CITY OF GRAHAM, N.C.

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CONSTRUCTION DOCUMENTS CHECKLIST FOR PLAN REVIEW

Date-January 1, 2006

Section 1: General Plan Preparation Guidelines

- ☐ Sheets shall be no larger than 36" x 24" plan and profile paper.
- ☐ Minimum text size shall be 1/8"
- ☐ Scale on plan view shall be no smaller than 1" = 50'; scale on profile view shall be no smaller than 1" = 50' horizontally and 1" = 5' vertically using a grid showing 1' intervals.
- ☐ Cover sheet shall have a vicinity map at a scale no smaller than 1" = 200'.
- ☐ Provide a legend indicating existing and proposed lines, features and symbols.
- ☐ Cover sheet shall include all general notes, owner's name, telephone number, and mailing address.
- ☐ All elevations shall be given in relation to mean sea level; elevations in profile view shall be labeled in 10' intervals on the heavy lines (Ex. 350, 360).
- ☐ Benchmark elevations and locations shall be shown on plan view.
- ☐ Plan views shall have a north arrow on each drawing.
- ☐ Each drawing shall have the following information in the title block: Street or project title, limits, horizontal and vertical scales, original date, revisions date, drawing number, checked by and drawn by. Recommended placement is lower right-hand corner.
- ☐ All drawings sealed, signed and dated by a NC Professional Engineer.
- ☐ Plan view shall show all actual street names. State road numbers shall be shown if applicable. Plan view should also indicate whether street is asphalt, concrete, gravel or dirt. Proposed street & Right-of-way widths will be dimensioned back-to-back and labeled in plan view.
- ☐ Plan view shall show proposed and existing curb and gutter, storm sewers, drainage structures, driveway pipes, water mains, sanitary sewer mains, etc. All available elevations shall be shown on the profile view. Direction of flow shall be shown on plan view for all sanitary sewers and storm drains. Materials and pipe sizes shall be labeled.
- ☐ Existing utility lines shall be shown and labeled on plan view and indicated in the legend.
- ☐ Plans shall show final proposed locations and dimensions of all water, storm drain, and sanitary sewer lines, including services to each property line for water and sanitary sewer, devices to be installed on the system, catch basins, culverts, ditches, including grades, pipes sizes, elevations, assumptions, calculations, invert elevations for all inlets and manholes and profiles of sanitary sewer lines.
- ☐ Plan shall bear the note: "All construction to be in accordance with all City of Graham, Specifications and Standard Details, latest edition."
- ☐ All existing and proposed water, storm drainage and sanitary sewer easements shall be shown on all applicable sheets.

Section 2: Water Distribution Design

Applicant Validation N/A	Applicant Validation Included	COG Staff Check	
____	_____	____	All water distribution system extensions shall be designed to provide fire flow plus peak daily water demand. The peak daily water demand is based on 2.5 times the average daily water demand for the type of user. The distribution system shall be designed to maintain a minimum of 20 PSI at all points in the distribution system under all conditions of usage, including fire flow. Fire flow demand varies with the type and size of user; however, the following shall be used as the minimum fire flow demand to design the distribution system extensions: A. Residential Buildings 1. One and two family dwellings if more than 11 ft. of separation between buildings---------1000 GPM 2. One and two family dwellings if less than 11 ft. of separation between buildings---------1500 GPM 3. Multifamily units----------1500 GPM minimum, but refer to Table B105.1 in the NC Fire Prevention Code if more applies. B. Commercial/Business Users------2000 GPM minimum, but refer to Table B105.1 in the NC Fire Prevention Code if more applies. C. Industrial Users----------2500 GPM minimum, but refer to Table B105.1 in the NC Fire Prevention Code if more applies. At the time of preliminary development plans, a preliminary design shall be submitted which indicates that the proposed distribution system extensions comply with the above requirements. Upon submittal of the construction plans, detailed modeling documentation shall be submitted showing compliance with the above requirements. Acceptable modeling programs include Watercad, HydrauliCad, WatSys by CivilSystems, or other modeling programs approved in advance using a C factor of 130. The minimum size water line extension shall be 8", except that in cul-de-sacs, 6" is allowed if less than 500 ft. in length and 4" is allowed if less than 250 ft. in length.
____	_____	____	In all residential districts, the maximum distance between fire hydrants, measured along public street centerlines and/or other private travel ways shall be 500 feet.
____	_____	____	Valves should be installed on all branches from feeder mains and between mains and hydrants according to the following schedule: a. three (3) valves at X's (crosses), b. two (2) valves at T's (tees) and c. one (1) valve on single hydrant branch Note: Additional valves may be required for specific design conditions.
____	_____	____	All fittings, valves, hydrants, plugs, etc. must be called off in a fitting box with the number of items.
____	_____	____	Show water service to each lot and show the water meter box 6" on street side of the right-of-way line. The developer will be responsible for the cost of relocating services and meters that fall within driveways.
____	_____	____	Multi-family, Commercial and Industrial Developments - Hydrants shall be located within 250 feet of most remote portion of building(s).

