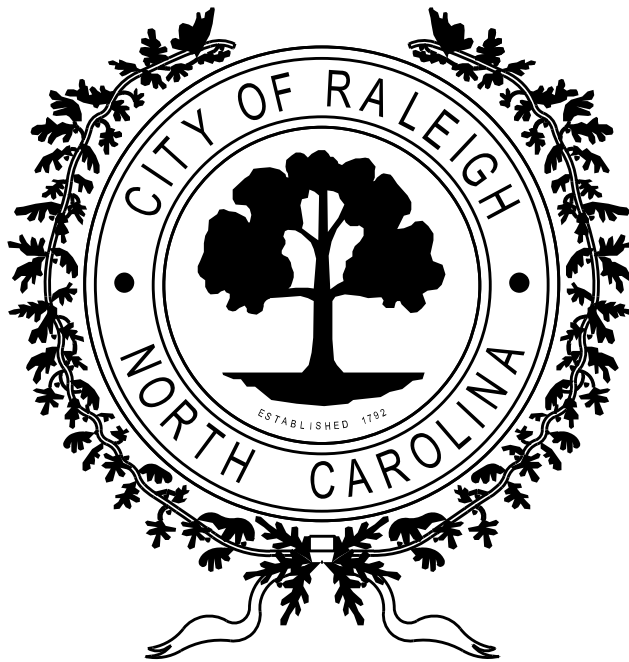
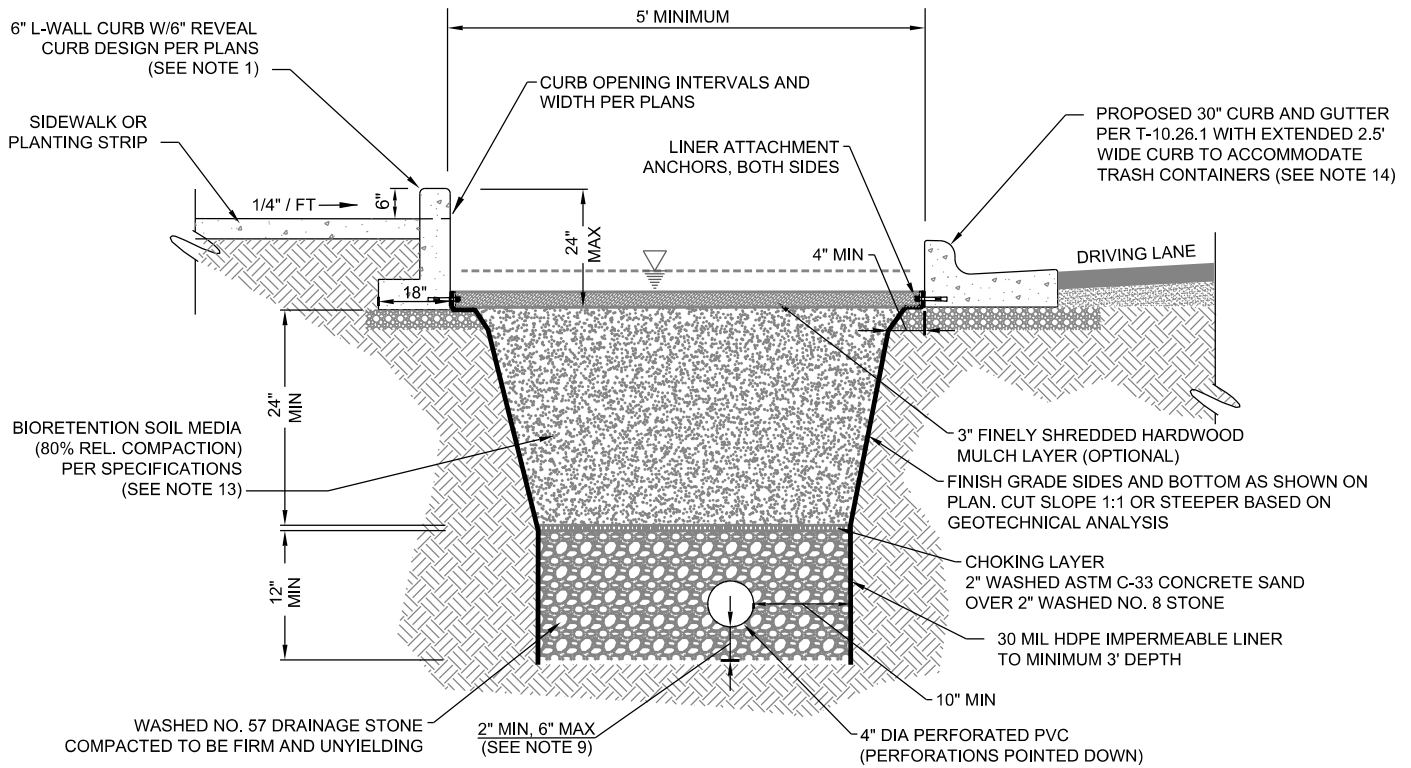


