Section 4.19.A.2. The overflow path drainage easement shall be designed to convey the 100-year storm runoff surface draining to the sag inlet. The minimum width of the paved path shall be 4 feet. Any structure or lot adjacent to the overflow path shall have a minimum finished floor elevation of 1 foot above the 100-year water surface elevations within the overflow path.

13. Curb inlet(s) shall be placed upstream of transitions in street cross slope.

The remainder of this page left blank intentionally.

Figure 2: Inlet Spreadsheet

FIGURE 2: Inlet Capacity Calculation Table



Enlargement of Figure 2: Inlet Capacity Calculation Table

| Inlet | | | Drainage Areas | | |

G. The Inlet Spreadsheet provided in Figure 2, or similar table conveying the information below, shall be provided with the construction plans for review by the City. A description of each of the columns shown in the inlet spreadsheet is provided below:

- Column 1: Design Point for Inlet
- Column 2: Inlet number
- Column 3: Location of inlet by storm drain station number
- Column 4: Drainage area designation for incremental area
- Column 5: Drainage area size (acres)
- Column 6: Runoff coefficient (C)
- Column 7: Time of concentration (minutes)
- Column 8: 100-year intensity (in/hr)
- Column 9: 100-year runoff, Q=CIA (cfs)
- Column 10: 100-year carryover flow from upstream inlet (cfs)
- Column 11: 100-year total gutter flow (Column 9 + Column 10) (cfs)
- Column 12: Percentage of flow traveling from lower station side of sag inlet based on percentage of drainage area and carryover flow from that side (cfs)
- Column 13: Percentage of flow traveling from higher station side of sag inlet based on percentage of drainage area and carryover flow from that side (cfs)
- Column 14: 100-year total gutter flow reaching the lower station side of the sag inlet (Column 11 times Column 12) (cfs)
- Column 15: 100-year total gutter flow reaching the higher station side of the sag inlet (Column 11 times Column 13) (cfs)
- Column 16: Longitudinal slope of the approach gutter. For sag inlets, half the longitudinal slope of the approach gutter on the lower station side of the inlet (S_0) (ft/ft)
- Column 17: Not used for on-grade inlets. For sag inlets, half the longitudinal slope of the approach gutter on the higher station side of the inlet (S_0) (ft/ft)
- Column 18: Street crown section type (straight crown [“rooftop”] or parabolic)
- Column 19: Roadway cross slope “Sx” (%)
- Column 20: Manning’s roughness coefficient (n) for pavement (0.0175 for concrete pavement)

- Column 21: Street capacity based on Manning's equation. For sag inlets calculate the street capacity for both the lower and higher station sides of the inlet and use the greater of the two. (cfs)

- Column 22: Total right-of-way (ROW) capacity as a function of the cross-sectional area of the ROW at the inlet. For sag inlets, the total ROW capacity on the lower station side of the inlet. (cfs), this column is for informational purposes only.

- Column 23: Not used for on-grade inlets. For sag inlets, the total ROW capacity on the higher station side of the inlet. (cfs), this column is for informational purposes only.

- Column 24: Depth of gutter flow "yo" in approach gutter from spread of water or from direct solution of Manning's equation for gutter capacity. For sag inlets, the depth of gutter flow on the lower station side of the inlet. (ft)

- Column 25: Not used for on-grade inlets. Depth of gutter flow "yo" in approach gutter from spread of water or from direct solution of Manning's equation for gutter capacity. For sag inlets, the depth of gutter flow on the higher station side of the inlet. (ft)

- Column 26: Spread of water (T) or width of ponding in the gutter measured from the face of curb. Column 19 times column 24, or the distance from the gutter to the crown, if the crown height is exceeded. For sag inlets, the spread of flow on the lower station side of the inlet. (ft)

- Column 27: Not used for on-grade inlets. Spread of water (T) or width of ponding in the gutter measured from the face of curb. Column 19 times column 25, or the distance from the gutter to the crown, if the crown height is exceeded. For sag inlets, the spread of flow on the higher station side of the inlet. (ft)

- Column 28: Gutter cross slope (Sw) (%)

- Column 29: Width of depressed gutter section (ft)

- Column 30: 100-year ratio of flow in the depressed gutter to the total flow (E_0)

- Column 31: Gutter depression depth (a) (ft)

- Column 32: Equivalent cross slope (Se) (%)

- Column 33: 100-year inlet length required to capture 100% of the gutter flow (L_T) (ft)

- Column 34: Actual length (L) in feet of inlet which is to be provided (10-, 15- or 20-feet). For "Y" inlets the length provided is equal to the perimeter of the opening intercepting flow. The length for "Y" inlets may be less than the total perimeter if the "Y" is not located in a sag location.

- Column 35: Efficiency of a curb inlet where the length provided is shorter than the length required. (E)

- Column 36: Discharge (Q) in cubic feet per second which the inlet in question actually intercepts.

- Column 37: Discharge capacity of the inlet (Q) (cfs)
- Column 38: Carryover flow (q) is the amount of water which passes the inlet in a 100-year storm. A substantial portion of the 100-year flow should be picked up by the inlet. The carry-over flow should be accounted for in further downstream inlets and should be reflected in the inlet bypass flow in the Storm Drain Hydraulics Table (minor variances may occur due to travel time routing in the Hydraulics Table).
- Column 39: Downstream inlet that carryover flow travels to
- Column 40: Important comments relating to inlet

4.10 Design of Enclosed Storm Sewer System

A. Design Flow

All enclosed systems shall be hydraulically designed and all required calculations shall be provided on the construction plans. The design storm event for storm sewer systems is the 100-year storm event using fully developed conditions. The hydraulic gradient and full-flow velocity shall be calculated using the design flow, appropriate pipe size, and Manning's equation:

$$Q = \left(\frac{1.486}{n}\right) A \left(R^{2/3}\right) \left(S_f^{1/2}\right)$$

Q	=	Runoff rate (cfs)
A	=	Cross sectional area of the conduit (ft^2)
n	=	Manning's roughness coefficient (0.013 for concrete)
R	=	Hydraulic radius (ft) (area of conduit divided by wetted perimeter, R = A / WP)
S_f	=	Friction Slope (hydraulic gradient) (ft/ft)

B. Hydraulic Gradient

1. The City requires that all hydraulic gradient calculations begin at the outfall of the system.
2. The starting hydraulic grade line (HGL) shall be based upon the results of the Downstream Assessment per Section 4.02 if a downstream assessment is conducted. The results of the Downstream Assessment will provide the Engineer with the capacity and resulting design storm of the downstream facilities.
3. The starting HGL at an outfall into a creek or channel shall be the 100-year fully developed water surface unless an approved flood hydrograph is available to provide a coincident flow elevation for the system's peak.
4. When a proposed storm sewer is to connect to an undersized existing storm sewer system, calculation of the hydraulic gradient for the proposed storm sewer shall start at the outfall of the existing storm sewer system.

C. Hydraulic Design

1. The hydraulic grade line (HGL) must be calculated for all storm drain mains and laterals using appropriate head loss equations. In all cases, the public storm drain HGL must be at least 1 foot below top of curb at each inlet.

2. The beginning (downstream) HGL of each pipe segment shall begin either at the top of pipe or at the hydraulic gradient of the receiving stream / conduit at the coincident frequency, whichever is higher.

3. In partial flow conditions, the HGL represents the actual water surface within the pipe. The velocity of the flow should be calculated based on actual area of flow, not the full flow area of the pipe or box.

4. Software that facilitates the design of stormwater systems may be utilized upon approval from the City Engineering Department.

D. Lateral Design

1. The HGL shall be calculated for all proposed laterals and inlets, and for the existing laterals being connected into a proposed drainage system

2. Laterals shall intersect the storm drain at standard angles. Connecting more than one lateral into a storm drain at the same joint localizes head losses; however, a manhole or junction structure shall be provided. An exception to this rule may be considered when the diameter of the main line is more than twice as great as the diameter of the largest adjoining lateral. Stormwater manholes should generally not be used per Section 4.10.I.

3. Private storm sewer laterals shall not connect into downstream inlets without approval of the Director of Engineering.

E. Friction Head Losses (H_f)

1. The head loss due to friction along the storm drain conduit is one of the head losses that must be accounted for when computing the HGL of a stormwater system and can be determined by the following formulas:

$$H_f = S_f L$$

H_f = Friction Head Loss (ft)
S_f = Friction Slope (hydraulic gradient) (ft/ft)
L = Length of conduit (ft)

Should the conduit have partial flow, then the frictional slope will match the pipe slope. For pressure flow or full flow of the conduit, the formula below can be used to determine the frictional slope of the conduit:

$$S_f = \left(\frac{Qn}{1.486 R^{2/3} A} \right)^2$$

S_f = Friction Slope (hydraulic gradient) (ft/ft)
Q = Runoff rate (cfs)
A = Cross sectional area of the conduit (ft^2)
n = Manning's roughness coefficient (0.013 for concrete)
R = Hydraulic radius (ft) (Area of conduit divided by wetted perimeter (R=A/WP)

F. Velocity Head Losses (H_L)

1. Adjustments are made in the HGL whenever the velocity in the main changes due to conduit size changes or discharge changes. Laterals in partial flow must be designed appropriately and the partial flow velocity shall be used in the calculations.

2. In determining the HGL for the lateral, begin with the hydraulic grade of the trunk line at the junction plus the H_L due to the velocity change. Where the lateral is in full flow, the hydraulic grade is projected along the friction slope calculated using Manning's Equation (see subsection E above).

3. H_L for pipe size changes and other velocity changes will be calculated by the following formula when $V_1 < V_2$:

$$H_L = \frac{V_2^2}{2g} - \frac{V_1^2}{2g}$$

H_L = Head loss (ft)
V_1 = Upstream velocity (fps)
V_2 = Downstream velocity (fps)
g = Gravity constant (32.2 ft/s^2)

A minimum head loss of 0.1 foot is to be applied for all structures, bends, wyes, junctions, and enlargements. Head gains will not be recognized.

4. H_L for pipe in full flow at manholes and bends, where the flow quantity remains the same, and inlets at the beginning of the line shall be calculated as follows:

$$H_L = K_j \frac{V_2^2}{2g}$$

H_L = Head loss or gain (ft)
V_2 = Downstream velocity (fps)
g = Gravity constant (32.2 ft/s^2)
K_j = Coefficient of loss per Table 4.5

5. H_L at wye connections, manholes, and junction boxes where there is an increase in flow quantity shall be calculated as follows:

$$H_L = \frac{V_2^2}{2g} - K_j \frac{V_1^2}{2g}$$

H_L = Head loss or gain (ft)
V_1 = Upstream velocity (fps)
V_2 = Downstream velocity (fps)
g = Gravity constant (32.2 ft/s^2)
K_j = Coefficient of loss per Table 4.5

The remainder of this page left blank intentionally.

Table 4.5 Velocity Head Loss in Closed Conduits

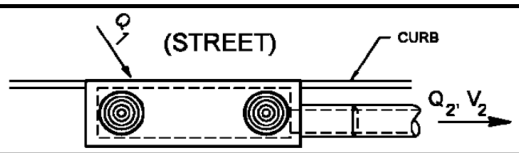
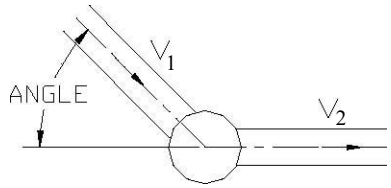
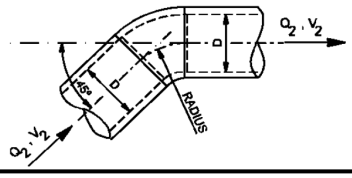
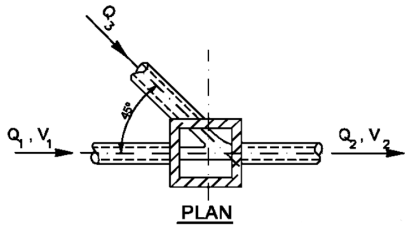
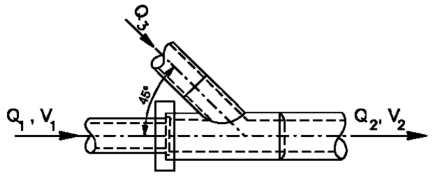
Inlet		
Schematic	**Description**	**Kj**
	Inlet at Beginning of Line: $H_L = \frac{1.25V_2^2}{2g}$	1.25
Manhole at Change in Pipe Direction (flow quantity remains the same)		
Schematic	**Angle**	**Kj**
	90°	0.55
	60°	0.48
	45°	0.42
	30°	0.30
	0°	0.05
Bend in Pipe (flow quantity remains the same)		
Schematic	**Angle**	**Kj**
	90°	0.50
	60°	0.43
	45°	0.35
	30°	0.20
Manhole with Branch Lateral (22.5°-90°)		
Schematic	**Angle**	**Kj**
	22 1/2°	0.75
	45°	0.50
	60°	0.35
	90°	0.25
Wye Connection		
Schematic	**Angle**	**Kj**
	45°	0.75
	60°	0.60

Figure 3: Storm Drain Calculations Spreadsheet

FIGURE 3: Storm Drain Calculations Spreadsheet

Storm Drain Calculations																																				
From	To	Pipe Length	Drainage Area			Runoff "c"	Incr. cA	Total cA	Time of Concentration			100-year Intensity	100-year Runoff	Inlet Carryover (To Inlet)	Inlet Carryover "q" (From Inlet)	Q pipe	Pipe Size Diameter	Box Size		n	Sf	HGL		Head Loss Calculations							Design HGL	Invert Elevation		T/C or Ground Elev.	
			Incremental		Total Area				Inlet	Travel	Total							Width	Height			U/S	D/S	V1 (in)	V2 (out)	$V1^2/2g$	$V2^2/2g$	Kj	$KjV1^2/2G$	Hk		From	To		
			No.	Area																																
		ft		acres	acres				min	min	min	in/hr	cfs	cfs	cfs	cfs	in	ft	ft		ft/ft	ft	ft	ft/s	ft/s	ft	ft		ft	ft	ft	ft	ft	ft	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

Enlargement of Figure 3: Storm Drain Calculations Spreadsheet

From	To	Pipe Length	Drainage Area			Runoff "c"	Incr. cA	Total cA	Time of Concentration			100-year Intensity	100-year Runoff	Inlet Carryover (To Inlet)	Inlet Carryover "q" (From Inlet)
			Incremental		Total Area				inlet	Travel	Total				
			No.	Area											
		ft		acres	acres				min	min	min	in/hr	cfs	cfs	cfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Storm Drain Calculations																				
Q pipe	Pipe Size Diameter	Box Size		n	Sf	HGL		Head Loss Calculations							Design HGL	Invert Elevation		T/C or Ground Elev.	
		Width	Height			U/S	D/S	V1 (in)	V2 (out)	$V1^2/2g$	$V2^2/2g$	Kj	$KjV1^2/2G$	Hk		From	To		
cfs	in	ft	ft		ft/ft	ft	ft	ft/s	ft/s	ft	ft		ft	ft	ft	ft	ft	ft	Comments
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

G. The Engineer shall include a completed Storm Drain Calculations Spreadsheet (see Figure 3) or similar table conveying the information below, in the construction plans. A description of the runoff calculations is provided below followed by a description of the hydraulic design calculations:

- Column 1: Enter the downstream storm drain station number.
- Column 2: Enter the upstream storm drain station number. This is the design point. Design should start at the farthest upstream point.
- Column 3: Enter the distance (in feet) between the storm drain stations.
- Column 4: Enter the designation of the drainage area(s) at the design point in Column 2 corresponding to the designations shown on the drainage area map.
- Column 5: Enter the area in acres for the drainage area identified in Column 4.
- Column 6: Enter the total drainage area in acres within the system corresponding to storm drain station shown in Column 2.
- Column 7: Enter the runoff coefficient “C” for the drainage area shown in Column 5.
- Column 8: Multiply Column 5 by Column 7 for each area.
- Column 9: Determine the total “CA” for the drainage system corresponding to the inlet or manhole shown in Column 2.
- Column 10: Determine inlet time of concentration.
- Column 11: Determine flow time in the storm drain in minutes. The flow time is equal to the distance in Column 3 divided by 60 times the velocity of flow through the storm drain in ft/sec.
- Column 12: Total time of concentration in minutes. Column 10 plus Column 11. Note that time of concentration only changes at a downstream junction with another drainage area(s). It remains the same from an inlet or junction to the next inlet or junction picking up additional drainage areas. The junction of two paired inlets with each other is not a downstream junction.
- Column 13: The intensity of rainfall in inches per hour for the 100-year storm frequency.
- Column 14: The 100-year storm runoff in cfs. Column 9 times Column 13.
- Column 15: The proposed inlet carryover from upstream inlets during a 100-year storm. This should generally correspond to the carryover flow in Column 10 of the Inlet Spreadsheet (minor variances may occur due to travel time routing in the Hydraulics Table).
- Column 16: The proposed inlet carryover during a 100-year storm. This should generally correspond to the carryover flow “q” in Column 38 of the Inlet

Spreadsheet (minor variances may occur due to travel time routing in the Hydraulics Table).

- Column 17: Design Discharge for the storm drain system ("Qpipe") in cfs
- Column 18: Enter the selected pipe size for circular pipe.
- Column 19: Enter the selected width for box pipe.
- Column 20: Enter the selected height for box pipe.
- Column 21: Enter the appropriate Manning's roughness coefficient "n" (0.013 for concrete pipe and box culverts).
- Column 22: Enter the slope of the frictional gradient (hydraulic gradient) determined by Manning's equation. In a partial flow condition, the friction slope is the slope of the water surface and should follow the slope of the pipe.
- Column 23: This is the upstream HGL before the structure and is calculated as Column 24 plus the friction loss (Column 3 times Column 22).
- Column 24: This is the beginning hydraulic gradient of the line. It is equal to the Design HGL (Column 32) for the next downstream segment, or the beginning HGL of the system as described above.
- Column 25: Velocity of flow in incoming pipe at the junction, inlet or manhole at the design point identified in Column 2.
- Column 26: Velocity of flow in outgoing pipe (i.e. the pipe segment being analyzed) at junction, inlet or manhole at design point identified in Column 2.
- Column 27: Velocity head of the velocity in Column 25.
- Column 28: Velocity head of the velocity in Column 26.
- Column 29: Head loss coefficient "Kj", at junction, inlet or manhole at design point from Table 4.5.
- Column 30: Multiply Column 27 by Column 29.
- Column 31: Head Loss at Structure. At a junction or change in pipe size, this is Column 28 minus Column 30. At a bend or inlet, this is Column 28 times Column 29. In all cases this is 0.10 foot minimum.
- Column 32: Design HGL at the design point identified in Column 2. Column 23 plus Column 31. This is the beginning HGL (Column 24) for any upstream pipe discharging into that junction.
- Column 33: Invert elevation for the pipe being analyzed at the downstream storm drain station in Column 1.

- Column 34: Invert elevation for the pipe being analyzed at the design point (upstream storm drain station) in Column 2.
- Column 35: Top of curb elevation at the design point in Column 2.
- Column 36: Comments regarding pipe being analyzed.

H. Storm Drain

1. Alignments of proposed storm drain systems shall use existing easements and rights-of-way. If located within an easement, the storm sewer shall be centered within the easement. If located within rights-of-way, the centerline of the storm sewer shall be located under paving 7 foot from the back of curb. No part of the storm sewer is to be designed within the improved subgrade of a proposed pavement
2. Horizontal and vertical curve design for storm sewers shall take into account joint closure. Where vertical and/or horizontal alignments require greater deflection, radius pipe on curved alignment shall be used
3. A minimum full flow velocity of 2.5 fps and a minimum slope of 0.5% shall be maintained in the pipe unless otherwise approved by the Director of Engineering. The maximum hydraulic gradient shall not produce a velocity that exceeds 15 feet per second (fps).
4. Only standard sizes shall be used. For public storm sewers, the minimum allowable pipe size is 21". Pipe sizes shall not be decreased in the downstream direction, unless otherwise approved by the Director of Engineering.
5. End-to-end connections of different size pipes must match at the crown of the pipe unless utility clearance dictates otherwise.
6. Concrete pipe collars are required at connections to existing storm sewer pipe or at grade breaks as directed by the Director of Engineering.
7. In situations where only the lower portion of an enclosed storm sewer system is being built, stub-outs for future connections must be included.
8. The required storm drain capacity to meet existing and future needs, if applicable, shall be provided.

I. Storm Drain Materials

1. All <u>public</u> storm sewers shall be reinforced concrete, minimum Class "III" pipe.
2. Any storm sewer or structure under a fire lane must be designed to withstand applicable loadings, including loading of a fire apparatus.

J. Manhole Placement

1. Storm sewer manholes should not be used except in special cases at the discretion of the Director of Engineering.

K. Outfall Design

The Engineer shall demonstrate the drainage from the site is conveyed to an adequate outfall. An adequate outfall is a structure or location that is adequately designed as to not cause adverse flooding conditions, erosion, or any other adverse impacts. An adequate outfall shall also have capacity to convey the increased runoff. Streambank stabilization shall be provided, when appropriate, as a result of any stream disturbance and encroachment and shall include both upstream and downstream banks.

1. Discharge flow lines of storm sewers shall be a maximum of 2 foot above the flow line of creeks and channels unless channel lining is present. All outfall pipes at open channels or ditches in public rights-of-way and drainage easements shall have a standard City of Garland headwall installed or approved equal.

2. The last 10 feet of the storm sewer pipe shall be laid on a maximum 1.0% grade.

3. Energy dissipation shall be provided when the outfall velocities exceed maximum allowable discharge velocities for the given soil condition, typically 8 fps for vegetated clay soils and 5 fps for vegetated sandy soils. When storm sewer pipe is in partial flow at outfalls, provide partial flow velocity on storm sewer profiles.

4. An appropriate headwall shall be provided at all discharge points and open ends of a storm sewer system. The Engineer shall be responsible for the headwall and wingwall designs. Headwalls refer to the entrances and exits of structures, respectively, and are usually formed of cast-in-place concrete and located at either end of the drainage system. For any public headwall or wingwall with a drop of 30-inches or more, a standard pedestrian rail shall be provided at the top of the headwall or wingwall to provide fall protection.

L. Construction Plan/Profile Sheets

1. Plan-profile sheets are required for all <u>public</u> storm sewer systems as described below. Profiles shall be provided for <u>private</u> storm sewer lines when they cross existing or proposed public utilities.

2. Plan-profile sheets must be prepared on a horizontal scale no greater than 1” = 40 feet and a vertical scale of 1” = 4 feet. All grades shall be shown to the nearest one-hundredth of a foot (0.01’) and shall be based on NAVD 88 datum. Unusually large conduits may require different scales to show the system adequately. Any variation in scale must be approved by the Director of Engineering.

3. In the plan view the storm drain designation and size of pipe must be shown adjacent to the storm drain. The storm drain plan must be stationed at 100-foot intervals with changes in size clearly indicted as they occur. If the storm drain alignment requires a horizontal curve, the following curve data must be shown on the plan:

   a. P.I. Station
   b. Tangent Distance
   c. Deflection Angle
   d. Length of Curve

e. Radius
f. PC Station and PT Station

4. The lateral size and item number must be shown on the plan. Existing topography, storm drains, sprinkler heads, double check assemblies, inlets, curbs, driveways, pavement, manholes, meters, valve boxes, trees, shrubs, fences, and other public and private utility lines within the ROW, must be shown on the plans, define the existing pavement type and thickness. Permanent City of Garland controlling benchmarks must be referenced in the lower right corner of each plan view sheet.

5. For Capital Improvement Projects, the item numbers must be shown for all items of work and a summary of quantities sheet shall be provided.

6. The storm drain profile stationing must be adjacent to the stationing on the plan. Even 100-foot stations must be shown at the bottom of the profile, and elevations must be shown on the left and right sides of the profile sheet. Stationing for drainage and paving profiles must be oriented in the same direction.

7. Laterals must be shown in the profile when they cross an existing utility, when they drain a sag inlet, or when they exceed 12 feet in length.

8. The profile portion of the storm drain plan-profile sheet must provide the following:

   a. Elevations of rock line (at boring locations)
   b. Soffit
   c. Invert
   d. Hydraulic grade line
   e. Top of pipe
   f. Existing ground and proposed finished grade
   g. Elevation of intersecting utilities
   h. Diameter of the proposed pipe
   i. Pipe grade in percent

9. Hydraulic data for each length of storm drain between interception points must be shown on the profile. This data must include of the following:

   a. Pipe diameter in inches
   b. Design discharge in cubic feet per second
   c. Slope of hydraulic gradient (in ft. /ft.)
   d. Capacity of pipe in cubic feet per second (Assuming the hydraulic gradient equals the pipe grade).
   e. Velocity in feet per second
   f. Velocity head in feet V2/2g
   g. Limits and velocity of partial flow where applicable.

M. The hydraulic grade adjustment at each interception point must be shown. Partial flow must be shown at the starting and ending stations clearly. Flow line elevations for the proposed storm drain must be shown at 100-foot intervals on the profile. Stationing and flow line elevations must be shown at all pipe grade changes, pipe size changes, lateral connections, manholes, and wye connections. On public storm sewers, pipe wyes connecting to the storm drain must be made centerline to centerline at 60-degrees, shown in the profile with the size of lateral, flow line of wye, and stationing of storm sewer indicated.

N. Boring locations with elevations of top of rock must be included on the drainage plans, and all existing and proposed easements, and right-of-ways.

O. Proposed paving plans and pavement location must be cross-referenced and agree horizontally and vertically with the storm drain plans inlet and manhole locations, cross-sections, and existing topographic features.

4.11 Detention/Retention Facility Design

A. Detention is mandatory if the project is located within the Spring Creek Forest Preserve Ecological Boundary. See Appendix 4A for map.

B. Detention is required per the GDC Section 3.87.

C. Should the Downstream Assessment results show that downstream facilities are adequate and on-site detention is not required, fully developed off-site conditions must be taken into account for the on-site design facilities.

D. Define maximum design water surface elevation for the 2, 10 and 100-year storms and the first 1" of rainfall.

E. Dentition facilities shall be designed based upon the following minimum criteria:

1. Detention shall be provided for the 2, 10, and 100 year design storms based on the results of a downstream assessment. Sites without a downstream assessment will be required to provide detention to undeveloped runoff rates.

2. All detention basins must include provisions to improve stormwater quality. Water quality enhancement measure shall be designed using the 1-year, 6-hour duration storm with an intensity of 0.35 inches per hour as shown in Table 4.3 (derived from *"iSWM Technical Manual for Hydrology")*.

   a. A dry detention pond shall, at a minimum, be designed to hold the first 1 inch of rainfall over a 24 hour period. Per Section 10.0 of the iSWM Site Development Controls Technical Manual, a dry detention pond only removes 65% of the Total Suspended Solids (TSS) and therefore must be part of a treatment train to provide the required 70% TSS removal. Provide details of the treatment train and TSS removal calculations within the construction plans unless using an alternative method as described by (b) below.

   b. Alternative Methods for Improvement per GDC 3.89.F: The Director of Engineering may approve alternate methods for detention and for achieving improved stormwater quality. Alternate methods may include utilization of mechanical filters, traps, or other prefabricated systems provided that the alternative methods prevent seventy percent (70%) or more of the total suspended solids, down to a one-hundred micron-sized particle, from passing through the outlet structure and entering the MS4 and so long as the intent of the provisions contained in the GDC are met. If using a prefabricated stormwater screening device, the applicant shall provide supporting literature/data from the manufacturer indicating that the selected unit is properly sized for the project and

that it complies with the intent of this TSM and the GDC. Provide backup data showing that the unit will treat the water quality flow prior to bypass of the larger flows. Account for the headloss through the unit and reflect on the HGL profile: contact the manufacturer or provide supporting calculations accounting for the loss. Note, if an alternative method is used, any associated dry detention pond shall no longer be required to hold the first 1 inch of rainfall over 24 hours, as detailed in subsection (a) above.

3. All detention/retention facilities shall demonstrate and provide an adequate outfall in accordance with City Requirements.

4. Criteria established by the State of Texas for dam safety (TAC Title 30, Part 1, Chapter 299) and impoundment of state waters (Texas Water Code Chapter 11) shall apply where required by the state, and where, in the Engineer's judgment, the potential hazard requires these more stringent criteria.

F. Detention Storage Calculation

1. Detention facilities without upstream detention areas and with drainage areas of 25 acres or less can be designed using the Modified Rational Method otherwise the Unit Hydrograph Method shall be used.

2. If the Unit Hydrograph Method is used, the model shall extend through the Zone of Influence (see Section 4.02.B) and include existing detention facilities within the Zone of Influence watershed.

3. No required parking space may be located within a surface drainage pond. A maximum depth of 6" of ponded water is allowed in a parking lot.

4. Modeling software that aids in the design computations of stormwater detention facilities may be utilized upon approval from the City Engineering Department.

G. Provide outlet restrictor details along with design and hydraulic calculations for orifice diameter and/or weir length with invert elevations defined.

1. The outfall structure shall have an external trash rack installed for the low flow scenarios that meets or exceeds the requirements in the iSWM Hydraulics Technical Manual for trash rack design, including but not limited to a 60-degree sloped rack attached to the structure, made of material that is rust resistant, and having two inches (2") openings.

2. The overflow spillway shall be computed using the broad-crested weir equation, when applicable (Brater and King, 1976):

$$Q = CLH^{1.5}$$

where:

Q = discharge (cfs)
C = broad-crested weir coefficient (see Table 4.6 below)
L = broad-crested weir length perpendicular to flow (ft)
H = head above weir crest (ft)

Figure 4: Broad-Crested Weir

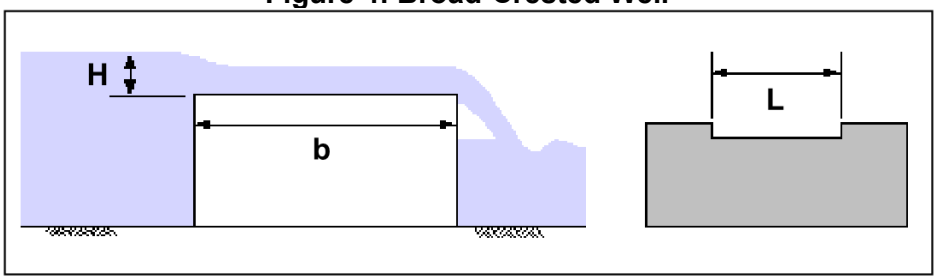


Table 4.6

Broad-Crested Weir Coefficient (C) Values											
Measured Head (H)*	Weir Crest Breadth (b) in feet										
In feet	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

* Measured at least 2.5H upstream of the weir.
Source: Brater and King (1976)

H. Provide stage versus storage tables on the construction plans.

I. Provide details on the construction plans, including but not limited to a plan and side elevation view defining the invert of the structure and flowlines of all pipes entering / exiting the structure. In addition, provide top of rim elevation, thickness of walls, etc.

J. When using perforated riser for water quality, spec number, spacing and diameter of perforations per iSWM Technical Manual, Hydraulics, Chapter 2.0 Storage Design. Verify water quality feature design used 1yr, 6-hr intensity of 0.35 in/hr (*iSWM)*.

K. Reinforced low flow pilot flumes are required for detention facilities between inlet / outlet and at point discharges to pond bottom, minimum paving slope 0.5%.

L. Detention Pond and Emergency Spillway Geometry:

1. Detention structures shall have a minimum of 1 foot of freeboard above the 100-year water surface elevation (WSEL).

2. All detention ponds shall have an emergency spillway that is stabilized for a minimum length of 10 feet in the direction of flow and subject to the following criteria. See Figure 5 below for a general representation of the detention pond and spillway design.

   a. The emergency spillway shall be designed to pass a minimum of the 100-year flood event.

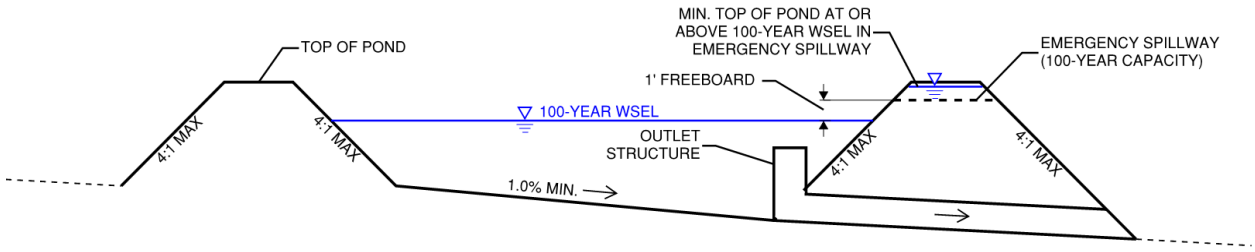
   b. The effective crest of the emergency spillway shall be a minimum of 1-foot above the 100-year water surface elevation in the detention pond.

   c. The top of detention pond shall be at or above the 100-year water surface elevation in the emergency spillway.

   d. If the emergency spillway is on top of an earthen embankment, the spillway shall be stabilized to the toe of the outer embankment.

   e. If the emergency spillway is adjacent to a public street and parkway or is visible from public property, the spillway shall be stabilized with stabilization material that can grow vegetation.

Figure 5: Detention Pond and Emergency Spillway Profile



3. The steepest side slope permitted for a vegetated embankment is 4:1.

4. Earth embankments used to temporarily or permanently impound surface water must be constructed according to specifications as required based on geotechnical investigations of the site and all regulatory requirements.

5. The detention facility bottom must be designed to provide positive drainage with a minimum 1.0% pond bottom slopes to the outlet structure.

6. In the scenario when a pond is entirely excavated, with no embankments, and the emergency spillway is adjacent and outfalls to a public street and parkway, the spillway is not required to be stabilized.

7. All weather access drive shall be provided to the storm screening device, banks and bottom of a detention facility for maintenance, 10-feet wide minimum with 20% maximum longitudinal slope and 10% maximum traverse slope. The access drive

must be from the detention facility to an adjoining public ROW or access easement. Provide a standard driveway approach at the public way and install removable bollards per City standard details. The driveway must meet all TSM requirements in Section 8. For a prefabricated screening device, 10-foot minimum width all weather access drive shall be provided to allow for the proper maintenance of said device from private property per the manufacturer's maintenance requirements.

8. Provide minimum 10 feet wide unobstructed access around pond, maximum 10% traverse slope.

9. All lots adjacent to the pond shall have a minimum finished floor elevation (FFE) of at least 2-feet above the 100-year water surface elevation (WSEL) in the pond.

10. All lots adjacent to the emergency spillway shall have a minimum FFE of at least 1-foot above the 100-year WSEL in the spillway.

M. It is the responsibility of the Engineer to consider pedestrian and vehicular safety in the design of detention facilities. Perimeter rails or fencing may be required.

N. Detention ponds should follow the Landscaping Standards as indicated in the GDC Section 3.89.I. Properly designed amenities and trees are allowed in the bottom of detention ponds only with approval of the Director of Engineering.

O. Detention ponds must be equipped with a permanent irrigation system per the GDC Section 3.89.E.11.

P. Facilities with permanent pools shall address dewatering procedures.

Q. Where underground detention facilities are utilized, the paving shall be designed with reinforced concrete with H-20 loading if located under parking and fire lanes.

R. A permanent detention pond easement shall be granted to the City containing the facility and the area surrounding the facility needed for maintenance, including all control structures and all piping contributing to the detention storage volume. The acceptance of the easement by the City shall not obligate the City to provide care or maintenance for the facility in any manner.

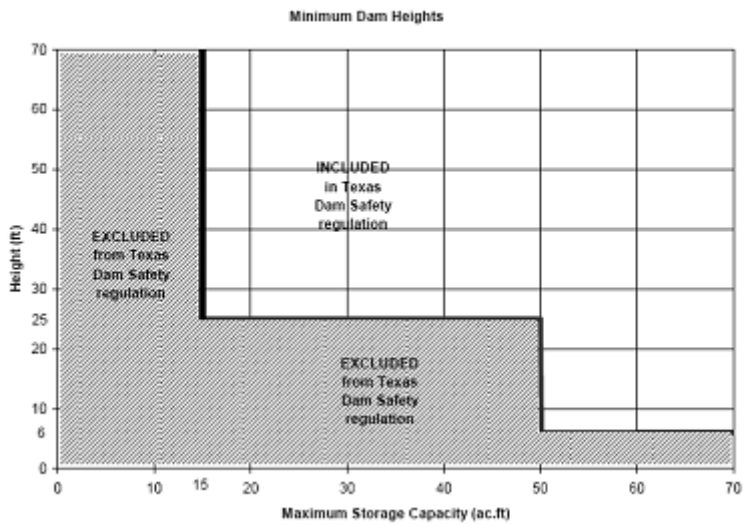
S. The Engineer shall provide an Operation and Maintenance Manual for the detention facility including amenity ponds as part of the design, see example in Appendix 4B. The maintenance plan shall indicate the ingress and egress locations to enter and maintain the pond, maintenance roles and responsibilities, standard detention general notes, contact information for the party responsible for the maintenance, and a maintenance schedule.

T. Texas Commission Environmental Quality Requirements for Dams

The Texas Commission on Environmental Quality (TCEQ) provides design and review criteria for construction plans and specifications, construction, operation and maintenance, inspection, repair, removal, emergency management, site security, and enforcement of dams. As of the date of these design standards, dams that fall under TCEQ dam safety regulations meet the following criteria:

- have a height greater than or equal to 25 feet, and a maximum storage capacity greater than or equal to 15 acre-feet
- have a height greater than 6 feet, and a maximum storage capacity greater than or equal to 50 acre-feet

Figure: 30 TAC §299.1(a)(2)



The design engineer shall refer to the Texas Administrative Code, Title 30, Part 1, Chapter 299 Dams and Reservoirs for current dam safety criteria. All proposed construction or modification of dams are required to adhere to TCEQ dam safety criteria. Should the design engineer desire to utilize an existing facility that would qualify under this criteria and the use of the facility changes from an agricultural use to another use, the existing facility may need to be brought into compliance with the TCEQ dam safety criteria. If dams that fall under the TCEQ dam safety criteria, the City will require review and approval from TCEQ prior to authorizing construction.

Water features and detention facilities with permanent pools must obtain a TCEQ water rights permit if applicable. Refer to TCEQ for water rights regulations.

For permanent pool ponds without a water rights permit, the Engineer shall provide a signed statement to the City stating the water rights permit is not required.

4.12 Miscellaneous Drainage Requirements

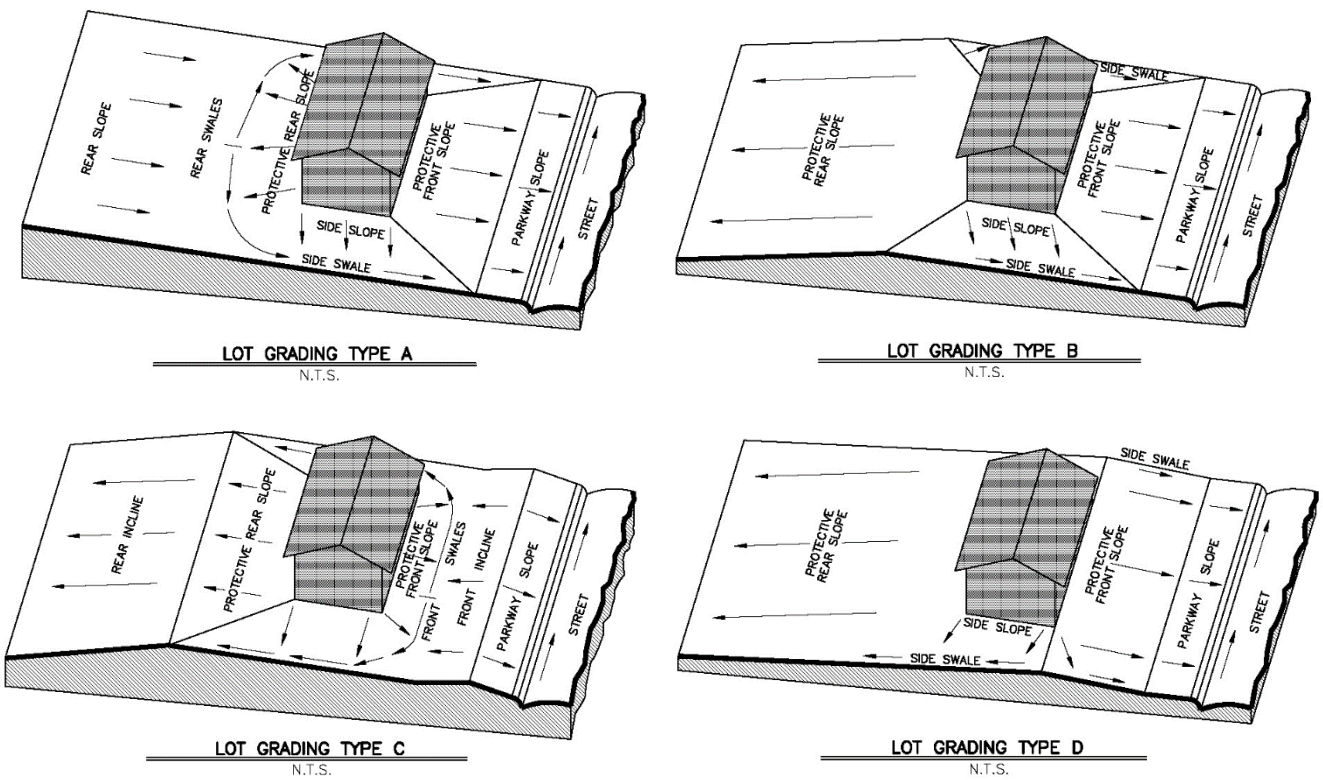
A. The maximum surface water discharge from a driveway shall be 5 cfs where the street has sufficient capacity. Point discharges into the curb line of an Arterial roadway are prohibited and only permitted on Collectors with approval by the Director of Engineering.

B. Public water from a street or alley entering private property via a driveway or flume is prohibited without a drainage easement approved by the Director of Engineering.

C. The minimum slope for non-paved areas shall be 1.00%. The minimum slope for paved areas within public rights of way and easements shall be 0.60%.

D. Lot Drainage - Lot to lot surface water drainage across property lines in single family residential subdivisions is prohibited. Pad elevations shall be no less than **12" above the lowest point of primary drainage across the lot unless the property is located adjacent to a detention pond spillway, see Section 4.11.L.10.** Figure 6 is provided below for reference when performing lot grading designs. Lot grading type and finished floor elevations shall be shown on the construction plans. Type B, Type C and Type D Lot Grading must back to alleys, open space, or drainage easement. Refer to the International Residential Building Code (IRC) Section 401.3 (latest version) for additional requirements.

Figure 6: Typical Lot Grading Patterns



E. Grading plans shall be of sufficient clarity to fully indicate the extent of the work proposed and shall show in detail, work conforms to all applicable standards and regulations. A licensed Professional Engineer in the State of Texas shall provide and seal grading plans. Ideally, grading plans will have 1-foot contours and show existing and proposed contours, including those on adjacent properties within 50 feet of the project site sufficient to show existing and proposed drainage patterns, finish floors, and pad elevations tied to the City of Garland/FEMA benchmark network.

F. Residential Single-Lot Grading Plans shall follow the Residential Single-Lot Grading Plan Checklist in Appendix 4C.

G. The minimum finished floor elevation for any lot adjacent to a drainage feature (i.e., creeks, detention ponds, and any open bodies of water) shall be 2 foot above the adjacent 100 year fully developed water surface elevation and shall be shown on the final plat. Per GDC Section 3.86(D), at no time shall any portion of the 100-year floodplain exist or be allowed within any single-family or two-family residential lot, unless it is part of a subdivision consisting of fewer than four lots.

H. Should mitigation be required under Section 404 of the Clean Water Act, the areas shall be identified on the engineering construction plans.

I. Refer to Section 4.17 for floodplain reclamation requirements.

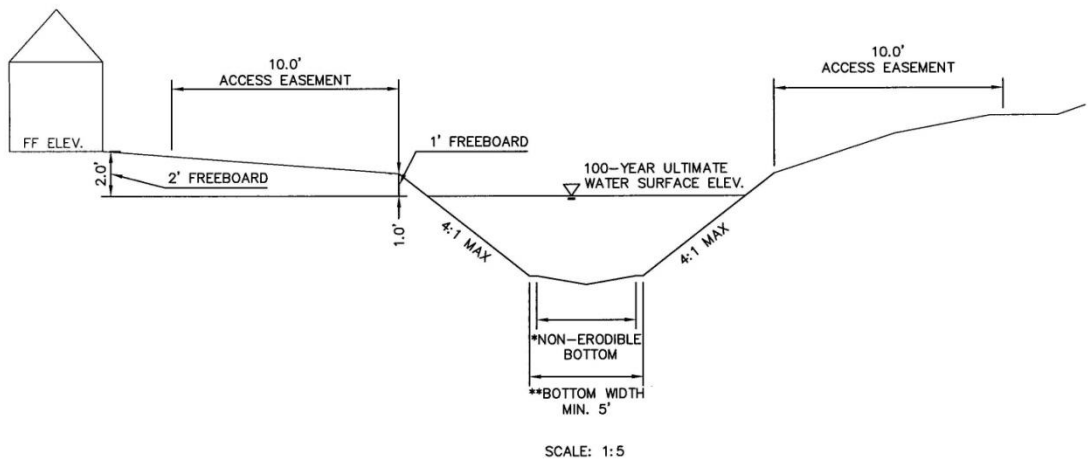
J. Maximum grading slope is 3:1, but in order to create a more useable yard, 4:1 or less is preferable. If the slope supports City improvements it shall not exceed 4:1 unless a stability analysis is provided.

4.13 Open Channel Design

The City prefers natural channels. Excavated open channels may be used to convey storm waters where the construction costs and/or long-term maintenance cost involved with a closed storm sewer system is not justified economically. Open channels shall be designed to convey the 100-year, 24 hour design storm event discharge using fully developed conditions with low flow protection measures included for bank and bottom stability. HEC-RAS, or similarly capable software approved by the City, shall be used to confirm the water surface profiles and velocities in open channels.

The allowable excavated channel cross section is shown on Figure 7 below. The maximum velocities allowed for various types of excavated channel cover can be calculated using the lower (maintained) Manning's n values, which are shown in Table 4.6. These maximum velocities do not apply for drainage facilities discharging off-site. A downstream assessment in accordance with Section 4.02 shall be performed to determine maximum discharge velocities.

Figure 7: Open Channels – Excavated



*NON-ERODIBLE BOTTOM SHALL BE DESIGNED BY THE ENGINEER AND DOCUMENTATION AND CALCULATIONS SHALL BE PROVIDED TO CITY STAFF FOR REVIEW. GRADES SHALL ENSURE POSITIVE DRAINAGE THROUGHOUT THE CHANNEL.

**MINIMUM BOTTOM WIDTH SHALL BE BASED UPON PROJECT SPECIFIC CHANNEL MAINTENANCE NEEDS. BOTTOM WIDTHS SMALLER THAN WHAT IS SHOWN SHALL BE APPROVED BY THE DIRECTOR OF ENGINEERING

THE DIRECTOR OF ENGINEERING MAY REQUIRE HYDRAULIC MODELING OF THE CONSTRUCTED CHANNEL TO CONSIDER A MANNINGS VALUE THAT REFLECTS A "MAINTAINED CHANNEL (0.25–0.35)" AND A "NON-MAINTAINED CHANNEL (0.35–0.055)".

A. Refer to GDC Section 3.86 for additional information.

B. Unlined unvegetated excavated channels are not allowed. Construction of excavated channels will not be considered complete until the channel banks are stabilized. Public rights of way, easements and common areas must be stabilized with perennial vegetation cover, fully established with 100% coverage or approved stabilization method prior to project final acceptance by the City.

C. Supercritical flow shall not be allowed in channels except at drop structures and other energy dissipators.

D. If relocation of a stream channel is unavoidable, the cross-sectional shape, meander, pattern, roughness, sediment transport, and slope shall conform to the existing conditions insofar as practicable. Energy dissipation will be necessary when existing conditions cannot be duplicated.

E. Streambank stabilization shall be provided, when appropriate, as a result of any stream disturbance such as encroachment and shall include both upstream and downstream banks as well as the local site. For channel banks steeper than a 4:1 slope, adequate slope stabilization shall be provided or a slope stability analysis by a Licensed Engineer shall be submitted for review and approval. For any banks steeper than a 3:1 slope, adequate hard armoring of the slope will be provided.

F. At transitions in channel characteristics, velocities must be reduced to the maximum velocity per the downstream assessment in accordance with Section 4.02.B. Velocities must be reduced before the flow reaches the natural channel using either energy dissipaters and/or wider less steep channel.

G. Channel armoring for erosion control shall be provided where deemed necessary by the Director of Engineering. Supporting calculations and/or documentation that the downstream velocities do not exceed the allowable range once the downstream modifications are installed must be provided. Allowable bank protection methods include stone riprap, gabions, and bio-engineered methods. Other methods / materials may be considered by the Director of Engineering.

H. If the channel cannot be maintained from the top of the bank, a reinforced concrete class "C" stormwater access drive and ramp shall be provided from the drainage easement to an adjoining public ROW or access easement unless waived by the Director of Engineering. The drive shall be 10-feet wide minimum with 20% maximum longitudinal slope and 10% maximum traverse slope. Provide standard driveway approach at public way and install removable bollards per standard City details.

I. Minimum channel bottom widths are recommended to be equal to twice the depth of the channel. Any permanent open channel shall have a minimum bottom width of 5 foot.

J. All open channels require a minimum freeboard of 1 foot freeboard.

K. The minimum slope for an excavated improved channel is 1% unless a pilot channel is constructed, or otherwise approved by the Director of Engineering.

Table 4.6 provides allowable ranges for roughness coefficients of open channels.

Table 4.6 Channel Roughness Coefficients

Channel Description	Roughness Coefficient		
	Minimum	Normal	Maximum
Minor Natural Streams			
Moderately Well Defined Channel			
-grass and weeds, little brush	0.025	0.030	0.033
-dense weeds, little brush	0.030	0.035	0.040
-weeds, light brush on banks	0.030	0.035	0.040
-weeds, heavy brush on banks	0.035	0.050	0.060
-weeds, dense willows on banks	0.040	0.060	0.080
Irregular Channel with Pools and Meanders			
-grass and weeds, little brush	0.030	0.036	0.042
-dense weeds, little brush	0.036	0.042	0.048
-weeds, light brush on banks	0.036	0.042	0.048
-weeds, heavy brush on banks	0.042	0.060	0.072
-weeds, dense willows on banks	0.048	0.072	0.096
Floodplain, Pasture			
-short grass, no brush	0.025	0.030	0.035
-tall grass, no brush	0.030	0.035	0.050
Floodplain, Cultivated			
-no crops	0.025	0.030	0.035
-mature crops	0.030	0.040	0.050
Floodplain, Uncleared			
-heavy weeds, light brush	0.035	0.050	0.070

Channel Description	Roughness Coefficient		
	Minimum	Normal	Maximum
-medium to dense brush	0.070	0.100	0.160
-trees with flood stage below branches	0.080	0.100	0.120
Major Natural Streams			
Moderately Well Defined Channel	0.025	-----	0.060
Irregular Channel	0.035	-----	0.100
Unlined Vegetated Channels			
Mowed Grass, Clay Soil	0.025	0.030	0.035
Mowed Grass, Sandy Soil	0.025	0.030	0.035
Unlined Unvegetated Channels			
Clean Gravel Section	0.022	0.025	0.030
Shale	0.025	0.030	0.035
Smooth Rock	0.025	0.030	0.035
Lined Channels			
Smooth Finished Concrete	0.013	0.015	0.020
Riprap (Rubble)	0.30	0.40	0.50

L. Water surface elevations and flow velocities in channels are impacted by the maintenance condition in the channel. Calculations shall be performed assuming maintained and unmaintained vegetative conditions. Lower (maintained) Manning's values shall be used to determine maximum velocities, while higher (unmaintained) Manning's values shall be used to determine water surface elevations per Figure 7.

M. Any channel modification must meet the applicable requirements of all Local, State and Federal Regulatory Agencies.

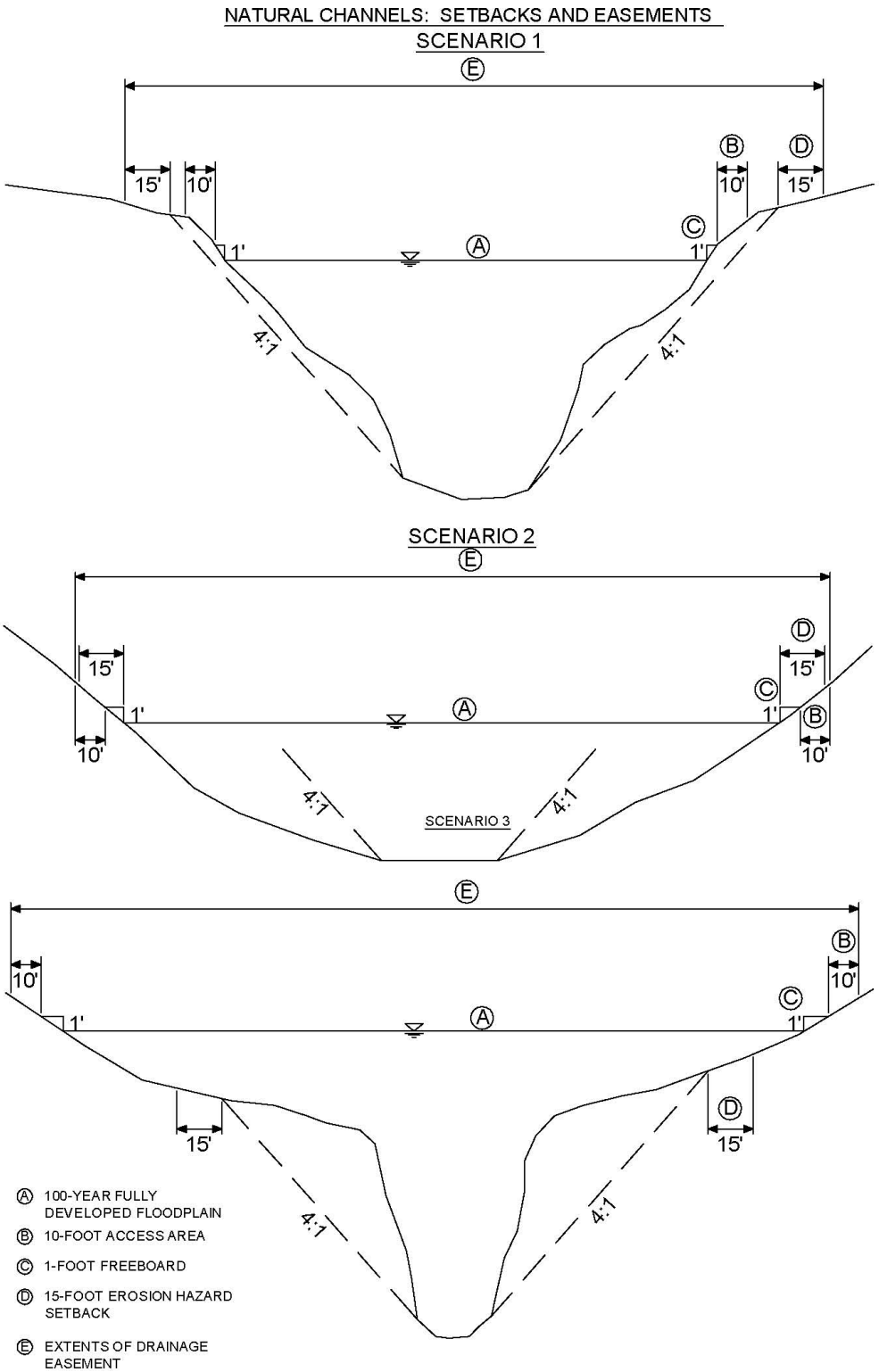
N. An erosion hazard setback shall be included within the Drainage Easement for the channel. The purpose of this setback is to reduce the potential for any damage to a private lot or street ROW caused by the erosion of the bank. The erosion hazard setback shall be determined as follows, and is provided in Figure 8 below:

1. For stream banks composed of material other than rock, locate the toe of the natural stream bank. Project a 4:1 line sloping away from the bank until it intersects finished grade. From this intersection add 15 feet away from the bank. This shall be the limit of the erosion hazard setback.

2. Figure 8 is intended to illustrate various scenarios under which the erosion hazard setback can be applied and how it interacts with the floodplain access easement. Scenario 1 shows a situation where the setback may be located outside the 100-year floodplain and drainage easement boundaries. Scenarios 2 and 3 show locations where the erosion hazard setback will be located inside the 100-year floodplain and drainage easement boundaries.

O. Any modifications within the area designated as erosion hazard setback, will require a geotechnical and geomorphological stability analysis.

Figure 8: Natural Open Channels



4.14 Hydraulic Design of Culverts

A. All culverts, headwalls, wingwalls, and aprons shall be designed in conformance with the Texas Department of Transportation Details and Standards and the City Standard Details. The Engineer is responsible for selecting the applicable detail.

B. Culvert calculations shall be provided to the City for review. For creeks that have been modeled in the HEC-2 or HEC-RAS program, culverts and bridges can be sized using the HEC-2 or HEC-RAS model. Calculations may include, but are not limited to, headwall, tailwater, and flowline elevations, lowest adjacent grade and structure elevations, inlet and outlet control calculations and velocity calculations.

C. Culverts should always be aligned to follow the natural stream channel. The engineer shall provide sufficient information to analyze the upstream and downstream impacts of the culvert and illustrate the interaction of the channel and culvert alignment. Survey information of the stream channel must be provided for 100 feet upstream and downstream from the proposed culverts, so that the channel alignment is evident.

D. To minimize the undesirable backwater effects and erosive conditions produced where the total width of box culverts exceeds the bottom width of the channel, a transition upstream and downstream of the culverts must be provided. The transition must have a minimum bottom width transition of 2 to 1 and include warping of side slopes as required. The 2 to 1 transition is 2 along the centerline of the channel and 1 perpendicular to the centerline.

E. Headwalls and Entrance Conditions:

1. The Engineer shall be responsible for the headwall and wingwall designs. Headwalls and endwalls refer to the entrances and exits of structures, respectively, and are usually formed of cast-in-place concrete and located at either end of the drainage system. Wingwalls are vertical walls, which project out from the sides of a headwall or endwall.

2. The culvert entrance losses are provided in Table 4.7 below. The values of the entrance coefficient K_e represent a combination of the effects of entrance and approach conditions. Losses shall be completed using the following formula:

$$H_e = K_e \frac{V^2}{2g}$$

H_e = Entrance head loss (ft)
K_e = Entrance loss coefficient
V = Velocity (fps)
g = Gravity constant (32.2 ft/s^2)

Table 4.7 Culvert Entrance Losses

Type of Structure	K_e
Pipe, Concrete	
-projecting from fill, socket and (groove end)	0.2
-projecting from fill, square cut end	0.5
-headwall or headwall and wingwalls: socket end of pipe (groove end)	0.2
-headwall or headwall and wingwalls: square edge	0.5
-headwall or headwall and wingwalls: rounded (radius = 0.0933D)	0.2
-mitered to conform to fill slope	0.7
-beveled edges, 33.7° or 45°	0.2
-side or sloped tapered inlet	0.2
Pipe, or Pipe-Arch	
-projecting from fill (no headwall)	0.9
-headwall or headwall and wingwalls: square edge	0.5
-mitered to conform to fill slope, paved / unpaved slope	0.7
-beveled edges, 33.7° or 45°	0.2
-side or sloped tapered inlet	0.2
Box, Reinforced Concrete	
-headwall parallel to embankment (no wingwalls): squared on three sides	0.5
-headwall parallel to embankment (no wingwalls): rounded on three sides to radius 1/12 barrel dimension on three sides	0.2
-wingwalls at 30° to 75° to barrel: square edged at crown	0.4
-wingwalls at 30° to 75° to barrel: crown edge rounded to radius of 2/12 barrel dimension, or beveled top edge.	0.2

4.15 Bridge Design Hydraulics

A. The City requires that head losses and depth of flow through bridges be determined with a HEC-RAS program or other approved program. The following guidelines pertain to the hydraulic design of bridges:

1. The design storm event for bridges is the 100-year, 24 hour discharge using fully developed conditions.

2. Fully developed 100 year water surface must not be increased upstream of the bridge.

3. Excavation of the natural channel is not allowed as compensation for loss of conveyance.

4. Channelization upstream or downstream of the proposed bridge will normally only be permitted when necessary to realign the flow to a more efficient angle of approach.

5. Side swales may be used to provide additional conveyance downstream of and through bridges.

6. Bridges are to be designed with the lowest point (low beam) low chord at least 2 foot above the water surface elevation of the design storm.

7. Bents shall not be in channel when possible. Bents must be aligned parallel to flow.

B. A scour analysis shall be submitted with design plans.

4.16 Energy Dissipators

A. The Engineer shall be responsible for all energy dissipation designs.

B. A Downstream Assessment shall be performed to ensure modifications to the storm drainage system, through development or construction of storm drainage facilities, do not have an adverse impact on downstream conditions.

C. Grouted rock rip-rap or gabion baskets or mattresses are required for energy dissipation. Other designs may be considered.

D. All energy dissipation designs shall include supporting calculations showing the design is adequate. The City may require the Engineer to provide a hydraulic model as supporting documentation.

E. All energy dissipators should be designed to facilitate future maintenance. The design of outlet structures in or near parks or residential areas shall give special consideration to appearance and shall be approved by the Director of Engineering and Park and Recreation Department.

4.17 Floodplain Alterations

A. No new construction is allowed in floodplain areas, unless a flood study is prepared by a Texas-licensed Professional Engineer that affirms that said construction shall not cause any rise in 100-year water surface elevations in the stream. This study must be reviewed and approved by the Engineering Department before a Floodplain Development Permit will be issued. New construction in floodplain areas must also comply with all applicable sections of Section 31, Article VII (Flood Damage Prevention) of the City of Garland Code of Ordinances. Construction is allowed in those areas that have been reclaimed from the floodplain, subject to the requirements of subsection B below.

   A complete flood study shall consist of the following basic elements in a bound report:

   1. Table of Contents

   2. Narrative, scope and objective of analysis, description of pre- and post-project floodplain conditions, source of data used, methodology used to analyze the existing conditions and proposed project effects. Provide summary tables of water surface elevation comparison at each cross section with a tabulation column of increases or decreases between the various models. Provide the same tables for channel velocity. Include a summary, conclusions and recommendations section. Discuss any potential maintenance concerns that may be created by the project; changes and impacts to adjacent, up- and downstream properties expected from the

proposed project; and the proposed project compliance with section 3.86(D)(5) of the Garland Development Code.

3. Input and output data along the impacted reach for the effective 10-, 50-, 100-, 500-year and 100-year Fully Developed condition discharges for the following:

   a. Duplicate effective Flood Insurance Study (FIS) model

   b. Pre-project model (effective FIS model with any added project cross sections that reflects conditions prior to construction of the project)

   c. Post-project model (Pre-project model reflecting the proposed project)

4. Floodway hydraulic backwater models of the following:

   a. Duplicate effective FIS model

   b. Pre-project conditions

   c. Post-project conditions

   Provide tabulation of increase or decrease in FEMA Floodway top widths and surcharges between effective and pre-project at each cross section along the project reach where changes occur and between the pre- and post-project FEMA Floodway top widths and surcharges.

5. Copy of the effective Flood Insurance Rate Map (FIRM) with the project area indicated.

   a. Proposed Post-project FIRM

6. Completed FEMA forms and the applicable “No Rise / No Impact” Certification form found in TSM Appendix 4E.

7. Full size (24-inch x 36-inch) floodplain work map at a legible scale of the entire area covered by the post-project hydraulic model delineating:

   a. All cross sections used in the model aligned and labeled.

   b. The post-project floodplain boundaries based on the effective 100- and 500-year and 100-year Fully Developed flows. For clarity purposes, if need be, these maps may have to be represented on more than one sheet.

   c. Locate and label ineffective flow boundaries.

   d. The effective and post-project FEMA Floodway boundary -- highlight any changes in the FEMA Floodway.

   e. Note the source of the base contours on the Work Map, include bench mark(s) used for any field surveyed cross sections. Field surveys must be referenced to the City of Garland Benchmark Control Network.

8. Pre- and Post-project model cross sections and profiles along the project reach with "n" values shown on the cross sections.

9. Provide a CD with all models used in the analysis.

   In all of the above hydraulic models, the following rules shall apply:

   - Alterations of the floodplain shall not increase the 100-year Fully Developed water surface along Rowlett Creek and Spring Creek, or have a net change in valley storage of 15% or more, and increases to existing average velocities shall be allowed to maximum average velocity of no greater than 6 feet per second.

   - Alterations shall be in compliance with FEMA guidelines and general modeling guidance provided in U.S. Army Corps of Engineer's hydraulic model user manuals.

   - Any alteration of the floodplain shall not cause any additional expense in any current or projected public improvements, including maintenance.

   - The floodplain shall be altered only to the extent permitted by equal conveyance on both sides of the natural channel, as defined by the U.S. Army Corps of Engineers in the HEC-2 and HEC-RAS user manuals.

   - The toe of any fill or wall shall parallel the natural direction of the flow.

   - The hydraulic parameters, such as bridge loss coefficients, "n" values, etc., used in the effective FIS models will only be changed where obvious errors or changes have taken place and must include documentation supporting the change.

   - The computed water surface elevation profiles have to converge with the effective model profiles upstream and downstream of the project.

   - All items shall be labeled for easy cross-referencing to the hydraulic model and summary data.

B. Floodplain alteration shall be allowed only if all the following criteria are met:

1. Flood studies shall include flows generated for existing conditions and fully-developed conditions where available for the 10, 50, and 100 year storm events.

2. Alterations of the floodplain shall not increase the water surface elevation of the design flood of the creek on other properties. The design engineer shall attest to this criteria by completing and submitting the applicable "No Rise / No Impact" Certification form found in Appendix 4E.

3. Alterations shall be in compliance with FEMA guidelines.

4. Alterations of the floodplain shall meet the requirements of Section 4.02.

5. Alterations along Rowlett and Spring Creek floodplains must use the 100-year fully developed discharge as computed in the 1988 Rowlett and Spring Creek Flood Plain Management Study, available in the Engineering Department for purchase. No

increase in the 100-year fully developed water surface elevation or decrease in floodplain valley storage of more than 15% is allowed along Rowlett and Spring Creek.

6. Any alteration of floodplain areas shall not cause any additional expense in any current or projected public improvements, including maintenance.

7. The floodplain shall be altered only to the extent permitted by equal conveyance on both sides of the natural channel, as defined by the United States Army Corps of Engineers in a HEC-RAS analysis. The right of equal conveyance applies to all owners and uses, including greenbelt, park areas, and recreational areas. Owners may relinquish their right to equal conveyance by providing a written agreement to the Director of Engineering.

8. The toe of any fill shall parallel the natural direction of the flow.

9. Grading activities in the floodplain shall incorporate and consider other City planning documents and ordinances such as the Tree Preservation Ordinance, Rowlett and Spring Creek Flood Plain Management Study, Flood Damage Prevention Ordinance, etc.

10. Incorporates and considers other city planning documents and ordinances.

C. The above criteria shall be met before any floodplain alteration may occur. Typical projects requiring a floodplain alteration include placing fill (whether or not it actually raises the property out of the floodplain), constructing a dam, straightening channel sections, making improvements (substantial or otherwise) to existing structures in a floodplain in which the existing outside dimensions of the structure are increased, and temporary storage of fill materials, supplies and equipment.

D. In general, the information needed for the application shall be performed by running a backwater model, such as HEC-2 or HEC-RAS, and a flood routing model, such as TR-20, HEC-1, or HEC-HMS. Unless a pre-existing model is in place, HEC-HMS and HEC-RAS shall be used. The backwater information shall be used to determine that upstream water surface elevations and erosive velocities have not increased. Flood routing information shall be used to insure that the cumulative effects of the reduction in floodplain storage of floodwater will not cause downstream increases in water surface elevations and erosive velocities.

E. The Engineer is responsible for providing documentation of the relevant USACE approved permits prior to beginning modification to the floodplain, or for providing a signed and sealed statement detailing why such permits are unnecessary.

F. The City of Garland requires that changes be made to effective Flood Insurance Rate Maps (FIRM) maps and Flood Insurance Study (FIS) documents if any of the following will occur as a result of the proposed work in a designated 100-year floodplain:

1. A change in water surface elevation

2. A change in the 100-year floodplain or floodway boundaries

3. A physical change to the floodplain and effective hydraulic model. (e.g., fill or excavation, roadway, structures)

G. Construction permits will not be issued until a Conditional Letter of Map Revision (CLOMR) or amendment has been accepted by the Director of Engineering for submittal to FEMA. Where a floodway is being impacted, the applicant must submit and obtain approval from FEMA for a conditional Letter of Map Revision prior to construction in the floodway.

H. The Developer is solely responsible for obtaining the necessary CLOMR, LOMR, and/or LOMA. FEMA charges a review fee for processing these requests. Contact FEMA for current rates and submittal requirements. Complete the Floodplain Development Permit form number 1, 2, and 3 in Appendix 4D per Article VIII of the Code.

I. Verification of Floodplain Alterations:

1. Prior to final acceptance by the City, an affirmation statement shall be prepared by a Licensed Professional Engineer or Registered Professional Land Surveyor showing that all lot elevations, as developed within the subject project, meet the required minimum finished floor elevations shown on the construction plans. This affirmation shall be filed with the Director of Engineering.

4.18 Erosion and Sedimentation Control

A. See Section 4.20 and TSM Section 6 for requirements for Stormwater Best Management Practices and Stormwater Management Plan.

4.19 Drainage Easements

A. The following minimum width exclusive drainage easements are required when facilities are not located within public rights-of-way:

1. Storm sewers are to be located within the center of a 20 feet drainage easement or 1.5 times the depth plus the width of the structure rounded up to the nearest 5 foot, whichever is greater.

2. Overflow flumes are to be sized for the projected emergency overflow and centered within a minimum 10 foot drainage easement.

B. Storm drain lines are considered public only if they collect runoff from public property, public rights of way or easements. Only public storm drain lines require drainage easements that shall be dedicated on the subdivision plat.

C. Any lot to lot storm water or system that does not collect public water is considered private. For any private storm sewer system crossing an adjacent lot(s), the developer shall provide the Director of Engineering with a copy of the subdivision covenants or letter stating the private storm water conveyance is acceptable to the adjacent owner prior to the plans being “Released for Construction”.

D. Drainage easements shall be dedicated on the subdivision plat. For single-family residential developments, storm drain lines shall not cross residential lots unless approved by the Director of Engineering. If drainage easements cross residential lots, they should be contained fully on one lot.

E. Drainage Easements shall be dedicated on the subdivision plat for all floodplains and shall include 1 foot freeboard, a minimum 10 foot stormwater access way on both sides of the channel, and an erosion hazard setback to reduce the potential for damage due to erosion of the bank. The drainage easement shall be based on the delineation of the 100-year WSE. Using FEMA FIRM overlays or GIS shapefiles is not an accurate way to depict floodplains and will not be accepted as such.

F. Detention Pond Easements shall be dedicated on the subdivision plat for all detention facilities containing the facility and the area surrounding the facility needed for maintenance of the facility.

G. Prior to any grading or filling operations in or within 10-feet of the 100-year floodplain or a drainage easement containing a creek or open channel, the easement area and 100-year floodplain shall be staked onsite by a Registered Professional Land Surveyor.

4.20 Sustainable Development

The City encourages developments to implement sustainable designs, concepts, and practices on site. The Engineer shall notify the City of the design intent and provide the necessary information, data, and calculations on the construction plans. The following items are potential concepts and designs that may be considered in a sustainable design. Concepts and designs not included on this list may be proposed by the Engineer. Refer to TSM Section 6: Stormwater Management for more information.

- Rainwater Harvesting
- Green Roofs
- Modular Porous Paver Systems
- Porous Concrete
- Extended Detention
- Bio Retention
- Reduction of impervious surfaces
- Preservation of natural drainage paths

The Engineer shall refer to published technical resources for the design of these sustainable designs, concepts, and practices. Such technical resources may be found on the North Central Texas Council of Governments' (NCTCOG) storm water website or the Environmental Protection Agency's (EPA) website for Low Impact Development.

SECTION 5

WATER & WASTEWATER DESIGN REQUIREMENTS

Section 5 – Index

Section 5 – Water & Wastewater Design Requirements

5.1 Water and Wastewater System Capacity Analysis 5-3
5.2 Water System - General 5-6
5.2.1 Dead End Water Mains 5-6
5.2.2 Horizontal and Vertical Alignment 5-6
5.2.3 Separation Distance between Water and Wastewater 5-7
5.2.4 Water Main Sizing 5-8
5.2.5 Water Main Materials 5-8
5.2.6 Water Services 5-9
5.2.7 Valves 5-9
5.2.8 Fire Hydrants 5-10
5.2.9 Fire Service Lines 5-11
5.2.10 Connections to Existing Water Mains 5-12
5.2.11 Backflow Prevention 5-12
5.2.12 Automatic Flushing Valve 5-13
5.3 Wastewater System - General 5-13
5.3.1 Wastewater Main Location 5-13
5.3.2 Horizontal and Vertical Alignment 5-13
5.3.3 Separation Distance between Wastewater and Water Mains 5-15
5.3.4 Wastewater Main Sizing 5-15
5.3.5 Wastewater Main Materials 5-16
5.3.6 Wastewater Service Laterals 5-16
5.3.7 Manholes and Cleanouts 5-17
5.3.8 Inverted Siphons 5-19
5.3.9 Wastewater Lift Stations 5-19
5.3.10 Force Mains 5-20
5.4 Easements 5-21
5.5 Thrust Restraint 5-22
5.6 Pavement Cut and Repair 5-22
5.7 Trenchless Construction 5-23
5.8 Crossings 5-23

Section 5 – Water & Wastewater Design Requirements

5.1 Water and Wastewater System Capacity Analysis

Design criteria for all water and waste water systems shall comply with Texas Commission on Environmental Quality (TCEQ) requirements of Chapter 290 (Rules and Regulations for Public Drinking Water) and Chapter 217 (Rules and Regulations for Design Criteria for Domestic Wastewater Systems), latest revision. A water and wastewater capacity analysis is required upon new development or re-development when the water usage and demand increase from the historical use. All capacity analysis shall be analyzed based on fully developed conditions.

