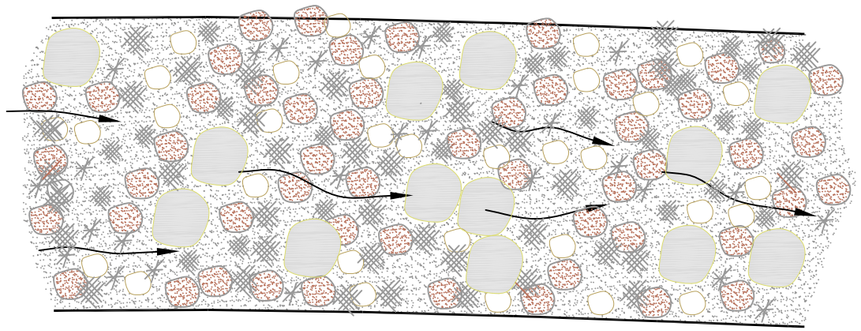
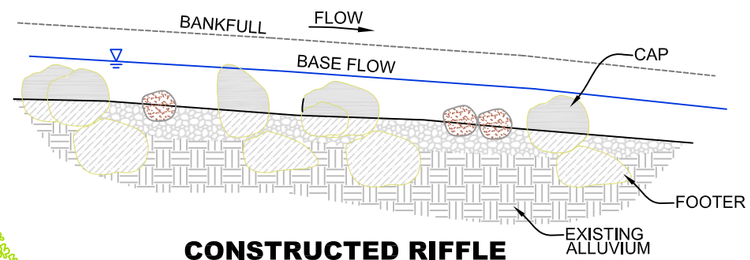
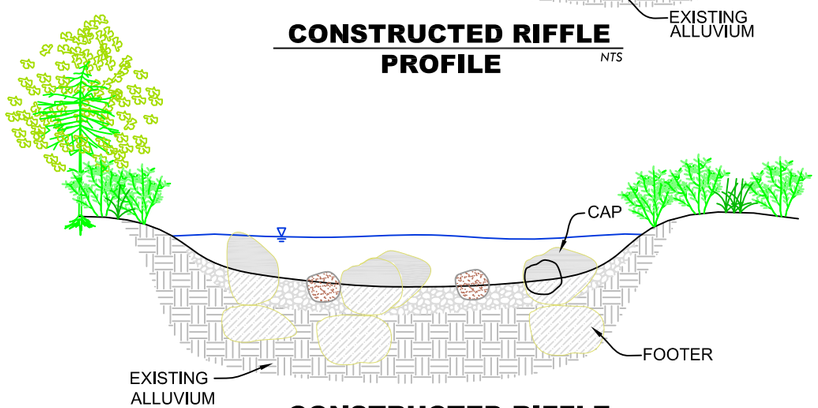


CONSTRUCTED RIFFLE
PLAN VIEW
NTS



CONSTRUCTED RIFFLE
PROFILE
NTS



CONSTRUCTED RIFFLE
CROSS SECTION
NTS

MATERIAL SPECIFICATIONS

Symbol	Type	Sieve Designation (in)	Percent Passing (%)
	Medium Boulder	24 -inch	100
	Small - Medium Boulder	18 -inch	80 - 100
	Medium Cobble - Small Boulder	12 -inch	60 - 80
	Small - Medium Cobble	8 -inch	40 - 60
	Medium Gravel - Small Cobble	4 -inch	20 - 40
	Sand - Fine Gravel	<0.5 -inch	0 - 20

DESIGN INTENT

The intent of the riffle channel bed construction is to provide a stable longitudinal bed profile to promote vertical channel stability, as well as to diversify flow paths to enhance fish habitat.

The structure is designed to be natural in appearance. Rock to be used in the structure will be reused from materials on-site or will be imported. Imported rock will be of the same or similar properties of rock found in the project area. The boulder structure will be submerged during elevated discharge, but will be partially exposed during baseflow to moderate flows. The structures will not abruptly affect the water surface profile and will maintain fish passage at all flows.

