City of Burlington, NC
Engineering Department
P.O Box 1358
425 S. Lexington Ave.
Burlington, North Carolina 27215
Phone (336) 222-5050
Fax (336) 513-5467

INFRASTRUCTURE PLAN CHECKLIST FOR PLAN REVIEW

August 7, 2020 10th Revision

Section 1: General Plan Preparation Guidelines

- ☐ Sheets shall be no larger than 36" x 24" plan and profile paper.
- ☐ Minimum text size shall be 0.06
- ☐ 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 that accurately shows the project and the surrounding streets.
- ☐ 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. The general notes shall include a note that states "ALL MATERIALS AND CONSTRUCTION METHODS PER THE LATEST EDITION OF CITY OF BURLINGTON SPECIFICATIONS AND DETAILS."
- ☐ 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. 650, 660).
- ☐ Benchmark elevations and locations shall be shown on plan view if not NAVD88.
- ☐ 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 Right-of-Way and street dimensions shall be labeled in plan view. Street widths shall be shown from back of curb to back of curb.
- ☐ 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.
- ☐ 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, and ditches. Plan information shall include grades, pipes sizes, elevations, assumptions, calculations, invert elevations for all inlets and manholes and profiles of sanitary sewer lines.
- ☐ All existing and proposed water, storm drainage and sanitary sewer easements shall be shown on all applicable sheets.
- ☐ Plans must have a City of Burlington Plan Review and Inspections Fee chart on the Cover Page with completed quantities and calculated fees.

Section 2: Water Distribution Design

Applicant Validation N/A	Applicant Validation Included	COB Staff Check	
____	_____	____	All fittings, valves, hydrants, plugs, etc. must be called out in a fitting box with the number of mechanical restraint retainer glands. See Example in Section 7.
____	_____	____	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. In all other districts, fire hydrants shall be spaced to adequately provide fire protection in accordance with the North Carolina Fire Prevention Code, latest edition as amended but in no case more than 1000 feet apart.
____	_____	____	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
____	_____	____	Water mains 12" and larger in diameter which have a change in elevation of fifteen feet or greater shall have an air release at high points and blow-off capability at the low point of the water line.
____	_____	____	Show water service to each lot and show the water meter 1 foot on street side of the right-of-way line. Water meters shall not be located in driveways, sidewalks, multi-use paths, or greenways. The developer will be responsible for the cost of relocating services and meters that fall within driveways, sidewalks, multi-use paths, and greenways.
____	_____	____	Multi-family, Commercial and Industrial Developments - Hydrants shall be located within 500 feet of most remote portion of building(s).
____	_____	____	Minimum Radius for ductile iron push on joint pipe without fittings: 4" - 205' 6" - 205' 8" - 205' 10" - 205' 12" - 205' 14" - 340' 16" - 340' 18" - 340' 20" - 340' 24" - 340"
____	_____	____	On all 12" and larger water mains provide joint restraint calculations for all fittings, valves and dead ends.
____	_____	____	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. Water mains shall be extended a minimum of one full joint beyond any pavement, including any temporary turn-arounds at the phase line. When extending water line to a new phase add additional valves beyond above requirements if necessary.
____	_____	____	Indicate in profile minimum vertical separation **12**" water to storm drain and **18**" water to a sanitary sewer.
____	_____	____	Provide 4 foot of cover minimum over water main and 5 foot of cover minimum at air release valve installation.
____	_____	____	If water main is outside of street right-of-way indicate 20 foot easement. Show all existing and proposed water line easements

____	_____	____	Indicate water main material Ductile Iron Pipe with a pressure class 350 and thickness class 50.
____	_____	____	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.
____	_____	____	Water mains shall be designed and installed across the entire lot frontage and at all stub out locations for extension of services in the future to adjoining properties.

Section 3: Sanitary Sewer Collection Design

Applicant Validation		COB Staff	
N/A	Included	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 Engineering Department 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 at all manholes shall be shown on the drawings. All elevations shall be tied to mean sea datum. 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, and slope (in percent). Established creek centerlines and inverts / creek bottom elevations will be shown 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 and require specific approval from the City Engineer.
_____	_____	_____	Minimum widths of permanent and construction sanitary sewer easements, for public sewer mains, are: Permanent / Construction 8" to 15" main - 30 feet wide / 20 feet wide 18" to 24" main - 40 feet wide / 20 feet wide Larger size easements may be required based upon the depth of installation or other consideration as determined by the Engineering Department. 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 one foot beyond right-of-way. Do not tie 4" lateral sanitary service directly into manhole, except at the end of a Cul-de-sac. Cleanouts shall not be placed in driveways, sidewalks, multi-use paths, or greenways. The developer will be responsible for the cost of relocating cleanouts that fall within driveways, sidewalks, multi-use paths and greenways.