Water Capacity Analysis: Capacity analysis for water systems shall note the source of the domestic and fire flow quoted, such as the latest edition of the International Building and Fire Codes, industry specific historical data, or other authoritative source.

For the water analysis contact Water Dispatch at 972-205-3210 to set up fire hydrant flow test(s) as needed. The analysis shall include but not limited to the following:

A. Zoning

B. Area in acres

C. Type of Development

D. Number of units and building square footage

E. Exhibit with connection locations, number of units/square footage per connection and proposed water main schematic

F. Fire Flows

G. Projected average day, peak day, and peak hour water demands

The water analysis shall utilize the Water Master Plan's Development Flow Determination Parameters, see Appendix 5B. The design engineer shall document the above items and perform an analysis to ensure the fully developed conditions meet or exceed TCEQ and the City's minimum standards. The minimum pressure shall be 40 psi under typical operating conditions and 20 psi under fire flow conditions. The available fire flow shall be higher than minimum fire flow calculated based on the International Fire Code (IFC) as adopted by the City of Garland, including local amendments to the Code, including but not limited to building size and construction type. The City of Garland Fire Marshal's Office is the authority having jurisdiction.

The design engineer shall prove out if the fire protection system can meet the City of Garland Fire Department requirements and specifications. If it cannot meet the minimum standards, then the developer shall be required to furnish additional means, methods and equipment to meet such requirements and specifications, including but not limited to offsite improvements, or onsite pumping storage facilities.

Wastewater Capacity Analysis:

Step 1: Determine Dry Flow:

Provide information on the actual daily dry flow for the existing use when available. In the absence of historical flow data, all capacity analyses shall use the daily wastewater flow – gallons per person and other generally accepted parameters established by the Garland Wastewater Master Plan (WWMP). In the absence of available data in the Garland WWMP, the TCEQ and or Dallas Water Utilities data identified below may be utilized to determine the Maximum Daily Dry weather flow (MDDF).

- Current City of Garland WWMP estimated design flows (population/employment per unit, Average Daily Flow per Capita and Peaking Factor), see Appendix 5B.
- The Texas Commission on Environmental Quality, Chapter 217 Subchapter B, 217.32(a)(3)
- The Dallas Water Utilities Water and Wastewater Design Manual Table 4.4.3.2.
- Actual fixture count for the project

Step 2: Existing vs Fully Developed Flow

If the site is undeveloped, proceed to Step 3. If the site involves a building expansion or is being redeveloped, calculate the site's fully developed MDDF using parameters stated in Step 1. Compare the site's fully developed MDDF to the historical MDDF calculated in Step 1. If fully developed MDDF<=historical MDDF, analysis can be stopped (show calculations on utility plan). If not, proceed to Step 3.

Step 3: Calculate Site's Total Peak Flow

Calculate the Total Peak flow for the project by one of the following methods:

- Calculate using City's Wastewater Master Plan's RDII Allowance Rates (I/I Rates) which are based on gallons per acre per day (gpad) and should be applied to the total development acreage, refer to Appendix 5B. Therefore,
  Total Peak Flow = MDDF (Step 2) + (I/I Rate * Total Acres), or
- Calculate using TCEQ Peaking Factor of 4.0 where Total Peak Flow = MDDF * 4.0, using the greater of either method.

Step 4: Downstream System Analysis

Contact the Engineering Department to determine what the modeled fully developed flows are for the downstream system and if the downstream wastewater system has additional capacity within the pipe (not surcharged) per the fully developed WWMP modeled results. Typically, the WWMP will provide fully developed flows for lines 12" and larger and your analysis can end once it reaches a modeled line that can handle your increase in flow.

For Capacity Analysis, the capacity of all wastewater mains downstream of the site shall be analyzed to determine if they have adequate capacity for the service area's fully developed conditions. Prepare a service area map, which shall include your site and the fully developed service area peak flow for the downstream wastewater system terminating at the nearest pipe from the WWMP with a modeled fully developed flow.

Service Area Map Information: Include a service area map of the wastewater trunk line(s) servicing the development. This map shall include the locations, sizes and slopes of existing and proposed wastewater main improvements. Define on the service area map the peaking factor, infiltration/inflow per acre contribution and fully developed population used which shall include the proposed development. Determine and define on the service area map the average daily and max daily dry flow in million gallons per day (MGD) in the trunk main and projected

contribution generated by the development. Use the Manning's equation to provide capacities, velocities and q/Q for all pipes being analyzed. Quote all sources and provide supporting exhibits and references for all variables assumed and used. Identify any existing or projected major commercial / retail, industrial, and institutional contributors if present or proposed within the service area.

Service area peak flow does not exceed programmed flow:
If the fully developed service area peak flow does not exceed the fully developed programed wastewater flow per the WWMP, then no further analysis is required.

Increased flow & downstream pipes are not surcharged:
If the flows from the development cause the downstream system to exceed the WWMP's fully developed programmed capacity and the pipes are not surcharged in the fully developed condition, then further static analysis is required. For the fully developed condition, the downstream system is allowed to utilize 100% capacity of the pipe, q/Q=1.0. The additional capacity of the downstream trunk mains can be derived statically by finding the most limiting section (flattest section of pipes) and determining what the 100% full capacity is of the pipe and compare that to the fully developed wet weather peak flow within the pipe. The difference between the 100% capacity and peak wet weather build out flow is available for the proposed project to utilize.

Increased flow & downstream pipes are surcharged:
If there is a proposed increase in fully developed wastewater flows and the downstream system is surcharged or shown to surcharge, actual hydraulic modeling may be required. If the MDDF from the site is increased by less than 10%, hydraulic modeling may be required at the discretion of the Director of Engineering. If the MDDF from the site is increased by more than 10%, then hydraulic modeling shall be required. In addition, for large projects it may be more prudent to evaluate the project using the City's WWMP dynamic hydraulic model to determine what downstream improvements would be necessitated by the additional flow. If utilizing the WWMP model, surcharging of the system would be allowed per the WWMP parameters.

At the discretion of the Director of Engineering, the City may elect to have the City's Wastewater Master Plan consultant perform the model update and require the developer to reimburse the City for hydraulic modeling and project evaluation services. As needed, the City shall request a proposal from our consultant and the City will send a letter identifying the proposal amount to the developer as a reimbursement agreement and it shall be executed prior to issuing a letter to proceed to the consultant.

The Director of Engineering will review the analysis and determine if any improvements are necessary to the downstream trunk mains. Any lines that are shown to be under capacity with the proposed development included and remaining service area's fully developed condition contributing flow shall be improved by the developer to add the necessary capacity, unless otherwise approved by the Director of Engineering.

New Wastewater Mains:
Wastewater analysis of any new mains shall be designed based on a maximum of 90% capacity, d/D<=0.90; where d=peak wet weather flow depth in pipe and D=diameter of pipe. This requirement is dictated by the WWMP. Pipe capacity shall be calculated using the Manning Equation. A roughness coefficient of 0.013 shall be used for both existing and new pipes.

5.2 Water System - General

A. The intent of the water system design requirements is to list minimum requirements for public water distribution and transmission system facilities and appurtenances. See the Plan Completeness checklist in Appendix 2A for items to represent on public works and site engineering, utility plans where connections to and extension of existing City water lines are proposed. Private fire service mains shall be designed according to these water system design requirements and the City's Fire Code and the National Fire Protection Association (NFPA) 24, Standard for the Installation of Private Fire Service Mains and Appurtenances, latest revision.

B. Design criteria for all water systems shall comply with Texas Commission on Environmental Quality (TCEQ) Chapter 290, Subchapter D (Rules and Regulations for Public Water Systems), latest revision. Chapter 290 is included in Part I of Title 30 of the Texas Administrative Code.

C. Line sizes shall comply with the City's Water & Wastewater Capital Improvement Plan, see Appendix 5A.

D. Water mains shall be sized and extended through the limits of a development to serve adjacent properties.

E. In phased developments, each phase shall be able to exist independently.

F. Water mains shall be looped to provide two independent sources of water.

G. Developer per GDC Section 3.66 shall, at a minimum, install all water taps, locate and raise to grade all water services, and properly install all meter boxes for each service per this Section and Standard Details. Public water main abandonments shall be verified by the requestor.

H. All lots shall have direct access to a public water system per GDC Section 3.42 (A) and private service lines cannot cross property lines.

5.2.1 Dead End Water Mains

A. Dead end water mains greater than 150' are not allowed without prior written approval by the Director of Engineering; if approved, a flushing device shall be provided (See Section 5.2.12). Dead end mains less than 150 feet shall have a fire hydrant or flush valve installed at the end of the dead end main.

B. Dead end water mains shall extend at least one joint past the edge of the pavement. If adjacent to a fitting, extend a minimum of 20' or one pipe joint beyond fitting.

5.2.2 Horizontal and Vertical Alignment

A. Water mains shall be installed 6 feet from the right of way line along the north and east parkways. In the Downtown District, water mains shall be placed within the street paving section.

B. Water mains shall be designed to minimize bends, 45 degree bends are preferred, follow the right-of-way or centerline alignment, curve sections shall be placed at a uniform distance from the right-of-way or centerline.

C. Water mains that are not located in right of way shall be centered within a minimum 15' wide utility easement.

D. A clearance of 18" shall be maintained when crossing storm drain systems. Where minimum clearance cannot be achieved, water mains shall be encased with steel pipe in accordance with the Standard Details.

E. Lines 8" and smaller shall have a minimum cover of 4'.

F. 10" and 12" lines shall have minimum 5' of cover.

G. Lines larger than 12" shall have a minimum cover of 6'.

H. Profiles are required for all bores across public rights of way and for mains greater than or equal to 12" in diameter. Encasement pipe shall be defined on the profile and extend at least 5' past the edge of street pavement and be a minimum of two nominal pipe sizes larger than the main. All 8" or larger water mains installed in an unimproved future street shall be profiled.

I. A minimum 5' spacing is required between adjacent water lines.

J. Buildings, building slabs or structures proposed outside of the utility easement but parallel to a water main shall be no closer than 12' minimum from the centerline of the water main unless structural and soil calculations are submitted by a licensed professional engineer in the state of Texas and approved by the Director of Engineering. The structural and soil calculations shall verify the integrity of the proposed structure under the condition of a water main failure adjacent to the structure.

K. Waters mains shall be designed as straight as possible following the existing or proposed grade at the minimum depth of cover. Bends shall be provided where vertical slope changes exceed 80% of the manufacturer's recommended joint deflection.

L. Excessive high points that trap air and restrict water flow shall be avoided. High points shall be designed to coincide with the location of fire hydrants where possible. Where high points are unavoidable, air valves shall be considered.

5.2.3 Separation Distance between Water and Wastewater

A. The separation distance between water and wastewater mains, manholes or other appurtenances is governed by Title 30 of the Texas Administrative Code, Part 1, Chapter 290, Subchapter D, Rule 290.44(e) and Chapter 217, Subchapter C, Rule 217.53(d).

B. Water mains shall have a minimum separation distance of 10 feet in all directions from wastewater collection facilities. Separation distances shall be measured from the outside surface of each of the respective facilities. For separation distances 9 feet or less, all TCEQ requirements shall be satisfied.

C. SDR 26 (ASTM D3034) wastewater mains are required for all new systems, however if the minimum separation distances cannot be achieved for parallel water and wastewater mains on existing systems, the separation distances may be reduced if the wastewater main has a pressure rating of 160 psi. In these cases, the water main shall be placed above the wastewater main with minimum separation distances of 4 feet horizontally and 2 feet vertically.

D. If the minimum separation distances cannot be achieved for crossing water and wastewater mains, the separation distances may be reduced under two scenarios:

1. The wastewater main has a minimum pressure rating of 160 psi.

2. The water or wastewater main is cased for a minimum of 18 feet with a casing pipe having a minimum pressure rating of 160 psi. The casing pipe shall be centered on the water main crossing, be a minimum of two nominal pipe sizes larger than the wastewater main and be sealed at each end with watertight non-shrink cement grout, or a manufactured watertight seal.

Under each scenario, the water main shall be centered on the wastewater main crossing with a minimum separation distance of 12”.

E. When water mains are designed to be closer than 9’ to wastewater manholes or cleanouts, the water main shall be cased as described in Section 5.2.3(D) above.

F. A new water main shall not cross below a new wastewater main, unless approved by the Director of Engineering.

G. A new water main shall not run parallel below an existing wastewater main, unless approved by the Director of Engineering.

5.2.4 Water Main Sizing

A. Water mains shall be sized in accordance with the Water System Capital Improvement Plan.

B. Water mains shall be a minimum of 8” and shall be extended to provide service to adjacent properties.

5.2.5 Water Main Materials

A. Polyvinyl Chloride (PVC) Pipe

1. PVC water mains from 8” to 14” in diameter shall be AWWA C900 DR18.

2. Reinforced Concrete Cylinder Pipe (RCCP) is required for pipe diameters greater than or equal to 16” unless approval is granted for an alternate pipe material by the City of Garland Water and Engineering Departments.

B. Fittings

1. All fittings on PVC water mains shall be ductile iron and have mechanical restraints (EBBA series 2000 PV or equal), stainless steel bolts, poly-wrapped, and standard thrust blocking. Compact fittings are allowed.

5.2.6 Water Services

Minimum requirements for water services are as follows:

A. Minimum of a 5/8” x 3/4” meter and 3/4” services are required for all residential and commercial services. The size necessary shall be selected based on design calculations of actual demands. The minimum service and meter size for duplex and townhouse units shall be 1 inch. Available meter sizes are 5/8” x 3/4”, 3/4”, 1”, 1.5”, 2”, 3”, 4”, 6” and 8”.

B. Twin meters in parallel are not permitted as meter size shall correlate to the line size. Bullhead connections are not permitted with any new water service installation.

C. Meters 3” and larger are required to be in a concrete vault.

D. Services less than or equal to 2” shall be copper, larger services lines shall be PVC AWWA C900 DR18.

E. Domestic or irrigation service connections shall not be allowed on a fire hydrant lead or fire service line unless otherwise approved by the Director of Engineering.

F. A domestic or irrigation service connection shall not exceed 70 feet in length in easements or Rights-of-Way.

G. The water meter size shall be the same size as the service line, except that 1.5” meters shall have a 2” service line and 3” meters shall have a minimum 4” service line. Service lines can be 3/4”, 1”, 1.5”, 2”, 3”, 4”, 6” or 8”.

H. For a water service requiring a vault, a minimum 4” water line shall be required off the water main with a minimum 4” gate valve prior to reducing in size.

I. Meter boxes shall be placed within the right-of-way or in a dedicated utility easement in an unpaved area.

J. Meter boxes, if allowed in pavement, shall be protected from vehicular traffic with bollards. If not protected by bollards, either a traffic-rated vault or curb is required.

K. Meters shall be placed generally in the center of residential lots according to the Standard Details unless a known conflict exists with the driveway location.

L. Water services shall be installed to avoid future driveway and sidewalk conflicts. If a conflict occurs, the water service will be relocated by the developer or builder at his expense

M. Show water service location from main to within 5 feet of the structure.

N. When required, water services shall be abandoned at the main by removing the corporation stop and service line to the main.

5.2.7 Valves

A. Isolation Valves

1. Isolation valves for private fire line services shall be placed at or near the connection to the public water main.

2. Isolation valves shall not be over 600' apart in residential and multi-family areas.

3. Isolation valves shall not be over 500' apart in all other non-residential areas on lines 12" and smaller. For lines 16" and larger, valves shall not be over 1000' apart.

4. Two isolation valves shall be placed such that only one fire hydrant / firefighting apparatus and one fire sprinkler private service system is shut down at a time. No more than three isolations valves shall be used to shut down the combined fire hydrant / firefighting apparatus and fire sprinkler system private service main.

5. An isolation valve shall be placed between a fire hydrant and the main.

6. Water mains supplying an automatic fire sprinkler system shall include isolation valves on the private fire service main.

7. Isolation valves shall not be located in parking spaces, curbs or sidewalks.

8. A cut in valve shall be placed between taps on existing mains 12" or smaller in order to establish a looped system.

B. Air Release Valves

1. The Engineer shall be responsible for locating and sizing air release valves in accordance with AWWA Manual M51: Air-Release, Air/Vacuum & Combination Air Valve.

2. Air release valves shall be installed on water mains 16" and larger. Vent pipes shall discharge air above grade and above the 100-year floodplain elevation if applicable.

3. Air valves are not required on water distribution mains smaller than 12" where fire hydrants and service connections provide a means for venting trapped air.

4. Air valve manholes shall not be located in parking spaces.

C. Blowoff Valves

1. Blowoff valves shall be provided on water mains 12" and larger, at low points and at isolation valves where the water main slopes toward the valve.

5.2.8 Fire Hydrants

Fire hydrants shall be provided as recommended by the "Guide for Determination of Required Fire Flow" published by the Insurance Service Office. The following minimum guidelines shall be met:

A. Fire hydrants shall be installed at a minimum of 10' from the curb return on all roadways.

B. Fire hydrants shall be installed at a minimum of 2'-6" and a maximum of 8' from the edge of pavement on Thoroughfare Types D, E, and F and fire lanes and as per the Fire Code.

C. Fire hydrants shall be installed a minimum of 5' from curb inlets or other structures.

D. Install 2-way blue reflector button per the Standard Details just off the center of the street or fire lane opposite fire hydrants.

E. Fire hydrant leads exceeding 150' shall be looped with a minimum 8" line.

F. Fire hydrant leads of 50' or less may be 6" in diameter and single valved. Leads greater than 50' shall be a minimum 8" in diameter and double valved. Leads shall be PVC AWWA C900 DR18.

G. Fire hydrants shall be provided within developments as measured along the route that a fire hose is laid by a fire apparatus per the latest requirements of the Fire Marshall's office.

H. The fire hydrant shall not be located in the sidewalk.

I. Fire hydrant valves shall be positioned to one side of the fire hydrant pumper nozzle.

J. Fire hydrants required to supplement water supply for automatic fire protection systems shall be located near the Fire Department connection per the current requirements of the Fire Marshall's office.

K. Fire hydrants on private property shall be located within utility easements and protected by curb stops or bollards. The property owner is responsible for keeping the curb stops or bollards in place and the maintenance of which shall be the responsibility of the property owner.

L. Fire hydrants on private property shall be accessible to the Fire Department at all times.

M. Fire hydrant location is subject to approval of the Fire Department. All proposed fire hydrants shall tie directly to a public main unless otherwise approved by the Fire Department.

5.2.9 Fire Service Lines

A. Fire service lines are privately owned and maintained and designated as the line from the isolation valve at the public water main to the connection to the building. All proposed fire service lines shall tie directly to a public main unless otherwise approved by the Fire Department. A fire service line shall be a minimum of 6" unless otherwise approved by the Fire Marshall's office.

B. Public works and site engineering construction plans shall show the alignment of the fire line within 5' of the structure. Note on drawings location of backflow device, Fire Department Connection (FDC), fire hydrants and fire lanes in accordance with the Fire Marshall office requirements.

C. Place the note below on construction drawings with Fire Service Lines:

"BE ADVISED construction drawings bearing the City of Garland Engineering Department "Release for Construction" stamp and a valid Right of Way work permit authorizes all work associated with connecting to the public water line and where applicable installation of backflow prevention device(s). THIS PLAN DOES NOT

AUTHORIZE WORK ON PRIVATE FIRE LINES. Submit fire line plan and obtain approval from the Fire Marshall's Office at 1500 SH 66, Garland, TX 75040, prior to installation of fire line."

5.2.10 Connections to Existing Water Mains

A. Tapping sleeve and valve shall be used whenever possible for connections to existing mains in order to avoid interruption of water service. When using a tapping sleeve and valve, the tap is restricted to a maximum of one standard pipe size smaller than the tapped pipe.

B. If a tapping sleeve and valve cannot be used, then a cut-in tee and valve shall be required.

C. Connections on Reinforced Concrete Cylinder Pipe, (RCCP) shall be performed by a contractor approved by the Water Department; provide an instructional note on the public works and site engineering construction drawings notating such.

D. The smallest pipe connection to water mains 16" and larger is 6".

5.2.11 Backflow Prevention

Backflow prevention devices shall be located outside of rights of way and utility easements and required at the following locations in order to protect the public water system from cross contamination:

A. Non-residential property water service lines

B. Dedicated irrigation lines

C. Private fire service main supplying fire sprinkler systems shall require a double check detector (backflow device) for the fire service line and, for new construction, shall be located inside the building. Contact the Water Department for double check detector models that are allowed.

D. Multi-family residential water service lines

E. Backflow prevention devices can be located within a building and if so, must be clearly indicated on the public works and site engineering construction drawings.

F. Place the note below on all public works and site engineering construction plan sheets with a backflow device being installed:

"Pursuant to the City of Garland Code of Ordinances, Article V, Section 51.72 (A) (1), Cross Connection Control; A backflow prevention assembly shall be tested immediately after installation, for a list of registered testers in the City of Garland, call Water Systems Analyst at 972-205-3214. Test results must be submitted to Garland Water Utilities within 48 hours of installation of device."

5.2.12 Automatic Flushing Valve

A. Automatic Flush Valves shall be placed on dead-end water mains. Water mains anticipated to be extended in the future may be required to install an automatic flush valve, depending on the timing of future work and the specific location.

B. Refer to Standard Detail for typical installation.

5.3 Wastewater System - General

A. Wastewater main sizes shall comply with the City's Water & Wastewater Capital Improvement Plan, see Appendix 5A.

B. Wastewater mains shall be sized in accordance with the City's Water & Wastewater Capital Improvement Plan and extended through the limits of a development to serve adjacent properties. The sizing of the wastewater main shall be based on an engineering analysis of initial and future flow of the area to be served per TSM Section 5.1. Public wastewater main abandonments shall be verified by the requestor and wastewater mains shall be TV'ed for the presence of active service connections.

C. See the Plan Completeness checklist in Appendix 2A for items to represent on public works and site engineering, utility plans where connections to and extension of existing City wastewater lines are proposed.

D. In phased developments, each phase shall be able to exist independently and wastewater mains must extend at least 1 joint past the end of pavement.

E. All lots shall have direct access to a public wastewater system or approved means of wastewater collection per GDC Section 3.42 (A) and private service lines cannot cross property lines.

5.3.1 Wastewater Main Location

A. Wastewater mains serving subdivisions and commercial developments shall be located under street paving along the center of the street.

B. New wastewater mains shall not be located in alleys. Replacement mains within an existing alley can remain in the alley with approval from the Water Department.

C. Wastewater mains located near open waterways shall follow the alignment of the waterway along the high bank and be located a minimum of 15' beyond the top of bank. Wastewater manholes located in the flow line of an existing waterway and or located within the 100-year flood plain shall be a Pressure Type per the Standard Construction Details.

D. No wastewater main shall be located inside the stormwater system.

5.3.2 Horizontal and Vertical Alignment

A. Wastewater mains shall be designed as straight as possible between manholes.

B. Wastewater mains running parallel with public right-of-ways shall match change in street direction. When streets have horizontal curvature, curved mains are acceptable to maintain parallel alignment in accordance with TCEQ requirements with manhole locations per Section 5.3.7.C. Joint deflection shall not exceed 80% of the manufacturer recommendations.

C. Minimum cover for 8" wastewater main shall be 4', and for 10" to 12" mains 5', for mains greater than 12", the minimum cover shall be 6'.

D. All grades shall be shown to the nearest one-hundredth of a foot (0.01').

E. In general, the minimum depth as measured from the Finished Pad Elevation for a wastewater main to serve a given residential property with a 4" lateral shall be 3' plus 2% times the length of the house lateral (the distance from the wastewater main to the center of the house). Thus, for a house 135' from the wastewater main, the depth would be 3' plus 2% x 135' = 3.0 + 2.7 = 5.7'. The depth of the flow line of the wastewater main should then be at least 5.7' below the finished pad elevation.

F. Larger mains shall not flow into smaller mains unless approved by the Director of Engineering.

G. No vertical bends or vertical curves shall be allowed between manholes.

H. A parallel wastewater main shall be required for wastewater lateral connections on wastewater mains deeper than 12'.

I. A profile is required for public mains greater than 4-inches in diameter. For any private line 4" and grater, the Engineer shall provide a profile for the private water, wastewater and stormwater mains where crossing public water, wastewater or stormwater mains a minimum of 10' on either side of the public main.

J. Wastewater mains shall be placed on such a grade that the velocity is not less than 2.0 fps or more than 10 fps at design peak flow. The following table of values may be used:

The remainder of this page left blank intentionally.

Table 5.3: Minimum and Maximum Grades for Wastewater Mains*

Size of Pipe (inches)	Minimum Slope in (Percent)	Maximum Slope in (Percent)
8	0.33	8.40
10	0.25	6.23
12	0.20	4.88
15	0.15	3.62
18	0.11	2.83
21	0.09	2.30
24	0.08	1.93
27	0.06	1.65
30	0.055	1.43
33	0.05	1.26
36	0.045	1.12
39	0.04	1.01
>39	**	**

*The slopes were calculated using Manning's Equation and a roughness coefficient of 0.013.
**For lines larger than 39" in diameter, the slope shall be determined using the following equation.

$$V = \left(\frac{1.486}{n}\right) * \left(R^{2/3}\right) * \left(S^{1/2}\right)$$

where:

V = velocity of flow in wastewater main (fps)
n = roughness coefficient of the wastewater main
R = hydraulic radius of the wastewater main (ft), which is equal to the area of the flow divided by the wetted perimeter (R=A/P)
S = Slope of the hydraulic gradient (ft/ft)

5.3.3 Separation Distance between Wastewater and Water Mains

A. Refer to Section 5.2.3.

B. Wastewater mains shall be installed in trenches separate from water mains.

C. Wastewater mains shall be a minimum of 10' from parallel water mains. All wastewater mains crossing water mains and/or within 9' of a water main shall follow TCEQ guidelines. When pressure class pipe is required by the TCEQ guidelines, the wastewater main shall be SDR 26 PVC (ASTM D2241) Pressure Rated pipe.

5.3.4 Wastewater Main Sizing

A. Although the Water & Wastewater Capital Improvement Plan, see Appendix 5A may be used as a guide for sizing wastewater mains, sizing should be based on an engineering analysis of initial and future flow of the total service area to be served.

B. Proposed wastewater mains shall be sized using the criteria defined in Section 5.1. The minimum public wastewater main shall be 8” and cannot be larger than the most immediate downstream segment.

5.3.5 Wastewater Main Materials

A. Polyvinyl Chloride (PVC) Wastewater Pipe

1. PVC gravity wastewater mains (non-pressure rated) from 8” to 12” in diameter shall be SDR 26 (ASTM D3034).

2. PVC pressure rated gravity wastewater mains and force mains from 6” to 12” in diameter shall be SDR 26 (ASTM D2241) with a minimum pressure rating of 160 psi.

3. PVC pressure rated gravity wastewater mains and force mains greater than 12” in diameter shall be AWWA C905 DR25 with a minimum pressure rating of 165 psi.

4. PVC profile wall pipe will not be allowed.

B. Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

1. Fiberglass non-pressure rated gravity wastewater mains 18” in diameter and greater shall be in accordance with ASTM D3262 with a minimum pipe stiffness of 46 psi and Class “B-2” embedment in accordance with NCTCOG.

2. Fiberglass pressure rated gravity wastewater mains and force mains 18” in diameter and greater shall be in accordance with ASTM D3754 with a minimum pressure rating of 150 psi and Class “B+” embedment in accordance with NCTCOG.

C. Vitrified clay pipe will not be allowed.

D. Other pipe may be considered by the Director of Engineering and the Water Department.

5.3.6 Wastewater Service Laterals

A. Wastewater laterals are defined as the line from the public main to the limits of the right-of-way or easement. Wastewater laterals shall be owned and maintained by the City. All laterals shall be PVC SDR 26 (ASTM D3034).

B. Wastewater service laterals for single-family residential shall be a minimum of 4” in diameter. Laterals shall be installed 10’ downstream from the center of the lot and have a minimum separation distance of 10’ separation from the water service.

C. Wastewater service laterals shall extend past retaining walls.

D. A single stack double sweep cleanout per the Standard Details shall be installed on all wastewater service laterals at the right of way or utility easement line unless waived by the Director of Engineering.

E. Wastewater service laterals for multiple units, apartments, restaurants, local retail, non-residential and commercial developments shall be a minimum of 6” in diameter.

F. Wastewater service laterals for manufacturing and industrial shall be a minimum of 8”.

G. Manholes are required on 6” and larger wastewater service laterals where they connect to the main line.

H. Wastewater service laterals shall not be attached to wastewater mains that are deeper than 12’. Deep cut or drop connections are not be permitted.

I. Each building shall have only one wastewater service lateral, except duplexes which shall have two wastewater service laterals independently attached to the main.

J. All mains installed for future developable areas shall include wastewater service laterals.

K. All wastewater service laterals crossing water mains shall conform to the requirements of the TCEQ Chapter 217, Subchapter C, Rule 217.53(d), latest revision, or Section 5.3.3 of this standard.

L. Abandoned services less than 6-inches in diameter shall be capped and plugged at the property line, Right-of-Way or easement limits. Abandoned services 6-inches or greater in diameter shall be plugged at the manhole.

M. Each lot must have an independent wastewater service; show location of service tap and lateral location from main to within 5-feet of structure.

5.3.7 Manholes and Cleanouts

A. Manholes shall be installed at all changes in grade and/or direction, and have a maximum spacing of 500’. Longer spacing may be considered but shall not exceed TCEQ regulations.

B. Cleanouts on public mains are not allowed unless approved by the Director of Engineering..

C. Manholes on curved wastewater mains shall be located at the P.C. and P.T. of the curve and have a maximum spacing of 300’ along the curve per TCEQ 217.53(m)(6).

D. Manholes shall be constructed of monolithic, cast-in-place concrete, precast concrete, or polymer concrete. Fiberglass manholes may be used on fiberglass mains with the approval of the Water Department. Polymer concrete manholes shall be utilized in corrosive environments in lieu of regular concrete manholes. Precast manholes must be installed with infiltration taping seal system at the joints or seams on the exterior of the manhole as approved by the Water Department.

E. Manholes shall be concentric type unless otherwise approved by the Director of Engineering.

F. Drop manholes shall be required when the inlet pipe flow line elevation is more than 24” above the outlet pipe flow line elevation, as required by TCEQ 217.55(l)(2)(G). Drops shall be inside the manhole per the Standard Details unless otherwise approved by the Director of Engineering. Drops must be installed with stainless steel straps and stainless steel bolts or studs.

G. Manholes shall be the minimum size as follows and larger diameters as needed for multiple connections and spacing:

1. 4’ in diameter for 8”, 10”, and 12” pipe with 32” lid.
2. 5’ in diameter for 15”, 18”, 21”, 24” and 27” pipe with 32” lid.
3. 6’ in diameter for 30” and greater pipe with 36” lid.
4. 5’ minimum diameter with 32” lid for manholes deeper or equal to 15’.
5. 5’ in diameter with a 32” lid for any manholes with three or more inflow mains connecting to the manhole. If a connection is added to an existing 4’ diameter manhole creating three or more inflow mains, the manhole shall be replaced with a 5’ diameter manhole per City Standard Details.

H. In Flood Plains, pressure type sealed manholes shall be used per the Standard Details. If the proposed manhole is within the base flow of a creek, the top of the manhole shall be one foot above the base flow water surface elevation. All manholes within a creek shall be poured-in-place polymer concrete manholes. Where more than three manholes in sequence are to be bolted and sealed, every fourth manhole shall be vented 2’ above the 100-year floodplain elevation or 10’ above the adjacent ground line, whichever is higher. The Engineer shall provide the elevation of the 100-year floodplain on the profile.

I. Construct manholes within 30’ of each end of wastewater mains that are installed by other than open cut and within 30’ of each end of aerial crossings.

J. Public manholes shall not be located in parking spaces.

K. A manhole with pipes of different sizes must have the tops of the pipes at the same elevation and flow channels in the invert sloped on an even slope from pipe to pipe.

L. A minimum of 0.1’ of fall through a manhole is required. However, a 0.2’ of fall through a manhole is recommended where achievable.

M. For a connection into an existing manhole, the schematic utility plan and utility construction plan shall identify the City’s Manhole ID# on the plan. The Wastewater Department will provide the MH ID#. If a new manhole is being proposed on a public main, the plan shall indicate the MH ID# of the nearest downstream manhole.

N. If a tap or re-tap is being installed on an existing brick or masonry manhole, the entire manhole shall be replaced to current standards. No new taps or re-taps onto brick or masonry manholes are allowed. Provide the internal manhole material on the plans.

O. For any adjustments to an existing manhole ring and lid outside of street paving, a new City standard manhole ring and lid shall be installed per the City Standard Details. For adjustments of existing manholes within existing street paving, the ring and lid shall be replaced to current standards if the final grade at the manhole lid is being modified by more than eighteen inches (18”).

5.3.8 Inverted Siphons

The use of an inverted siphon to avoid obstructions along the alignment of the wastewater main requires approval by the Director of Engineering. Should an inverted siphon be necessary, the design shall include:

A. Two or more barrels (pipes).

B. A minimum pipe diameter of 6”.

C. The necessary appurtenances for convenient flushing and maintenance.

D. One upstream and one downstream manhole for cleaning equipment, inspection and flushing.

E. The siphon must be sized with sufficient head to achieve velocity of at least 3 fps at initial and design flows.

F. The inlet and outlet shall divert the normal flow to one barrel.

G. The system shall be designed to allow any barrel to be taken out of service for cleaning.

H. The system shall be designed to minimize nuisance odors.

I. All weather access roadway for maintenance vehicles.

5.3.9 Wastewater Lift Stations

Subdivisions shall be laid out so that all wastewater mains shall flow by gravity. Where this is not possible the Engineer shall prepare an engineering design report for the wastewater lift station. Lift station design shall meet the minimum requirements of TCEQ Chapter 217 Design Criteria for Domestic Wastewater Systems except where exceeded as follows:

A. Power Supply (Primary): 3-Phase from Electric Utility. Single Phase to 3-Phase Converters Are Not Allowed. *Power Supply (Secondary):* On-Site Emergency Generator with Automatic Transfer Switch larger enough to power all pumps during peak flow.

B. Pumps: Minimum of Two Flygt Submersible Pumps, Each Pump Sized to Convey the Peak Flow. *Pump Motor Starter:* Soft Starter for each pump. *Pump Control (Primary):* Submersed pressure transducer with (4 – 20 ma) output. Pump Control (Secondary): Floats

C. Wet Well: Cast-in-place or pre-cast concrete with an approved interior coating system suitable for this environment or approved equal. Joints and openings shall be sealed to prevent water infiltration / exfiltration. Wet well shall be accessed through the top using Flygt aluminum hatches with integral safety grate. All metallic appurtenances located inside the wet well (guide rails, brackets, fasteners, etc.) shall be stainless steel. Removable conduit seals shall be installed where conduits penetrate the wet well. Adequate storage shall be provided for normal pump operation based on a minimum cycle time in accordance with TCEQ regulations. The lead and lag pump "on" elevations shall be located below invert of the influent line.

Additional storage is not necessary due to the city's requirement for secondary power supply.

D. Valve Vault: Cast-in-place or pre-cast concrete. Joints & openings shall be sealed to prevent water infiltration. Valve vault shall be accessed through the top using Flygt aluminum hatches. A floor drain with p-trap shall be provided in the floor of the valve vault to drain water into the wet well. A flap valve shall be provided on the drain pipe where it enters the wet well.

E. Lift Station Piping: Piping in the wet well and valve vault shall be stainless steel with flanged connections. All bolts shall be 316 stainless steel. Pipe shall be rated to withstand external loadings and internal working pressure and shall meet or exceed minimum TCEQ requirements.

F. Interior and exterior of pipe shall be lined with fusion bond epoxy. A thrust harness assembly, check valve and gate valve shall be located on each pump discharge pipe in the valve vault. Check valves shall be lever and weight type. Gate valves shall be rising - stem type.

G. All-Weather Electrical Equipment Enclosure: All lift station control equipment including motor control centers, pump starters, pump controls, automatic transfer switch and any other equipment that could require access during inclement weather shall be mounted in a ventilated electrical building. Enclosure shall at minimum be an architecturally treated pre-cast concrete structure acceptable to the City of Garland.

H. Lift Station Site: Site shall be accessed using a reinforced concrete driveway in accordance with City of Garland driveway standards. Site shall be secured with an 8' high welded steel perimeter fence and 16 ft. sliding gate.

5.3.10 Force Mains

A. Force Main Piping: Polyvinyl Chloride (PVC), Fusible Polyvinyl Chloride (FPVC) or Fusible High Density Polyethylene (HDPE). Pipe shall be rated to withstand external loadings, internal working pressure, installation loads (as required when installing using directional drill techniques) and shall meet or exceed minimum TCEQ requirements. A combination sewage air/vacuum valve shall be provided at each high point.

B. Use white-colored pipe material whenever available.

C. 12" and smaller pipe shall be PVC ASTM D2241 SDR 26, or as determined by the Engineer and approved by the Director of Engineering.

D. Pipes larger than 12" shall be PVC AWWA C905 DR 18 or as determined by the Engineer and approved by the Director of Engineering.

E. Minimum size for public force mains is 6".

F. The manhole at the termination of the force main and the two consecutive manholes downstream shall be of a material that is impervious to wastewater gas, such as Armorock Manholes.

5.4 Easements

A. In single-family residential developments, water and wastewater mains shall not cross residential lots unless specifically approved by the Director of Engineering, in which case the easement shall be located within a single lot and be a minimum of 15' in width.

B. Where private streets are utilized, utility easements shall be provided covering public water and wastewater mains and appurtenances with the minimum widths as described here in. For any utility easement containing only public water and/or wastewater mains, the easement shall be dedicated as a City Utility Easement (C.U.E.).

C. Wastewater mains servicing more than one property are public and shall be contained and centered in a City Utility Easement or street right-of-way.

D. All easements required by the City shall be dedicated by plat if within the platted boundary. If outside the platted boundary, provide easement by separate instrument prior to construction plans being stamped by the Engineering Department "Release for Construction". In addition, the plat shall not be allowed to move forward to Plan Commission without the offsite easement filing information noted on the plat.

E. Site paving, such as, parking, fire lanes and access drives are allowed over City Utility Easements. Ground mounted structures such as walls, signs, planter boxes, light poles, irrigation, landscaping, etc. are not allowed in the C.U.E. without an approved Real Property Agreement, see Appendix 3E.

F. The following minimum width exclusive City Utility Easements (C.U.E.) are required when facilities are not located within public rights-of-way:

   1. Water mains 12" and smaller are to be located within the center of a minimum 15' C.U.E..

   2. Easement widths for water mains 16" and larger not paralleling the Right of Way shall be a minimum of 20' subject to the approval of the Director of Engineering.

   3. Wastewater mains with a depth up to 15' are to be located in the center of a minimum 15'C.U.E.

   4. Wastewater mains with a depth between 15' and 20' are to be located in the center of a minimum 20' C.U.E.

   5. Wastewater mains with a depth greater than 20' are to be located in the center of a minimum 30' C.U.E.

   6. For water and wastewater in the same easement, a minimum of 10' separation between mains is required and on either side of the water and wastewater main a minimum 7.5' distance provided to the easement limit. Any greater requirements in width from above will supersede.

G. Fire hydrants and automatic flushing valve located outside of public rights-of-way shall be located within a 15' x 15' C.U.E.

H. 2” and smaller meters serving multi-family residential and non-residential developments shall be located within the right-of-way or in a minimum 15’ x 15’ C.U.E.

I. 3” and larger meters shall be located within a minimum 15’ x 15’ C.U.E outside the right-of-way.

J. All water main appurtenances such as air release valves with vents must be contained within a C.U.E with a minimum 3’ clearance from the edge of the easement.

5.5 Thrust Restraint

A. All pressurized water and wastewater mains shall be restrained against thrust forces due to change in pipeline diameter or alignment in order to prevent joint separation or movement.

B. Thrust restraint shall be accomplished by concrete thrust blocks and restrained joints.

C. All valves and fittings shall have concrete thrust blocks and restrained joints installed. Fittings are required at all changes in direction that exceed the manufacturer’s allowed pipe deflection.

D. Thrust blocking shall be per City’s Standard Details and be able to withstand a minimum 200 psi test pressure with a minimum safety factor of 1.5 without exceeding the soil bearing capacity.

E. Restrained joints lengths shall be calculated to withstand a minimum 200 psi test pressure with a minimum factor of safety of 2.0.

F. The following technical references are available for calculating thrust restraint systems:

1. AWWA Manual M9: Concrete Pressure Pipe by AWWA, Latest Edition.

2. AWWA Manual M11: Steel Pipe – A Guide for Design and Installation by AWWA, Latest Edition.

3. AWWA Manual M23: PVC Pipe – Design and Installation by AWWA, Latest Edition.

4. Thrust Restraint for Ductile Iron Pipe by Ductile Iron Pipe Research Association (DIPRA), 2006, or Latest Edition.

5. Thrust Blocking, National Fire Protection Association Standard 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2007 Edition

5.6 Pavement Cut and Repair

A. Water and wastewater main improvements shall be designed to minimize the impact to existing pavement, where feasible.

B. Per Ordinance 51.108(M), cutting of a street, alley or sidewalk surface that is less than five years old is prohibited. In these cases, water and wastewater facilities shall be installed by way of trenchless construction. No pavement shall be cut unless approved in writing by the Director of Engineering. Pavement cut, excavation and repair shall be in accordance with City Standard Details and the Right of Way Management Ordinance.

C. Typically half or full panel concrete pavement replacement will be required if pavement must be cut, refer to Standard Details.

5.7 Trenchless Construction

A. Launching and receiving pits for trenchless construction shall be a minimum of 5' from the edge of pavement unless approved by the Director of Engineering.

B. The location, size and depth of the launching and receiving pits for trenchless construction shall be evaluated during construction plan review.

C. Approved Methods

1. Horizontal Boring - Horizontal boring shall require a steel casing pipe with a minimum yield strength of 35,000 psi and minimum wall thickness of (1/4") unless alternate methods are approved by the Director of Engineering. Actual wall thickness shall be designed based on a highway loading of HL-20, a maximum deflection of 5% and a minimum factor of safety of 2.0.

2. Pipe Jacking - Pipe shall be designed to withstand all jacking forces with a factor of safety of 2.0 during construction.

3. Tunneling shall be in accordance with NCTCOG specifications.

4. Bores for lines 6-inch and larger must be a dry auger bore as wet bore or directional drilling is not permitted.

5.8 Crossings

A. Highway Crossings

1. The design of water and wastewater mains within a state or North Texas Tollway Authority (NTTA) highway must be in compliance with all applicable requirements of the Texas Department of Transportation (TXDOT) or NTTA, unless a variance is approved by TXDOT or NTTA. The following reference applies: Title 43 of the Texas Administrative Code, Part 1, Chapter 21, Subchapter C – Utilities Accommodation

2. For Private Development projects, the Developer's Engineer shall communicate with TXDOT or NTTA for preliminary approval. The Developer's Engineer shall provide documentation of TxDOT's preliminary approval to the City. Once the Engineer receives notification from the City that the construction plans are sufficient, the City will then create a TxDOT permit through TxDOT's Utility Installation Review (UIR) system for TxDOT review and approval. If rejected, the Developer's Engineer will be

responsible for any design modifications as noted. The City will obtain the permit from TxDOT once approved.

For City Projects: The consulting engineer works with the Capital Improvement Engineer to request a TxDOT permit through the TxDOT Utility Installation Review (UIR) system. First, the CIP engineer reviews and approves the design, it then grants the consulting Engineer access to its TxDOT UIR channel. TxDOT then reviews the request and if it rejects it then the consulting Engineer will then discuss an alternative solution with the CIP engineer.

3. Water and wastewater mains shall be located so as to avoid or minimize the impact to future highway projects and improvements, to allow other utilities in the right-of-way, and to permit access to water and wastewater mains and other utility facilities for their maintenance with minimum interference to highway traffic.

4. New water and wastewater mains crossing a highway shall be installed at approximately 90° to the centerline of the highway.

5. New water and wastewater mains located longitudinally along a highway shall be designed parallel to the right-of-way.

6. All water and wastewater crossings shall be encased with steel casing pipe in accordance with Section 5.7C(1) Horizontal Boring, or approved equal. Casing pipe shall be extended to 5-feet pass the street pavement.

7. Water valves, manholes and other appurtenances shall not be placed in the pavement or shoulder of highway.

8. Water main crossings shall include a valve on each side of the highway crossing.

9. Individual service meters shall be placed outside the limits of the right-of-way and in a minimum 15’ x 15’ utility easement.

B. Railroad Crossings

1. The design of water and wastewater mains within railroad right-of-way must be in compliance with the requirements of the appropriate railroad authority. The designer should determine which railroad company right-of-way is being crossed and obtain their utility accommodation policies prior to beginning the design. The following references may be applicable:

   a. American Railway Engineering & Maintenance Association (AREMA), Latest Edition.

2. New water and wastewater mains crossing a railroad shall be installed at approximately 90° to the centerline of the railroad. All water and wastewater crossings shall be encased with steel casing pipe in accordance with Section 5.7C(1) Horizontal Boring, or approved equal. Casing pipe crossing railroad tracks shall be designed to withstand E80 railroad loadings and shall extend to the railroad right-of-way lines.

3. New water and wastewater mains located longitudinally along a railroad shall be designed parallel to the right-of-way.

4. Water valves, manholes, meters and other appurtenances shall be placed outside the limits of the railroad right-of-way and in a minimum 15' x 15' utility easement..

5. Water main crossings shall include a valve on each side of the railroad crossing.

C. Creek Crossings

1. All water and wastewater mains crossing under a flowing stream or semi-permanent body of water such as a marsh or pond shall be encased with steel casing pipe in accordance with Section 5.7C(1) Horizontal Boring, or approved equal.

2. Wastewater main crossings shall include a manhole on each side of the creek crossing beyond the top of creek bank.

3. Water main crossings shall include a valve beyond the top of creek bank on each side.

4. Water and wastewater mains installed under and across creeks or ditches shall be designed according to the following:

   a. Trench backfill under creeks and ditches shall consist of flowable backfill in accordance with the Standard Details.

   b. Rock bottom creeks and ditches shall include a 6" concrete cap at the surface in accordance with the Standard Details.

   c. Bank stabilization shall be required at all crossings and shall consist of a pervious armored surface to resist scour and shear forces on all disturbed areas.

D. Elevated Crossings

1. Elevated crossings for water and wastewater mains should be avoided.

The remainder of this page left blank intentionally.

This page left blank intentionally.

SECTION 6

STORMWATER MANAGEMENT REQUIREMENTS

Section 6 – Index

Section 6 – Stormwater Management Requirements

6.01 General 6-3

6.02 Impervious Area Status Sheet 6-3

6.03 Storm Water Management Plan (SWMP) – Permanent Controls 6-3

6.04 TCEQ Construction General Permit (CGP) 6-4

6.05 Storm Water Pollution Prevention Plan (SW3P) 6-5

Section 6 – Stormwater Management Requirements

6.01 General

The Owner must provide proof of compliance with applicable local, state, and federal environmental regulations upon request by the City. Developments discharging into impaired water bodies with or without an approved Total Maximum Daily Load (TMDL) may be required to design and construct additional/alternative methods for improvement to stormwater quality. This will be implemented based on requirements from the City of Garland TPDES Stormwater permit and/or any approved TMDL's from the Texas Commission on Environmental Quality (TCEQ) and Environmental Protection Agency (EPA).

6.02 Impervious Area Status Sheet

For all non-residential projects an Impervious Area Status Sheet must be completed and submitted to the Engineering Department (Stormwater Division) with the first submittal of Site and/or Building Permit plans. See Appendix 6A for current form.

6.03 Storm Water Management Plan (SWMP) – Permanent Controls

A. General Requirements

A Storm Water Management Plan (SWMP) shall be prepared for all developments in accordance with the Garland Development Code (GDC). The SWMP shall be developed and coordinated with the site drainage plan and may be shown on the same sheet. The SWMP shall identify permanent site features and controls that will be constructed with the project to minimize and mitigate the project's long-term effects on storm water quality and quantity.

The SWMP should also be coordinated with the landscaping plan to prevent conflicts and ensure compatible land use.

B. Site Development Controls (Permanent)

It is the responsibility of the engineer to design permanent controls that address site specific conditions using appropriate design criteria for the North Central Texas region. Refer to NCTCOG iSWM Technical Manual for current recommended practices. Some of the factors to be considered when evaluating and selecting controls for a development are as follows:

- Effect of the development on runoff volumes and rates
- Potential pollutants from the development
- Percent of site treated by the control
- On-site natural resources
- Configuration of site (existing waterways, topography, etc.)

The following are some examples of permanent controls:

- Preservation of natural creeks
- Site specific stormwater controls
- Vegetated swales
- Preservation of the 100-year floodplain
- Detention ponds
- Retention ponds

6.04 TCEQ Construction General Permit (CGP)

Construction activities that discharge storm water runoff into or adjacent to any surface water of the state are regulated by the state of Texas under the, most current, Construction General Permit (CGP) (TXR150000). The governing agency is the Texas Commission on Environmental Quality (TCEQ). Construction activities are regulated according to the area of land disturbed.

Large construction activities
For sites that disturb five or more acres, or are part of a larger common plan of development that will disturb five or more acres, and meet the definition of an operator, the following applies:

- Prepare and implement a Storm Water Pollution Prevention Plan (SW3P) Use City of Garland Standard SW3P Sheets: http://www.garlandtx.gov/3353/Stormwater-Plan-Submittal-Templates
- Submit a copy of the Site Notice to the MS4 Operator
- Submit a Notice of Intent (NOI) to TCEQ
- Submit a copy of the NOI to the MS4 Operator
- Post the NOI and Site Notice

Small construction activities
For sites that disturb at least one but less than five acres, or are part of a larger common plan of development that will disturb at least one, but less than five acres and meet the definition of an operator, the following applies:

- Prepare and implement a SW3P
- Submit a copy of the Site Notice to the MS4 Operator
- Post a Site Notice

Projects Disturbing 5,000 SF to Less than One Acre
Sites that disturb less than one acre and that are not part of a larger common plan of development that would disturb one or more acres, are not required to have coverage under the general permit. The following applies:

For sites that disturb 5,000 sf to less than one acre and are not a part of a larger common plan on development, the following applies:

- Prepare and implement an Erosion Control Plan
  Use City of Garland Standard Erosion Control Sheets:

http://www.garlandtx.gov/3353/Stormwater-Plan-Submittal-Templates

Refer to the General Permit definitions for Operator and Primary Operator. Additional information on the Texas Construction General Permit can be found at the following link:

https://www.tceq.texas.gov/permitting/stormwater/

6.05 Storm Water Pollution Prevention Plan (SW3P)

One of the requirements of the Construction General Permit is to develop a SW3P. The purpose of the SW3P is to provide guidelines for minimizing sediment and other pollutants that may originate on the site, from flowing into municipal storm systems, or jurisdictional waters during construction. The plan must also address the principal activities known to disturb significant amounts of ground surface during construction.

The storm water management controls included in the SW3P should focus on providing control of pollutant discharges with practical approaches that use readily available techniques, expertise, materials, and equipment. The SW3P must be implemented prior to the start of construction activity.

A. Construction Controls

Structural and non-structural controls may be used for controlling pollutants for storm water discharges from small and large sites. Structural controls shall comply with details and specifications in the latest edition of the NCTCOG iSWM Technical Manual and these standards. When the NCTCOG Manual and these standards are in conflict, these standards shall govern.

The following are acceptable temporary controls for use during construction:

Non-Structural
- Minimizing the area of disturbance
- Preserving existing vegetation
- Hydromulch

Structural
- Silt fence
- Inlet protection
- Rock check dams
- Stabilized construction entrances
- Sediment traps
- Vegetated buffer strips
- Temporary detention structure

Suggested construction controls can be found on the NCTCOG iSWM websites as well as the City of Garland website.

It is the responsibility of the design engineer to select and design appropriate construction controls for each site. If the most appropriate control is not shown in the

iSWM Technical Manual, the design engineer shall submit calculations and references for design of the control to the Director of Engineering for review and approval.

B. Waste and Hazardous Material Controls

Covered containers shall be provided for waste construction materials and daily trash. Hazardous materials shall be stored in a manner that prevents contact with rainfall and runoff. Onsite fuel tanks and other containers of motor vehicle fluids shall be placed in a bermed area with a liquid-tight liner or be provided with other secondary containment and spill prevention controls.

The SW3P shall require federal, state and local reporting of any spills and releases of hazardous materials greater than the regulated Reportable Quantity (RQ) and reporting to Director of Engineering of all spills and releases to the storm drainage system.

C. Temporary Stabilization

Portions of a site that have been disturbed, but where no work will occur for more than 21 days shall be temporarily stabilized as soon as practicable, and no later than 14 days, except when precluded by seasonal arid conditions, or prolonged drought.

Temporary stabilization shall consist of providing a protective cover, designed to reduce erosion on disturbed areas. Temporary stabilization may be achieved using temporary seeding, soil retention blankets, hydro-mulches and other techniques that cover 100 percent of the disturbed areas until either final stabilization can be achieved or until further construction activities take place.

Perimeter controls such as silt fence, vegetated buffer strips or other similar perimeter controls are intended to act as controls when stabilization has not occurred. Perimeter controls shall remain in place during temporary stabilization.

D. Final Stabilization

Final stabilization consists of soil cover such as vegetation, geo-textiles, mulch, rock, or placement of pavement. For stabilizing vegetated drainage ways, sod or seeded soil retention blankets shall be used. Hydromulch will not be allowed in vegetated swales, channels or other drainage ways.

The plan for final stabilization shall be coordinated with permanent controls in the SWMP and with the landscaping plan, if applicable.

E. Notice of Intent (NOI)

If applicable, copies of the NOI shall be sent to the Director of Engineering at least 2 days prior to commencing construction.

F. TCEQ Site Notice

A signed copy of the Construction Site Notice shall be posted at the construction site in a location where it is readily viewed by the general public during all construction activity.

G. Notice of Termination (NOT)

All parties that submitted a NOI shall submit a NOT to the Engineering Department and TCEQ within 30 days after final stabilization is established. When the owner of a residential subdivision transfers ownership of individual lots to builders before final stabilization is achieved, the SW3P shall include controls for each individual lot in lieu of final stabilization. These controls shall consist of stabilization of the right-of-way and placement of structural controls at the low point of each individual lot or equivalent measures to retain soil on each lot during construction. Additionally, the builder must submit a valid NOI before an NOT can be submitted by the owner.

H. Inspection and Maintenance during Construction

The owner shall construct all controls required by the SW3P. The owner shall have qualified personnel inspect the controls at least every two weeks during construction and within 24 hours after a storm event of 0.5", or greater. Alternately, inspections may be performed every 7 days with no additional inspections after rain events.

Certified inspection reports shall be retained as part of the SW3P. Within seven days of the inspection, controls identified as damaged or deteriorated shall be repaired or replaced, as appropriate. controls shall also be routinely cleaned to maintain adequate capacity.

Changes or additions shall be made to the controls within 7 days to prevent discharges from the site. The owner shall implement procedures to remove discharged soil from all portions of the storm drainage system including streets, gutters, inlets, storm drain, channels, creeks, ponds, etc.

Notes requiring the inspection and maintenance shall be placed on SW3P drawings. The SW3P shall identify the responsible party for inspecting and maintaining each control. If no party is identified, each owner and operator that submitted a NOI for the site shall be fully responsible for implementing all requirements of the SW3P.

I. Construction and Maintenance

The owner shall construct all permanent controls and is responsible for maintenance of the controls. When the control falls within a drainage easement, the plat or separate instrument dedicating the easement shall include a statement of the owner's responsibility for maintenance.

This page left blank intentionally.

SECTION 7

STRUCTURAL DESIGN REQUIREMENTS

Section 7 – Index

Section 7 – Structural Design Requirements

7.01 General 7-3
7.02 Code Requirements 7-3
7.03 Geotechnical Performance Specifications 7-4
7.04 Bridge Design 7-8
7.05 Retaining Wall Design 7-9
7.06 Slope Stability Design Criteria 7-11
7.07 Screening Wall Design Criteria 7-11
7.08 Excavation Support 7-12
7.09 Construction Plans 7-12
7.10 Construction Inspection and Certification. 7-16

Section 7 – Structural Design Requirements

7.01 General

A. The Design Engineer of record shall bear the sole responsibility for meeting the engineering standard of care for all aspects of the design and providing a design that's required by the site-specific conditions and intended use of the facilities.

B. For the purposes of this section of the Technical Standards Manual, the following items shall be considered structures: bridges, foundations, retaining walls (structural and gravity), headwalls and wingwalls, culverts, slopes and embankments, and screening walls.

C. All walls greater than or equal to 4-feet in height are permitted by the Building Inspection Department. Engineering design and details for retaining walls within or supporting public rights of way and easements shall be submitted and included with the Site Permit Construction Plans. At the discretion of the Director of Engineering, the City may seek the services of a structural engineering consultant to evaluate the suitability of any proposed retaining wall supporting public right-of-way and easements. The City will send a letter identifying the proposal amount to the developer as a reimbursement agreement and it shall be executed prior to issuing a letter to proceed to the consultant. See Section 7.09.E.

D. The City's review of any structural design is limited to determining whether the construction plans are in general compliance with the City's Master Plans and Technical Standards. The City's review and release of the construction plans does not represent that the City has re-engineered or verified the engineering of the proposed improvements.

E. The structural design must be signed and sealed by a structural engineer or civil engineer competent in structural engineering licensed in the State of Texas. The Design Engineer is responsible for all engineering and recognizes that specific site circumstances or conditions may require improvements constructed to exceed minimum standards contained in the City's Technical Standards. The Design Engineer is responsible for the applicability and accuracy of the construction plans and specifications.

F. Walls shall be permitted and constructed in accordance with all requirements of these Technical Standards. If required, third-party inspections shall be performed during construction, and reports provided to the City. A third-party shall certify the wall was constructed in general compliance with the City-approved plans and specifications, and a certification shall be provided to the City.

7.02 Code Requirements

A. All structural design shall comply with the City's currently adopted version of the *International Building Code*. All walls within or supporting public rights of way and easements shall also comply with City Standard Details and/or TxDOT Details.

B. The design and construction of structural concrete for buildings and where applicable in non-building structures shall be provided in accordance with the requirements of the current version of "Building Code Requirements for Structural Concrete (ACI 318)" as published by the American Concrete Institute.

C. Reinforcing steel in reinforced concrete structures shall be fabricated and placed in accordance with the requirements of the current version of the "ACI Detailing Manual (ACI 315)" as published by the American Concrete Institute.

D. The design and construction of concrete tanks, reservoirs, and other structures commonly used in water and wastewater treatment works where dense, impermeable concrete with high resistance to chemical attack is required shall be provided in accordance with the requirements of the current version of "Environmental Engineering Concrete Structures (ACI 350)" as published by the American Concrete Institute. This code places special emphasis on structural design that minimizes the possibility of cracking and accommodates vibrating equipment and other special loads. ACI 350's minimum requirements for proportioning of concrete, placement, curing, and protection against chemicals shall be met or exceeded. The design and spacing of joints shall also meet or exceed the minimum requirements of ACI 350.

E. The design and construction of roadway bridges shall be provided in accordance with the requirements of the current version of the "Standard Specifications for Highway Bridges" as published by the American Association of State and Highway Transportation Officials (AASHTO).

F. More stringent requirements may be required for unusual designs or specific site conditions. The codes cannot replace sound engineering knowledge, experience, and judgment.

G. For any structure, the City or the structural engineer may require the quality of materials and construction to be higher than the minimum requirements as stated in the codes.

7.03 Geotechnical Performance Specifications

A. Field investigation, geotechnical testing, and geotechnical engineering shall be performed in accordance with the standard of care taking into account local experience and conditions. The geotechnical recommendations shall establish the minimum design criteria upon which the Design Engineer can rely. However, based on the Design Engineer's experience and engineering judgment, if the Design Engineer is compelled to use more conservative geotechnical design criteria for his/her structural design, that is the Design Engineer's prerogative. In no case shall the Design Engineer use geotechnical design criteria less conservative than the geotechnical engineer's recommendations.

B. ROW Permit, Section 2.6A, must be obtained prior to performing any boring within the City's right-of-way.

C. The complexity of geological conditions and the type, length, and width of structure will determine the number and locations of test holes required. The following should be considered by the Design Engineer in coordination with the geotechnical engineer:

Depth of test hole, location of proposed grade relative to existing grade, channel relocations and/or channel widening, scour, foundation loads, foundation types.

D. Locations required by (C) above, whether accessible or difficult, use extreme care when boring near overhead power lines and underground utilities, avoid steep slopes and standing or flowing water. Identify test hole locations on the plans.

E. Provide a complete soil and bedrock classification and log record for each test hole, including all pertinent information to complete the standard log. Location and surface elevation shall be shown on the boring logs.

F. Perform the appropriate field and laboratory tests necessary to determine the soil shear strength for proper soil evaluation and geotechnical design criteria. The geotechnical engineer shall consider the short-term and long-term conditions. In addition, special attention is required when testing highly plastic clays. Tests of these soil types shall be performed at a slow enough rate such that any excess pore water pressure is dissipated, or in a manner that measures pore water pressure.

G. Ground water elevations shall be included as part of the data acquisition. Site conditions may require the installation of piezometers to establish a true groundwater surface elevation and method of monitoring water surface fluctuations

H. Minimum boring requirements are as follows:

1. Slopes and Embankments including Bridge Approaches**.** Obtain soil borings for cuts greater than 10’ or embankments taller than 10’. The exploration shall include the following:

   a. The soil under future embankments. Advance borings to a depth at least equal to the embankment height or 20’, whichever is greater, unless a greater depth is recommended by the geotechnical engineer.

   b. Soil in proposed cuts. Advance borings to a depth of at least 15’ below the bottom of the proposed cut, unless a greater depth is recommended by the geotechnical engineer.

2. Bridges

   a. In general, drill test holes 10’ to 15’ deeper than the probable top elevation of the bridge foundation.

   b. Test holes near each abutment of the proposed structure plus a sufficient number of intermediate holes to determine depth and location of all significant soil and rock strata.

   c. Stream crossings with foundation structures in the channel require borings at the proposed structure.

   d. If boring information varies significantly from one side of the channel to the other, a boring in the channel may be required by the Director of Engineering.

e. Grade Separations. If the borings indicate soft surface soils (fewer than 10 blows per foot), additional borings and testing shall be required for the design of the bridge approach embankments.

3. Retaining Walls: Obtain soil borings for **walls taller than 4-ft**.

a. Soil boring shall be obtained at the discretion of the geotechnical engineer and standard engineering practice. Soil borings and associated laboratory testing and design recommendations shall be performed by a competent geotechnical consulting firm experienced with retaining structures.

b. Fill Walls. For spread footing walls and Mechanically Stabilized Earth (MSE) walls, the depth of the boring shall be greater than or equal to the wall height depending on the wall type and existing and proposed ground lines. The minimum boring depth is ten feet (10') below the bottom of the proposed wall footing unless rock is encountered (see Section 7.03.H.4). Extend borings at least 5' into rock for fill walls unless additional depth is recommended by the geotechnical engineer.

c. Cut Walls. For drilled shaft walls, tied-back walls, and soil and rock nail walls, the depth of the boring is based on the proposed ground line. Cantilever drilled shaft walls require the depth of boring to extend the anticipated depth of the shaft below the cut, which is typically between one and two times the wall height unless additional depth is recommended by the geotechnical engineer of record. Borings for soil nail and rock nailed walls need to be advanced through the material that is to be nailed. The minimum boring depth is 15' below the bottom of the proposed wall. Borings for proposed cut walls may need to penetrate rock significant distances depending on the depth of the cut and wall height.

d. Provide additional testing for taller walls, walls on slopes, or walls on soft founding strata as necessary, or recommended by the geotechnical engineer of record, to completely evaluate wall stability.

4. Borings Encountering Rock

a. Based on the geotechnical engineer's experience and engineering judgment, if rock is encountered, the minimum boring depths specified above may be reduced but only at the direction of the geotechnical engineer.

I. Uncontrolled Fill

Uncontrolled and unknown fill materials that have previously been placed within a proposed project area are cause of serious concern for the City of Garland ("City"). Specifically, the nature, suitability and stability of the fill materials are the concern, as well as the potential differential settlement that will most likely occur to public infrastructure and throughout the site if left in its current condition. The uncontrolled fill could contain construction debris, deleterious and organic material, rebar, rock boulders, plates of concrete, etc. that will likely have nested voids. If left in place, uncontrolled / unknown fill could result in differential foundation loading and stresses.

In order to create a safe and stable site suitable for the proposed project, the following actions are required of the developer for the construction and development of a site with uncontrolled and unknown fill materials.

1. A detailed excavation and mitigation plan shall be prepared by a Licensed Geotechnical Engineer and presented to the City for review and approval prior to Site Permit Issuance. The plan shall clearly define that all organic and deleterious material including but not limited to metal, rebar, concrete, and asphalt pieces that are 6 or more inches in diameter and that are encountered under any residential lot or within any dedicated right-of-way (ROW), City Utility Easement or drainage easement shall be removed to native soil or limestone, whichever is encountered first. In addition, the mitigation methods to be used to stabilize the site shall be defined.

2. Refer to Section 9.01 for additional requirements for a Geotechnical Investigation and analysis regarding public roadways and alleys.

3. All current exiting fill must be removed to the depth of the limestone, or other native materials, under each ROW and utility or drainage easement that will be dedicated to the public and that contain public improvements. All materials removed shall be disposed of according to the Health Department and TCEQ regulations. The developer must secure the services of a licensed geotechnical engineer approved by the City ("Geotechnical Engineer") to document and certify that all ROW excavations are performed to the depth of the limestone or native materials. Excavations must meet all OSHA trench shoring and safety requirements. The material excavated must be screened to remove deleterious material and particles larger than 6 inches. For City ROW and easements, any fill material must meet the requirements of Select Fill per Section 9.02.D.

4. The earthen material used for backfill outside of the ROW and easement areas must be approved by the Geotechnical Engineer. Backfilling may only occur in level lifts of no more that 8-inch loose thickness and be properly compacted and tested by the Geotechnical Engineer. Every other lift must be tested and approved prior to placement of next lift. Backfill must be moisture conditioned to several points over the optimum moisture content for each soil type encountered. The amount of moisture is to be determined by the Geotechnical Engineer through testing for each soil type encountered to resist possible hydro consolidation of fill placement. Compaction must be in nearly level lifts and occur with approved equipment by the Geotechnical Engineer. Compaction must proceed until a minimum of 95% of ASTM D698 (Standard Proctor) for the upper five feet below pavement subgrade, and to a minimum of 95% ASTM D1557 (Modified Proctor) for depths of backfill greater than five feet. See Section 9.02.D for further requirements for areas within ROW and easements.

5. All residential service lines shall have flexible connections at the point of connection to all public water and wastewater systems.

6. Contact the Building Official of the City of Garland for private structure foundation requirements.

7.04 Bridge Design

A. The structural engineer shall be responsible for selecting the appropriate bridge foundation. The engineer shall consider the following factors in that selection:

   1. Design load. The magnitude of the design load dictates the required size of the foundation.

   2. Geotechnical engineering recommendations. The strength and depth of subsurface formations determine the type of foundation chosen. In general, drilled shafts are well suited to areas with competent soil and rock, and is the preferred foundation type subject to concurrence of the geotechnical and structural engineers' concurrence. Alternative foundation types require approval in writing by the Director of Engineering.

   3. Corrosive conditions. Salts, chlorides, and sulfates are detrimental to foundations. Where these conditions exist, the Design Engineer shall specify sulfate-resistant concrete as defined in these Technical Standards.

B. The structural engineer shall use the geotechnical investigation recommendations as minimum design criteria. If in the structural engineer's judgment, the structural design needs to be based upon more conservative geotechnical design criteria, the structural engineer shall provide the more conservative design.

C. Disregard surface soil in the design of drilled shaft foundations. The disregarded depth is the amount of surface soil that is not included in the design of the foundation due to potential erosion from scour, future excavation, seasonal moisture variation (shrinkage and swelling), lateral migration of waterways, and recommendations of the geotechnical investigation.

D. Drilled shaft capacity relies upon penetrating a specific stratum a specified depth. The plans shall provide a note instructing the contractor and field personnel of the penetration requirement. The plans shall identify the specific type of material to be penetrated and the minimum penetration depth. The plan may allow for the drilled shaft to be shortened if the founding stratum is encountered at a shallower depth, and it requires the shaft to be lengthened if the founding stratum is not encountered at the expected elevation.

   When the founding stratum is present at or near the surface, the structural engineer shall consider the load-carrying capacity along with the stability of the superstructure on the foundation. For these conditions, a minimum drilled shaft length shall be specified on the plans and the drilled shaft will not be allowed to be shortened from plan length, but it may be lengthened if the founding stratum is not encountered at the expected elevation.

E. Bridge foundations for new bridges over waterways require a scour analysis. A scour analysis shall be conducted in accordance with the following:

   1. TxDOT guidelines in "Evaluating Scour at Bridges" (HEC-18).

   2. Abutment scour does not need to be calculated. However, abutments shall be protected against potential scour through use of flexible revetment, where possible or hard armoring.

3. Design bridge foundations to withstand the scour depths for either the 100-year flood or smaller flood if it will cause scour depths deeper than the 100-year flood.

4. Check the bridge foundations against the scour depth associated with the 500-year flood. This flood event is considered an extreme event and the factor of safety on the bridge foundations shall be greater than or equal to 1.

7.05 Retaining Wall Design

A. The Design Engineer is responsible for ensuring that the retaining wall selected for a given location is appropriate. Be advised at the discretion of the Director of Engineering, the Director may require the developer to reimburse the City for the City's structural engineering consultant's evaluation of the structural integrity of retaining walls within the zone of influence of public right-of-way and easements. The retaining wall selection process shall consider the following:

1. Height. Any retaining wall exceeding 4-ft. in height measured from the top of foundation and/or pier to the top of wall shall be engineered. The structural design shall be provided in accordance with the geotechnical recommendations and minimum design criteria provided in Section 7.03.

2. Geometry. Determine applicability of wall type - cut, cut/fill, or fill – based on geometry, site constraints, existing and proposed topography, and wall alignment and location. Identify available ROW and any necessary ROW or easements to accommodate the proposed improvements and the access necessary to accommodate access for maintenance. Identify location and type of existing and proposed utilities and drainage structures. Private walls are prohibited in right of way and city easements without prior written approval from the Director of Engineering.

3. Economics. For walls installed with Capital Improvement Projects, evaluate the total installed cost of the wall and consider long-term maintenance requirements. Identify necessary excavation requirements (including shoring), required utility adjustments and costs, project schedule, construction phasing requirements, and these effects on the wall design and construction.

4. Stability. The Design Engineer is responsible for the global stability of the wall. Evaluate all walls to ensure that the minimum applicable factors of safety are a least met (see Section 7.05.C), if not exceeded depending on the Design Engineer's judgment. When possible, avoid placing walls on slopes. A slope in front of the wall dramatically reduces the passive earth pressure (resistance), increasing the chance for wall failure. Additionally a slope in front of the wall will have a significant effect on global stability of the wall and embankment in which it resides. For situations where the walls above a slope cannot be avoided, a rigorous slope stability analysis shall be required in accordance with these Technical Standards.

5. Constructability. Determine whether walls are near water or subject to inundation or groundwater. Identify access limitations for equipment both during and after construction. Ensure adequate horizontal and vertical clearances are provided.

6. Drainage. Design the wall to prevent the build-up of hydrostatic pressure behind the wall. If conditions warrant, the City may require the wall design to withstand full hydrostatic pressure load. The wall design shall consider potential deleterious short and long term effects of water inundation including scour and rapid draw down.

7. Aesthetics. Ensure that aesthetic treatments of walls complement the retaining wall and does not interfere with the functionality of the wall. Detailed consideration shall be given to aesthetic treatments of retaining walls that involve landscaping. Additionally, the wall's drainage system design shall avoid potential compromise of the wall aesthetics because of water related damages. All private walls shall conform to the GDC requirements.

8. Loading. Design loads shall be in accordance with these Technical Standards (for building code references, see Section 7.02), including construction loads and surcharge loads from slopes, structures, and vehicles.

B. Analyze and design walls following accepted geotechnical engineering industry standards for this geographical area. In analysis, use earth pressures that follow the requirements of the project's geotechnical investigation specifically addressing the retaining wall design requirements for the project's specific location.

C. The Design Engineer must ensure that the retaining wall system is appropriate for its location and application. The Design Engineer shall design for all potential modes of wall system failure; including, sliding, overturning, bearing pressure, global stability, and structural capacity of the wall itself. The design of the retaining wall shall meet the following minimum factors of safety:

   a. Sliding: 1.5
   b. Overturning: 2.0
   c. Bearing Pressure: 3.0
   d. Global Stability: 1.5

D. Avoid perching wall on slopes steeper than 8H:1V. When walls must be placed on slopes steeper than 5H:1V, or the retaining wall height or the combined wall and slope heights exceed 8-ft., the geotechnical engineer shall conduct a short-term and long-term global stability analysis using applicable soil strength characteristics, geometry, and loading conditions (including load surcharge, hydrostatic, etc.). The Design Engineer is responsible for the design of the wall system, including its global stability.

E. A series of two or more walls built in tiers shall be considered a single wall in height for the purposes of conforming to these Technical Standards when the base of the upper tier is set back from the base of the lower tier less than two times the height of the lower tier wall.

F. If TxDOT or City standard detail sheets pertaining to cast-in-place spread footing structural retaining walls are utilized, the Design Engineer shall ensure that the actual wall geometry, loading conditions, and soil characteristicsare applicable to the standard wall design selected. The Design Engineer shall ensure that interruptions to the wall stem or footing reinforcement by openings, utilities, geometric changes or curved sections of the wall do not compromise the design and performance of the wall. No TxDOT standard wall design shall be modified unless the Design Engineer designs, draws, and seals the modified standard.

G. TxDOT standard sheets pertaining to cast-in-place spread footing walls provide a choice between high pressure (HP) and low pressure (LP) footings. Selection by the Design Engineer is a function of the loading, geometry, and allowable soil pressures. **TxDOT standard sheets pertaining to cast-in-place spread footing walls are developed based on the wall being drained, and the design parameters for foundation and retained soils of a cohesion factor of zero, a friction factor of 30 degrees, and a unit weight of 120 pounds/cubic foot.** Give special consideration to the site-specific geotechnical requirements and whether a TxDOT standard wall design is applicable. Also give special consideration to walls subject to potential inundation. The Design Engineer is solely responsible for the suitability of TxDOT standard detail sheets selected for use at the specific site.