CITY OF RALEIGH

STANDARD DETAILS



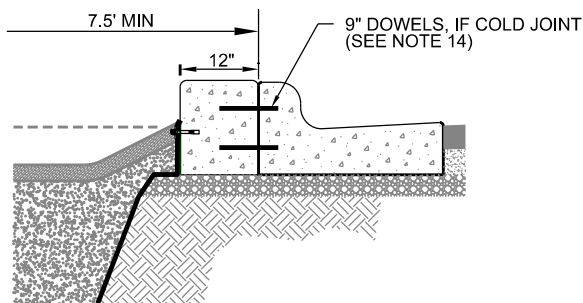
GREEN STORMWATER INFRASTRUCTURE



TYPICAL BUMP-OUT BIORETENTION SECTION

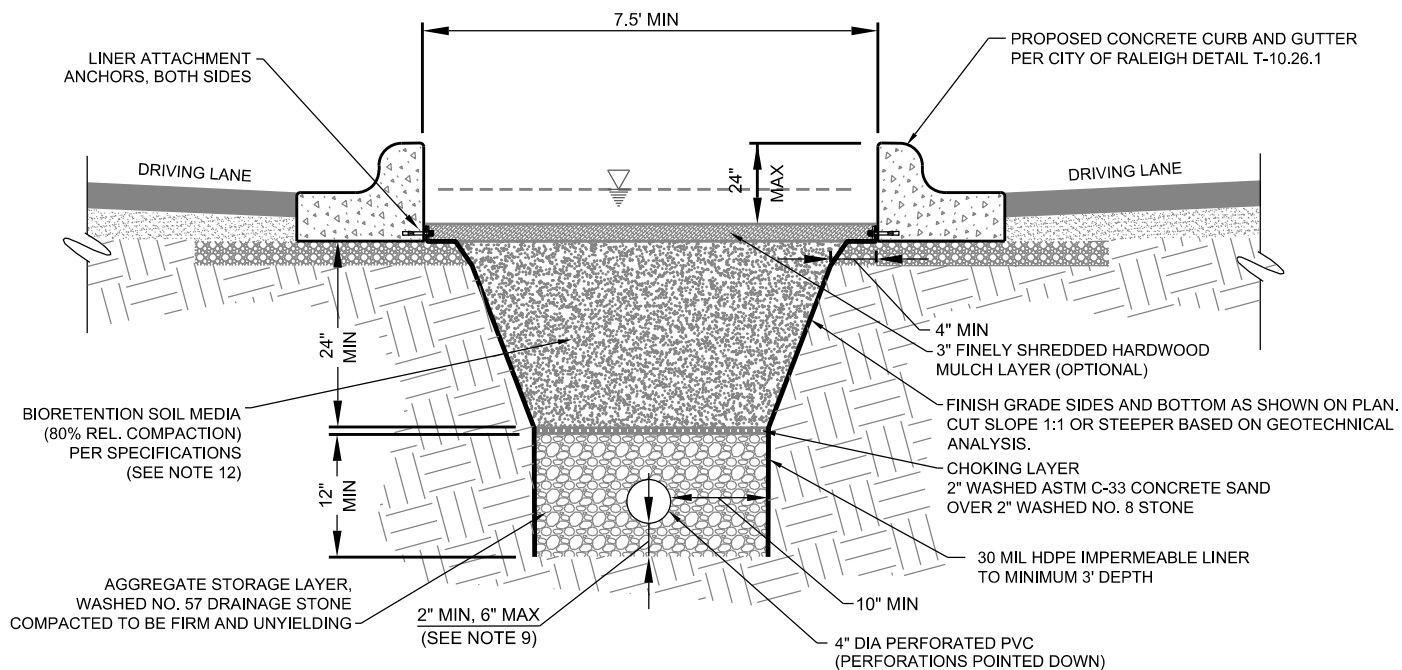
NOTES:

1. EXPANSION JOINTS AND DUMMY JOINTS SHALL BE PER STANDARD DETAIL T-10.26.1, CURB AND GUTTER.
2. REFER TO DESIGN PLANS FOR HORIZONTAL CONTROL INFORMATION.
3. BIORETENTION SIZING IS THE RESPONSIBILITY OF THE DESIGN ENGINEER. SIZING CALCULATIONS SHALL BE SUBMITTED TO THE CITY FOR REVIEW.
4. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RECOMMENDATION OF GEOTECHNICAL INVESTIGATION.
5. IF REQUIRED, REFER TO DESIGN PLANS FOR UNDERDRAIN INVERT ELEVATIONS.
6. REFER TO PLANS FOR UNDERDRAIN CLEANOUT LOCATIONS AND INSTALLATION DETAILS.
7. BOTH PIPE PENETRATIONS AND ATTACHMENT OF 30 MIL HDPE LINER TO CONCRETE CURBS (USING CONCRETE ANCHORS SPACED AT MAXIMUM 18" O.C. AND BATTEN STRIPS) SHALL BE DONE IN ACCORDANCE WITH ASTM 6497.
8. GEOTEXTILE MAY BE UTILIZED IN-LIEU OF AGGREGATE CHOKING LAYER IF APPROVED BY ENGINEER.
9. FOR BIORETENTION SYSTEMS THAT DO NOT REQUIRE AN IMPERMEABLE LINER, A MAXIMUM OFFSET OF 6 INCHES IS REQUIRED BETWEEN THE INVERT OF THE UNDERDRAIN AND BOTTOM OF DRAINAGE LAYER.
10. BOTTOM OF STORAGE LAYER SHALL BE SCARIFIED TO PROMOTE INFILTRATION PRIOR TO BACKFILL.
11. ALL UNDERDRAINS, IF REQUIRED, SHALL CONNECT TO STORM DRAIN OR OTHER DRAINAGE FEATURE.
12. ALL FEATURES INTEGRATED INTO BUMP-OUT BIORETENTION, INCLUDING VEGETATION, SHALL MEET SIGHT DISTANCE REQUIREMENTS PER STREET DESIGN MANUAL AND RECOMMENDED PLANT SPECIES IN THE NCDEQ STORMWATER DESIGN MANUAL.
13. MINIMUM RADII FOR BUMP-OUT BIORETENTION SHALL MEET ENGINEERING SPECIFICATIONS IN STREET DESIGN MANUAL DEPENDING ON ROADWAY TYPE.
14. BIORETENTION MEDIA SHALL BE PLACED IN 8" LIFTS THAT ARE WALKED ON OR WATERED TO CONSOLIDATE AND ALLOW SHAPING OF THE MEDIA'S SURFACE. THE MEDIA SHALL NOT BE MECHANICALLY COMPACTED. REFER TO NCDEQ STORMWATER DESIGN MANUAL FOR BIORETENTION SOIL MEDIA SPECIFICATIONS.
15. CONCRETE CURB EXTENSIONS ARE RECOMMENDED WHERE PARKING IS IMMEDIATELY ADJACENT AND/OR WHERE SPEED LIMITS EXCEED 35 MPH. POUR 1' WIDE CONCRETE EXTENDED CURB MONOLITHICALLY WITH THE PROPOSED CURB AND GUTTER. OTHERWISE, ANCHOR CONCRETE STRIP TO EXISTING CURB WITH OILED OR GREASED BAR (1/2"x9") AT 24" O.C. INSTALL BAR 3" INTO THE EXISTING CURB. USE CONCRETE ADHESIVE ON THE EXISTING CURB.