_____ _____ _____ Indicate in profile minimum vertical separation **24**" 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 25 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 (400') feet.

_____ _____ _____ Indicate pipe bedding requirements limits in the profile for VCP when Class B Bedding is required. (COB Detail SS-1)

_____ _____ _____ The elevation of all sewer lines at creek crossings shall be set such that the top of the pipe is a minimum of 12” 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. Aerial crossing shall be approved by City Engineer only when no others means or routes are possible.

_____ _____ _____ Sewer manholes located within the 100-year flood plain shall be constructed in accordance with Page 5 of the "Standard Specification Drawings" 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.

_____ _____ _____ Public sanitary sewer pipe material shall be indicated in profile. Material shall be vitrified clay pipe or Protecto 401 coated ductile iron pipe where authorized. PVC Sewer Pipe may be used in residential developments where no offsite drainage can or could connect to the line. PVC sewer shall be SDR-21 pipe with elastometric gasket, push-on type. PVC Sewer shall require a minimum of Type B bedding. PVC sewer shall be approved by City Engineer. Indicate Fernco type coupling between connections of different material. Private sanitary sewer pipe material is choice of engineer certifying the 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

Lines larger than 12” shall be per NCDEQ Standards or as approved by City Engineer.

_____	_____	_____	If road bore and jack is required show bore size (dia.), length, thickness of steel encasement and length of restrained pipe through encasement.
_____	_____	_____	Sewer mains shall be designed and installed across the entire lot frontage and at all stub out locations for extension of services in the future to adjoining properties, including natural drainage locations to adjoining properties. Easements shall be required to facilitate sewer extension in the future without disruption of service to existing customers.
_____	_____	_____	Sewer services shall not use fittings or bends within the Right-of-Way. Laterals shall be perpendicular to the main unless tying into a manhole.

Section 4: Storm Drainage Design

Applicant Validation N/A	Applicant Validation Included	COB Staff Check	
_____	_____	_____	Provide Storm Sewer Calculations on plans in a chart that shows drainage structure #, inlet drainage area, inlet drainage C value, inlet drainage intensity, inlet Q, previous Q (flow entering the box from the system), total outlet Q, invert(s) in with pipe name, invert out, exiting pipe name Storm sewers shall be designed to carry a 10 yr. Storm with storm drainage upstream fully urbanized with no pressurized flow. Culvert and bridge crossings shall be designed to carry a 25 yr. Storm for minor streets and 50 yr. Storm for major streets with upstream conditions fully urbanized. The resulting HW/D shall be less than 1.5 and result in at least 1' of clearance for the headwater elevation to the shoulder hinge beyond the sidewalk. Culverts and bridges in a FEMA regulated floodplain and /or floodway shall carry the 100 yr. Storm with a no-rise certification or as approved through a FEMA Map Revision. - Indicate all assumptions
_____	_____	_____	If storm drainage is off the right-of-way, a minimum 20 foot wide permanent Storm Drainage easements must be shown. A storm drain structure shall provide a clear change between publicly maintained storm sewer and privately maintained storm sewer at the Right of Way or the curb line. All storm sewer outside the Right of Way shall be labeled as privately maintained and disclose the party responsible for perpetual maintenance (either HOA, developer, or property owner). The easement shall be shown and labeled on the final plat with the same information.
_____	_____	_____	Provide Inlet/Outlet Protection (Rip/Rap)
_____	_____	_____	All Drainage Areas used in calculations shall be accurately depicted on a minimum 400-scale plan.
_____	_____	_____	Indicate storm drain pipe material. In right-of-way use Reinforced Concrete Pipe. Outside of right-of-way HDPE pipe or RCP.
_____	_____	_____	Provide calculations used to determine cross-section and lining for all swales, ditches and channels, (permanent and/or temporary).
_____	_____	_____	Provide calculations for design of outlet structure and emergency spillway for permanent detention/retention measures.

_____	_____	_____	Pipe inlets and outlets shall be checked for inlet and outlet headwater / tailwater control so as to insure that headwater will not encroach on uphill adjacent property or create a hazard to existing and future development.
_____	_____	_____	Gutter spread shall be calculated and shown, no inlet structure shall create a gutter spread of greater than 8'.
_____	_____	_____	The minimum size for a storm sewer pipe shall be 15" in diameter. The minimum storm sewer pipe grade is 0.5% Storm sewer pipe grades greater than 10% shall be approved by the City Engineer.
_____	_____	_____	Endwalls or Flared-End Sections, plus an approved energy dissipator will be required at all release points.
_____	_____	_____	All by-pass storm sewer systems shall not mix with storm sewer systems conveying onsite, developed run-off unless the BMP is sized to treat such by-pass flow. No developed area shall drain or enter the by-pass storm sewer system.