7.06 Slope Stability Design Criteria

A. All slopes exceeding 8-ft. in height with a steepness of 4H:1V or greater, regardless of soil type, cut, or fill, shall be evaluated for global stability for both the short-term and the long-term conditions. Additionally, any known areas of existing fill, deleterious material, or soft soils which have a height over 4 feet or slope angle greater than 6H:1V shall be evaluated for global stability for both the short-term and the long-term conditions. Specific site conditions may require evaluation for additional types of slope failure, such as bearing capacity, settlement, shear, and undercutting. Calculations pertinent to the analysis shall be submitted with the construction drawings when required by the City.

B. Use the following data to analyze global stability of a slope:

1. Geometry (cross section and loading conditions);
2. Location of the water table;
3. Soil/rock stratigraphy; and
4. Soil/rock properties (unit weight, Atterberg Limits, undrained and drained shear strength).

C. For global stability of a slope, the minimum factor of safety of 1.5 is required unless the geotechnical engineer recommends a higher value.

7.07 Screening Wall Design Criteria

A. Screening Walls shall meet or exceed the minimum requirements included in the GDC, and the City's Standard Details for Screening Wall Standards.

B. An opening designed to allow for storm water drainage shall be provided unless it has been determined by the Director of Engineering that no drainage problems are anticipated. The opening shall be a uniform 4" high the full length between columns.

C. If not using the City's Standard Details screen wall, walls shall be designed to meet or exceed the minimum structural integrity of the screen walls shown in the City's Standard Details and designed by a Professional Engineer licensed in the State of Texas. These

plans shall be signed, sealed and dated and submitted to the City's Building Inspection Department for review and permitting.

7.08 Excavation Support

A. All excavation must be done in compliance with Occupational Safety Heath Administration (OSHA) Standards and Interpretations, 29 CFR 1926, Subpart P, "Excavations."

B. Temporary special shoring is used for installations of walls, footings, and other structures that require excavations deeper than 5'. Temporary special shoring is designed and constructed to hold the surrounding earth, water, or both out of the work area. It provides vertical or sloped cuts, benches, shields support systems, or other systems to provide the necessary protection in accordance with the approved design. Unless a complete design for temporary special shoring systems are included in the plans, the contractor is responsible for the design of the temporary special shoring system. The Contractor must submit to the City, for informational purposes only, the design calculations and details sealed by a Professional Engineer licensed in the State of Texas before constructing the shoring. The design of the shoring must provide protection in accordance with Occupational Safety Heath Administration (OSHA) Standards and Interpretations, 29 CFR 1926, Subpart P, "Excavations."

7.09 Construction Plans

A. Construction drawings and technical specifications for **all structural** construction shall include the following:

1. Design engineer's seal, date, signature, and Texas Board of Professional Engineers (TBPE) firm registration number;

2. Name and date of issue of the codes and supplements to which the design conforms;

3. Name and date of the project-specific geotechnical engineering report upon which the Design Engineer relied;

4. Live load and other loads used in the design, including surcharge loads and potential exposure to storm water inundation. Specifically identify the applicable loads and their load factors;

5. Identification of geotechnical investigation and report to which the design conforms (including report name and number (if applicable), date of issuance, engineering firm name and address, firm TBPE firm registration number, and name of geotechnical engineer of record).

6. Where plans indicate compacted soil, provide compaction specification.

7. Specified compressive strength of concrete at stated ages or stages of construction for which each part of the structure is designed.

8. The design shall specifically address construction loading and sequencing. Service loads shall not be applied until the concrete has reached its minimum specified compressive strength or the structure is adequately shored to withstand the service loads;

9. Drainage system (if applicable), including material specification, diameter, daylight point, and outfall connection detail (if applicable), granular material (if applicable) specification, filter fabric material specification and installation requirements, and weepholes (if applicable), including material type, diameter, and spacing;

10. Size and location of all structural elements, reinforcement, and anchors;

11. Identification of shop drawing requirements for fabrication, bending, and placement of concrete reinforcement. Provide bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Provide additional details for reinforcement of openings in concrete walls and slabs. Shop drawings shall be provided in accordance with the requirements of the technical specifications and submitted to the City for review and approval.

12. Provisions for dimensional changes resulting from creep, shrinkage, and temperature;

13. Details of all contraction, isolation joints, or expansion joints and the appropriate spacing specified;

14. Anchorage length of reinforcement and location and length of lap splices (if applicable);

15. Type and location of mechanical splices of reinforcement (if applicable). Welding of reinforcement shall not be permitted unless approved by the Design Engineer and the Director of Engineering;

16. The technical specifications for concrete mixtures shall be provided. Responsibility for maintenance of the structure shall be clearly noted on the plans. The plans shall clearly reference a structure maintenance plan and schedule. The maintenance plan shall clearly identify any drainage system required to relieve hydrostatic pressure on the structural system and ensure that it remains fully functional throughout the life of the structure; and

17. Sight visibility triangles (where applicable).

B. **Retaining wall** plans shall also include the following information:

1. Plan view. The plan view shall include location of soil borings, surface and subsurface drainage structures and utilities that could be affected by wall construction.

2. Elevation view. The elevation view shall include a profile of the existing ground line along the wall alignment, proposed finished grade at face of wall, limits of wall

payment (if applicable), top of wall profile, soil boring log shown at the correct elevation and scale, wall rail if applicable, drainage structures and utilities as noted above. Pedestrian safety guard railing shall be provided at or directly adjacent to the wall in areas with an elevation difference (drop-off) exceeding thirty inches (30") per the most current International Building Code adopted by the City of Garland.

3. Estimated quantity table for Capital Improvement Projects. Include the estimated quantity table for each retaining wall type. The table should contain the area of wall (for payment) and linear footage of railing (if applicable). Unless noted otherwise and approved by the Director of Engineering, wall quantities shall be based upon the surface area of the wall from the top of wall to the bottom of wall. The bottom of wall is defined as the proposed finished grade at the face of the wall. The bottom of wall shall not be measured from the top of footing unless the top of footing is the proposed finished grade at the face of the wall.

4. Typical section. The typical section shall include a cross section with wall dimensions and showing the relationship of the wall to the roadway, property line, or controlling adjacency, control point(s) for horizontal and vertical alignment (typically the top outermost corner of the wall), indication of maximum slope on top of and in front of the wall, location of proposed finished grade, railing type, flume, and mow strip, etc. if applicable.

5. General notes. The general notes shall include a note stating the required minimum embedment depth of the footing.

C. **Spread Footing Retaining Wall** plans shall also include the following:

1. If TxDOT retaining wall standards are used, provide the panel design designation (for example, LC-10-32) for each wall panel corresponding to the appropriate cast-in-place spread footing wall standard sheet. The designation includes a reference to the controlling standard drawing, design height, and panel width.

2. Location of expansion and allowable construction joints (assuming 32' panels, every third joint is typically designated as an expansion joint).

3. Set bottom of wall (top of footing) horizontal and stepped to meet minimum embedment depth criteria. Distance from one step to the next is typically greater than 12". Provide bottom of wall elevations for all panels.

4. Include the appropriate TxDOT standard sheets pertaining to cast-in-place spread footing walls if applicable. Otherwise provide typical section details including a cross section with dimensions and reinforcement layout and callouts.

5. If TxDOT standard sheets pertaining to cast-in-place spread footing walls are not applicable to the design, a custom structural wall design shall be provided. The general notes shall specifically identify the applicable concrete specification, the requirement that no service loads shall be imposed until after the concrete has reached its specified minimum compressive strength, and that shop drawing submittals shall be required for fabrication, bending, and placement of concrete reinforcement.

D. **Screening Wall** plans shall include the following information (in addition to the information included under Section 7.09A):

1. The title shall include the legal name of the property on which the wall is being constructed;
2. Construction plans shall include a note stating: Screening Wall design meets or exceeds the City of Garland Standard Construction Details for Screening Walls.
3. A plan view of the wall showing its location, limits, and stationing;
4. Wall material specification;
5. Mortar specification.
6. A profile of the wall including grades for the top of the concrete mow strip, adjacent top of curb, sidewalk and finished floor of proposed and/or existing adjacent slabs;
7. Elevation view of a typical column;
8. Elevation view of the wall;
9. Mow-strip detail;
10. Drainage clearance under wall (uniform 2”);
11. Steel tensile strength;
12. Concrete compressive strength; and
13. Wind load calculations

E. **Gravity Retaining Walls**, Gravity walls supporting or inside of City right of way are prohibited. Gravity walls supporting or inside easements are not allowed except for the following: along creeks and drainage ways supporting private property and City open spaces. Gravity walls are allowed adjacent to City right-of-way if the wall, all wall components and structural backfill is outside of the zone of influence of the right-of-way. A geotechnical analysis shall be provided defining the zone of influence and proving that the wall and all wall components are outside of the zone of influence. In order to determine the zone of influence, the active pressure failure plane is typically used and valid for uniform soil with no unusual subsurface or drainage conditions. The active pressure failure plane must be defined for the area where the tallest section of the proposed gravity wall is closest to the right-of-way. The analysis must be accompanied by site specific geotechnical information including borings and associated laboratory testing. In addition, please consult Sections 7.05 and 7.06 for additional required geotechnical information needed to properly evaluate any proposed retaining walls.

Gravity Retaining Wall Plans shall also include the following:

1. Wall height, including batter requirements;
2. Wall material specification;

3. Base embedment depth and width requirements, including key depth if applicable;
4. Wall thickness at bottom and top of wall;
5. Mortared zone requirements (if applicable), including zone thickness and the specification to mortar on all sides and no voids;
6. Mortar specifications
7. Drainage and backfill material specifications
8. Clay cap, including material specification and dimension requirements.

F. Calculations pertinent to the design of any and all walls shall be submitted with the construction drawings when required by the City.

G. Drawings must be site specific and show actual dimensions to be used.

H. All wall construction plans and specifications submitted to the Building Inspection Department for review must include a permit application submittal.

7.10 Construction Inspection and Certification

A. A permit is required for the construction of any wall as defined in these Technical Standards.

B. Third-party inspections shall be performed during construction, and reports provided to the City. The inspections and reports shall be performed at the following stages of construction (at a minimum):

1. Sub-base preparation geotechnical testing
2. Pre-pour / sub-base / footing:
   a. Drilled shaft drilling and concrete placement (if applicable); and
   b. Forming of footing, beam, placement of reinforcement (if applicable)
3. Wall construction;
4. Backfill placement - geotechnical testing
5. Drainage system construction (if applicable); and
6. Final completion

C. A third-party shall certify wall construction inspections were performed at the prescribed stages of construction in accordance with Section 7.10.B. The inspection reports and final certificate of compliance shall be submitted to the City and include the following:

1. Specific reference to the City-approved plans and specifications for the wall;

2. Specific reference to the address and/or legal description for the wall construction location;

3. Specific reference to the name and date of the project-specific geotechnical engineering report;

4. A certification letter signed and sealed by a licensed professional engineer in the State of Texas, that includes a statement that the wall system was constructed in general compliance with the geotechnical design criteria identified in the plans and specifications and the City-approved construction plans and specifications.

This page left blank intentionally.

SECTION 8

THOROUGHFARE DESIGN REQUIREMENTS

Section 8 – Index

Section 8 – Thoroughfare Design Requirements

8.01 General 8-3
8.02 Street Design 8-3
8.03 Median, Left-Turn Lane, Right-Turn Lane, Deceleration Lane, and Island Design .. 8-19
8.04 Alley Design 8-24
8.05 Driveway Design 8-28
8.06 Parking Standards 8-37
8.07 Sidewalk Location and Design 8-42
8.08 Sight Line Triangles Requirements 8-44
8.09 Loading Zones / Truck Berths 8-45
8.10 Frontage Road Design 8-48
8.11 Traffic Signal Installation 8-48
8.12 Street Name Signs 8-49
8.13 Traffic Impact Analysis and Mitigation 8-49

Section 8 – Thoroughfare Design Requirements

8.01 General

A. The arrangement, character, extent, width, alignment, and location of all streets, public ways, alleys, and driveways shall be in conformity with the City's Major Thoroughfare Plan and Comprehensive Plan and should be considered in their relation to existing and planned streets, alleys and driveways, topographical and environmental features, scenic views, and the land uses proposed to be served by such streets.

B. All thoroughfare designs shall meet the guidelines in AASHTO's current *A Policy on Geometric Design of Highways and Streets* and Texas Manual on Uniform Traffic Control Devices (TMUTCD).

8.02 Street Design

A. Thoroughfare Definitions – The City recognizes six basic classifications of public roadways that include freeways, major arterials, minor arterials, major collectors, minor collectors and local streets as identified in the transportation element of the Comprehensive Plan. Each class provides a certain degree of continuity, capacity, and accessibility to adjacent land uses. While differentiated by function, there is also a variance in geometric design. Table 8.1 summarizes the general design criteria of roadways within the City. The typical cross sections are depicted in Figure 8.1.

1. Freeways – Freeways are arterial highways with full control of access. Freeways are intended to provide for high levels of safety and efficiency in the movement of large volumes of traffic at high speeds. Essential freeway elements include the roadway, medians, grade separations at crossroads, ramps to and from the traveled way at selected locations, and in most cases, frontage roads. Freeways and toll roads in the vicinity are classified as "A-A" on the thoroughfare plan map.

2. Frontage roads are significant as they relate to City of Garland thoroughfare and access needs. They provide important access parallel to limited-access freeways and toll roads in and around the City. Frontage roads are controlled by Texas Department of Transportation (TxDOT). Frontage roads shall be classified as an "Arterial" for driveway requirements purposes.

3. Major Arterials – Major arterials are typically six-lane divided roadways designed to allow large volumes of traffic operate at a high level of mobility. Major arterials are roadways defined herein as Type A, A-C and B thoroughfares. Type A and B thoroughfares are typically initially constructed as four-lane divided roadways with a wider median and then widened to six lanes at a later date. Type A-C thoroughfares are one-way couplet and are typically 3 or more lanes.

4. Minor Arterials – Minor arterials connect traffic from collector roadways to major arterials. Minor arterials are typically four-lane divided roadways defined herein as Type C1, C2 and D1 thoroughfares.

5. Major Collectors – Major collectors provide access from a Type A, B, C1, C2 and D1 thoroughfares to both non-residential and residential properties and are defined herein as Type D2, D3 and E thoroughfares.

6. Minor Collectors – Minor collectors are designed for short trips and low speeds. They serve primarily to connect trips to higher functional class facilities. Minor collectors are roadways defined herein as Type F thoroughfares.

7. Local Streets – Residential streets with homes fronting on them are defined herein as Type G thoroughfares, each with different design characteristics depending on whether the homes are front entry or alley served and whether or not the street is adjacent to a school or park. For front entry residential lots, local streets can have mountable monolithic curbs as approved by the Director of Transportation. Local streets with mountable curbs shall be 29-feet wide from back of curb to back of curb. The curb shall be transitioned to a standard 6" curb section at all curb inlets, intersections, sideyards and in front of all non-buildable lots or portions thereof.

Private Streets – Private streets shall be designed and constructed to the same standards as public streets. Any gated entrances shall also meet the requirements of Section 8.05.I.

Type III barricades shall be installed and maintained on all streets prior to acceptance by City.

B. Roadway Geometrics – Geometrics of City streets shall be defined as the geometry of the pavement and curb areas that govern the movement of traffic within the confines of the right-of-way (ROW). Included in the geometrics are pavement width, horizontal curvature, width of traffic lanes, median nose radii, curb radii at street intersections, pavement cross-slope, crown height, pavement thickness, and geometric shapes of islands separating traffic movements and other features.

1. Design Speed – The design speed is a primary factor in the horizontal and vertical alignment of roadways. Design features such as curvature, super-elevation, turning movement radii, and sight distance affects roadway lane width, pavement width, pavement cross-slope, pavement crown, and clearances. Refer to Table 8.1.

2. Grades – Roadway grades shall be a minimum of six-tenths percent (0.6%) in order to insure proper flow of surface drainage toward inlets and a maximum of six percent (6%) for arterial roadways and eight percent (8%) for collector roadways. Steeper grades of ten percent (10%) may be permitted on local residential streets and where required by topographical and/or natural features, as approved by the Engineering and Transportation Directors.

3. Roadway Centerline

   a. Roadways shall be placed in the center of the ROW. The centerline of curves shall be tangent to the centerline of street at each end of curve.
   b. The minimum centerline intersection spacing between adjacent streets measured on thru streets are as followed:

i.	Local to Local	125'
ii.	Local to Collector	150'
iii.	Collector to Collector	200'
iv.	Collector to Arterial	250'

c. Offset Intersections – Residential roadways that have offset intersections must have a minimum of 125 feet distance from centerline to centerline and collector roadways that have offset intersection must have a minimum of 250 feet distance from centerline to centerline. Offset intersections shall be avoided on undivided arterial roadways. (See Figure 8.0)

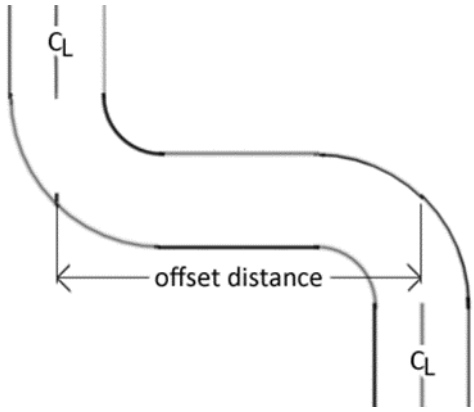


FIGURE 8.0: Offset Intersections

4. Cross-Slope/Crown Height – Type A, B, C1, C2, and D1 thoroughfares shall have a two-percent (2%) cross-slope. The cross-slope can vary where there is a transition into or out of a maximum two percent (2%) superelevation. Type D2, D3, and E thoroughfares shall have eight-inch (8") parabolic crowns. Type F shall have seven-inch (7") parabolic crowns for commercial and a six-inch parabolic crowns for residential. Type G thoroughfares shall have a five-inch (5") parabolic crown

5. Pavement Thickness and Reinforcement – Refer to the City's Standard Construction Details.

6. Dead-End Streets/Cul-de-Sacs/Stub Streets/Elbows

   a. All dead-end streets shall have a turn-around unless otherwise allowed in Subsection d below. Turn-arounds at the end of dead-end streets (cul-de-sacs) shall have a circular concrete driving surface that has a minimum radius of forty-eight feet (48') and a street right-of-way that has a minimum radius of sixty feet (60').

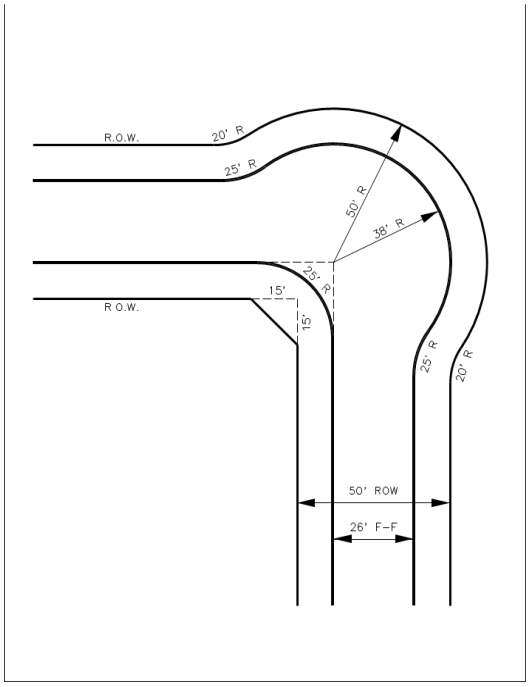
   b. The maximum length of a dead-end street with a turn-around (cul-de-sac) shall be seven hundred and fifty feet (750'), measured from the right-of-way line of the intersecting street to the center point of the turn-around, except in conditions of unusual topography.

   c. If any residential lot fronts onto the dead-end portion of a street that will be extended in the future, a temporary turn-around that meets the standards described above shall be constructed at the end of the dead-end street within a temporary street easement. The following note shall be placed on the plat: "Cross-hatched area is temporary street easement for turn-around until street is extended (give direction) with future development of abutting property".

d. A stub street is an undivided dead-end street that will be extended in the future that does not have a turn-around, which is only allowed under the following conditions: No residential lots shall front onto a stub street. The length of a residential stub street shall not exceed the depth of the adjacent lots. It shall be temporarily blocked at the rear edge or the lots (or alley) with end of street barricades. Non-residential lots adjacent to a stub street shall have access to another street. If a non-residential stub street extends more than one hundred feet (100') beyond the last driveway on the street, it shall be temporarily blocked at the last driveway with end of street barricades.

e. A stub street shall have a permanent Type III barricade installed at its terminus. A residential stub street shall also have a 24"x30" sign prominently posted at its terminus with black letters on a white background that states, "NOTICE – This street will be extended as part of a future development." The installation and cost of these barricades and signs shall be the responsibility of the developer.

f. Street Elbow Turn Design - For a residential street that changes direction with angle ranging from ninety degree (90º) to one hundred and twenty degree (120º), a minimum fifty foot (50') radius is required for the outer right-of-way radius. The radius starts at the intersection of the extended curb lines of the street. An eleven and a half feet (11.5') of parkway (from back of curb) is maintained along the radius right-of-way. See example below:



C. Minimum Horizontal Design Radius

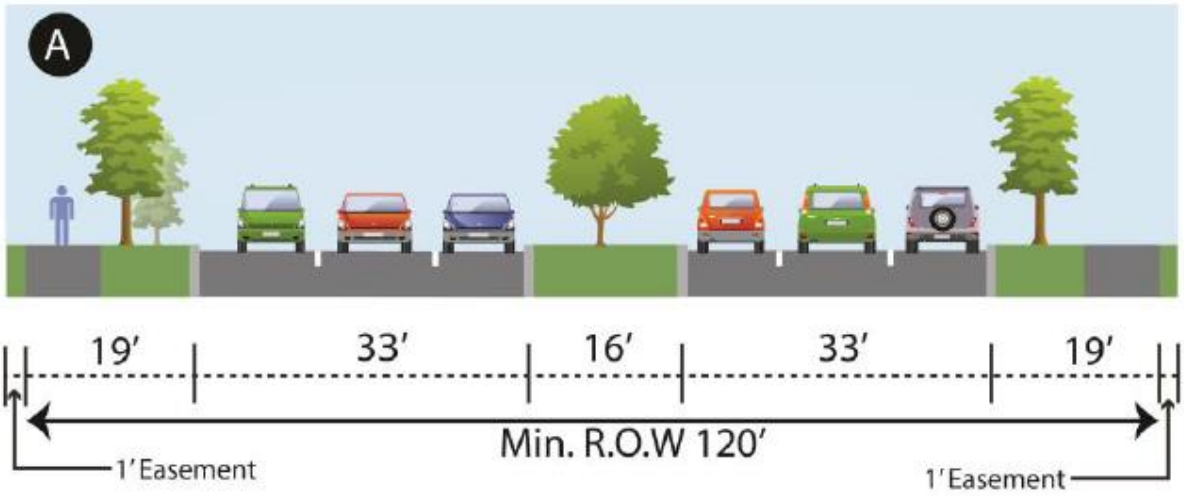
1. The minimum centerline radius is a function of design speed, superelevation, and the vehicle side friction factor. Side friction is the force that keeps a vehicle from sliding off of the roadway.

The minimum horizontal radii are shown in Table 8.2 and are in accordance with the guidelines in AASHTO's 2011 edition of *A Policy on Geometric Design of Highways and Streets*.

TABLE 8.1: General Roadway Design Criteria

Criteria	Major Thoroughfare Classifications												
	Major Arterial (1)			Minor Arterial (2)			Major Collector (2)			Minor Collector	Local		
	Type A	Type A-C (one-way couplet)	Type B	Type C1	Type C2	Type D1	Type D2	Type D3	Type E	Type F	Type G (with alley)	Type G (without alley)	Alley
Right-of-Way (ROW)	120'	70'	100'	100'	100'	82'	80'	80'	80'	60'	50'	50'	20'
Pedestrian & Utility Easement (P.U.E.)	1' on both sides	None	10' on both sides	10' on both sides	10' on both sides	5' on both sides	5' on both sides	5' on both sides	None	None	None	None	None
Utility Easement (U.E.)	None	None	None	None	None	None	None	None	None	None	None	10' on both sides	None
Pavement Width (face to face)	33' each direction	44'	33' each direction	24' each direction	33' each direction	24' each direction	60'	44'	44'	36'	26'	26'	10'
# of Traffic Lanes	6	4	6	4	4	4	5	3	4	2	2	2	1
Left-turn Lane Width	10'	-	10'	10'	10'	10'	-	-	-	-	-	-	-
Right-turn Lane Width	11'	-	11'	11'	11'	11'	11'	11'	11'	-	-	-	-
Cont. Two-Way Left Turn Lane	-	-	-	-	-	-	14'	12'	-	-	-	-	-
Median Width	16'	-	14'	32'	14'	14'	-	-	-	-	-	-	-
Parkway Width	19'	10'/18'	10'	10'	10'	10'	10'	18'	18'	12'	12'	12'	5'
Design Speed, V (mph)	45/50	40	45	40	40	40	40	35	35	30	30	30	20
Minimum Grade	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
Maximum Grade	6%	6%	6%	6%	6%	6%	8%	8%	8%	8%	10%	10%	10%
Minimum Horizontal Radius	1400'	850'	1050'	850'	850'	850'	850'	600'	600'	350'	350'	350'	175'
Min. Tangent Between Curves	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	50'	50'	-
Min. Vertical Curves	See Table 8.3 and Table 8.4												
Parking(3)	X	X	X	X	X	X	X	X	X	√	√	√	X

(1) Additional ROW at Type A/B roadway intersecting a Type A/B roadway (See Figure 8.2)
(2) Additional ROW at Type A, B, C1, C2, D1, D2, D3 and E roadway intersecting a Type C1, C2, D1, D2, D3 and E roadway (See Figure 8.3)
(3) X = Prohibited; √ = Allowed



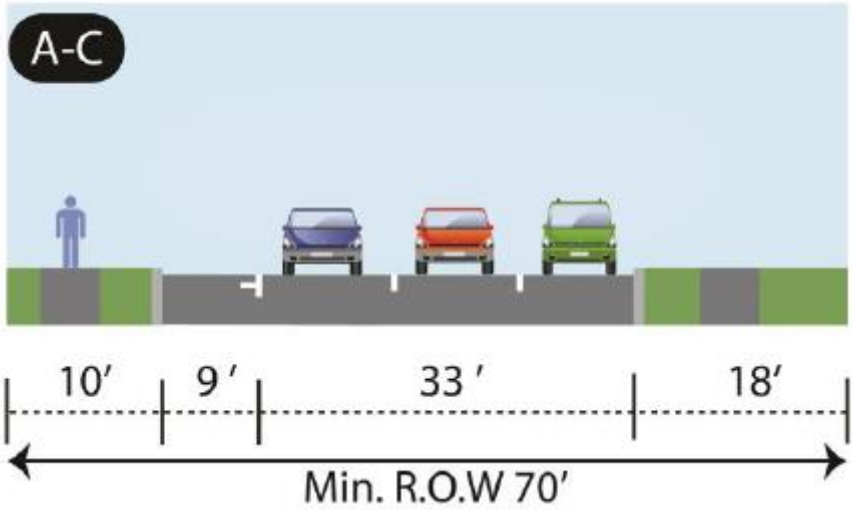
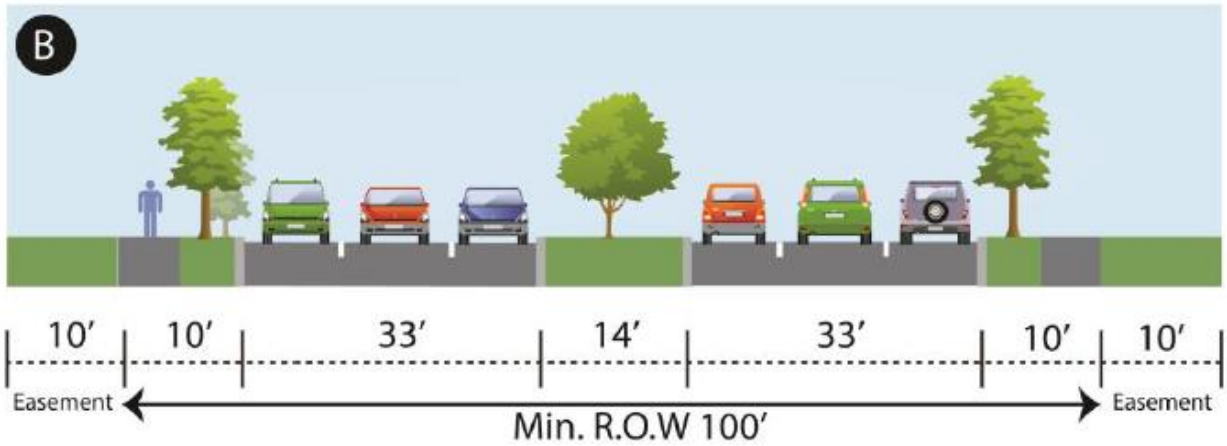
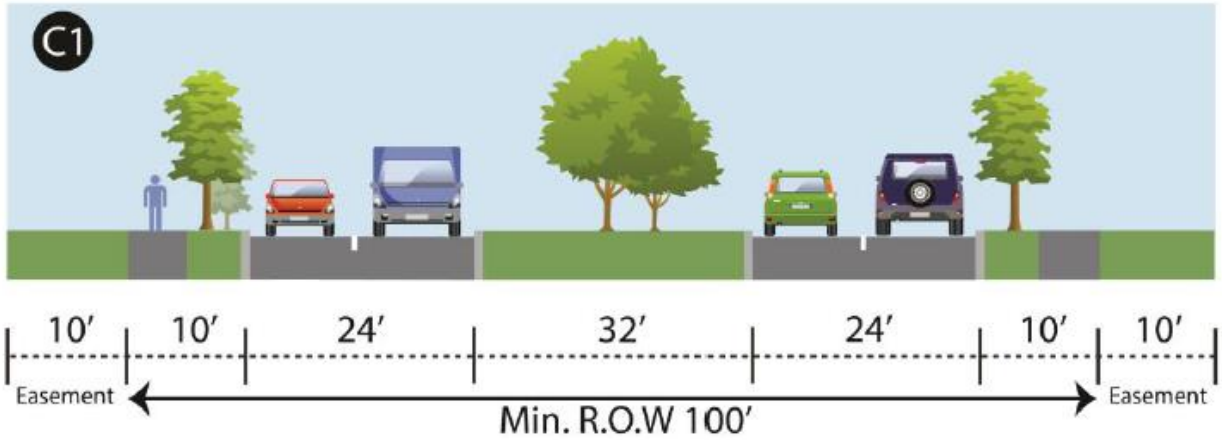


FIGURE 8.1: Typical Cross Sections





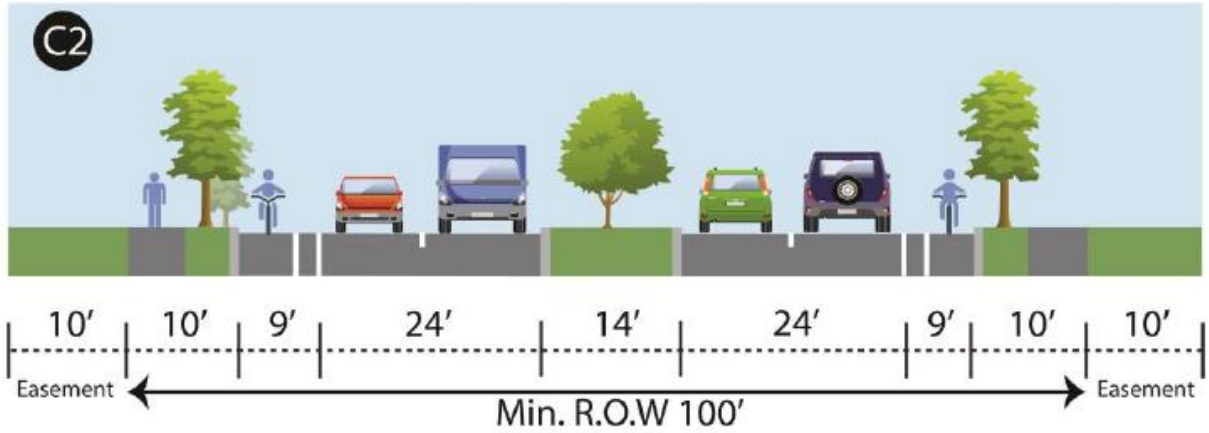
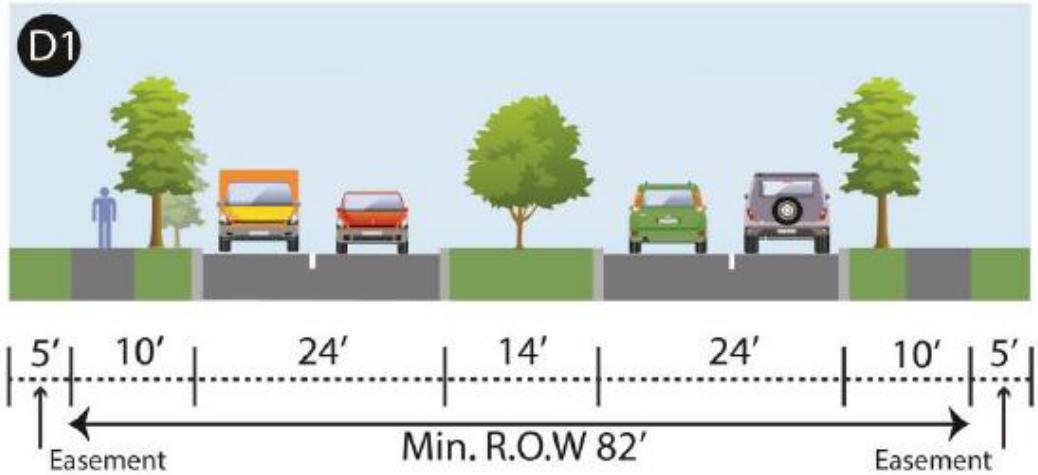
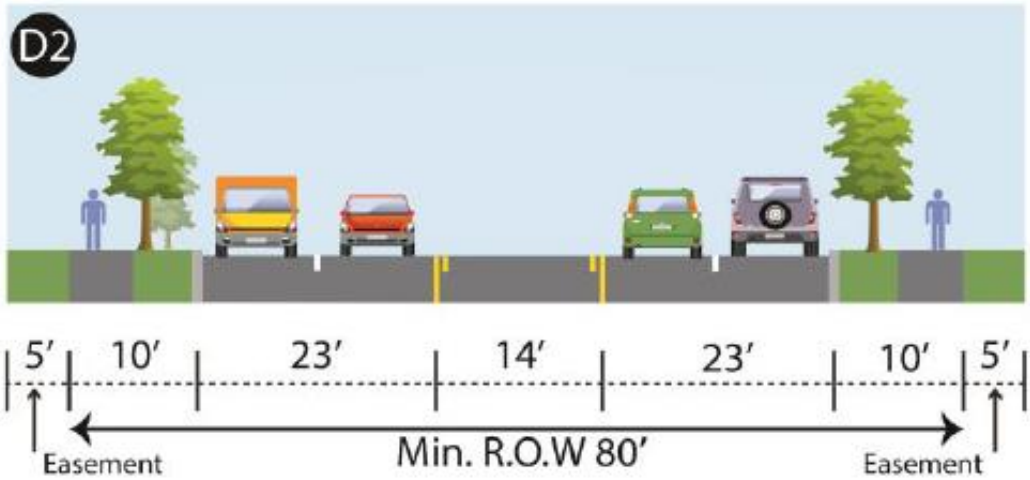


FIGURE 8.1 (Cont.): Typical Cross Sections





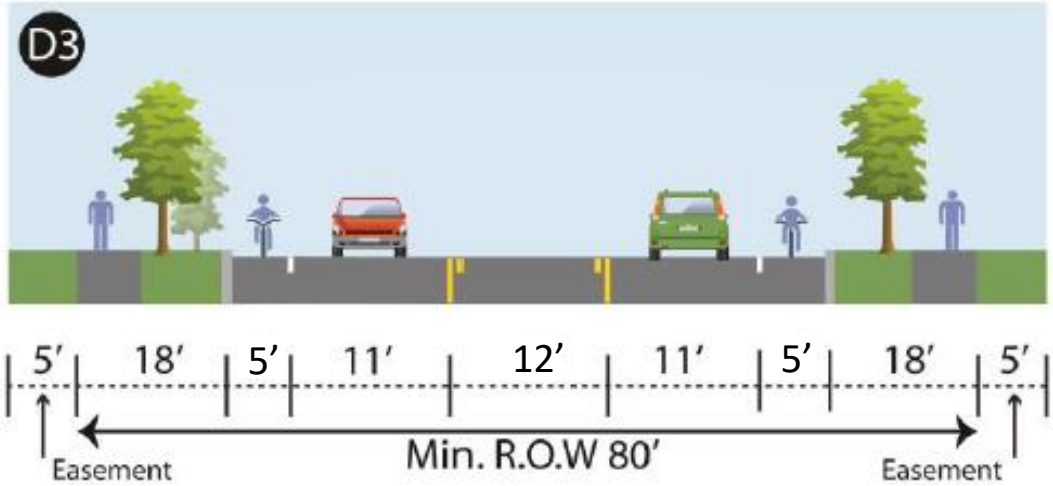
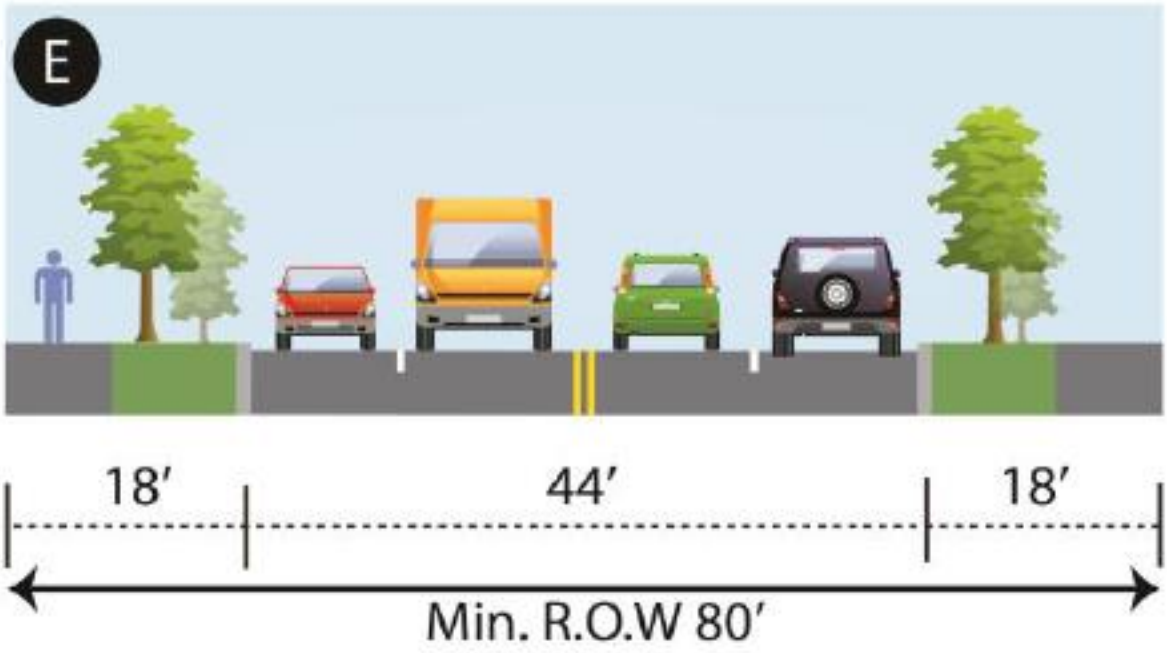


FIGURE 8.1 (Cont.): Typical Cross Sections



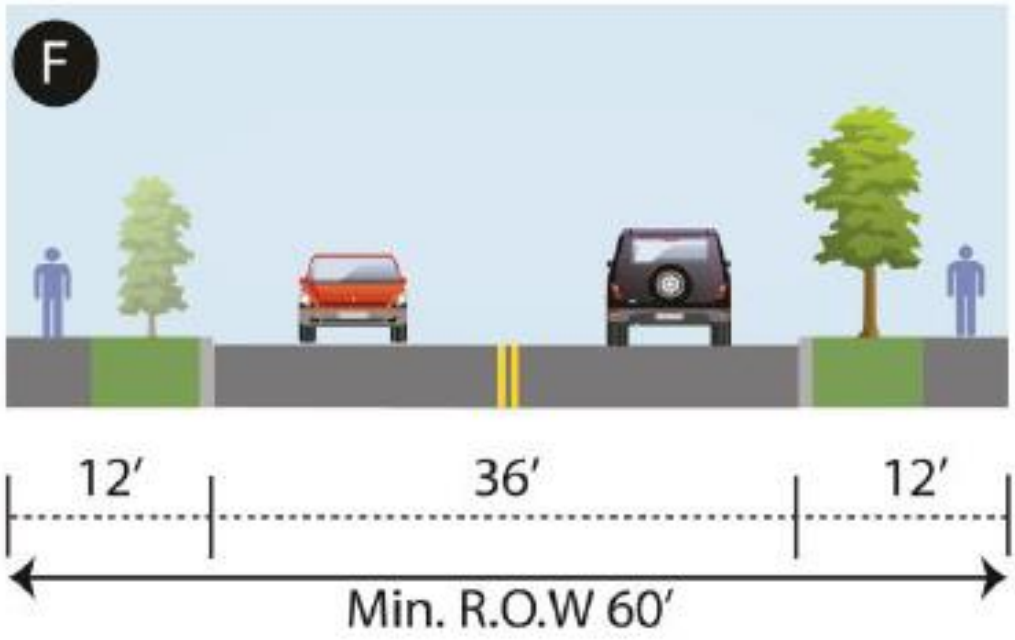
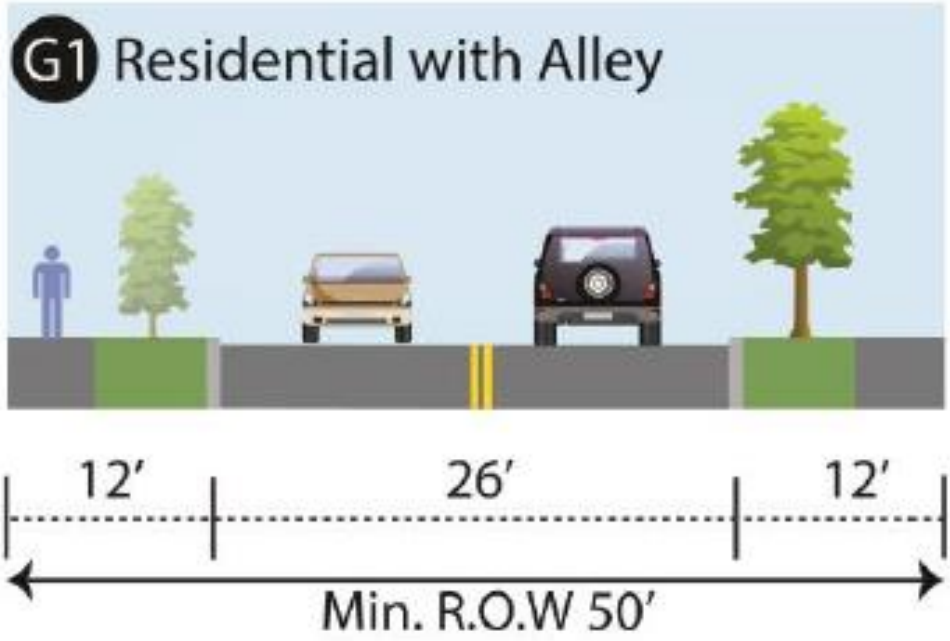


FIGURE 8.1 (Cont.): Typical Cross Sections



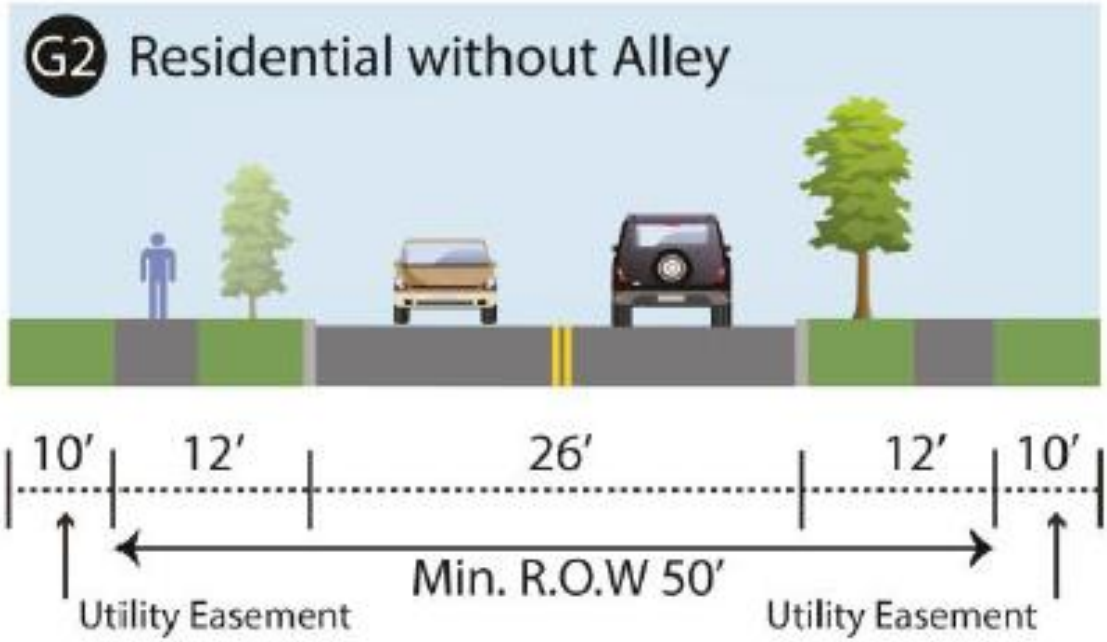


FIGURE 8.1 (Cont.): Typical Cross Sections

TABLE 8.2: Minimum Horizontal Centerline Radius

Design Speed, V (MPH)	Friction Factor, F	Superelevation, e (ft/ft)	Radius, R (ft) (Rounded for Design)
25	0.23	-0.02	250
30	0.20	-0.02	350
35	0.18	-0.02	600
40	0.16	-0.02	850
45	0.15	-0.02	1050
50	0.14	-0.02	1400

D. Minimum Vertical Alignment

1. Vertical curves are utilized in roadway design to affect gradual change between tangent grades and will result in a design which is safe, comfortable in operation, pleasing in appearance and adequate for drainage. Vertical curve alignment shall also provide Stopping Sight Distance (SSD) in all cases. SSD is a function of design speed, perception-reaction time, and deceleration rate. The perception-reaction time is assumed to be 2.5 seconds and is in accordance with the guidelines in AASHTO's 2011 edition of *A Policy on Geometric Design of Highways and Streets*. The equation for SSD appears below:

$$SSD = 1.47Vt + 1.075\frac{V^2}{a}$$

SSD = stopping Sight Distance (ft)
t = brake reaction time (2.5 sec.);
V = vehicle design speed (MPH); and
a = deceleration rate, (11.2 ft/s^2)

2. To determine the minimum acceptable length of Crest and Sag curves shown in Tables 8.3 and 8.4, it is assumed that approach grades are between -3% and 3% in the SSD calculation. The SSD for grades steeper than -3 % or 3% shall be in accordance with the guidelines in AASHTO's current *A Policy on Geometric Design of Highways and Streets*. Tables 8.3 and 8.4 also show values of K. K is defined as the rate of vertical curvature and is equivalent to the horizontal distance in feet required to make a one percent (1%) change in grade. The values of A are equivalent to the algebraic difference in grade between the two grades that are being joined together by the vertical curve.

3. Where two streets intersect, the grade difference at the intersection shall be less than or equal to 4.6 percent, which is the maximum slope rate for the standard low-clearance vehicle.

TABLE 8.3: Minimum Acceptable Crest Curve Given Speed and Difference in Grade of Road

Design Speed, V (MPH)	SSD (ft)	K	Length of Vertical Curve (L=KA)											
			A<1.0	A=1.2	A=1.6	A=2	A=3	A=4	A=5	A=6	A=7	A=8	A=9	A=10
20	115	10	-	50	50	50	50	50	50	60	70	80	90	100
25	150	20	-	100	100	100	100	100	100	120	140	160	180	200
30	200	30	-	100	100	100	100	120	150	180	210	240	270	300
35	250	50	-	100	100	100	150	200	250	300	350	400	450	500
40	305	80	-	125	128	160	240	320	400	480	560	640	720	800
45	360	120	-	144	192	240	360	480	600	720	840	960	1080	1200
50	425	160	150	192	256	320	480	640	800	960	1120	1280	1440	1600

TABLE 8.4: Minimum Acceptable Sag Curve Given Speed and Difference in Grade of Road

Design Speed, V (MPH)	SSD (ft)	K	Length of Vertical Curve (L=KA)											
			A<1.0	A=1.2	A=1.6	A=2	A=3	A=4	A=5	A=6	A=7	A=8	A=9	A=10
20	115	20	-	50	50	50	60	80	100	120	140	160	180	200
25	150	30	-	100	100	100	100	120	150	180	210	240	270	300
30	200	40	-	100	100	100	120	160	200	240	280	320	360	400
35	250	50	-	100	100	100	150	200	250	300	350	400	450	500
40	305	70	-	125	125	140	210	280	350	420	490	560	630	700
45	360	90	-	125	144	180	270	360	450	540	630	720	810	900
50	425	110	150	150	176	220	330	440	550	660	770	880	990	1100

E. Standard Intersection Layout

1. Street intersections shall intersect at ninety degree (90º) angles. Thoroughfare intersections shall remain perpendicular for a minimum distance equal to the corresponding design speed Stopping Sight Distance (SSD) identified in Tables 8.3 and 8.4. For residential collector and/or local street intersections, up to a five degree (5º) tolerance is allowable.

2. When the classification of a thoroughfare changes as it crosses an intersecting street, the design of both thoroughfare approaches shall maintain the characteristics of the higher class thoroughfare for a minimum distance specified by the Transportation Director.

3. The curb radii shall be a minimum of twenty-five feet (25') where Type F and G thoroughfares intersect with Type A, A-C, B, C, D, E, F, and G thoroughfares. The

curb radii shall be a minimum of forty-five (45') where Type A, B, and C thoroughfares intersect with Type A, B, and C thoroughfares. The curb radii at all other intersecting streets shall be a minimum of thirty feet (30'). Larger curb radii may be required to accommodate fire trucks and/or commercial trucks.

4. A minimum of nine and a half feet (9.5') of parkway shall be maintained from the back of the curb along the curb's radius.

5. On Type A or B roadways (as designated by the City of Garland Thoroughfare Plan), right-of-way in addition to that prescribed by the Thoroughfare Plan shall be dedicated near the intersection with other type A or B roadways to provide for the future construction of turn lanes and increased curb return radius. The amount of additional right-of-way shall be specified in Figure 8.2.

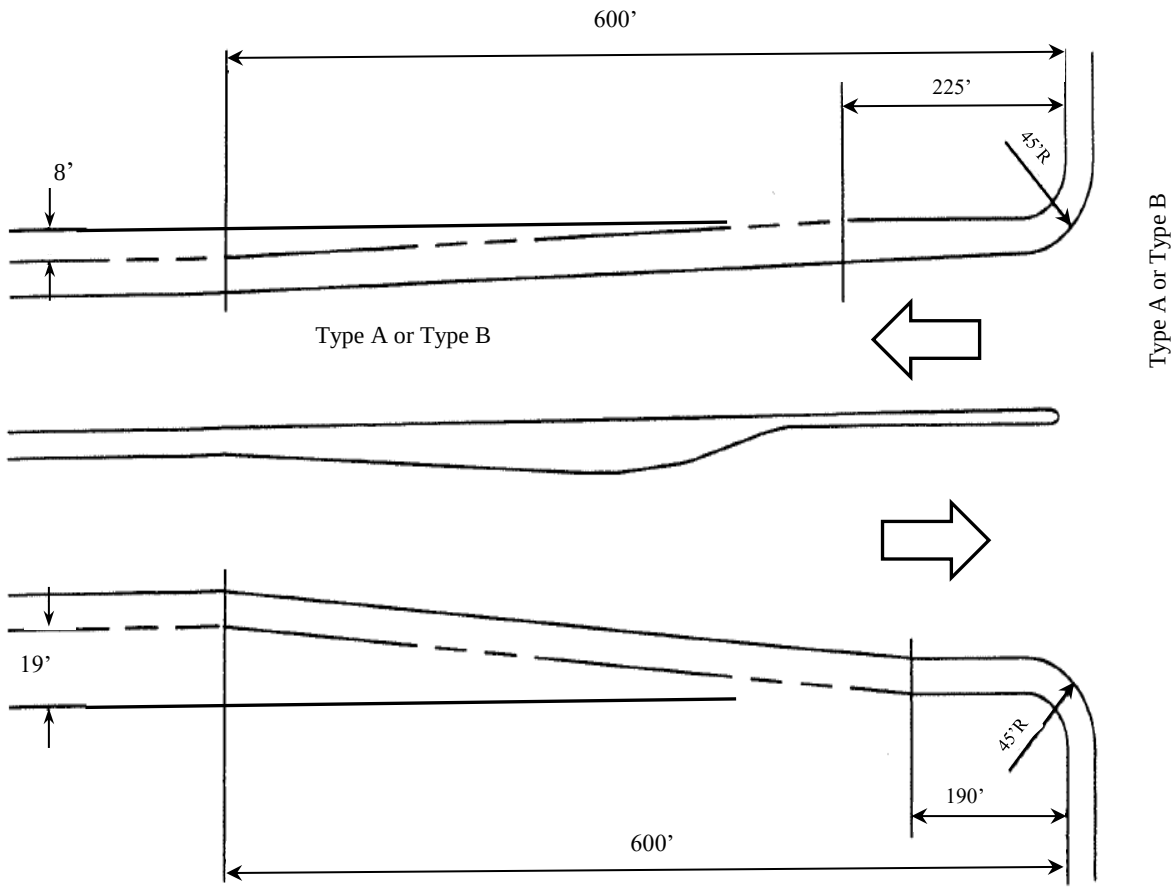


FIGURE 8.2: Type A/B Thoroughfare Intersection Detail

6. On Type A, B, C1, C2, D1, D2, D3 or E roadways, (as designated by the City of Garland Thoroughfare Plan), right-of-way in addition to that prescribed by the Thoroughfare Plan shall be dedicated for the construction of an exclusive right turn lane at the intersections with other Type C1, C2, D1, D2, D3 and E roadways. The additional right-of-way shall be eleven feet (11') wide and extend one hundred feet (100') from the intersection then taper to zero (0) over an additional one hundred feet (100'). The amount of additional right-of-way shall be specified in Figure 8.3.

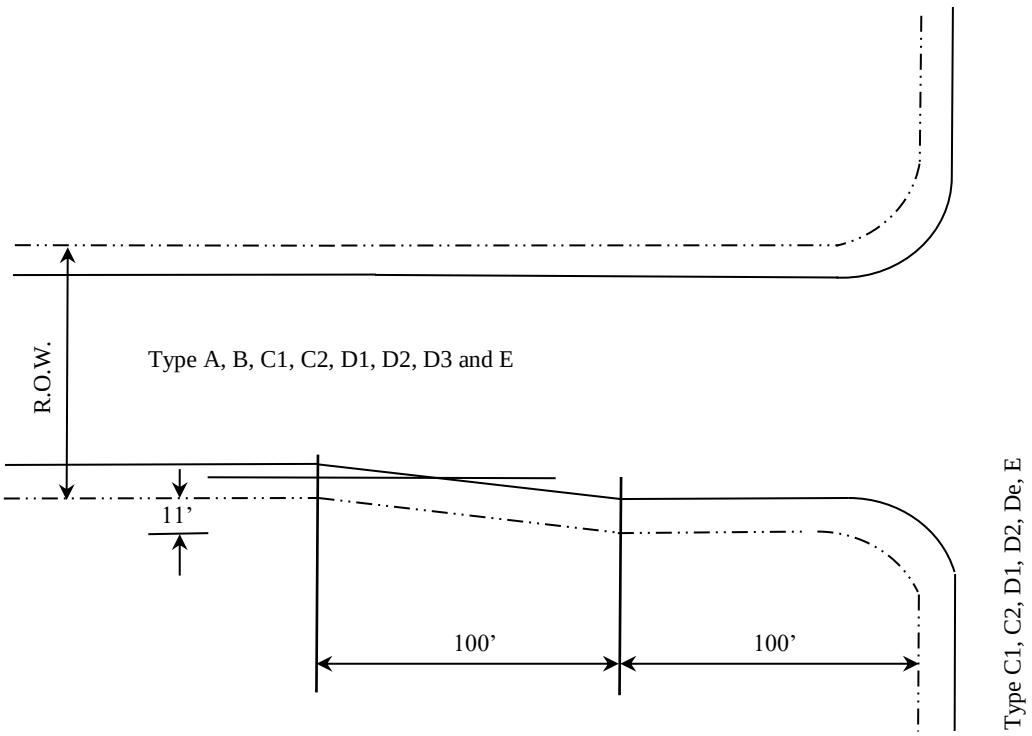


FIGURE 8.3: Type E and above Thoroughfare Intersection Detail

7. In addition to the right-of-way width prescribed by the Thoroughfare Plan and by 8.02.E.5 and 8.02.E.6 above, additional pedestrian and utility easement (p.u.e.) shall be dedicated to provide the minimum parkway widths for Type D3 and above thoroughfares. Type A, B, C1 and C2 thoroughfares required ten feet (10') pedestrian and utility easement. Type D1, D2, and D3 thoroughfares required five feet (5') pedestrian and utility easement. In areas of the City that are fully and almost developed, the strict application of this section on pedestrian and utility easement dedication may not be practical. In such cases, the Engineering and Transportation Directors may alter or waive the requirements.

8. Local residential subdivision streets (Type G) that intersects with a divided street (Type A, B, C1, C2 or D1 thoroughfare) are required to dedicate additional right-of-way and to construct a collector size street (Type F) at the intersection. The increased pavement width will extend one hundred feet (100') from the ultimate intersection curb line and transition back to normal width over a distance of hundred feet (100') or 10 to 1 taper.

F. Residential Frontage

1. Residential lots shall not front onto a Type A, A-C, B, C1, C2 or D1 thoroughfare.

2. Residential lots shall not front onto a Type D2, D3, E or F thoroughfare within one hundred feet (100') of the ROW line of the nearest Type A, A-C, B, C1, C2 or D1 thoroughfare.

G. Partial Streets

1. Longitudinal partial dedications of Type A, B, C1, C2 and D1 thoroughfares shall be permitted when only one side of a future thoroughfare is being developed. In such a case, one-half of the total right-of-way shall be dedicated and a minimum of twenty four feet (24') of pavement, face-to-face, shall be constructed. Refer to the GDC Section 3.47 for additional requirements.

2. Longitudinal partial dedications of Type D2, D3, E, F, and G thoroughfares shall be prohibited, except when essential to the reasonable development of a property in conforming with the requirements of the Garland Development Code in general and specifically to Section 3.47. Whenever a partial street exists along a common property line, the other portion of the street shall be dedicated when the adjoining property is subdivided or developed.

   a. The developer shall construct a minimum of twenty four feet (24') of pavement, face-to-face, for all Type D2, D3, E, and F thoroughfares that are partial streets at the time of development. Refer to GDC Section 3.47 for additional information.

   b. The developer shall construct the full width of pavement face-to-face for all Type G thoroughfares that are partial street dedications at the time of development.

H. Street Lengths

1. Residential streets (Type F and G thoroughfares in a single-family, duplex, or townhome neighborhood) shall have street length restrictions to discourage speeding and cut-through traffic.

2. Residential streets shall not exceed one thousand two hundred feet (1,200') in length before changing direction. A change in direction occurs when one of the following elements is used:

   a. A horizontal curve radius of three hundred fifty feet (350') is required for a Type F or G thoroughfare that changes the course of the street between one hundred twenty (120°) and one hundred fifty degrees (150°) (see Figure 8.4). A tangent that is a minimum of one hundred feet (100') long shall be provided between reverse curves.

   b. A street offset using two elbow intersections, each between ninety (90°) and one hundred twenty degrees (120°). The minimum distance between reverse elbows shall be one hundred fifty feet (150'). See Figure 8.5.

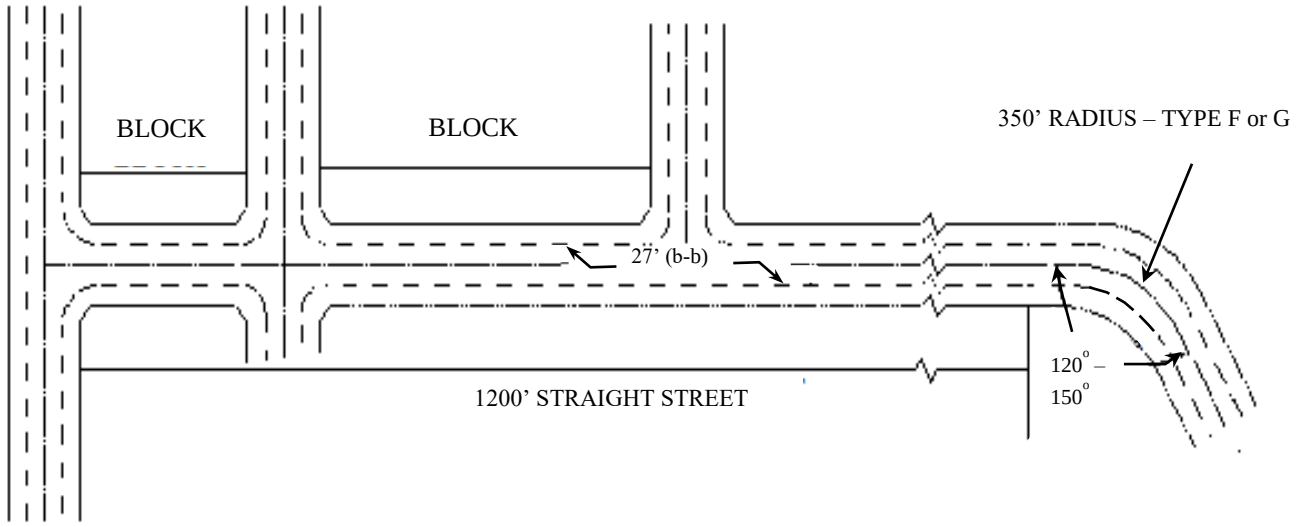


FIGURE 8.4: Change in Street Direction: Curve

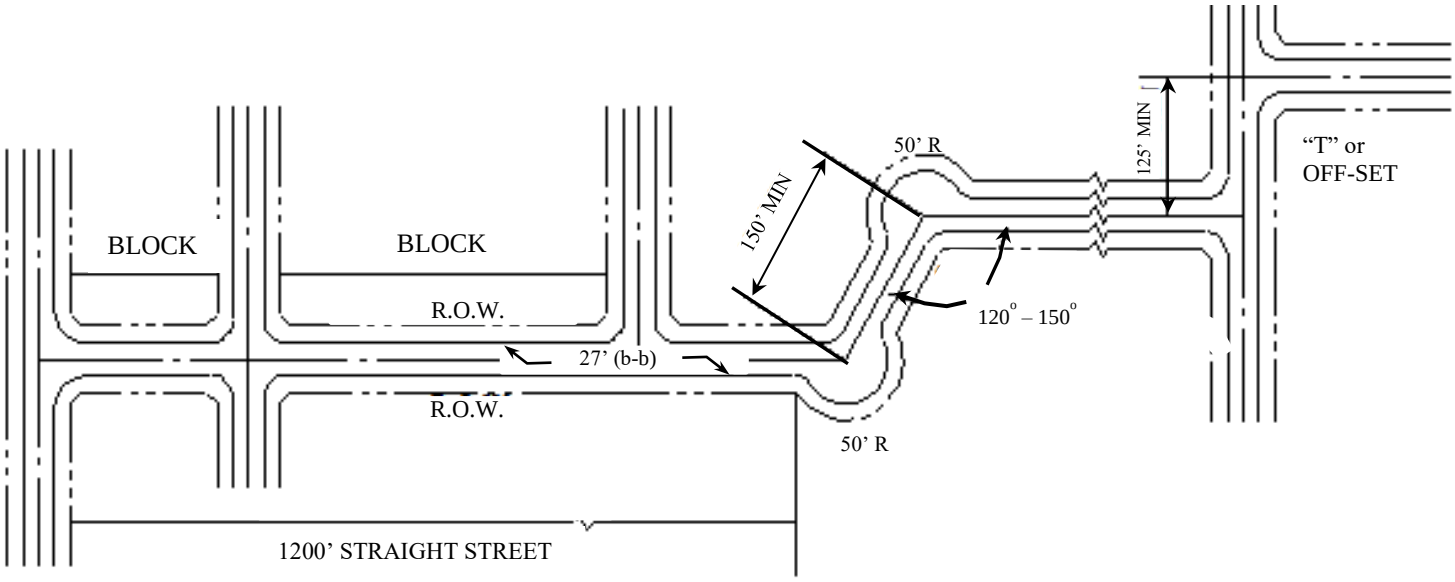


FIGURE 8.5: Change in Street Direction: Offset

I. Block Requirements

1. Block Length – Blocks shall not exceed one thousand two hundred feet (1,200') in length, measured from street ROW line to street ROW line. In the case of non-rectangular blocks, each side of the block with lots fronting it shall not exceed one thousand two hundred feet (1,200'), measured between the vertices formed by the extension of ROW lines at each corner of the block.

2. Block Width – Blocks shall be wide enough to allow two (2) tiers of lots and shall have a block width no less than two hundred feet (200'), except when only one tier of lots is possible due to the size of the property or the need to back up to a Type A, B, C1, C2 and D1 thoroughfare.

J. Clear Zones

1. No headwalls, culverts, drainage ditches or inlets shall be within fifteen feet (15') of the street back of curb without appropriate vehicle impact protection measures.

8.03 Median, Left-Turn Lane, Right-Turn Lane, Deceleration Lane, and Island Design

A. Required Median Openings and Left-Turn Lanes

1. Median openings on divided thoroughfares shall be required when possible at all street intersections provided that the minimum spacing requirements are met. Median openings may be constructed to serve non-residential drives provided that the minimum spacing requirements herein are met. Left-turn lanes are required for each street or driveway that connects to a median opening. The design of median openings and left-turn lanes shall accommodate potential future left-turn lanes that might serve undeveloped land.

2. Multi-family developments on a divided thoroughfare are required to have direct access to a median opening.

3. The City can modify, relocate, or remove any existing or planned median opening to facilitate traffic flow and/or preserve the health, safety and welfare of the Public, as reasonably determined by the Transportation Director utilizing recognized industry standards as they exist, may be amended, or in the future arising.

4. To the greatest extent practicable, median openings shall be located at public street intersections or major driveways.

5. Cross access easements shall be encouraged to grant each platted lot access to at least one median opening on each divided street which that lot abuts.

6. The minimum spacing between openings shall be as provided for in Figure 8.6.

7. Construction of a left turn bay will be required where any street or private driveway is constructed to align with an existing or proposed median opening.

8. Where sufficient room does not exist for the construction of a typical left turn bay, in accordance with 8.03.A.6, or where a proposed driveway cannot be properly aligned

with existing median access, permanent median and/or driveway channelization to prohibit left turn access for the requested driveway will be required or the proposed driveway shall be constructed at least one hundred feet (100') from the near side median opening.

9. Median opening shall not be less than sixty feet (60') or greater than ninety feet (90') wide for service to private development driveways.

B. Minimum Left-Turn Storage, Taper Length, and Median Opening Width, Location, and Spacing Requirements

1. Left-Turn Lane Storage

   a. All single left-turn lanes constructed on divided thoroughfares of ultimate cross section width shall be a minimum of ten feet (10') wide. Where double left-turn lanes are provided, each left-turn lane shall be a minimum of ten feet (10') wide.
   b. All left-turn lanes constructed as future through lanes on divided thoroughfares shall be eleven feet (11') wide for the entire storage and taper length requirements as listed in Table 8.5.
   c. Minimum storage requirements are listed in Table 8.5. Storage requirements may be increased by the City based upon actual and projected traffic demands of the properties that will be served by the left-turn lane.
   d. Left-turn lanes will be delineated by using the City's current Pavement Markings and Markers standard details.
   e. Concrete median paving shall be required in the median where the median width is six feet (6') or less, back of curb to back of curb. If the median width is greater than six feet (6'), then concrete median paving shall be required for a minimum distance of ten feet (10') from the median nose. See Figure 8.7.

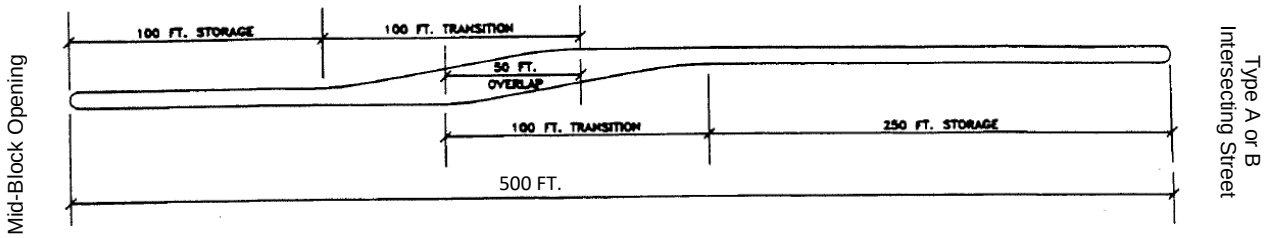
2. Taper Length – The taper specifications for left-turn lane entrance areas are specified in Table 8.5. The variables used for the specifications are shown in Figure 8.7.

TABLE 8.5: Minimum Left-Turn Lane Design Requirements

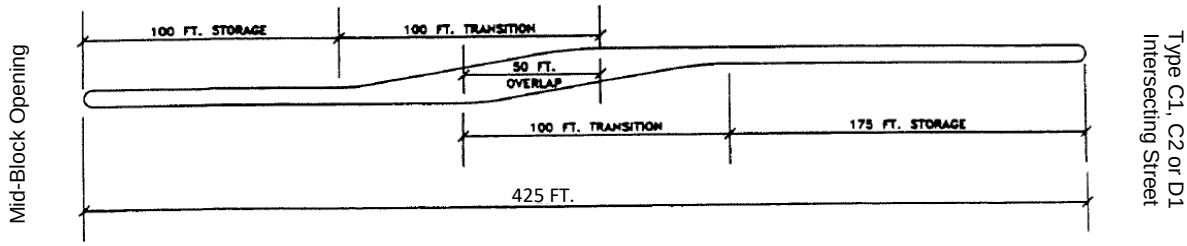
Type of Thoroughfare On	Type of Thoroughfare At	Turn Lane Width(s) (ft)	Minimum Length of Full-Width Storage(ft)	Taper Specifications		
				Length(ft)	R_1(ft)	R_2(ft)
A, B	A, B	10	250, 200(1)	100	250	250
A, B	C1, C2, D1	10	175,150(1)	100	250	250
C1, C2, D1	A, B	10	175,150(1)	100	250	250
A, B	D2, D3, E, F, G	10	100	100	250	250
	Non-Residential Driveway	10	100	100	250	250
C1, C2, D1	C1, C2, D1, D2, D3, E, F, G	10	100	100	250	250
	Non-Residential Driveway	10	100	100	250	250
TxDOT Road	A,B,C1,C2,D1,D2,D3, E,F,G and Non-Residential Driveway	See TxDOT's *Roadway Design Guide* and Specifications				

(1) Double left-turn lanes

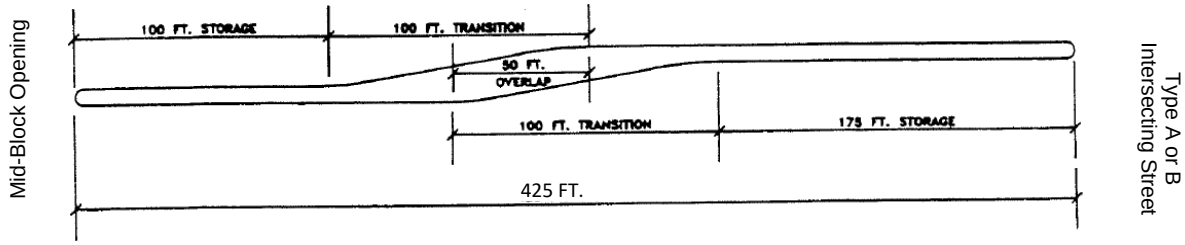
Type A or B Street Intersecting
Type A or B Street



Type A or B Street Intersecting
Type C1, C2 or D1 Street



Type C1, C2 or D1 Street Intersecting
Type A or B Street



Any Divided Street Intersecting an Undivided Street or
Private Driveway

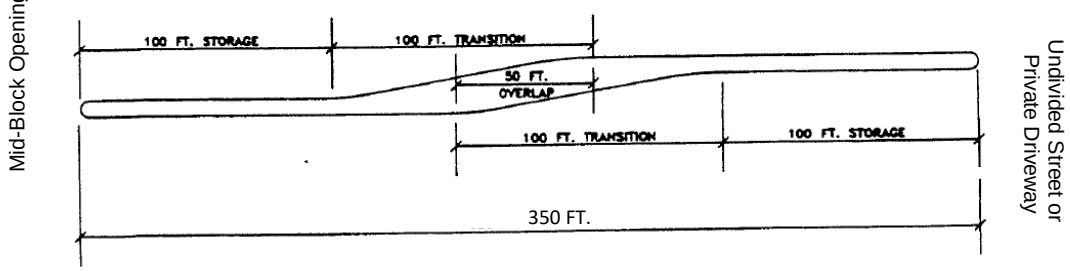


FIGURE 8.6: Minimum Length of Left Turn Bays, Transitions and Spacing Between Median Openings

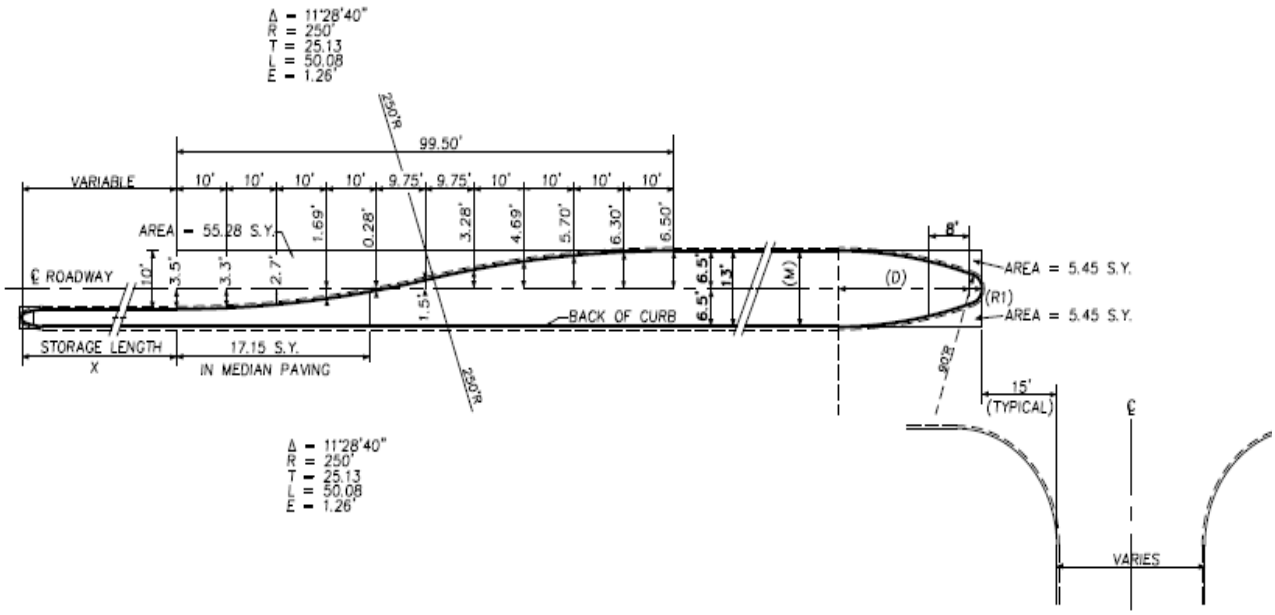


FIGURE 8.7: Typical Left Turn Lane Dimensions

3. Median Openings

   a. Median openings shall accommodate all turning paths and crosswalks.

   b. The width of mid-block median openings shall not be less than sixty feet (60'). They may be greater than sixty feet (60') where necessary to accommodate turning paths and crosswalks subject to approval by the Transportation Director.

   c. Median openings shall not be less than seventy feet (70') wide at divided high capacity driveways (see Section 8.05.B.5).