(OPTIONAL) CONCRETE CURB EXTENSION DETAIL

CITY OF RALEIGH STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
		CURB-SIDE AND BUMP-OUT BIORETENTION
GSI-01		

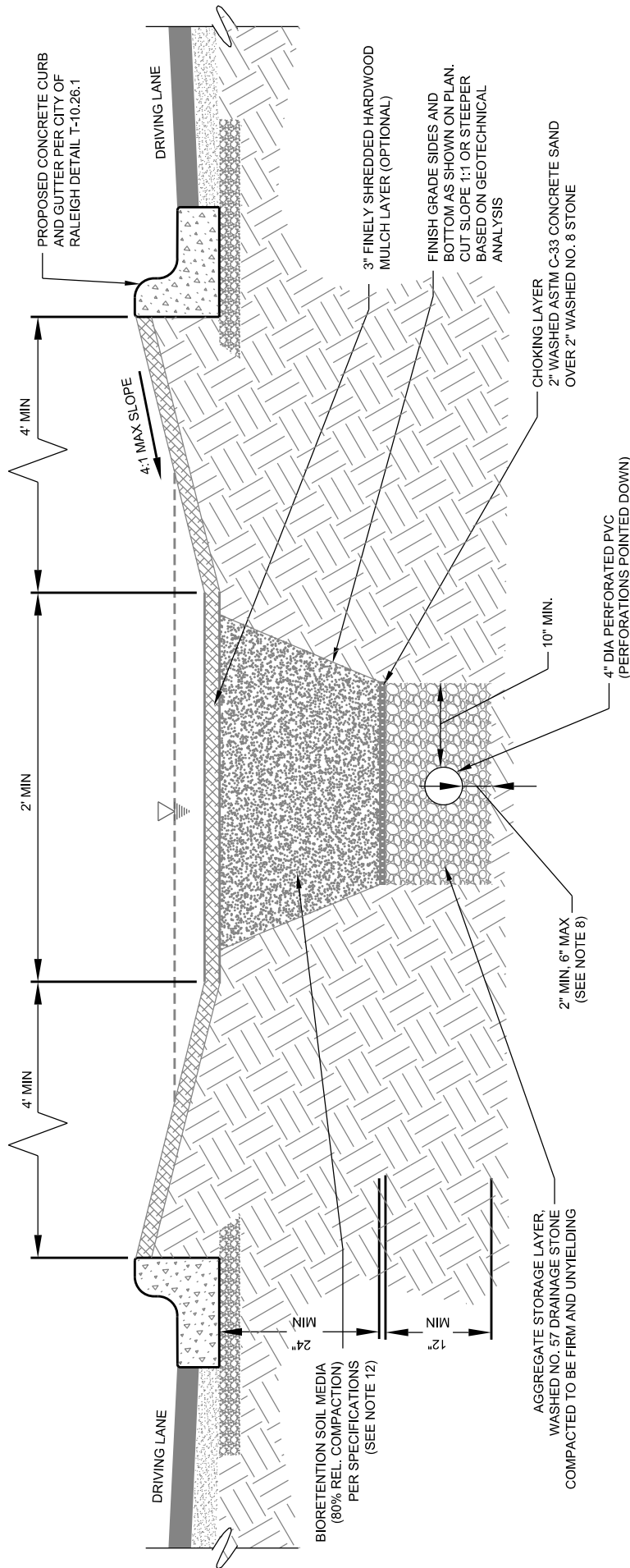


**TYPICAL MEDIAN BIORETENTION SECTION
POSTED SPEED LIMIT OF 30 MPH AND LOWER**

NOTES:

1. REFER TO DESIGN PLANS FOR HORIZONTAL CONTROL INFORMATION.
2. BIORETENTION SIZING IS THE RESPONSIBILITY OF THE DESIGN ENGINEER. SIZING CALCULATIONS SHALL BE SUBMITTED TO THE CITY FOR REVIEW.
3. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RECOMMENDATION OF GEOTECHNICAL INVESTIGATION.
4. IF REQUIRED, REFER TO DESIGN PLANS FOR UNDERDRAIN INVERT ELEVATIONS.
5. THE SEASONAL HIGH WATER TABLE SHALL BE 2 FEET BELOW THE BOTTOM OF THE AGGREGATE STORAGE LAYER.
6. REFER TO PLANS FOR UNDERDRAIN CLEANOUT LOCATIONS AND INSTALLATION DETAILS.
7. BOTH PIPE PENETRATIONS, AND ATTACHMENT OF 30 MIL HDPE LINER TO CONCRETE CURBS (USING CONCRETE ANCHORS SPACED AT MAXIMUM 18" O.C. AND BATTEN STRIPS), SHALL BE DONE IN ACCORDANCE WITH ASTM 6497.
8. GEOTEXTILE MAY BE UTILIZED IN-LIEU OF AGGREGATE CHOKING LAYER IF APPROVED BY ENGINEER.
9. FOR BIORETENTION SYSTEMS THAT DO NOT REQUIRE AN IMPERMEABLE LINER, A MAXIMUM OFFSET OF 6 INCHES IS REQUIRED BETWEEN THE INVERT OF THE UNDERDRAIN AND BOTTOM OF STORAGE LAYER. BOTTOM OF STORAGE LAYER SHALL BE SCARIFIED TO PROMOTE INFILTRATION PRIOR TO BACKFILL.
10. ALL UNDERDRAINS, IF REQUIRED, SHALL CONNECT TO STORM DRAIN OR OTHER DRAINAGE FEATURE.
11. ALL FEATURES, INCLUDING VEGETATION, INTEGRATED INTO BUMP-OUT BIORETENTION SHALL MEET SIGHT DISTANCE REQUIREMENTS PER STREET DESIGN MANUAL AND RECOMMENDED PLANT SPECIES IN THE NCDEQ STORMWATER DESIGN MANUAL.
12. BIORETENTION MEDIA SHALL BE PLACED IN 8" LIFTS THAT ARE WALKED ON OR WATERED TO CONSOLIDATE AND ALLOW SHAPING OF THE MEDIA'S SURFACE. THE MEDIA SHALL NOT BE MECHANICALLY COMPACTED. REFER TO NCDEQ STORMWATER DESIGN MANUAL FOR BIORETENTION SOIL MEDIA SPECIFICATIONS.

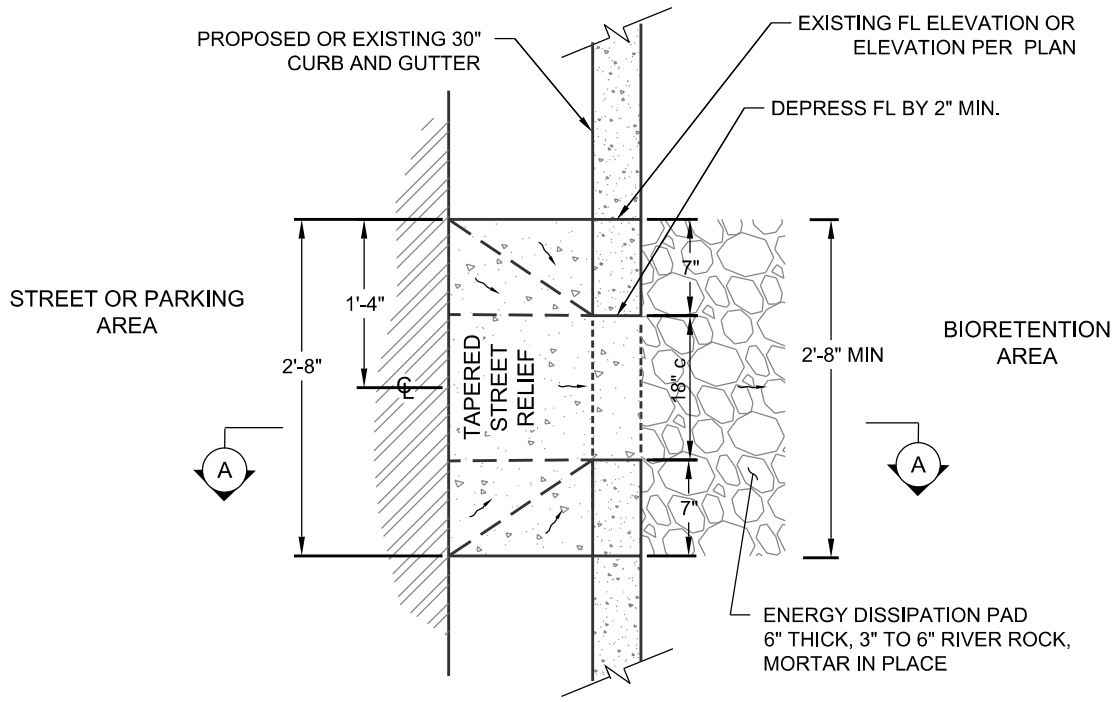
CITY OF RALEIGH STANDARD DETAIL		
<i>REVISIONS</i>	<i>DATE: 8/1/18</i>	<i>NOT TO SCALE</i>
	MEDIAN BIORETENTION (FOR 30 MPH AND BELOW)	
	GSI-02.1	