Section 5: Erosion and Sediment Control Design

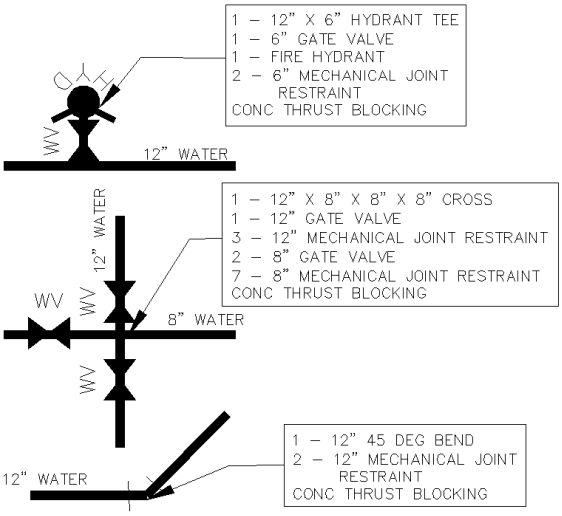
Applicant Validation N/A	Applicant Validation Included	COB Staff Check	
____	_____	_____	Dimensions and locations of all permanent erosion control measures shall be shown on all applicable plan view sheets.
____	_____	_____	Erosion control measures are shown on Infrastructure Plans for reference only and should show measures per approved erosion control plans. Infrastructure Plans approval does not constitute Erosion Control Plan Approval.
____	_____	_____	Provide detailed sequence of construction.
____	_____	_____	Provide a calculated area of disturbance in ACRES. Indicate limits of disturbance on plan.
____	_____	_____	All existing Topography on site as well as 100' off-site throughout the boundary. (buildings, roads, sewer, water…)
____	_____	_____	Overall grading of the site including proposed grades for all lot corners, side/rear yard swales, finish grades for all lots/buildings and proposed contours.

Section 6: Roadway and Street Design

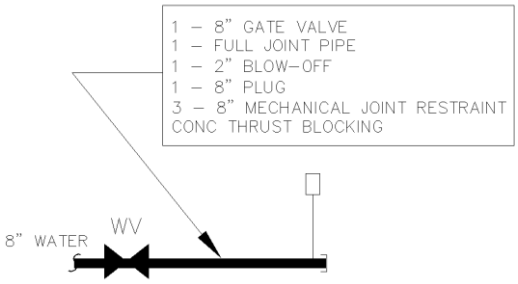
Applicant Validation N/A	Applicant Validation Included	COB Staff Check	
____	_____	_____	Street typical sections shall be shown on a detail page per COB STD R-1 and R-23.
____	_____	_____	Pavement Cross Section meets or exceeds City Standards – 6" ABC, 1 ½" of SF 9.5C) and 1" SF 9.5B Bit. Pavement. No ABC under 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 centerline profiles, vertical curve length, rate of vertical curvature (K), PVI, PVC, and PVT station and elevation, horizontal curve length, tangent, centerline radius, and delta. Design requirements can be found in Section 6.3 of the UDO. In particular: Street grades shall not exceed 12% for local streets, 8% for Collectors and 6% for arterials. No street grades shall be less than 1%. No grades shall exceed 3% for a distance of 100' from an intersection. Grade changes shall be connected by a vertical curve with a minimum "k" value of 40. Stop conditions shall have a minimum "k" value of 14. Centerline minimum radii shall be 150' for local streets, 400' for collectors, and 600' for arterials. All applicable standards of UDO Section 6.3 shall apply.
____	_____	_____	On major thoroughfares, tangents between reverse curves shall be greater than 150 ft. On minor thoroughfares, tangents between reverse curves shall be greater than 100 ft. On local access streets, tangents between reverse curves may be 0 ft.
____	_____	_____	Provide spot elevations around the top of curb at all intersections, around all cul-de-sacs, and at all curb ramps.
____	_____	_____	Provide a USPS Cluster Box Unit for Subdivision. Provide turn out lanes or off-street parking as per City of Burlington Standards as per December 15, 2017 Addendum to COB Engineering Specifications. Label Central Mailbox Unit.