4. The minimum distance to the first mid-block median opening along a Type A, B, C1, C2 and D1 thoroughfare that is immediately downstream from a Type A, B, C1, C2, and D1 thoroughfare is shown in Figure 8.6. This distance varies from four hundred twenty-five feet (425') to five hundred feet (500'), measured nose to nose, depending on the thoroughfare type and the type of mid-block opening.

5. Medians on Public Street Entrances to Developments

   a. Medians installed on undivided thoroughfares at entrances to subdivisions for aesthetics or any other purpose shall be a minimum of ten feet (10') wide and one hundred feet (100') long.

   b. A divided residential subdivision entrance shall transition to the normal residential street width upstream or downstream of the first street intersection. No part of the transition shall occur within an intersection.

   c. If specified by zoning, alternative design standards may be required for these types of subdivision entrances.

C. Minimum Deceleration/Right-Turn Lane Storage and Taper Length

1. Deceleration/Right-Turn Lane Storage

   a. Deceleration/Right-Turn lanes are required when projected traffic volumes entering a proposed non-residential and multi-family development are likely to interfere with the peak traffic flow on an adjoining street. A minimum of fifty (50) turning vehicles during peak hour are necessary to require a deceleration lane.

   b. All Deceleration/Right-Turn lane storage areas shall be eleven feet (11') wide. Additional street right-of-way (R.O.W.) or street easement shall be provided paralleling the turn lane curb to provide an additional eleven feet (11') of R.O.W. or street easement at the full width of the turn lane. If the Master Thoroughfare Plan requires a P.U.E., then an additional P.U.E. shall be dedicated paralleling the proposed R.O.W. or street easement. See Figure 8.8 for more details.

   c. Deceleration/Right-Turn lanes will be delineated by using the City's current Pavement Markings and Markers standard details.

   d. Minimum storage length requirement is one hundred feet (100'). Storage length requirement may increase based upon actual and projected traffic demands.

   e. A minimum tangent section of thirty feet (30') shall be provided between the preceding driveway or cross street curb return and the taper of a deceleration lane.

2. Taper Length – The taper specifications for deceleration lane entrance areas are specified in Table 8.6. The variables used for the specification are shown in Figure 8.8.

TABLE 8.6: Minimum Deceleration/Right-Turn Lane Design Requirements

Type of Thoroughfare On	Type of Thoroughfare At	Turn Lane Width(s) (ft)	Minimum Length of Full-Width Storage(ft)(1)	Minimum Taper (2) Length(ft)
A, B	A, B	11	150	100
B, C, D, E	C, D, E	11	100	100
A, B, C, D, E	Non-Residential Driveway	11	100	100
TxDOT Road	A,B,C,D,E,F,G	See TxDOT's *Roadway Design Guide* and Specifications		

(1) Measured from the intersecting thoroughfare face of curb.
(2) No driveways are permitted within the taper area.

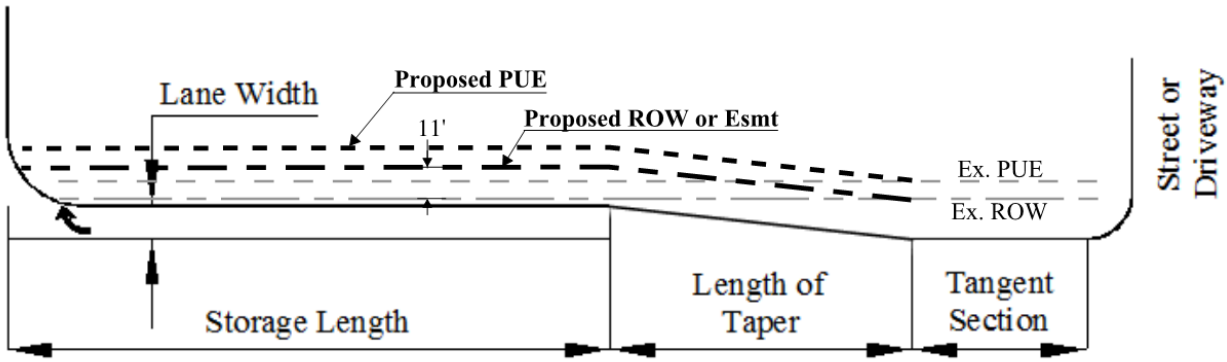


FIGURE 8.8: Minimum Deceleration/Right-Turn Lane Design Requirements

D. Cost of Median Openings and Turn Lanes

1. Median openings, left-turn lanes, and right-turn lanes constructed for residential streets and/or subdivision entrances not referenced on the Thoroughfare Plan shall be the responsibility of the developer and shall be constructed to City (or TxDOT) standards and inspected by the governing entity.

2. Median openings, left-turn lanes and deceleration lanes for multi-family and non-residential developments shall be the responsibility of the developer and shall be constructed to City (or TxDOT) standards and inspected by the governing entity.

8.04 Alley Design

A. Alley Intersections

1. Alleys shall not intersect any Type E thoroughfare and above.

2. Alleys that are parallel to and share a common ROW line with a Type A, B, C, D or E thoroughfare or a residential collector shall turn away from that thoroughfare not less than fifty feet (50') or one subdivision lot width (whichever is greater) from the cross street ROW as shown in Figure 8.9.

3. Alleys shall intersect with a residential street so that the alley ROW line is not less than fifty feet (50') or one subdivision lot width (whichever is greater) from the ROW of the nearest cross street as shown in Figure 8.9.

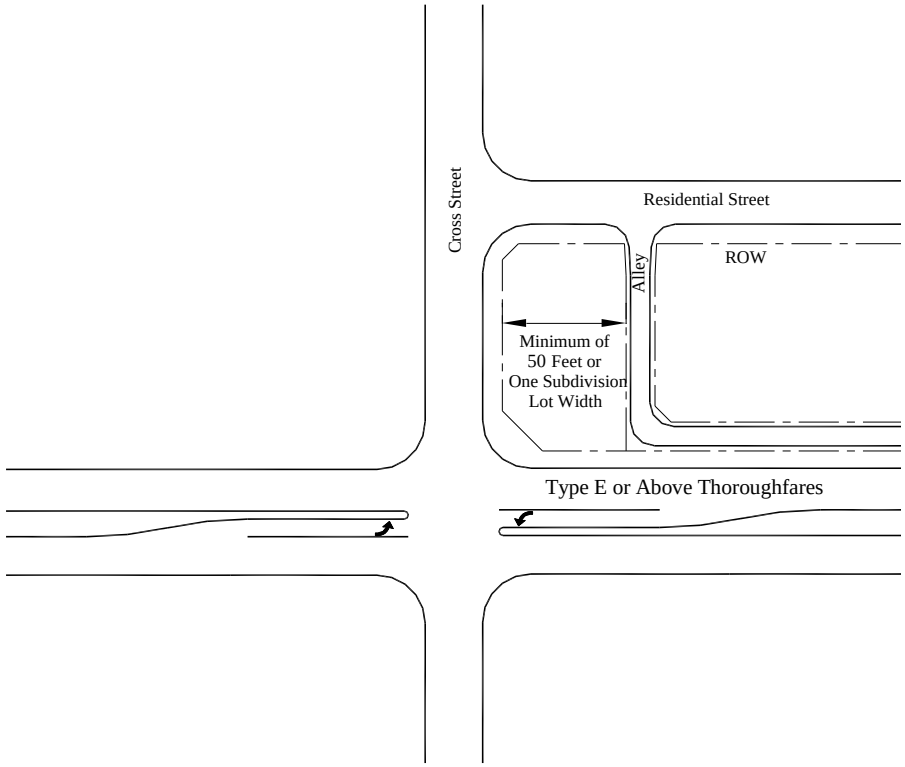


FIGURE 8.9: Minimum Distance from Intersection for Parallel Alley

4. All alley intersections with streets shall be perpendicular or radial, within a five degree (5°) tolerance, at the intersection of the ROW lines.

5. The offset between alleys on opposite sides of a residential street shall align (centerline to centerline) with each other or be greater than seventy-five feet (75') measured from edge of alley to edge of alley.

6. Alleys shall not align with existing or future streets on the opposite side of a street. Alleys shall be offset from such a street by a minimum of seventy-five feet (75') measured from edge of alley to edge of street.

7. Internal alley intersections shall consist of no more than three alley approaches.

8. As an alley approaches an intersection with another alley, the pavement width shall increase to twelve feet (12') using a taper ten feet (10') long. The wider pavement shall be maintained for a distance of fifteen feet (15') prior to the radius of the intersection. Four feet (4') of parkway shall be maintained between the pavement and the ROW line at all times. See Figure 8.10.

9. No permanent dead end alley shall be permitted in new subdivisions. Alleys shall connect and/or be aligned with alleys in adjacent subdivisions.

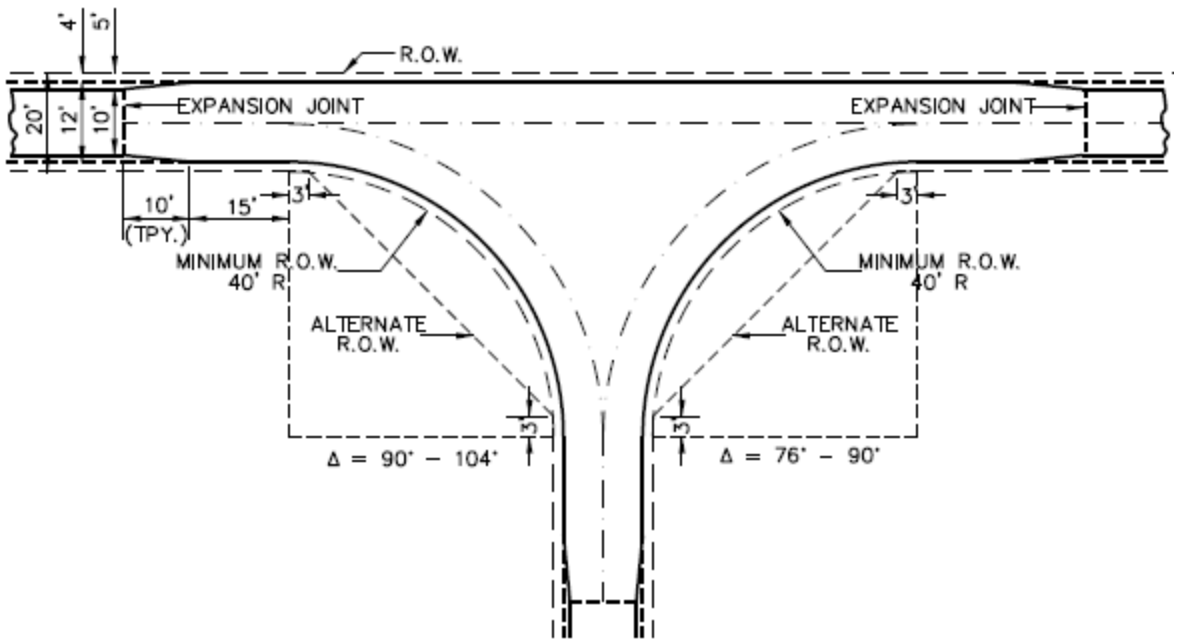


FIGURE 8.10: Alley to Alley Intersection

10. The radius of alley pavement at street intersections shall not be less than ten feet (10') as shown in Figure 8.11. At the intersection of two alleys, the radius of the alley ROW is dependent upon the alley ROW intersection angle. See the City of Garland's Standard Construction Details for alley intersection requirements.

B. Alley ROW Width – Alley ROW shall be twenty feet (20') wide.

C. Alley Pavement Width – Alley pavement shall be ten feet (10') wide except near alley intersections, as shown in Figure 8.10, and except near street intersections as shown in Figure 8.11.

The remainder of this page
left blank intentionally.

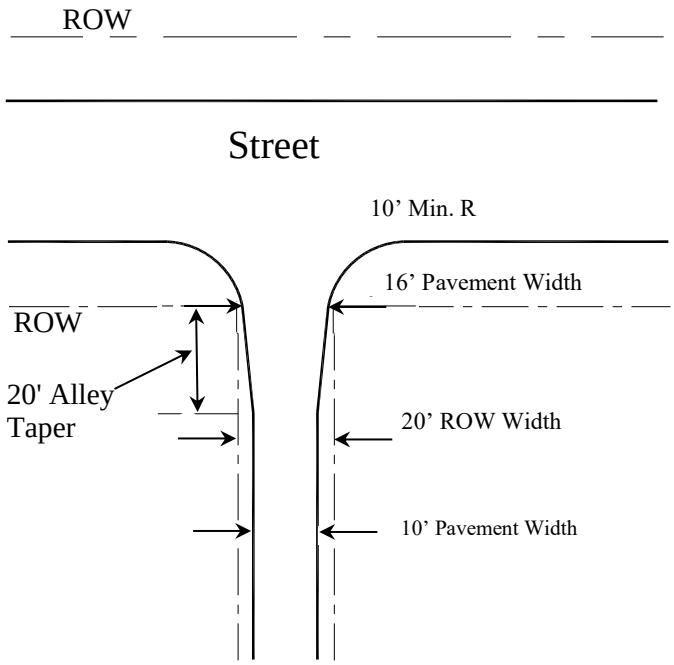


FIGURE 8.11: Alley to Street Intersection

D. Alley Length – Alleys shall not exceed eight hundred feet (800') in length without an intermediate connection to a residential street.

E. Alley Pavement Thickness – Refer to TSM Section 9 and the City's Standard Construction Details.

F. Rear Alley Frontage – The minimum alley rear frontage shall be twenty feet (20').

G. Alley Visibility Obstructions

1. No fence, wall, screen, sign, structure, landscaping rock greater than four inches (4") in height, or foliage of hedges, trees, bushes, or shrubs shall be erected, planted or maintained in any alley ROW.

2. Foliage of hedges, trees, bushes, and shrubs planted adjacent to the alley ROW shall be maintained by the property owner such that the overhang or encroachment shall be no less than fourteen feet (14') above the alley surface and no less than one foot (1') outside the edge of the pavement.

H. Alley Grade

1. Alleys shall have a maximum grade of ten percent (10%). Steeper grades may be permitted where required by topographical and/or natural features, as approved by the Engineering and Transportation Directors.

2. Alleys shall maintain a maximum cross-slope of two percent (2%) at the intersection of the adjacent sidewalk.

I. Vertical Curves in Alleys – Vertical curves in alleys shall be used in order to provide a design which is safe, comfortable in operation, pleasing in appearance and adequate for drainage. Vertical curve alignment shall also provide stopping sight distance in all cases based on a design speed of twenty (20) mph.

J. Where an alley is proposed adjacent to a non-buildable lot or non-buildable portion of a lot (HOA lots, drainage easements, thoroughfare, etc..), a 6" monolithic curb shall be constructed per the City's Standard Construction Details to prevent vehicular access to these areas.

8.05 Driveway Design

A. Introduction – Driveway design standards are needed to provide safe and efficient vehicular access to and from the public street system, to provide public street capacity for accommodating peak traffic volumes of public streets, to maintain smooth traffic flow, and to maintain street ROW and drainage. The intent of driveway design standards is to achieve the following:

1. Prohibit the indiscriminate location and spacing of driveways while maintaining reasonable vehicular access to and from the public street system.

2. Reduce conflicting turning movements and congestion thereby reducing vehicular crashes.

B. Definition of Driveway Types

1. Residential Driveway – Provides access to a single-family residence, duplex, or multi-family building containing four or fewer dwelling units. Residential driveways shall intersect Type E, F and G thoroughfares only (according to the restrictions described below).

2. Non-Residential Driveway

   a. Commercial Driveway – Provides direct access to an office, retail or institutional building, or multi-family building having more than four dwelling units. It is anticipated that such buildings will have incidental truck service.

   b. Industrial Driveway – Serves truck movements to and from loading areas of an industrial facility, manufacturing, warehouse, or truck terminal. A retail development may have one or more driveways specially designed, signed, and located to provide access for trucks, which shall be considered industrial driveways. Industrial plant driveways whose principle function is to serve administrative or employee parking lots shall be considered commercial driveways.

3. Standard Driveway – Provides two-way access at a single, undivided curb opening. The minimum width of a standard driveway depends on land use and is shown in Table 8.7.

4. One-Way Driveway – Provides only inbound or outbound access and can only be permitted when the orientation of on-site circulation and parking layout clearly utilize the driveway for one-way movements. The minimum width for a one-way driveway depends on land use and is shown in Table 8.7.

5. High Capacity Driveways – Intended to provide two-way access with geometric provisions which more adequately respond to greater driveway volumes and/or access limitations than standard driveways. These provisions include increased width, increased internal storage and a median divider.

   a. The primary multi-family driveway shall be a divided high capacity driveway at a median opening.

   b. Divided high capacity driveways are required on Type D1 and above thoroughfares when the number of parking spaces per driveway exceeds two hundred (200), except along a frontage road.

C. Driveway General Design Parameters

1. The centerline angle for a driveway approach shall be ninety degrees (90º) to the street curb line for all driveways.

2. Driveways shall not be permitted in the taper area of any right-turn lane or deceleration lane.

3. Driveways that intersect at a mid-block median opening shall have the driveway centerline intersect with the midpoint of the median opening (measured nose-to-nose).

4. Driveway connections can be required by the Transportation Director to ensure adequate circulation.

5. Cross access is required between adjacent non-residential properties so that each property can share the use of the driveway(s) on the adjacent property. A shared driveway that is centered on the common property line is also encouraged. When one non-residential property develops before the adjacent property develops, the full width of the shared driveway shall be constructed at that time.

6. The maximum driveway grades allowed on public right-of-way are:

   a. High volume driveway on an arterial or collector street, max. grade is 6%.

   b. Low volume driveway on an arterial or collector street, max. grade is 8%.

   c. Low volume driveway on local street, max. grade is 10% for commercial and 12% for residential.

7. Driveway grades in a fire lane shall not exceed 10%. Steeper grades may be permitted in areas where buildings are not present, as approved by the Director of Engineering and the Fire Department.

8. Driveways that serve as a fire lane shall be a minimum of twenty-four feet (24') in width.

9. Differential grades on driveways shall not exceed 10%.

10. Any sidewalk access across a driveway shall meet all state and federal ADA requirements for accessibility.

11. Commercial (non-residential) driveway is not allowed to access a residential serving alley.

12. Residential driveways shall be prohibited along Type A, B, C1, C2, D1, D2, and D3

13. Residential driveways shall provide access to an alley or an eligible public street according to the following restrictions:

    a. A residential lot shall be allowed a maximum of one (1) driveway onto a public street, except in the case of a circular driveway approved by the Transportation Director.

    b. A residential driveway that provides access to a garage shall connect to an alley or shall connect to a residential street that is at least twenty seven feet (27') wide, face-to-face.

    c. A residential lot shall be prohibited from having multiple driveway connections in a configuration that would create the possibility of a cut-through route between a public street and an alley that do not intersect or between two public streets that do not intersect, as determined by the Transportation Director.

    d. If a residential driveway is shared between two properties, a common access easement is required and the driveway shall be centered on the common property line unless otherwise approved by the Transportation Director.

    e. A residential driveway connecting to an alley shall not be located within twenty feet (20') of the ROW line of a public street so as to prevent the driveway from being located in the alley taper

14. Driveways shall be located so that they meet the required spacing from other driveways and streets, as described in Subsections F, G and H below. The spacing and location of driveways shall be related to existing driveways and streets and to future driveways and streets that are shown on approved preliminary site plans and/or site plans that have not expired.

D. Driveway Width – The width of a driveway refers to the width of pavement at the property line and is measured where the curb return radii ends perpendicular to the street curb or edge of pavement. The minimum and maximum widths of driveways are listed in Table 8.7. A driveway may transition to a different width as it extends onto the property, but its width shall not change abruptly at the property line.

TABLE 8.7: Minimum and Maximum Driveway Widths(1)

Driveway Type	Land Use	Width in Feet (face to face)(2)	
		Minimum (ft)	Maximum(ft)
Standard Driveway	Residential Single-Family	10	24 to a street 32 to an alley(3)
	Multi-Family	24	30(4)
	Commercial – Office, Retail	24	30(4)
	Service Stations	24	40
	Industrial	30	45
One-Way Driveway	Residential (circular)	10	16
	Multi-Family	20	25
	Commercial– Office, Retail	20	25
	Industrial	20	25
Divided High Capacity Driveway	Entrance	20	24
	Exit: Two Lanes	24	24
	Three Lanes	33	36
Driveway Medians		6	10

(1) Driveway width at the property line. A driveway may transition to a different width as it extends onto the property.
(2) Driveways that serve as a fire lane shall be a minimum of twenty-four feet (24') in width.
(3) A residential driveway connecting to an alley may have a width up to a maximum of thirty-two feet (32') if the garage faces onto the alley; otherwise, its width is limited to twenty-four feet (24').
(4) For driveways at median opening, a maximum driveway width forty feet (40') is allowed.

E. Driveway Radius

1. All driveways intersecting dedicated streets shall be built with a circular curb radius connecting the six-inch (6") raised curb of the roadway to the design width pavement of the driveway.

2. Driveway radii shall fall entirely within the subject property so as to begin at the street curb at the extension of the property line.

3. Table 8.10 presents the minimum and/or maximum standards to be applied in designing and locating driveways on public streets.

4. High capacity driveways shall meet the same standards as those defined in Table 8.8.

The remainder of this page left blank intentionally.

TABLE 8.8: Driveway Design Requirements

Driveway Type	Land Use	Driveway Curb Radius	
		Minimum (ft)	Maximum(ft)
Standard Driveway	Residential Single-Family	5	10
	Multi-Family (MF)	15	30
	Commercial – Office, Retail	15	30
	Service Stations	20	40
	Industrial	25	50
One-Way Driveway	Residential (circular)	5	10
	Multi-Family	15	30
	Commercial– Office, Retail	15	30
	Industrial	25	50
Divided High Capacity Driveway	Commercial – MF, Office, Retail	15	40

F. Maximum Number and Spacing of Driveways

1. The maximum number of driveways allowed per platted lot is determined by the amount of street frontage the property is abutted to, the type of land use for the property and the thoroughfare classification of the roadway. Table 8.9 defines the maximum number of driveways allowed per platted lot frontage as a function of thoroughfare classification and the type of land use.

2. Spacing between driveways is measured along the property line from the end of radius of one driveway to the end of radius of the next driveway. Table 8.9 defines minimum driveway spacing as a function of thoroughfare classification.

3. In the vicinity of a railroad crossing, the closest edge of a driveway shall be a minimum of one hundred feet (100') from the railroad ROW line.

4. Non-residential and multi-family driveways on opposite sides of an undivided street shall align with each other or be spaced a minimum of seventy-five feet (75') apart, measured edge to edge, to ensure that conflicting movements do not overlap. This spacing shall also apply to a driveway that is on the opposite side of an undivided street from an intersecting street. See Figure 8.12.

The remainder of this page left blank intentionally.

TABLE 8.9: Maximum Number of Driveway and Driveway Spacing Requirements

Land Use	Lot Frontage (Feet)	Maximum Number of Driveway (Per Platted Lot) (1)	Minimum Spacing Between Driveways on Same Platted Lot (Feet)	Minimum Spacing Between Driveways on Adjacent Lot (Feet)
Single-Family Residential	Less than 60	1	N/A	10
Single-Family Residential	60 or more	2	20	10
Multi-Family, Commercial or Industrial Abutting a Type D1, D2, D3, E, F or G Thoroughfare	Less than 200	1	N/A	50
	200 to 300	2	75	50
	More than 300	1 per 150' of Frontage	100	50
Multi-Family, Commercial or Industrial Abutting a Type A, B, C1 or C2 Thoroughfare	Less than 500	1	N/A	100
	500 to 1000	2	250	100
	More than 1000	1 per 500' of frontage	250	100

(1) Common access driveways, when filed for record with Dallas County, will not be included in the driveway count per platted lot. Minimum spacing requirements still apply.

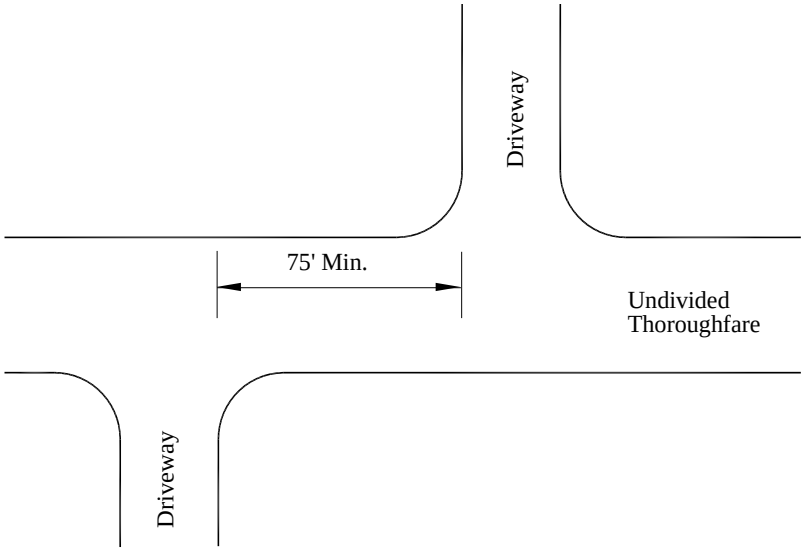


FIGURE 8.12: Driveway Spacing on Opposite Sides of an Undivided Street

G. Distance between Driveway and Intersection

1. Adequate distance between cross street intersections and access driveways shall be provided to ensure intersection/driveway conflict areas are minimized.

2. Table 8.10 defines the upstream and downstream distance from an intersection as a function of thoroughfare classification.

TABLE 8.10: Minimum Corner Clearances Between Driveway and Intersection

Type of Street Intersection	Type of Street Intersection	Approach Side of Intersection	Departure Side of Intersection
Arterial	Arterial	150	100
Arterial	Collector	100	70
Arterial	Local	50	30
Collector	Arterial	100	70
Collector	Collector	70	50
Collector	Local	40	30
Local	Arterial	50	30
Local	Collector	40	30
Local	Local	30	30

Notes: 1. For the purposes of this Table, the thoroughfares are classified as:
Arterial - Type A, B, C1, C2 and D1 thoroughfare on the City of Garland Thoroughfare Plan
Collector - Type D2, D3, E and F thoroughfare on the City of Garland Thoroughfare Plan
Local - Type G or any other street not designated on the City of Garland Thoroughfare Plan
2. Service roads shall be classified as an arterial for driveway purposes.
3. Corner clearance distance is measured from end of radius to end of radius.

H. Driveway Storage Lengths

1. On-site internal storage shall be provided at all non-residential and multi-family driveways for queuing of vehicles off-street, to minimize congestion, and increase safety both on the public street and within the driveway.

2. Internal storage requirements shall be based on the number of parking spaces accessible by the affected driveway. Divide the total number of parking spaces by the number of driveways and then use Table 8.11 to determine the amount of internal storage required. This calculation shall be based on the preliminary site plan for an overall development or the site plan for a specific lot, whichever produces the largest ratio of parking spaces per driveway.

3. Internal storage length shall be measured from the ROW line to the first intersecting aisle, internal driveway, or parking stall.

4. A circulation study will be required for all multi-story parking structures. Driveway storage requirements will be determined as a result of the study.

TABLE 8.11: Minimum Driveway Storage Lengths

Parking Spaces per Driveway	Storage Required (ft)			
	Multi-family or Commercial Uses		Industrial Land Uses	
	Non-Median Opening(1)	Median Opening(2)	Non-Median Opening(1)	Median Opening(2)
Less than 25	28	28	28	28
25-50	28	28	28	50
51-100	28	50	50	50
101-200	50	75	50	75
More than 200	75	75	75	75

(1) Includes driveways that connect to one-way frontage roads.
(2) Includes any driveway where a left-turn exit can be made, including driveways that connect to undivided roadways.

I. Entrance Streets and Driveways for Gated Developments

1. To ensure that the minimum dimensions are adequate, a traffic study is required with the submission of a Specific Use Permit application for all gated communities.

2. Residential/Multi-family Developments

   a. Gated developments shall have a median divided street or driveway that will allow for a vehicular turn-around prior to the gate in the event that access is denied.

   b. The turn-around shall be a minimum of eighteen feet (18') in width.

   c. Entry gates shall be set back from the ROW line a minimum of one hundred thirty five feet (135') or as indicated in the traffic study. The card reader, or first stop, shall be set back from the ROW line a minimum of one hundred feet (100'), or as indicated in the traffic study, to provide storage for the longest queue of vehicles expected to access the gate. See Figure 8.13.

   d. Each direction of the divided street or driveway shall be a minimum of twenty-four feet (24') in width with curb radii of thirty feet (30'). See Figure 8.13.

   e. The hinge point of the gate shall be a minimum of eighteen inches (18") behind back of the curb. The gate shall open to twenty-four inches (24") behind back of curb.

   f. Gates shall open sideways or swing open in the direction of travel on each side of the divided street.

   g. Gates shall be equipped with emergency access devices as required by the Fire Department.

h. All gates shall provide pedestrian access. The movement of the gates shall not encroach on sidewalks.

i. Any alternative designs shall require the approval of the Transportation Director.

3. Non-Residential Developments

a. Gated developments shall have a median separating ingress and egress traffic flow allowing for a vehicular turn-around prior to the gate in the event that access is denied.

b. The turn-around shall be a minimum of eighteen feet (18') in width.

c. Entry gates shall be set back from the ROW line, or fire lane, a minimum of seventy-five feet (75'), or as indicated in the traffic study. The card reader, or first stop, shall be set back from the ROW line a minimum of fifty feet (50'), or as indicated in the traffic study, to provide storage for the longest queue of vehicles expected to access the gate.

d. Each direction of the driveway shall be a minimum of twenty-four feet (24') in width with curb radii of thirty feet (30'). See Figure 8.13.

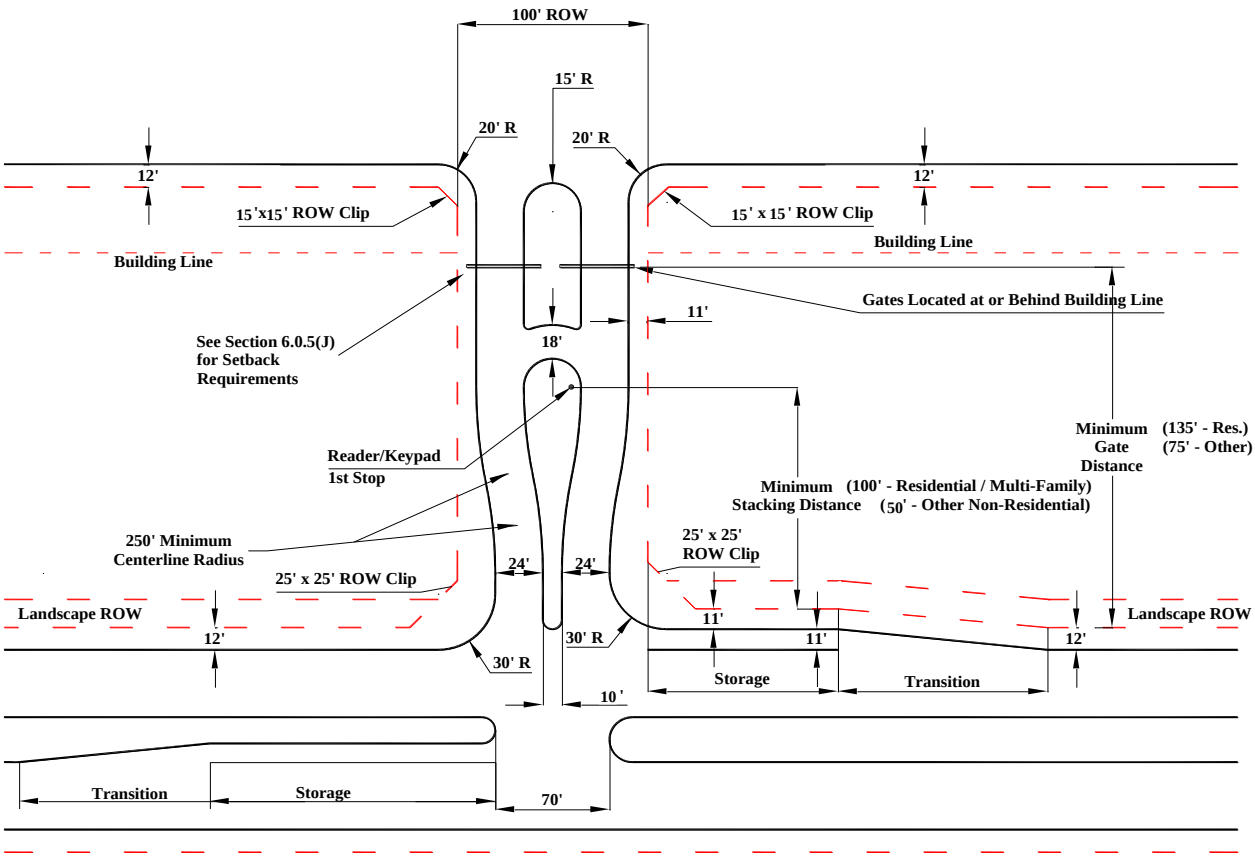


FIGURE 8.13: Gated Entrance Detail

e. The hinge point of the gate shall be a minimum of eighteen inches (18”) behind back of the curb. The gate shall open to twenty-four inches (24”) behind back of curb.

f. Gates shall open sideways or swing open in the direction of travel on each side of the divided entrance.

g. Gates shall be equipped with emergency access devices as required by the Fire Department.

h. All gates shall provide pedestrian access. The movement of the gates shall not encroach on sidewalks.

4. Individual gated single-family residences shall have a minimum setback of twenty feet (20’) from the property line along Type E and above thoroughfare. The movement of the gate(s) shall not encroach on a sidewalk, alley, or street.

J. Non-Conforming Driveways

1. All nonconforming driveways on a lot, tract, parcel or site shall be allowed to remain in use until the occurrence of one or more of the following events:

a. Any building expansion or addition to site that will exceed greater than forty percent (40%) of existing building square footage.

b. A change in use, or an increase in intensity of use, occurs such that the site requires a ten percent (10%) increase in required parking spaces.

c. Addition or expansion of required stacking spaces.

d. Any modification that changes the design or function of the existing driveway.

e. The addition of a median opening on the public street by a developer. All driveways that are served by the new median opening shall comply with the requirements of these standards.

2. Upon the occurrence of the events described above, the nonconforming driveway shall either be reconstructed in accordance with these design requirements, or eliminated.

8.06 Parking Standards

A. Off-Street Parking, Stall and Aisle Dimensions, Stacking/Queuing Requirements

1. All uses of land and buildings in the City of Garland, except within the Downtown district, shall provide off-street parking at the ratios set forth within the Land Use Matrix of the Garland Development Code (GDC) Chapter 2, Article 5, Division 2. Land uses within the Downtown district shall provide parking in accordance with that district. In any district, when more than one use occurs on a site, the required off-street parking shall be prorated according to the requirements of each uses. In computing the total

required parking, a fraction in the final figure shall be rounded up to the next whole number.

2. The minimum dimensions for parking stalls and aisles shall be as shown in Table 8.12.

3. In lots whose primary use is not retail, and which have one hundred (100) or more spaces, up to fifteen percent (15%) of the spaces may be designed for compact cars using the minimum dimensions shown in Table 8.13. Any such spaces or aisles shall be conspicuously signed for use by compact cars only.

4. Refer to Figure 8.14 for a parking diagram reflecting the information provided in Table 8.12 and Table 8.13.

5. Parking of vehicles shall be permitted on paved surfaces only. Parking stalls shall be delineated with white paint striping, raised pavement markings or equivalent means. Paving or delineation shall be adequately maintained at all times.

6. All parking and vehicles areas shall have a vehicle stopping devices (such as curbs or wheel stops) installed so as to prevent any parked vehicle from overhanging onto public right-of-way line, public sidewalk or adjacent property. A parked vehicle cannot overhang into any sidewalk unless there is a minimum four feet (4') of unobstructed sidewalk area is maintained.

7. A minimum six inch (6") raised curb or other device to prevent vehicular movement shall be provided to separate parking areas from all areas (such as landscaped islands at ends of parking rows, sidewalks, etc.) not intended for vehicle movement.

8. To allow for bumper overhang, a raised curbing at the end of parking stalls shall be set back at least two feet (2') from any property line or landscape buffer strip.

9. A stacking/queuing space shall be in an area on a site measuring eight feet by twenty-two feet with direct forward access to a service window or station of a drive-through facility which does not constitute space for any other circulation driveway, parking space or maneuvering area, and which does not include the area where a vehicle is actually being served from a drive-through window. An escape lane, of at least eight feet in width and with negotiable geometric design, must be provided to allow vehicles to get out of stacking lane in the event of a stalled vehicle, emergency, accidental entry, etc. The stacking/queuing space requirements are set forth in the GDC Chapter 4, Article 2, Division 3.

10. Minimum parking lot paving thickness is 5" reinforced concrete over engineered subbase.

TABLE 8.12: Parking Design Standards (Full Size Cars)

Parking Angles	Stall Width (Feet)	Stall Depth (Feet)	Minimum Aisle One-Way (Feet)	Minimum Aisle Two-Way (Feet)	Aisle Length Per Stall (Feet)	Module Width One-Way (Feet)	Curb to Curb Width Two-Way (Feet)	Curb Overhang (Feet)
A	B	C	D	D	E	F	F	G
Parallel	22.0	8.0	12.0	20.0	22.0	28.0	36.0	0.0
20°	9.0	12.5	12.0	20.0	26.3	37.0	45.0	2.0
30°	9.0	14.5	12.0	20.0	18.0	41.0	49.0	2.0
45°	9.0	17.5	14.0	20.0	12.7	49.0	57.0	2.0
50°	9.0	19.0	14.0	20.0	11.7	52.0	58.0	2.0
60°	9.0	18.5	18.0	24.0	10.4	55.0	61.0	2.0
75°	9.0	19.0	24.0	24.0	9.3	62.0	62.0	2.0
90°	9.0	18.0	24.0	24.0	9.0	60.0	60.0	2.0

TABLE 8.13: Parking Design Standards (Compact Size Cars)

Parking Angles	Stall Width (Feet)	Stall Depth (Feet)	Minimum Aisle One-Way (Feet)	Minimum Aisle Two-Way (Feet)	Aisle Length Per Stall (Feet)	Module Width One-Way (Feet)	Curb to Curb Width Two-Way (Feet)	Curb Overhang (Feet)
A	B	C	D	D	E	F	F	G
Parallel	18.0	8.0	12.0	20.0	18.0	28.0	36.0	0.0
20°	8.0	10.5	12.0	20.0	23.4	33.0	41.0	2.0
30°	8.0	12.5	12.0	20.0	16.0	37.0	45.0	2.0
45°	9.0	14.5	12.0	20.0	12.7	41.0	49.0	2.0
50°	9.0	15.0	14.0	20.0	11.8	44.0	50.0	2.0
60°	9.0	16.0	14.0	20.0	10.4	46.0	52.0	2.0
75°	9.0	16.0	24.0	24.0	9.3	56.0	56.0	2.0
90°	9.0	16.0	24.0	24.0	9.0	56.0	56.0	2.0

Notes: In lots those primary use is not retail, and which have 100 or more spaces, up to 15% of the spaces may be designed for compact cars. Spaces designed specifically for compact cars shall be grouped together and conspicuously signed for compact cars only.

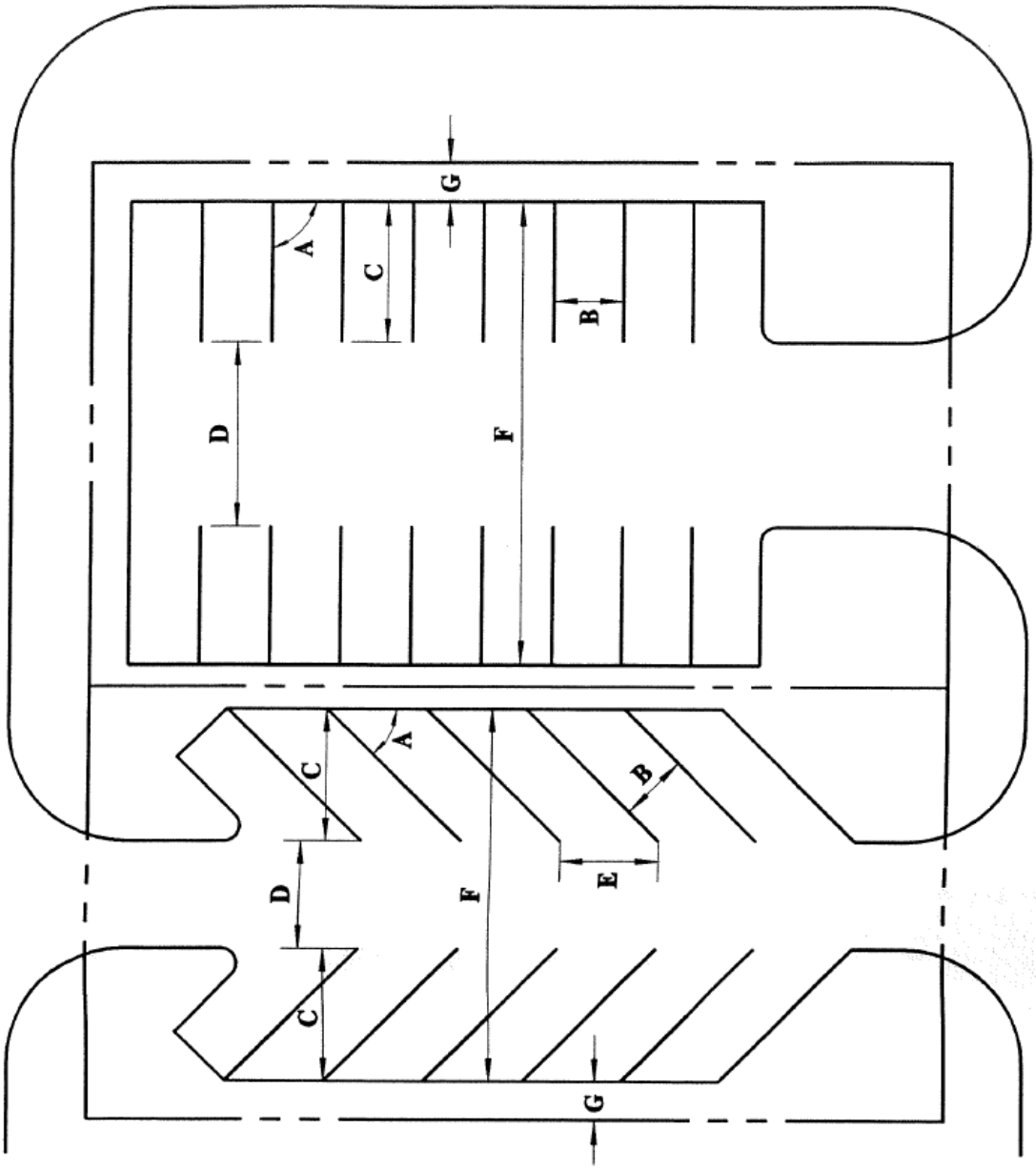


FIGURE 8.14: Parking Design Standards Diagram

B. Internal Islands / End Islands

1. An internal island designed to meet the parking landscape requirements must have a minimum width of 8 feet.

2. An end island is required at the end of parking rows at all driving aisle intersections and driveways. The minimum dimensions of the end islands shall be as shown in Figure 8.15.

3. At aisle intersections, there shall be a sight triangle having minimum dimensions of eight feet (8') by eight feet (8'). Within this triangle, there shall be no walls, fence, signs or shrubberies higher than two and a half feet (2.5') above the pavement surface grade. Poles, sign support columns or single trunk trees may be within this triangle if the diameter or width does not exceed one foot (1'). Tree limbs or signs that are located within the sight triangle must be have a minimum height of eight feet (8') above the pavement grade

End Island Design

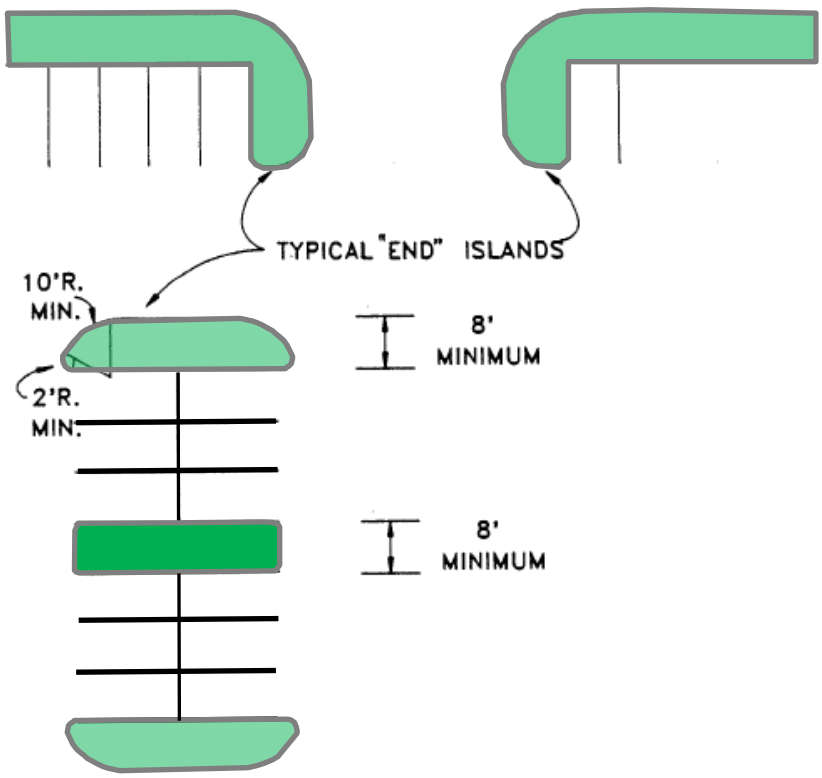


FIGURE 8.15: End Island Design

C. Fire Lane Design

1. Minimum paving thickness is 6", reinforced Class "P1" (4,000 psi) concrete over engineered subbase per City Standard Construction Detail.

2. See Fire Marshall's Office Details at: http://www.garlandtx.gov/300/Forms-Publications or contact the Fire Marshall/s Office at (972) 781-7100.

8.07 Sidewalk Location and Design

A. Definition of Sidewalk – A sidewalk is defined as the paved area designated for pedestrian use which is generally located between the curb of the roadway and the adjacent property line. The inside edge of the sidewalk is the edge closest to the street while the outside edge of the sidewalk is farthest from the street.

1. On Schematic Engineering Drawings and Public Works Site Engineering Construction Plans, locate and label all proposed and existing public and private sidewalks; specify widths and ADA ramps.

B. Sidewalk Design – Sidewalks shall conform to the most current federal, state, and local ADA requirements and to the following standards:

1. Sidewalk Grade – The maximum longitudinal grade of the sidewalk shall be five percent (5%) or the grade of the adjacent street, whichever is greater. The maximum cross-slope of the sidewalk shall be two percent (2%).

2. Zoning Classification Requiring Sidewalks – Concrete sidewalks designed and located according to City standards shall be constructed along all streets in all zoning classifications. Prior to developing any single-family, duplex, or townhome residential lots, residential developers shall build sidewalks along all streets adjacent to the subdivision and along the portions of any street within the subdivision where residential lots do not front or side onto the street. Sidewalks along residential lots shall be constructed by the homebuilder at the time each lot develops. Sidewalks adjacent to non-residential and multi-family land uses shall be built at the time of lot development.

3. Type A-A, A, B, C1, C2, D1, D2, and E Thoroughfares – For residential subdivision, a concrete sidewalk, a minimum of six feet (6') in width, shall be located along all Type A-A through E thoroughfares. The sidewalk should typically be located within the street ROW, but may extend into a pedestrian easement. For all non-residential and multifamily developments, a concrete sidewalk, a minimum of six feet (6') in width, shall be located along all thoroughfares. Typically, the outside edge of the sidewalk is located one feet (1') from right-of-way line.

4. Type F, and G Thoroughfares – A concrete sidewalk, a minimum four feet (4') in width, shall be located along all Type F, and G thoroughfares. The sidewalk shall be located within the street ROW unless pre-existing physical encroachments (e.g., utility infrastructure or trees) dictate otherwise. The outside edge of the sidewalk shall be located one foot (1') from right-of-way line. A five feet (5') by five feet (5') passing area is required for every two hundred feet (200') of sidewalk that is four feet (4') in width.

5. Refer to the City's Standard Construction Details for sidewalk thickness requirements. All sidewalks shall be a minimum of four-inch (4") thick Class "C" concrete.

6. Pedestrian Easements – A pedestrian easement shall be provided if any portion of the sidewalk extends beyond the right-of-way line.

7. Parkways – The area between the curb and ROW line shall be graded at two percent (2%) above the top of street curb.

8. Meandering Sidewalks – Sidewalks along Type A-A thru F thoroughfares and residential collectors may meander for aesthetics and/or to avoid pre-existing physical encroachments. Pedestrian easements adjacent to the standard right-of-way line will be required to contain any portion of the meandering sidewalk that extends beyond the ROW.

9. Sidewalks Adjacent to Screening Walls – In areas where a screening wall is provided along a thoroughfare, the outside edge of the sidewalk shall either remain a minimum of two feet (2') from the wall or the sidewalk shall be paved up to the wall.

10. Access Ramps – Barrier-free ADA access ramps shall be provided at all street intersection corners, at all crosswalks, alley-street intersection and across any non-residential or multi-family driveway.

11. Sidewalks on Culverts – All culvert crossings shall have a sidewalk, a minimum of six feet (6') wide, constructed on each side of the culvert. A standard pedestrian hand rail as shown in Figure 8.16 shall be provided on the outside edge of the culvert. A parapet wall may be required by the Transportation Director.

12. In residential subdivisions, sidewalks shall be constructed by the developer on all non-buildable lots.

Typical Thoroughfare

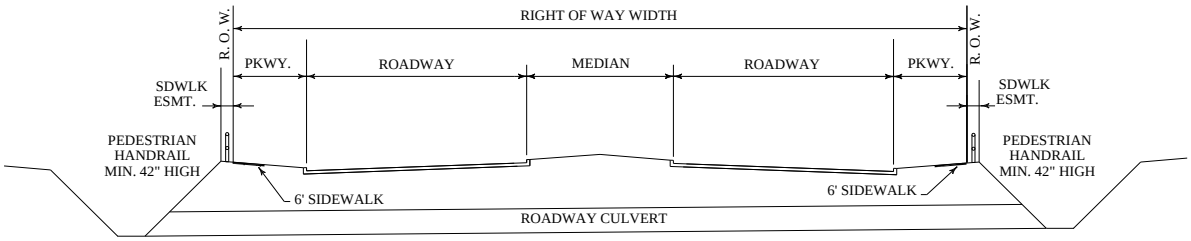


FIGURE 8.16: Typical Pedestrian Handrail Over Culvert

13. Sidewalk Escrow – Refer to the TSM Section 2.4.9.D.1 and the GDC 3.93, in instances where a request for sidewalk waiver is approved by Plan Commission, that the applicant pay the City an amount equal to the estimated cost of constructing a standard width sidewalk on straight and level terrain equal to the linear footage waived. The Engineering Department uses the unit cost from the City's annual concrete contract to calculate sidewalk escrow. Sidewalk escrow must be paid prior to the release of a Site Permit per GDC Section 3.93.F.3.

8.08 Sight Line Triangles Requirements

A. The purpose for the sight line triangle is to provide minimum standards to obtain a reasonable degree of safety at the intersection of a thoroughfare and a proposed thoroughfare, driveway, or alley for motor vehicles to enter or cross roadway.

1. Sight Line Triangles or Visibility, Access and Maintenance Easement (V.A.M.) shall be provided where a driveway, an alley, or a stop-controlled thoroughfare intersects an uncontrolled thoroughfare and on any signalized intersection approach where right turn on red operation is permitted.

2. No fence, wall, screen, sign, structure, utility pole, foliage, hedge, tree, bush, shrub, berm, driveways, parking, drive aisles, or any other item, either man-made or natural shall be erected, planted, or maintained will be allowed within the sight distance triangles that is greater than two and a half feet (2.5') or less than eight feet (8') as measured from the top of the adjacent curb.

3. The City has the right to prune or remove any vegetation within City right-of-way, including within the sight distance triangle, and within sight line triangle easements (including V.A.M.), to abate a safety hazard and/or a nuisance.

B. Sight Line Triangles

1. The sight line triangle is formed by first extending a line along the center line of the proposed thoroughfare or driveway that begins at the tangent curb of the intersecting thoroughfare and extends to its endpoint fifteen feet (15') into the proposed thoroughfare or driveway. For the sight line triangle to the left, construct a second imaginary line that is parallel to and five feet (5') out from the intersecting thoroughfare's curb that begins at the centerline of the side street and continues to the left for a distance L (see Table 8.14) to its endpoint. To complete the sight line triangle, connect the endpoints of the first two lines as shown in Figure 8.17. In the case of the sight line triangle to the right, the second imaginary line is parallel and five feet (5') out from the nearest edge of the conflicting traffic flow (or adjacent median in the event of a divided thoroughfare). It begins at the centerline of the side street and continues to the right for a distance R (see Table 8.14) to its endpoint. To complete the sight line triangle, connect the endpoints of the first two lines as shown in Figure 8.17.

2. Distance to driver's eye for driveways that intersect a street is fifteen feet (15') from the intersecting curb line as shown in Figure 8.17.

3. In the case where the thoroughfare contains existing horizontal curvature, the distances L and R must be measured along the horizontal curve.

4. Sight Line Triangles that extend outside of the ROW shall be identified and dedicated as Visibility Access and Maintenance Easements (V.A.M.) on the plat using City-approved V.A.M. language.

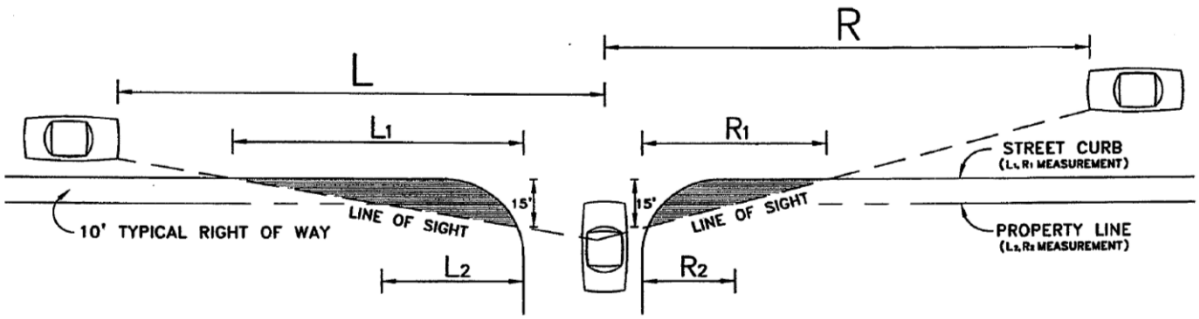


FIGURE 8.17: Sight Line Triangle

TABLE 8.14: Minimum Sight Line Triangle Requirements

Thoroughfare Type*	L	L1	L2	R	R1	R2
A, B, & C	550’	400’	135’	550’	135’	45’
D1, D2, & D3	500’	360’	120’	500’	145’	50’
E & F	400’	290’	95’	400’	165’	55’
G & Unclassified	300’	215’	75’	300’	170’	60’

* Thoroughfare as designated on the Major Thoroughfare Plan.

C. Traffic Control Devices – Any landscape requirements in the Technical Standards, the Garland Development Code, or any other City ordinance shall not interfere with the placement, visibility or maintenance of traffic control devices under governmental authority and control.

8.09 Loading Zones / Truck Berths

A. Loading areas and truck berths are designated areas for large delivery trucks or heavy load vehicle uses for the loading and unloading of delivered goods. A truck berth is defined as the parking area designed for trucks to back up for loading and unloading of merchandise goods. All non-residential uses shall provide and maintain off-street parking facilities for the loading and unloading of merchandise and goods at the ratios consistent as prescribed in the GDC Chapter 4, Article 2, Division 3.

1. Driveways, aisles, maneuvering areas, and heavy load vehicle berths shall be designed to accommodate the largest vehicles that would normally be expected to use those particular driveways, aisles, maneuvering areas and heavy load vehicle berths.

2. All parking, loading and maneuvering of trucks shall be conducted off-street and on private property.

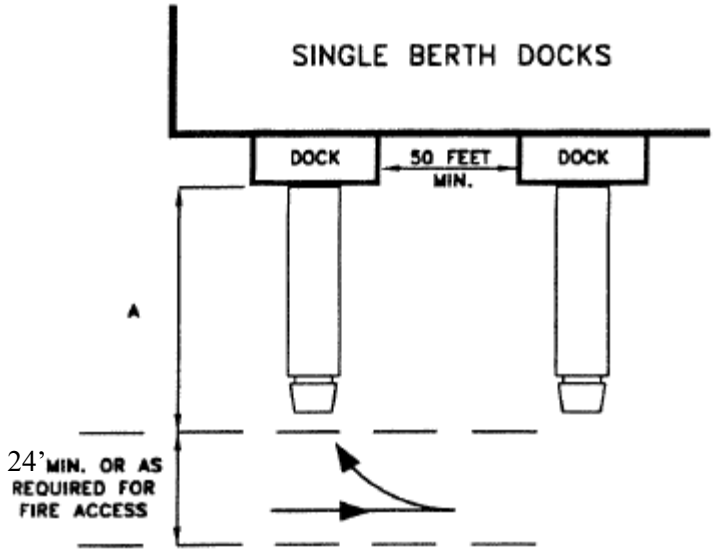
3. Required vehicle parking space will not be allowed within a truck dock apron space.

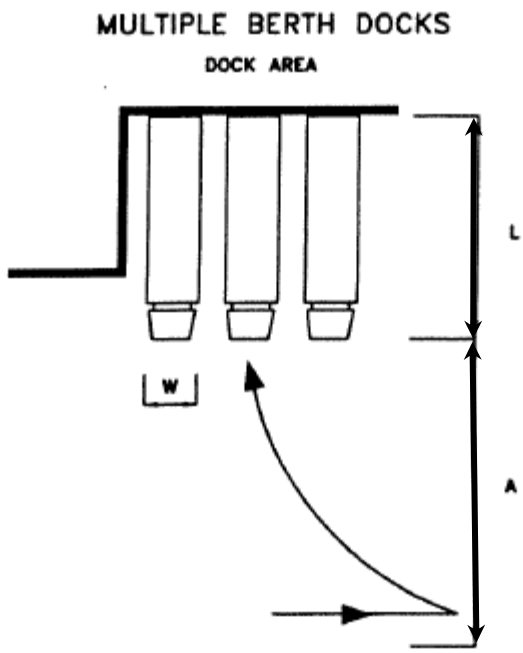
4. On-site circulation should be designed for counter clock-wise movement due to increase driver sight visibility during left turns and left handed backing of trucks.

5. The minimum dimensions of truck berth shall be as shown in Figure 8.18.

6. Fire lane or driving aisle may be used as part of the maneuvering areas only. No parking of trucks or trailers allowed within fire lane or driving aisles.

The remainder of this page left blank intentionally.





Minimum Apron Space Requirements		
Length of Design Vehicle (L)	Width of Berth (W)	Apron Spaces Required (A)
Single-Unit Truck or 35' Tractor Trailer	10' 12' 14' or more	46' 43' 39'
40' Tractor Trailer	10' 12' 14' or more	48' 44' 42'
45' Tractor Trailer	10' 12' 14' or more	57' 51' 48'
50' Tractor Trailer	10' 12' 14' or more	63' 56' 53'
55' Tractor Trailer	10' 12' 14' or more	67' 61' 58'

Notes: Single berth docks must have a minimum separation of fifty feet (50'). The apron space (A) for a single berth unobstructed dock is measured from the face of the dock. For multiple berth docks, the apron space (A) is measured from the outermost part of any vehicle or other possible obstruction in the area of the maneuver such as curbs, poles, walls or parked vehicles.

FIGURE 8.18: Design Standards for Truck Loading Berth

8.10 Frontage Road Design

A. Frontage roads are typically a pair of one-way roadways found adjacent to existing or planned freeway or tollway facilities.

B. Frontage roads are considered Type A-A thoroughfares. Frontage roads along state highways and tollway facilities shall follow Texas Department of Transportation (TxDOT) design guidelines.

C. Access to frontage roads shall also conform to TxDOT design guidelines and require TxDOT approval.

8.11 Traffic Signal Installation

A. Introduction – According to the *Texas Manual of Uniform Traffic Control Devices* (TMUTCD), traffic control signals should not be installed unless one or more of the signal warrants in the manual are met. The satisfaction of a warrant or warrants is not in itself justification for a signal. Information should be obtained by means of engineering studies and compared with the requirements set forth in the warrants. The engineering study should indicate the installation of a traffic signal will improve the overall safety and/or operation of the intersection. If these requirements are not met, a traffic signal should neither be put into operation nor continued in operation (if already installed).

B. Warrant Criteria

1. To justify the installation of a traffic signal, Part IV in the TMUTCD shall be followed. Part IV describes the warrants for a traffic signal installation and provides guidelines and requirements for the actual design and operation of a traffic signal.

2. Engineering studies must be conducted in order to assess whether a particular location satisfies the warrant criteria listed in the TMUTCD. These studies may include one or more of the following:

   a. Traffic volume counts
   b. Pedestrian volume counts
   c. Delay studies
   d. Speed studies
   e. Gap studies
   f. Diagram of physical conditions
   g. Accident studies

C. Traffic Signal Spacing – Signal spacing is an important factor in being able to provide progressive flow for a platoon of traffic. Traffic signal spacing shall be determined by the Transportation Director.

D. Traffic Signal Design and Installation – The design and installation of traffic signals shall follow the City's Technical Specifications.

E. Cost of Traffic Signal Installation

1. Traffic signals where a private driveway or a residential street intersects with a street that is designated by the Major Thoroughfare Plan as an arterial street or major collector – The developer is responsible for the total cost of designing and constructing a traffic signal that would only be warranted based on the traffic generated by the development. The developer shall escrow funds for the cost of the traffic signal and the City shall construct the traffic signal at the time of development or when the development reaches a certain level of activity, as determined by the Transportation Director. If a future traffic signal will equally serve a development on each side of the thoroughfare, each development shall be responsible for half the cost of the traffic signal.

8.12 Street Name Signs

A. Owners, developers, and/or contractors should contact the Planning Department to obtain block numbers. Block numbers are required on all street name blades, even if no homes or buildings front onto the street.

B. Owners, developers, and/or contractors shall contact the Transportation Department at (972) 205-2430 to obtain the cost for street name installation prior to approval of the subdivision street.

8.13 Traffic Impact Analysis and Mitigation

A. Purpose – The purpose of a Traffic Impact Analysis (TIA) is to assess the effects of specific development activity on the existing and planned thoroughfare system. Development activity may include but is not limited to rezoning, preliminary site plans, site plans, preliminary plats, driveway permits, certificates of occupancy, and Thoroughfare Plan amendments.

B. Pre-submission Meeting – Prior to the commencement of a TIA, an initial or pre-submission meeting with City staff is required to establish a base of communication between the City and the applicant. This meeting will define the requirements and scope relative to conducting a TIA and ensure that any questions by the applicant are addressed.

C. Applicability of TIA Requirements

1. Zoning – These TIA requirements shall apply to all zoning requests for land uses which will generate 2,500 or more vehicle trips per day or contain a density of 0.75 Floor Area Ratio (FAR) or greater. Applicable requests include zoning requests and Thoroughfare Plan amendments, if no previous traffic assessment was performed. Special circumstances, including but not limited to development with no case history, which do not meet the daily trip generation threshold, may also require a TIA. Such

circumstances, as determined by the Transportation Director may include, but are not limited to, impacts to residential neighborhoods from non-residential development, inadequate site accessibility, the implementation of the surrounding Thoroughfare Plan is not anticipated during the estimated time period of the proposed development, the proposed land use differs significantly from that contemplated in the Comprehensive Plan, or the internal street or access is not anticipated to accommodate the expected traffic generation.

2. Development – These TIA requirements shall apply to all development requests for land uses, except single-family residential development, which will generate over 100 total trips during the AM or PM peak hour. Applicable development requests include concept plans, preliminary site plans, site plans and preliminary plats. Special cases, in which site generated peak hour trip activity is different from that of the adjacent street (weekdays 7:00-9:00 a.m. and 4:00-6:00 p.m.), may require an additional separate analysis as determined by the Transportation Director. Such circumstances may include, but are not limited to, commercial/retail, entertainment or institutional activity. The Transportation Director may waive the TIA for a development request if a TIA was performed previously with the Zoning request and conditions listed in the report are still current.

3. Single-Family Residential Exception – A TIA for single-family residential development will not be required if the development contains fewer than six dwelling units unless special circumstances exist, as determined by the Transportation Director. These special circumstances may include, but are not limited to, impacts to other residential development from cut-through traffic, inadequate site accessibility, the implementation of the surrounding Thoroughfare Plan is not anticipated during the estimated time period of the proposed development, the internal street or access system is not anticipated to accommodate the expected traffic generation, or the development is outside the urban core of the community.

4. Daycares and Schools – All development requests and/or specific use permit requests for a daycare, Montessori school, private school, charter school, or public school shall include, at a minimum, a traffic circulation study. This study shall include the estimated maximum peak hour trip generation of the facility, the planned circulation of inbound and outbound traffic during drop-off and pick-up operations, and the estimated length of the queue of cars waiting to pick up students. The design of the site and the circulation plan shall ensure that school traffic does back up onto any public street. The traffic circulation study shall include a statement that the owner and/or operator of the daycare or school agree to operate the facility in accordance with the approved circulation plan. The circulation plan must be approved by the Transportation Director before the development request or the specific use permit can be approved.

5. Determination of Applicability – The Transportation Director shall make the final determination whether a TIA is required independent from the requirements in this section and/or based upon the results and recommendation from a pre-submission meeting. It shall be the responsibility of the applicant to demonstrate that a TIA should not be required. If a TIA is required, the level of effort for a TIA submission shall be determined based on the criteria set forth in Table 8.15.

6. Depending upon the specific site characteristics of the proposed development, one or more of the following elements may also be required as part of the TIA: an accident

analysis, sight distance survey, traffic simulation, traffic signal warrant analysis, queuing analysis, turn lane analysis, and/or traffic circulation plan.

TABLE 8.15: Criteria for Determining TIA Study Requirements

Analysis Category	Site Trips Generated at Full Build-Out	TIA Analysis Periods(1)	Minimum Study Area(3)
I	>50 peak hour driveway trips; or 100-500 total peak hour trips	1. Existing year 2. Opening year(2) 3. Five years after opening	1. All site access drives 2. All signalized intersections and/or major unsignalized intersections within 0.5 mile to 1 mile of site boundary
II	>500 total peak hour trips	1. Existing year 2. Opening year of each phase 3. Five years after initial opening 4. Ten years after final opening with full build-out	1. All site access drives 2. All signalized intersections and/or major unsignalized intersections within 1.5 miles of site boundary

(1) Analysis periods shall include build and no-build scenarios. Assume full occupancy when each phase opens.
(2) Assume full build-out.
(3) For certain projects, the City may require an enlarged study area. Land uses within the study area should include recently approved or pending development adjacent to the site.

D. Requirements for TIA Updates – A TIA shall be updated when time or circumstances of the original study fall within the parameters presented in Table 8.16. The applicant is responsible for preparation and submittal of appropriate documentation in order for City staff to process the zoning or development application. A TIA for site development requests must be updated if two years have passed since the original submittal, or if existing or assumed conditions have changed within the defined study area. The Transportation Director shall make the final determination as to the extent of a TIA update.

TABLE 8.16: Criteria for Determining TIA Update Requirements

Original TIA Report was based on:	Changes to the Originally Proposed Development:	
	Access Changed[1] or Trip Generation Increased by more than 10%	Access Not Changed and Trip Generation Increased by less than 10%
Zoning; or Preliminary Site Plan or Site Plan that is less than 2 years old	Letter Amendment Required: Identify and report only analysis conditions that have changed	Letter Documenting Change (No analysis is required)
Preliminary Site Plan or Site Plan that is more than 2 years old	Prepare New Study. Must meet all current TIA requirements	Prepare New Study. Must meet all current TIA requirements.

(1) Changed access includes proposed new access or refinement of general access locations not specifically addressed in original proposed development.

E. Responsibility of TIA Preparation and Review

1. A TIA shall be prepared in accordance with all of the guidelines in this section and submitted in accordance with the Development Review Schedule set by the City. The responsibility for TIA preparation shall rest with the applicant and must be performed by a Professional Engineer (P.E.) licensed in the State of Texas with experience in traffic and transportation engineering. The final TIA report must be signed and sealed by the P.E. responsible for the analysis to be considered for review by the City. City staff shall serve primarily in a review and advisory capacity and will only provide data to the applicant when available.

2. It shall be the responsibility of the applicant to submit two (2) hard copy and digital copy (CD, email, or any other way of digital transmittal) draft TIA reports and executive summaries with the zoning and/or development request submission. The proper number of reports, the timing for submission, and the review of these reports shall be based on standard City development review procedures. Incomplete TIAs or failure to submit a TIA with the submission shall delay consideration of zoning and development requests. Should it be determined during the review of any zoning and/or development plans that a TIA is required; consideration shall be deferred until the applicant submits a completed TIA and the City has reviewed the assessment.

3. The City shall review the TIA and provide comments to the applicant. It shall be the responsibility of the applicant to submit two (2) hard copy and digital copy (CD, email, or any other way of digital transmittal) finalized TIA reports and executive summaries once all review comments have been addressed. Electronic submission may substitute for the required hard copies only with written authorization of the Transportation Director.

F. TIA Standards

1. Design Level of Service – The minimum acceptable level of service (LOS) within the City shall be defined as LOS "D" in the peak hour for all critical movements and links. All development impacts on both thoroughfare and intersection operations must be measured against this standard.

2. Trip Generation Resources – The City's standard for trip generation rates for various land use categories shall be those found in the latest edition of *Trip Generation* published by the Institute of Transportation Engineers (ITE) or other published or recognized sources applicable to the region. Alternate trip generation rates may be accepted on a case-by-case basis if the applicant can provide current supporting data substantiating that their development significantly differs from the ITE rates. The Transportation Director must approve alternative trip generation rates in writing in advance of the TIA submission.

3. Trip Reductions – Trip reductions for passer-by trips and mixed-use developments will be permitted, subject to analytical support provided by the applicant and approval by the Transportation Director on a case-by-case basis. Assumptions relative to automobile occupancy, transit mode share, or percentage of daily traffic to occur in the peak hour must be documented and will be considered subject to analytical support provided by the applicant.

4. Study Horizon Years – The TIA must evaluate the impact of the proposed development on both existing traffic conditions and future traffic conditions for the horizon year(s) as specified in Table 8.15. These applications should also assume full development of the Master Thoroughfare Plan or pending amendments.

G. TIA Methodology

1. Site Location/Study Area – A brief description of the size, general features, and location of the site, including a map of the site in relation to the study area and surrounding vicinity.