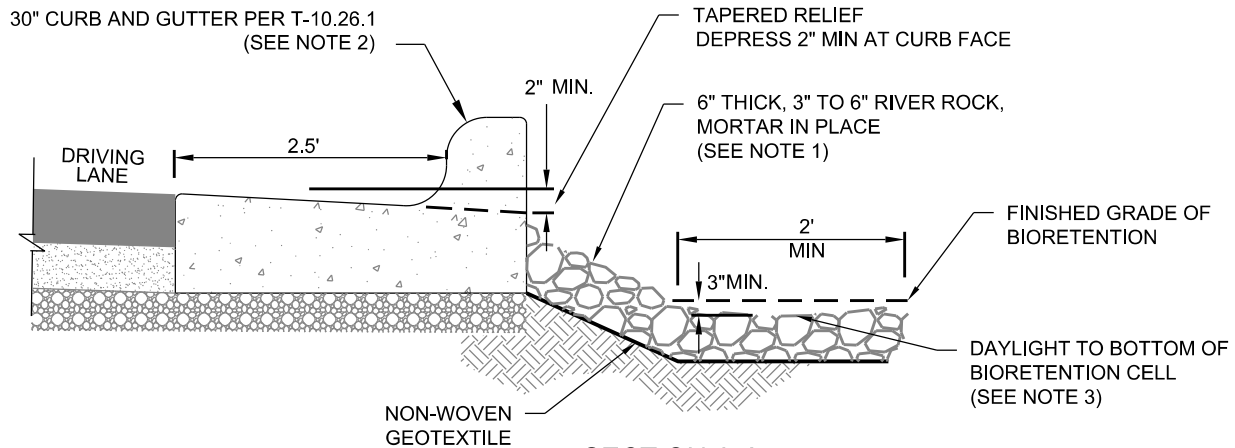
**TYPICAL MEDIAN BIORETENTION SECTION
POSTED SPEED LIMIT HIGHER THAN 30 MPH**

- NOTES:**
- REFER TO DESIGN PLANS FOR HORIZONTAL CONTROL INFORMATION.
 - BIORETENTION SIZING IS THE RESPONSIBILITY OF THE DESIGN ENGINEER. SIZING CALCULATIONS SHALL BE SUBMITTED TO THE CITY FOR REVIEW.
 - THE INCLUSION OF AN UNDERDRAIN SYSTEM IS DEPENDENT UPON THE RECOMMENDATION OF GEOTECHNICAL INVESTIGATION.
 - IF UNDERDRAIN IS REQUIRED, REFER TO DESIGN PLANS FOR UNDERDRAIN INVERT ELEVATIONS.
 - THE SEASONAL HIGH WATER TABLE SHALL BE 2 FEET BELOW THE BOTTOM OF THE AGGREGATE STORAGE LAYER.
 - REFER TO PLANS FOR UNDERDRAIN CLEANOUT LOCATIONS AND INSTALLATION DETAILS.
 - GEOTEXTILE MAY BE UTILIZED IN-LIEU OF AGGREGATE CHOKING LAYER IF APPROVED BY ENGINEER.
 - A MAXIMUM OFFSET OF 6 INCHES IS REQUIRED BETWEEN THE INVERT OF THE UNDERDRAIN AND BOTTOM OF STORAGE LAYER.
 - BOTTOM OF STORAGE LAYER SHALL BE SCARIFIED TO PROMOTE INFILTRATION PRIOR TO BACKFILL.
 - ALL UNDERDRAINS, IF REQUIRED, SHALL CONNECT TO STORM DRAIN OR OTHER DRAINAGE FEATURE.
 - VEGETATION MAY BE PLACED ON SIDE SLOPES TO ANCHOR MULCH IF DESIRED.
 - ALL FEATURES, INCLUDING VEGETATION, INTEGRATED INTO MEDIAN BIORETENTION SHALL MEET SIGHT DISTANCE REQUIREMENTS PER STREET DESIGN MANUAL AND RECOMMENDED PLANT SPECIES IN THE NCDEQ STORMWATER DESIGN MANUAL.
 - BIORETENTION MEDIA SHALL BE PLACED IN 8" LIFTS THAT ARE WALKED ON OR WATERED TO CONSOLIDATE AND ALLOW SHAPING OF THE MEDIA'S SURFACE. THE MEDIA SHALL NOT BE MECHANICALLY COMPACTED. REFER TO NCDEQ STORMWATER DESIGN MANUAL FOR BIORETENTION SOIL MEDIA SPECIFICATIONS.

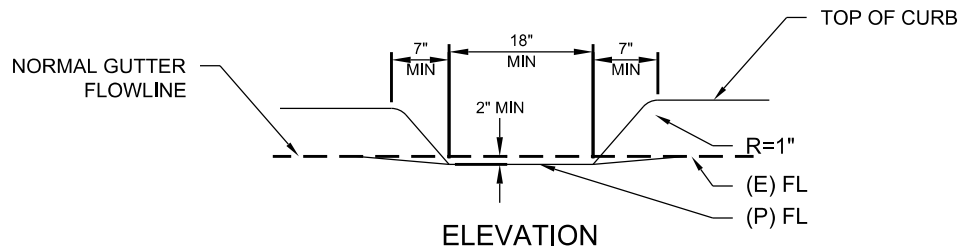
CITY OF RALEIGH		
STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
MEDIAN BIORETENTION (FOR ABOVE 30 MPH)		
GSI-02.2		