Section 7: Examples

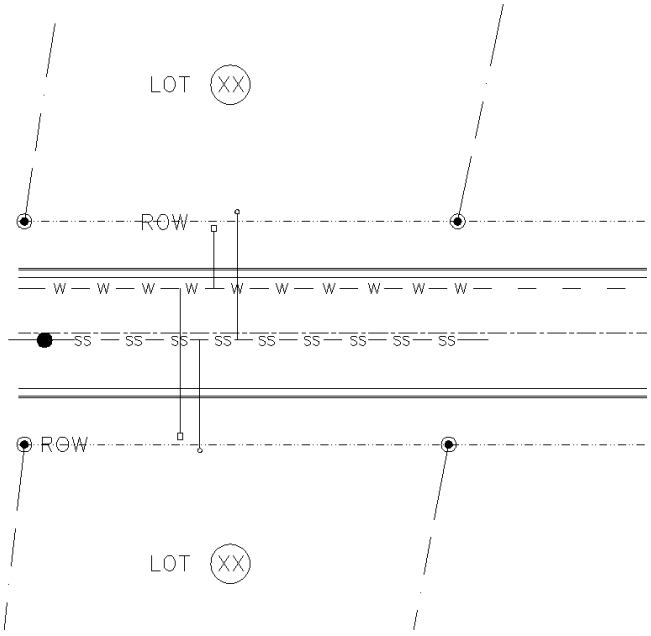
Water Main Fitting Box



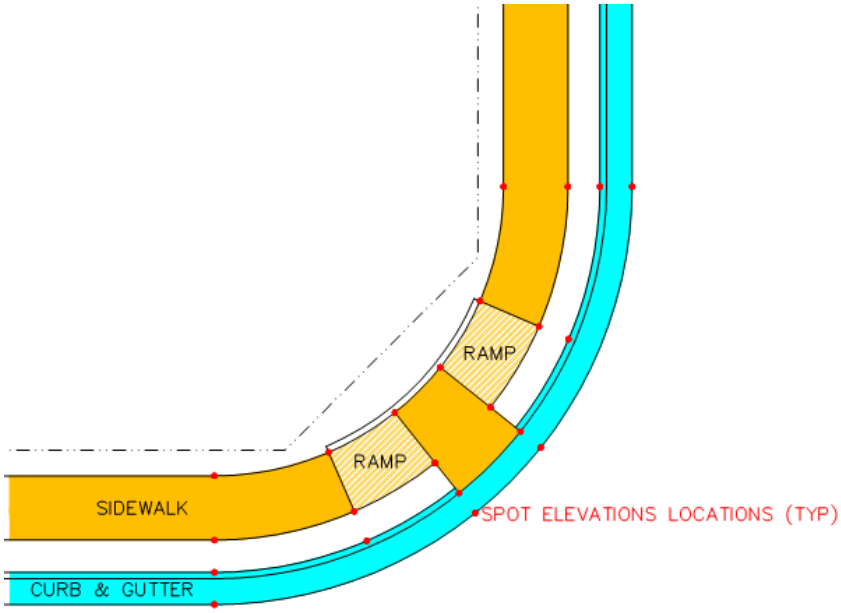
End of Water Line with Future Connection

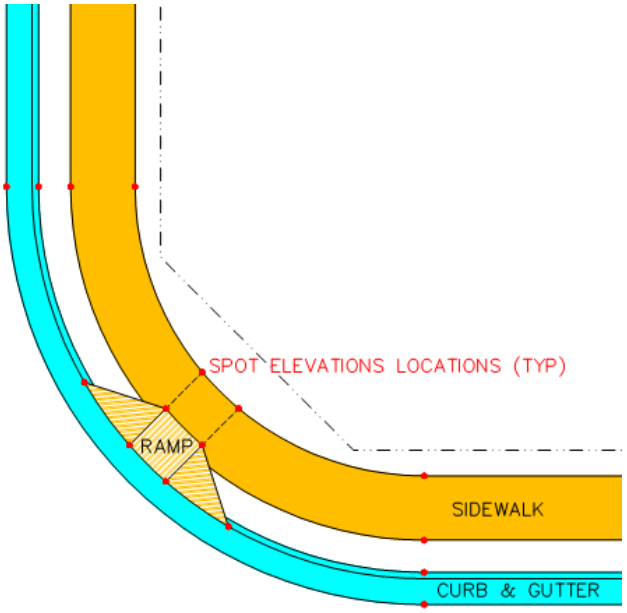


Typical Service Layout



Minimum Spot Elevation Locations
At Intersections and Curb Ramps





MINIMUM SPOT ELEVATIONS
FOR INTERSECTIONS AND
VARIOUS SIDEWALK RAMPS