2. Existing Zoning – A description of the existing zoning for the site and adjacent property, including land area by zoning classification and density by FAR, square footage, number of hotel rooms, and dwelling units (as appropriate);

3. Existing Development – A description of any existing development on the site and adjacent to the site and how it would be affected by the development proposal;

4. Proposed Zoning / Site Development – A description of the proposed zoning/development for the site, including land area by zoning classification and density by FAR, square footage, number of hotel rooms, and dwelling units (as appropriate); identify other adjacent land uses that have similar peaking characteristics as the proposed land use; identify recently approved or pending land uses within the area;

5. Thoroughfare System – A description and map of existing planned or proposed thoroughfares and traffic signals for horizon year(s) within the study area;

6. Existing Traffic Volumes – Recent traffic counts for existing thoroughfares and major intersections within the study area;

7. Projected Traffic Volumes – Background traffic projections for the planned thoroughfare system within the study area for the horizon year(s);

8. Density of Development – A table displaying the amount of development assumed for existing zoning and/or the proposed development (using gross floor area, dwelling units, occupied beds, etc., as required by the trip generation methodology);

9. Existing Site Trip Generation – A table displaying trip generation rates and total trips generated by land use category for the AM and PM peak hours and on a daily basis, assuming full development and occupancy based on existing zoning (if applicable), and including all appropriate trip reductions (as approved by the Transportation Director);

10. Proposed Site Trip Generation – A table displaying trip generation rates and total trips generated by land use category for the AM and PM peak hours and on a daily basis, assuming full development and occupancy for the proposed development, and including all appropriate trip reductions (as approved by the Transportation Director);

11. Net Change in Trip Generation (for rezoning cases) – Proposed trip generation minus existing trip generation (if applicable); the net increase in trips to be added to base volumes for the design year;

12. Trip Distribution and Traffic Assignment – Tables and figures of trips generated by the proposed development (or net change in trips, if applicable) added to the existing and projected volumes, as appropriate, with distribution and assignment assumptions, unless computer modeling has been performed;

13. Level of Service Evaluations – Capacity analyses for weekday AM and PM peak hours of the roadway and peak hour of the site, if different from the roadway, for both existing conditions and horizon year projections for intersections, thoroughfare links, median openings and turn lanes associated with the site, as applicable;

14. Traffic Signal Evaluations – The need for new traffic signals based on warrants and their impact on the performance of the transportation system;

15. Evaluation of Proposed/Necessary Mitigation – Capacity analyses for weekday AM and PM peak hours of the roadway and peak hour of the site, if different from the roadway, for intersections, thoroughfare links, median openings and turn lanes associated with the site under proposed/necessary traffic mitigation measures;

16. Conclusions – Identification of all thoroughfares, driveways, intersections, and individual movements that exceed LOS D or degrade by one or more LOS, the percentage of roadway volume change produced by the proposed development, and any operational problems likely to occur;

17. Recommendations – Proposed impact mitigation measures consistent with Subsection I below; and

18. Other information required for proper review – As requested by the Transportation Director.

H. TIA Report Format

1. The TIA report must be prepared on 8½" x 11" sheets of paper. However, it may contain figures on larger sheets, provided they are folded to this size. All text and map products shall be computer-based and provided in both published format and computer file format (PDF). In addition, all electronic files used as part of the traffic analysis (i.e., Synchro, HCS, Passer II/III, CORSIM, VISSIM, etc.) shall be provided.

2. The sections of the TIA report should be categorized according to the outline shown below:

Executive Summary

I. Introduction
   A. Purpose
   B. Methodology
II. Existing And Proposed Land Use
   A. Site Location/Study Area
   B. Existing Zoning
   C. Existing Development
   D. Proposed Zoning (if applicable)
III. Existing And Proposed Transportation System
   A. Thoroughfare System
   B. Existing Traffic Volumes
   C. Projected Traffic Volumes
IV. Site Traffic Characteristics
   A. Existing Site Trip Generation (if applicable)
   B. Proposed Site Trip Generation
   C. Net Change in Trip Generation (if applicable)
   D. Trip Distribution and Traffic Assignment
V. Traffic Analysis
   A. Level of Service Evaluations
   B. Traffic Signal Evaluations
VI. Mitigation
VII. Conclusions
VIII. Recommendations

Appendices

I. Traffic Impact Mitigation

1. Mitigation of traffic impacts shall be required if the proposed development would cause a facility or traffic movement to exceed LOS D, or where it already exceeds LOS D and the development would contribute five percent (5%) or more of the total traffic during any projected horizon year. If mitigation is required, the applicant must only mitigate the impact of the proposed development, and would not be responsible for alleviating any deficiencies in the thoroughfare system that may occur without the proposed development.

2. Acceptable mitigation measures shall include:

   a. Staging of development in order to relate site development to the construction of the required thoroughfare system;

   b. Staging of development so that the site contributes less than five percent (5%) of the total traffic to the affected facility or traffic movement during the projected horizon year;

   c. Off-site improvements, including the provision of right-of-way and/or the participation in funding for needed thoroughfare and intersection improvement projects (including, but not limited to, through lanes, turn lanes or traffic signals); and

   d. On-site improvements, including access controls and site circulation adjustments.

3. Mitigation is not required if it can be shown that the traffic impacts of the project are fully mitigated ten (10) years after the final opening with any improvements that are already programmed to be implemented within five (5) years of the initial opening.

J. Administration of the TIA – Based on the results of the TIA and actions recommended by the Transportation Director, the Planning & Zoning Commission and/or the City Council, as appropriate, shall take one or more of the following actions:

1. Approve the zoning or development request, if the project has been determined to have no significant impact or where the impacts can be adequately mitigated;

2. Approve the development request, subject to a phasing plan;

3. Recommend study of the City Thoroughfare Plan to determine amendments required to increase capacity;

4. Recommend amendment of the Capital Improvement Program (CIP) to expedite construction of needed improvements; or

5. Deny the zoning or development request, where the impacts cannot be adequately mitigated.

The remainder of this page left blank intentionally.

SECTION 9

PAVEMENT AND SUBGRADE DESIGN REQUIREMENTS

Section 9 – Index

Section 9 – Pavement and Subgrade Design Requirements

9.01 General..... 9-3
9.02 Existing Surface/Subsurface Investigation..... 9-5
9.03 Subsurface Design..... 9-7
9.04 Subgrade Design..... 9-8
9.05 Pavement Design..... 9-9

Section 9 – Pavement and Subgrade Design Requirements

9.01 General

A. The following specifies standard requirements for the pavement and subgrade design for roadways and alleys within the City. These standards are not intended to replace the professional judgment and technical analysis of the Geotechnical Engineer for any specific project. The standards may need to be expanded or modified on a case-by-case basis as determined necessary and appropriate by the Geotechnical Engineer and the actual site conditions, and as approved by the Director of Engineering in writing.

B. Pavement design life shall be 40 years.

C. Table 9.1 lists the City's standard pavement and subgrade requirements and are in accordance with the City's Standard Details. These standards meet or exceed the 40-year design life in accordance with the Pavement Design Input Values per Table 9.5.

TABLE 9.1: Pavement and Subgrade Standards

Criteria	Thoroughfare Classification						
	Types A and B	Types C and D1	Type D2	Type E	Type G (Residential)	Street Department Section	Alleys
Concrete Thickness (inches)	11	10	9	10	6	6	8-5-8 Refer to City Standard Detail
Stabilized Subgrade Thickness (inches) and Rate (1,2)	8 18#/SY Lime and 36#/SY Cement	8 18#/SY Lime and 36#/SY Cement	8 18#/SY Lime and 36#/SY Cement	8 18#/SY Lime and 36#/SY Cement	8 18#/SY Lime and 36#/SY Cement	8 18#/SY Lime and 36#/SY Cement (3)	8 18#/SY Lime and 36#/SY Cement (4)
Concrete Strength (psi) (5)	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Reinforcing Steel Size and Spacing	#4 on 18" C-C	#4 on 18" C-C	#4 on 18" C-C	#4 on 18" C-C	#4 on 18" C-C	#4 on 18" C-C	#4 on 18" C-C

(1) All sections shall have a minimum of 8" stabilized subgrade of either lime/cement, lime only, or cement only mix at rates specified by the geotechnical investigation to achieve a modulus of subgrade reaction of 300 pci, but in no case less than the standard.
*(2) Refer to **Section 9.04** for allowable subgrade alternatives.*
(3) Street Department residential street section may have an 8" stabilized subgrade of TxDOT Item 260 Type D crushed concrete with 5% cement slurry per current City criteria in lieu of 8" stabilized subgrade of lime/cement mix.
(4) In lieu of 8" stabilized subgrade of lime/cement mix, alley pavement may be placed on compacted subgrade contingent that a modulus of subgrade reaction of 300 pci can be achieved with existing materials which shall be proven out in the Geotechnical Report.
(5) Concrete strength of 4,000 psi shall be Class P1 per NCTCOG 5th Edition Item 303 for machine and hand pours.

D. All roadways and alleys (CIP and Development) shall have a geotechnical investigation and subgrade design performed meeting the following requirements. If after the

geotechnical investigation, the soil parameters and standard subgrade result in a modulus of subgrade reaction of 300 pci and all other parameters are applicable, the City's standard subgrade and pavement can be specified per **Table 9.1**. If not, a custom pavement design to achieve a 40-year design life will be required. If the soil parameters and standard subgrade exceed the parameters specified in this section, a pavement design may be performed to reduce the concrete thickness within the allowable reduction as defined in **Section 9.05**. Geotechnical investigations are not required for street maintenance projects and panel replacements.

1. Results of the geotechnical investigation, engineering analysis, and recommendations shall be presented in a Geotechnical Report for Roadways (Report). The Report and any subsequent re-evaluations and/or supplemental reports shall be signed and sealed by a Professional Engineer licensed in the State of Texas trained and qualified to provide geotechnical engineering analysis and pavement and subgrade design recommendations. A PDF of the report shall be required and submitted with the first submittal of Civil Engineering Construction Plans where any public roadway is being proposed or reconstructed. Not including a report with the first submittal of construction plans may deem the submittal incomplete and may be returned un-reviewed.

2. The Report shall address all items listed in the Geotechnical Report for Roadways Checklist (Checklist) in **Appendix 9A**. The Checklist shall be filled out completely and submitted with the Report. Any "N/A" response on the Checklist shall include a written explanation and adequate justification as deemed necessary by the Director of Engineering.

3. If the Standard Pavement Section in **Table 9.1** is not valid or electing to deviate from the standards, then the Summary of Geotechnical Recommendations Form (Form) in **Appendix 9B** shall be filled out completely and submitted with the Report.

4. City review of the Report will be conducted as a means to verify if the pavement and subgrade design has been performed in general conformance to the City's requirements and shall not be considered a detailed technical review of the pavement and subgrade design for adequacy, accuracy, or completeness. The Geotechnical Engineer performing the subgrade design (and pavement design, if applicable) shall remain responsible for the technical adequacy, accuracy, and completeness of the pavement and subgrade design and shall not be relieved of any responsibility for such as a result of the City's review.

5. The information and recommendations contained in the Report and any subsequent re-evaluation and/or supplement reports shall be accepted by the Director of Engineering in writing prior to Release of Construction.

E. The results of the geotechnical engineering analysis shall verify if the existing soils on-site can achieve the City's minimum standards. Refer to **Table 9.5** for applicable parameters that must be met. If soil parameters cannot achieve a 300 pci modulus of subgrade reaction, a pavement and subgrade design must be performed per **Section 9.05**.

F. Proposed median openings, turn lanes, deceleration lanes and driveway approaches shall be designed in accordance with the Standard Details and do not require a

geotechnical investigation. In lieu of 8” stabilized subgrade of lime/cement mix, additional 2” of concrete can be used on compacted subgrade.

G. Alley paving shall be designed in accordance with the Standard Details contingent that a modulus of subgrade reaction of 300 pci can be achieved with existing materials which shall be proven out in the Geotechnical Report.

H. Expansion joints shall be at PC, PT, and intersections and shall be spaced at 600 feet maximum intervals for all roadways and alleys. Expansion joints shall have smooth dowels at 12” on-center spacing. The dowel size and length shall be in accordance with **Table 9.2**. Refer to the City’s Standard Details for more information on jointing layouts.

TABLE 9.2: Expansion Joint Dowel Size

Concrete Thickness (inches)	Dowel Size, Diameter (inches)	Dowel Length (inches)
11	1.0	24
10	1.0	24
9	1.0	24
8 (and alleys)	1.0	24
7	0.75	24
6	0.75	24

I. Saw and construction joint spacing and depth are based on concrete thickness. All sawcuts shall be 1/8” to 1/4” wide and one-fourth the depth of the concrete thickness. Refer to **Table 9.3**. Refer to the City’s Standard Details.

TABLE 9.3: Saw and Construction Joints

Concrete Thickness (inches)	Maximum Joint Spacing (feet)
11	20
10	20
9	15
8 (and alleys)	15
7	15
6	15

J. Refer to the City’s Standard Details and the North Central Texas Council of Governments (NCTCOG) *Public Works Construction Standards North Central Texas* edition(s) currently adopted by the City and any City adopted amendments for additional specific requirements related to pavement and subgrade.

9.02 Existing Surface/Subsurface Investigation

A. Field investigation shall include the following:

1. Borings shall be drilled on center of proposed roadway, or within the center of proposed roadway widening, at maximum 500-foot spacing, along the roadway alignment to depths of at least 20 feet below finished subgrade or until competent rock is encountered, whichever is shallower. If mass grading results in cuts

greater than 10 feet, boring depths shall be increased 10 feet for each 10 feet of cut. Where existing roadways exist, borings may be taken just outside the limits of the existing roadway. Additional borings may be required between borings (< 500-foot spacing or > 20-foot depth) if anomalies exist at the discretion of the City, including, but not limited to, changed conditions, outcropping, creek crossings, trees, exposed rock, borrow/fill pits, groundwater, and/or history of subgrade and pavement failures. Refer to **Section 7.03** for boring requirements for structures. Additional borings may be requested by the Director of Engineering.

2. Geotechnical investigation must address heavily treed areas, where such trees are to be removed. Additional borings may be required in these areas.

3. Borings shall be sampled at 3-foot intervals (or less) to a depth of 10 feet below finished subgrade, and at 5-foot intervals or less thereafter.

B. Laboratory investigation shall include the following:

1. Moisture Content Tests (ASTM D 2216) shall be performed. When the samples are wetter than normally expected due to seasonal variability, the samples shall be air dried such that the samples represent the drier portion of the year.

   a. For samples taken during the months of July through October, use the mean swell percentage to determine the design swell percentage.

   b. For samples taken during the months of November through June, use the mean plus one standard deviation to determine the design swell percentage.

2. Soil types in each boring shall be classified including the following:

   a. Atterberg limits (ASTM D 4318);

   b. Percent Passing the No. 200 sieve (ASTM D 1140); and,

   c. Moisture/Density.

C. A geotechnical re-evaluation will be required if the following situations occur:

1. If more than two months occur between the end of initial grading and beginning of liming operations or otherwise approved by the Director of Engineering;

2. When conditions have changed significantly between initial grading and liming operations;

3. If material is encountered during construction that varies from the surrounding bore results (i.e. soft packets of sand or clay);

4. If public infrastructure is being placed on undocumented fill;

5. When Contractor and/or Owner have not properly maintained moisture content; or,

6. As deemed necessary by the Director of Engineering due to unseasonable drought or wet conditions.

D. Any undesirable materials within the City Right-of-Way (ROW) and easements shall be excavated, materials removed, and filled with compacted select fill. Undesirable materials to be removed include, but are not limited to, organic material, unstable material, or undocumented fill. All materials removed shall be disposed of according to the Health Department and TCEQ regulations. Select fill shall be provided, placed, and compacted in accordance with TxDOT current edition of *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges* Item 132. Select fill shall be capable of forming a stable embankment from the required excavation and shall be granular material that is free from vegetation or other objectionable material and shall meet the requirements of TxDOT Item 132.2 Type A. The existing subgrade shall provide a stable working platform when the soil is compacted to a density of 95% of standard proctor at optimum moisture content according to ASTM D698.

E. If required, the re-evaluation shall include additional field and laboratory testing to either confirm recommendations are still acceptable or determine how to rectify the substandard condition prior to liming operations. Borings for the re-evaluation will be required on center of roadway at 1,000-foot spacing (or less) to a depth of at least 20 feet below finished grade or until competent rock is encountered, whichever is shallower.

9.03 Subsurface Design

A. Laboratory investigation elements shall include determining swell characteristics and movement potential using the Swell Test and the calculated Potential Vertical Rise (PVR) – TxDOT Tex-124-E methods for a 20-foot depth of moisture penetration. The results of both tests shall be included in the Report. The Geotechnical Engineer shall use the more conservative value in determining swell potential and depths of moisture treatment.

1. Swell Test: Test for swell potential using swell test (ASTM D 4546) at least one sample per boring to approximate overburden pressure at the specific test depth to determine the average swell potential of the subgrade. If swell potential is greater than 2%, the Geotechnical Engineer shall provide recommendations to reduce the swell potential to 2% or less.

2. PVR-TxDOT Tex-124-E: Test for swell potential using swell test (ASTM D 4546) necessary to calculate PVR for a 20-foot moisture penetration. The PVR shall be calculated based upon 20-foot moisture penetration and shall provide moisture treatment depth to limit PVR to 4.5 inches in accordance with TxDOT testing requirements.

B. The Geotechnical Engineer shall address transitions between zones of varying depths of moisture treatment. Zones shall remain at the most conservative depth 150 feet from the location of the boring resulting in the greatest depth, prior to transitioning to a zone with less moisture conditioning depth. In no case shall the transitions be greater than 1H:1V.

C. If street trees are proposed within 10-feet of the limits of the treated subgrade, the Geotechnical Engineer shall address this condition in the Report and specify the use of

the City's Standard Detail and/or propose an alternate moisture/root barrier for the City's review.

D. If existing trees are removed within the limits of the treated subgrade, the Geotechnical Engineer shall address mitigation of this condition in the Report.

E. Geotechnical Report shall provide recommendations to mitigate for swell potential exceeding 2% (for Swell Test) or 4.5 inches (for PVR-TxDOT Tex-124-E), including moisture conditioning treatment.

F. All subsurface improvements shall be in accordance with a technical specification provided by the Geotechnical Engineer and shall be approved by the Director of Engineering.

9.04 Subgrade Design

A. The subgrade must achieve a modulus of subgrade reaction of at least 300 pci. If the existing soils meet a modulus of subgrade reaction of at least 300 pci, the minimums are still required unless rock is encountered. If rock is present, the Geotechnical Engineer must validate it is suitable to serve as a subgrade. The following subgrade types are acceptable (8" minimum thickness). The report shall provide analysis showing that the proposed subgrade improvements or the standard subgrade treatment per **Table 9.1** will achieve a modulus of subgrade reaction of 300 pci. If deviations from the standard subgrade treatment are proposed, the report shall meet all of the following requirements:

1. Lime/Cement – The City's standard application rate is 18 pounds per square yard lime and 36 pounds per square yard cement. All sections shall have a stabilized subgrade of lime/cement mix at rates specified by the geotechnical investigation, but in no case less than the standard, and in accordance with the City's Technical Specifications.

2. Lime – The City's minimum application rate is 8%. All sections shall have a stabilized subgrade at rates specified by the geotechnical investigation, but in no case less than the standard, and in accordance with the City's Technical Specifications.

3. Cement – The City's minimum application rate is 8%. All sections shall have a stabilized subgrade at rates specified by the geotechnical investigation, but in no case less than the standard, and in accordance with the City's Technical Specifications.

4. Crushed Concrete/Flexible Base – TxDOT Item 260 Type D crushed concrete with 5% cement slurry.

5. Approved Equal – Alternative subgrade types may be approved at the discretion of the Director of Engineering.

B. Laboratory investigation elements include:

1. Lime stabilization series for each soil type expected to be in the upper 12 inches of the subgrade. The Eades-Grimm method of pH testing shall be used to obtain

a beginning point. Additional testing shall be performed for each soil type to determine lime content. Minimum design criteria are:

a. pH = 12.4 (or maximum pH) after mellowing (ASTM D 2976)

b. Swell potential <1.0% under 125 psf stress test (ASTM D 4546)

c. The minimum lime content shall be the percentage, by weight, of hydrated lime as determined by lime stabilization series plus 1.0% and in no case be less than the City's standard requirements as listed in **Table 9.1**.

2. Test for sulfates in the upper 10 feet at one-foot intervals of the finished grade in each boring using TxDOT Tex-145-E with 20:1 dilution ratio. Provide testing to determine the levels of sulfate present in all soil types in the upper 10 feet.

3. Formations having between 3,000 and 8,000 ppm sulfates shall be lime stabilized using a double application method. Refer to the City's Technical Specifications for lime application methods.

C. Alternative subgrade options may be proposed by the Geotechnical Engineer and may be approved by the Director of Engineering.

D. All subgrade improvements shall be in accordance with the City's Technical Specifications unless otherwise approved by the Director of Engineering.

9.05 Pavement Design

A. If the Standard Pavement Section in **Table 9.1** is not valid or if the Geotechnical Engineer elects to deviate from the standards, then all requirements of this section shall be met. All concrete pavement shall be in accordance with City's Technical Specification, Standard Details, and General Notes unless otherwise approved by the Director of Engineering.

B. The Standard Pavement Sections listed in **Table 9.1** are based on the Pavement Design Input Values contained in **Table 9.5**. The Pavement Design Input Values are minimums. It is the Geotechnical Engineer's responsibility to ensure those input values are applicable based on actual conditions. Additional pavement reinforcing shall be evaluated and determined for all concrete pavement sections thicker than 13 inches.

C. If an alternate pavement section less than the City standard is considered (i.e., when rock is present or when a modulus of subgrade reaction of at least 300 pci can be achieved), a pavement design will be required and must be designed using the Pavement Design Input Values contained in **Table 9.5** with a higher modulus of subgrade reaction (based on actual conditions). The Geotechnical Engineer must validate the rock/subgrade they have encountered with a modulus of subgrade reaction of at least 300 pci is suitable to serve as a subgrade.

1. **Table 9.4** includes the maximum reduction of concrete thickness that will be considered.

2. The allowable reduction shall be based on a Geotechnical Engineer's recommendation and must be based on a 40-year design life.

3. All pavement thicknesses shall be rounded up to the nearest inch.

TABLE 9.4: Maximum Allowable Pavement Thickness Reduction Amount

Thoroughfare Classification	Maximum Allowable Reduction Amount (inches) (1)
Types A and B	3
Types C and D1	2
Type D2	2
Type E	3
Type G (Residential)	0

*(1) Refer to **Table 9.1** for standard concrete pavement thicknesses.*

D. Pavement design shall be based on American Association of State Highway and Transportation Officials (AASHTO) current edition of *Guide for Design of Pavement Structures* utilizing WinPAS, Pavement Analysis Software. A *Rigid Pavement Design* printout from the WinPAS software program showing all inputs and a section achieving a 40-year design life shall be required.

The remainder of this page left blank intentionally.

TABLE 9.5: Pavement Design Input Values

Pavement Design Inputs (1)	Type A	Type B	Types C and D1	Type D2	Type E	Type G (Residential)
Design Period (years)	40	40	40	40	40	40
Reliability, R (percent)	90	90	90	90	90	85
Overall Standard Deviation, S_0 (psi)	0.35	0.35	0.35	0.35	0.35	0.35
Concrete Modulus of Rupture @ 28 days, S'_C (psi)	620	620	620	620	620	620
Concrete Modulus of Elasticity @ 28 days, E_C (psi)	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Drainage Coefficient, C_d	1.0	1.0	1.0	1.0	1.0	1.0
Load Transfer Coefficient, J	2.9	2.9	2.9	2.9	2.9	2.9
Initial Pavement Serviceability, P_0	4.5	4.5	4.5	4.5	4.5	4.5
Terminal Pavement Serviceability, P_t	2.5	2.5	2.3	2.3	2.3	2.0
Thickness of Subgrade (inches)	8	8	8	8	8	8
Modulus of Subgrade Reaction, k (pci) (2)	300	300	300	300	300	300
Loss of Support, LS	0	0	0	0	0	0
Design Average Daily Traffic (ADT)	45,000	45,000	29,000	17,500	17,500	5,000
Traffic Growth Rate	0%	0%	0%	0%	0%	0%
Percent Trucks (3)	4%	3%	2%	2%	3%	0.5%
Lanes	6	6	4	5	5	2
Lane Distribution Factor	0.7	0.7	1.0	1.0	1.0	1.0

(1) Pavement design inputs based on AASHTO's current edition of Guide for Design of Pavement Structures. Refer to AASHTO's current edition of Guide for Design of Pavement Structures for further description and procedure.

(2) Modulus of subgrade reaction based on average soil condition with 8" Lime/Cement Mix of 18#/SY Lime and 36#/SY Cement, 8% Lime, 8% Cement, 8" Crushed Concrete, or 8" Flexible Base. Actual will vary based on site condition. Subgrade treatment must be provided to achieve at least a modulus of subgrade reaction of 300 pci.

*(3) If anticipated percentage of trucks for the proposed roadway or development exceeds the minimum criteria shown in **Table 9.5**, the actual percentage based on traffic counts and a traffic study as approved by the Transportation Department shall be used. Trucks are defined as all vehicles 3 axle (48 kips, 1.48 design ESAL per vehicle) or greater.*

The remainder of this page left blank intentionally.

This page left blank intentionally.

APPENDIX

Appendix – Index

Appendix Section 1:

Reserved

Appendix Section 2:

2A Plan Completeness Checklist
2A.1 Schematic Plan Checklist
2B Cover Sheet General Notes
2C Comment Response Form
2D Capital Improvement Project (C.I.P.) Plan Checklist
2E Public Utility Survey Affirmation Letter
2F Public Utility Survey Coordinates & Vertical Control
2G Permission to Work Letter
2H Engineering First Submittal Form
2I Engineering Fee Summary Sheets

Appendix Section 3:

3A Plat Review Checklist
3B Subdivision Plat Dedication Language
3C Right of Way & Easement Abandonment Forms
3D License Agreement Template
3E Real Property Improvement Authorization Template
3F Request for Verification of Subdivision Monumentation
3G Field Note Guidelines
3H Working Plat Submittal Requirements

Appendix Section 4:

4A Spring Creek Preserve Environmental Boundary
4B Detention Pond Example, Checklist & Operation & Maintenance Manual
4C Single Family Lot Grading Checklist & Exhibit
4D Flood Plain Development Permit Forms
4E No Rise Certification

Appendix Section 5:

5A Water & Wastewater CIP Plan

5B Water & Wastewater Demand Determination Parameters

Appendix Section 6:

6A Impervious Area Status Sheet

Appendix Section 7:

N/A

Appendix Section 8:

N/A

Appendix Section 9:

9A Geotechnical Report for Roadways Checklist

9B Summary of Geotechnical Recommendations Form

This page left blank intentionally.

1.1 Appendix 2A: Plan Completeness Checklist

The intent of this checklist is to minimize redline comments on plans submitted for Site Permitting and to maintain consistency amongst plan reviewers. The checklist is not meant to be totally inclusive of all possible items that may be needed for proper review and approval, but depicts ordinance requirements and other commonly requested items. Plan approval, and ultimately issuing of the Site Permit depends on compliance with the comments made on the check prints and this checklist. The Engineer or record shall satisfy themselves of the completeness and accuracy of the design. The City may use a modified form of this checklist to indicate where submittals are inadequate rather than providing a detailed redline plan.

Project Name _____ **CASE No.** _____

(X) Required (√) OK (N/A) Not Applicable

1.1.1 General Information

- ❑ Recommended sheet layout: 1. Cover w/general notes 2. Plat, 3. Site Plan / dimension control, 4. Paving, 5. Grading, 6. Drainage 7. Water & sewer, 8. Stormwater pollution prevention, 9. Special details.
- ❑ Provide cover sheet w/ plans having two or more sheets w/ recorded subdivision name (lot/blk) prominently shown, case number, sheet index, vicinity map, north arrow, graphic scale, owner, design firm and general notes.
- ❑ Standard sheet size, 24”x36”, with north arrow, graphic scale, title block defining project / sheet name, name of subdivision lot/block, design firm, owner, contact information, case number.
- ❑ Identify benchmarks used including primary and secondary/onsite.
- ❑ Include legend w/ drawing symbols used with explanations.
- ❑ Are improvement plans presented in an uncluttered manner with clear instructions and notes? Plans depict:
  1. Where improvements go and how they fit in w/ existing conditions and how each piece is built.
  2. Fully indicating the extent of work necessary to create the desired finished product.
  3. Plans show in detail, work conforms to the City’s standard construction details with accurate dimensions, and computations to support the issuance of Site Permit.
  4. Prepared at a legible scale and readable at 50% reduction clearly displaying the Engineer’s seal.
- ❑ Look at the Big Picture, identify and insure design addresses the following questions:
  1. Any foreseeable hazards / adverse conditions affecting end user’s safety impairing use and enjoyment of property?
  2. Is Right of Way (ROW) construction subject to cause public interruption and inconvenience?
  3. Are future extensions of water and sanitary, and storm sewers possible?
  4. Identify any conflicts w/ other utilities? Are adjustments required? If so reflect and provide instructions on plans.
  5. Will the project create drainage problems downstream and upstream?
- ❑ Provide special details for construction items not covered in the City’s standard construction details.
- ❑ Is site adjacent to imminent TXDOT, County or City project? Identify if so.
- ❑ Plan Revisions 1.Cloud change area 2.Triangle w/ revision number 3. Provide explanation in lower right corner

1.1.2 Site Plan (*include w/ non-residential submittals*)

Property / Right of Way (ROW) Details

- ❑ Use heavy line weight for property lines, label bearings, distances, radii, and area in acres or sq ft
- ❑ Provide distance from the center of nearest street intersection to property corner
- ❑ Indicate adjacent ownership and /or recorded property information, subdivision name, lot and block
- ❑ Show existing improvements on and w/in 15 feet of property line, structures, paving, signs, fences, etc.
- ❑ Identify adjoining railroad, alley and street with name, ROW width, pavement, type, curb, and curb cuts on both sides of the street, medians and openings
- ❑ Access to divided streets must indicate existing and proposed median openings, 70-ft wide minimum.
- ❑ Identify existing driveway widths and radii
- ❑ Locate and label existing public/private drainage, utility, pedestrian, traffic control, visibility and common access easements with recording information
- ❑ Note location of electric transformers, transmission structures, towers, antennas, etc
- ❑ Note location of monitoring and water wells, underground storage tanks, and graveyards
- ❑ Plot 100 year flood plain, floodway, wetlands, detention ponds, and jurisdictional US waters

Site Improvement Details *(locate and label all applicable information)*

- ❑ Identify propose driveway widths and radii, provide instruction install to standard driveway per city details and barrier free ramps
- ❑ Identify additional right of way, pedestrian, utility, traffic control, visibility, and/or common access easement as required by the project or Major Thoroughfare Plan
- ❑ Locate and fully indicate extent of ROW improvements, such as inlet relocation, left and right turn lanes, pavement and sidewalk removal and replacement, etc, provide dimension to clarify limits
- ❑ Locate and label proposed public and private sidewalks specify widths and ADA ramps
- ❑ Locate proposed off street parking layout with easily identifiable standard, compact, and handicap spaces defined, typical 90 degree stall, 9-ft wide by 18-ft deep with 24-ft aisle.
- ❑ Include pavement specifications if used as paving plan
- ❑ Minimum parking lot paving thickness = 5-inches, reinforced concrete over engineered subbase.
- ❑ Define dimensions of parking spaces, islands, aisles, drives, review internal circulation
- ❑ Provide dimension of improvements from property line
- ❑ Verify bumper overhang is a minimum of 2 ft from property line or landscape buffer.
- ❑ Raised curbing required to separate parking areas from areas not intended for vehicle movement.
- ❑ Identify and label existing and proposed fire lanes and turnarounds (maximum 10% shading)
- ❑ Locate, label and dimension loading, service and dock areas w/ screening check w/ Planning, typically required for retail, commercial, industrial use, structures > 5000 SF<25000 SF requires 1- 10 ft x 25 ft area, additional spaces required at 45000 SF
- ❑ Specify loading & fire lane paving, as Class “C” concrete w/ reinforcement specs equal city street.
- ❑ Identify refuse facilities w/ enclosure, provide12-foot wide and 16-foot long 6-inch thick concrete pad
- ❑ Locate and label light standards, benches, utility poles and other ground mounted structures
- ❑ Locate and label landscape buffer width, interior parking lot landscape areas and protected tree clusters. Include prominently displayed note stating: **“No landscaping such as trees, hedges, above and underground structures shall be located within existing or proposed utility easements and right of way.”**
- ❑ Provide landscape & irrigation plans on a separate sheet, don’t show landscaping on Site Plan
- ❑ Locate, label, and dimension screening walls, fences and retaining walls. When adjacent to ROW, provide note to construct per City Standard Construction Details or equal
- ❑ Define signage location, orientation and width in relation to ROW and utility and drainage easements
- ❑ Define existing and proposed structure footprint with square footage noted, tied to property lines

- ❑ Indicate additions w/ square footage to existing structures and / or portions to remain or remove
- ❑ Indicate front door location on building footprint for addressing
- ❑ Show proposed building overhangs / canopies, no encroachment allowed in City easement
- ❑ Check driveway intersections for possible hazards, obstructed site distance, danger to pedestrians.
- ❑ At aisle intersections, minimum sight triangle 8 ft x 8 ft, with no obstruction > 3.9 ft above surface
- ❑ Are circulation / maneuvering areas design to accommodate vehicles normally using the site?

Fire

- ❑ Provide exact locations of existing and proposed Fire lanes, hydrants and Fire Department Connection, located out of collapse zone.

Utility Elements

- ❑ Locate, label and dimension existing and proposed utility easements with recording information
- ❑ Locate and define size of existing water & sanitary sewer lines with flow direction arrow to be connected to
- ❑ Locate valves, reducers, meters, manholes, cleanouts, grease traps, etc.
- ❑ Locate and label of franchise utilities ground mounted equipment, above grade utility cabinets and easements for gas, cable TV, electric, telecommunication, etc
- ❑ **Provide a separate utility plan or define on the site plan** the exact location and size of sanitary sewer and water service connections.
- ❑ Show water service location from the main to within 5 feet of the structure.
- ❑ Where applicable, locate and label fire line tap and backflow device and show line within 5-feet of the structure and from sprinkler room to Fire Department Connection.
- ❑ Locate and label domestic and irrigation water service and meter w/in utility easement and backflow devices out of easement.
- ❑ Define finish floor elevation; each lot must have an independent sanitary sewer service, show exact service tap location and lateral location from the main to the structure.
- ❑ Define / show and dimension any offsite water / sanitary sewer extension / utility easement (15ft min).
- ❑ Verify no trees, retaining walls, post, signs, private lines, structures, etc within and/or paralleling drainage easement.

Drainage Elements

- ❑ Show contours and flow arrows on and within 50 feet of property line for plans w/o separate D.A.M.
- ❑ Locate and label natural and man-made channels, existing and proposed detention ponds and drainage easements.
- ❑ Locate and label existing and proposed private storm sewer systems and inlets w/sizes and tie-ins to public system, indicate Q into each inlet and bypass flow if any, limit runoff into to public ROW.
- ❑ Locate and label beginning and end, top and bottom elevations of all existing and proposed walls.
- ❑ Define finish floor elevation, plan must show runoff is directed away from structure or show on D.A.M.
- ❑ Define pre- and post-project imperviousness.
- ❑ Define / show and dimension any offsite storm sewer extension and drainage easement (20ft min.).
- ❑ Provide drainage easement on creeks for the area below 100-year + 1-foot + 10 to 15-foot access.
- ❑ Indicate source of flood data, reference effective Flood Insurance Rate Map (FIRM) where applicable.
- ❑ Where grade adjustments are proposed along adjacent properties or ROW, provide typical cross section detailing the relationship of the improvements and adjacent property.
- ❑ Verify no trees, retaining walls, post, signs, private lines, structures, etc within and/or paralleling drainage easement.
- ❑ When detention ponds are proposed, verify site / paving plan includes note detention pond must be operational prior to paving.

1.1.3 Paving

1.1.3.1Driveways

- ❑ Show existing and proposed ROW, pavement type, access width, radii.
- ❑ Driveway widths:

	Min (ft)	Max (ft)	R min (ft)	R max (ft)
Single family	10	25	5	10
Multi-family	20	30	15	30
Office / Retail	24	30	15	30
Service Stations	24	40	15	30
Industrial	30	45	25	50
One Way	20	25	15 out	30 out

- ❑ 8 % maximum retail/office driveway grade, 10% maximum industrial.
- ❑ Driveways aligned w/ median openings, minimum 40-ft wide back to back with 20-ft radius.
- ❑ Verify longitudinal butt joint called out when proposed paving connects to existing.
- ❑ Verify driveway grades provide for maximum 2% cross fall walkway per ADA requirements.
- ❑ Note on construction plans where applicable at all new barrier free ramps in right of way: Existing driveways may have to be removed and replaced to comply with ADA requirements in accordance with the City of Garland Standard Construction Details.
- ❑ Steps, fences, walls, buttresses, projections, etc., prohibited in streets and alleys.
- ❑ Driveways shall not be constructed w/in curb return of street
  (F) Public parkway shall not be used at any time for parking.
  (G) Entrances/exits on street right of way shall be confined within property frontage.
  (I) Common driveways may be approved w/ permanent access easement filed for record w/ Dallas County. If used, submit access easement with first plan submittal.
  (J) All driveway approaches shall be constructed in accordance w/ City of Garland specifications. Verify note provided on plans
  (M) Vehicular access to nonresidential uses shall not be permitted from alley.
- ❑ Check driveway culvert verify w/ D.A.M. Provide station, offset, size, min 21-inch RCP in ROW, fit to conditions, install 6:1 TXDOT headwall.
- ❑ GDC requires the property owner to construct curb when / at abandoned driveway.

Sidewalks (General)

- ❑ Sidewalk width is based on zoning, residential 4 ft, and other zoning districts 6 ft.
- ❑ Verify barrier free ADA conforming ramps are present at driveways & street intersections.
- ❑ Are corner clips required for barrier free ADA conforming ramps at street intersections?
- ❑ Sidewalks waived by Plan Commission require escrow payment to the City, equal to cost of sidewalk.

Residential Sidewalks

- ❑ Residential subdivisions, developer is required to construct sidewalks at1) non-buildable lots or 2) along streets abutting subdivision's screen wall.
- ❑ Include and verify that standard verbiage regarding sidewalk construction is on all paving sheets: The Developer will install sidewalks and barrier ramps along all non-buildable lots in accordance w/ current American w/ Disability Act rules and regulations. All other intersections w/in the subdivision will have lay down curbs to facilitate the construction of barrier free ramps by homebuilders.

1.1.3.2Street Paving

- ❑ Provide plan and profile for dedicated streets and alleys defining:

❑ Centerline stations ❑ ROW dimension ❑ Tangent length & bearings ❑ PC, PRC &, PT's ❑ Horizontal curve data ❑ Benchmark ❑ Street Name(s)	❑ Typ. street cross section ❑ Exist. & propose top of curb elevations @ begin /end of project and other critical points of interest ❑ Utility/drainage easement intersecting & adjacent to ❑ Sight visibility easements	❑ Property information ❑ Manholes & fire hydrants ❑ Ditch/gutter spot elev ❑ Flow direction arrows ❑ Existing & prop. curb ❑ Ex & prop. driveways ❑ Existing sidewalk	❑ Proposed sidewalks ❑ Barrier free ramps ❑ Utility poles/structures ❑ Fences & manholes ❑ Inlets & ditches ❑ Retaining walls

1. Show /provide details where required to clarify beginning and end project, intersections and intersecting street w/ flow arrows, provide instructions regarding conflicts.
2. Provide instructions to install longitudinal butt joint when proposed paving connects to existing.
3. Each paving sheet has the proper detail for the type of street / arterial to be constructed.
4. Show sufficient area to clarify drainage transitions, use flow arrows, flow paths should be clear.
5. Retaining walls adjacent to right of way are required to reference City standard construction details and / or provide equal detail.
6. Residential sidewalks 4ft wide placed 1ft from property line, non-residential sidewalks – 6 feet.
7. Opposite each inlet label per D.A.M., w/ type, size, paving station, top of curb & flowline elevation.
8. Valley gutters cross lower classified street.

- ❑ Min local street radius = 250 ft residential, 350 ft commercial / industrial, minimum grade = 0.60%, desired maximum 7.0%, maximum local street grade =10.0%, within 100 ft of intersection 5%.
- ❑ Cul da Sac>300 ft min paving radius of 61 ft plus 10' PUE, <300 ft, 50ft ROW, 5ft P.U.E. and 45 ft paving radius.
- ❑ Type "F" 60 ft ROW 37 b-b 6" thick pavement, local
- ❑ Type "G" 50 ft ROW 27 b-b 5" thick pavement
- ❑ Type "E" 80 ft ROW 45ftb-b 7" thick pavement
- ❑ Include vegetation note for all ROW areas:
  PUBLIC RIGHT OF WAY, EASEMENTS, AND COMMON AREAS MUST BE STABLILZED W/ PERENNIAL VEGETATION COVER, FULLY ESTABLISHED W/ 100% COVERAGE, OR OTHER APPROVED STABILIZATION METHOD.
- ❑ City streets – provide instruction: Install 2-type III barricades until street acceptance by City.
- ❑ Show existing driveway widths and define type of paving, remove approach no longer used, install curb / gutter / sidewalk.
- ❑ Verify propose street conforms to Thoroughfare Plan, and reasonable extension of existing streets.
- ❑ Intersect cross streets < 1200 ft w/ 50 ft min ROW and 80 to 100° intersection angle.
- ❑ At street stubs, show positive drainage grading on plan and profile, provide typical cross section w/ Q, v, d, slope (1% minimum), and erosion control measures.
- ❑ Verify placement of pavement headers on all street and alleys stubs.
- ❑ Check for utility conflicts between water/sanitary/storm sewers/ other utilities & structures.
- ❑ Check cul da sac grades in relation to undeveloped adjacent properties. Does grade match?
- ❑ Check / verify paving grade of streets and around cul da sac bulb are ≥ 0.6%.
- ❑ Check for vertical and horizontal sight distance conflicts, provide visibility easement where required.
- ❑ Check centerline stationing on plan view with curve table information and critical points.
- ❑ Compare elevations on plan versus profile views, especially at intersections and low points.
- ❑ Compare / verify flow arrows in plan view to profile on both sides of grade breaks.
- ❑ Verify low point inlets labeled w/ positive overflow easement, coordinate w/ plat D.A.M.

Intersections

- ❑ Type A & B intersection provide additional ROW - future right turn lane (11 ft), typically19 ft.
- ❑ Type C, D, or E streets provide additional ROW - right turn lane at Type E's and above intersections.
- ❑ Dedicate add ROW or P.U.E. for minimum parkway, measured from curb face - Type A, B, C-20 ft, Type D-15 ft.
- ❑ Intersection of Local Street w/ Type A, B, C, or D, typically requires additional ROW or easement and construction of Type F collector extending 75 ft w/ 5 ft P.U.E.
- ❑ Intersection radius – 25ft local to local-arterial, 30ft collector-to-collector and arterial.
- ❑ Maximum / Minimum street intersection angle 100/80°.
- ❑ Check visibility triangle-length along each projected curb line for streets, 45ft, and alleys-25 ft.
- ❑ Check cross slopes, investigate need for drainage inlets where finish grade <2%.

Alleys

- ❑ Residential subdivision lots shall be served by alleys at the rear w/ minimum 20ft ROW
- ❑ Provide /show additional two feet of alley paving at alley intersections and curves per City details.
- ❑ At street intersections, verify 16- to 10-ft paving flare is properly shown within 20-ft.
- ❑ Curb required at alleys adjacent to unimproved roadway or drainage way.
- ❑ Compare / verify plan versus profile elevations, verify alley invert elevations at approaches.
- ❑ If alley slopes to ROW, then 0.50ft difference in gutter elevation to invert elevation at ROW.
- ❑ If alley slopes away from ROW, 0.75ft difference in gutter elevation to invert elevation at ROW.

Profiles

- ❑ Profiles show:

❑ Left / right top of curb ❑ Existing ground at ROW ❑ Proposed ground at ROW ❑ Grades @ every 100 ft, intersections & PI's ❑ Curb return grades	❑ Begin/end project grades ❑ Critical points of interest ❑ Intersecting utility grade ❑ Intersecting storm grade ❑ Vertical curve ❑ high/low point station, k	❑PVC, PVI, PVT ❑Compacted Fill 95% Std. Proctor Density ❑Hatch fill ❑Benchmark ❑	❑Manholes ❑Retaining walls

- ❑ Compare all elevations from profile to plan view, check for unequal curbs, drainage complications.
- ❑ Is there a change in existing road grade? Are existing driveway profiles needed to reflect adjustments within ROW? Review /check parkway and access grade, drainage issues
- ❑ Verify vertical curves provided, at grade difference > 1%, minimum length = 100 ft, 4% maximum change at intersections.
- ❑ Check sag inlets, does it correspond to low point station? Check for any locations where water may pond. Minimum K values:

	Crest	Sag
Alley (20ft ROW, 8"-5"-8", 10ft wide)	10	20
Residential Collector (60ft ROW, 6", 37ftb-b)	30	40
Commercial Collector (7" 45b-b)	50	50

Divided Streets / Collectors

- ❑ Cross sections required for divided thoroughfares and collectors, use same inside top of curb.
- ❑ Review top of curb / ground elevation at ROW. Will improvement create future access problem?
- ❑ Street lights and bases check with GP&L and TXU for requirements.
- ❑ Buttoning, barricading, signalization and conduit requirements refer to Transportation Dept.
- ❑ Check w/ Parks Department if water service required to medians.

Left/Right Turn Lane

❑ Typical section thickness / subgrade ❑ Street lights ❑ Pull box & traffic loops	❑ Positive drainage ❑ Monolithic concrete median nose ❑ Traffic signals	❑ Longitudinal butt joint instructions ❑ Existing trees ❑ Proposed trees	❑ Irrigation system & conduit ❑ Transition & storage ❑ Buttons

- ❑ Reference standard barricading detail.
- ❑ Left turn lane configuration conforms to standard details w/ 10' pavement.
- ❑ Right turn lanes configuration conforms to standard details w/ 11' pavement.
- ❑ Along divided street, verify access to median opening provided for each platted lot, easement?
- ❑ Verify w/ Parks need for water service and conduit through crossover at medians.

1.1.4 <u>Grading</u>

Fundamentals:

1. Provide suitable access from and to abutting street,
2. Immediate diversion of surface water away from buildings and off of site,
3. Avoid concentrating runoff onto neighboring properties,
4. Minimize disruption to adjacent properties, erosion and ponding.

- ❑ Provide grading / drainage plans for other than 1 to 2 family residential.
- ❑ Grading plan show contours on and w/in 50 ft of property, including the following applicable on- and offsite features:

❑ Inlets & grates w/ size ❑ Offsite drainage areas ❑ Spot elevations at high points intersections, and sags. ❑ 100-year flood plain ❑ Trees	❑ Flow arrows ❑ Sag & on grade inlets ❑ Creeks & ditches ❑ Proposed & existing utilities & easements ❑ Landscape buffers	❑ Structure locations ❑ Paving, curbs, streets ❑ Sidewalks, & pathways ❑ Driveways & fences ❑ Detention & amenity ponds	❑ Street layout ❑ Street names ❑ Right of way ❑ Benchmark ❑ Property lines

- ❑ Indicate north, and provide numeric and graphic scale and if warranted Legend.
- ❑ Indicate source of base contours if not City topography.
- ❑ Locate protected trees and/or outline perimeter of wooded areas per Tree Preservation Plan.
- ❑ Show existing topography minimum 2 ft contour interval, and proposed contours using distinctly different line type, supplement w/ finish grade spot elevations, preferably shown in boxes.
- ❑ Connect proposed to existing contours. Show existing and proposed finish floors .
- ❑ Provide flow direction arrows indicating primary flow paths on, adjacent to and through the property.
- ❑ Show all onsite building footprints and / or buildings on and w/in 15 feet of property line.
- ❑ Show and verify flow arrows are provided to depict existing / proposed drainage patterns.
- ❑ Plan demonstrates how positive runoff of surface waters is accomplished and means of ultimate runoff disposal to public right of way or easement.
- ❑ Show and provide cut/fill toe and top of slope grades, and easement limits defined.
- ❑ On all dead end streets and alleys, show grade out at 1.0% min, provide erosion control measures, and specify type and dimensions, etc.
- ❑ Check grading w/ paving plan and D.A.M. verify locations coordinated at

❑ Inlet	❑ positive overflows	❑ divides	❑ flow directions.
❑ Sags	❑ easements	❑ swales	❑ property lines

- ❑ Verify lot minimum finish floor elevation, 1)2 ft above 100-year flood plain or 2)2 ft above lowest curb when draining primarily to front, and/or 3) if to the rear 2 ft above lowest alley.
- ❑ Verify design ensures drainage protects structures and prevents adjacent property damage.
- ❑ Maintain positive drainage around and away from pad and sidewalks, minimum pad elevation = 0.3' above swale, verify usable yard no slope exceeding 3:1.
- ❑ At sags trace overflow path, check and verify adjacent lot finish pad and floor are > low point.

- ❑ Check / verify grades at property line? Matches existing / Cut / Fill? How is transition made at property line? Retaining wall, slope to/or away?
- ❑ Verify no offsite grading, lot-to-lot drainage, diversion, obstruction or constriction of adjacent surface water flow patterns is created w/out an agreement or easement.
- ❑ Verify 1.0% minimum grade for grass swale, lesser slopes used paved swale minimum 0.6%.
- ❑ Compare with paving plans / verify same top of curb shown at ROW.
- ❑ Check access drive maximum grades residential < 12%, non-res 10%. Provide grade transitions at steep drives.
- ❑ Residential - Verify lots at alley T's are higher than alley ROW.

Walls

- ❑ >4 feet – structural engineered plan required, showing type, reinforcement, expansion/construction joint spacing, backfill, % compaction, and drainage specs, weep hole diameter and spacing.
- ❑ Define beginning, end, length and top/bottom elevations. Include detail showing high side swale and where applicable property line or adjacent utilities and easements.
- ❑ Show and provide details for all walls adjacent to ROW or provide reference to construct per City standard construction details.
- ❑ Walls greater than 2.5 feet adjacent to public space require fence or 42" high railing.
- ❑ Verify walls are not w/in and paralleling City utility or drainage easements.
- ❑ Is there adequate room to construct footing / wall? Identify any special maintenance requirements?

1.1.5 <u>Drainage</u>

General

- ❑ Is drainage coming in or going out? How is it handled? Are public drainage easements needed?
- ❑ Is it shown that all site runoff leaves in public ROW, easement, storm sewer, natural or manmade channel?
- ❑ Review and verify receiving system capacity and adequacy to carry the design discharge.
- ❑ Is detention or offsite improvements required? *See detention for additional requirements.*
- ❑ Check perimeter of project, verify project does not cause damage, increase erosion, divert, constrict, and impound runoff or other unforeseen problems.
- ❑ Check zoning for ultimate land use; insure storm sewers sized for fully developed conditions.
- ❑ Check for encroachments into and paralleling drainage easement such as walls, signs, poles, private lines, structures, etc.
- ❑ Compare plat versus storm sewer plans; insure storm pipe center line is a minimum 10-foot from the edge of right of way or easement.
- ❑ Verify future extension stub out sized for ultimate condition w/ public drainage easement.
- ❑ Verify drainage easement adequacy, minimum 20-feet, provide extra width for deep lines.
- ❑ Grade to drain points verify adjacent grades above WSEL, provide typical cross section with Q, slope, depth, velocity and drainage easement defined.
- ❑ Check need for Flood Plain Development permit when work is adjacent to FIRM designated creeks.
- ❑ Any significant changes to the FIRM designated flood plains must have a flood study included with first submittal and subject to submittal to FEMA for a Conditional Letter of Map Revision.
- ❑ Provide special details for all structures not in City's standard details.

Drainage Area Map (D.A.M.)

- ❑ Identify north, graphic scale, minimum 2-ft contour interval, provide legend where necessary.

Locate and label:

❑ Existing storm sewers(dash) ❑ Proposed storm (solid) ❑ Size & line designation ❑ Subareas and divides ❑ Offsite drainage areas	❑ Inlets & grates w/ size, designations, Q100 and Q bypass ❑ 100-yr flood plain ❑ Detention and amenity ponds	❑ Intersection flow arrows ❑ Flow arrows ❑ Crests & sags, ❑ Creeks & ditches ❑ Stock tanks & lakes	❑ Street names ❑ Street layout ❑ Right of way ❑ Benchmark ❑ Property lines ❑ Points of concentration

- ❑ Clearly identify and label natural and / or man made drainage facilities located w/in 50 ft of site affecting stormwater flow such as lakes, ponds, creeks, etc.
- ❑ Indicate runoff for all subareas including:

❑ Alleys ❑ streets	❑ dead end street stubs	❑ offsite drainage areas	❑ onto adjacent properties	❑ points of flow concentration

- ❑ Compare D.A.M. divides to lot grading and paving plan, check / verify crest, sags and valley gutter locations.
- ❑ Verify offsite drainage area/topography extends to a point where crest can be clearly identified.
- ❑ Verify all subareas are picked up. Does D.A.M. and storm sewer plans agree?
- ❑ For residential subdivisions, Check and Verify
  1. Flow crosses minor street, No flow through major intersections
  2. Runoff versus street capacity, Ensure flow does not exceed right of way.
  3. No street drainage enters alley, and
  4. Review need for curb at steep alley "T" intersections or flatting of steep advancing grades.
- ❑ Provide subarea inlet table with designations and Q=CIA variables defined .
- ❑ Verify design based on projected ultimate watershed development w/ zoning map.
- ❑ C for Parks, 0.15-0.35; Residential 0.45-0.60; Multi-family 0.60-0.85; Industrial, Commercial (I/C) (light) 0.50-0.80, I/C (heavy) 0.75-0.90. Show composite C calc's *church 0.80, school 0.70.*
- ❑ Residential minimum time of concentration TC=15 min, Non- residential minimum TC =10min.
- ❑ Check time of concentration calculations if greater than minimums, state / review assumptions, show existing and proposed flow paths on DAM, review travel time equation and variables
- ❑ Check cumulative runoff calculations, verify capacity and adequacy of downstream system,
- ❑ When connecting to existing sewers, review record drawing D.A.M. for allowable discharge from outside ROW such as for a parking lot.
- ❑ Check depth & spread of flow in street & alley, ensure flow in ROW and one dry lane on arterial.
- ❑ Check size and position of inlets such that drainage doesn't cross over street crown. Avoid flow concentrations across City sidewalks except at driveways.

Inlets

Curb inlet on constant street grade capacities

❑ 1.0% = 1cfs/ft	❑ 1%-2% = 0.85cfs/ft	❑ 2-4% = 0.70 cfs/ft	❑ 4.0-7.0% = 0.6 cfs/ft	❑ >7%=0.5cfs

- ❑ Standard curb inlets are 5-, 10-, 15-, & 20- ft wide and 4.5 feet deep.
- ❑ Size and position on grade curb inlets so runoff does not exceed street capacity or interfere w/ pedestrians. Check gutter spread and depth, insure dry lane requirements are met.
- ❑ Locate upstream of pedestrian crossings, intersections & prior to alley approach when added alley Q exceeds street capacity.
- ❑ Locate inlets at sags, 10 feet from street curb returns (unless site constraints dictate otherwise).
- ❑ On paving plan, opposite each public inlet provide station, size, type, D.A.M. designation, top of curb / flowline elevation, and Q100 to and bypass.
- ❑ Avoid junction box inlets and inlets located on curves near intersections, place upstream of intersection.
- ❑ Grate and combination inlets are not allowed on the City system w/o prior consent from the Street and Engineering Department
- ❑ Provide recessed inlets on divided roadways & collectors, where parking is not expected.
- ❑ Provide Y inlet in ditches and for undeveloped areas, locate min 20 ft from street, insure grading allows runoff to get to inlet.
- ❑ Provide 10-ft curb on both sides alley inlet include note "Warp alley pavement to inlet throat".

- ❑ Check alley inlet placement avoid future driveway conflicts, placement on property line is best.
- ❑ Compare and verify D.A.M. inlet locations and sizes w/ inlet sizing chart and grading plan.
- ❑ Check sizing chart Insure 100% collection at sags, on grade capacities conform to criteria and all flow is accounted for.
- ❑ Private systems check curb and grate inlet capacities against D.A.M. subarea flow. Insure flow doesn't enter / bypass to public right of way and structures, verify blockage accounted for in design.
- ❑ Check properties opposite steep streets and alleys, verify finish pad above TC.
- ❑ At sags verify inlets / overflow at low point and placement of concrete flume are w/in easement.

Storm Sewers

- ❑ Provide plan / profile for all connections to and from public storm sewers. Show:

❑ Existing storm sewers(dash) ❑ Proposed storm (solid) ❑ Diameters & line designation ❑ Water/sewer lines ❑ Other existing utilities ❑ Inlets & grates w/ size & designations ❑ Q100 & Q bypass	❑ Stationing & 100ft tick marks ❑ PC, PT &curve data ❑ Creeks & ditches ❑ 100-yr flood plain ❑ Detention / retention ❑ Label private lines ❑ Trees & signs,	❑ Right of way ❑ Fences & manholes, ❑ Sprinkler systems ❑ Valves & meters ❑ Back flow devices ❑ Other above ground features w/in ROW	❑ Easement(s) ❑ Street names &layout ❑ Pavement & curbs ❑ Driveways ❑ Benchmark ❑ Property lines ❑ Water & sanitary sewer lines

- ❑ Provide pipe calculation chart for all sewers connecting to public system.
- ❑ Minimum 21-inch Class III RCP required in ROW, specify Class IV RCP when crown w/in 2 foot from top of pavement and at RR crossing.
- ❑ Provide details for connections using different pipe materials.
- ❑ Avoid bends unless site conditions warrant, use radius < 48" point connections and outfalls downstream.
- ❑ Intersect laterals w/ factory 60 degree wye connection for pipe sizes ≤ 48" diameter.
- ❑ Specify rim elevation at junction boxes
- ❑ At emergency overflow flumes indicate paving station and elevation, size, Q100, and drainage easement width.
- ❑ At sags verify positive overflow is at low point, adjacent lot minimum finish floor elevations and easement width.
- ❑ At grade to drains, provide swale/ditch cross section, Q, n, velocity, depth and slope, 1 % minimum required for grass lined swales.
- ❑ Check plan view and grades with as-built / record drawing.
- ❑ Check placement w/in right of way or easement and verify 10-ft minimum from centerline alignment.
- ❑ Check stationing by scale from know PT and PC, review curve data.
- ❑ Compare inlet locations and sizes to D.A.M. for accuracy.
- ❑ Check / verify paving station opposite each inlet, define size, type, D.AM. designation, TC / FL elevation, Q100 to and bypass.
- ❑ Check top of curb elevation at inlets against paving plan/profile, verify standard inlet depth used.
- ❑ Minimum 20 foot drainage easement required for public lines, verify NO retaining walls, post, signs, private lines, structures, etc allowed w/in easement.
- ❑ Verify system extends to and captures offsite contributing drainage area.
- ❑ Check outfall flowline, point downstream, and grading coordinated w/ drainage easement.
- ❑ Specify / Verify headwall types are per City standard details, Type A, B, 42-inch handrail at outfalls > 30" drop near rights of way.
  1) For velocities > 8 fps, provide downstream erosion protection for riprap specify diameter and pad dimensions, check gradation spec's, specify thickness of blanket and filter fabric.
  2) Verify downstream easement sized to convey fully developed flow.

Profiles

- ❑ Storm sewer profiles line up directly under plan view (1"=40ft > h, 1"=4ft > v).

- ❑ Show existing and proposed ground at storm sewer centerline, utility crossing station / elevation.
- ❑ Provide station / elevation at every 100 ft, size and grade change, manholes in/out flowlines.
- ❑ Where connections are made to existing system storm drain, match soffits, indicate starting hydraulic grade line, reference and verify source of information or assumptions made.
- ❑ Note to install concrete collars at proposed to existing pipe connection locations.
- ❑ Where sewer outfalls to creeks, indicate and verify 100-year water surface elevation used.
- ❑ For each segment indicate pipe diameter, % grade, class and hydraulics between interception points Q100, Q cap, S (ft/ft), V, V2/2G, elevations to 0.01 at minimum 100' intervals.
- ❑ For full flow, define hydraulic grade line elevations at size / grade changes, laterals and junctions.
- ❑ Define start and end of partial flow provide pipe hydraulic data / Check v partial at outfalls.
- ❑ Fill areas - show hatching and specify minimum 95% compaction, standard proctor density.
- ❑ Specify / verify Type A or B headwalls located at outfalls, check / review grades and grading.
- ❑ Verify outfall pipe and swale bottom elevations are coordinated, place outfalls maximum 2 feet above creek flowline or onto stable rock.
- ❑ Velocities > 8fps, verify riprap diameter and dimensions are adequate, check gradation spec's, specify thickness of blanket and filter fabric.
- ❑ Verify outfall easement and grading / elevation is sized to convey fully developed flow.
- ❑ Use TXDOT 6:1 sloped end headwalls on driveway culvert in City ROW.
- ❑ Compare plan/profile stations, elevations, pipe sizes, designations, and utility locations.
- ❑ Compare/ verify pipe segment hydraulic data, Q100, Q cap, S, V, V2/2G on profile is same as storm sewer sizing chart, headloss calc's, TC at interception points, and Q100 along sewer.
- ❑ Verify HGL, 2 ft below top of curb at inlets, check 1.5V2/2g for full flow laterals.
- ❑ Verify profile shows lateral size, station and elevation, w/ centerline to centerline connection.

Laterals

- ❑ On plan, indicate designation, length, % slope, slopes > 33% requires flowable backfill in ROW.
- ❑ Lateral profiles required for full flow and/or crossing City utility.
- ❑ Lateral profiles required for partial flow laterals when crossing City utility.
- ❑ Insure collection of stormwater at full pipe flow; verify HGL min 2 ft below curb check 1.5V2/2g.

Creeks

- ❑ Provide paved ramps w/ driveway and bollards at end of each major segment .
- ❑ Development adjacent to Creek – Is it on a previously studied creek? Is a study needed? > 200ac requires Unit Hydrograph method.
- ❑ Creek study sealed by PE and include

❑ hydrology parameters	❑ assumptions	❑ methodology	❑ HEC-1 & 2 digital file

- ❑ Submit computer files and other programs used to develop discharges with first plan submittal.
- ❑ Work along FEMA floodplains requires a Flood Plain Dev. Permit. Is a 404 permit needed?
- ❑ Review offsite drainage work or points of flow concentration point in excess of pre-project conditions. Is an easement necessary?
- ❑ Easement sized to convey fully developed flow, provide metes / bounds to City surveyor.
- ❑ Check topography and cross-sections of man made channels and swales.
- ❑ Review / check capacity, slope, depth, velocity calculations, easement, maintenance requirements, and adequacy of erosion protection.
- ❑ Include note on plan: **PRIOR TO CITY ACCEPTANCE CLEAR UNDER BRUSH, DEBRIS AND PLACE IN MAINTAINABLE CONDITION. PRIOR TO CITY ACCEPTANCE DETENTION / RETENTION FACILITIES, CHANNELS, DRAINAGE WAYS, AND OUTFALLS SHALL HAVE ESTABLISHED PERENNIAL VEGETATION W/ 100% COVERAGE.**
- ❑ Curb alleys adjacent to creeks and open bodies of water.
- ❑ Verify creek w/in easement per plat w/access width, typical 100yr+1ft+10 horizontal if creek bank is 4:1 or flatter, 15ft if earthen creek bank is 3:1 or steeper. If 100-year is less than bank full place easement at top of bank + sufficient horizontal access.

- ❑ Verify lot and rights of way are outside erosion hazard area, 4:1 projection from toe of slope.
- ❑ Spring & Rowlett Ck -use fully developed WSEL per 1989 Rowlett and Spring Creek FPM Study.
- ❑ Spring Creek Forest Preserve criteria: 1 / no alteration/channelization within ecological boundary. 2/ maintain by +/- 10% adjoining surface drainage patterns volume and velocity 3/ Runoff rates approximate predevelopment use detention.4/ Use pre-determined utility corridors per Master Plan for utility construction.

1.1.6 Detention Basins

- ❑ Required for contributing sites > 1.0 acres or in areas of known flooding and inadequate downstream drainage systems.
- ❑ Provide standard detention pond general notes on plans.
- ❑ Include note on plan: Prior to City acceptance DETENTION/RETENTION FACILITIES, CHANNELS, DRAINAGE WAYS, AND OUTFALLS SHALL HAVE ESTABLISHED PERENNIAL VEGETATION W/ 100% COVERAGE.
- ❑ Side slopes no steeper than 4:1, unusual height or poor soil requires slope stability study by P.E.
- ❑ Provide / check paved low flow flume minimum 0.5% between inlet / outlet and at point discharges to pond bottom.
- ❑ Provide all-weather access to ROW, 15ft wide minimum, 20% maximum slope.
- ❑ Provide pond typical cross section(s), showing emergency spillway, outlet structure, excavated side slopes (4:1 or flatter), level access path with width specified, pond bottom slope and low flow swale.
- ❑ Define / verify benchmark number, location and elevation.
- ❑ Show / review detention pond grading and layout of outlet structure w/ respect to property lines and easement shown.
- ❑ Verify location, elevation, adequacy of emergency overflow spillway, bottom width.
- ❑ Check / insure outfall pipe and swale bottom elevations are coordinated.
- ❑ Are offsite flows entering the site? If so, have provisions been made to bypass flows?
- ❑ Review / verify pre- and post-project composite c values, time of concentration calculations, review assumptions, show existing and proposed flow paths on D.A.M., review travel time equation and variables
- ❑ Show / verify detention storage calculation, use modified rational method up to 25 ac, > 25 ac unit hydrograph method.
- ❑ Define / check site pre-project 10- and 100-yr runoff and/or available downstream capacity = allowable release rate.
- ❑ Define outlet structure location / dimensions, horizontal control from property line, provide trash rack and low flow dewatering device 4-inch minimum diameter.
- ❑ Define top of lid or grate and invert elevations of all pipes, structures, inlets, and manholes.
- ❑ Provide / Verify 10-foot minimum unobstructed access around pond. Can outlet structure be reasonably accessed for maintenance? Check drainage easement.
- ❑ Provide restrictor hydraulic calculations, design, orifice diameter or weir length, elevation, details.
- ❑ Define / verify maximum design WSEL for 10 and 100-year and the first 1-inch of rainfall.
- ❑ Provide minimum one (1) foot of freeboard above the design 100-year water surface elevation.
- ❑ Provide outlet detail for restrictor / weir and elevation versus discharge table on plans.
- ❑ Review elevation versus storage table and check dimensions / area / depth / volume.
- ❑ Verify design includes water quality features, detains first flush volume = (0.08 ft) c (A) or storm screening device used.
- ❑ When storm water screening device used, provide plan and details.
- ❑ When using perforated riser for water quality, spec number, spacing and diameter of perforations per NCTCOG. Verify water quality feature design used 1yr, 6-hr intensity of 0.35 in/hr (*iSMM)*.
- ❑ Define outfall pipe flowlines, diameter, velocity, length, and slope.
- ❑ Does tail water effect pond? Is an anti-seepage collar needed? If so provide design.
- ❑ Provide structural details and calculations for any item not in City standard construction details.

- ❑ Landscaping and irrigation are required, landscaping subject to the approval of the Planning Dept.

1.1.7 Water

- ❑ Provide overall layout of existing / proposed water and sanitary sewer, w/ sufficient street and lot including:

❑ Line designations & diameters ❑ Flow directions ❑ Trunk line tie ins & service taps ❑ Valves, tees, crosses, ❑ Plugs, bends, reducers ❑ Meters & fire hydrants ❑ Back flow devices	❑ Manholes & cleanouts ❑ Right of way & easements ❑ Dash in storm sewers alignment ❑ Creeks & 100yr flood plain ❑ Stationing &100ft tick marks ❑ PC, PT& curve data ❑ Benchmark ❑ Property lines ❑ Pavement & curbs	❑ Utility poles ❑ Fences ❑ Sprinkler systems ❑ Structures ❑ Trees & signs ❑ Label private lines ❑ Retaining walls ❑ North & graphic scale ❑ Other above ground features w/in ROW

- ❑ Locate, label and dimension existing and proposed utility easements with recording information.
- ❑ Locate and define size of existing water lines to be connected to, and proposed lines.
- ❑ Locate and label existing and proposed sanitary, storm sewer lines with flow direction arrow.
- ❑ Review and verify existing water, storm and sanitary sewers w/ as-builts / record drawings.
- ❑ Verify capacity / adequacy of existing lines to serve proposed use.
- ❑ For commercial developments, are mains of sufficient size to provide total fire flow required?
- ❑ Mains 6 to 12-inches, PVC DR-18 (C900) located north and east of street centerline, 6ft from ROW.
- ❑ Water lines > 12-inches RCCP, Note on plans: Taps made by Hanson Products Personnel Only.
- ❑ Minimum cover 6” & 8”=4.0ft, 10” & 12”=5.0ft, > 12”=6.0ft, verify properly shown on storm and sanitary sewer profiles.
- ❑ Water mains greater than 12-inch diameter requires profile.
- ❑ Each development must have two sources of water, no closed loops allowed.
- ❑ Use 45 deg bends where possible avoid 90 degree bends.
- ❑ Minimum 5-feet separation required between structures such as inlets / manholes and 10-feet between parallel lines.
- ❑ Define domestic and irrigation tap sizes and meter locations.
- ❑ Locate and label all fittings used to connect to existing and proposed mains.
- ❑ Locate and label all proposed valves, bends, crosses, tees, fire hydrants, reducers, etc.
- ❑ Verify no trees, retaining walls; post, signs, private lines, structures, etc are w/in utility easement.
- ❑ Verify utility crossing on existing concrete streets specified by other than open cut.
- ❑ Verify development facilitates future extensions.
- ❑ At creek crossing plans must note, “Install concrete cap per City standard construction details”.

Dead End Lines

- ❑ Maximum length equals 150 feet
- ❑ Locate valve at end of main, provide instruction extend one full joint past valve.

Valves

- ❑ Valves spacing 1000 feet - residential, 500 feet - non-residential
- ❑ Locate 6” valves adjacent to all fire hydrants and fire service lines.
- ❑ Place valve after last tap and extend one joint of pipe.
- ❑ Provide air release/blow off valves at high points and creek crossings.
- ❑ Butterfly valves required on 16” and larger size mains.
- ❑ Where required to establish a loop system - verify cut in valves are specified, between taps on existing mains up through 12”.

- ❑ Verify valve placement, allows block shut down w/ 2 but not more than 3 valves and no more than 1 fire hydrant out of service.

Water Services

- ❑ Minimum size for all zoning is ¾" service line, installed from main to property line.
- ❑ Maximum service line length from main to meter is 70-feet.
- ❑ Provide irrigation service / meter / easement / backflow device to detention ponds.
- ❑ Residential plans must show water/sewer connection detail w/ ¾" min. water service, 4" sanitary.
- ❑ For residential subdivisions: Indicate no taps on lines in utility easements.
- ❑ Residential, verify water service shown at center of each lot 10 ft upstream of sanitary sewer.
- ❑ Show existing water meters, if removal spec-plug service at main, return meter to Water Dept.
- ❑ Verify meters located out of driveways and sidewalks, in ROW or easement and allows for free impeded access.
- ❑ Standard size taps on City side 1-, 2-, 3-inch, etc. no half sizes allowed.
- ❑ Non-residential taps, specify domestic or irrigation service, plan must locate and label back flow device on private property.
- ❑ Services allowed off of fire hydrant lead only if double valved, not allowed off of fire line.

Fire Hydrants

- ❑ Locate and label exact locations of existing and propose hydrants, verify in easement and/or ROW.
- ❑ Fire hydrants leads - 50 feet or less = 6" and single valve. Leads > 50ft double valve and 8".
- ❑ Max dead end water line = 150 feet, if greater lines must be looped.
- ❑ Existing fire hydrants can only be relocated with approval of the Water and Fire Departments.
- ❑ Specify: Install two way blue reflector button in center of fire lane or street opposite hydrant.
- ❑ Spacing, check with Fire Department for current requirements.
- ❑ Check for conflicts w/ sidewalks, driveways, and utilities.
- ❑ Verify location is at least 10 feet pass curb returns, fire hydrants are not allowed in radius.
- ❑ Verify fire hydrant protection, 2.5 - 8 feet from curb or fire lane, if no curb specify bollard protection.

Fire

- ❑ Fire lanes (10% max shading allowed on Site Plan), specify 6-inch minimum thickness, Class "C" concrete, 24-ft wide, turnaround required at dead ends >150 feet.
- ❑ Fire line tap 6-inch minimum with valve for commercial and industrial applications.
- ❑ Check and verify fire line note is on utility plan:

BE ADVISED construction drawings bearing the City of Garland Engineering Department "Release for Construction" stamp and a valid Right of Way work permit authorizes all work associated with connecting to the public water line and where applicable installation of backflow prevention device(s). <u>THIS PLAN DOES NOT AUTHORIZE WORK ON PRIVATE FIRE LINES.</u> Submit fire line plan and obtain approval from the Fire Marshall's Office at 1500 SH 66, Garland, TX 75040, prior to installation of fire line.

- ❑ Show exact location fire line w/in 5 ft of structure, and backflow device shown on private property.
- ❑ Fire Department Connection w/in 50ft of fire hydrant, on private property not w/in utility easement.
- ❑ Verify fire lane grades are less than 10%.

Water Profiles (nearest 0.10-foot)

- ❑ Indicate:

❑ Existing & propose water, sanitary and storm sewer, gas, electric, phone, others ❑ Size, slope & line designation ❑ Valves, tees & ends, to be tied to ❑ Street, creek, railroad xings	❑ Stationing of ❑ Tees, crosses, plugs bores, & sleeves, ❑ Wet tap connections ❑ Bends & reducers ❑ Easements	❑ Fire hydrants ❑ Right of way ❑ Manholes, ❑ Other below ground features w/in ROW ❑ Benchmark

- ❑ At creek crossing, specify embedment per City standard construction details.

1.1.8 Sanitary Sewer

- ❑ Provide overall plan view of existing / proposed water & sanitary sewer layout w/

❑ Line designations & diameters ❑ Flow directions ❑ Trunk line tie ins & service taps ❑ Valves, tees, crosses, ❑ Plugs, bends, reducers ❑ Meters & fire hydrants ❑ Back flow devices ❑ Stationing &100ft tick marks	❑ Manholes & cleanouts ❑ Right of way & easements ❑ Dash in storm sewers alignment ❑ Creeks & 100yr flood plain ❑ PC, PT& curve data	❑ Other utilities ❑ Fences, signs ❑ Sprinkler systems ❑ Structures, poles ❑ Trees & signs ❑ Label private lines ❑ North & graphic scale	❑ Pavement & curbs ❑ Benchmark ❑ Property lines ❑ Other above ground features w/in ROW ❑ Retaining walls

- ❑ Dash in proposed and existing water, storm sewers, and other utility lines crossing over or under sanitary sewer.
- ❑ Mains - 8” minimum
- ❑ Indicate on both plan and profile line designations, existing and propose size, stationing, and flow directions.
- ❑ Check curve data w/ stationing and alignment shown.
- ❑ Verify capacity / adequacy of existing lines and locations w/ record drawings.
- ❑ Verify development facilitates future extension complies w/ standard details, traffic control, TCEQ regulations, SH 190 & E. Garland Master Plan and other plans where applicable
- ❑ Verify no trees, retaining walls, post, signs, private lines, structures, etc within and/or paralleling utility easement.