PLAN VIEW



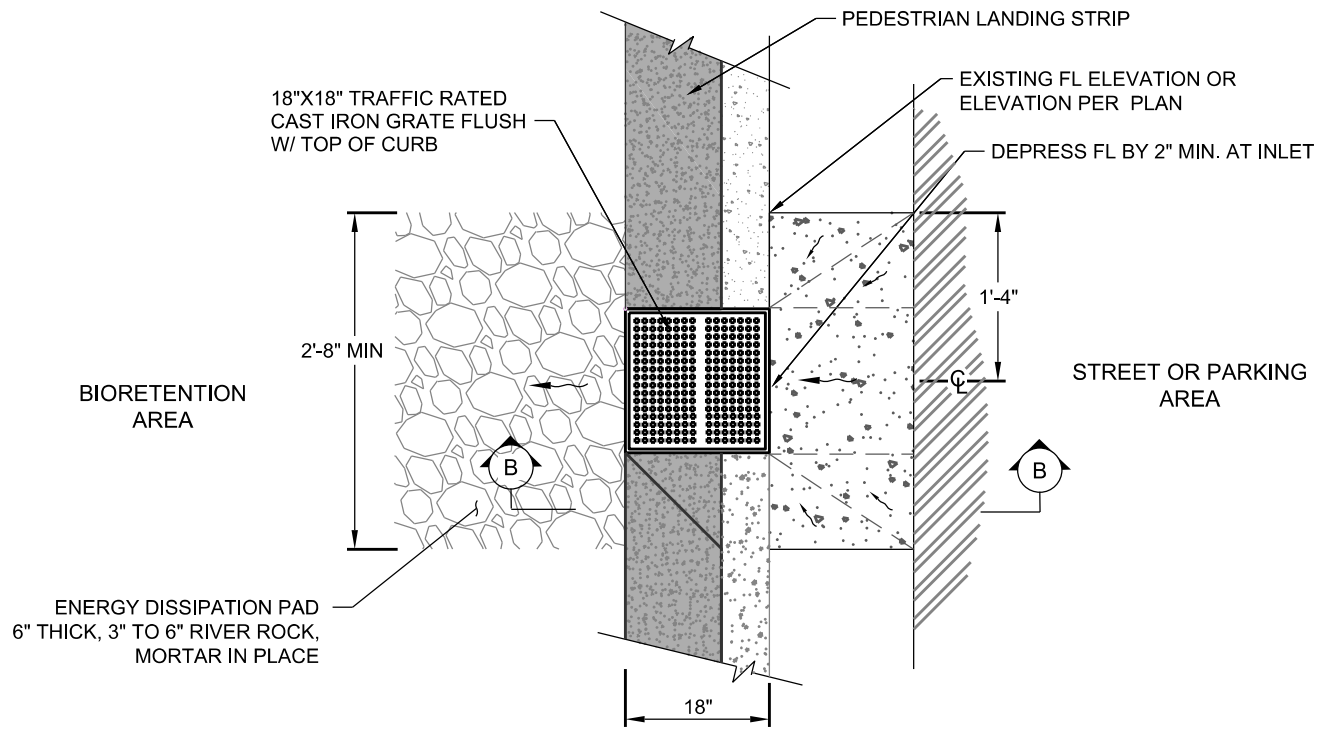
SECTION A-A



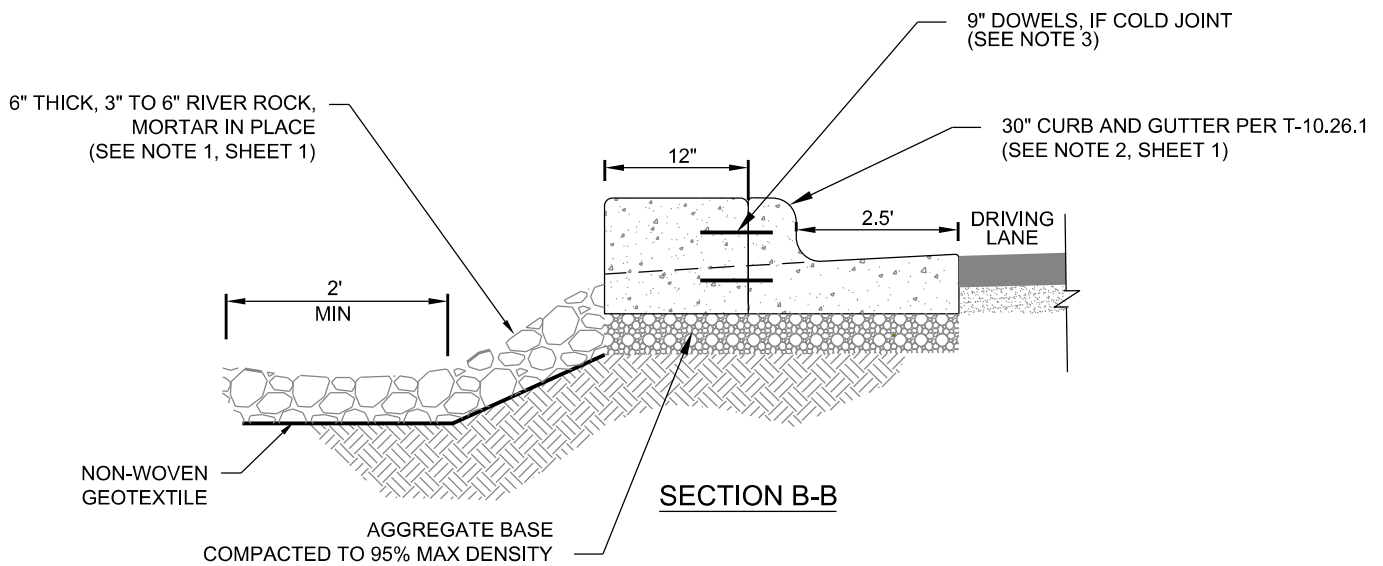
NOTES:

1. ENERGY DISSIPATION PAD PROVIDED AS STABILIZED ENTRANCE TO BIOTETENTION SYSTEM. ROCK SHALL BE PLACED IN IRREGULAR PATTERN USING NON-UNIFORM SIZES TO PREVENT PREFERENTIAL FLOW PATHS, INCREASE ENERGY DISSIPATION, AND TO LIMIT THE SURFACE AREA OF EXPOSED MORTAR. ALTERNATIVE PRE-TREATMENT SOLUTIONS WILL BE CONSIDERED.
2. WHERE NECESSARY, EXTEND GUTTER TO 2.5' WIDTH TO ACCOMMODATE TRASH CONTAINER PLACEMENT.
3. ROCK AND MORTAR INLET PROTECTION SHALL EXTEND ACROSS BOTTOM OF BIORETENTION TO OPPOSITE TOE OF SLOPE, OR 2' MINIMUM. FINISH GRADE OF MORTARED BOTTOM SHALL BE AT LEAST 3" BELOW ADJACENT BIORETENTION BOTTOM ELEVATION TO PROVIDE SEDIMENT STORAGE.

