

RIP RAP SIZING AT OUTFALLS FOR PIPES GREATER THAN 6 INCHES IN DIAMETER

DISCHARGE VELOCITY AT DESIGN FLOW (FPS)	REQUIRED PROTECTION MINIMUM DIMENSIONS				
	TYPE	DEPTH*	WIDTH	LENGTH**	WIDTH
0 - 5	RIPRAP*	2 X (MAX STONE SIZE)	DIAMETER +6 FEET	10' MIN. OR AS CALCULATED IF LONGER	CROWN +1 FOOT
6 - 10	RIPRAP*	2 X (MAX STONE SIZE)	DIAMETER +6 FEET OR 3 X DIA. WHICH— EVER IS GREATER	AS CALCULATED	CROWN +1 FOOT
11 - 20	GABION OR RIPRAP*	2 X (MAX STONE SIZE)	DIAMETER +6 FEET OR 4 X DIA. WHICH— EVER IS GREATER	AS CALCULATED	CROWN +1 FOOT
OVER 20	ENGINEERED ENERGY DISSIPATER REQUIRED				

* RIPRAP SIZE SHALL BE DETERMINED USING THE FOLLOWING FORMULAE***

V = AVERAGE VELOCITY (FT/S)
 Do = PIPE DIAMETER (FT)
 ds = RIPRAP DIAMETER (FT)
 Lsp = APRON LENGTH (FT)
 depth = THICKNESS (FT)
 $Fo = \sqrt{(g \cdot DO)^{0.5}}$

*RIPRAP SIZE $ds=0.25 \cdot Do \cdot Fo$ (6" MINIMUM)
 DEPTH=2*ds (1-FOOT MINIMUM)
 **APRON LENGTH $Lsp=Do(8+17 \cdot \text{Log } Fo)$

$g= 32.2 \text{ FT/S}^2$

*** US ARMY CORPS OF ENGINEERE DESIGN FORMULAS FROM EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM OUTLETS, JANUARY 1970.



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APPROVAL DATE: 2013 SCALE: N.T.S.

STORM - OUTFALL
 RIP RAP SIZING

STANDARD
 DRAWING
 SWM
 ST-10.1