Profile

- ❑ Profile views should line up directly under the plan view, typical scale (1”=40’ H, 1”=4’ V).
- ❑ Profiles required for lines greater than 4-inch, specify:
  Invert elevations (nearest 0.01 ft) at every 100 ft, manholes in/out (0.1 ft min. fall), tie ins, clean-outs, proposed and existing water / storm / utility crossings. Indicate pipe % grade, flow direction, diameter, total footage, ground above pipe, fill area hatching w/ 95 % compaction note.
- ❑ Profile private sanitary sewers systems when crossing public water / storm sewer lines.
- ❑ Show benchmark on all profile sheets.
- ❑ Sanitary sewer slopes per TCEQ regulations
  6” - minimum 0.50%, maximum 12.35%,
  8” - minimum 0.33%, maximum 8.40%,
  10” - minimum 0.25%, maximum 6.23%.
- ❑ Minimum grades sufficient to provide gravity flow of sewage at velocity of < 2 fps, maximum 8 fps.
- ❑ Indicate/note all sanitary sewers shall be SDR-26 PVC pipe
- ❑ Aerial crossings reference to construct per City Standard Details, indicate pier diameter, spacing, etc, place crossing 2 feet above 100 yr WSEL where possible.
- ❑ Check service conflicts and need for parallel system when > 12 feet.
- ❑ Compare and verify line designations, and slope is > TCEQ minimum % grade requirements.
- ❑ Verify stations / elevations in plan and profile views are the same.
- ❑ Compare and verify all propose station / elevations of water / storm and utility crossing on plan and profile views, compare existing line location with as-builts / record drawing.
- ❑ Check manhole top of rim elevation against paving profile, provide 0.10 ft drop across manhole.
- ❑ Provide instructions where required, to adjust existing manhole tops to finish grade.
- ❑ Check proposed elevation above the line w/ grading / paving plan every 100 ft and at critical points.

Services

- ❑ All sewer services > 4-inch shall tie into manhole.

- ❑ Trunk depths greater than 12 feet require parallel line.
- ❑ Services sized per uniform plumbing code, common services are not allowed.
- ❑ Check and verify that service laterals are provided to all platted lots, 4-inch minimum.
- ❑ Insure instruction is provided to install single stack double sweep cleanout on services at the property line and/or easement
- ❑ Check / avoid conflicts w/ walls, storm sewers, inlets, fire hydrants, etc. Extend services past walls.
- ❑ Verify service laterals will not conflict w/ storm sewer.
- ❑ For shallow lines check finish floors and verify structures can be serviced.

Manholes

- ❑ Provide false bottom when connecting to existing manhole, note “to remove prior to acceptance”.
- ❑ Cleanout required at dead end < 100 feet from manhole, > 100 feet requires manhole.
- ❑ Sealed manholes required in creeks, drainage easements, and 100-year flood plains.
- ❑ Manholes spacing ≤ 500 ft, locate at pipe size and direction changes, junctions.
- ❑ Standard manhole = 4’ diameter w/ 0.10 ft drop, depths ≥15’ - 5’ diameter manholes required.
- ❑ Internal drop manhole connection required when distance between connections ≥ 2.

Special Structures

- ❑ Provide reference on plan to construct special structures such as, retaining walls, junction boxes and headwalls per City standard construction details or include separate equivalent detail.
- ❑ Show proposed grading contours at headwalls and culvert - confirm slopes w/in easement or ROW.
- ❑ Provide culvert design using TXDOT procedure; specify inlet or outlet control, calculations, details, boring logs, etc.
- ❑ Ensure culvert conveys 100-yr, w/ minimum 1 foot of freeboard from top of curb. Show Q, V, S, length, tail- and head water and flowline elevations.
- ❑ Provide gabion specifications when used.

1.1.9 Stormwater Pollution Prevention Plans / Narrative

	Acceptable	N/A
1. Total area of site----------_____acres	o	o
2. Area to disturbed---------- _____acres	o	o
3. Nature of activity ----------	o	o
4. Sequence of major construction----------	o	o
5. Description of potential pollutants----------	o	o
6. Estimated project start date----------	o	o
7. Estimated project completion date----------	o	o
8. Name of receiving waters----------	o	o
9. Soil data----------	o	o
10. Impervious area sheet (commercial only)----------	o	o
11. Structural practices proposed----------	o	o
12. Non-structural practices proposed----------	o	o
13. Stabilization practices proposed ----------	o	o
14. Waste management practices proposed----------	o	o
15. Runoff coefficient before and after construction----------	o	o
16. Inspection/maintenance procedures for cntrl measures-	o	o
17. Acknowledgement that historic places considered-------	o	o
18. Onsite batch plant considered----------	o	o
19. Operator certification----------	o	o
20. Engineers seal----------	o	o
21. Notice of Intent / Site Notice from Operator/s----------	o	o
22. Copy of TPDES permit attached----------	o	o
Site Plan (Map)	o	o
1. Drainage patterns (pre-construction contours) --------	o	o
2. Location of disturbance ----------	o	o
3. Location of structural controls ----------	o	o
4. Location of construction entrances----------	o	o
5. Location of onsite & adjacent surface waters ----------	o	o
6. Location of stormwater discharges ----------	o	o
7. Tree Survey with summary table----------	o	o
8. Approximate slopes after grading ----------	o	o
9. Location of on site and adjacent wetlands----------	o	o
10. Location of stabilization practices----------	o	o
11. Location of off site material waste, borrow, fill, or equipment storage----------	o	o
12. Location of sanitary facilities----------	o	o
13. NCTCOG details attached ----------	o	o

Stormwater Pollution Prevention Plan Checklist

DEVELOPMENT/ADDRESS: _____

SWPPP Sheets 1-5 are part of the site engineering and public works construction plans. All data fields must be filled out. If not applicable, indicate "N/A". Please do not alter the original contents and format of these SWPPP sheets. The standard SWPPP sheets are available via email by contacting the Engineering Department at 972-205-2170.

SWPPP Narrative sheet 1:

- ❑ Indicate areas of responsibilities of operators if a shared SWPPP.
- ❑ Provide "intended sequence or sequence of activities that will disturb soils".
- ❑ Provide "description of potential pollutants", as described on the TCEQ permit.
- ❑ Provide "description of locations where stormwater discharges from the project will drain directly to surface water bodies (Waters of the U.S. or Waters of the State).
- ❑ For 10 acres and larger development, provide temporary sediment basin or provide written explanation (on letterhead) of why basin not feasible.

➢ ***For SWPPP Narrative Sheet 2:***

- ❑ Provide "Sequence and Timing of Indicated Erosion Control Practices and/or Features".
- ❑ Provide detailed description of BMP maintenance protocols.
- ❑ Provide description of methods to modify pollution controls if existing controls are inadequate.
- ❑ Provide Operator's signatures per TCEQ General Permit TXR15000 requirements.

➢ ***Sheet 3, Erosion Control Plan***

- ❑ Show location of onsite and adjacent surface waters.
- ❑ Show location of onsite and adjacent wetlands. Obtain information from National Fish and Wildlife website at *http://www.fws.gov/*
- ❑ Locate proposed stabilization practices, (seed, sod, paving…) on erosion control plan.
- ❑ Indicate proposed location of sanitary facilities.

➢ ***For 5 acres and larger development:***

- ❑ Provide an executed copy of Owner/Operator N.O.I. on TCEQ form.
- ❑ Provide an executed copy of Contractor/Operator N.O.I. on TCEQ form.

➢ ***Other related items***

- ❑ Place erosion and sediment control details on Sheet 4.
- ❑ Place housekeeping details on Sheet 5.
- ❑ For other than single-family residential developments, provide impervious area status sheet with the correct development address.
- ❑ For 1 acre and larger development, provide an executed copy of the TCEQ Site Notice, ("Attachment 2" of the TCEQ permit).
- ❑ Provide a tree survey with summary table or a letter addressed to Stormwater Manager, on the Engineer's letterhead indicating that no trees are on site or that no trees are cut and removed from this project.

Obtain preliminary SWPPP approval prior to final plan submittal. All questions related to stormwater comments should be address to Wayne Wolverton and Michael Wilson at 972-205-2170.

<u>Appendix 2A.1:</u> Schematic Engineering Plans checklist

Schematic utility and drainage drawings are required in support of the Detail Plan or other zoning submittals per TSM 2.3. ***Basically, the schematic shows the project can work with the existing infrastructure or if it can't, it identifies any needed on- or offsite improvements.*** Schematics allows for an assessment to be made of the project's potential impact on

1) Surrounding properties,
2) Infrastructure and
3) Flood plains.

Staff may waive the need for certain aspects of the schematic plans when a development's impact on surrounding infrastructure and properties are minimal; or when the adequacy of existing infrastructure is not in question.

Schematic / Detail Plan Set Consists of at least 4 Sheets

1. Site Plan / Detail Plan (As submitted in the zoning application)
2. Downstream Assessment (see TSM Section 4.02)
3. Drainage Plan and Capacity Analysis (see TSM Section 4.04). When a detention facility is proposed, locate and label the pond's configuration, structures, and easement.
4. Schematic Utility Plan for water and wastewater system

General Sheet Requirements (Required on <u>ALL</u> Sheets):

- ❑ Plans must be accurately drawn to an Engineer's scale with a minimum text height of 0.10 of an inch. Instructions and notes must be legible when plans are reduced by 50%.

- ❑ Sheets shall be either 24"x36" or 22"X34" bordered sheets.

- ❑ Title block including, at a minimum, the following project information:

  a. Project Name and Address
  b. Subdivision name, lot / block
  c. City's Case Number
  d. Name of plan sheet and sheet number
  e. Design firm, firm registration no. and contact information, including phone number, address, and email.

- ❑ Show and label proposed building / development location w/ square footage.

- ❑ Label City Case number on all plan sheets.

- ❑ Provide Ownership of surrounding properties.

- ❑ All sheets with elevation data must have a Benchmark referenced to the City of Garland Benchmark Control Network.

- ❑ Note location of monitoring and water wells, underground storage tanks, and graveyards

- ❑ Plot 100 year flood plain, floodway, wetlands, detention ponds, and jurisdictional US waters.

- ❑ Show and label floodplains and floodways, creeks, and streams.

Site / Detail Plan Requirements:

- ❑ Provide vicinity map with north arrow, clearly showing the project location.

- ❑ Locate and label landscape buffers, property boundaries, ownership, and right of way on and within 50 feet of the project.

- ❑ Show and label ground mounted drainage facilities such as stormwater inlets and retaining walls.

- ❑ Show and label fire hydrants, water meters, manholes and associated easements, fire lanes, and Fire Department Connections.

- ❑ Show and label existing and proposed easements.

- ❑ Show and label significant tree clusters.

Existing Conditions Drainage Area Map Requirements:

- ❑ Show and label existing contours on and within 50 feet of the project.

- ❑ Show and label existing storm drain systems; for inlets provide $Q_{CAPACITY}$ and $Q_{EXISTING}$ for each inlet.

- ❑ Define existing drainage patterns, stormwater layout, sizes, inlets, 100-year runoff entering and leaving the site and disposition of the stormwater runoff before development.

- ❑ Show and label existing sub-drainage areas with primary flow path arrows.

- ❑ Show and label existing drainage easement and FEMA effective 100-year flood plain, reclamation areas, ditches, creeks, ponds, wetlands, and mitigation areas on and within 100 feet of the development. For development along Rowlett and Spring Creek, use the 100-year fully developed flood plain per the1988 Rowlett and Spring Creek Flood Plain Management Study.

Proposed Conditions Schematic Drainage Area Map Requirements:

- ❑ Show and label existing and proposed contours on and within 50 feet of the project.

- ❑ Show and label existing and proposed storm drain systems; for inlets provide $Q_{CAPACITY}$ and $Q_{PROPOSED}$ for each inlet.

- ❑ Define proposed drainage patterns / preliminary grading, stormwater layout, sizes, inlets, 100-year runoff entering and leaving the site and disposition of the stormwater runoff after development.

- ❑ Show and label proposed sub-drainage areas with primary flow path arrows.
- ❑ Show and label existing and proposed drainage easement and FEMA effective 100-year flood plain, reclamation areas, ditches, creeks, ponds, wetlands, and mitigation areas on and within 100 feet of the development. For development along Rowlett and Spring Creek, use the 100-year fully developed flood plain per the1988 Rowlett and Spring Creek Flood Plain Management Study.
- ❑ Note the change in imperviousness.
- ❑ Show how drainage is handled above and below proposed retaining walls.
- ❑ Show how existing system will function under proposed loading.
- ❑ Show the location and preliminary sizing of offsite improvement required to connect to public drainage system, including any offsite drainage easement needs.
- ❑ Show and label any retention and detention pond(s), easements, outlets, and provide preliminary sizing calculations. Define water quality enhancement feature and probable location.

Schematic Utility Plan Requirements:

- ❑ Locate and label, size and alignment of existing and proposed water lines, stormwater lines and inlets, wastewater lines with flow direction and manholes on and within 50 feet of the project. Check and verify existing locations, size and alignments shown on Detail / Schematic Plan with water, wastewater, and stormwater line with locators and record drawings.
- ❑ Water lines should be located in the North and East part of the right of way.
- ❑ No dead end water mains longer than 150 feet. No closed loops, loop must have two independent sources.
- ❑ Locate and label proposed public and private water, storm, and wastewater lines to be constructed with the project. .
- ❑ Locate and label future alignments and sizes of streets, water lines, storm, and wastewater improvements near the development as defined in the City's current Capital Improvement Program, Major Thoroughfare and Master Utility Plans.
- ❑ Development requiring phasing, indicate how each phase can exist as a stable independent unit consistent with Code provisions for providing safe access and City services.
- ❑ Check and verify water, wastewater and stormwater lines extend to limits of the development.

1.1.1.1 Water and Wastewater Capacity Analysis:

Use criteria in Section 5.1 of the TSM, check and verify the adequacy of existing lines ability to handle the increased demand generated by the proposed development.

Water analysis shall include but not limited to the following:

❑Zoning
❑Area in acres
❑Type of Development
❑Number of units and / or building square footage
❑Exhibit with connection locations and proposed water main schematic
❑Peak Hourly Flow and Peak Daily Flow in gallons per day
❑Fire Flow
❑Projected Average Daily Water Demands

Wastewater analysis shall include but not limited to the following:

❑A Service Area Map of wastewater trunk line(s) servicing development; include on map:

1. Peaking Factor
2. Infiltration / inflow contribution
3. Fully developed population used
4. Average Daily an Peak Domestic flow (in gallons per day)
5. Projected contribution generated by development.
6. Existing or projected major commercial / retail, industrial, and institutional contributors if present or proposed within service area.
7. Supporting exhibits and references for variable assumed and used
8. For private developments-indicate any improvements to be made by Developer that may be necessary to existing facilities that are affected by the proposed development.

Proposed Developer installed utility lines shall be designed using fully developed conditions and the City's Master Utility Plans. Plans must indicate any proposed offsite utility easements.

1.1.1.2 Schematic Drainage Plan and Capacity Analysis:

Use TSM sections 4.01, 4.02, and 4.04 for analysis and design Check and verify the following:

❑ Site runoff leaves in public ROW, easement, stormwater, natural or manmade channel

❑ Receiving system capacity and adequacy to carry fully developed conditions

❑ Future extension stub-out sized for ultimate condition w/ public drainage easement

❑ Need for Floodplain Development permit when work is adjacent to FIRM designated creeks

❑ Flood Study for significant changes to FIRM designated floodplains and subject to submittal to FEMA for a Conditional Letter of Map Revision (CLOMR)

Provide all the necessary data, calculations, and designs necessary to demonstrate the design does not adversely impact the surrounding or downstream property and meet local, state, and federal rules, regulations, and requirements.

- ❑ If a floodplain reclamation is proposed provide bound copies and a compact disk of the effective, pre- and post- project computer models along with all supporting information including but limited to cross-sections, profiles, and work maps; see Section 4.17 for requirements. The analysis must show that the development will be reasonable safe from flooding during the 100-year storm

    1. Be advised the City of Garland requires changes to be made to the effective FIRM maps and FIS documents if any of the following occurs as a result of the proposed work in a designated 100-year floodplain:

        1. A change in water surface elevation.
        2. A change in the floodplain boundaries.
        3. A physical change to the hydraulic model (e.g. fill or excavation, roadway, structures).

1.1.1.3 Environmental Feature Assessment:

Environmental feature assessments shall include a delineation of:

❑Onsite flood plains,
❑Creeks,
❑Seeps,
❑Springs,
❑Steep slopes areas greater than 14 %.
❑Significant tree clusters,
❑Landfills,
❑Underground storage tanks,
❑Archaeological features,
❑Wetlands and waters of the U.S.

1.1.1.4 Traffic Impacts/Major Thoroughfare;

Indicate the location of local, collector and arterial streets within and adjacent to the development.

Define existing and proposed:
❑Private streets
❑Pedestrian and utility easements abutting the development
❑Right of way widths, (City / TXDOT)
❑Onsite and offsite parking with circulation, loading and raised curbing defined
❑Driveway location in relation to property lines and nearby intersections and median openings
❑Fire lanes
❑For divided thoroughfares, locate existing and proposed median breaks
❑Left and right turn lanes to and near the development
❑Site visibility triangles, and
❑Sidewalks with widths

- ❑Proposed right of way dedications as required by the Major Thoroughfare Plan.

Appendix 2B: Cover Sheet General Notes

THIS NOTE SHALL APPEAR ON THE COVER SHEET OF ALL DEVELOPMENT PLANS WITHIN THE CITY OF GARLAND

GENERAL NOTES

ALL CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION IN NORTH CENTRAL TEXAS, LATEST EDITION AS ADOPTED BY CITY OF GARLAND ENGINEERING DEPARTMENT IN THE TECHNICAL STANDARDS MANUAL, BY NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS, P.O. BOX COG, ARLINGTON, TEXAS 76005-5888 (817) 461-3300, AS AMENDED BY THE CITY OF GARLAND. A COPY OF THIS BOOK MAY BE OBTAINED FROM THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS AT THE ADDRESS OR PHONE NUMBER LISTED ABOVE. A COPY OF THE CITY OF GARLAND AMENDMENTS IS AVAILABLE IN THE ENGINEERING DEPARTMENT, LOCATED AT 800 MAIN STREET, THIRD FLOOR, GARLAND, TEXAS.

1. The licensed professional engineer affixing his or her seal to the cover sheet of this document certifies that the license holder has reviewed and elects to use the City of Garland Standard Construction Details and specifications and said details are applicable for this particular project and site conditions in conformance with Section 137.33 (c) of the Texas Engineering Practice Act.

2. The Engineer of Record for the construction documents is responsible for the accuracy and completeness of the documents. The City reserves the right to require corrections to the construction documents to accommodate actual site conditions differing from that shown on the approved plans; for details not consistent or equivalent to the latest revision to the City of Garland standard construction details; and, to accommodate omissions on the approved plans.

3. The existing public water, sanitary sewer, and storm sewer utility lines and appurtenances shown on these plans have been taken from record drawings and utility locator maps. The City of Garland makes no guarantee that the underground utility lines and structures shown comprise all the City of Garland underground utility lines and appurtenances in the area, either in service or abandoned. The City of Garland furthermore does not warrant the accuracy of the information shown on the record drawings and the utility locator maps.

4. The contractor shall be responsible for determining the depth and location of existing underground utilities prior to trenching or excavation and is required to take any precautionary measures to protect all lines shown and / or any other underground utilities not of record or not shown on the plans. Contractor is responsible for contacting all the franchise utility companies, city utility departments and DIGTESS for locates prior to construction.

5. The developer and contractor shall comply with all acceptance procedures and processes identified at the pre-construction meeting. Schedule the MANDATORY PRECONSTRUCTION MEETING PRIOR TO ANY CONSTRUCTION by contacting the Engineering Department's Field Inspection Supervisor at 972-205-2170.

6. The developer or his / her contractor shall maintain daily contact with the city inspector during construction of improvements. No public sanitary sewer, water or storm sewer pipe shall be covered without approval of the city inspector. No subgrade material, stabilization or paving shall be applied in public right of way without approval of the city inspector. The inspector may at any time cause any construction, installation, maintenance of improvements to cease when, in his/her judgment the City's Standard Construction Details have been violated and may require reconstruction or other work as may be necessary to correct the violation.

7. Construction plans without the City of Garland's "Released for Construction" stamp are not valid for construction and shall be removed from the construction site. A copy of the current City of Garland standard construction details with all the latest revisions shall be onsite during construction.

8. The developer is responsible for obtaining all applicable city, state, and federal permits.

9. Prior to any construction activity within rights of way (ROW) and easements a Utility Construction Permit is required. Contact the ROW Administrator at 972-205-3622 for further information.

10. Flood plain development permits are required when a project is located in a special flood hazard area as defined on the City of Garland effective Flood Insurance Rate Maps (FIRM). Prior to issuance of building permits the developer shall process, coordinate and correct FIRMs according to current Federal Emergency Management Agency rules and regulations.

11. Erosion control and storm water management measures must be in place and comply with applicable city, state and federal regulations. Erosion and sedimentation control measures and practices shall be maintained at all times during construction, additional measures and practices shall be installed if deemed necessary by the city inspector.

12. Detention pond and outlet structure(s) shall be in accordance with Chapter 31.36 of the Code of Ordinances and fully operational prior to any paving activities.

13. The contractor shall make every effort not to impede traffic on existing streets, alleys or fire lanes open to the public. The developer / contractor is responsible for furnishing and installing all temporary and permanent traffic control devices in accordance with the minimum requirements of the latest revision to the Texas Manual on Uniform Traffic Control Handbook.

14. All excavations within the right of way shall be filled and compacted within twenty-four (24) hours of completion of work and no excavation shall remain open for longer than 96 hours.

15. **The contractor shall be responsible for providing "Record Drawings" to the Engineer of Record / Firm defining the location of improvements and any changes to the City approved drawings constructed in conjunction with the project including but not limited to public and private paving, grading, drainage, and utilities and appurtenances. Prior to final acceptance by the City, the Engineer of Record / Firm shall provide the city inspector with "Record Drawings" and the surveyor shall provide a Public Utility Survey as indicated in the TSM Section 2.7.9 & 2.7.10 submitted on 24" x 36" sheets. The Record Drawings and Public Utility Survey shall also be submitted as PDF's and a digital copy of all files on compact disk (cd) in a City approved MicroStation (.dgn) or AutoCAD (.dwg) format of all drawings bearing the City's "Release for Construction" stamp.**

Appendix 2C: Comment Response Form

Comment Response Sheet

Project Case Number : _____

Project Name :

Submittal or Version _____

Project Address :

Reviewing Department (circle one): 1. Engineering 2. Planning / Transportation 3. Fire / Water 4. Building / GP&L 5. City Surveyor / Storm Water

Sheet / Page Number	Comment Code	Comment Addressed?		**REMARKS** Provide explanations as to how comments were addressed; why a comment was addressed differently than requested; or why a particular comment or request couldn't be done.
		YES	NO	

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

Appendix 2D: CIP Checklist

- ❑ **TxDOT Requirements**
  - ❑ **Environmental Assessment or Categorical Exclusion**
    Comments:_____
    _____
  - ❑ **Noise Walls**
    Comments:_____
    _____
  - ❑ **Driveway Permit**
    Comments:_____
    _____
  - ❑ **Utility Permit**
    Comments:_____
    _____
- ❑ **Corps of Engineers**
  - ❑ **Nationwide Permit**
    Comments:_____
    _____
  - ❑ **Individual Permit**
    Comments:_____
    _____
  - ❑ **Letter of Permission**
    Comments:_____
    _____
- ❑ **Existing Utility Facilities (known)**
  - ❑ **Water**
    Comments:_____
    _____
  - ❑ **Sanitary Sewer**
    Comments:_____
    _____

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

- ❑ **GP&L**
  Comments:_____
  _____
- ❑ **TXU Electric**
  Comments:_____
  _____
- ❑ **ONCOR Gas**
  Comments:_____
  _____
- ❑ **Verizon**
  Comments:_____
  _____
- ❑ **SBC**
  Comments:_____
  _____
- ❑ **North Texas Municipal Water District**
  Comments:_____
  _____
- ❑ **Time Warner**
  Comments:_____
  _____

❑ **<u>Drainage</u>**

- ❑ **New Storm Sewer**
  Comments:_____
  _____
- ❑ **Off-Site Storm Sewer**
  Comments:_____
  _____
- ❑ **Channelization**
  Comments:_____
  _____

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

- ❑ **Flood Study, FEMA Submittal (CLOMR/LOMR)**
  Comments:_____
  _____
- ❑ **Halff Study Modification**
  Comments:_____
  _____
- ❑ **Detention**
  Comments:_____
  _____

❑ **Railroad Crossing**
Comments:_____
_____

❑ **Environmental Aspects**

- ❑ **Park Property**
  Comments:_____
  _____
- ❑ **Forest Preserve**
  Comments:_____
  _____

❑ **ROW/Easements**

- ❑ **Assessments**
  Comments:_____
  _____
- ❑ **GPS / Survey Monuments / Benchmarks**
  Comments:_____
  _____
- ❑ **Obstructions in existing or proposed ROW/Easements (sheds, fences, trees, etc)**
  Comments:_____
  _____

TRANSPORTATION DEPARTMENT

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

- ❑ **Right turn lanes**
  Comments:_____
  _____

- ❑ **Sidewalks**

  - ❑ **One Side**
    Comments:_____
    _____

  - ❑ **Both**
    Comments:_____
    _____

- ❑ **Additional ROW**
  Comments:_____
  _____

- ❑ **Sight Distance Triangles**
  Comments:_____
  _____

- ❑ **Pedestrian and Utility Easements**
  Comments:_____
  _____

- ❑ **Signalization (Loops, pull boxes, conduit, etc…)**
  Comments:_____
  _____

- ❑ **Temporary Signalization (Loops, pull boxes, conduit, etc…)**
  Comments:_____
  _____

- ❑ **School Zone flashers**
  Comments:_____
  _____

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

- ❑ **Lane markings**
  - ❑ **Striping**
    Comments:_____
    _____
  - ❑ **Buttons**
    Comments:_____
    _____
  - ❑ **Directional Indicators**
    Comments:_____
    _____

STREET DEPARTMENT

- ❑ **Coordinate Scheduled Replacements/Repairs**
  Comments:_____
  _____

PARKS DEPARTMENT

- ❑ **Adjacent to Parks Property**
  Comments:_____
  _____
- ❑ **Irrigation in Medians**
  Comments:_____
  _____
- ❑ **Landscaping**
  Comments:_____
  _____

WATER DEPARTMENT

- ❑ **New water main installation**
  Comments:_____
  _____

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

- ❑ **Water main replacement**
  Comments:_____
  _____

- ❑ **New sanitary sewer installation**
  Comments:_____
  _____

- ❑ **Sanitary sewer replacement**
  Comments:_____
  _____

- ❑ **Off-Site Extension**
  Comments:_____
  _____

TELECOMMUNICATIONS DEPARTMENT

- ❑ **New fiber optic facilities**
  Comments:_____
  _____

GARLAND POWER AND LIGHT (GP&L)

- ❑ **New facilities**
  Comments:_____
  _____

- ❑ **Replace Facilities**
  Comments:_____
  _____

TXU ELECTRIC

- ❑ **New facilities**
  Comments:_____
  _____

- ❑ **Replace Facilities**
  Comments:_____
  _____

PROJECT CHECKLIST

PROJECT NO: _____
PROJECT NAME: _____
FROM: _____
TO: _____

ONCOR GAS

❑ **New facilities**
Comments:_____
_____

❑ **Replace Facilities**
Comments:_____
_____

TIME WARNER

❑ **New facilities**
Comments:_____
_____

❑ **Replace Facilities**
Comments:_____
_____

VERIZON

❑ **New facilities**
Comments:_____
_____

❑ **Replace Facilities**
Comments:_____
_____

SBC

❑ **New facilities**
Comments:_____
_____

❑ **Replace Facilities**
Comments:_____
_____

Appendix 2E: Affirmation Letter for Public Utility Survey

Format for Affirmation Letter for Public Utility Survey; Submitted on Letterhead of Surveyor

(Date)

City of Garland Engineering Department
City Surveyor
800 Main Street
Garland, Texas 75040

Attn: Glenn Breysacher, RPLS, City Surveyor
RE: ***(Name of Subdivision)***
(Name of Private Development)
City Case Number: _____-_
Public Utility Survey Affirmation Letter

I hereby affirm that the Public Utility Survey ("Survey") attached to this letter and dated _____, was prepared under my direct supervision from evidence on the ground during field survey and other reliable documentation, and does accurately reflect the visible public utilities, including those items listed in Section 2.7.10 of the Technical Standards Manual promulgated by the Garland Development Code, City of Garland, Texas, and that the subdivision lots, easements, and boundary lines are a precise representation of the referenced subdivision plat and project as included in the approved & stamped "Release for Construction" Site Permit Public Works & Site Engineering Construction Plans. I further affirm that this Survey substantially complies with the Rules and Regulations of the Texas Board of Professional Land Surveying and that the digital drawing file accompanying this letter is a precise representation of said Survey.

Sincerely,

{Signed Seal of Surveyor}

***(Name of Surveyor)*, RPLS No. _____**
(Title of Surveyor and Firm)

cc: (***Field Engineering Inspector's name***)

Appendix 2F: Public Utility Survey Coordinates & Vertical Control

All drawing elements in the electronic drawing file shall be on State Plane/Grid bearings as indicate below and drawn with surface distances. The entire drawing file shall be translated to State Plane Coordinates on one of the boundary corners where State Plane Coordinates are provided. Failure to rotate and translate all drawing elements to State Plane shall result in rejection of Survey.

The Public Utility Survey basis of bearings shall be the North Central Zone (4202) of the Texas Coordinate System of 1983, (NAD83- cite current NGS iteration). Vertical control shall be on NAVD88 datum with benchmarks referenced on the Survey. All benchmarks used shall be the same as shown on the approved & stamped “Release for Construction” Site Permit Public Works & Site Engineering Construction Plans.

State Plane coordinates shall be provided on at least two corners of the boundary, including metadata summarizing the horizontal and vertical datums. COORDINATES THAT HAVE BEEN SCALED BY *ANY* SCALE FACTOR ARE NOT GRID/STATE PLANE COORDINATES. If the coordinates are obtained independent of the city's geodetic control, via OPUS, STATIC post-processed, or VRS-RTK methods, state so, or list at least two city gps/geodetic control monuments tied to and their coordinates and metadata (i.e.-2002 datum), and list method of tie (conventional, rtk, static, etc).

EXAMPLE METADATA STATEMENT (DO NOT COPY THE NUMERIC VALUES IN THIS EXAMPLE):

METADATA STATEMENT

COORDINATES (INSERT “AND BEARINGS” HERE IF USED FOR BASIS OF BEARINGS) SHOWN HEREON ARE NAD83(cite current NGS iteration) TIED TO THE TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE (4202) USING CITY OF GARLAND GEODETIC CONTROL (2002 DATUM) MONUMENTS 24 AND 25;

GPS24- N=7021483.019	*GPS25- N=7023392.672*
E=2538741.969	*E=2545208.193*
Z=554.14	*Z=526.18*

THE CONVERGENCE/MAPPING ANGLE AT THE P.O.B. (or label alternate point on dwg with letter for reference here) IS 01°01'05" WITH A COMBINED SCALE FACTOR OF 0.999863513.

BENCHMARKS (NAVD88):

PRIMARY BENCHMARK:

City of Garland Geodetic Monument No. 131, a 2" brass located at……

ELEV. – XXX.XX

SECONDARY/ON-SITE BENCHMARK:

Square cut on back of curb located at……

ELEV. – XXX.XX

Appendix 2G: Permission to Perform Work on Property Letter

Date: _____

Name: _____

Title: _____

Address: _____

Phone: _____

RE: Permission to perform work on property

To Whom It May Concern:

I, the property owner or owner representative of _____
(Address, Subdivision, Lot and Block Info)

_____ give permission to _____
(Developer's Name/Company)

_____ and their contractor(s) to perform work on said property in conjunction of

_____ construction plans.
(Name of Project)

Signature: _____

Name: _____

Title: _____

Date: _____

Appendix 2H:

ENGINEERING FIRST SUBMITTAL FORM (SCHEMATIC / CONSTRUCTION / WORKING PLAT)

Project Case Number: _____ **Project Name:** _____

Project Address: _____

Subdivision / Lot / Block: _____

Submission Type: ☐ **Schematic Engineering Plans** ☐ **Construction Plans** ☐ **Working Plat Only**

Engineer / Surveyor	Developer
Name:	Name:
Company:	Company:
Address:	Address:
City/St/Zip:	City/St/Zip:
Phone:	Phone:
Email:	Email:

See below for a list of items that shall be provided to the Engineering Department (800 Main St., 3rd Floor) at the time of first submittal (no fee or application required by the Engineering Department until issuance of a Site Permit). **Identify the items included in your submittal.**

➢ **Schematic Engineering Plans:**

PLAN REQUIREMENTS	ADDITIONAL DOCUMENTS NEEDED
☐ **Five (5) sets of full size schematic plans.** Schematic Engineering Plans shall include the following minimum sheets, *refer to the TSM Section 2.3 for details*: ☐ Site Plan / Detail Plan (as submitted in the Zoning Application) ☐ Downstream Assessment (see TSM Section 4.02) ☐ Drainage Plan and Capacity Analysis (See TSM Section 4.04) ☐ Utility Plan	☐ Vector-based PDFs of the Plans ☐ Flood Study (hard copy & PDF), if applicable (see TSM Sections 2.3.3 and 4.17) ☐ Capacity Analysis of Water & Wastewater Facilities, if applicable (see TSM Section 5.1) ☐ Traffic Impact Analysis submitted directly to the Transportation Department, if applicable (see TSM Section 8.13)

➢ **Construction Plans for a Site Permit:**

PLAN REQUIREMENTS	ADDITIONAL DOCUMENTS NEEDED
☐ **Five (5) sets of full size construction plans.** Public Works & Site Engineering construction plans shall include the following minimum sheets, *refer to the TSM Section 2.4.5 & 2.4.6 for details*: ☐ Cover Sheet ☐ Plat (include copy of filed plat or a draft version of the working plat) ☐ Site Improvement Survey ☐ Demolition Plan (as applicable) ☐ Site Plan / Dimensional Control (for non-residential developments) ☐ Paving Plan ☐ Utility Plan ☐ Grading Plan ☐ Drainage Area Maps (existing and proposed) ☐ Drainage Plan (as applicable) ☐ Erosion Control / SW3P, download sheets here: http://www.garlandtx.gov/3353/Stormwater-Plan-Submittal-Templates ☐ Special Construction Details (as applicable) ☐ Tree Survey / Mitigation Plan (as applicable) ☐ **Landscape Plan (as applicable)** ☐ **Irrigation Plan (as applicable)** ☐ Screening & Retaining Wall Plans (as applicable)	☐ Vector-based PDFs of the Plans and Working Plat ☐ One (1) additional hard copy of Working Plat, 24”x36” ☐ All Working Plat supporting documentation, if applicable (**see *WORKING PLAT SUBMITTAL REQUIREMENTS* in TSM Appendix 3H**) ☐ Impervious Area Status Sheet (see TSM Appendix 6A) ☐ Geotechnical Investigation in PDF format for ALL new or expanded public roadways and alleys (see TSM Section 9.01.D) ☐ Flood Study (hard copy & PDF), if applicable (see TSM Sections 2.3.3 and 4.17) ☐ Tree preservation & mitigation calculations in Excel format, if applicable (see GDC 4.58)

➢ **Working Plat Only: see *WORKING PLAT SUBMITTAL REQUIREMENTS* in TSM Appendix 3H.**

Submittals with significant omissions and lacking in details may result in the entire submittal being considered incomplete and returned to the design professional within 2 days and not reviewed.

Appendix 2I: Engineering Fee Summary Sheets

For Engineering Inspection Fee calculation, submit a copy of the actual Contractor's cost-breakdown or Engineer's probable estimates of construction costs with the fee calculation as certified by the developer's engineer for verification. Cost breakdown document must include item quantities and unit pricing. The fee is 4% of the total cost of the proposed installation, with a $100.00 minimum (see TSM 2.4.9.A.1). The fee is based on any appurtenances installed in the City's R.O.W. and Easements that will be maintained by the City of Garland, and is due prior to release of plans for construction per GDC Section 1.51. This document is necessary prior to the issuance of approval letter to the Public Works and Site Engineering plans.

Private items that should NOT be included are: sidewalks, driveways, private storm and wastewater lines, private service lines, fire lines, Fire Department Connections and lines, backflow prevention devices, fire lane and on-site pavement, earthwork, screening walls, and retaining walls.

CITY OF GARLAND - ENGINEERING DEPARTMENT - PRIVATE DEVELOPMENT

WATER UTILITIES SUMMARY

CASE NUMBER:

PROJECT NAME:

CONTRACTOR/ENGINEER:

PHONE NUMBER:

(rev. 01/2020)

ITEM #	DESCRIPTION	UNIT	QUANT.	COST/UNIT	TOTAL
	6" Water Main	LF			
	8" Water Main	LF			
	10" Water Main	LF			
	12" Water Main	LF			
	16" Water Main	LF			
	21" Water Main and Larger	LF			
	4" Gate Valve	EA			
	6" Gate Valve	EA			
	8" Gate Valve	EA			
	10" Gate Valve	EA			
	12" Gate Valve	EA			
	16" Butterfly Valve	EA			
	21" Butterfly Valve and Larger	EA			
	Tapping Sleeve & Valve (size)	EA			
	Tapping Sleeve & Valve (size)	EA			
	Tapping Sleeve & Valve (size)	EA			
	Air Release Valve (size)	EA			
	Air Release Valve (size)	EA			
	3/4" Water Services, box and lid	EA			
	1" Water Service, box and lid	EA			
	2" Water Service, box and lid	EA			
	4" Water Service	EA			
	6" Water Service and Larger	EA			
	Meter Vault for 3", 4" and 6" Service and Larger	EA			
	Fire Hydrants	EA			
	Other Items*	LS			
				TOTAL	

*Other Items: Includes Special details, fittings, blocking, atypical embedment, bores, and testing, pavement repair, etc.

Note: **Above quantities and cost shall represent and include the complete in place installation cost for all improvements placed in the City of Garland rights of way and easements that will be owned and maintained by the City.**

CITY OF GARLAND - ENGINEERING DEPARTMENT - PRIVATE DEVELOPMENT

WASTEWATER UTILITIES SUMMARY

CASE NUMBER:

PROJECT NAME:

CONTRACTOR/ENGINEER:

PHONE NUMBER:

(rev. 01/2020)

ITEM #	DESCRIPTION	UNIT	QUANT.	COST/UNIT	TOTAL
	6" SDR 26 Sanitary Sewer Main	LF			
	8" SDR 26 Sanitary Sewer Main	LF			
	10" Sanitary Sewer Main	LF			
	12" Sanitary Sewer Main	LF			
	15" Sanitary Sewer Main	LF			
	18" Sanitary Sewer Main	LF			
	21" Sanitary Sewer Main	LF			
	24" Sanitary Sewer Main and Larger	LF			
	4' Standard Manhole	EA			
	4' Internal Drop Manhole	EA			
	5' Standard Manhole	EA			
	Pressure Type Manhole	EA			
	4" Sanitary Sewer Services	EA			
	6" Sanitary Sewer Services	EA			
	8" Sanitary Sewer Services and Larger	EA			
	Other Items*	LS			
				TOTAL	

*Other Items: Includes Special Details, connections, bores, atypical embedment, encasement, testing, pavement repair, etc

Note: **Above quantities and cost shall represent and include the complete in place installation cost for all improvements placed in the City of Garland rights of way and easements that will be owned and maintained by the City.**

CITY OF GARLAND - ENGINEERING DEPARTMENT - PRIVATE DEVELOPMENT

STORMWATER SUMMARY

CASE NUMBER:

PROJECT NAME:

CONTRACTOR/ENGINEER:

PHONE NUMBER:

(rev. 01/2020)

ITEM #	DESCRIPTION	UNIT	QUANT.	COST/UNIT	TOTAL
	21" RCP	LF			
	24" RCP	LF			
	27" RCP	LF			
	30" RCP	LF			
	33" RCP	LF			
	36" RCP	LF			
	39" RCP	LF			
	42" RCP	LF			
	45" RCP	LF			
	48" RCP	LF			
	51" RCP	LF			
	54" RCP	LF			
	60" RCP	LF			
	66" RCP	LF			
	72" RCP	LF			
	78" RCP	LF			
	"Y" Inlets	EA			
	5' Inlets, standard and recessed	EA			
	10' Inlets, standard and recessed	EA			
	10' Inlets - Alley	EA			
	15' Inlets, standard and recessed	EA			
	20' Inlets, standard and recessed	EA			
	Overflow Flume	SY			
	Box Culverts ( )	LF			
	Box Culverts ( )	LF			
	Box Culverts ( )	LF			
	Junction Boxes / Storm sewer manhole	EA			
	Concrete Headwalls	EA			
	5" Concrete Channel Paving	SY			
	6" Concrete Channel Paving	SY			
	Other Items*	LS			
				TOTAL	

*Other Items: Includes Special Details, riprap, bores, concrete collars, etc…

NOTE: Above quantities and cost shall represent and include the complete in place installation cost for all improvements placed in the City of Garland rights of way and easements that will be owned and maintained by the City.

CITY OF GARLAND - ENGINEERING DEPARTMENT - PRIVATE DEVELOPMENT

PAVING SUMMARY

CASE NUMBER:

PROJECT NAME:

CONTRACTOR/ENGINEER:

PHONE NUMBER:

(rev. 01/2020)

ITEM #	DESCRIPTION	UNIT	QUANT.	COST/UNIT	TOTAL
	6" Concrete Street Paving including curbs	SY			
	7" Concrete Street Paving including curbs	SY			
	8" Concrete Street Paving including curbs	SY			
	9" Concrete Street Paving including curbs	SY			
	10" Concrete Street Paving including curbs	SY			
	8-5-8 Concrete Alley Paving	SY			
	Left Turn Lane including median and nose paving	SY			
	Right Turn Lane	SY			
	Reinforced Concrete Retaining Walls	SY			
	Subgrade (Lime & Cement Mix)	SY			
	Pavement Repairs	SY			
	*Other	LS			
				TOTAL	

*Other Items: Includes Special Details, barricading, sawcutting, joint installation, pavement markings, testing, etc.

Note: **Above quantities and cost shall represent and include the complete in place installation cost for all new improvements placed in the City of Garland rights of way and easements that will be owned and maintained by the City.**

GARLAND
TEXAS MADE HERE

PLAT REVIEW CHECKLIST

Engineering Dept.
Survey Plat Review Group

____PRELIMINARY ____FINAL PLAT____REPLAT ____MINOR PLAT
____CONVEYANCE PLAT ____AMENDING PLAT (check one)

CITY CASE NO.:_____

SUBDIVISION NAME: _____

THIS COMPLETED CHECKLIST SHALL ACCOMPANY THE WORKING PLAT SUBMITTAL. COMPLETE ALL APPLICABLE ITEMS. PLACE A CHECK MARK IN THE SPACE LABELED "APPLICANT" TO SHOW THAT YOU HAVE COMPLIED WITH THIS PARTICULAR REQUIREMENT. ITEMS THAT ARE NOT APPLICABLE TO YOUR PARTICULAR PLAT SHOULD BE LABELED "N/A". DO NOT LEAVE ANY ITEMS BLANK OR THE CHECKLIST WILL BE CONSIDERED INCOMPLETE.

GENERAL REQUIREMENTS (*NOTE: ALL COMMENTS AND REQUIREMENTS FROM ALL DEPARTMENTS, WHICH MAY NOT BE INCLUDED IN THIS CHECKLIST, SHALL BE ADDRESSED:*

	APPLI-CANT	CITY STAFF	
1.	_____	_____	PLAT SHEET SIZE SHALL BE 24"X36" AND HAVE A PERIMETER BORDER
2.	_____	_____	PLAT SHALL BE OF HIGH REPRODUCTIVE QUALITY AND LEGIBILITY.
3.	_____	_____	TEXT HEIGHT NOT LESS THAN 10 CHARACTERS PER INCH (LEGAL DESCRIPTION, NOTES, CERTIFICATIONS, ETC.) OR MIN. 1/10 OF DRAWING SCALE (i.e- IF SCALE IS 1"=30, TEXT SHALL BE A MIN. 3' IN HEIGHT).
4.	_____	_____	SCALE OF 1" = 20', 30', 40' etc. OR LARGEST PRACTICAL SCALE, STANDARD SCALES ONLY (1"=80' OR SIMILAR NOT ALLOWED)
5.	_____	_____	NORTH ARROW AND GRAPHIC SCALE ON PLAT
6.	_____	_____	ALL LEADERS **SHALL HAVE ARROWHEADS** THAT ARE SIZED APPROPRIATELY, TO ENSURE CLARITY IN FUTURE REPRODUCTION. THIS MEANS THAT THEY MUST BE **EASILY VISIBLE**. (THIS IS NOT OPTIONAL).
7.	_____	_____	VICINITY MAP SHOWING: • ALL THOROUGHFARES AND EXISTING STREETS BOUNDED BY THE TWO NEAREST INTERSECTING MAJOR THOROUGHFARES SHOWN IN HEAVIER LINE WEIGHT AND LABELED WITH BOLD & LARGER FONT.NORTH ARROW ON VICINITY MAP • SCALE IF ANY, OR THE STATEMENT "NOT TO SCALE". • (MAP SCALE SHALL BE AT LEAST EQUAL TO 1" = 2000")
8.	_____	_____	NAME, ADDRESS AND PHONE NUMBER OF: • SURVEYOR AND/OR ENGINEERING FIRM. • ALL OWNERS.
9.	_____	_____	LEGEND INDICATING SYMBOLS USED ON PLAT. LEGEND SHALL INCLUDE ONLY THOSE SYMBOLS ACTUALLY APPEARING ON THE PLAT.
10.	_____	_____	**DO NOT** SHOW TOPOGRAPHIC FEATURES (i.e- CONTOUR LINES, FLOOD PLAIN, UTILITIES, TREES, SHRUBS, FENCES, PAVING, BUILDINGS AND STRUCTURES, ETC. **(ENG. DEPT. MAY REQUIRE A SEPARATE SHEET SHOWING THESE ITEMS IF A DRAINAGE AREA MAP IS NOT INCLUDED WITH THE CIVIL ENGINEERING PLAN SET SUBMITTED FOR REVIEW).**

GENERAL NOTES

11. _____ _____ IF PROPERTY IS AT A **STREET OR ALLEY INTERSECTION,** ADD AS A GENERAL NOTE:

"PROPERTY OWNERS OF CORNER LOTS SHALL MAINTAIN SIGHT VISIBILTY TRIANGLES IN ACCORDANCE WITH CHAPTER EIGHT OF THE TECHNICAL STANDARDS MANUAL OF THE CITY OF GARLAND,TEXAS."

12. _____ _____ ALL CONVEYANCE PLATS SHALL BEAR THE FOLLOWING NOTE ON ALL SHEETS:

"*THIS PLAT IS A CONVEYANCE PLAT ONLY, AND IS APPROVED SOLELY FOR THE PURPOSE OF DEFINING LOTS AND OTHER INTERESTS IN THE LAND DESCRIBED HEREIN. NO BUILDING PERMIT, CERTIFICATE OF OCCUPANCY, OR OTHER DEVELOPMENT APPROVAL SHALL BE ISSUED OR IS HEREBY INTENDED, NOR SHALL PERMANENT PUBLIC UTILITY SERVICE BE PROVIDED TO ANY LOT DESCRIBED ON THIS CONVEYANCE PLAT UNTIL A FINAL PLAT IS APPROVED, FILED OF RECORD, AND THE PUBLIC IMPROVEMENTS SHOWN THEREON HAVE BEEN ACCEPTED IN ACCORDANCE WITH THE PROVISIONS OF THE ORDINANCES OF THE CITY OF GARLAND, TEXAS.*"

13. _____ _____ ALL **REPLATS** (NOT NEW PLATS) SHALL BEAR A PURPOSE OF REPLAT STATEMENT ON ALL SHEETS THAT IS GENERAL IN NATURE, **EXAMPLE:**

"*THE PURPOSE OF THIS REPLAT IS TO CREATE TWO ADDITIONAL LOTS FOR DEVELOPMENT OF STORAGE FACILITY AND ADD ADDITIONAL UTILITY EASEMENTS.*"

14. _____ _____ ALL PLATS SHALL NOTE WHAT TYPE OF MONUMENTATION IS SET AT ALL LOT CORNERS THROUGHOUT THE ENTIRE SUBDIVISION, TO **INCLUDE SIZE, TYPE OF MATERIAL, CAP COLOR & TEXT STAMPED THEREON.** EXAMPLE:

"*EACH LOT CORNER IS MONUMENTED BY A 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED 'RPLS 7777' UNLESS DENOTED OTHERWISE*"

15. _____ _____ ALL PLATS SHALL BEAR THE FOLLOWING NOTE:

"*SELLING A PORTION OF THIS ADDITION BY METES AND BOUNDS IS A VIOLATION OF THE CITY OF GARLAND DEVELOPMENT CODE AND IS SUBJECT TO WITHHOLDING OF UTILITIES AND BUILDING PERMITS.*"

16. _____ _____ ALL PLATS INVOLVING A **HOME OWNER'S ASSOCIATION** SHALL BEAR THE FOLLOWING AS GENERAL NOTE:

"ANY AND ALL MAINTENANCE OF HOA COMMON AREAS, HOA LOTS, PRIVATE EASEMENTS, SCREEN WALLS, SCREEN WALL EASEMENTS AND WALL MAINTENANCE EASEMENTS IS THE RESPONSIBILITY OF THE HOME OWNERS ASSOCIATION, ITS SUCCESSORS, OR ASSIGNS."

BOUNDARY REQUIREMENTS

17. _____ _____ BOUNDARY DRAWING BEARINGS & DIMENSIONS (all being consistent in placement along or straddling boundary lines) SHALL AGREE WITH LEGAL DESCRIPTION BEARINGS & DIMENSIONS - INCLUDING:
    - POINT OF COMMENCING (IF APPLICABLE)
    - POINT OF BEGINNING
    - BEARINGS & DISTANCES (note record vs. measured as necessary)
    - CURVE DATA TO INCLUDE:
        a. DIRECTION TO THE RIGHT OR LEFT
        b. DELTA ANGLE
        c. RADIUS
        d. CHORD BEARING FROM THE BEGINNING OF THE CURVE
        e. CHORD LENGTH
        f. ARC LENGTH
        g. WHETHER CURVE IS TANGENT OR NON-TANGENT

18. _____ _____ BOUNDARY OF AREA BEING PLATTED SHOULD BE OUTLINED WITH A **HEAVY, SOLID, CONTINUOUS BOLD LINE TYPE (do not use phantom or other line type)**; ALL OTHER LOT LINES (*LIGHTER WEIGHT THAN BOUNDARY-CONTINOUS LINE TYPE*), AND ADJOINING PROPERTY (*LIGHTER WEIGHT THAN LOT LINES-CONTINOUS LINE TYPE*)) SHOULD BE A SOLID THIN LINE. IN OTHER WORDS, **THERE SHALL BE THREE LINE WEIGHTS**, WITH YOUR BOUNDARY BEING THE HEAVIEST, THE INTERIOR LOT LINES BEING LIGHTER AND NEXT HEAVIEST, AND ALL ADJOINERS AND EASEMENT LINES BEING THE LIGHTEST AND LEAST HEAVY;

1) BOUNDARY
2) INTERIOR LOT LINES
3) ADJOINERS / EASEMENTS

19. _____ _____ PLAT BOUNDARY LINES SHALL BE PUNCTUATED ONLY WITH OPEN CIRCLES (OR OTHER SYMBOL DENOTED IN LEGEND) AT THE ANGLE POINTS AND POINTS OF CURVATURE, **WITH BOUNDARY LINES TRIMMED OUT OF THE CIRCLES**. CIRCLES OR OTHER CORNER SYMBOLS SHALL NOT BE PLACED BREAKING SUCH BOUNDARY LINES AT THE POINTS WHERE THEY ARE INTERSECTED BY ADJOINING TRACT LINES. IF SUCH POINTS ARE MARKED WITH PHYSICAL OBJECTS, NOTE THE CHARACTER OF THE MONUMENT IN TEXT WITH AN ARROW TO THE LOCATION (TO AVOID ANY AMBIGUITY AS TO THE TERMINUS OF THE ANNOTATED BOUNDARY).

20. _____ _____ LABEL EACH LOT & BLOCK WITH NUMBERS ONLY, **NO ALPHA CHARACTERS ALLOWED** (unless as part of a replat, i.e.- LOT 1R, BLOCK A)

21. _____ _____ LABEL AREA (**SQUARE FOOTAGE AND ACREAGE**) OF EACH LOT, CENTERED ON LOT (UNDER THE LOT/BLOCK NUMBER) OR IN TABLE. **ACREAGE SHALL BE REPORTED TO THE THIRD DECIMAL PLACE, NO EXCEPTIONS.**

22. _____ _____ LABEL EXISTING PLATS/ADDITIONS WITHIN YOUR BOUNDARY **(USE DOT FONT)** WITH VOLUME, PAGE, OR COUNTY CLERK INST No., AND SOURCE OF RECORD (O.P.R.D.C.T, D.R.D.C.T, D.R.C.C.T. OR OTHER CONTIGUOUS COUNTIES WITHIN GARLAND CITY LIMITS)

23. _____ _____ IDENTIFY OLD LOT LINES OR TRACT LINES (WITHIN YOUR PLAT BOUNDARY) WITH A **DOTTED LINE (NOT DASHED)** AND GHOST IN **(USE DOT FONT)** OLD LOT NUMBERS, TRACT NUMBERS, ETC.

24. _____ _____ STATE A BASIS OF BEARING FOR PLAT ON ***DRAWING*** (**even if stated in legal**) THAT CONFORMS TO T.B.P.E.L.S. RULE 663.19(c) (see Rule below sample statement):

SAMPLE STATEMENT

BASIS OF BEARING IS THE NORTH LINE OF MILLER ROAD (INSERT RECORDED BEARING, I.E. BEING NORTH 00 DEGREES 00 MINUTES 00 SECONDS EAST) AS RECORDED IN VOLUME 88327, PAGE 0235, DEED RECORDS OF DALLAS COUNTY, TEXAS.

****IF GPS OBSERVATIONS ARE USED FOR BASIS OF BEARINGS, SEE EXAMPLE BELOW IN ITEM No. 24.**

Per T.B.P.E.L.S.: §663.19. Survey Drawing/Written /Description/Report. (c)
Courses shall be referenced by notation upon the survey drawing to an identifiable and monumented line or an established geodetic system for directional control.

25. _____ _____ IDENTIFY STATE PLANE COORDINATES (**referenced properly as codified in the Texas Natural Resources Code as *TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE (4202)***) ON AT LEAST TWO CORNERS OF THE BOUNDARY INCLUDING METADATA. **STATE PLANE COORDINATES ARE NOT SCALED, FOR ANY REASON, AT ANY TIME.** IF THE COORDINATES ARE OBTAINED INDEPENDENT OF THE CITY'S GEODETIC CONTROL, VIA OPUS, STATIC POST-PROCESSED, OR VRS/RTK METHODS, **STATE SO**, OR LIST AT LEAST TWO CITY GPS/GEODETIC CONTROL MONUMENTS TIED TO AND THEIR COORDINATES AND METADATA (i.e.-City of Garland 2002 Datum), AND LIST METHOD OF TIE (conventional, RTK, VRS, static, etc). *See Section 3.03 of the Technical Standards Manual for more information.*

SAMPLE METADATA STATEMENT
(continued on next page)

(DO NOT COPY THE NUMERIC VALUES IN THIS EXAMPLE):

*COORDINATES (*INSERT "AND BEARINGS" HERE IF USED FOR BASIS OF BEARINGS*) SHOWN HEREON ARE ON GRID (THE PROJECTION PLANE), ARE NOT SCALED, AND ARE TIED TO THE TEXAS COORDINATE SYSTEM OF 1983 (NAD83(2011) EPOCH 2013), NORTH CENTRAL ZONE (4202)USING CITY OF GARLAND GEODETIC CONTROL MONUMENTS 24 AND 25;*

GPS-024	*GPS-025*
N=7021483.019	*N=7023392.672*
E=2538741.969	*E=2545208.193*
Z=554.14	*Z=526.18*

26. _____ _____ SUBMIT A GEOMETRIC CLOSURE FOR THE BOUNDARY OF THE AREA BEING PLATTED. ***LABEL WITH PLAT NAME & CITY CASE NUMBER AT TOP***; ALSO INCLUDE CLOSURE SHEET FOR EACH LOT. THIS IS REQUIRED FOR THE FINAL PLAT FILE PRIOR TO CONSIDERATION FOR BEING PLACED ON PLAN COMMISSION AGENDA OR ADMINISTRATIVE APPROVAL, ATTACH TO SUBMITTAL.

- INCLUDE BEARINGS AND DISTANCES
- CURVE DATA TO INCLUDE:
  a. DIRECTION TO THE RIGHT OR LEFT (STATE IF NON-TANGENT)
  b. DELTA ANGLE
  c. RADIUS
  d. CHORD BEARING FROM THE BEGINNING OF THE CURVE
  e. CHORD LENGTH
  f. ARC LENGTH
- PRECISION OF BOUNDARY CLOSURE (MINIMUM 1:15000)

27. _____ _____ AREA WITHIN 150 FEET OF THE PERIMETER OF PLATTED BOUNDARY (**even if across street or alley**) SHALL BE DETAILED (see example below):

- SHOW DISTANCES WITHIN 150 FEET ON ADJOINERS FOR LOT OR TRACT LINES, TAKEN FROM DEEDS, PLATS, AND OTHER RECORD RESEARCH.
- SHOW ADDITION NAME(S)
- PROPERTY OWNER NAME(S) (**if not in a platted subdivision**). **DO NOT SHOW OWNER NAMES IF IN A PLATTED SUBDIVISION**.
- SHOW LOTS AND BLOCKS, OR TRACTS, LABEL WITH APPROPRIATE NUMBERS
- **ABSTRACT No. & ACREAGE** DESCRIBED IN DEED (IF UNPLATTED)
- SHOW ABSTRACT/SURVEY LINE AND LABEL APPROPRIATELY
- IF UNPLATTED, LABEL AS UNPLATTED IN PARENTHESES below the abstract No.
- SHOW VOLUME & PAGE, AND SOURCE OF RECORD (O.P.R.D.C.T., D.R.D.C.T., ETC.).
- SHOW WIDTHS OF STREETS, ALLEYS, AND EXISTING EASEMENTS LEGIBLY. LABEL VOLUME AND PAGE AND SOURCE OF RECORD. ADD DISTANCE TIES ACROSS R.OW. AT VARIABLE WIDTH R.O.W.
- DO NOT SHOW DALLAS COUNTY APPRAISAL DIST. ACCOUNT NUMBERS
- OTHER PERTINENT DATA

EXAMPLE ADJOINER CITATION:

Abst. 761 (unplatted)
Joe Public & Jane Public
3.56 acres
C.C. Inst. No. 123456789
O.P.R.D.C.T.

28. _____ _____ GENERALLY, THE STYLE AND TEXT ELEMENTS OF THE PLAT SHALL BE COMMENSURATE WITH THE IMPORTANCE OF PRESENTATION RANK AND BE DETAILED AS FOLLOWS:

- STREET NAME TEXT SHALL BE LARGER THAN BEARING TEXT
- ADJOINER TEXT (INCLUDING SUBDIVISIONS) SHALL BE SMALLER AND NOT VISUALLY COMPETE WITH OR EXCEED SUBJECT PLAT TEXT SIZE
- BLOCK NUMBERS ON SUBJECT PLAT SHALL BE BOLDED WITH TEXT LARGER THAN LOT NUMBERS
- INTERIOR LOT LINE BEARING/DIST. TEXT SHALL BE SMALLER THAN BOUNDARY BEARING/DIST. TEXT
- MONUMENTATION TEXT AT BOUNDARY CORNERS SHALL BE SMALLER THAN BOUNDARY BEARING/DIST., BUT NOT MINISCULE
- EASEMENT TEXT SIZE SHALL BE APPROPRIATE FOR THE SIZE OF THE EASEMENT
- ALL TEXT CANNOT BE THE SAME SIZE

29. _____ _____ PROVIDE IMPROVEMENT/AS-BUILT SURVEY OF PROPERTY ON SEPARATE SHEET (TWO (2) 24"x36" HARD COPIES, ONE (1) PDF), SIGNED & SEALED BY SURVEYOR, SHOWING THE FOLLOWING:

- ALL EXISTING STRUCTURES (SHOW SIDE YARD AND SETBACK DIMENSIONS)
- PAVING, DRIVE APPROACHES, PARKING, SIDEWALKS, SIGNS, ETC.
- VISIBLE CITY INFRASTRUCTURE (including, but not limited to; fire hydrants, curb inlets, grate inlets, elec. transformers, power poles & guys, etc.).
- TOPOGRAPHY IS NOT REQUIRED
- EXISTING BUILDINGS MAY NOT EXTEND ACROSS PROPOSED PROPERTY LINES (PLAT BOUNDARY OR LOT LINES). **IF THE PROPERTY IS VACANT, WITH NO STRUCTURES, IMPROVEMENTS, OR CITY INFRASTRUCTURE, PROVIDE** A LETTER FROM THE SURVEYOR STATING THAT TO THE BEST OF HIS/HER KNOWLEDGE, NO ON-SITE STRUCTURES OR IMPROVEMENTS EXIST ON THE PROPERTY

MONUMENTATION REQUIREMENTS

30. _____ _____ COMPLIANCE WITH MONUMENTATION STANDARDS AS SET FORTH IN Section 3.06 OF THE *TECHNICAL STANDARDS MANUAL*, INCLUDING SPECIFICATIONS SET FORTH BY CITY SURVEYOR. **ALL SUBDIVISIONS SHALL HAVE A MINIMUM OF TWO (2) STANDARD SUBDIVISION MONUMENTS SET ON BOUNDARY (WITH STATE PLANE COORDINATES & METADATA STATEMENT) OR ALTERNATE LOCATION APPROVED BY THE CITY SURVEYOR (972-205-2157 – gbreysac@garlandtx.gov).**

- **PERIMETER OF PLATTED BOUNDARY** - AT ***ALL*** ANGLE POINTS, POINTS OF CURVE, AND POINTS OF TANGENCY - MIN. THREE & ONE-QUARTER INCH (3 1/4") METALLIC CAP DISK ATTACHED TO METAL PIPE OR ROD AND IMPRINTED WITH INSCRIPTIONS SHOWN IN THE CITY'S *TECHNICAL STANDARDS MANUAL*
- **BLOCK CORNERS -** MIN. TWO INCH (2") METALLIC CAP ATTACHED TO METAL PIPE OR ROD AND IMPRINTED WITH "RPLS" OR "FIRM" AND APPROPRIATE REGISTRATION NUMBER OF THE SURVEYOR OR FIRM
- **LOT CORNERS** – MIN. FIVE-EIGHTHS (5/8") INCH DIAMETER METAL PIPE OR ROD WITH CAP IMPRINTED WITH "RPLS" OR "FIRM" AND APPROPRIATE REGISTRATION NUMBER OF THE SURVEYOR OR FIRM

31. _____ _____ ALL MONUMENTATION SHALL BE LABELED AND DESCRIBED IN FULL ON **DRAWING AND LEGAL DESCRIPTION**, i.e- ***5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "RPLS 7777" FOUND FOR CORNER*** (LEGEND MAY BE USED TO COMPLY WITH THE DRAWING PORTION OF THE REQUIREMENT). ***WHEN PLACING DESCRIPTION OF SUBDIVISION MONUMENTS ON DRAWING AND IN LEGAL DESCRIPTION, DESCRIBE IN FULL.*** (i.e.- 5/8" iron rod with 3-1/4" aluminum disc stamped "SMITH ESTATES-2007" set)

32. _____ _____ LABEL AT LEAST TWO FOUND CONTROLLING MONUMENTS ON PLAT THAT ARE RELATED TO CORNERS OF RECORD DIGNITY. MONUMENTATION THAT IS TO BE SET OR IS NOT DESCRIBED BY RECORD DOCUMENTS DOES NOT MEET OR SATISFY THE TEXAS BOARD OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS RULE(S)

33. _____ _____ PROVIDE A SIGNED LETTER TITILED **"REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION"** FROM THE RESPONSIBLE REGISTERED PROFESSIONAL LAND SURVEYOR SHALL BE SUBMITTED TO THE CITY SURVEYOR STATING REQUEST FOR A FIELD INSPECTION AND VERIFICATION OF SUBDIVISION MONUMENTATION

MONUMENTATION SHALL BE FLAGGED AND MARKED FOR FIELD INSPECTION UPON DATE OF FIRST SUBMITTAL. IF MONUMENTATION HAS NOT BEEN SET OR MARKED, ANOTHER REQUEST LETTER MUST BE SUBMITTED. UNDER NO CIRCUMSTANCES SHALL A PLAT ACHIEVE ACCEPTABLE STATUS WITHOUT A **REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION** LETTER AND CONFIRMATION OF SAME BY CITY SURVEYOR FIELD INSPECTION

EASEMENT REQUIREMENTS

34. _____ _____ LABEL & DIMENSION EXISTING EASEMENTS AS MUCH AS POSSIBLE:
    - LABEL TYPE OF EASEMENT, LABEL VOLUME AND PAGE OR COUNTY CLERK FILE No., AND LABEL EASEMENT RECORDING DATA (D.R.D.C.T., ETC.). **AT A MINIMUM, TIE ESMT. TO BOUNDARY AT ITS' ENTRANCE & EXIT. EASEMENTS MUST BE LOCATABLE.** USE ENLARGED DETAIL AS NECESSARY OR AS DIRECTED BY CITY STAFF.

35. _____ _____ EASEMENTS CREATED BY THIS PLAT SHALL BE LABELED AS TO TYPE:
    - City Utility Easement
    - Public Utility Easement
    - Drainage Easement
    - Detention Easement
    - Access Easement
    - Street Easement
    - Pedestrian Easement, Pedestrian & Public Utility Easement, Pedestrian and Bike Trail Easement
    - Wall Maintenance Easement
    - Visibility, Access and Maintenance Easement

    - LOCATED WITH BEARINGS AND DISTANCES ON ALL COURSES
    - **SHALL BE LABELED "BY THIS PLAT"**. IF GRAPHICALLY LIMITED BY SPACE, A NOTE MAY BE PLACED ON THE PLAT STATING "ALL EASEMENTS SHOWN HEREON ARE DEDICATED BY THIS PLAT UNLESS SPECIFICALLY NOTED OTHERWISE BY INSTRUMENT RECORDING INFORMATION". IF DEDICATED BY SEPARATE INSTRUMENT SHOW VOLUME AND PAGE/COUNTY CLERK INSTRUMENT NUMBER(S) AND SOURCE OF RECORD (i.e.-O.P.R.D.C.T., D.R.D.C.T., etc.).
    - **LOCATABLE; USE ENLARGED DETAIL AS NECESSARY OR AS DIRECTED BY CITY STAFF.**

36. _____ _____ ALL EASEMENT COMMENTS (IF ANY) FROM CIVIL ENGINEERING PLAN SET REVIEW SHALL BE INCORPORATED AND SHOWN ON PLAT.

37. _____ _____ ALL EASEMENTS SHALL BE SHOWN AS A DASHED LINETYPE. WHERE SEVERAL EASEMENTS ARE PARALLEL OR OTHERWISE INDISTINGUISHABLE, **USE SMALLER/LARGER SCALE ON LINETYPES FOR EACH.**

38. _____ _____ ALL ON-SITE OR OFF-SITE EASEMENTS BY SEPARATE INSTRUMENT THAT ARE REQUIRED FOR DEVELOPMENT **SHALL BE SHOWN** ALONG WITH VOLUME AND PAGE/COUNTY CLERK INST. NUMBER(S) OF RECORDING AND A COPY PROVIDED TO THE ENGINEERING DEPARTMENT. ***THE PLAT WILL NOT BE APPROVED WITHOUT THIS INFORMATION.***

39. _____ _____ AREAS TO BE ABANDONED BY SEPARATE INSTRUMENT WITHIN THE PLATTED AREA SHALL BE PROCESSED BY SEPARATE DOCUMENT (ABANDONMENT APPLICATION, CITY COUNCIL APPROVAL, & ABANDONMENT INSTRUMENT) AND RECORDING DATA AND ORDINANCE/RESOLUTION NUMBERS SHALL BE NOTED ON PLAT **PRIOR TO APPROVAL**.

TITLE BLOCK AND LEGAL ELEMENTS

40. _____ _____ TITLE BLOCK (USE THE FOLLOWING SEQUENCE FOR LAYOUT; 1-7) see examples below
    - LOCATED AT LOWER RIGHT HAND CORNER
    - (1) ALL SUBMITTALS TO THE ENGINEERING DEPARTMENT SHALL BE TITLED AS "WORKING PLAT" ABOVE THE PLAT TYPE (ie. Final, Replat, Amending, etc.), UNTIL IT ACHIEVES ***ACCEPTABLE STATUS*** (notification will be sent by Engineering Department). "WORKING PLAT" DESIGNATION SHALL BE REMOVED AT TIME OF PLAT APPLICATION TO THE PLANNING DEPARTMENT.
    - (2) APPLICABLE PLAT TYPE. FOR FINAL PLAT, CHANGE TITLE FROM PRELIMINARY PLAT TO **FINAL PLAT.** FOR CONVEYANCE PLATS, MINOR PLATS, AMENDING PLATS, VACATION PLATS, HEADING IN TITLE BLOCK SHOULD BE LABELED **AS SUCH.**

(continued on next page)

- (3) **ADDITION NAME** (section no., or installment no. if needed). **THIS TEXT SHOULD STAND OUT OR BE LARGER THAN ANY OTHER IN THE TITLE BLOCK**. THERE CAN BE NO DUPLICATION OF (OR CLOSELY SIMILAR TO) ANY EXISTING SUBDIVISION NAME. **ADDITION NAMES CANNOT BEGIN WITH THE WORDS "THE" OR "REPLAT" OR A NUMBER** (i.e.- THE DUCK CREEK ADDITION, REPLAT OF DUCK CREEK ADDITION, OR 2116 DUCK CREEKADDITION)
- (4) **LOT 000** (a number), **BLOCK 0000** (a number), (i.e.- LOTS 1-12, BLOCK 1). REFERENCE SOURCE (IF APPLICABLE; i.e.- REPLAT OF LOT 00, BLOCK 000, OF THE SNARLEY ADDITION) ***USE SMALLER/LIGHTER WEIGHT FONT THAN PLAT NAME***
- (5) **SURVEY AND ABSTRACT NO.** (i.e.-JAMES WINSLOW SURVEY, ABSTRACT NO. 000)
- (6) **CITY OF GARLAND, DALLAS COUNTY, TEXAS** (OR APPROPRIATE COUNTY), SHALL BE ON PLAT
- (7) **CITY CASE NUMBER** (ISSUED WITH SUBDIVISION APPLICATION, I.E. 190531-2).

WORKING PLAT
FINAL PLAT
DUCK CREEK NO. 3 ADDITION
LOTS 1-185, BLOCK 1
REASON CRIST SURVEY, ABSTRACT NO. 153
CITY OF GARLAND, DALLAS COUNTY, TEXAS
CITY CASE NO. 111111-1

or

WORKING PLAT
FINAL PLAT
OAKWOOD ESTATES
LOTS 1,2,3 BLOCK 1
A REPLAT OF LOTS 4, 5, 6, BLOCK 7 OF
GLENWOOD HEIGHTS NO. 2
REASON CRIST SURVEY, ABSTRACT NO. 153
CITY OF GARLAND, DALLAS COUNTY, TEXAS
CITY CASE NO. 222222-2

or

WORKING PLAT
REPLAT
GARLAND ACRES SECOND REPLAT
LOTS 3R & 4, BLOCK 1
A REPLAT OF LOTS 2 & 3,, BLOCK 1 OF
GARLAND ACRES REPLAT
JOHN LITTLE SURVEY, ABSTRACT NO. 761
CITY OF GARLAND, DALLAS COUNTY, TEXAS
CITY CASE NO. 333333-3

41. _____ _____ ORDER OF LEGAL ELEMENTS SHALL BE FROM TOP OF THE SHEET TO THE BOTTOM, READING FROM LEFT TO RIGHT (if more than one column) AS FOLLOWS, UNLESS CITY STAFF ALTERNATE ORDER IS APPROVED:
    1. OWNER'S CERTIFICATE INCLUDING METES & BOUNDS DESCRIPTION
    2. OWNER'S DEDICATION INCLUDING OWNER'S SIGNATURE BLOCK
    3. OWNER'S NOTARY ACKNOWLEDGMENT(S)
    4. SURVEYOR'S STATEMENT
    5. SURVEYOR'S NOTARY ACKNOWLEDGMENT
    6. PLAN COMMISSION SIGNATURE BLOCK INCLUDING 180 DAY FILING STATEMENT

42. _____ _____ **OWNER'S CERTIFICATE** (***CENTER*** & LABEL HEADING; OWNER'S CERTIFICATE)
    - LABEL; **STATE OF TEXAS**
    - LABEL; **COUNTY OF DALLAS** (OR APPROPRIATE COUNTY)
    - OWNER'S NAME (**SHALL MATCH DEED *EXACTLY***). IF OWNER'S NAME HAS BEEN LEGALLY CHANGED SINCE RECORDING OF VESTING DEED, PROVIDE LEGAL DOCUMENTS STATING SUCH.