CITY OF RALEIGH STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
CURB-CUT INLET (TAPERED STREET RELIEF)		
GSI-03.1		



PLAN VIEW
PEDESTRIAN OPTION

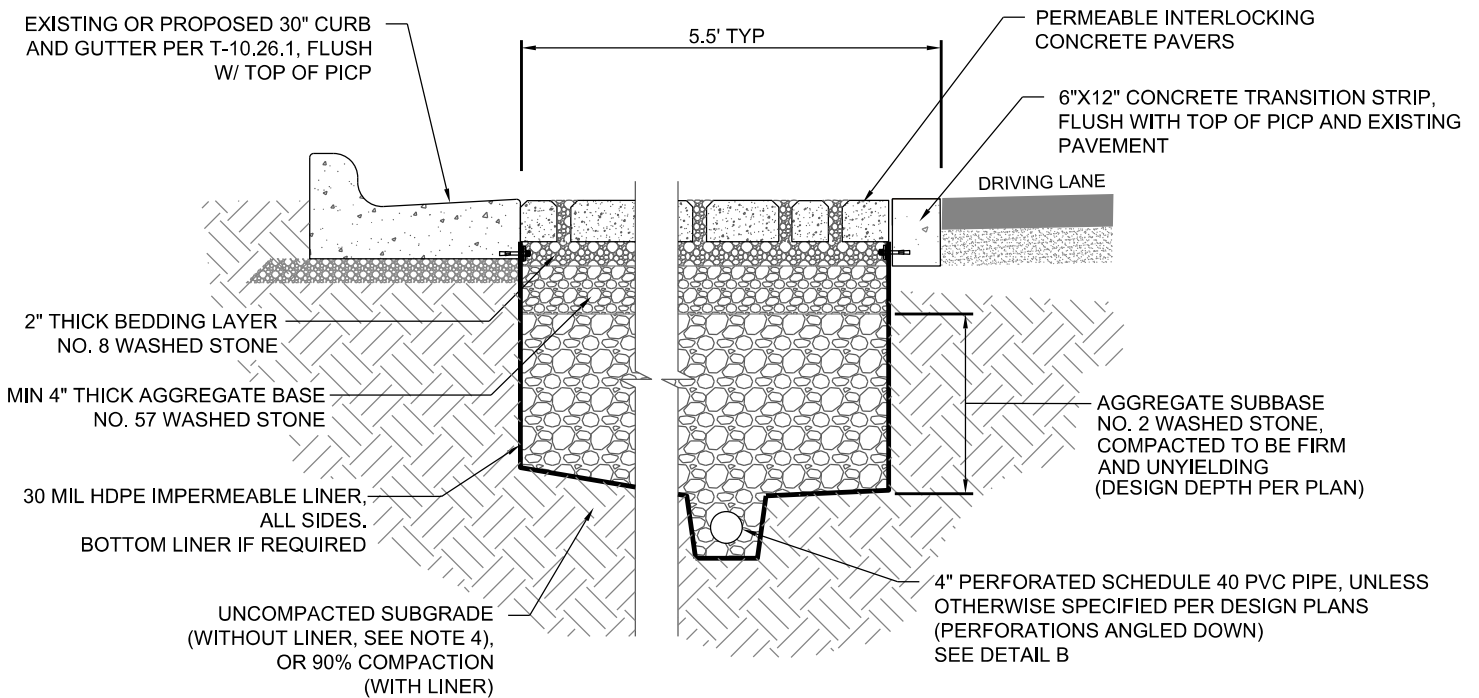


SECTION B-B

NOTES:

1. CURB CUT SHALL BE 18" WIDE WITH VERTICAL SIDES.
2. GRATE FRAME SHALL BE CAST INTO TOP EDGES OF CURB CUT SO GRATE IS FLUSH WITH TOP OF CURB AND PEDESTRIAN LANDING STRIP.
3. CONCRETE CURB EXTENSIONS ARE RECOMMENDED WHERE PARKING IS IMMEDIATELY ADJACENT AND/OR WHERE SPEED LIMITS EXCEED 35 MPH. POUR 1' WIDE CONCRETE EXTENDED CURB MONOLITHICALLY WITH THE PROPOSED CURB AND GUTTER. OTHERWISE, ANCHOR CONCRETE STRIP TO EXISTING CURB WITH OILED OR GREASED BAR (1/2" X 9") AT 24" O.C. INSTALL BAR 3" INTO THE EXISTING CURB. USE CONCRETE ADHESIVE ON THE EXISTING CURB.

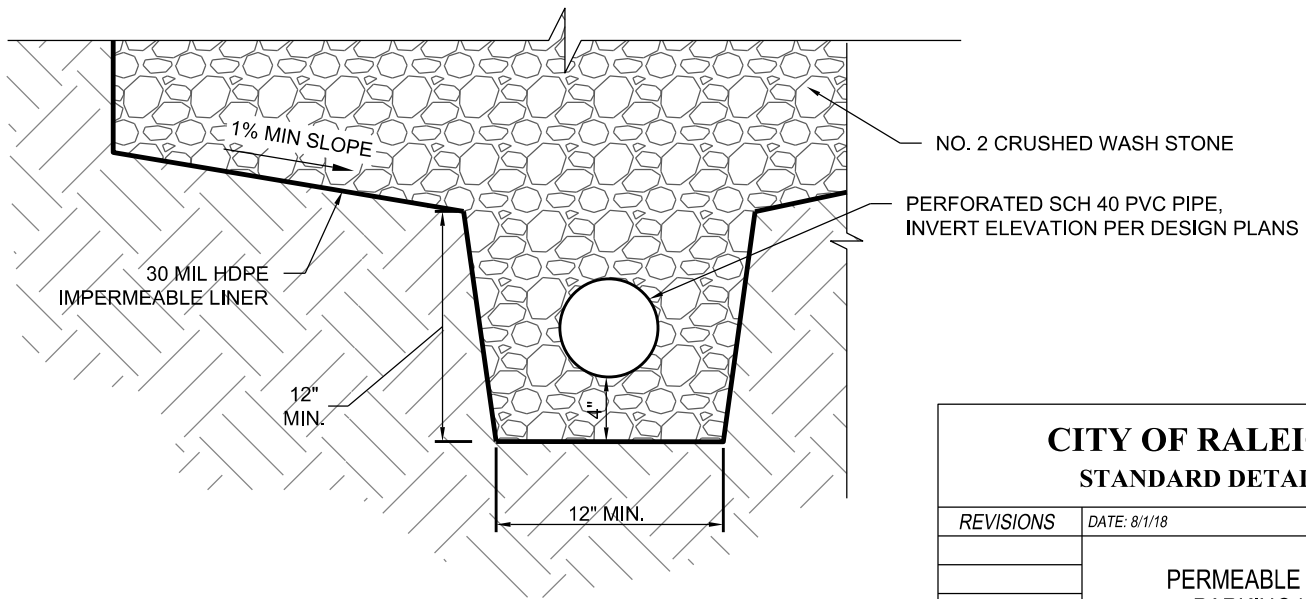
CITY OF RALEIGH		
STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
		CURB-CUT INLET (CAST IRON GRATE)
GSI-03.2		



