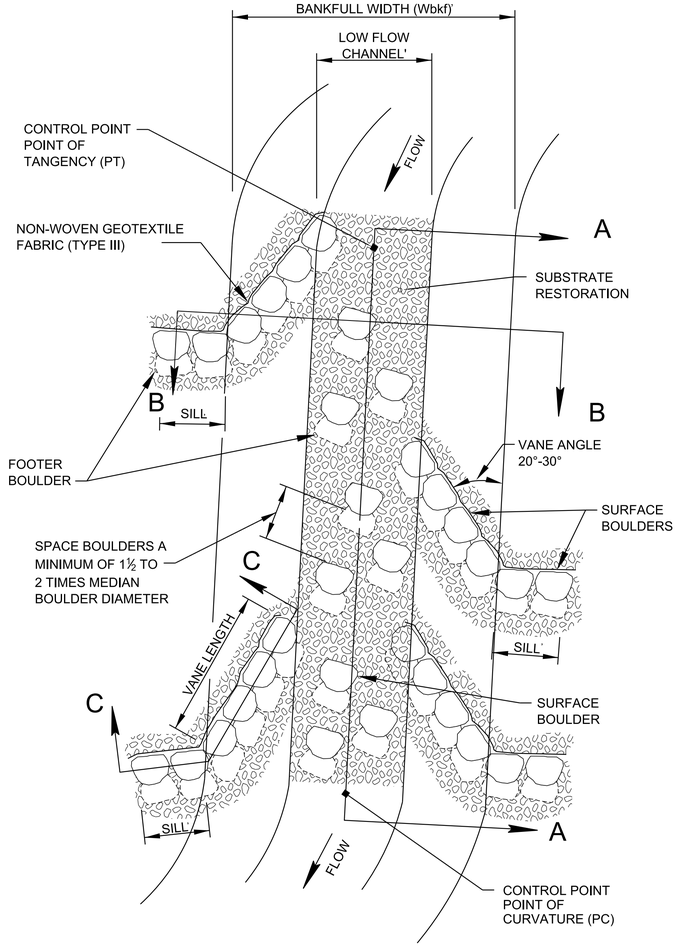
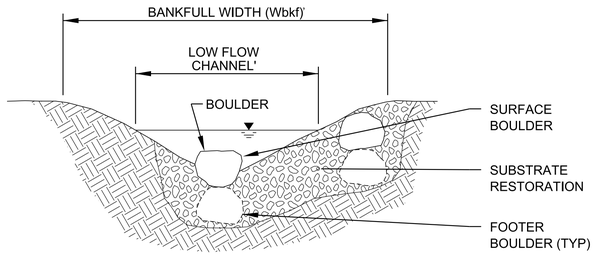
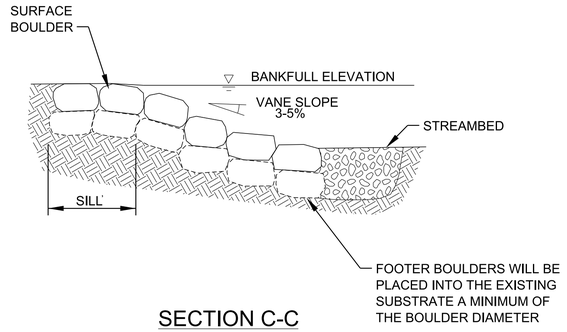


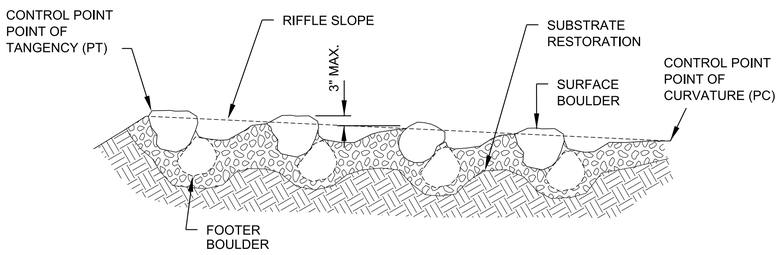
PLAN VIEW



SECTION B-B



SECTION C-C



SECTION A-A

STREAM MITIGATION PLAN LEGEND: BOULDER CLUSTERS

BOULDER CLUSTER NOTES

(A) CONVERGING BOULDER CLUSTERS ARE HABITAT ENHANCEMENT MEASURES CONSISTING OF A GROUP OF ONE OR MORE LARGE IMMOBILE BOULDERS ARRANGED IN RIFFLE-RUN HABITATS TO CREATE AREAS OF CONCENTRATED CONVERGENT FLOW. THEY SHOULD ONLY BE USED WITH BOULDER MINI-VANES, WHICH PROTECT THE ADJACENT STREAM BANK FROM SCOUR BY REDUCING NEAR-BANK SHEAR STRESS.