43. _____ _____ **LEGAL DESCRIPTION/METES & BOUNDS**

GENERAL DESCRIPTION:

- VESTING DEED FOR CURRENT OWNER REFERENCED WITH COMPLETE RECORDING INFORMATION IN GENERAL DESCRIPTION OF LEGAL, **A COPY OF THE RECORDED DEED(S) SHALL BE FURNISHED FOR PLATTED PROPERTY. ATTACH TO SUBMITTAL.**
- **REFERENCE:**
  - SURVEY, ABSTRACT NO.
  - TRACT INFORMATION (TRACT NUMBER (IF ANY), ACREAGE, PARENT TRACT CONVEYENCE / RECORDING INFORMATION, PREVIOUS TRACT CONVEYANCE / RECORDING INFO. AS NECESSARY, , ETC.)
  - IF PREVIOUSLY PLATTED, CITE PRIOR ADDITION NAME, INCLUDE SUBJECT LOT AND BLOCK, WITH VOLUME AND PAGE, OR PREVIOUS OWNERS AND DEEDS OF REFERENCE, WITH VOLUME AND PAGE OR COUNTY CLERK INST. No., AND COUNTY RECORD LOCATION.

SPECIFIC DESCRIPTION:

- POINT OF COMMENCING (IF APPLICABLE)
- POINT OF BEGINNING
- COMMENCE OR BEGIN AT A STREET INTERSECTION, RECORDED ADDITION CORNER, OR LOT CORNER OF A RECORDED ADDITION.
- PROVIDE BEARINGS AND DISTANCES (BEARINGS TO SECONDS, DISTANCES TO HUNDRETHS), AND CURVE DATA TO INCLUDE:
  - i. DIRECTION TO THE RIGHT OR LEFT
  - ii. CENTRAL ANGLE
  - iii. RADIUS
  - iv. CHORD BEARING FROM THE BEGINNING OF THE CURVE
  - v. CHORD LENGTH
  - vi. ARC LENGTH
- **COMPLETE MONUMENTATION DESCRIPTIONS** (EXAMPLE: TO A 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "RPLS 7777" SET).
- CONCLUDE LISTING **SQUARE FOOTAGE *AND* ACREAGE** OF PLATTED AREA, I.E. AND CONTAINING 43,560 SQUARE FEET OR 1.000 ACRES OF LAND (SQUARE FEET TO WHOLE FOOT, AND ACREAGE TO THOUSANDTHS, **NO EXCEPTIONS**).

44. _____ _____ **OWNER'S DEDICATION** (***CENTER*** & LABEL HEADING; OWNER'S DEDICATION)

- NAME OF ADDITION IN DEDICATION *SHALL BE IN BOLD TYPE*. **DO NOT PUT LOT AND BLOCK NUMBERS WITH NAME OF ADDITION.**
- USE APPROPRIATE FORM OF STANDARD CITY OF GARLAND DEDICATION LANGUAGE (i.e.-corporate owner, private/individual owner, private streets, access esmts., etc.).
- IF APPLICABLE, INCLUDE ACCESS ESMT, DRAINAGE WAY, DETENTION AREA, OR OTHER APPROPRIATE EASEMENT LANGUAGE PER CITY OF GARLAND TECHNICAL STANDARDS MANUAL.
- OWNER'S SIGNATURE BLOCK SHALL CONTAIN THE PERSON'S PRINTED NAME UNDER THE SIGNATURE LINE. IF THE PERSON IS SIGNING ON BEHALF OF A CORPORATION, CHURCH, OR OTHER BUSINESS ENTITY, PROVIDE THEIR PRINTED NAME & TITLE OR PROVIDE SEPARATE LINES LABELED "**PRINTED NAME**" AND "**TITLE**" IF IT IS UNKNOWN

45. _____ _____ THE FOLLOWING STATEMENT WILL BE USED FOR THE SURVEYOR'S STATEMENT ON THE RECORDED FINAL PLAT:

(continued on next page)

SURVEYOR'S STATEMENT (*center heading*):

I,_____, a Registered Professional Land Surveyor, licensed by the State of Texas, affirm that this plat was prepared under my direct supervision, from recorded documentation, evidence collected on the ground during field operations and other reliable documentation; and that this plat substantially complies with the Rules and Regulations of the Texas Board of Professional Engineers and Land Surveyors, Texas Local Government Code, Chapter 212, and the City of Garland Development Code. I further affirm that monumentation shown hereon was either found or placed as described hereon and is in substantial compliance with the City of Garland Development Code; and that the digital drawing file accompanying this plat is a precise representation of this Signed Final Plat

Dated this the_____day of_____, 20

(Signature) _____

(Surveyor's Typed Name)
Texas Registered Professional Land Surveyor No. _____

46. _____ _____ **PLAN COMMISSION SIGNATURE BLOCK** (FOR CHAIRMAN & PLANNING DIR.) or **ADMINISTRAVELY APPROVED SIGNATURE BLOCK** (FOR DIRECTOR OF PLANNING & CITY SURVEYOR), **INCLUDING 180 DAY FILING STATEMENT** (ALLOWABLE TIME FOR FILING)

47. _____ _____ **NOTARY STATEMENTS FOR ALL SIGNING PARTIES**
- OWNER/OWNERS, OWNER'S AGENT
- LAND SURVEYOR

48. _____ _____ PROVIDE **2"x4"** DOTTED OR DASHED BOX LABELED WITH GREYSCALE OR DOT FONT STATING **"*SPACE RESERVED FOR COUNTY RECORDING LABEL*"**

49. _____ _____ **FLOODWAY/FLOODPLAIN REQUIREMENTS, ETC**. (FOR PLATS IN FLOODPLAIN, JURISDICTIONAL WATERS OF THE U.S., ETC.)
- FOR PLATS WITH MINIMUM FINISH FLOOR ELEVATIONS, THE FOLLOWING ITEMS SHALL BE CITED IN THE GENERAL NOTES SECTION ON THE FACE OF THE PLAT:
  - **THE FLOOD STUDY, FIRM PANEL/FIS, OR OTHER SOURCE USED TO DETERMINE THE MINIMUM FINISH FLOOR ELEVATION(S) TO INCLUDE BUT NOT LIMITED TO:**
    - THE **PRIMARY BENCHMARK(S)** USED FOR THE FLOOD STUDY (if flood study is used),
    - THE **PRIMARY & SECONDARY BENCHMARK(S)** USED ON THE APPROVED CIVIL ENGINEERING CONSTRUCTION PLANS (if flood study is not used or is unavailable)
    - OTHER PERTINENT ITEMS IDENTIFIED (i.e. - Engineering Firm/Engineer, Panel Number/FIS Volume, Date of Document/Study, etc.) AND OTHER INFORMATION AS DIRECTED BY THE ENGINEERING DEPT.
- FLOODWAY/FLOODPLAIN MAY REQUIRE DEDICATION AS AN EASEMENT OR IN FEE AT THE DISCRETION OF THE DIRECTOR OF ENGINEERING
- IF REQUIRED, MONUMENTATION SET ON LINE, TO BE SHOWN ON THE PLAT DRAWING

50. _____ _____ **FRANCHISE UTILITY NOTIFICATION LETTERS** SHALL BE PROVIDED TO EACH FRANCHISE UTILITY PROVIDER BEFORE PLAT WILL BE ALLOWED TO PROCEED TO PLAN COMMISSION. COPIES OF THE LETTERS SENT SHALL ALSO ACCOMPANY THE PLAT APPLICATION TO THE PLANNING DEPARTMENT. FRANCHISE UTILITY CONTACT INFO. AND SAMPLE LETTER IS AVAILABLE FROM THE ENGINEERING DEPT. (IT IS THE APPLICANT'S RESPONSIBILITY TO OBTAIN CURRENT CONTACT INFO. FOR FRANCHISE UTILITIES IF PROVIDED LIST IS NOT CURRENT)

51. _____ _____ **APPROVAL LETTERS, MISC. (if applicable)** ANY LETTERS OF AGREEMENT FROM OTHER ENTITIES SUCH AS, BUT NOT LIMITED TO, CITY OF GARLAND PARKS DEPT., TMPA, NTMWD, ETC. SHALL BE PROVIDED BEFORE PLAT WILL BE ALLOWED TO PROCEED TO PLAN COMMISSION OR BE ADMINISTRATIVELY APPROVED

52. _____ _____ **CITY SURVEYOR'S MARK-UP** INCLUDE AND RETURN CITY SURVEYOR'S CURRENT MARK-UP OF THE CURRENT PLAT SUBMITTAL WITH THE NEXT SUBMITTAL. SHOW THAT COMMENTS HAVE BEEN ADDRESSED BY HIGHLIGHTING EACH COMMENT.

53. _____ _____ **FOLDED PLATS** *ALL PLATS SHALL BE FOLDED* ACCORDING TO THE INSTRUCTIONS ATTACHED HERETO (***TITLE BLOCK OUT***), **OR** BE 8-1/2" x 12" OR SMALLER, **NO EXCEPTIONS**.

I, the surveyor of record, understand and agree that the City Surveyor's office will require that the plat be resubmitted for review if it is determined that this checklist contained incomplete or incorrect information. By review of this plat, the City Surveyor's office and Engineering Department do not assume any liability for this plat nor does this review release the surveyor of record from his/her responsibilities as a surveyor set forth by the Texas Board of Professional Engineers and Land Surveyors. The plat must meet all standards set forth in the Garland Development Code.

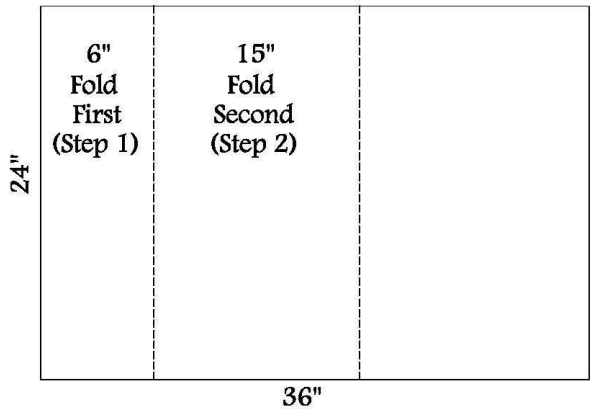
Signature:_____Date:_____
Printed Name: _____, RPLS

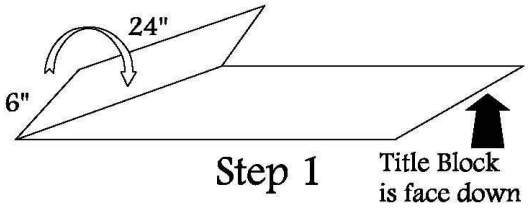
ADDITIONAL COMMENTS: ***SEE RED-LINE MARK-UP FOR FURTHER INFO.***

_____
_____
_____
_____
_____

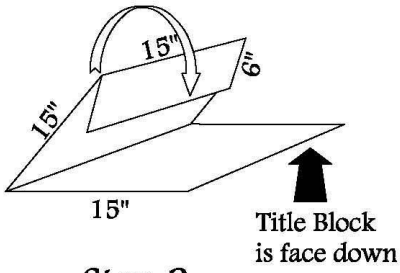
FINISHED FOLDED SIZE SHALL BE APPROXIMATELY 7.5” X 12” AND FOLDED SO
OUTSIDE PORTION IS THE TITLE BLOCK

Folding a 24" x 36" Plat
WITH TITLE BLOCK OUT

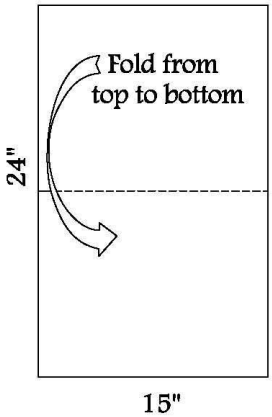


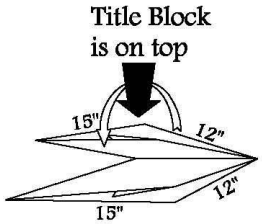


Step 1

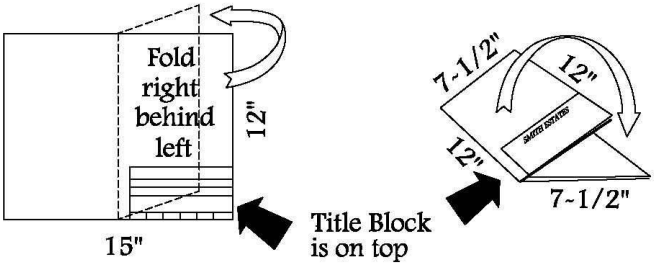


Step 2





Step 3



Step 4

Appendix 3B: Subdivision Plat Dedication Language

City of Garland

Subdivision Plat Dedication Language

4/18/2019

Contact: Glenn S. Breysacher, City Surveyor
Phone – 972.205.2157
Email – gbreysac@garlandtx.gov

Dedication form for an ***individual*** *(NO HOA):*

NOW THEREFORE, KNOW ALL BY THESE PRESENTS:

That _____, the owner of the property described in this plat does hereby adopt this plat, designating the property as _____ an addition to the City of Garland, Dallas County, Texas and does hereby dedicate, in fee simple and to the public use forever, any streets and alleys shown thereon and does further dedicate to the public use forever the easements shown thereon for the purposes indicated; provided, however, that no public dedication is made or intended as to any private easement, screen wall easement, or wall maintenance easement shown on this plat. All easements dedicated by this plat shall be open to, without limitation, all public and private utilities using or desiring to use the same for the purposes dedicated. No building, fence, tree, shrub, or other structure, improvement or growth shall be constructed, reconstructed or placed upon, over or across any easement dedicated by this plat in such a manner as to restrict the use or scope of, or interfere with the purpose and intent of the easement. Any public or private utility shall have: (1) the right to remove and keep removed all or any part of any building, fence, tree, shrub, or other structure, improvement or growth which in any way may endanger or interfere with the construction, reconstruction, maintenance, operation or efficiency of such utility; and (2) the right of ingress and egress to or from and upon such easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining and adding to, enlarging, or removing all or parts of its operation without the necessity at any time of procuring the permission of anyone. The maintenance of paving on utility easements and fire lanes is the responsibility of the property owner. Any and all maintenance of screening walls, screen wall easements, retaining walls, and wall maintenance easements is the responsibility of the property owner, their successors, or assigns.

All utility easements dedicated by this plat shall also include an additional area of working space for construction, reconstruction, additions, enlargements, and maintenance including such additional area necessary for installation and maintenance of manholes, cleanouts, fire hydrants, water services and wastewater services from the main to the curb or pavement line.

Dedication form for an ***individual*** *(WITH HOA):*

NOW THEREFORE, KNOW ALL BY THESE PRESENTS:

That _____, the owner of the property described in this plat, does hereby adopt this plat, designating the property as _____ an addition to the City of Garland, Dallas County, Texas and does hereby dedicate, in fee simple and to the public use forever, the streets and alleys shown thereon and does further dedicate to the public use forever the easements shown thereon for the purposes indicated; provided, however, that no public dedication is made or intended as to any private easement, screen wall easement, or wall maintenance easement shown on this plat. All easements dedicated by this plat shall be open to, without limitation, all public and private utilities using or desiring to use the same for the purposes dedicated. No building, fence, tree, shrub, or other structure, improvement or growth shall be constructed, reconstructed or placed upon, over or across any public easement dedicated by this plat in such a manner as to restrict the use or scope of, or interfere with the purpose and intent of the easement. Any public or private utility shall have: (1) the right to remove and keep removed all or any part of any building, fence, tree, shrub, or other structure, improvement or growth which in any way may endanger or interfere with the construction, reconstruction, maintenance, operation or efficiency of such utility within a public easement; and (2) the right of ingress and egress to or from and upon the such easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining and adding to, enlarging, or removing all or parts of its operation without the necessity at any time of procuring the permission of anyone. The maintenance of paving on utility easements and fire lanes is the responsibility of the property owner. Any and all maintenance of Home Owners Association common areas or lots, private easements, screening walls, screen wall easements and wall maintenance easements is the responsibility of the Home Owners Association, its successors, or assigns.

All utility easements dedicated by this plat shall also include an additional area of working space for construction, reconstruction, additions, enlargements, and maintenance including such additional area necessary for installation and maintenance of manholes, cleanouts, fire hydrants, water services and wastewater services from the main to the curb or pavement line.

Dedication form for ***corporations, partnerships, trusts, and other business entities*** *(NO HOA):*

NOW THEREFORE, KNOW ALL BY THESE PRESENTS:

That _____, the owner of the property described in this plat, acting by and through its duly authorized agent, does hereby adopt this plat, designating the property as _____ an addition to the City of Garland, Dallas County, Texas and does hereby dedicate, in fee simple and to the public use forever, any streets and alleys shown thereon and does further dedicate to the public use forever the easements shown thereon for the purposes indicated; provided, however, that no public dedication is made or intended as to any private easement, screen wall easement, or wall maintenance easement shown on this plat. All easements dedicated by this plat shall be open to, without limitation, all public and private utilities using or desiring to use the same for the purposes dedicated. No building, fence, tree, shrub, or other structure, improvement or growth shall be constructed, reconstructed or placed upon, over or across any easement dedicated by this plat in such a manner as to restrict the use or scope of, or interfere with the purpose and intent of the easement. Any public or private utility shall have: (1) the right to remove and keep removed all or any part of any building, fence, tree, shrub, or other structure, improvement or growth which in any way may endanger or interfere with the construction, reconstruction, maintenance, operation or efficiency of such utility; and (2) the right of ingress and egress to or from and upon such easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining and adding to, enlarging, or removing all or parts of its operation without the necessity at any time of procuring the permission of anyone. The maintenance of paving on utility easements and fire lanes is the responsibility of the property owner. Any and all maintenance of screening walls, screen wall easements, retaining walls, and wall maintenance easements is the responsibility of the property owner, its successors, or assigns.

All utility easements dedicated by this plat shall also include an additional area of working space for construction, reconstruction, additions, enlargements, and maintenance including such additional area necessary for installation and maintenance of manholes, cleanouts, fire hydrants, water services and wastewater services from the main to the curb or pavement line.

Dedication form for ***corporations, partnerships, trusts, and other business entities*** *(WITH HOA):*

NOW THEREFORE, KNOW ALL BY THESE PRESENTS:

That _____, the owner of the property described in this plat, acting by and through its duly authorized agent, does hereby adopt this plat, designating the property as _____ an addition to the City of Garland, Dallas County, Texas and does hereby dedicate, in fee simple and to the public use forever, the streets and alleys shown thereon and does further dedicate to the public use forever the easements shown thereon for the purposes indicated; provided, however, that no public dedication is made or intended as to any private easement, screen wall easement, or wall maintenance easement shown on this plat. All easements dedicated by this plat shall be open to, without limitation, all public and private utilities using or desiring to use the same for the purposes dedicated. No building, fence, tree, shrub, or other structure, improvement or growth shall be constructed, reconstructed or placed upon, over or across any public easement dedicated by this plat in such a manner as to restrict the use or scope of, or interfere with the purpose and intent of the easement. Any public or private utility shall have: (1) the right to remove and keep removed all or any part of any building, fence, tree, shrub, or other structure, improvement or growth which in any way may endanger or interfere with the construction, reconstruction, maintenance, operation or efficiency of such utility within a public easement; and (2) the right of ingress and egress to or from and upon the such easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining and adding to, enlarging, or removing all or parts of its operation without the necessity at any time of procuring the permission of anyone. The maintenance of paving on utility easements and fire lanes is the responsibility of the property owner. Any and all maintenance of Home Owners Association common areas or lots, private easements, screening walls, screen wall easements and wall maintenance easements is the responsibility of the Home Owners Association, its successors, or assigns.

All utility easements dedicated by this plat shall also include an additional area of working space for construction, reconstruction, additions, enlargements, and maintenance including such additional area necessary for installation and maintenance of manholes, cleanouts, fire hydrants, water services and wastewater services from the main to the curb or pavement line.

[Additional dedications asrequired:]

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS A DRAINAGE EASEMENT OR FLOODWAY]:

Each property owner shall keep the drainage channels and/or drainage and floodway easements traversing or adjacent to his property clean and free of debris, silt, and any other substance which may impede the flow of stormwater or result in unsanitary conditions. This includes all necessary establishment of ground cover, slope stabilization, mowing, weeding, litter pick-up, and other normal property owner responsibilities. The City of Garland shall have the right of ingress and egress for the purposes of inspection and supervision of maintenance work by the property owner to alleviate any undesirable conditions which may occur.

No obstruction to the natural flow of stormwater runoff shall be permitted by filling or by construction of any type, including, but not limited to, construction of any dam, building, fence, bridge, walkway, or any other structure within the drainage channels or easements, unless approved by the City of Garland, provided, however, it is understood that in the event it becomes necessary for the City of Garland to erect any type of drainage structure in order to improve the storm drainage that may be occasioned by the streets and alleys in or adjacent to the subdivision, then in such event, the City shall have the right to enter upon the drainage or floodway easements at any point or points to erect, construct, or maintain any drainage facility deemed necessary for drainage purposes.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS A DETENTION, RETENTION, OR AMENITY POND AREA]:

The City of Garland, Texas shall not be responsible for the maintenance or operation of any detention [INSERT RETENTION OR AMENITY POND AS NECESSARY] area designated on this plat or for any damage or injury to property or persons that results from the flow of water along, into or out of those detention areas, or for the control of erosion. The construction, operation, and maintenance of any detention area designated on this plat is controlled by and subject to the applicable provisions of the Code of Ordinances of the City of Garland, as amended, or the Garland Development Code, as amended.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS A MINIMUM FINISHED FLOOR ELEVATION FOR ANY LOT]

The City reserves the right to require minimum finish floor elevations on any lot contained within this addition. The minimum elevations shown are based on the most current information available at the time the plat is filed and are subject to change.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS ACCESS EASEMENTS]

The undersigned does covenant and agree that the access easement(s) dedicated on this plat may be utilized by any person, including the general public, for ingress and egress to other real property,

for both vehicular and pedestrian use and access, in, along, upon and across the premises containing the access easement(s).This plat approved subject to all applicable ordinances, rules, regulations, and resolutions of the City of Garland, Texas.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS A STREET EASEMENT]

The area or areas shown on the plat as "Street Easement" are hereby given and granted to the City of Garland ("City"), its successors and assigns, as an easement to construct, reconstruct, operate, repair, re-build, replace, relocate, alter, remove and perpetually maintain street and highway facilities, together with all appurtenances and incidental improvements, in, upon and across certain real property owned by Grantor. Appurtenances and incidental improvements include, but are not limited to, curbs, gutters, inlets, aprons, traffic signs with or without attached flashing lights, guard rails, sidewalks, buried conduits, buried City utilities, and underground franchise utilities. Street Easements shall remain accessible at all times and shall be maintained by the Owners of the lot or lots that are traversed by, or adjacent to the Street Easement. After doing any work in connection with the construction, operation or repair of the street and highway facilities, the City shall restore the surface of the Street Easement as close to the condition in which it was found before such work was undertaken as is reasonably practicable, except for trees, shrubs and structures within the Street Easement that were removed as a result of such work.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS A VISIBILITY, ACCESS AND MAINTENANCE EASEMENT (VAM)]

The area or areas shown on the plat as "VAM" (Visibility, Access and Maintenance) Easement(s) are hereby given and granted to the City of Garland ("City"), its successors and assigns, as an easement to provide visibility, right of access, and maintenance upon and across said VAM Easement. Property owners of corner lots shall maintain the VAM Easement(s) in accordance with Chapter Eight of the Technical Standards Manual of the City of Garland, Texas. The City shall have the right, but not the obligation, to maintain all landscaping within the VAM Easement. Should the City exercise this maintenance right it shall be permitted to remove and dispose of any and all landscaping improvements, including without limitation, any trees, shrubs, flowers, ground cover, structure and/or fixtures. The City in its sole discretion may withdraw maintenance of the VAM Easement at any time. The ultimate maintenance responsibility for the VAM Easement shall rest with the property owner(s). No building, fence, wall, screen, berm, sign, parking stall, drive aisle, driveway, hedge, shrub, tree, or other improvements or growths, which in any way endanger or interfere with the visibility, shall be constructed in, on, over, or across the VAM Easement. The City shall also have the right, but not the obligation, to add any landscape improvements to the VAM Easement, to erect any traffic control devices or signs on the VAM Easement, and to remove any obstruction thereon. The City, its successors, assigns, or agents shall have the right and privilege at all times to enter upon the VAM Easement or any part thereof for the purposes and with all rights and privileges set forth herein.

[INCLUDE THE FOLLOWING PROVISION IF THE PLAT CONTAINS PEDESTRIAN & BIKE TRAIL EASEMENTS]

The Pedestrian and Bike Trail Easement is hereby dedicated for pedestrian, passive recreational trail purposes, such as walking, hiking, jogging, bicycling, and other similar recreational purposes. The City of Garland shall have the right to occupy, maintain, re-grade, modify, and expand trail improvements and use the surface of the Pedestrian and Bike Trail Easement Area. However, the property owner shall retain title to all improvements and is responsible for designing, constructing, and maintaining all improvements to the minimum standards set by applicable city, state, and federal laws and regulations. Notwithstanding any other language contained herein to the contrary, the City is not required to maintain the Pedestrian and Bike Trail Easement or any improvements therein. In the event the City elects to conduct maintenance, modification, or expansion activities to any improvements within the Pedestrian and Bike Trail Easement, the City shall obtain prior written authorization from the property owner, which shall not be unreasonably withheld, before making substantive modifications to, or conducting maintenance activities on, trail improvements.

[Owner's Signature block and Notary Acknowledgement]

This plat approved subject to all applicable ordinances, rules, regulations, and resolutions of the City of Garland, Texas.

WITNESS, my hand at Garland, Texas, this the _____ day of _____, 20_____.

BY:_____
AUTHORIZED SIGNATURE

STATE OF TEXAS §
§
COUNTY OF DALLAS §

Before me, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration and under the authority therein expressed.

GIVEN under my hand and seal of office this _____ day of _____, 20__.

_____
Notary Public for and in the State of Texas

My commission expires: _____

Dedication form for Vacation Plats:

- The word "VACATED" shall be stamped across the platted area and above title block.
- The vacated plat and the new final plat submitted on a property shall be considered at the same time and filed for record at the same time.

Every plat of a subdivision which is being vacated shall contain the following inscription:

WHEREAS, _____ presented to the City Plan Commission of the City of Garland, Texas, this plat for approval; and

WHEREAS, at its' meeting on _____, the City Plan Commission of the City of Garland, approved this plat;

WHEREAS, this plat was filed for record in the Official Public Records of Dallas County, Texas, on the _____ and recorded in Volume _____, Page _____, ***[OR INSTRUMENT NUMBER IF FILED AFTER MID-2005]*** of the Official Public Records of Dallas County, Texas; and

WHEREAS, it is the desire of the owner of the property to vacate this plat.

NOW, THEREFORE, KNOW ALL BY THESE PRESENTS:

THAT, _____, owner of the property described in this plat, does hereby vacate the said plat so that it shall no longer have any force or effect for any purpose.

EXECUTED this the _____ day of _____, 20__

{NOTARY SEAL}

CERTIFICATION OF VACATION

I, _____, Chairman of the City Plan Commission of the City of Garland, Texas, do hereby certify that this plat originally approved by the City Plan Commission on the _____, and recorded in Volume _____, Page _____, ***[OR INSTRUMENT NUMBER IF FILED AFTER MID-2005]*** of the Official Public Records of Dallas County, Texas, has been presented to the City Plan Commission of the City of Garland, Texas, for vacation and that the City Plan Commission on the _____, did hereby vacate this plat, so that it shall no longer have any force or affect.

_____ _____

City Secretary Chairman, City Plan Commission
City of Garland, Texas

RIGHT-OF-WAY AND EASEMENT ABANDONMENT/VACATION

Rights-of-way and easements are dedicated to the City and are held in trust for public use for the intended purpose. Public right-of-way and easement abandonment is the process by which the City releases the public's interest, if any, in rights-of-way or easements. Only the City council can formally abandon City of Garland right-of-way or easements. Some form of consideration may be required for abandoned rights-of-way and easements, which shall be determined at the time of application review. All abandonment requests require a pre-submittal meeting to initiate the process, consent letters from franchise utilities, and are subject to a public hearing before City Council. Any letters of agreement from other entities including, but not limited to, City of Garland Parks Dept., T.M.P.A., N.T.M.W.D., etc. shall be provided to the Engineering Department. Franchise utility contact information and a sample letter is available from the Engineering Dept. It is the applicant's responsibility to obtain current contact information for franchise utilities if the provided contact list has changed. It is recommended that a Registered Professional Land Surveyor be contacted for preparation of required survey documents. This application shall be not accepted unless complete at time of submittal to the Engineering Department.

The following documents are required for easement or right-of-way abandonment:

1. Letter to the Director of Engineering requesting the abandonment of a City right-of-way or easement, and the subsequent purpose for which the property shall be used. Please reference case number (assigned by the Planning Dept.) on all correspondence and submittals;

2. After review of the request, the Director of Engineering may direct the applicant to complete the Application for the Vacation/Abandonment of a Public Easement, Street or Alley Right of Way form. The application shall include, but not be limited to an exhibit containing a boundary survey with metes and bounds description of the area to be abandoned, a survey plat or graphical depiction of the area to be abandoned, both labeled as "Exhibit 'A'" at the top of each sheet, and signed and sealed by a registered professional land surveyor in the State of Texas. The survey plat shall depict all existing easements and rights-of-way of record. The boundary survey shall substantially conform to the City of Garland Engineering Dept. Technical Standards Manual Appendix Section 3G for Field Note Guidelines. However, if a separate instrument of the public easement, street, or alley has been filed of record with the appropriate County Clerk's office, then a copy of that filed instrument shall be furnished to the Engineering Department with this application in lieu of the plat or survey. The existing separate instrument may be used, at the discretion of the City Surveyor or City Attorney's office, as the abandonment exhibit. If so, the existing instrument shall be labeled "Exhibit 'A'" at the top of each page. Additionally, provide a separate survey drawing locating and labeling on the ground locations of all contiguous and intersecting public and private utility lines, structures, or other facilities within the abandonment area;

3. A copy of the recorded plat or separate instrument that created the right-of-way or easement;

4. Letters of consent from all public/franchise utility companies (if applicable);

5. Consent from all abutting property owners (if applicable).

Public rights-of-way or easements may have been acquired by plat, deed, or separate instruments. Typically, the easement would need to be abandoned in the manner in which it was dedicated. That is to say, if the easement was created by plat, it would most likely need to be abandoned by replat, or if created by separate instrument, then it would most likely need to be abandoned by a separate instrument.

In instances where a replat is required, the applicant should follow the platting procedure as required by the City of Garland Development Code.

In certain cases, a License Agreement may be more appropriate if the request only involves minor encroachments. Please see Section 3.09 of the TSM for more information.

APPLICATION FOR THE ABANDONMENT/VACATION

APPLICATION FOR THE ABANDONMENT/VACATION OF A PUBLIC EASEMENT, STREET OR ALLEY RIGHT-OF-WAY AT OR NEAR

_____
(Street name, address or nearest intersection)

☐ EASEMENT
☐ STREET
☐ ALLEY

BEING PART OF: _____
(Entire name of subdivision – i.e.-Windsor Park No. 2)

-OR-

SURVEY/ABSTRACT NO.: _____
(Complete if not in a platted subdivision – i.e. - J. Crumpacker Survey, Abstract No. 328)

TO THE CITY OF GARLAND: Date: _____

The undersigned hereby makes application for the abandonment and vacation of that portion of the public easement, street, or alley right-of-way as indicated above, and more particularly described or depicted in Exhibit "A", attached hereto. **If a separate instrument of the public easement, street, or alley has been filed of record with the appropriate County Clerk's office, then it is preferred that a copy of that filed instrument be used, at the discretion of the Engineering Department or City Attorney's Office, as Exhibit "A" (with "EXHIBIT 'A' labeled at the top of each page of the complete document) in lieu of Items No. 1 & 2 below**. In support of this application, the undersigned represents, warrants, and submits the following:

1. A metes and bounds description of the public easement, street, or alley right-of-way proposed for abandonment, is attached hereto as Exhibit "A" (labeled Page One of Two) and incorporated herein by reference, and substantially conforms to the Field Note Guidelines contained in Section 3G of Technical Standards Manual

2. A survey plat graphically depicting the limits of the property interests to be abandoned and being the same property as described in the metes and bounds description in Item 1 above, the record owners and boundary lines of all contiguous lots, tracts, or parcels, and any easements or public facilities contained in the area for which abandonment is requested, attached hereto as Exhibit "A" (labeled Page Two of Two) and incorporated herein by reference.

3. A copy of the recorded plat or separate instrument that created the right-of-way or easement.

4. A copy of the vesting/current deed of ownership **if the application is for abandonment/vacation of an easement**.

5. Signatures of consent, or separate letters of consent to the vacation or abandonment by utility companies, if applicable, attached hereto as Exhibit "B", and incorporated herein by reference.

6. Signatures of consent, or separate letters of consent, to the vacation or abandonment by all the abutting property owner(s), if applicable, attached hereto as Exhibit "C" and incorporated herein by reference.

PROPERTY OWNER/APPLICANT:

The property owner of the property containing the easement, or property owner contiguous to the right-of-way shall sign below.

_____	_____	_____
Printed Name	Title (if applicable)	Phone No.

_____	_____	_____	_____
Street Address	City	State	Zip Code

_____	_____
Signature	Date

APPLICATION FOR THE ABANDONMENT/VACATION OF

_____,
A PUBLIC EASEMENT, STREET OR ALLEY RIGHT-OF-WAY

The following questions should be answered completely.

1. Why does the property owner wish to vacate this easement, street or alley right-of-way?

   _____
   _____
   _____

2. How is this easement or right-of-way currently being used?

   _____
   _____

3. How does the property owner propose to use the area of the easement or right-of-way, if vacated?

   _____
   _____

4. Is it proposed that the City retain an easement for utilities after abandonment, or that a new easement may be platted subsequent to the abandonment? If possible, please indicate if either case is proposed or if it is unknown at this time.

   _____
   _____

5. Are there any public utilities or infrastructure currently located in the easement or right-of-way? If so, please fully describe.

   _____
   _____

Exhibit "B"

The undersigned public utility companies, using or entitled to use, under the terms and provisions of our respective franchise with the City of Garland, that portion of the public easement, street, or alley right-of-way as described in EXHIBIT "A" of the Application to Abandon/Vacate a Public Easement, Street, or Alley Right-of-Way, do hereby CONSENT to the abandonment and vacation of that particular portion of public right-of-way or easement described in said Exhibit "A"

ATMOS ENERGY-GAS

_____

Print Name Title

_____

Signature Date

AT&T

_____

Print Name Title

_____

Signature Date

TIME WARNER

_____

Print Name Title

_____

Signature Date

FRONTIER

Print Name Title

Signature Date

ONCOR ELECTRIC

Print Name Title

Signature Date

GARLAND INDEPENDENT SCHOOL DISTRICT

Print Name Title

Signature Date

GARLAND POWER & LIGHT

Print Name Title

Signature Date

WATER UTILITIES DEPARTMENT/ENGINEERING

Print Name Title

Signature Date

NORTH TEXAS MUNICIPAL WATER DISTRICT

Print Name	Title
Signature	Date

Exhibit "C"

The following abutting/impacted property owners **DO NOT APPROVE** nor give their consent to this request for abandonment/vacation of that particular right-of-way or easement described in Exhibit "A" for the reasons stated herein. If no abutting/impacted property owner(s) exist, indicate such below. This sheet may be copied and attached hereto if additional signatures are required.

Property Owner: _____

Address: _____

Lot: _____ Block: _____ , _____ Addition

_____ _____
Signature Date

Property Owner: _____

Address: _____

Lot: _____ Block: _____ , _____ Addition

_____ _____
Signature Date

Property Owner: _____

Address: _____

Lot: _____ Block: _____ , _____ Addition

_____ _____
Signature Date

Property Owner: _____

Address: _____

Lot: _____ Block: _____ , _____ Addition

_____ _____
Signature Date

Property Owner: _____

Address: _____

Lot: _____ Block: _____ , _____ Addition

_____ _____
Signature Date

INSTRUCTIONS FOR COMPLETING THE LICENSE AGREEMENT

{For "Facilities" in City owned property/Right of Way}

(Please do not attach this page to the submitted document; it is intended for the information of the licensee only)

In order to complete this document, the following steps should be taken:

1. On page 1, please complete the following information:
   a. Please complete the blank marked "Licensee". This is normally the owner of the property or their approved representative.
   b. Please fill in the dollar amount required for the filing fee. This fee amount is based on the number of pages in the document and is set by the Dallas County Clerk's Office. The fee for most license agreements is **$46.00** (six pages total), assuming that one page is used for the required Exhibit "A". If more pages are used, the fee will increase by $4 per page.
   c. For "Facilities", please fill in the type of work to be done, i.e. "Landscaping", "Irrigation Facilities", "Privacy Fence", etc.
   d. For the location, please include the **address of the property**, as well as the **subdivision name, lot, and block**. This information is required by the County and the agreement may be rejected if it is not included.

2. On Signature Page 1, please sign the document and have it notarized in the appropriate locations.

3. An exhibit is required to be included with the agreement. This exhibit must be on an 8-1/2" X 11" paper and must include adequate information to show where the proposed improvements are going within the right-of-way. The exhibit does not have to be to a particular scale, but enough dimensional information needs to be included to accurately locate the improvements. All public right-of-way that are being affected by the agreement must also be shown on the exhibit. **Be sure to include the address and subdivision, lot and block on the exhibit.**

4. Documents to be submitted to the City of Garland Engineering Department at 800 W. Main Street, Third Floor, Garland, TX 75040:

   a. Executed License Agreement Document (Original Document) with the exhibit.
   b. A check for the filing fee payable to the Dallas County Clerk's Office.

   The submittal should be sent to the attention of the Development Engineering Group. Please note that we must have the original document; the County will not accept a copy for filing. Once all of this information has been received, it will be checked for accuracy and completeness. Once the agreement is accepted, our Director of Engineering will countersign and notarize Signature Page 2, and we will send the agreement in to Dallas County for processing. Once the County has recorded the agreement, they will send us a copy for our records. This process normally takes several weeks. Once we receive our record copy back, a copy can be made available to you upon request.

5. If there are any questions, please contact any member of the Development Engineering Group at 972-205-2170.

LICENSE AGREEMENT

This Agreement is made and entered between the City of Garland, Texas (the "City"), a home-rule municipality duly incorporated and existing under the constitution and laws of the State of Texas, and _____ ("Licensee").

W I T N E S S E T H

Section 1. Grant of License.

In and for the consideration of _____ dollars (depending on the number of pages to be filed), paid in hand by Licensee, the City hereby grants to Licensee the nonexclusive right and license to install, place and maintain a _____ (the "Facilities) **and incidentals** at _____ _____. Incidentals include, but are not limited to, items such as trees, bushes, shrubs, ornamental grasses, flowers, other landscaping, landscape walls, and the like. The license hereby granted extends only to those Facilities in the locations and pertaining only to the public right-of-way and easements of the City (the "Property") as depicted in Exhibit "A" attached hereto and incorporated herein. Licensee shall not alter, add to, expand or otherwise change the Facilities or the use of the Facilities without a written amendment to this License.

Section 2. License Non-exclusive.

The license granted hereby is non-exclusive and the City reserves all rights it has or may have in and to the Property to which this License pertains. Licensee shall not assign, transfer or sublet this License, in whole or in part, without the express written approval of the City.

Section 3. Indemnity.

Licensee shall indemnify and hold harmless the City of Garland, Texas, and all of its present and former agents, employees, officials and representatives in their official, individual and representative capacities (collectively referred to hereinafter as the "City") from any and all claims, demands, causes of action, judgments, liens and expenses (including attorney's fees and attorney's fees under 42 U.S.C. §1988), costs and damages (whether common law or statutory, whether actual, punitive, consequential or incidental and expressly including those caused by the negligence or other fault or strict liability of any party indemnified herein), of any conceivable character, from injuries to persons (including death) or to property (both real and personal) created by, arising from or in any manner relating to the Facilities or the Property, without limitation. The City, its officers, employees and agents shall not be liable for any loss or damage to any real or personal property of any person, or for any injury to or death of any person, arising out of or in connection with the use, construction, operation, maintenance, repair or removal of, or other action or event with respect to the Facilities regardless of cause.

Section 4. Removal or Modification of Facilities.

The City reserves the right to require Licensee to relocate or remove, at the sole expense of Licensee, any part of the Facilities, if determined necessary by the City. The Licensee acknowledges that the City holds a paramount right to the use of the Property. The City shall not be liable to the Licensee for any damage to or loss of all or any part of the Facilities regardless of cause. City may require the Facilities to be removed or modified, in which event the cost of removal or modification shall be borne exclusively by Licensee. In the event that Licensee fails or refuses to remove the Facilities as required, the City may perform such removal or cause the removal to be done and charge the cost to Licensee.

Section 5. Termination.

This Agreement may be terminated by the City upon: (i) substantial breach of a material provision of this Agreement by Licensee; (ii) abandonment (whether intentional or inadvertent) or non-use of the Facilities for a period of one-hundred eighty (180) days or more; or (iii) by delivering written notice of termination at least one-hundred eighty (180) days prior to the date of termination. Licensee shall have the right to terminate this Agreement by delivering written notice of termination at least one-hundred eighty (180) days prior to the date of termination. Upon termination, Licensee shall promptly remove the Facilities from the Property and restore the Property, at Licensee's expense, to as good a condition as that prevailing before the installation of the Facilities. The indemnity provisions of this Agreement shall survive termination to extent of occurrence arising prior to termination.

Section 6. Severability. If any term or provision of this Agreement is held to be illegal, invalid or unenforceable, the legality, validity or enforceability of the remaining terms or provisions of this Agreement shall not be affected thereby, and in lieu of each such illegal, invalid or unenforceable term or provision, there shall be added automatically to this Agreement a legal, valid or enforceable term or provision as similar as possible to the term or provision declared illegal, invalid or unenforceable.

Section 7. Waiver. Either City or License shall have the right to waive any requirement contained in this Agreement, which is intended for the waiving party's benefit, but, except as otherwise provided herein, such waiver shall be effective only if in writing executed by the party for whose benefit such requirement is intended. No waiver of any breach or violation of any term of this Agreement shall be deemed or construed to constitute a waiver of any other breach or violation, whether concurrent or subsequent, and whether of the same or of a different type of breach or violation.

Section 8. Governing Law; Venue. This Agreement and all of the transactions contemplated herein shall be governed by and construed in accordance with the laws of the State of Texas. The provisions and obligations of this Agreement are performable in Dallas County, Texas such that exclusive venue for any action arising out of this Agreement shall be in Dallas County, Texas.

Section 9. Paragraph Headings; Construction. The paragraph headings contained in this Agreement are for convenience only and shall in no way enlarge or limit the scope or meaning of the various and several paragraphs hereof. Both parties have participated in the negotiation and preparation of this Agreement and this Agreement shall not be construed either more or less strongly against or for either party.

Section 10. Binding Effect. Except as limited herein, the terms and provisions of this Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective heirs, devisees, personal and legal representatives, successors and assigns.

Section 11. Gender. Within this Agreement, words of any gender shall be held and construed to include any other gender, and words in the singular number shall be held and construed to include the plural, unless the context otherwise requires.

Section 12. Counterparts. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, and all of which shall constitute but one and the same instrument.

Section 13. Exhibits. All exhibits to this Agreement are incorporated herein by reference for all purposes wherever reference is made to the same.

Section 14. Entire Agreement. It is understood and agreed that this Agreement contains the entire agreement between the parties and supersedes any and all prior agreements, arrangements or understandings between the parties relating to the subject matter. No oral understandings, statements, promises or inducements contrary to the terms of this Agreement exist. This Agreement cannot be changed or terminated orally.

Section 15. Relationship of Parties. Nothing contained in this Agreement shall be deemed or construed by the parties hereto or by any third party to create the relationship of principal and agent or of partnership or of joint venture or of any association whatsoever between the parties, it being expressly understood and agreed that no provision contained in this Agreement nor any act or acts of the parties hereto shall be deemed to create any relationship between the parties other than the relationship of independent parties contracting with each other solely for the purpose of effecting the provisions of this Agreement.

SIGNATURE PAGE ONE – TO BE EXECUTED BY THE LICENSEE

EXECUTED AND AGREED this _____ day of _____, 20___.

LICENSEE

By: _____

Title: _____

STATE OF TEXAS

Before Me _____ (here insert the name and character of the officer) **on this day personally appeared** _____**,** known to me (or proved to me through _____ (description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument **and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.**

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____ , 20___.

_____
Notary Public in and for
The State of Texas

SIGNATURE PAGE TWO – TO BE EXECUTED BY THE CITY OF GARLAND AFTER SIGNATURE PAGE ONE HAS BEEN COMPLETED

THE CITY OF GARLAND, TEXAS

By: _____

Title: _ Director of Engineering __ _____

STATE OF TEXAS

Before Me _____ (here insert the name and character of the officer) **on this day personally appeared** _____, known to me (or proved to me through _____ (description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument **and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.**

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____ , 20___.

_____
Notary Public in and for
The State of Texas

INSTRUCTIONS FOR COMPLETING THE REAL PROPERTY IMPROVEMENT AUTHORIZATION {For "Facilities" in City Easements}

(Please do not attach this page to the submitted document; it is intended for the information of the Applicant only)

In order to complete this document, the following steps should be taken:

1. On page 1, please complete the following information:
   a. Please complete the blank marked "Applicant". This is normally the owner of the property or their approved representative.
   b. Please fill in the dollar amount required for the filing fee. This fee amount is based on the number of pages in the document and is set by the Dallas County Clerk's Office. The fee for most authorization agreements is **$50.00** (seven pages total), assuming that one page is used for the required Exhibit "A". If more pages are used, the fee will increase by $4 per page.
   c. For "Improvements", please fill in the type of work to be done, i.e. "Landscaping", "Irrigation Facilities", "Privacy Fence", etc.
   d. For the location, please include the **address of the property**, as well as the **subdivision name, lot, and block**. This information is required by the County and the agreement may be rejected if it is not included.

2. On Signature Page 1, please sign the document and have it notarized in the appropriate locations.

3. An exhibit is required to be included with the authorization. This exhibit must be on an 8-1/2" X 11" paper and must include adequate information to show where the proposed improvements are going within public utility and/or drainage easements. The exhibit does not have to be to a particular scale, but enough dimensional information needs to be included to accurately locate the improvements. All easements that are being affected by the authorization must also be shown on the exhibit. **Be sure to include the address and subdivision, lot and block on the exhibit.**

4. Documents to be submitted to the City of Garland Engineering Department at 800 W. Main Street, Third Floor, Garland, TX 75040:

   a. Executed Real Property Improvement Authorization Document (Original Document) with the exhibit.
   b. A check for the filing fee payable to the Dallas County Clerk's Office.

   The submittal should be sent to the attention of the Development Engineering Group. Please note that we must have the original document; the County will not accept a copy for filing. Once all of this information has been received, it will be checked for accuracy and completeness. Once the document is accepted, our Director of Engineering will countersign and notarize Signature Page 2, and we will send the document in to Dallas County for processing. Once the County has recorded the document, they will send us a copy for our records. This process normally takes several weeks. Once we receive our record copy back, a copy can be made available to you upon request.

5. If there are any questions, please contact any member of the Development Engineering Group at 972-205-2170.

REAL PROPERTY IMPROVEMENT AUTHORIZATION

This Authorization is hereby given by the City of Garland, Texas (the "City"), a home-rule municipality duly incorporated and existing under the constitution and laws of the State of Texas, to _____ ("Applicant").

W I T N E S S E T H

Section 1. Authorization.

To the extent that the Applicant's use of the Property and Improvements do not interfere with or in any manner restrict the City's or another third-party's lawful use of, and interest in and to the Property, for the non-refundable fee of _____ dollars (depending on the number of pages to be filed), paid in hand by Applicant, the City hereby grants to Applicant the nonexclusive right and authority to install, place and maintain a _____ (the "Improvements") **and incidentals** at _____. Incidentals include, but are not limited to, items such as trees, bushes, shrubs, ornamental grasses, flowers, other landscaping, landscape walls, and the like. The authority hereby granted extends only to those Improvements in the locations and pertaining only to the public right-of-way and easements of the City (the "Property") as depicted in Exhibit "A" attached hereto and incorporated herein. Applicant shall not alter, add to, expand or otherwise change the Improvements or the use of the Improvements without a written amendment to this Authorization.

THE CITY DOES NOT WARRANT OR MAKE ANY REPRESENTATION AS TO THE APPLICANT'S USE OF THE PROPERTY AS IT RELATES TO THE RIGHTS AND OWNERSHIP INTERESTS OF THIRD PARTIES. THIS AUTHORIZATION IS MADE WITHOUT WARRANTY, EXPRESS OR IMPLIED, AND THE CITY EXPRESSLY DISCLAIMS, EXCEPTS AND EXCLUDES ANY AND ALL WARRANTIES OF ANY TYPE OR NATURE FROM THIS AUTHORIZATION, INCLUDING—WITHOUT LIMITATION—ANY WARRANTIES ARISING UNDERR COMMON LAW OR UNDER SECTION 5.023 OF THE TEXAS PROPERTY CODE OR OTHER STATUTE. THE CITY DOES NOT WARRANT OR MAKE ANY REPRESENTATION, EXPRESS OR IMPLIED, AS TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, ABSENCE OF LATENT DEFECTS OR COMPLIANCE WITH LAWS AND REGULATIONS, OR ANY OTHER MATTER AFFECTING THE PROPERTY. BY ACCPETANCE OF THIS AUTHORIZATION, APPLICANT ACKNOWLEDGES THAT IT'S USE OF THE PROPERTY SHALL BE "AS IS—WHERE IS, WITH ALL FAULTS".

Section 2. Authorization Non-exclusive.

The hereby granted authority is non-exclusive and the City reserves all rights it has or may have in and to the Property to which this Authorization pertains. Applicant may not assign, transfer or sublet this authorization, in whole or in part, without the express written approval of the City.

Section 3. Indemnity.

In consideration for Applicant's use of the Property, Applicant shall indemnify and hold harmless the City of Garland, Texas, and all of its present and former agents, employees, officials and representatives in their official, individual and representative capacities (collectively referred to hereinafter as the "City") from any and all claims, demands, causes of action, judgments, liens and expenses (including attorney's fees and attorney's fees under 42 U.S.C. §1988), costs and damages (whether common law or statutory, whether actual, punitive, consequential or incidental and expressly including those caused by the negligence or other fault or strict liability of any party indemnified herein), of any conceivable character, from injuries to persons (including death) or to property (both real and personal) created by, arising from or in any manner relating to the Improvements or the Property, without limitation. The City, its officers, employees and agents shall not be liable for any loss or damage to any real or personal property of any person, or for any injury to or death of any person, arising out of or in connection with the use, construction, operation, maintenance, repair or removal of, or other action or event with respect to the Improvements regardless of cause, including but not limited to the negligence of the City.

Section 4. Removal or Modification of Improvements.

The City reserves the right to require Applicant to relocate or remove, at the sole expense of Applicant, any part of the Facilities, if determined necessary by the City. The Applicant acknowledges that the City holds a paramount right to the use of the Property. The City shall not be liable to the Applicant for any damage to or loss of all or any part of the Improvements regardless of cause. City may require the Improvements to be removed or modified, in which event the cost of removal or modification shall be borne exclusively by Applicant. In the event that Applicant fails or refuses to remove the Improvements as required, the City may perform such removal or cause the removal to be done and charge the cost to Applicant.

Section 5. Termination.

This Authorization may be terminated by the City upon: (i) breach of any provision of this Authorization by Applicant; (ii) abandonment (whether intentional or inadvertent) or non-use of the Improvements for a period of one-hundred eighty (180) days or more; or (iii) by delivering written notice of termination at least one-hundred eighty (180) days prior to the date of termination. Applicant shall have the right to terminate this Authorization by delivering written notice of termination at least one-hundred eighty (180) days prior to the date of termination. Upon termination, Applicant shall promptly remove the Improvements from the Property and restore the Property, at Applicant's expense, to as good a condition as that prevailing before the installation of the Improvements. The indemnity provisions of this Authorization shall survive termination to extent of occurrence arising prior to termination.

Section 6. Severability. If any term or provision of this Authorization is held to be illegal, invalid or unenforceable, the legality, validity or enforceability of the remaining terms or provisions of this

Authorization shall not be affected thereby, and in lieu of each such illegal, invalid or unenforceable term or provision, there shall be added automatically to this Authorization a legal, valid or enforceable term or provision as similar as possible to the term or provision declared illegal, invalid or unenforceable.

Section 7. Waiver. Either City or Applicant shall have the right to waive any requirement contained in this Authorization, which is intended for the waiving party's benefit, but, except as otherwise provided herein, such waiver shall be effective only if in writing executed by the party for whose benefit such requirement is intended. No waiver of any breach or violation of any term of this Authorization shall be deemed or construed to constitute a waiver of any other breach or violation, whether concurrent or subsequent, and whether of the same or of a different type of breach or violation.

Section 8. Governing Law; Venue. This Authorization and all of the transactions contemplated herein shall be governed by and construed in accordance with the laws of the State of Texas. The provisions and obligations of this Authorization are performable in Dallas County, Texas such that exclusive venue for any action arising out of this Authorization shall be in Dallas County, Texas.

Section 9. Paragraph Headings; Construction. The paragraph headings contained in this Authorization are for convenience only and shall in no way enlarge or limit the scope or meaning of the various and several paragraphs hereof. Both parties have participated in the negotiation and preparation of this Authorization and this Authorization shall not be construed either more or less strongly against or for either party.

Section 10. Binding Effect. Except as limited herein, the terms and provisions of this Authorization shall be binding upon and inure to the benefit of the parties hereto and their respective heirs, devisees, personal and legal representatives, successors and assigns.

Section 11. Gender. Within this Authorization, words of any gender shall be held and construed to include any other gender, and words in the singular number shall be held and construed to include the plural, unless the context otherwise requires.

Section 12. Counterparts. This Authorization may be executed in multiple counterparts, each of which shall be deemed an original, and all of which shall constitute but one and the same instrument.

Section 13. Exhibits. All exhibits to this Authorization are incorporated herein by reference for all purposes wherever reference is made to the same.

Section 14. Entire Authorization. It is understood and agreed that this Authorization contains the entire Authorization between the parties and supersedes any and all prior Authorizations, arrangements or understandings between the parties relating to the subject matter. No oral understandings, statements, promises or inducements contrary to the terms of this Authorization exist. This Authorization cannot be changed or terminated orally.

Section 15. <u>Relationship of Parties</u>. Nothing contained in this Authorization shall be deemed or construed by the parties hereto or by any third party to create the relationship of principal and agent or of partnership or of joint venture or of any association whatsoever between the parties, it being expressly understood and agreed that no provision contained in this Authorization nor any act or acts of the parties hereto shall be deemed to create any relationship between the parties other than the relationship of independent parties contracting with each other solely for the purpose of effecting the provisions of this Authorization.

SIGNATURE PAGE ONE – TO BE EXECUTED BY THE APPLICANT

EXECUTED AND AGREED this _____ day of _____, 20___.

APPLICANT

By: _____

Title: _____

STATE OF TEXAS

Before Me _____ (here insert the name and character of the officer) **on this day personally appeared** _____**,** known to me (or proved to me through _____(description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument **and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.**

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____ , 20___.

_____
Notary Public in and for
The State of Texas

SIGNATURE PAGE TWO – TO BE EXECUTED BY THE CITY OF GARLAND AFTER SIGNATURE PAGE ONE HAS BEEN COMPLETED

THE CITY OF GARLAND, TEXAS

By: _____

Title: _ Director of Engineering __ _____

STATE OF TEXAS

Before Me _____ (here insert the name and character of the officer) **on this day personally appeared** _____, known to me (or proved to me through _____ (description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument **and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.**

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____ , 20___.

_____
Notary Public in and for
The State of Texas

Appendix 3F: Request for Verification of Subdivision Monumentation

REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION

March 5, 20XX

TO.: Glenn Breysacher, RPLS
City Surveyor
City of Garland Eng. Dept.
P.O. Box. 469002
Garland, TX 75046-9002

RE: Subdivision Monumentation
Example Estates
City Case No. 110824-2

Dear Mr. Breysacher,

The subdivision monumentation on the boundary and lot corners for the referenced subdivision is found or set as of the date of this letter. Per the City of Garland Engineering Department subdivision acceptance requirements, this letter is a request for field inspection and verification of the monumentation and release for this requirement.

If you have any questions or comments, please contact me at XXX-XXX-XXXX.

Sincerely,

Joe Surveyor, RPLS
ABC Surveying

Appendix 3G: Field Note Guidelines

Field Note Guidelines

Engineering Department
Surveying Services

City of Garland

November 2019

The following guidelines are to be used and incorporated into the preparation of real property descriptions for fee title conveyances, Rights-of-Way, easements, lease agreements, abandonments, licenses, etc., for the City of Garland.

Field notes will be subjected to a review process to insure substantial compliance with both the form and content outlined in these guidelines. Your cooperation is needed to assist the City of Garland in preparing and processing the legal instruments so that these field note descriptions can be relied upon to provide certain relevant information in a reasonably standard format. Surveys and descriptions must meet all of the requirements of the Texas Board of Professional Engineers and Land Surveyors (Rules), and fully comply with the Professional Land Surveying Practices Act (Act). For the laws regarding land surveying and the preparation of field note descriptions, please refer to the publications of the Texas Board of Professional Engineers and Land Surveyors.

Field notes for the purposes of these guidelines are defined as a worded metes and bounds description of the results of an on-the-ground survey of real property.

Field notes shall include sufficient information to identify the location, boundaries, Monumentation, and area of the described tract, as well as its relationship to the parent tract out of which it was surveyed, and all adjacent tracts. Each field note description will be accompanied by a drawing which graphically depicts the worded description.

The Surveyor of Record shall assume the responsibility for adequate title research to support the determination of the location of intended boundaries of the land parcel surveyed. The title must be searched back in time sufficiently far enough to uncover all of the pertinent information. In many cases, this will be to the sovereignty of the soil. Research shall include all public record resources, including but not limited to, the following:

- City of Garland Records
- Dallas, Collin, Rockwall or Kaufman County Records
- Texas Department of Transportation (TXDOT) Right-of-Way Records
- Private Utility Providers Records for gas, telephone, electric, cable, fiber optics and other utilities
- Ownership or Easement Records as available

Field notes submitted to the City Surveyor for review shall be typed on a plain **8 ½" x 11" white bond paper** and shall include at least two (2) sets, bearing the original seal, date and signature of the responsible surveyor. All originals are to be of high reproductive quality and legibility.

ORDER OF PARTS OF FIELD NOTES

All field note documents shall be arranged and submitted together in the following order:

1. Field note (or metes and bounds) description
2. Field note drawing
3. Vicinity Map
4. Closure sheet (only one set needed) [Example not included with this document]
5. Copy of the deed of current ownership (*see Part 2, Paragraph 5*)
   [Example not included with this document]

All field note descriptions submitted shall consist of the following parts:

PART 1 – HEADING

This part shall appear on the top of <u>each</u> page and include the following information:

1. As the first line, title each sheet **EXHIBIT "A"**.
2. The **area** in square feet and acres (to three decimal places) of the proposed conveyance. (In all cases where area is stated, it shall be expressed in both square feet and acres. Acreage may be in parenthesis following the square footage.)
3. The **type of conveyance** for which the tract is being described
   i.e. drainage easement, street widening, Right-of-Way dedication, water easement, wastewater easement, covenant, abandonment, license agreement, ingress-egress, etc.
   (A "corner clip" must be further defined to express the actual type of easement conveyed.)
4. For Right-of-Way acquisition, include name of the affected roadway.
5. The **owner's name**(s) whose tract is affected by the conveyance.

PART 2 – GENERAL DESCRIPTION

1. The **area** described in the field notes described in square feet, with acres in parenthesis.
2. The **Survey and Abstract number.**
3. Cite the appropriate **County** and **City, Subdivision name**, **Lot and Block designation** (when applicable).
4. **Dallas County Recording nomenclature**:
   a) Prior to 1903: all records, including maps and addition plats filed in Dallas County Records were filed as **Deed Records**
   b) **Plats** and Additions recorded in Volume 1, Page 1, beginning January 14, 1903 thru Volume 51, Page 154, ending February 14, 1963 were filed as **Map Records Deeds** for the period of January 14, 1903 to February 14, 1963 were still recorded as **Deed Records**
   c) Deeds, plats and additions recorded from February 1963 thru Volume 2003221, Page 10186 thru November 4, 2003 are recorded in **Deed Records**

d) Deeds, plats and additions recorded from November 4, 2003, starting with Volume 2003221, Page 10186 thru to the present are filed in **Official Public Records**
e) **Official Public Records of Dallas County** went from a Volume and Page filing system to an Instrument number filing system in mid-2005.

5. **Ownership information** for the affected area: the current record owner's name and the type of conveyance instrument (i.e. Warranty Deed, etc.).
   a) The conveyance instrument recording information shall be included (Deed Record designation, Volume, Page, cause number, execution date, etc.)
   b) A legible copy of the current deed of ownership must be attached to each field notes submitted.
6. All Right-of-Way abandonments must include reference information as to how the Right-of-Way was created, such as by deed with Volume, Page, date, or dedicated by Addition plat, with recording information.

PART 3 –PARTICULAR DESCRIPTION

1. This part shall contain specific information identifying the boundary of the described tract. As a general rule, **descriptions should be written with the calls proceeding in a clockwise direction from the point of beginning**.
2. The mathematical figure described must close with a precision of at least 1 : 15,000 ±0.10 feet.
3. The following items shall be clearly identified within this part of the description:
   a) **Point of Beginning**: identifying the type (including cap material, color and inscription), size, and material of monument found (or set), and its relationship to the parent tract, explaining which corner of the described tract it represents. **Point of Beginning shall be tied to a found monument of record**, at a dedicated street intersection, Block corner or Lot corner recorded in the subdivision plat or parent tract containing the tract of land.
   b) **Points of reference or Commencement**: (if applicable) identify the type (including cap material, color and inscription), size, and material of monuments and their relationship to the Point of Beginning.
   c) **Monumentation:** All monuments set shall be (at a minimum) 5/8" diameter iron rods capped (*with cap color and specific inscription noted*) with Surveyor's name and registration number or Survey Company's name.
   d) **Metes and bounds** calls: stating bearings in degrees, minutes and seconds; distances in feet and hundredth of a foot.
   e) **Curve Data:** Defined curve geometry such as Point of Curvature (P.C.), Point of Tangency (P.T.), Point of Reverse Curvature (P.R.C.), and Point of Compound Curvature (P.C.C.) are always tangent to curve.
   A call for any of these elements is understood to be a point of tangent alignment. Point on Tangent (P.O.T.) is defined as lying on a line, and Point on Curve (P.O.C.) is a point lying on a curve.

If the beginning of a curve, or any change in alignment involving a curve is not a tangent point, the field notes must state the fact.

Curves shall be defined by

A. direction being left or right,
B. tangent or non-tangent,
C. delta or central angle,
D. radius,
E. arc length,
F. chord bearing and **chord distance**.

4. **References to adjoining properties** (calls for adjoiners): which helps to identify or clarify the described boundaries.
   Show dimensions for all boundaries of adjoining properties.
   a) Rights-of-Way (indicating width)
   b) Natural or physical locative features
   c) Witness or reference monumentation, etc.
5. **Reference discrepancies**: note when recorded measurements and field measurements differ.
6. **Volume and Page of any covenants, licenses, abandonments, closures or easements** the described tract is subject to.
7. **Area** in square feet and acres (to three decimal places).
8. **The Basis of Bearings** shall be clearly stated at the end of every metes and bounds description on which the description was established.

   Per the "Professional Land Surveying Practices Act and General Rules of Procedures and Practices," under §663.19 (c)
   "Courses shall be referenced by notation upon the survey drawing to an identifiable and monumented line or an established geodetic system for directional control."

   Therefore, if a boundary line is used as Basis of Bearings it must be a line with a minimum of two monuments.
   Reference or cite controlling monuments and the recording information of the instrument which defines the Basis of Bearings.

   Reference to a Datum, such as "Texas Coordinate System of 1983, North Central Zone, North American Datum of 1983" is sufficient in itself.
9. Signature and seal of the surveyor conducting the survey of the property.
10. Each page of multiple pages must be referenced to the total number of pages.
    Page number and total number of pages must be shown. (Including Vicinity Map.) i.e. Page 1 of 4.

An example of this type of document is contained in "**Attachment A**," appended to these Guidelines.

NOTE:

A legible copy of the recorded plat(s) and/or parent tract(s) cited must be supplied with the field notes.

FIELD NOTE DRAWING

Field note descriptions shall be accompanied by a field note drawing produced on a plain **8 ½" x 11"** white bond paper bearing the seal, date and signature of the responsible Registered Professional Land Surveyor.
All copies shall be of high reproductive quality and legibility.
In an instance where the field note description represents a part of a larger subdivision plat or tract of land, a portion of the larger subdivision plat or tract of land will be required.

Field note drawings shall show the following:

1. Each drawing sheet shall be titled **EXHIBIT "A"** at the top. Use heavy, bold font.
2. North arrow and graphic scale (or mention of the drawing being not to scale).
3. Legend which includes symbols for all monuments found or set and description.
4. Title block giving information on
    a) the tract to be acquired with Block and Lot numbers (if exists)
    b) the purpose of the acquisition
    c) surveyor and drafter information
    d) City Case Number
    e) date
    f) scale
4. Survey and Abstract name and number. Approximate Survey line between two surveys labeled on both sides of the line where it is applicable.
5. **Do not show topographic information or drafting construction lines (centerlines, reference lines, etc.).**
6. To easily identify the subject tract, the property to be acquired shall be shown on the drawing with a <u>solid</u> line, **with a line-weight significantly heavier than any other**. Block boundaries and Right-of-Ways shall also be significantly different from other line segments (see example attached to these Field Note Guidelines).
7. Information to identify adjoining properties or locative features, including subdivision, Lot and Block designations, names of adjoining owners of record, Volume and Page/County Clerk Instrument No. references to instruments defining adjoining boundaries, including roadways (with Right-of-Way width information) or prominent natural features.
8. Relationship of the described tract to its parent tract(s), showing any appropriate Lot and Block designation(s), subdivision name(s), and recording information.
9. Show bearings and distances for all abutting property lines.
10. Location of the Point of Commencing (if it exists), the Point of Beginning and any reference or witness points.
11. Monuments set or found at each corner of the tract of land to be acquired whether it is fee title or other type of acquisition. See "Describing Easements" section below for easement monumentation.

The City of Garland requires all corners be monumented if the tract to be acquired is a fee title acquisition. Additionally, your attention is directed to the "Professional Land Surveying Practices Act and General Rules of Procedures and Practices," under §663.17 (b):

"*When delineating a property or boundary line as an integral portion of a survey (survey being defined in the Act, §1071.002(6) or (8)), the land surveyor shall set, or leave as found, an adequate quantity of monuments of a stable and reasonably permanent nature to represent or reference the property or boundary corners. All survey markers shall be shown and described with sufficient evidence of the location of such markers on the land surveyors' drawing, written description or report.*"

12. All bearings and distances referred to in the field note description. Avoid using tables for line and curve information.
13. Reference and clearly identify discrepancies, i.e. measured bearings and distances vs. recorded bearings and distances.
14. Easements shall be shown and identified by width, use and ownership, and tied to parent tract.
15. Area of the described tract in square feet and acres (to three decimal places).
16. The name(s) of the present owner(s) of record as cited in the deed of the described tract and surrounding properties with recording information.
17. Basis of Bearings:

    Per the "Professional Land Surveying Practices Act and General Rules of Procedures and Practices," under §663.19 (c):

    "*Courses shall be referenced by notation upon the survey drawing to an identifiable and monumented line or an established geodetic system for directional control*."
18. Signature and seal of the surveyor conducting the survey of the property.
19. Each page of multiple pages must be referenced to the total number of pages. **Page number** and total number of pages must be shown. (Including a Vicinity Map.) i.e. Page 1 of 4.

An example of this type of document is contained in "**Attachment B**," appended to these Guidelines**.**

VICINITY MAP

Vicinity Maps are used for identifying the general area of the project.

1. Vicinity Map drawing shall be plotted on a plain **8 ½" x 11"** white bond paper.
2. No company letterheads or logos, except in title block.
3. The drawing need not be at a specific scale; it generally indicates the subject parcel boundaries and includes readily recognized streets. The affected parcel shall be cross hatched.

4. A legend shall denote the purpose of the cross hatched area – i.e. "Project Location", "Area to be acquired for Street Widening"; "Area to be acquired for Drainage Easement"; etc.

5. The Vicinity Map will be filed for record, it will be necessary to number this page.

DESCRIBING EASEMENTS

Easements will be prepared by metes and bounds description, unless prior approval is granted to use another method of description.
Descriptions for easements will be subject to the same guidelines as for fee title or Right-of-Way conveyances. Monumentation of easements may be required by the City Surveyor.

All easement descriptions must be prepared per the "Professional Land Surveying Practices Act and General Rules of Procedures and Practices," under §663.17 (c):

> "All metes and bounds descriptions prepared as an exhibit to be used in easements shall be tied to corners of record related to the boundary of the affected tract in accordance with §663.17(b). "
>
> **Therefore, the description must be tied to two or more "physical monuments" to comply with this rule.**
>
> Per the State of Texas Occupations Code §1071.002 (6):
>
> "Professional surveying" means the practice of land, boundary, or property surveying or other similar professional practices. The term includes:
>
> (A) (iii) preparing and perpetuating maps, record plats, field note records, **easements**, and real property descriptions that represent those surveys.

TEMPORARY CONSTRUCTION EASEMENTS

Temporary construction easements will require a metes and bounds description, when a temporary construction easement is prepared to accompany and adjoin a permanent easement. The guidelines for easements will be used for temporary construction easements.

LOT AND BLOCK DESCRIPTIONS

When appropriate, a Lot and Block description which does not represent an actual field survey may be acceptable for the City of Garland to purchase real property. Prior approval must be granted by the City Surveyor to use this method of description.

As a document of this type does not represent a field survey, it cannot have affixed to it the seal and signature of a Registered Professional Land Surveyor.

The Lot and Block description shall instead contain, at the conclusion of the descriptive paragraph, the statement "Approved as to Form," and a signature line containing the name and title of the City of Garland City Surveyor.

An example of this type of document is contained in "**Attachment C**," appended to these Guidelines.

The following checklist is provided for your convenience. It is intended as a **MINIMUM** standard.

FIELD NOTE CHECKLIST

For your help in field note submittal include the following:

☐	Two (2) sets of signed, sealed and dated field notes of the RPLS who prepared the description	1.
☐	One signed, sealed and dated electronic PDF file	2.
☐	Closure sheet – 1 copy	3.
☐	Copy of the recorded instrument of current ownership of the property to be acquired or the easement or Temporary Construction Easement – 1 copy	4.

PART 1 : HEADING

☐	Area of property to be acquired in square feet and acres (to three decimal places)	1.
☐	Type of conveyance	2.
☐	Lot and Block number	3.
☐	Name of affected roadway, creek, project, etc.	4.
☐	Name of the owner of the tract of land	5.

PART 2 : GENERAL DESCRIPTION

☐	Area of property to be acquired in square feet and acres (to three decimal places)	1.
☐	Survey name and Abstract number	2.
☐	City, County and State where the property is located	3.
☐	Subdivision name, Lot and Block number, County Land Records recording information. Copy of subdivision map must be supplied with recording information.	4.
☐	Current record owner's name as cited in the deed, type of conveyance instrument , recording information (Volume, Page, Cause (if applicable), execution date, Records information.	5.

PART 3 : PARTICULAR DESCRIPTION

☐	Point of Commencing (if used)	1.
☐	Point of Beginning	2.
☐	Bearings and distances around the tract of land to be acquired	3.
☐	Curve data: direction of curvature, tangent or non-tangent, all significant curve elements (radius, delta, length, chord bearing and chord length)	4.
☐	Monuments set for the property to be acquired and monuments found and called out with size, type, and capping (**incl. cap material and color**) stamped with the RPLS number or company name	5.
☐	Property information: Lot or Tract number, Block number, subdivision name(s), acreage, current owner's name and recording information	6.
☐	Roadway information (if encountered) with Right-of-Way width specified in parenthesis	7.
☐	Adjoining properties – any adjoining property call must have recording information	8.
☐	Any easements, covenants, licenses, etc., that tract is subject to, included in the description and shown on the field note drawing	9.
☐	Area in square feet and acres (to three decimal places) for the tract of land to be acquired or easement or temporary work space.	10.
☐	Basis of Bearings statement that conforms to TBPLS Rules	11.
☐	Seal, signature and date of RPLS who prepared the description	12.

An example of this type of document is contained in "**Attachment A**," appended to these Guidelines**.**

FIELD NOTE DRAWING CHECKLIST

☐	Exhibit "A" title at top of sheet	1.
☐	North arrow	2.
☐	Graphic Scale (if applicable)	3.
☐	Legend with symbols and descriptions of monuments set and found	4.
☐	Survey name and Abstract number, approximate location of Survey line between surveys (if near enough) labeled on both sides of the line (use unique line type if not a boundary line)	5.