SECTION VIEW

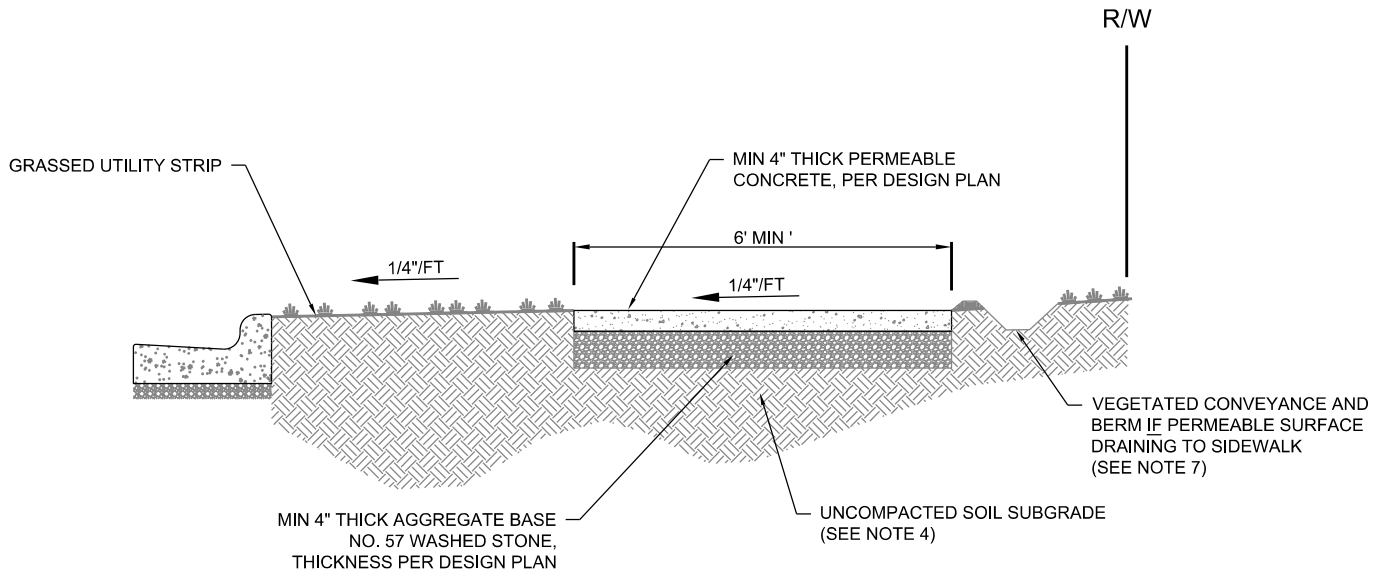
NOTES:

1. ALL PICP SHALL CONFORM TO ASTM C936 AND ADA DESIGN GUIDELINES.
2. SLOPE OF SOIL SUBGRADE SHALL BE 0.5% OR LESS. MAXIMUM PICP SURFACE SLOPE SHALL BE 6%.
3. THE SEASONAL HIGH WATER TABLE SHALL HAVE A MINIMUM 2 FT SEPARATION FROM THE BOTTOM OF THE SUBBASE AGGREGATE STORAGE LAYER.
4. IN HSG B, C, OR D SOILS, THE SURFACE OF THE SUBGRADE UNDER INFILTRATING PICP SYSTEMS SHOULD BE SCARIFIED, RIPPED, OR TRENCHED IMMEDIATELY PRIOR TO AGGREGATE SUBBASE PLACEMENT TO MAINTAIN PRE-CONSTRUCTION SUBGRADE INFILTRATION RATE.
5. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.
6. ELEVATION GRADIENT BETWEEN THE CONCRETE GUTTER AND ADJACENT PICP SHALL NOT EXCEED 1/4"; OTHERWISE, PROVIDE 1:2 BEVEL ON EDGE OF GUTTER.
7. OPEN VOID FILL MEDIA AROUND PICP SHALL BE NO. 8, NO. 9, OR NO. 89 WASHED DRAINAGE STONE DEPENDING ON JOINT SIZE.
8. BOTH PIPE PENETRATIONS AND ATTACHMENT OF 30 MIL HDPE LINER TO CONCRETE CURBS (USING CONCRETE ANCHORS SPACED AT MAXIMUM 18" O.C. AND BATTEN STRIPS) SHALL BE DONE IN ACCORDANCE WITH ASTM 6497.
9. ALL AGGREGATE SIZED ACCORDING TO ASTM C136.
10. AASHTO LAYER COEFFICIENTS FOR OPEN-GRADED BASE AND SUBBASE SHALL RANGE BETWEEN 0.06 AND 0.10.
11. AASHTO MINIMUM LAYER COEFFICIENT OF 0.3 FOR PAVER AND BEDDING LAYERS IS RECOMMENDED.
12. LOCATE UNDERDRAIN AS SHOWN ON THE IMPROVEMENT PLANS. HORIZONTAL LOCATION MAY VARY WITHIN PAVEMENT SECTION AS LONG AS MINIMUM OFFSET DISTANCES AND BOTTOM SLOPES ARE MAINTAINED.
13. DEPTH OF PERFORATED PVC PIPE MAY BE ADJUSTED TO TIE INTO THE ADJACENT DRAINAGE INFRASTRUCTURE AS NEEDED.