(B) BOULDER CLUSTERS AND MINI-VANES SHOULD BE PLACED AT THE STATIONS, OFFSETS, ELEVATIONS, AND CONFIGURATION INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS, STREAM MITIGATION PLAN, OR AS DIRECTED BY THE ENGINEER. AT A MINIMUM, THE BEGINNING AND ENDING STATIONS OF THE CONVERGING BOULDER CLUSTERS, THE BANKFULL WIDTH, MEDIAN BOULDER SIZE, VANE AND SILL LENGTHS, SHOULD BE SPECIFIED IN THE STREAM MITIGATION DATA TABLE.

(C) REFER TO D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN".

(D) BOULDERS PRESENT IN THE EXISTING STREAM MEETING THE SPECIFIED TYPE AND SIZE SHOULD BE USED IN THE RESTORED CHANNEL SEGMENT.

(E) SURFACE BOULDERS IN BOULDER CLUSTERS SHOULD PROTRUDE A MAXIMUM OF 3 INCHES ABOVE THE RIFFLE SLOPE.

(F) THE MAXIMUM AMOUNT OF DROP FROM ONE MINI-VANE TO THE NEXT SHALL BE NO GREATER THAN THE HEIGHT SPECIFIED ON THE PROPOSED PROFILE. THE COMBINED AMOUNT OF DROP OVER ALL THE MINI-VANES SHALL NOT EXCEED THE TOTAL AMOUNT OF FALL IN THE RIFFLE SLOPE. THE MINI-VANES AT THE TOP AND BOTTOM OF THE TANGENT SECTIONS SHOULD BE PLACED ON THE OUTSIDE BANK OF THE ADJACENT MEANDER.

(H) A MIXTURE OF SELECT MATERIALS, AS SPECIFIED ON THE STREAM MITIGATION PLAN SHEETS, SHOULD BE USED FOR SUBSTRATE RESTORATION IN RIFFLE AND RUN HABITATS AND TO FILL GAPS IN THE MINI-VANE BOULDERS. COARSE ALLUVIUM EXCAVATED FROM THE EXISTING STREAM BED, WHICH MEETS THE SPECIFIED SIZE CLASSIFICATION, IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE RESTORATION. REFER TO D-NSD-30 AND D-NSD-37 FOR ADDITIONAL SUBSTRATE RESTORATION INFORMATION.

(I) CONSTRUCT BOULDER CLUSTERS AND MINI-VANES BY:

(1) FIRST SHAPE CHANNEL AND FLOODPLAIN TO THE SPECIFIED GRADE AND DIMENSIONS.
(2) NEXT, EXCAVATE ENOUGH BED MATERIAL TO PLACE THE BOULDERS FOR MINI-VANES, THE NON-WOVEN GEOTEXTILE FABRIC (TYPE III), AND SELECT MATERIAL FOR BACKFILL AND SUBSTRATE REPLACEMENT.
(3) PLACE FOOTER AND SURFACE BOULDERS AT THE INVERTS SPECIFIED IN THE PLANS AND THEN CHECK THE ELEVATIONS OF THE INVERTS WITH SURVEY EQUIPMENT. FOR MINI-VANES, PLACE BOULDERS TO MINIMIZE VOIDS AND TO PRODUCE A SMOOTH COMPACT SURFACE.
(4) ONCE THE INVERTS HAVE BEEN ESTABLISHED, FILL THE VOIDS BETWEEN BOULDERS ON THE UPSTREAM SIDE OF THE STRUCTURE.
(5) PLACE NON-WOVEN GEOTEXTILE FABRIC (TYPE III) ALONG THE ENTIRE UPSTREAM FACE OF THE MINI-VANES, EXTENDING FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.
(6) BACKFILL STRUCTURE AND NON-WOVEN GEOTEXTILE FABRIC (TYPE III) WITH EXCAVATED ON-SITE STREAM ALLUVIUM (IF AVAILABLE), OTHERWISE USE THE SPECIFIED SELECT MATERIAL. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF THE MINI-VANES. TRIM ANY EXPOSED NON-WOVEN GEOTEXTILE FABRIC (TYPE III).
(7) RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

(J) ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION OBSERVER.

(K) BOULDER CLUSTERS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.32 STREAM MITIGATION - BOULDER CLUSTER PER EACH.

PAYMENT SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE BOULDER CLUSTERS AND MINI-VANES.

REV. 9-15-17: MODIFIED PAY ITEM DESCRIPTION.

MATERIAL SHOWN ARE ONLY A GRAPHICAL REPRESENTATION AND DO NOT DEPICT THE ACTUAL DEPTH OR QUANTITY OF MATERIALS TO APPROPRIATELY CONSTRUCT OR STABILIZE THE CHANNEL.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

BOULDER CLUSTERS

NOT TO SCALE | 11-01-16 | D-NSD-21

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