CONSTRUCTION NOTES

Within channel alluvium, the footprint of the large rock location will be excavated to the specified depth. A footer rock will be placed at the specified elevation. A cap boulder will be placed on top of the footer rock, positioned slightly upstream of the underlying footer rock. The displaced alluvium will be placed around the base of the cap rock. Footer rocks may be smaller boulders but should be larger than the native bed material and be flat enough to maintain the overlying cap rock.

Notify the owner's representative of any proposed changes prior to implementation. The owner's representative reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.

EXAMPLE OF A CONSTRUCTED RIFFLE AT BASE FLOW

EXAMPLE OF A CONSTRUCTED RIFFLE AT BASE FLOW

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CONSTRUCTED RIFFLE DETAIL

Owl Creek Restoration Project
Condon, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-5

CONSTRUCTION NOTES

Rock shall be from an approved source and shall be sound, dense (sg=2.65 min) and free from cracks, seams or other defects conducive to accelerated weathering.

Rock shall be equipment placed so that larger rocks are distributed per construction manager and smaller rocks filling in voids. No end dumping of rock will be allowed.

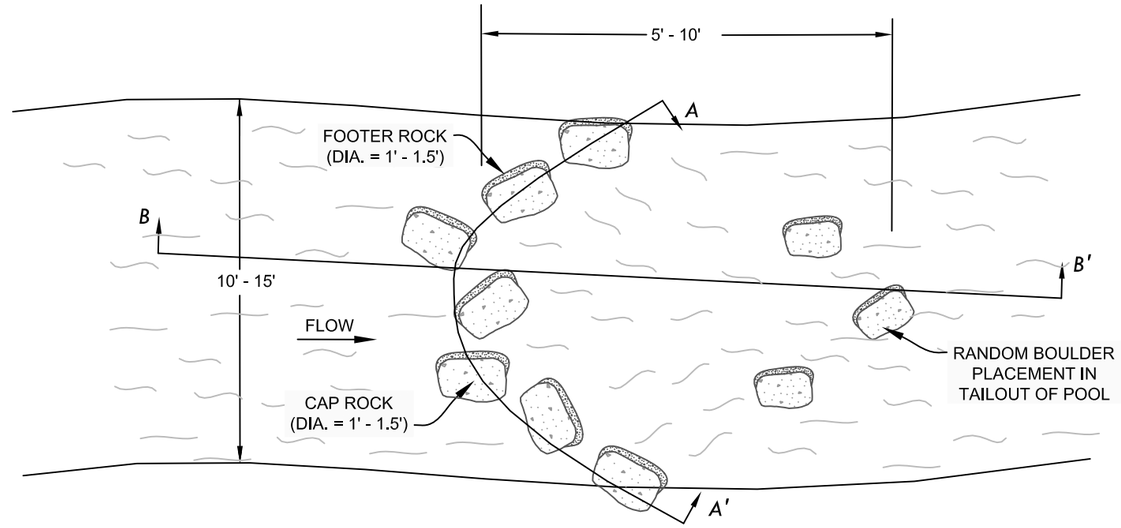
Excavate pool to set footer and pool foundation rocks. Footer rocks are to be placed to minimize voids and maximize rock to rock contact.

Place cap rocks ontop of footers, align as shown in detail. Weir and wing rock shall be placed at a distance specified.

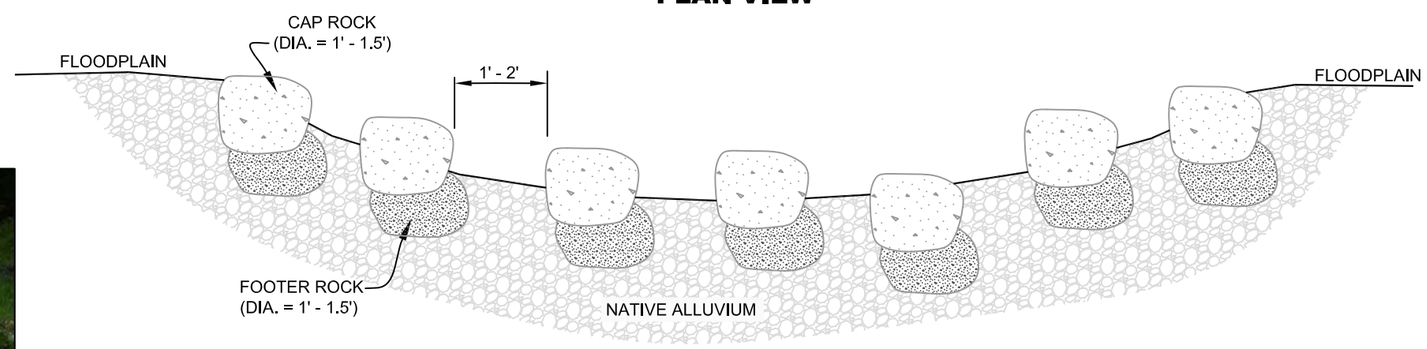
Backfill each pool and fill all gaps and voids of each structure with native gravels and cobble to minimize piping of water through each structure.

Excavate pool according to specified dimensions. Use excavated material for structure backfill or haul to a location specified by construction manager.

The construction manager has the right to alter or change the design during construction due to unforeseen circumstances.

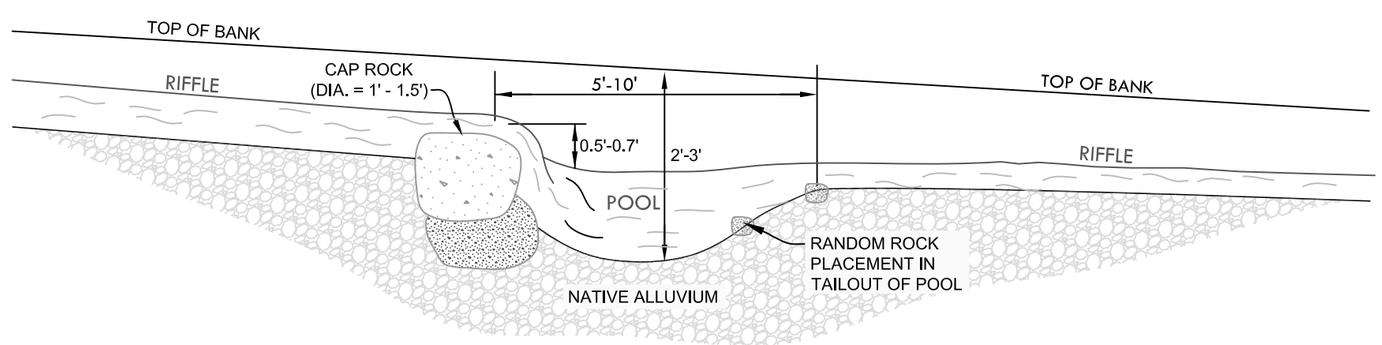


STEP-POOL HABITAT STRUCTURE
PLAN VIEW
NTS



STEP-POOL HABITAT STRUCTURE
A - A'
NTS

EXAMPLE OF A CONSTRUCTED ROCK STEP-POOL HABITAT STRUCTURE



STEP-POOL HABITAT STRUCTURE
B - B'
NTS

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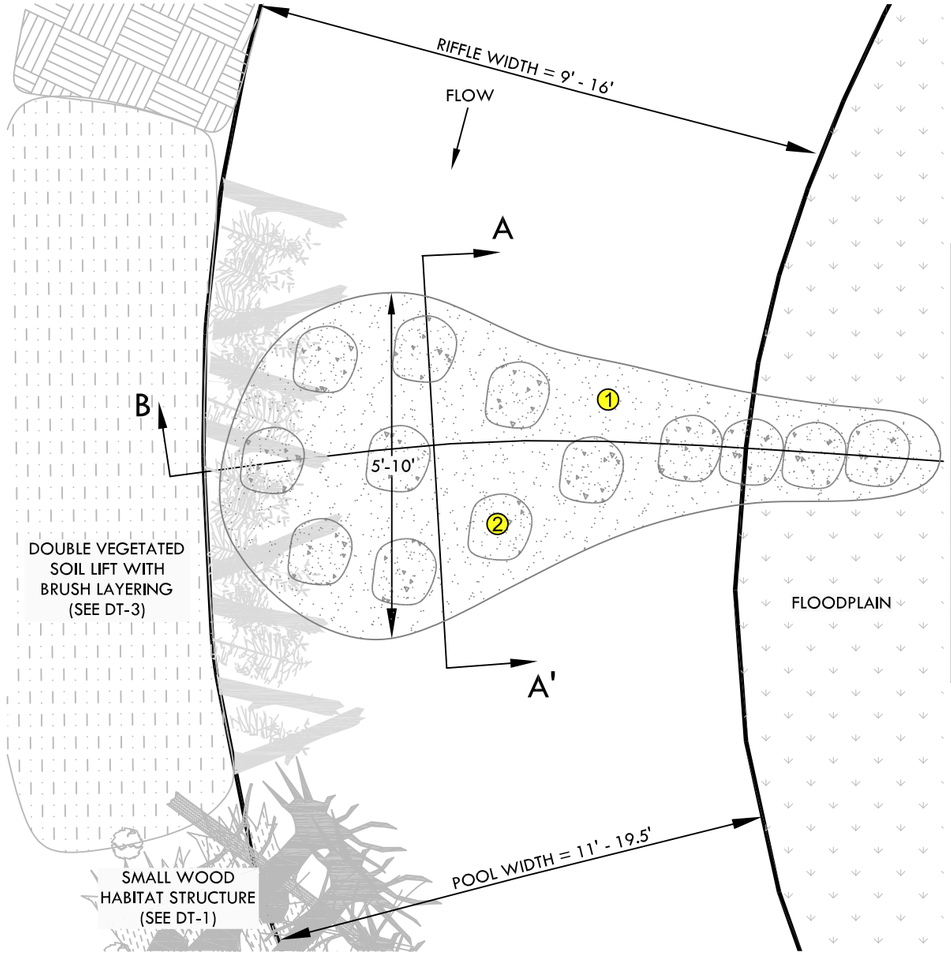
STEP-POOL HABITAT STRUCTURE

Owl Creek Restoration Project
Condon, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-6



ROCK ENERGY DISSIPATOR
PLAN VIEW NTS

EXAMPLE OF A CONSTRUCTED BOULDER ENERGY DISSIPATOR STRUCTURE

DESIGN INTENT

The intent of the submerged rock energy dissipater is to reduce flow energy in meanders and redirect flow away from the banks. The structure is designed to provide interim stream bed grade control in run features until natural armoring/sorting processes develop and control long term vertical stability. A pool will form downstream of the structure.

The submerged rock energy dissipater is designed to be natural in appearance and shall be submerged at all flow levels. The structure is designed to have no abrupt affect on the water surface profile and maintain fish passage at all flow levels. A matrix of large, immobile and irregularly-placed boulders forms the foundation of the structure. Gaps between boulders are filled with smaller, mobile alluvium thus maintaining bedload transport through the structure.

CONSTRUCTION NOTES

Over- excavate footprint to specified structure dimensions and stockpile or haul excavated material for use as backfill. Use boulders with d50 as specified. Surface boulders should be rounded or semi-rounded. Footer rocks may be angular or semi-angular. Use alluvium with specified gradation.