DETAIL B

CITY OF RALEIGH STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
PERMEABLE PAVER PARKING LANE		
GSI-04		

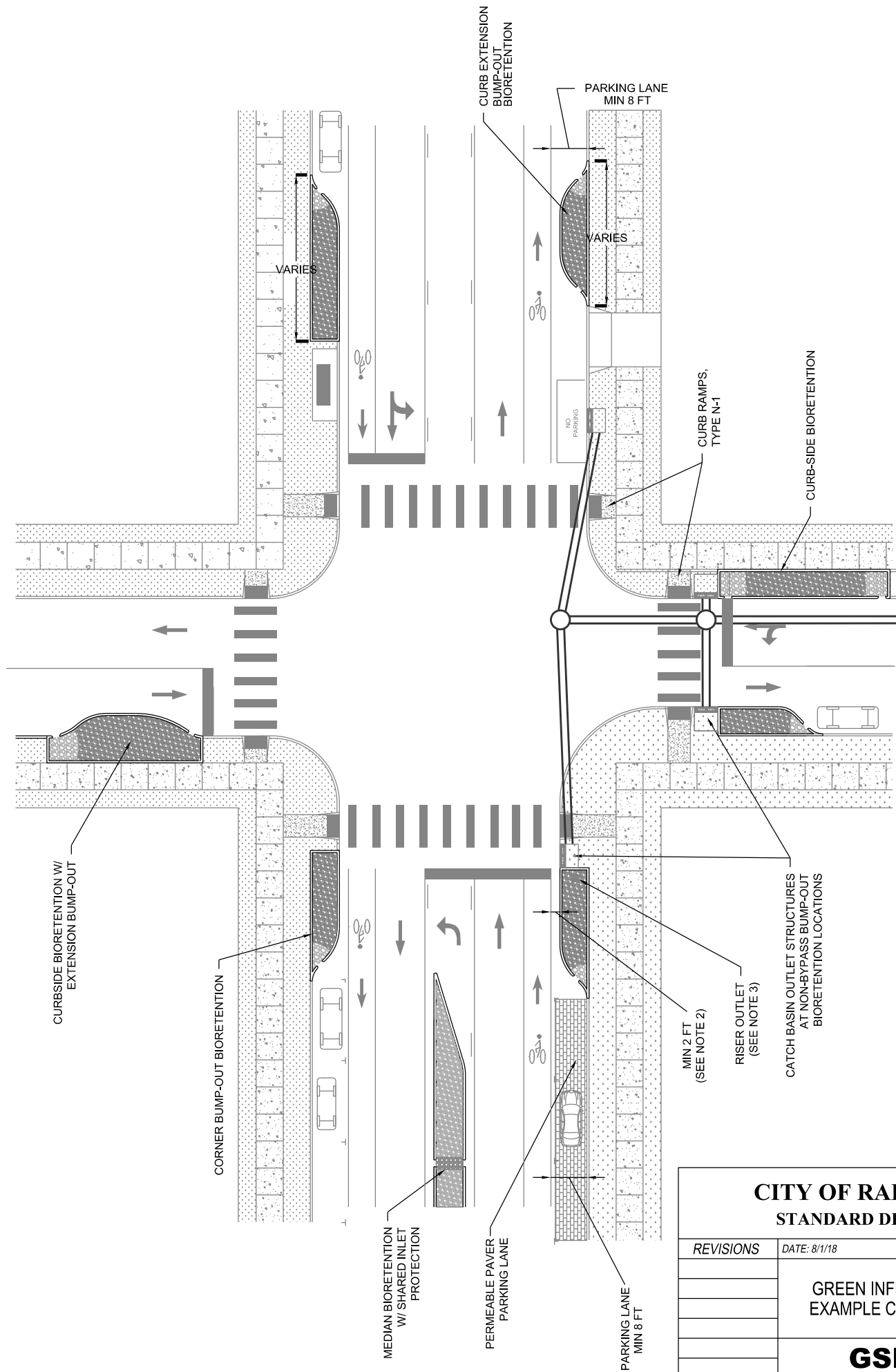


SECTION VIEW

NOTES:

1. MATERIALS AND CONSTRUCTION OF PERMEABLE CONCRETE (PC) SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS: MIX DESIGN (ACI 522.1); FRESH UNIT WEIGHTS AND VOIDS (ASTM C1688); FIELD INFILTRATION (ASTM C1701); RAVELING POTENTIAL (ASTM C1747); HARDENED UNIT WEIGHT AND VOID CONTENT (ASTM C1754).
2. RECOMMENDED VOIDS RATIO FOR PC IS 20% (15-25% ACCEPTABLE).
3. SLOPE OF SOIL SUBGRADE SHALL BE 0.5% OR LESS. MAXIMUM PC SURFACE SLOPE SHALL BE 6%.
4. THE SEASONAL HIGH WATER TABLE SHALL BE 2 FEET BELOW THE BOTTOM OF THE SUBBASE AGGREGATE STORAGE LAYER.
5. IN HSG B, C, OR D SOILS, THE SURFACE OF THE SUBGRADE SHOULD BE SCARIFIED, RIPPED, OR TRENCHED IMMEDIATELY PRIOR TO AGGREGATE SUBBASE PLACEMENT TO MAINTAIN PRE-CONSTRUCTION SUBGRADE INFILTRATION RATE.
6. THE INCLUSION OF AN UNDERDRAIN SYSTEM WITH IMPERMEABLE LINER (INCLUDING BOTTOM LAYER) IS DEPENDENT UPON THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.
7. IF PERMEABLE RUNOFF DRAINS TO THE PC SIDEWALK, A VEGETATED CONVEYANCE DIVERSION SHALL BE INSTALLED UPGRADIENT AND SIZED FOR SAFE CONVEYANCE OF THE 10-YR, 24-HR STORM.
8. IMPERMEABLE RUNOFF IS ALLOWED TO DRAIN TO THE PC SIDEWALK IN ACCORDANCE WITH DESIGN CRITERIA PROVIDED IN CHAPTER 18 OF THE NCDEQ STORMWATER DESIGN MANUAL.
9. ALL AGGREGATE SIZED ACCORDING TO ASTM C136.
AASHTO LAYER COEFFICIENTS FOR OPEN-GRADED BASE AND SUBBASE SHALL RANGE BETWEEN 0.06 AND 0.10.
10. IF REQUIRED BASED ON SITE CONDITIONS, INCLUDING SIGNIFICANT IMPERVIOUS RUN-ON VOLUMES, LOCATE UNDERDRAIN AS SHOWN ON THE IMPROVEMENT PLANS. HORIZONTAL LOCATION MAY VARY WITHIN PAVEMENT SECTION AS LONG AS MINIMUM OFFSET DISTANCES AND BOTTOM SLOPES ARE MAINTAINED. DEPTH OF PERFORATED PVC PIPE MAY BE ADJUSTED TO TIE INTO THE ADJACENT DRAINAGE INFRASTRUCTURE AS NEEDED.

CITY OF RALEIGH		
STANDARD DETAIL		
<i>REVISIONS</i>	<i>DATE: 8/1/18</i>	<i>NOT TO SCALE</i>
	PERMEABLE CONCRETE SIDEWALK	
	GSI-05	



PLAN VIEW

CITY OF RALEIGH STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
	GREEN INFRASTRUCTURE EXAMPLE CONFIGURATION	
	GSI-06.1	

NOTES:

1. SELECTION OF BUMP-OUT BIORETENTION TYPE AND LOCATION DEPENDS ON EXISTING ROADWAY DESIGN CONDITIONS AND ARE ASSUMED TO BE INSTALLED IN CONJUNCTION WITH RETROFIT/STREET IMPROVEMENT PROJECTS.
2. IN ALL CASES, BUMP-OUTS MUST MAINTAIN REQUIRED GUTTER SPREAD TO SAFELY PASS OVERFLOW FROM THE 2-YR STORM (I.E., PONDED WATER LESS THAN 1/2 LANE WIDTH FROM EDGE OF CURB).
3. WHERE NECESSARY, RISER STRUCTURES SIZED FOR THE 2-YR STORM SHALL BE LOCATED WITHIN BUMP-OUT BIORETENTION. ALL BIORETENTION BUMP-OUTS SHALL BE DESIGNED TO BYPASS STORMS LARGER THAN THE 2-YR EVENT.
4. ALL BIORETENTION AND PERMEABLE PAVEMENT UNDERDRAINS, IF REQUIRED, SHALL CONNECT TO STORM DRAIN OR OTHER DRAINAGE FEATURE.
5. ALL FEATURES, INCLUDING VEGETATION, INTERGRATED INTO BUMP-OUT BIORETENTION SHALL MEET SIGHT DISTANCE REQUIREMENTS PER STREET DESIGN MANUAL AND RECOMMENDED PLANT SPECIES IN THE NC DEQ STORMWATER BMP MANUAL.
6. ROADWAY FEATURES AND PAVEMENT MARKINGS ARE FOR REFERENCE ONLY. ACTUAL DIMENSIONS AND MARKINGS SHALL CONFORM TO THE CITY OF RALEIGH STREET DESIGN MANUAL.

CITY OF RALEIGH		
STANDARD DETAIL		
REVISIONS	DATE: 8/1/18	NOT TO SCALE
	GREEN INFRASTRUCTURE GENERAL NOTES	
	GSI-06.2	