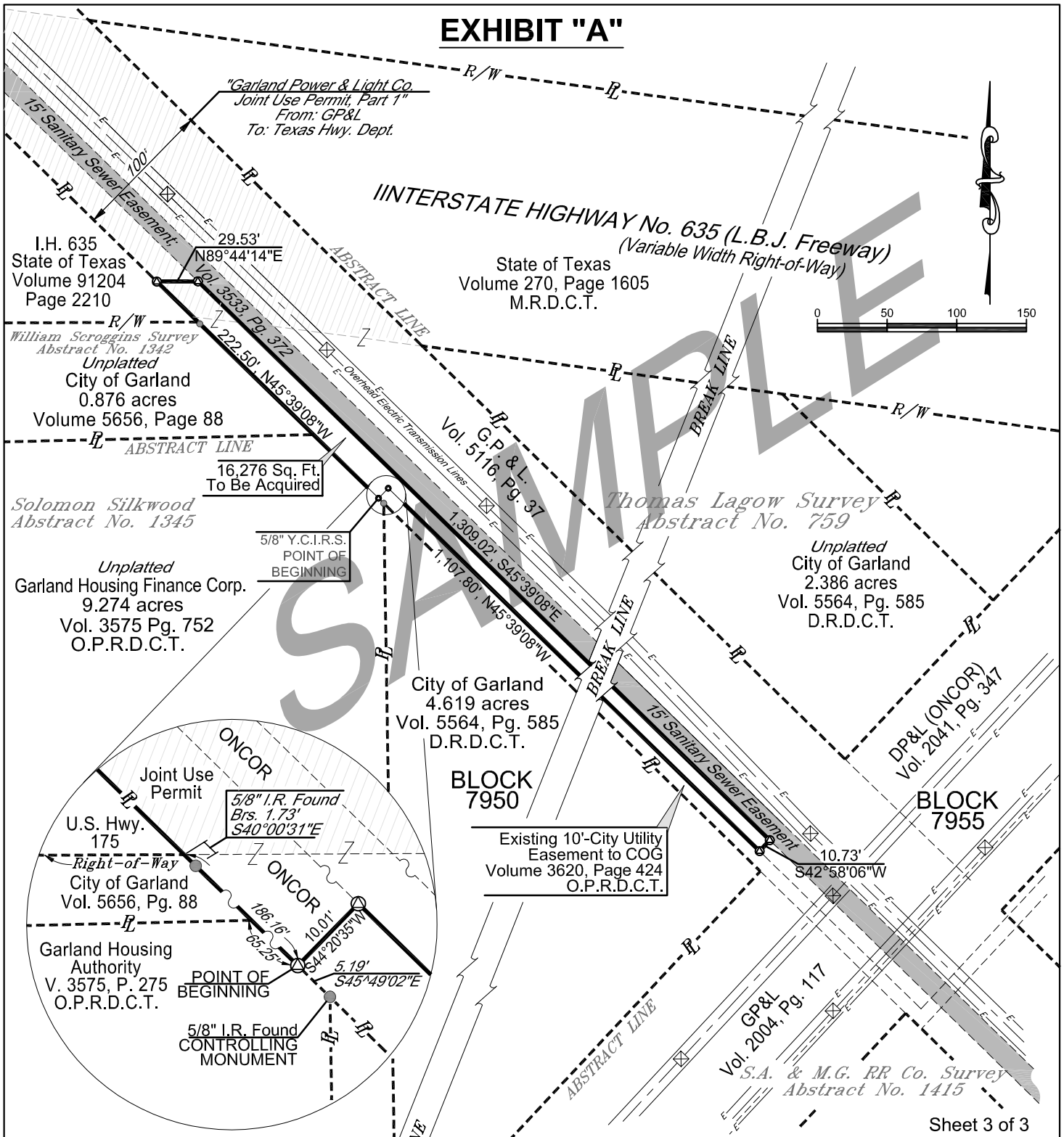
☐	"Area to be acquired" or "Area to be abandoned" with area in square feet and acres	6.
☐	Point of Commencing (if used), Point of Beginning	7.
☐	All bearings and distances as referred to in the field notes with notation of discrepancies from record and measured distances	8.
☐	- Point of Curvature (P.C.) - Point of Tangency (P.T.) - Point of Reverse Curvature (P.R.C.) - Point of Compound Curvature (P.C.C.) - Point on Tangent (P.O.T.) - Point on Curve (P.O.C.)	9.
☐	All Curve data along curve segments: radius, arc length, delta (central angle), chord bearing and chord length Identify non-tangent curves	10.
☐	Addition name (if it exist, or otherwise note "Unplatted") and/or Ownership information (name as appears in the recorded instrument and recording information) of all adjoining properties called in field notes Common ownership between platted lots shall be shown	11.
☐	Identify specific purpose areas shown on the plat (detention area, floodway easement, park and common areas, etc.)	12.
☐	Easement(s) information : show and identify all easements with width, use and ownership information, where applicable	13.
☐	Corporate (City) limits and County lines, where applicable	14.
☐	Basis of Bearings statement that conforms to T.B.P. E.L.S. Rule 663.19(c)	15.
☐	Seal, signature of RPLS preparing the description, and date	16.

VICINITY MAP CHECKLIST

☐	North Arrow	1.
☐	Wider area with recognizable streets and highways	2.
☐	Affected parcel shaded or hatched	3.
☐	Legend	4.
☐	Scale, or "Not To Scale" noted	5.

ATTACHMENT A

EXHIBIT "A"



Sheet 3 of 3

Area of Joint Use Agreement: ONCOR to TxDOT

Electrical Transmission Tower

5/8" Yellow Capped Iron Rod STAMPED "RPLS 0001" (Set)

Easement To Be Acquired by this instrument

BASIS OF BEARINGS: Bearing are based on the Texas Coordinate System of 1983, North Central Zone (4202), North American Datum of 1983.

GARLAND

ELECTRIC EASEMENT			
Easement Acquisition From ONCOR			
PUBLIC WORKS & TRANSPORTATION			
GARLAND ENGINEERING DEPARTMENT			
CITY SURVEYOR'S OFFICE			
RPLS	DESIGN FILE PATH & NAME	SCALE	DATE
I.C. ROD	C:\dwg\survey\garland\example project\EXAMPLESMT.dwg	1"=100'	8-10-2017
PARTY CHIEF	DRAWING	FOLDER	CITY CASE NO.
P. Chief Sr.	CAD Tech.	Esmt. & Field Notes	171231-5

ATTACHMENT B

EXHIBIT "A"

ELECTRIC EASEMENT

16,276 SQ FT (0.374 ACS)
ONCOR ELECTRIC TRANSMISSION COMPANY

Being a 16,276 Square Foot (0.374 Acre) tract of land out of the Thomas Lagow Survey, Abstract Number 759, Dallas County, Texas, and being a part of that tract of land conveyed to the Dallas Power and Light Company (current ownership is in the ONCOR Electric Transmission Company) by Deed recorded in Volume 5116, Page 37 of the Deed Records of Dallas County, Texas, and being more particularly described as follows:

BEGINNING at a 5/8 inch diameter iron rod with yellow plastic cap marked "GARLAND" (hereinafter referred to as "5/8" YCIR stamped "COG" Cap") set on the Southwest line of said ONCOR property at the most Westerly North corner of a 10.00 foot wide Water Pipeline Easement to the City of Dallas, recorded in Volume 3620, Page 424 of the Deed Records of Dallas County, Texas, from which a 5/8 in dia. Iron rod found on the said DP&L Southwest line at the intersection with the common line between a tract of land conveyed to the Dallas Housing Authority by deed recorded in Volume 3575, Page 275 of the Deed Records of Dallas County, Texas, and a tract conveyed to the City of Dallas by Deed recorded in Volume 5564, Page 585 of the Deed Records of Dallas County, Texas, at the most Northerly corner of said City of Dallas tract, bears South 45°49'02" East a distance of 5.19 feet;

THENCE North 45°39'08" West with the common line between said ONCOR and Dallas Housing Authority tracts, pass at 65.25 feet the common line with a tract of land conveyed to the City of Dallas by Deed recorded in Volume 5656, Page 88 of the Deed Records of Dallas County, Texas, at 186.16 feet pass the South Right-of-Way line of U.S. Highway 175 (C.F. Hawn Freeway) conveyed to the State of Texas by Deed recorded in Volume 91204, Page 2210 of the Deed Records of Dallas County, Texas (from which a 5/8 inch diameter iron rod found, bears South 40°00'31" East a distance of 1.73 feet) and continuing for a total distance of 222.50 feet to a 5/8" YCIR stamped "COG" Cap set on the Southwest line of said ONCOR tract, at the Northwest corner of the herein described tract of land;

THENCE North 89°44'14" East departing the last said common line between said ONCOR and State of Texas tracts, a distance of 29.53 feet to a 5/8" YCIR stamped "COG" Cap set in the Southwest line of a 15.00 foot wide Sanitary Sewer Easement conveyed to the City of Dallas by Deed recorded in Volume 3533, Page 372 of the Deed Records of Dallas County, Texas, and being also the Northeast corner of the herein described tract of land;

THENCE South 45°39'08" East parallel with the Southwest line of the above said ONCOR tract and with the Southwest line of said Sanitary Sewer Easement, a distance of 1,309.02 feet to a 5/8" YCIR stamped "COG" Cap set at the most Easterly corner of the herein described tract of land;

THENCE South 42°58'06" West departing the Southwest line of said Sanitary Sewer Easement, a distance of 10.73 feet to a 5/8" YCIR stamped "COG" Cap set at the most Southerly corner of the herein described tract of land, on the Northeast line of the above said 10.00 foot wide Water Pipeline Easement;

THENCE North 45°39'08" West with the Northeast line of said Water Pipeline Easement a distance of 1,107.80 feet to a 5/8" YCIR stamped "COG" Cap set at the most Northerly corner of said Water Pipeline Easement, at an inside corner of the herein described tract of land;

THENCE South 44°20'35" West with the Northwest line of said Water Pipeline Easement a distance of 10.01 feet to the **POINT OF BEGINNING**, containing 16,276 Square Feet, or 0.3736 Acres of land.

SAMPLE

Sheet 1 of 3

Area of Joint Use Agreement: ONCOR to TxDOT

Electrical Transmission Tower

5/8" Yellow Capped Iron Rod STAMPED "RPLS 0001" (Set)

Easement To Be Acquired by this instrument

BASIS OF BEARINGS: Bearing are based on the Texas Coordinate System of 1983, North Central Zone (4202), North American Datum of 1983.

A drawing of even date accompanies this description .

GARLAND	ELECTRIC EASEMENT		
	Easement Acquisition From ONCOR		
PUBLIC WORKS & TRANSPORTATION			
GARLAND ENGINEERING DEPARTMENT			
CITY SURVEYOR'S OFFICE			
RPLS	DESIGN FILE PATH & NAME	SCALE	DATE
I.C. ROD	C:\dwg\survey\garland\example project\EXAMPLESMT.dwg	1"=100'	8-10-2017
PARTY CHIEF	DRAWING	FOLDER	CITY CASE NO.
P. Chief Sr.	CAD Tech.	Esmt. & Field Notes	171231-5

***ATTACHMENT C* (example for field note guidelines)**

EXHIBIT "A"

Being Lot 4, Block 1, Dairy/Marguerita Addition, an addition to the City of Garland, Texas, according the plat thereof recorded in County Clerk Instrument Number 200600463489, Official Public Records of Dallas County, Texas.

APPROVED AS TO FORM: _____

Glenn S. Breysacher
City Surveyor
City of Garland, Texas

Appendix 3H: Working Plat Submittal Requirements

WORKING PLAT SUBMITTAL REQUIREMENTS

The following *SHALL* be provided to the Engineering Dept. at the time of first submittal of the Working Plat (no fee or plat application required at this time):

□ If full civil construction plans ARE required submit the following:

- One (1) 24”x36” black line print of Working Plat.
- Five (5) sets of civil construction plans that include a copy of the Working Plat within each set.
- One PDF copy of Working Plat on CD (vector based, not scanned/raster image).

□ If full civil construction plans are NOT required submit the following:

- Six (6) 24”x36” black line prints of Working Plat.
- One PDF copy of Working Plat on CD (vector based, not scanned/raster image).

For ALL Working Plat first submittals, include of the following:

□ Completed Plat Review Checklist – found on City of Garland website and within the Technical Standards Manual.

□ Two (2) 24”x36” black line prints and one PDF copy of Improvement/As-Built Survey signed and sealed by a Texas Registered Professional Land Surveyor (RPLS), showing, at a minimum, the following:

- All existing structures (show side yard and setback dimensions). Existing buildings may not extend across proposed property lines (plat boundary or lot lines).
- Concrete & asphalt paving, drive approaches, parking spaces.
- Visible city infrastructure (including, but not limited to; fire hydrants, curb inlets, grate inlets, elec. transformers, power poles & guys, etc.) on the property or between the curb and property line.
- **If the property is vacant, with no structures, improvements, or city infrastructure, provide** a letter from the surveyor stating that to the best of his/her knowledge, no on-site structures or improvements exist on the property.
- Topography is not required.

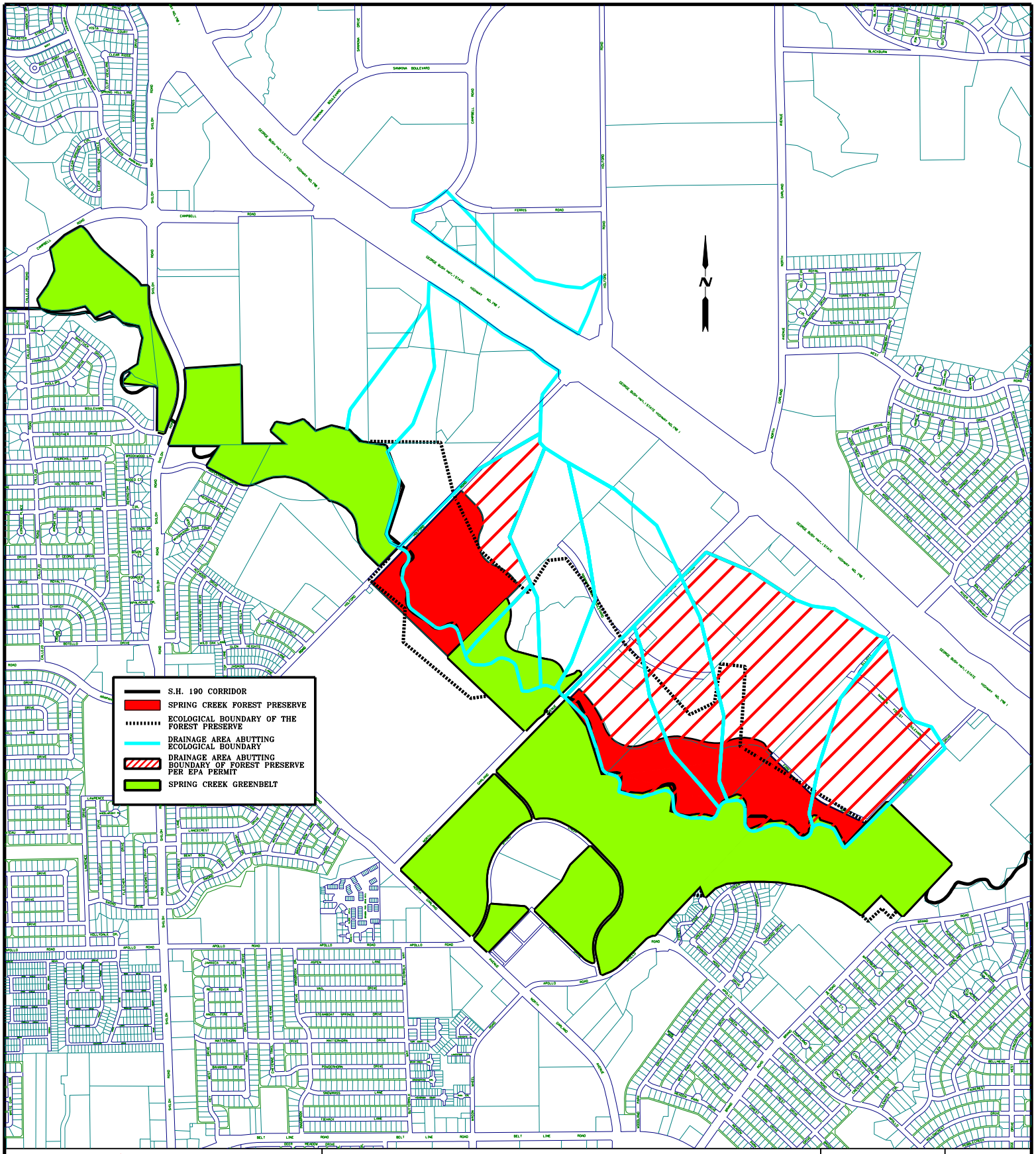
□ Boundary closure statement for overall boundary and individual lots, completed with bearings and distances, all curve data, precision of closure; and total lot area.

□ A current Title Commitment issued by a title insurance company authorized to do business in Texas in the form of a vesting deed, a title opinion letter from an attorney licensed to practice in Texas, or some other acceptable proof of ownership, identifying all persons having an ownership interest in the property subject to the plat application. Regardless of proof provided, a ***copy of the recorded vesting deed must be provided***.

□ A letter titled "***REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION***" from the responsible Registered Professional Land Surveyor shall be submitted to the City Surveyor stating request for a field inspection and verification of subdivision monumentation. *All monumentation shall be marked for field inspection at time of first submittal. UNDER NO CIRCUMSTANCES SHALL A PLAT ACHIEVE ACCEPTABLE STATUS WITHOUT A REQUEST FOR VERIFICATION OF SUBDIVISION MONUMENTATION LETTER AND CONFIRMATION OF SAME BY CITY SURVEYOR FIELD INSPECTION.*

□ Franchise utility notification letters shall be provided to each franchise utility before plat will be allowed to proceed to plan commission. Copies of the letters sent shall accompany the plat application. Franchise utility contact information and sample letter is available from the planning dept. (it is the applicant's responsibility to obtain current contact info. for franchise utilities if provided list is not current).

If any portion of this checklist is incomplete, the Working Plat submittal will be rejected and will not be reviewed until all documentation is provided in the next review cycle.



GARLAND

ENGINEERING DEPT.

ENVIRONMENTAL BOUNDARIES

Scale : 1'= 1600'	SHEET
File : eco_bound2	1
Date : 11/09/01	OF
Drawn : SAN	1

...\eco_bound2.dgn Oct. 08, 2008 09:34:58

Appendix 4B: Detention Pond Checklist & Manual

Detention/Retention Pond Requirements & Example

A. Detention is required per the GDC Section 3.87 when a downstream storm sewer system is not adequately sized to convey the increased runoff generated by a private development using current design criteria and in areas abutting the Spring Creek Forest Preserve and its ecological boundary, north of Spring Creek. GDC Section 3.89 and Section 4.11 of this TSM contains design and maintenance requirements for detention basins in the City.

B. The modified rational method can be used to size detention ponds for contributing drainage areas up to 25 acres. The unit hydrograph method must be used above 25 acres. A multi-staged orifice, weir and/or combination of outlet types shall be provided at the detention pond outlet to release the pre-development 2-, 10- and 100-year runoff generated by the site. Provide a stage storage table for the pond and a stage discharge table for the outlet structure. A detailed checklist of plan requirements is provided below. Modeling software that aids in the design computations of stormwater detention facilities may be utilized upon approval from the City Engineering Department.

C. All detention basins must include provisions to improve stormwater quality. Water quality enhancement measure shall be designed using the 1-year, 6-hour duration storm with an intensity of 0.35 inches per hour as defined in Table 4.3 from the *"iSWM Technical Manual*. Per the iSWM Manual in the Site Development Controls section, a dry detention pond designed to hold the first 1 inch of rainfall over a 24 hour period will remove 65% of the total suspended solids (TSS). Additional measures will have to be calculated and implemented to provide an additional 5% TSS removal essentially creating a treatment train for the project which will remove a minimum of 70% of the TSS particles 100 microns or larger. Consult the "iSWM Technical Manual, Hydraulics, Chapter 2.0" for accepted methods. Or alternative Methods for Improvement, per GDC 3.89.F: The Director of Engineering may approve alternate methods for detention and for achieving improved stormwater quality. Alternate methods may include utilization of mechanical filters, traps, or other prefabricated systems provided that the alternative methods prevent seventy percent (70%) or more of the TSS, up to a one-hundred micron-sized particle (100 µm), from passing through the outlet structure and entering the MS4 and so long as the intent of the provisions contained in the GDC are met. If using a prefabricated stormwater screening device, the applicant shall provide supporting literature/data from the manufacturer indicating that the selected unit is properly sized for the project and that it complies with the intent of this TSM and the GDC.

D. An Operation and Maintenance Manual is required for all ponds including amenity ponds (**see example at end of this Section**). Plans must include the Detention Basin General Notes provided below. The criteria established by the State of Texas for dam safety and impoundment of state waters shall apply where required by the state, and where the Engineering Department deems necessary due to potential hazards.

E. EXAMPLE

GIVEN: A 10 acre site is currently undeveloped and will be developed as a non-residential use. The entire site is the drainage area for the proposed detention basin.

DETERMINE: Maximum release rate and required detention storage.

SOLUTION:

1.) Determine 100-year peak runoff rate for single family runoff (Q=C*I*A). This is the maximum release rate from the site after development. (Any area within the drainage area not being conveyed to the detention basin shall be accounted for in the calculation for the maximum release rate.)

Existing Conditions:	C	=	0.3
	T_c	=	20 minutes
	I_{100}	=	7.05 inches / hour
	A	=	10 acres
	Q_{100}	=	(0.3)*(7.05)*10 = 21.15 cfs

2.) Determine inflow Hydrograph for storms of various durations in order to determine maximum volume required with maximum release rate calculated in step 1. (Incrementally increase durations by 10 minutes until the duration of peak inflow is less than the maximum release rate or where the required storage is less than the storage for the prior duration. The prior duration storage shall be used for the required detention storage.)

Proposed Conditions:	C	=	0.90
	Tc	=	10 minutes
	I_{100}	=	9.27 inches / hour
	A	=	10 acres
	Q_{100}	=	(0.90)*(9.27)*10 = 83.43 cfs

Check various duration storms:

10 minutes	I=9.27;	Q=0.9(9.27)10	=	83.43	cfs
20 minutes	I=7.05;	Q=0.9(7.05)10	=	63.45	cfs
30 minutes	I=5.77;	Q=0.9(5.77)10	=	51.93	cfs
40 minutes	I=4.92;	Q=0.9(4.92)10	=	44.28	cfs
50 minutes	I=4.32;	Q=0.9(4.32)10	=	38.88	cfs
60 minutes	I=3.86;	Q=0.9(3.86)10	=	34.74	cfs
70 minutes	I=3.50;	Q=0.9(3.50)10	=	31.50	cfs
80 minutes	I=3.21;	Q=0.9(3.21)10	=	28.89	cfs
90 minutes	I=2.97;	Q=0.9(2.97)10	=	26.73	cfs

Maximum Detention Storage Volume is determined by deducting the volume of runoff released during the time of inflow from the total inflow for each storm duration:

10 minute storm

INFLOW	=	10(83.43)60 sec/min	=	50,058 cf
OUTFLOW	=	(0.5)20(21.15)60 sec/min	=	12,690 cf
STORAGE	=	INFLOW - OUTFLOW	=	37,368 cf

20 minute storm

INFLOW	=	20(63.45)60 sec/min	=	76,140 cf
OUTFLOW	=	(0.5)30(21.15)60 sec/min	=	19,035 cf
STORAGE	=	INFLOW - OUTFLOW	=	57,105 cf

30 minute storm

INFLOW	=	30(51.93)60 sec/min	=	93,474 cf
OUTFLOW	=	(0.5)40(21.15)60 sec/min	=	25,380 cf
STORAGE	=	INFLOW - OUTFLOW	=	68,094 cf

40 minute storm

INFLOW	=	40(44.28)60 sec/min	=	106,272 cf
OUTFLOW	=	(0.5)50(21.15)60 sec/min	=	31,725 cf
STORAGE	=	INFLOW - OUTFLOW	=	74,547 cf

50 minute storm

INFLOW	=	50(38.88)60 sec/min	=	116,640 cf
OUTFLOW	=	(0.5)60(21.15)60 sec/min	=	38,070 cf
STORAGE	=	INFLOW - OUTFLOW	=	78,570 cf

60 minute storm

INFLOW	=	60(34.74)60 sec/min	=	125,064 cf
OUTFLOW	=	(0.5)70(21.15)60 sec/min	=	44,415 cf
STORAGE	=	INFLOW - OUTFLOW	=	80,649 cf

70 minute storm

INFLOW	=	70(31.50)60 sec/min	=	132,300 cf
OUTFLOW	=	(0.5)80(21.15)60 sec/min	=	50,760 cf
STORAGE	=	INFLOW - OUTFLOW	=	81.540 cf

80 minute storm

INFLOW	=	80(28.89)60 sec/min	=	138,672 cf
OUTFLOW	=	(0.5)90(21.15)60 sec/min	=	57,105 cf
STORAGE	=	INFLOW - OUTFLOW	=	81,567 cf

90 minute storm

INFLOW	=	90(26.73)60 sec/min	=	144,342 cf
OUTFLOW	=	(0.5)100 (21.15)60 sec/min	=	63,450 cf
STORAGE	=	INFLOW - OUTFLOW	=	80,892 cf

Required detention storage is 81,567 cf at the 80 minute storm duration.

Detention Basins Checklist

- ❑ Required for contributing sites > 1 acres or in areas of known flooding and inadequate downstream drainage systems.
- ❑ Provide standard detention pond general notes on plans (see below).
- ❑ Include note on plan: Prior to City acceptance DETENTION/RETENTION FACILITIES, CHANNELS, DRAINAGE WAYS, AND OUTFALLS SHALL HAVE ESTABLISHED PERENNIAL VEGETATION W/ 100% COVERAGE.
- ❑ Side slopes no steeper than 4:1, unusual height or poor soil requires slope stability study by P.E.
- ❑ Provide / check paved low flow flume minimum 0.5% between inlet / outlet and at point discharges to pond bottom.
- ❑ Provide all-weather access to ROW/access easement, 10ft wide minimum, 20% maximum slope.
- ❑ Provide pond typical cross section(s), showing emergency spillway, outlet structure, excavated side slopes (4:1 or flatter), level access path with width specified, pond bottom slope and low flow swale.
- ❑ Define / verify benchmark number, location and elevation.
- ❑ Show / review detention pond grading and layout of outlet structure w/ respect to property lines and easement shown.
- ❑ Check / insure outfall pipe and swale bottom elevations are coordinated.
- ❑ Are offsite flows entering the site? If so, have provisions been made to bypass flows?
- ❑ Review / verify pre- and post-project composite C values, time of concentration calculations, review assumptions, show existing and proposed flow paths on D.A.M., review travel time equation and variables
- ❑ Show / verify detention storage calculation, use modified rational method up to 25 ac, > 25 ac unit hydrograph method. Modeling software must be approved by Engineering Department.
- ❑ Define / check site pre-project 2-, 10- and 100-yr runoff and/or available downstream storm system capacity and specify the allowable release rate.
- ❑ Define outlet structure location / dimensions, horizontal control from property line, provide 60° sloped trash rack (2” openings) and low flow dewatering device 4-inch minimum diameter.
- ❑ Define top of lid or grate and invert elevations of all pipes, structures, inlets, and manholes.
- ❑ Provide / Verify 10-foot minimum unobstructed access around pond. Can outlet structure be reasonably accessed for maintenance? Check permanent detention pond easement.
- ❑ Provide restrictor hydraulic calculations, design, orifice diameter or weir length, elevation, details.
- ❑ Define / verify maximum design WSEL for 2, 10 and 100-year and the first 1-inch of rainfall.
- ❑ Provide minimum one (1) foot of freeboard from the design 100-year water surface elevation up to the emergency spillway effective crest.
- ❑ Ensure criteria discussed and illustrated in Section 4.11.L.2 is being met.
- ❑ Provide outlet detail for restrictor / weir and elevation versus discharge table on plans.
- ❑ Review elevation versus storage table and check dimensions / area / depth / volume.
- ❑ Verify design includes water quality features, detains first flush volume = (0.08 ft)(C)(A), or storm screening device used.
- ❑ When storm water screening device used, provide plan and details.
- ❑ When using perforated riser for water quality, spec number, spacing and diameter of perforations per NCTCOG.
- ❑ Define outfall pipe flowlines, diameter, velocity, length, and slope.
- ❑ Does tailwater affect pond? Is an anti-seepage collar needed? If so, provide design.
- ❑ Provide structural details and calculations for any item not in City standard construction details.
- ❑ Landscaping and irrigation are required, landscaping subject to the approval of the Planning Dept.

Example Detention Pond Manual

An example manual is attached. Manual must be approved prior to stamping plans "Released for Construction".

SAMPLE ONLY

Detention / Retention Pond
Operation and Maintenance Manual

Project Case Number:

Project Name:

Project Address:

Subdivision, Lot & Block Info:

Note: Any detention pond modifications affecting the storage capacity or outlet structure of a detention pond will require a new manual and calculations reflecting the altered configuration to be approved by the Engineering Department prior to release for Site Permit. An updated plan view is required for pond modifications affecting only side slopes prior to release for Site Permit. The updated plan view reflecting the modifications must be included in the owner's Operations and Maintenance Manual.

Prior to final acceptance of the pond, the Stormwater Department will require a CD containing a PDF of the completed and updated signed and sealed Detention Pond O&M Manual, and the O&M Manual shall include any applicable asbuilt record drawing sheets (Title Sheet, Grading Plan, Drainage Plan, Detention Pond Plans, Calculations & Details, Landscape Plan and Irrigation Plan).

Engineering of Record:

Seal & Signature:

Background / Purpose

A defined maintenance program is essential for detention facilities to maintain their operational integrity and original design intent. Prior to plan approval, the owner will provide an Operation and Maintenance (O&M) Manual to the Engineering Department for review and approval. Attached is an outline of the major topics and specific procedures the O&M manual shall address. O&M manuals are required for retention, detention, and amenity ponds.

The O&M manual will define the pond's key components, their function, and operational characteristics under normal flow conditions. The O&M manual will define the design intent of the system's primary components, its scope, and schedule of maintenance activities required to maintain a safe and effective operating facility.

The O&M manual shall include the name, address and telephone number of the party or parties responsible for long-term maintenance. Documentation of their assumption of this responsibility shall be included in the O&M manual with the completion of Attachment Number 1. The transfer of maintenance responsibility to individual property owners in residential subdivisions shall be prohibited except through a homeowner's association agreement.

Maintenance responsibility, as detailed in GDC Section 3.87, shall be defined on the subdivision plat. Additionally, permanent access to the facility shall be provided by platting a 15-foot wide continuous stormwater access easement to a public right of way or access easement to a public right of way.

General Maintenance Procedures

The structural and functional integrity of the ponds shall be maintained at all times by removing and preventing drainage interference, obstructions, blockages, or other adverse effects into, through, or out of the system.

The O&M manual shall include provisions for periodic silt removal when standing water conditions occur or the pond's storage volume is reduced by more than 10%. Silt shall be removed and the pond/basin returned to original lines and grades shown on the approved engineering plans. In addition, corrective measures are required any time a basin does not drain completely within 72 hours of cessation of inflow. NO STANDING WATER IS ALLOWED in basins designed for dry detention purposes.

Accumulated litter, sediment, and debris shall be removed every 6 months or as necessary to maintain proper operation of the basin. Disposal shall be in accordance with federal, state and local regulations.

Detention facilities shall be mowed monthly between the months of April and October or anytime vegetation exceeds 12-inches in height.

During subdivision construction, the detention facility and all associated appurtenances will be constructed in accordance with GDC Section 3.89 and the approved design plans. Note the GDC requires, among other things, that the basin and appurtenances be constructed at the beginning of the project. The manual will address interim facility maintenance from initial construction through final inspection and acceptance by the City.

Vegetation shall be established on disturbed areas in accordance with the Stormwater Pollution and Prevention Plan and North Central Texas Council of Governments Best Management Practices Manual specification. Irrigation shall be provided during and after subdivision construction. Hardy, disease resistant, perennial grasses shall be specified for the bottom and side slopes of the detention basin.

To prevent debris from entering and clogging the downstream storm sewer system, a wire mesh screen or similar screening device shall be installed over the outlet until final acceptance.

As indicated in the GDC Section 3.89 the example O&M manual below outlines minimum sections to be included. Additional sections / procedures shall be included to address unique or unusual features.

SAMPLE

DETENTION BASIN OPERATION AND MAINTENANCE **MANUAL**

CONTENTS

- Scope and Responsibilities
- Design & Performance Criteria
- Operational Procedures
- Normal
- Abnormal Indicators
- Preventive Maintenance and Inspection
- Maintenance & Repair
- Safety
- Inspection

1. SCOPE AND RESPONSIBILITIES

The O&M manual shall include sections defining the scope and the party or parties responsible for maintenance. Attachment Number 1, must be included, signed, and notarized by the owner.

The O&M manual shall provide guidance for:

- Funding needed – anticipated future monitoring and maintenance cost,
- Training required,
- Reporting,
- Record retention, and
- Coordination required with others.

2. CITY RESPONSIBILITY

The only responsibility the City of Garland has in the operation and maintenance of this facility is inspection. The City of Garland will inspect the basin at a minimum annually and prepare a Notice of Violation (NOV) if required.

Any deficiencies noted on the NOV that are not corrected in the times specified herein will result in criminal fines not exceeding $2,000.00 per day or application of a lien upon the property adequate to cover the required maintenance and/or repair plus administrative costs.

3. PROJECT INFORMATION

Project Name:_____

Project Location: _____

Contact:_____

Address: _____

Phone Number(s): _____

A. DETENTION BASIN PHYSICAL CHARACTERISTICS

(A separate form should be provided for projects with multiple ponds. Pond name should correspond with the identification shown on the approved plans.)

Pond flowline at inlet _____Pond flowline at outlet_____Pond normal pool elev.___

Pond 100 yr. WSEL_____ Pond overflow elev._____

Pond water quality elev. (first 1" rainfall)_____

1-year, 6-hour storm: 0.35 inches / hour = _____ cfs

Pond inlet pipe diameter(s)_____

Pond outlet pipe diameter(s)_____

Aerator information (if applicable) _____

Water quality enhancement measures are provided by treating the first one-inch of rainfall runoff from the site. The first one-inch runoff from the site is ____cfs during the 1-year storm event with a 6-hour duration. The water quality portion of the outlet is the _____ *(state manufacturer if prefabricated storm screening device is use)* Model _____ *(provide unit number when applicable)* or approved equal with a capacity of ___cfs. [The device shall be protected by a trash rack to prevent clogging.] The structure removes 70% or greater of the total suspended solids greater than or equal to 100 micron particle size from the first 1-inch of runoff from the site.

NOTE: Water quality enhancement measure shall be designed using the 1-year, 6-hour duration storm with an intensity of 0.35 inches per hour as defined in "iSWM Design Manual for Site Development, Appendix A", January 2006.

If using a prefabricated stormwater screening device provide supporting literature/data from the manufacturer, indicating that the selected unit is properly sized for this project and complies with the City requirements

B. DESIGN AND PERFORMANCE CRITERIA

Describe design approach, methods, assumptions and performance criteria, stormwater quality enhancement measures. Document manufacture's recommendations where pre-fabricated devices are used. Include pertinent structural details and shop drawings where necessary.

4. OPERATIONAL PROCEDURES

NORMAL

- Describe what is considered normal operating conditions, and

ABNORMAL INDICATORS

- Outflow reductions,
- Side slope and erosion near outfalls,
- Sinkholes along drain line,
- Standing water,
- Evidence of piping along embankments,
- Trees along embankments / emergency spillway,
- Spotty / thin plant cover and weed growth,
- Increases in water loving plants, and
- Other.

5. PREVENTIVE MAINTENANCE / INSPECTION

Preventive maintenance guidelines and a routine and annual inspection checklist shall be developed and included in the O&M manual for the detention basin and appurtenances. Visual inspections of all components will be conducted every 6 months. The O&M manual shall stress and require that a log be kept of maintenance actions, and inspections. The log should document the condition of the detention system's primary components, mowing, and silt, litter and debris removal dates. Document aeration of the basin bottoms and replanting to prevent the sealing of the basin bottom.

A good quality assurance and quality control program is essential at the outset. Records are important for evaluation and protection. There is little benefit to monitoring if records are poorly kept. A system should be established with the thought that it may someday have to be defended. **Written maintenance and repair records shall be maintained by the party or parties signing the O&M manual and shall be provided to the City upon request.**

Additional items to consider and suggestions when inspecting and monitoring detention basins and appurtenances include but are not limited to the following:

MANHOLES

- Monitor monthly during construction and every 6 months thereafter unless problems develop.
- When monitoring manholes, these items should be noted:
  - Observe and document general condition of manholes. Check for cracks or other signs of deterioration.
  - Measure and record depth of water surface from lid.
  - Note whether water is clear or cloudy.
  - Note sand or silt in the bottom of the manhole. If bottom is covered, measure the depth.
  - Note condition of inlet and outlet pipes.

INTAKE / OUTLET STRUCTURES

- Observe condition of appurtenant structures in relation to the as-built facilities.
- Monitor every 1 to 2 years or following 2-inch storm event.
- When monitoring, the following items should be noted:
  - General condition of intake / outlet structure.
  - Condition of the riprap, if any.
  - The outfall structure for open detention ponds shall have an external trash rack installed for the low flow scenarios that meets or exceeds the requirements in the iSWM Hydraulics Technical Manual for trash rack design, including but not limited to a 60-degree sloped rack attached to the structure, made of material that is rust resistant, and having two inches openings. Check and remove debris and obstructions from openings.
  - Check for signs of recent erosion in the vicinity of the structure
  - Check the vicinity of the structure for sinkholes.

SIDE SLOPE AND BOTTOM

- Observe condition of side slopes and bottom in relation to the as-built facilities.
- Note silt & sand accumulations.
- Note cracks along side slope, and slope failure areas.
- Inspect geosynthetic fabrics used for slope protection

FLUMES

- Observe /document standing water areas.

STORMWATER QUALITY DEVICES

- Observe / document clogging of filters and/or other devices.

6. MAINTENANCE & REPAIR

Identify basic requirements to maintain the operational characteristics of the facility, expected and typical materials and equipment to be used. Discuss methods and procedures required to repair and replace system components.

BASIC REQUIREMENTS

- Preserve the drain system in good working condition so it will perform without interruption.
- Keep the pipe and structures clear of obstructions.
- Keep structures in proper repair and earthwork in good condition.

MATERIALS

- Identify materials needed for maintaining the detention basin.

EQUIPMENT: Identify equipment needed, such as;

- Lawn Mower
- Weed Eater
- Excavator, front end loader, etc.
- Trucks and appropriate small tools
- Pumps and ladders
- High pressure hydraulic drain cleaner
- Trench box
- Video inspection equipment
- Oxygen sensor
- Rain Gauge

METHODS AND PROCEDURES

- Define anticipated maintenance operations and procedures.

REPAIR, REPLACEMENTS AND ADDITIONS

- System repairs should always be to the original design standards or better.
- Replacements and additions should be treated as original construction.

7. SAFETY

- Establish general safety guidelines and procedures. Safety measures may include but are not limited to fencing, warning signs, and stadia rod indicating depth at lowest point, outlet structures to limit public access, Trench safety and work in confined spaces could raise additional safety concerns.

ATTACHMENT NUMBER 1

MAINTENANCE ACKNOWLEDGEMENT

I acknowledge and agree by my signature below that I am responsible for the performance of the detention basin maintenance as defined in the attached Operation and Maintenance (O&M) manual. I agree to notify the City of Garland of any problems with the system and / or prior to any changes to the system or responsible party.

Print Name:_____

Title:_____

Email Address:_____

Address:_____

Phone:_____

Signature:_____

Date:_____

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I,_____, Notary Public for the State of _____

County of _____, do hereby certify that _____

_____ personally appeared before me this _____

day of _____ , ____ , and acknowledge the due execution of forgoing maintenance requirements identified in the attached O&M manual. Witness my hand and official seal,

My commission expires _____

8. INSPECTION CHECKLIST CHART

FREQUENT INSPECTION	DATE	REPAIRS REQUIRED	REPAIRS MADE	NOTES
Mowing				
Remove trash and debris				
Inspect irrigation system operation				
Remove grass clippings				
Violations noted				

MINOR INSPECTION				
Condition of Pond				
Amount of silt in pond				
Amount of silt in flume				
Amount of ponded water				
Amount of wetland vegetation				
Location of Erosion				
Percent of vegetation				
Condition of trash guard				
Location of erosion				

MAJOR INSPECTIONS				
Condition of Stormwater Quality Structure				
Type of Stormwater Quality Structure				
Structure type and Condition				
Condition of rip-rap				
Condition of filtration system				
Berm or Embankment Settlement				
Location of erosion				
Evidence of Animals				
Evidence of Aquatic life				
Condition of Aeration Fountain				

Format for Detention Facility Letter of Conformance; Submitted on Letterhead of Engineering Firm

(Date)

City of Garland Engineering Department
Field Operations
800 Main Street
Garland, Texas 75040

Attn: Mike Rozelle, P.E. Senior Field Engineer

RE: ***(Name of Subdivision or Private Development)***

Detention Facility Conformance

I confirm that the design, as approved by the City of Garland, of each Detention Facility located at ***(Name of Subdivision or Private Development and street address, if applicable)*** conforms to the requirements of the Garland Development Code Section 3.89. I further confirm that each Detention Facility has been constructed in accordance with the lines and grades on the approved design drawings and I believe will function in accordance with the intent and purpose of the approved design.

Sincerely,

{Signed Seal of Engineer}

***(Name of Engineer)*, PE**

(Title of Engineer)

cc: Wayne Wolverton, Stormwater Detention Inspector

(Developer/Owner of Facility)

(Contractor)

Detention Basin General Notes

1. All construction shall be done in accordance with the Standard Specifications for Public Works Construction in North Central Texas, most current adopted edition by the City of Garland Engineering Department, by North Central Texas Council of Governments, (NCTCOG) P.O. Box COG, Arlington, Texas 76005-5888 (817) 461-3300, as amended by the City of Garland.

2. Detention pond and outlet structure(s) shall be in accordance with the GDC Section 3.89 and fully operational prior to any paving activities.

3. The property owner or homeowner's association shall maintain the pond in accordance with the maintenance and operation manual approved by the Engineering Department.

4. Erosion control shall be in accordance with the stormwater quality ordinance and the latest revision to the NCTCOG standard specifications and NCTCOG BMP manual.

5. All ponds shall be constructed with a permanent irrigation system around the perimeter of the pond. The irrigation system shall provide sufficient coverage to establish and maintain grass vegetation to prevent erosion of the pond side slopes and bottom.

6. Pond(s) shall be excavated to the lines and grades shown on the approved construction plans including the inlet and outlet structures and shall be verified by the design Engineer. Written certification shall be provided by the design engineer to the Engineering Department confirming that the pond(s) has been constructed and is operating in accordance with the approved design and construction plans.

7. Ponds with a slope greater than 4:1 or in soils with unstable characteristics may require a slope stability analysis by a licensed geotechnical engineer. The analysis shall be submitted to the City Engineering Department. Pond depth shall not exceed twenty feet with side slopes no greater than 4:1 unless a variance is specifically approved by the Engineering Department.

8. Grass coverage shall be defined as 70% perennial vegetative cover per NCTCOG latest specifications including St. Augustine, Bermuda, Buffalo or equally hardy warm weather grasses as approved by the Engineering Department.

9. When warm weather grasses will not germinate due to fall or winter seasonal conditions annual, cool weather grass cover (rye or fescue) shall be established as a temporary substitution. The owner shall establish the required perennial vegetative cover no later than June 1st of the following year.

10. Should the owner fail to establish 70% perennial vegetative cover, refundable fees of an amount equal to the cost to grade and sod the pond shall be submitted to the Director of Engineering prior to release of the plans for construction. Said fee shall not be less than $12 per square yard. If vegetation is not established, the fee will be forfeited to the City for use in establishing required vegetative cover. Building Inspection will cease and final occupancy approval for the property will be withheld until approved, 70% perennial vegetative cover is established.

11. Pond(s) shall be constructed with a paved low flow concrete flume (4 feet min. width) between the inlet and outlet structures.

12. Flumes must be constructed at point discharge locations, such as curb outlets or swale outfalls between the top of slope and the pond's low flow flume.

13. Items 1 through 12 shall be completed prior to the City granting acceptance to the public improvements and issuing a Certificate of Occupancy for non-residential developments or a Building Permit for single family residential developments.

14. Stormwater quality measures with minimum removal efficiency of 70% of total suspended solids down to 100 microns are required to be constructed in conjunction with all detention and retention pond(s).

15. Pond design and operation shall be in accordance with the most current "Stormwater Detention and Retention Facilities" requirements as defined in GDC Section 3.89.

16. A dedicated stormwater access easement (10 foot min. width) is required by plat to a public right of way or access easement that leads to a public right of way. An all-weather access surface to the bottom of the pond shall be provided.

17. The owner shall remain responsible for silt, trash and miscellaneous construction debris removal from the pond during all phases of subdivision and building construction.

18. Should the condition of the pond deteriorate during construction, building permits, inspections, and certificate of occupancy will be denied by the Building Inspection Department until the pond is brought into compliance with the approved construction plans.

Appendix 4C: Single Family Lot Grading Checklist & Exhibit

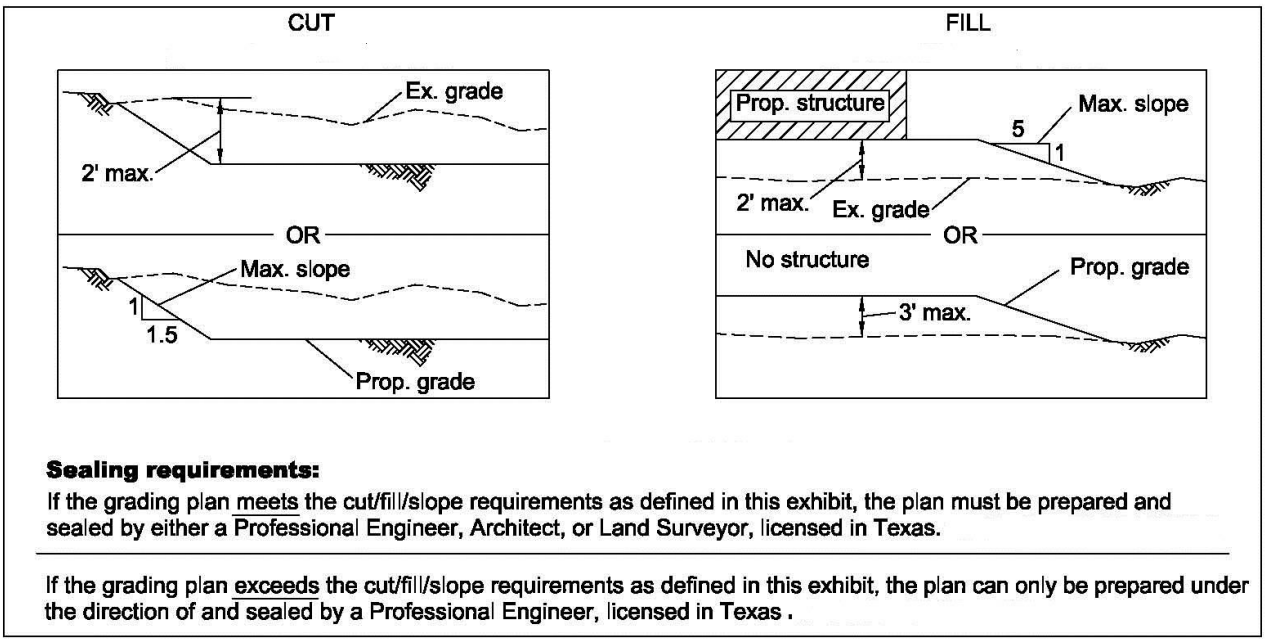
Residential Single-Lot Grading Plan Requirements & Checklist

Enabling Ordinance: *GDC 3.85: Grading and drainage of one and two family developments shall be in accordance with the applicable provisions established herein for all subdivisions having engineering plans and specifications reviewed by the Director of Engineering after the effective date of this section.*

General Requirements:

- ❑ All single-lot grading plans shall be on 24" X 36" or 22" x 34" bordered sheets, using a standard engineering scale showing the required level of detail described below.
- ❑ Provide and verify the following basic items are on the grading plan:
  1. North arrow pointing up or to the right with numeric and graphic scale
  2. Vicinity map defining property location.
  3. Legend showing all symbols / line types used, if symbols are not labeled on the grading plan.
  4. Name and address of property owner.
  5. Name and address of the design professional who prepared the plan.
  6. Subdivision name, lot, block number and property address.
  7. All elevations and instructional text size are at least 0.10 inches or greater.
  8. Benchmark location, description and elevation.
  9. Locate and label existing tree(s) to be removed and/or protected.
- ❑ Define and verify location of all proposed structures, plot the foundation's footprint relative to property lines; note, check, and verify minimum finished floor elevation and square footage are shown on the plan.
- ❑ Locate and label all existing structures, existing and proposed water meters, manholes, fire hydrants, inlets and any other ground-mounted equipment and structures that may be on or within 15 feet of the property line.
- ❑ Locate and label all roadways, alleys, easements, fences, driveways, sidewalks, parking lots on or within 15 feet of the property line. Provide grades where appropriate.
- ❑ **For lots 7,000 square feet or less**, it is permissible to use spot elevations only in lieu of contours. Provide and verify existing and proposed spot elevations, show proposed elevations in boxes. Provide spot elevations at all critical points of interest including, but not limited to the following: grade breaks, high points, property corners, sag and on-grade inlets, etc. See Exhibit 2 on page 3 for more information.
- ❑ **For lots greater than 7000 square feet**, provide existing and proposed contours using a minimum of two (2) foot contours within 15 feet of the property. Use distinctly different line types for existing and proposed contours. Indicate source of base contours if not City topography. See Exhibit 2 on page 3 for more information.
- ❑ Where applicable, delineate the 100-year flood plain across the property. Note the source of the flood plain information presented, such as FEMA Flood Insurance Rate Map (FIRM) panel number and effective date.

Exhibit 1: Design Professional Sealing Requirements



Appendix 4C: Single Family Lot Grading Checklist & Exhibit

Lot Grading: Fundamentals

1. Provide suitable access to and from abutting street,
2. Immediate diversion of surface water away from buildings and off of the site,
3. Avoid concentrating runoff onto neighboring properties,
4. Minimize disruption to adjacent properties.

- ❑ Grading plan must demonstrate how positive runoff of surface waters is accomplished and means of ultimate runoff disposal to public right-of-way or drainage easement.
- ❑ Verify that the design ensures that onsite drainage protects structures and prevents adjacent property damage.

Minimum Finish Floor Requirements - Enabling Ordinance: *TSM 4.12.D: The finished pad elevation shall be a minimum of twelve (12) inches above the top of the street curb, measured at the lowest portion of the curb along the front of the lot, where the primary drainage flow is towards the street. On lots where the drainage is primarily towards the rear property line or alley, the finished pad elevation shall be twelve (12) inches higher than the top of the lower portion of the alley pavement edge, or the lowest portion of the finished grade along the rear property line. Provided, that when the twelve (12) inches clearance elevation cannot be met due to unusual conditions of the lot, the lot shall be graded to provide either (a) a quarter-inch-per-foot fall (two (2) percent slope) to the street curb, rear finished property line, or alley, as determined by the primary drainage flow, or (b) a one-eighth-inch-per-foot drop (one percent slope) towards a drainage facility if approved by the Director of Engineering or Building Official.*

Lot Grading: Specific Requirements

- ❑ Provide and verify flow direction arrows depict existing and proposed drainage patterns.
- ❑ Check and verify yard spot elevations are a minimum of 0.3 feet below the finished pad elevation and positive drainage is established around and away from the pad.
- ❑ Verify that the usable yard and earthen side slopes do not exceed 3:1, recommend 4:1 max.
- ❑ Within 10 feet of the structure, provide and verify that a minimum fall of 6 inches is provided away from the structure, subject to property line location and other site constraints.
- ❑ Maximum allowable driveway grade is 12%, preferably 10% or less. Verify driveway grades do not exceed maximum grade. Provide grade transitions at steep driveways and graded per the standard City driveway detail.
- ❑ The minimum longitudinal grade for unpaved swales is 1.0%. For lesser slopes use paved swales with a minimum grade of 0.5%. Verify swale slope, depth, width and finish grades are adequate to carry the anticipated runoff.
- ❑ Check and verify that proposed grades match existing at property lines. Verify instruction is provided: Match existing grade at the property lines and maintain drainage patterns; no flow diversions are allowed.
- ❑ Verify all grading work is contained within the property, and/or provide an offsite grading easement or letter of approval from the adjacent property owner per the TSM Appendix 2G.
- ❑ At street sags, review and verify positive overflow path and drainage easement placement and width per TSM 4.09.F.12.
- ❑ Along open channels and FEMA-designated streams, verify that structure finish floor is at least 2 feet above 100-year flood plain elevation; along Rowlett and Spring Creeks, use fully developed flood plain elevations. See TSM 4.13 for more requirements.

Retaining Walls (where required):

- ❑ Define and verify wall type along with any required reinforcement, expansion/construction joint spacing, backfill, percent compaction, drainage specifications, weep hole diameter and spacing.
- ❑ Define beginning, end, length, and top/bottom elevations of retaining walls. We recommend including a detail showing high side swale, property line, and any adjacent utilities and easements.
- ❑ Structural engineered plan required for walls greater than or equal to 4 feet high.
- ❑ Show and provide details for all walls adjacent to right-of-way or provide reference on the grading plan to construct per City standard construction details and per TSM Section 7.
- ❑ Walls greater than 2.5 feet adjacent to public space require a fence or 42 inch high railing.
- ❑ Verify that walls are not within and paralleling City utility or drainage easements.
- ❑ Verify adequate room is provided to construct wall and foundation.

Other Requirements:

- ❑ If more than 5000 square feet of ground is to be disturbed (including building footprint, driveway, and all other graded areas on the property), complete and provide City of Garland Erosion Control sheets 1, 2, and 3 with the grading plan. Contact the Engineering Department's technical staff at (972) 205-2170 for copies of these sheets.
- ❑ Contact any member of the Engineering Department's Development Engineering Group at (972) 205-2170 for flood plain information for properties located partially or entirely within the FEMA designated 100-year flood plains and along smaller streams.

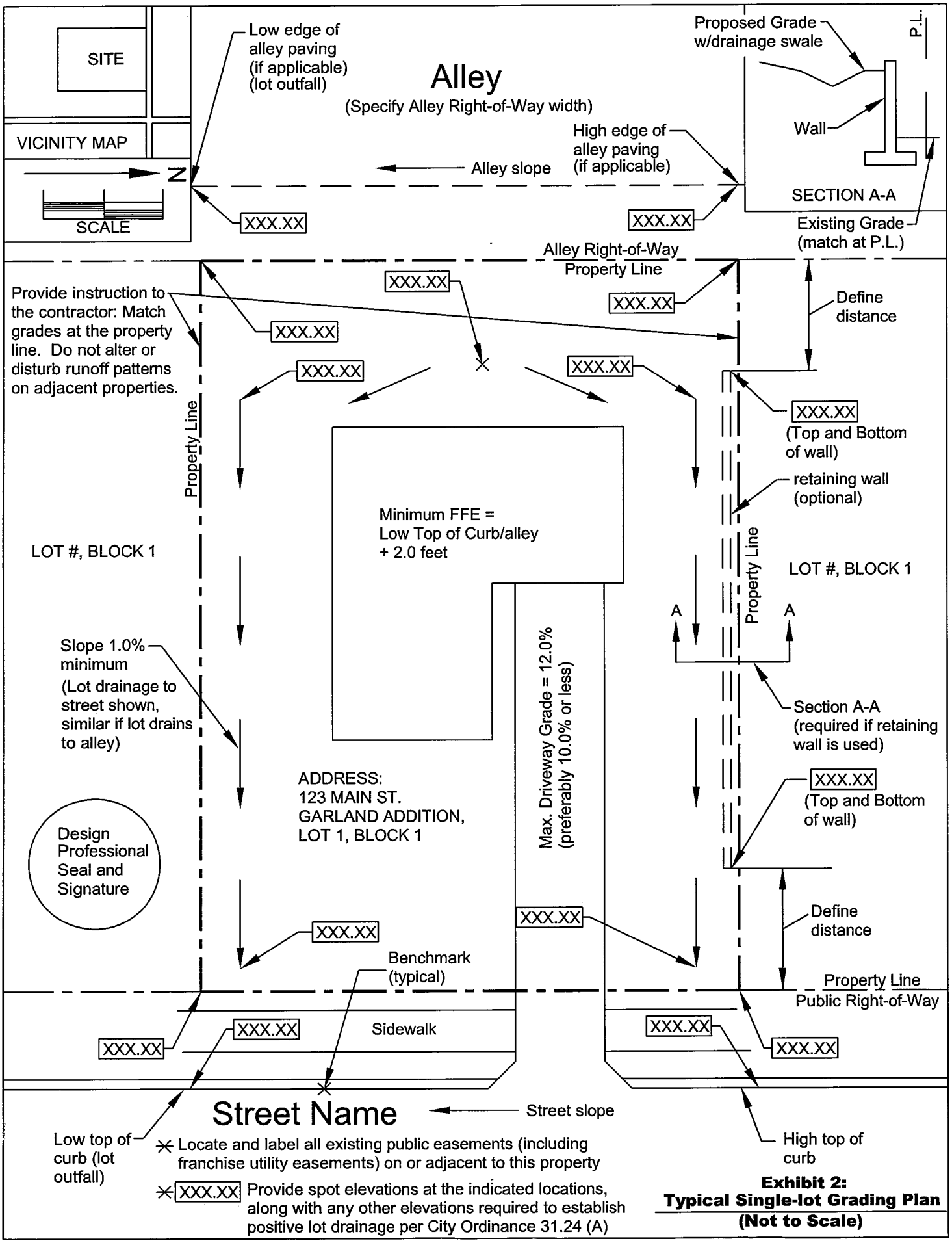


Exhibit 2:
Typical Single-lot Grading Plan
(Not to Scale)

Appendix 4D: Flood Plain Development Permit

CITY OF GARLAND, TEXAS

DEVELOPMENT PERMIT APPLICATION FORM (Form DP-1)

CASE NUMBER: _____ **DATE**: _____

1. **Name of Applicant**: _____
   Mailing Address: _____
   Phone Number: _____

2. **LOCATION OF PROPERTY** (complete as appropriate):
   If located within a subdivision:

   _____
   Name of Subdivision Section No. Block No. Lot No.

   If not located within a subdivision:

   _____
   Name and No. of Survey/Abstract Acreage

   _____
   Location Description (Attach a vicinity map.)

3. **NATURE OF PROPOSED CONSTRUCTION** (check and complete as appropriate):
   ☐ Residential ☐ Non-Residential ☐ Other
   ☐ Alternation of a Natural Waterway or Drainage Course
   ☐ Placement of Fill

4. **DESCRIPTION OF PROPOSED CONSTRUCTION** (check & complete as appropriate):
   ☐ New Construction ☐ Substantial Improvement to Existing Structure
   ☐ House ☐ Mobile Home ☐ Non-Residential _____
   Specify
   ☐ Commercial _____
   Name and Type of Business
   ☐ Other _____

5. **APPLICANT WILL PROVIDE ONE COPY OF PLANS AND SPECIFICATIONS OF THE PROPOSED CONSTRUCTION TO THE CITY ENGINEERING DEPARTMENT.**

FOR USE BY CITY ADMINISTRATOR

Is the property located in an identified flood hazard area?	☐ Yes	☐ No
Is additional Information required?	☐ Yes	☐ No
Are other Federal, State or Local permits required?	☐ Yes	☐ No
Are other regulations applicable?	☐ Yes	☐ No

☐ Permit application approved.
☐ Permit application rejected.

_____ _____
Signature of City Administrator Date

CITY OF GARLAND, TEXAS
NOTICE TO DEVELOPMENT PERMIT APPLICANT (Form DP-2)

CASE NUMBER: _____
NAME OF APPLICANT: _____

THE ABOVE NAMED APPLICANT APPLIED FOR A DEVELOPMENT PERMIT ON _____. THE CITY ADMINISTRATOR REVIEWED THE APPLICATION AND DETERMINED THAT THE PROPOSED DEVELOPMENT IS LOCATED WITHIN AN IDENTIFIED FLOODPLAIN OF THE CITY OF GARLAND.

THE CITY ADMINISTRATOR REVIEWED THE PLANS AND SPECIFICATIONS OF THE PROPOSED DEVELOPMENT FOR CONFORMANCE WITH THE DEVELOPMENT STANDARDS REQUIRED BY THE *CITY OF GARLAND FLOODPLAIN MANAGEMENT REGULATIONS*.

BASED ON THIS REVIEW, THE CITY ADMINISTRATOR DEEMS IT APPROPRIATE TO:

☐ **APPROVE** THE APPLICATION FOR DEVELOPMENT
☐ **REJECT** THE APPLICATION FOR DEVELOPMENT

CONDITIONS FOR APPROVALS OR REASONS FOR REJECTION ARE AS FOLLOWS:

_____

_____

WARNING:
The flood hazard boundary maps and other flood data used by the City Administrator in evaluating flood hazards to proposed developments are considered reasonable and accurate for regulatory purposes and are based on the best available scientific and engineering data. On rare occasions, greater floods can and will occur and flood heights may be increased by man-made or natural causes. Construction standards required by the City Floodplain Management Regulations are the minimum standard deemed necessary to minimize or eliminate flood damage, but reliance on these minimum standards shall not create liability on the part of the City of Garland, the City Administrator, or any other officer or employee of the City of Garland in the event of flooding or flood damage.

I, the undersigned applicant, do hereby:

☐ acknowledge the warning and disclaimer of liability of the City;
☐ agree with the conditions of permit approval;
☐ agree to construct my development in strict compliance with the specified conditions once a permit has been issued;
☐ agree to provide certification of work as may be required.

OR

☐ disagree with the reasons for rejection of my application and desire to make a formal appeal to the City Council of Garland;
☐ disagree with the conditions for approval of a development permit and desire to make a formal appeal to the City Council of Garland.

_____	_____
Signature of Applicant	Signature of City Administrator
_____	_____
Date	Date

CITY OF GARLAND, TEXAS
DEVELOPMENT PERMIT (Form DP-3)

CASE NUMBER: _____
NAME OF APPLICANT: _____
NAME OF PERMITTEE: _____

THE ABOVE NAMED APPLICANT APPLIED FOR A DEVELOPMENT PERMIT ON _____. THE CITY ADMINISTRATOR REVIEWED THE APPLICATION AND DETERMINED THAT THE PROPOSED DEVELOPMENT IS LOCATED WITHIN AN IDENTIFIED FLOODPLAIN OF THE CITY OF GARLAND.

THE CITY ADMINISTRATOR REVIEWED THE PLAN AND SPECIFICATIONS OF THE PROPOSED DEVELOPMENT FOR CONFORMANCE WITH THE DEVELOPMENT STANDARDS REQUIRED BY THE *CITY OF GARLAND FLOODPLAIN MANAGEMENT REGULATIONS*. YOU ARE HEREBY AUTHORIZED TO PROCEED WITH THE FOLLOWING DESCRIBED WORK:

_____
_____
_____

ON THE FOLLOWING DESCRIBED PROPERTY:

_____
_____
_____

In order to maintain compliance with the development Standard of the *City of Garland Floodplain Management Regulations* and to eliminate or minimize flood damage potential to the proposed development, you are hereby directed to construct you proposed development in accordance with the following special provisions:

- ☐ For residential structures, the lowest floor (including basement) must be elevated to _____ feet mean sea level.
- ☐ For non-residential structures, the lowest floor (including basement) must be elevated or floodproofed to _____ feet mean sea level.
- ☐ Permittee must submit a certification from a registered Professional Engineer or land surveyor that the finished floor level of the residential structure was constructed at the specified elevation.
- ☐ For non-residential floodproofing, a registered Professional Engineer must certify that the floodproofing methods are adequate to withstand the flood depths, pressure, velocities, impact, and uplift forces and other factors associated with the base flood.
- ☐ Other provisions (see attached list).

_____
Acknowledgment of Conditions by Permittee Signature of City Administrator

_____ _____
Date Date

NOTE: THIS PERMIT EXPIRES ONE (1) YEAR FROM THE DATE OF ISSUANCE.

Appendix 4E:

ROWLETT AND SPRING CREEK
FULLY DEVLOPED FLOODPLAIN "NO RISE / NO IMPACT" CERTIFICATIONS

This document is to certify that I am a duly qualified professional engineer licensed to practice in the State of Texas. It is to further certify that the attached technical data supports the fact that the proposed _____ will not adversely impact the 100-year fully
(Name of Project)
developed water surface elevations on _____ at published cross sections
(Name of Stream)
in the 1988 Albert H. Halff Associates, Inc. Rowlett and Spring Creek Flood Plain Management Study and will not adversely impact the water surface elevations at the unpublished cross sections in the area of the proposed project. Additionally, I certify the proposed project will not decrease floodplain valley storage by more than 15% in accordance with the City of Garland Code of Ordinances.

SEAL, SIGNATURE, AND DATE

_____
Printed Name

_____
Company Title

_____

_____
Company Address

FOR COMMUNITY USE ONLY:		
Community Approval ☐ Approved ☐ Disapproved		
Community Official's Name	Community Official's Signature	Title

Appendix 4E:

FEMA FLOODWAY "NO-RISE / NO-IMPACT" CERTIFICATION

This document is to certify that I am a duly qualified professional engineer licensed to practice in the State of Texas. It is to further certify that the attached technical data supports the fact that proposed _____ will not adversely impact the base flood elevations,
(Name of Project)

floodway elevations, or floodway widths on _____ at published cross
(Name of Stream)

sections in the Flood Insurance Study for the City of Garland, dated _____ and will
(Study Date)

not adversely impact the base flood elevations, floodway elevations, and floodway widths at the unpublished cross sections in the area of the proposed project.

SEAL, SIGNATURE, AND DATE

_____
Printed Name

_____
Company Title

_____

_____
Company Address

FOR COMMUNITY USE ONLY:		
Community Approval ☐ Approved ☐ Disapproved		
Community Official's Name	Community Official's Signature	Title

Appendix 4E:

FEMA FLOOD PLAIN "NO-RISE / NO-IMPACT" CERTIFICATION

This document is to certify that I am a duly qualified professional engineer licensed to practice in the State of Texas. It is to further certify that the attached technical data supports the fact that the proposed _____ will not adversely impact the base flood
(Name of Project)

elevations on _____ at published cross sections in the Flood Insurance
(Name of Stream)

Study for the City of Garland, dated _____ and will not adversely impact the base flood
(Study Date)

elevations at the unpublished cross sections in the area of the proposed project.

SEAL, SIGNATURE, AND DATE

_____
Printed Name

_____
Company Title

_____

_____
Company Address

FOR COMMUNITY USE ONLY:		
Community Approval ☐ Approved ☐ Disapproved		
Community Official's Name	Community Official's Signature	Title

Appendix 5A: Water & Wastewater CIP Plan

Contact the Engineering Department for a copy of the latest Water and Wastewater Capital Improvement Plan. 972-205-2170

Appendix 5B: Water and Wastewater Demand Determination Parameters

Table 5B.1: Development Water Demand Determination Parameters

Land Use Type	Population/Employment per Unit	Average Day Demand per Capita (gpcd)	Maximum Day to Average Dry Peaking Factor	Peak Hour to Maximum Day Peaking Factor
Single Family	3.09	120	2.3	1.8
Multi-Family	3.05	120	2.3	1.8
Mixed Use	3.05 people/unit 1 employee/400 sf	120 60	2.3 1.5	1.8 1.5
Commercial and Retail	1 employee / 400 sf 0.5 Floor to Area Ratio[1]	60	1.5	1.5
Office and Professional Services	1 employee / 400 sf 0.5 Floor to Area Ratio[1]	60	1.5	1.5
Industrial[2]	-	-	-	-

[1]Floor to Area Ratio is the ratio of a building's total floor area to the size of the land upon which it is built.

[2]Industrial water flows will be evaluated on a case-by-case basis due to the variability in flow generated within the industrial land use type.

Table 5B.2: Development Wastewater Demand Determination Parameters

Land Use Type	Population/Employment per Unit	Average Daily Flow per Capita (gpcd)	Maximum Dry to Average Dry Peaking Factor	RDII Allowance (gpad)
Single Family	3.09	100	1.8	5,000
Multi-Family	3.05	100	1.8	5,000
Mixed Use	3.05 people/unit 1 employee/400 sf	100 35	1.8	5,000
Commercial and Retail	1 employee per 400 sf 0.5 Floor to Area Ratio[1]	35	1.8	5,000
Office and Professional Services	1 employee per 400 sf 0.5 Floor to Area Ratio[1]	35	1.8	5,000
Industrial[2]	-	-	-	-

[1]Floor to Area Ratio is the ratio of a buildings total floor area to the size of the land upon which it is built.
[2]Industrial wastewater flows will be evaluated on a case-by-case basis due to the variability in flow generated within the industrial land use type.

IMPERVIOUS AREA STATUS
COMMERCIAL DEVELOPMENT

Name of Business: _____

Street Address: _____

Subdivision: _____

Engineer/Surveyor: _____

Phone No.: _____

Net Change in Impervious Area, This Project: _____ Square Feet
(nearest 100 SF)

Net Area Disturbed During Construction, This Project: _____ Square Feet
(nearest 100 SF)

TOTAL IMPERVIOUS AREA, for This Site: _____ Square Feet
(nearest 100 SF)

_____ _____
Signature of Engineer or Surveyor Date

OFFICE USE ONLY:

Polygon ID # : _____

Account No. : _____

Changes Implemented:

By: _____ Date: _____

Appendix 9A: Geotechnical Report for Roadways Checklist

Project Case Number: _____ **Project Name:**_____

Geotechnical Engineer/Firm: _____

Texas Firm Registration No.: _____ **Report Date:** _____ **Date Received:**_____

A PDF of the report shall be required and submitted with the first submittal of Civil Engineering Construction Plans where any public roadway is being proposed or reconstructed. Not including a report with the first submittal of construction plans may deem the submittal incomplete and may be returned un-reviewed.

*Note: All roadways and alleys (CIP and Development) shall have a geotechnical investigation and subgrade design performed. All investigations must fulfill and comply to all components of **Section 9.01**, **9.02**, **9.03** and **9.04** of the TSM. The requirements of **Section 9.05** are only applicable if Standard Pavement Section in **Table 9.1** is not valid or electing to deviate from the standards in **Table 9.1** or **Table 9.5**. Any N/A response shall include a written explanation with adequate justification, as deemed necessary by the Director of Engineering.*

COMPLETE	N/A	1. SECTION 9.01 GENERAL
☐	☐	A. Include the *Summary of Geotechnical Recommendations Form*
☐	☐	B. Description of Project
☐	☐	C. Location of Project
☐	☐	D. Roadway type and classification
☐	☐	E. Grading plan and summary
☐	☐	F. Discussion of underground utilities within the Project limits

COMPLETE	N/A	2. SECTION 9.02 EXISTING SURFACE/SUBSURFACE INVESTIGATION
☐	☐	A. Discussion of existing surface/subsurface conditions that may affect subgrade and pavement design or performance (i.e., ability to achieve 300 pci, vegetation, terrain, existing structures, existing pavement, etc.)
☐	☐	B. Discussion of geological conditions that may impact subgrade and pavement design or performance. Specify formation.
☐	☐	C. Surface/subsurface conditions with logs • Sampling techniques (ex. borings meeting 9.02.A, etc…) • Description of soil and rock encountered, including lab test details • Discussion of water and groundwater conditions • Discussion of seasonal variations in moisture content • Atterberg limits (ASTM D 4318) • Percent Passing the No. 200 sieve (ASTM D 1140)
☐	☐	E. All standards used in field and laboratory testing shall be identified. Any deviations to standard procedures shall be discussed.

COMPLETE	N/A	3. SECTION 9.03 SUBSURFACE DESIGN
☐	☐	A. Expansive Soils Evaluation • Percent swell calculation and test results • Effect of cut/fills (i.e., long-term soil uplift in cut areas; settlement overburden pressure effects in fill areas) • Identify soil movement estimates at each boring location • Explanation of anomalous variations within the soil profile and between borings (i.e., Atterberg limits, PI, sulfates, clay to rock, etc.)

☐ ☐ B. Soil Moisture Conditioning and/or Additional Subsurface Conditions

- Discussion of swell test results summary
- Recommended depth of moisture conditioning
- Address transition between zones of varying depth
- Discussion of possible variations during construction and mitigation thereof
- Discussion of techniques to maintain moisture in soil
- Discussion of methods to test soil moisture conditioning during construction (i.e., a second geotechnical investigation/re-evaluation may be required to specifically address soil moisture prior to lime operations)
- Address street trees

COMPLETE N/A 4. SECTION 9.04 SUBGRADE DESIGN

☐ ☐ A. Subgrade Stabilization

- Typical subgrade type and documentation validating subgrade type can achieve a subgrade reaction of 300 pci
- Explanation of anomalous soil conditions anticipated and discussion of potential variations to consider
- Construction techniques to implement
- Effects of rock/rock fragments encountered during construction and recommendations to abate

☐ ☐ B. Soluble Sulfates

- Identify soluble sulfate test results; summarize results and discuss variations
- Discussion of techniques during construction to mitigate sulfate-induced heaving
- Sulfate retesting during construction

COMPLETE N/A 5. SECTION 9.05 PAVEMENT DESIGN (Pavement Design only applicable if Standard Pavement Section in **Table 9.1** is not valid or electing to deviate from the standards)

☐ ☐ A. Identify roadway type(s) and classifications(s)

☐ ☐ B. Identify deviations from Pavement Design Input Values (Re: **Table 9.5**)

☐ ☐ C. Identify recommended pavement section

COMPLETE N/A 6. APPENDIX

☐ ☐ A. Geological Map

☐ ☐ B. Boring Locations

☐ ☐ C. Boring Logs

☐ ☐ D. Grading Plan (for non-linear projects)

☐ ☐ E. Cut vs. fill by station number or proposed road profiles (for linear projects)

☐ ☐ F. Printout from WinPAS pavement design software program (if applicable)

☐ ☐ G. Proposed typical section with dimensions showing pavement thickness, subgrade type and thickness, and moisture conditioning depth. If applicable, location of proposed trees and root barriers shall be shown.

Geotechnical Engineer Printed Name: _____

Geotechnical Engineer Signature: _____ **Date:** _____

Appendix 9B: Summary of Geotechnical Recommendations Form

Project Case Number: _____

Project Name: _____

Geotechnical Engineer/Firm: _____

Texas Firm Registration No.: _____

Report Date: _____ **Date Received:** _____

*Note: Pavement Design only applicable if Standard Pavement Section in **Table 9.1** is not valid or electing to deviate from the standards in **Table 9.1** or **Table 9.5**. Geotechnical Engineer must fill out this form completely and submit with the Report.*

1. Design Input Values:

Thoroughfare Classification(s): _____

Geological Formation from Geological Atlas of Texas, Dallas Sheet (circle all that apply):

Ozan Formation (Clay or Lower Taylor Marl)

Austin Chalk

Alluvial and Terrace Deposits

Other/Explain: _____

Pavement Design Input Value Deviation(s) from **Table 9.5**: _____

2. Design Recommendations:

Moisture Conditioning Depth (inches): _____ *If yes, include plan layout depicting limits*

Subgrade Treatment: _____ *Lime/Cement, Lime, Cement, Crushed Stone*

Lime/Cement Thickness (inches): _____

Lime/Cement Application Rates: _____

Alternate Subgrade (Y/N): _____ *If yes, describe*

Concrete Thickness (inches): _____

Miscellaneous Items and Notes:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Miscellaneous Items and Notes Continued:

Geotechnical Engineer Printed Name: _____

Geotechnical Engineer Signature: _____ **Date**: _____

Geotechnical Engineer Seal, Signature, and Date: