Length of Stream Degraded By One Acre of Impervious Area or Restored By Treating an Impervious Acre With Highly-Effective BMPs

	Factor	Value	Unit	Formula
Length of Excellent Quality Stream Degraded				
A	Impervious area impact threshold for an Excellent quality stream	5%	percent impervious area	
B	Stream length per square mile of watershed area	4	miles	
C	Miles converted to feet of stream per square mile	21,120	feet	B x 5280
D	Acres per square mile	640	acres	
E	Impervious area equalling 5% of a one square mile watershed	32	acres	D x 0.05
F	**Length of Excellent quality stream degraded per impervious acre**	**660**	**feet**	C ÷ E
Length of Poor Quality Stream Restored				
G	Impervious area of a Poor quality stream	20%	percent impervious area	
H	Stream length per square mile of watershed area	4	miles	
I	Miles converted to feet of stream per square mile	21,120	feet	H x 5280
J	Acres per square mile	640	acres	
K	Impervious area equalling 20% of a one square mile watershed	128	acres	J x 0.20
L	**Length of Poor quality stream restored per impervious acre treated with highly-effective BMPs**	**165**	**feet**	I ÷ K

Explanation:
A number of studies show that aquatic resource health impairment does not generally occur until the extent of buildings, streets, parking lots and other impervious surfaces cover 5% or more of the land area (watershed) draining to an Excellent quality stream, lake or other water body. These studies also show that a resource will be of Poor quality when watershed impervious area exceeds 15%. References to these studies can be found in the table at:

http://ceds.org/aquatic.html#Watershed_Impervious_Area_&_Aquatic_Resource_Damage

The following paper indicated that the average density of streams in the Mid-Atlantic was 2.5 kilometers per square kilometer of watershed, which equals 4 miles per square mile of watershed.
Potential Stream Density in Mid-Atlantic U.S. Watersheds

The table above goes through calculations to show that 660 feet of waterway are degraded for each impervious acre added to the watershed of an Excellent quality stream. The lower half of the table shows that 165 feet of Poor quality stream are restored for each acre of impervious area retrofitted so stormwater runoff from that acre is treated with highly-effective best management practices. However, the effectiveness of these retrofits is mostly theory at this point. Restoration has yet to be proven through scientific research.

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