SC-6 Sediment Trap (ST)

Description

Sediment traps are small ponding areas that allow sediment to settle out of runoff water. They are usually installed in a drainage way or other point of discharge from a disturbed area. Diversion ditches can be used to direct runoff to the sediment trap. Sediment traps are formed by excavating below grade and/or by constructing an earthen embankment.

Applicability

Sediment traps are generally temporary control measures used at the outlets of storm water diversion structures, channels, slope drains, or any other runoff conveyance that discharges waters containing erosion sediment and debris. Sediment traps may also be used at the inlets to culverts. Each sediment trap should be used for a drainage area less than five acres, however multiple sediment traps may be constructed in series for larger areas or areas with larger expected flows.

Limitations

- Although sediment traps allow for settling of eroded soils, because of their short detention periods for storm water they typically do not remove fine particles such as silts and clays.

- Water will remain in trap for extended periods.
- Never construct a sediment trap on a flowing stream or in wetlands.
- Unless no other options exist, sediment traps should not be constructed in ephemeral draws where the BMP will trap natural run-off along with construction site stormwater.

Design Criteria

Location

Traps are typically located at points of discharge from disturbed areas. The location will be determined by the natural terrain, drainage pattern of the runoff, and the accessibility for maintenance. Sediment traps should not be located in areas where their failure due to storm water runoff excess can lead to further erosive damage of the landscape. Alternative diversion pathways may be designed to accommodate these potential overflows.

Storage Capacity

Sediment traps shall be sized to accommodate site runoff volumes resulting from the 2-year 24-hour precipitation event as provided by regional NOAA Precipitation Atlases and calculated from the Rational Method. From the table below, the sediment trap volume has been calculated by multiplying its tributary disturbed area in acres by the runoff volume for the appropriate runoff coefficient and adding 15% for sediment accumulation. A sediment trap should be designed to maximize surface area for infiltration and sediment settling. This will increase the effectiveness of the trap and decrease the likelihood of backup during and after periods of high runoff intensity. Half of the storage volume shall be in the form of wet storage or a permanent pool. The other half shall be in the form of dry storage. When possible, the wet storage volume should be contained within the excavated portion of the trap. The volume of each sediment trap should be based on site conditions and available space.

A sediment trap can be utilized as a SC-10 Water Quality Capture Detention Area and may be designed to maximize surface area for infiltration, evaporation and sediment settling. If the sediment trap is to be utilized as a WQCDA, the minimum trap depth can be computed with:

Minimum Depth (ft.) = (Surface Area of the WQCDA + Tributary Runon Surface Area) / Surface Area of the WQCDA x 1.2 inches / 12 inches/foot + 0.5 ft. (freeboard & sediment)

Where:
Area = square feet (one acre = 43560 square feet)
NOAA Atlas 2, Vol III reports the 2-yr 24-hr precipitation for Northwest Colorado to be 1.2 inches
Cut slopes do not require a berm.

Runoff Volume Estimates Using the Rational Method for Northwest Colorado

Runoff Coefficient	Area (Acres)	2-year 24-hour Rainfall Intensity[1] (Inches/hour)	Peak Flow[2] (cfs)	Estimated Runoff Volume[3] (ft.3)
0.3	1	0.05	0.015	1296
0.4	1	0.05	0.02	1728
0.5	1	0.05	0.025	2160
0.6	1	0.05	0.03	2592
0.7	1	0.05	0.035	3024

(1) NOAA Atlas 2, Vol III reports the 2-yr 24-hr precipitation for Northwest Colorado to be 1.2 inches .

(2) Peak Flow using Rational Method: Q = C x I X A

where C = runoff coefficient; I = rainfall in inches/hour; A = tributary area in acres

(3) Runoff Volume = Peak flow in cfs x Storm Duration in seconds

Example: Sediment Trap as a WQCDA

Sediment Trap Surface Area (WQCDA): 50 ft. long by 6 ft. wide = 300 square feet
Tributary Runon Area : 0.25 acres = 0.25 acre x 43560 square ft./acre = 10980 sq. ft.

Minimum Depth (ft.) = (300 + 10980) / 300 x 1.2 / 12 + 0.5
= 11280 / 300 x 0.1 + 0.5
= 3.76 + 0.5
Minimum Depth (ft.) = 4.26 ft.

Construction Specifications

See Figure SC-6-1 and SC-6-2 for installation details.

1. If possible, sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area.

2. Area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

3. The fill material for the embankment shall be free of roots and other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

4. A spillway or slope drain may be utilize to drain the sediment trap. Slope drain pipe diameter sizes may be determined using the slope drain sizing table below. Should a spillway be desired, the spillway shall be compacted and lined with coarse angular aggregate/riprap, or local adequately sized rock to provide for filtering/detention capability and to prevent erosion of the spillway. The spillway may alternately be constructed with a small section of pipe or may consist of a level spreader, where the entire embankment is constructed at a uniform elevation. The spillway weir for each sediment trap should be at least four feet long for a 1-acre drainage area and increase by 2 feet for each additional drainage acre added, up to a maximum drainage area of 5 acres.

