



THIS FIGURE IS ONLY MEANT TO DEFINE THE MINIMUM INFORMATION REQUIRED BY THE CITY OF CHARLOTTE TO BE INCLUDED IN A DETAIL FOR THIS TYPE OF TECHNIQUE.
 THIS FIGURE IS NOT MEANT TO REPRESENT A STANDARD DESIGN METHOD FOR THIS TYPE OF TECHNIQUE AND SHALL NOT BE USED AS SUCH.

NOT TO SCALE



CHARLOTTE-MECKLENBURG
 STORM WATER SERVICES
 GENERIC DETAIL REQUIREMENTS

DOUBLE DROP BOULDER CROSS VANE

DRAFT - NOT TO BE USED FOR CONSTRUCTION

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PHOTO: DOUBLE DROP BOULDER CROSS VANE

DIMENSIONS (VALUES TO BE PROVIDED BY DESIGNER)			
VARIABLE	VALUES	TYPICAL UNIT	DESCRIPTION
X1		FT. (NAVD)	CROSS VANE INVERT CONTROL POINT ELEVATION
X2		FT. (NAVD)	LEFT VANE ARM INTERCEPT CONTROL POINT ELEVATION
X3		FT. (NAVD)	RIGHT VANE ARM INTERCEPT CONTROL POINT ELEVATION
X4		FT. (NAVD)	STEP INVERT CONTROL POINT ELEVATION
X5		FT. (NAVD)	POOL CONTROL POINT ELEVATION
X6		FT.	BANKFULL WIDTH
X7		FT.	LENGTH OF FLOODPLAIN SILL
X8		FT.	LENGTH BETWEEN CROSS VANE INVERT AND STEP
X9		FT.	LENGTH OF COARSE BACKFILL
X10		FT.	VANE ARM LENGTH
X11		DEGREES	VANE ARM ANGLE WITH STREAM BANK
X12		PERCENT	VANE ARM SLOPE
X13		FT. OR IN.	DIFFERENCE BETWEEN TOP OF BANK (BANKFULL) AND VANE ARM INTERCEPT POINT
X14		FT. OR IN.	BOULDER LENGTH
X15		FT. OR IN.	BOULDER WIDTH
X16		FT. OR IN.	BOULDER THICKNESS
X17		IN.	D50 OF COARSE BACKFILL
X18		FT.	MAXIMUM POOL DEPTH FROM VAN ARM INTERCEPT CONTROL POINT ELEVATION
X19		IN.	HEADER BOULDER SETBACK

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NOTES:

1. A DOUBLE DROP BOULDER CROSS VANE IS A GRADE CONTROL, IN-STREAM STRUCTURE THAT DIRECTS STREAM FLOW AWAY FROM THE STREAM BANKS AND IN TOWARD THE CENTER OF THE CHANNEL. IT IS SIMILAR TO A BOULDER CROSS VANE WITH AN ADDITIONAL DROP (OR "STEP"). THE "STEP" EFFECTS A GRADE CHANGE OVER MULTIPLE DROPS TO MINIMIZE THE HEIGHT OF ANY SINGLE DROP TO PREVENT BARRIERS TO FISH PASSAGE.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE UPSTREAM INVERT (CENTER) OF THE CROSS VANE AND AT THE STEP TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. THE VANE ARM SHALL INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN ½ BANKFULL STAGE AND BANKFULL STAGE. ELEVATION CONTROL POINTS MAY BE ESTABLISHED AT THE LEFT AND RIGHT STREAM BANK/VANE ARM INTERCEPT POINTS. THE VANE ARM INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
4. IF PLANS DESIGNATE THE USE OF MULTIPLE DOUBLE DROP BOULDER CROSS VANES, A TABLE OF ALL STATION LOCATIONS AND CONTROL POINT ELEVATIONS SHALL BE PROVIDED IN THIS DETAIL OR PROVIDED ELSEWHERE IN THE PLANS AND REFERENCED HEREIN.
5. TYPICAL RIFFLE AND POOL CROSS SECTIONS SHALL BE PROVIDED ELSEWHERE IN THE PLANS TO ESTABLISH THE DIMENSIONS OF THE CHANNEL GRADING INTO WHICH THE DOUBLE DROP BOULDER CROSS VANES ARE TO BE INSTALLED.
6. THE DOUBLE DROP BOULDER CROSS VANE SHALL BE CONSTRUCTED WITH FLAT-SIDED BOULDERS OF A SIZE (LENGTH, WIDTH, AND DEPTH) AS SPECIFIED BY THE DESIGNER.
7. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE BOULDERS AND UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
8. COARSE BACKFILL OF THE DOUBLE DROP BOULDER CROSS VANE SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER AND FOOTER BOULDERS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM A DISTANCE SPECIFIED BY THE DESIGNER.
9. THE INVERT (CENTER) OF THE DOUBLE DROP BOULDER CROSS VANE SHALL BE CONSTRUCTED FIRST, FOLLOWED BY ONE VANE ARM, THE OTHER VANE ARM, AND THEN THE STEP. THE FLOODPLAIN SILLS SHALL BE CONSTRUCTED LAST
10. DOUBLE DROP BOULDER CROSS VANES SHALL BE BUILT TYPICALLY AS FOLLOWS:
 - A. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER AND FOOTER BOULDERS
 - B. PLACE FOOTER BOULDERS. THERE SHALL BE NO GAPS BETWEEN BOULDERS
 - C. INSTALL FILTER FABRIC.
 - D. PLACE COURSE BACKFILL BEHIND THE FOOTER BOULDERS.
 - E. INSTALL HEADER BOULDERS ON TOP OF AND SET SLIGHTLY BACK FROM THE FOOTER BOULDERS (SUCH THAT PART OF THE HEADER BOULDER IS RESTING ON THE COARSE BACKFILL). HEADER BOULDERS SHALL SPAN THE SEAMS OF THE FOOTER BOULDERS. THERE SHALL BE NO GAPS BETWEEN BOULDERS. THE SLOPE OF THE VANE ARM IS MEASURED ALONG THE VANE ARM WHICH IS INSTALLED AT AN ANGLE TO THE STREAM BANK AND PROFILE.
 - F. PLACE COARSE BACKFILL BEHIND HEADER BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE BOULDERS ARE FILLED.
11. IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE VANE ARM INTERCEPT POINTS AND FLOODPLAIN SILLS ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE BOULDERS.

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