Section 2: Water Distribution Design – cont.

Applicant Validation N/A	Applicant Validation Included	COG Staff Check	
____	____	____	Minimum Radius for ductile iron pipe without fittings: 4" - 125' 6" - 145' 8" - 195' 10" - 195' 12" - 195' 14" - 285' 16" - 285' 18" - 340' 20" - 340' 24" - 450"
____	____	____	On all 12" and larger water main, provide joint restraint calculations. Fittings,valves,and hydrants to be restrained with Megalugs and concrete.
____	____	____	Main line valves on straight runs between street intersections shall be spaced no greater than the distances given below and shall be located within fifty (50) feet of the nearest hydrant to their location. Main Size Maximum Spacing 6"- 600' 8"- 900' 12"- 1000' 16"- 1000' 24"- 1500'
____	____	____	When phasing a project, locate valves in order to not place any existing service out of water. When extending water line to a new phase add additional valves beyond above requirements if necessary.
____	____	____	Indicate in profile vertical separation 12" water to storm drain 18" water to a sanitary sewer.
____	____	____	Provide 3 foot of cover minimum over water main (8" or less),4 foot of cover (10" or greater) and 5 foot of cover minimum at air release valve installation.
____	____	____	If water main is outside of street right-of-way indicate 20 feet easement. Show all existing and proposed water line easements
____	____	____	Indicate water main material Ductile Iron Pipe and class (Class 50 is min.)
____	____	____	Indicate how new water will connect to existing water main.
____	____	____	Indicate backflow prevention.
____	____	____	Hydrant leads are off hydrant tees unless at the end of a water main.
____	____	____	If road bore and jack is required show bore size (dia.), length, thickness of steel encasement and length of restrained pipe through encasement.
____	____	____	For water service connections >3/4" show meter size, vault, backflow prevention etc., meter to be Badger. Specific approval required if Badger is not used.

Section 3: Sanitary Sewer Collection Design

Applicant Validation N/A	Applicant Validation Included	COG Staff Check	
_____	_____	_____	All gravity sewer mains shall be designed and sized to serve the total natural drainage basin. The total off-site drainage area in acres must be shown on the plans and calculations should be submitted to the City upon request to justify pipe sizing. An 8-inch main shall be the minimum size permitted.
_____	_____	_____	When preparing the plans for sewer mains, deflection angles for all horizontal turns shall be shown on the drawings (at least 90°). All elevations shall be tied to mean sea datum and the benchmark shall be shown or described on the plans. Spot elevations on 100 foot stations, 75 feet from the centerline on both sides, shall be shown on the plan, or cross-sections supplied to ensure that the sewer can adequately serve the property. The plans shall show the manhole number (MH #1 etc.), top elevation, station, depth including invert elevations, length of sewer reach between manholes, and slope (in percent). Established creek centerlines and inverts will be platted on the sewer plan and profile sheets, adjacent to proposed sewer alignment, within 75 feet.
_____	_____	_____	Grades for sanitary sewers must be such that a minimum flow velocity of 2 feet per second is maintained. The minimum grade for an 8-inch sewer line is 0.50%. If necessary for slope to be less then 0.50%, provide reason.
_____	_____	_____	Minimum widths of permanent and construction sanitary sewer easements, for public sewer mains, are: Permanent / Construction 8" & 15" main - 20 feet wide / 30 feet wide 18" & 24" main - 20 feet wide / 40 feet wide Larger size easements may be required based upon the depth of installation or other consideration as determined by the Staff. Sewer mains shall be centered in the easement. Indicate all existing and proposed easements.
_____	_____	_____	If less than 3 feet of cover over proposed sanitary sewer, pipe shall be ductile iron.
_____	_____	_____	Show sewer service terminating at a cleanout on the right-of-way line. Do not tie 4" lateral sanitary service directly into manhole. Cleanouts shall not be placed in drives.
_____	_____	_____	Indicate in profile vertical separation 12" sanitary sewer to storm drain and 18"sanitary sewer to water main.
_____	_____	_____	Sanitary sewer lines shall be located a minimum distance of 100 feet from the center of any well used as a community or private water supply. This buffer may be reduced to 50 feet provided that the sanitary sewer lines are constructed of materials and joints that are equivalent to water main standards.
_____	_____	_____	The maximum length of sewer line, which shall be constructed between manholes, shall be four hundred (425') feet.

Section 3: Sanitary Sewer Collection Design – cont.

Applicant Validation		COG Staff Check	
N/A	Included		
_____	_____	_____	The elevation of all sewer lines at creek crossings shall be set such that the top of the pipe is at or below the elevation of the stream bed or for crossings above water level, the bottom of the pipe should be located above the 25-year flood elevation.
_____	_____	_____	Sewer manholes located within the 100-year flood plain shall be constructed for watertight manholes, or sewer manholes located within the 100-year flood plain shall have a minimum height of two (2') feet above the 100-year flood elevation.
_____	_____	_____	Drop in manhole greater than 6" but less than or equal to 30" indicate concrete slide. If drop is greater than 30" provide an outside drop manhole. Inside drops may be allowed at existing manholes, with specific approval by the City.
_____	_____	_____	Public sanitary sewer pipe material shall be indicated in profile and bedding type. Connections to existing manholes shall be made by coring into the manhole. Provide plugs in all new line connections until the project is accepted to prevent mud and inflow into the existing sewer system.
_____	_____	_____	Where it is not possible to provide gravity sanitary sewer service, indicate which lots will have a private pump system.
_____	_____	_____	Minimum Slope requirements:

Dia of Pipe (inches)	Minimum Slope (Feet per 100 feet)
8	0.50
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

_____	_____	_____	If road bore and jack is required show bore size (dia.), length, thickness of steel encasement and length of restrained pipe through encasement.

Section 4: Roadway and Street Design

Applicant Validation N/A	Applicant Validation Included	COG Staff Check	
____	_____	_____	Street typical sections shall be on the cover sheet or the first sheet of plan and profiles and will include street and right-of-way width, sidewalk location, cross-slopes, and pavement design. Do not place aggregate under curb for City streets.
____	_____	_____	Pavement Cross Section to meet or exceed City Standards. Typical section for residential streets is 8"ABC,1.25"SF9.5A,1.25"SF9.5A surface course. Surface course to be placed between 6 – 12 months after the first layer. Typical street width is 31 ft. B-B with 30" curb and gutter.
____	_____	_____	Plan view shall show all property lines and lot frontages. Existing property irons shall be labeled "E.I.P." Right-of-way lines shall be dimensioned and labeled "R/W."
____	_____	_____	Complete street curve data shall be shown on plans. This information shall include, but is not limited to: intersection radii, length of all arcs, internal angles, sight triangles, intersection centerlines, superelevation rates, if any along with the top of curb or edge of pavement profiles, vertical curve length, rate of vertical curvature (K), PVI, PVC, and PVT station and elevation, horizontal curve length, tangent, centerline radius, and delta. Minimum K factor is 30 for typical residential streets. Show top of curb elevations around all radii at intersections and every 25 ft. around cul-de-sacs.

Other: The design engineer shall provide a copy of this checklist with each submittal of construction plans and shall check the appropriate response under the applicant validation column and sign below.

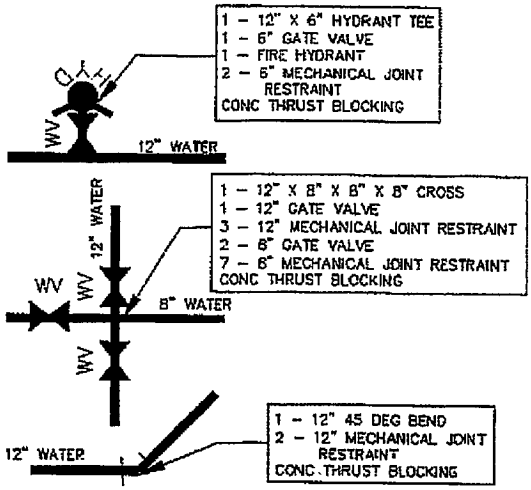
Name_____ **Date**_____
Company_____

OTHER

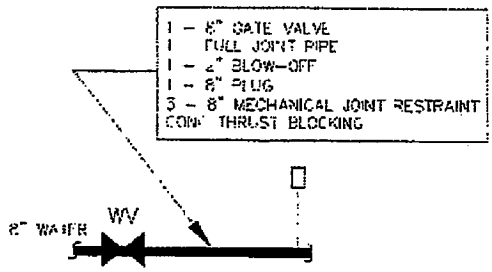
1. **Refer to Graham Storm Sewer Design Manual and Flood Damage Prevention Ordinance.**
2. **All Storm Sewers to be Designed for Q10 Storm, except that the Q100 flows shall be confined to within the cub inlets.**

Section 5: Examples

Water Main Fitting Box



End of Water Line with Future Connection



Typical Service Layout