The Construction Manager shall inspect the excavation extents, materials and final elevations of the structure prior to final channel shaping.

Shape the channel to the specified feature dimensions upstream and downstream of structure.

The top of floodplain grade control sill shall be 0.5 feet below bankfull elevation and covered with 0.5 feet of sod/shrub transplants.

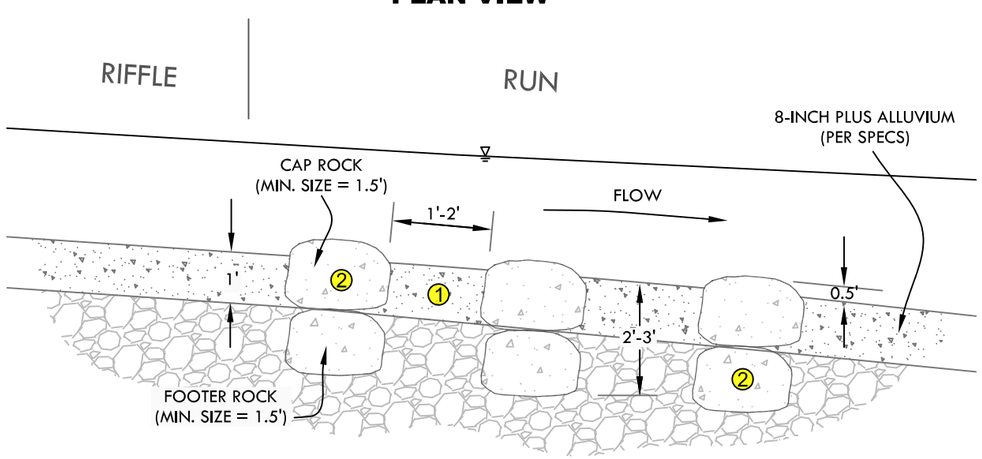
Notify the Construction Managere of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction, if warranted, due to unforeseen conditions.

MATERIAL SCHEDULE (PER STRUCTURE)

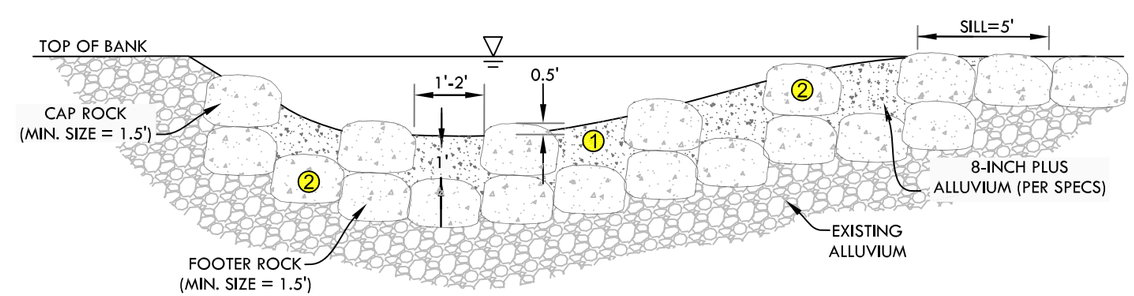
ITEM	QUANTITY	DIA. (IN)
1 CY OF 8-INCH PLUS	7	
2 BOULDERS	15	18 - 24

8-INCH PLUS ALLUVIUM GRADATION

SIZE CLASS	% OF MIX
12-INCH	20
11-INCH	20
10-INCH	20
9-INCH	20
8-INCH	20



ROCK ENERGY DISSIPATOR
A - A' NTS



ROCK ENERGY DISSIPATOR
B - B' NTS

NOTE: IF LARGER BOULDERS ARE OBTAINED FOR CONSTRUCTION THAT REACH FOOTER ROCK DEPTH, FOOTERS CAN BE ELIMINATED

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ROCK ENERGY DISSIPATER

Owl Creek Restoration Project
Condon, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-7