Pipe Slope Drains Sizing Table

Diameter inches	Estimated Flow Capacity* cfs
4	0.28
6	0.84
8	1.7
10	2.89
12	4.45
15	8.07
18	11.82
24	25.48

*Based on Chezy Manning open channel flow equation with a minimum slope of 3% for corrugated & smooth walled pipe.

5. If necessary, a geotextile may be placed at the stone-soil interface to act as a separator.

Maintenance Considerations

Inspection frequency shall be in accordance with the Storm Water Management Plan. The primary maintenance consideration for temporary sediment traps is the removal of accumulated sediment from the basin. Sediments should be removed when the basin reaches approximately 50 percent sediment capacity. A sediment trap should be inspected, according to the Stormwater Management Plan. Inspectors should also

check the structure for damage from erosion. The depth of the spillway should be checked and maintained below the low point of the trap embankment.

Removal/Abandonment

The structure may or may not be removed when the drainage area has been properly stabilized.

References

Colorado Department of Transportation (CDOT), *Erosion Control and Stormwater Quality Guide.* 2002. <http://www.coloradodot.info/programs/environmental/water-quality/documents/erosion-storm-quality>

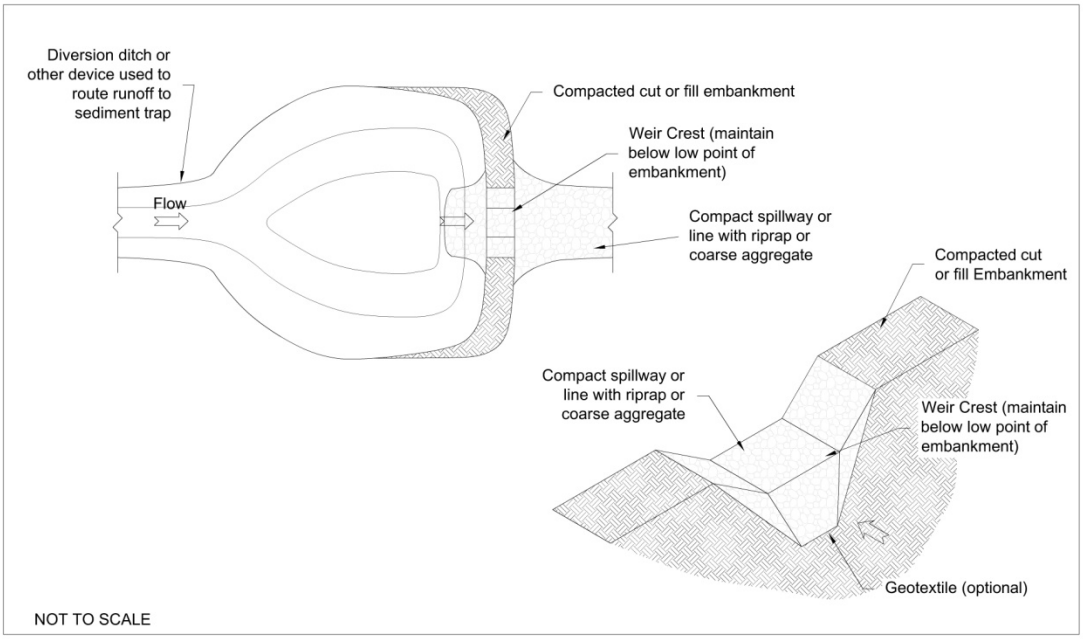
Environmental Protection Agency (EPA), *National Pollutant Discharge Elimination System (NPDES). Construction Site Storm Water Runoff Control.* Washington, D.C., February, 2003. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>

Horizon Environmental Services, Inc, *Guidance Document Reasonable and Prudent Practices for Stabilization (RAPPS) of Oil and Gas Construction Sites.* Produced by Independent Petroleum Association of America (IPAA). April 2004. http://www.dpcusa.org/enviro/rapps.html

Precipitation-Frequency Atlas of the United States, Volume 2 Version 3.0: Delaware, District of Columbia, Illinois, Indiana, Kentucky, Maryland, New Jersey, North Carolina, Tennessee, Virginia, West Virginia. 2004

http://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume2.pdf

Figure SC-6-1
Sediment Trap Installation



Minimum trap volumes ($ft.^3$)

0.25 ac.	0.5 ac	0.75 ac.	1.0 ac.
(373 $ft.^3$)	(745 $ft.^3$)	(1118 $ft.^3$)	(1490 $ft.^3$)

Figure SC-6-2
Diversion Ditch as Sediment Trap

Diversion Ditch As Sediment Trap Volume Computations
($ft.^3$)

2 ft. Wide Bottom Ditch with 1:1 Sideslopes

Length (ft.)	Depth (in.) 12	18	24	30	36	42	48
10	30	53	80	113	150	193	240
15	45	79	120	169	225	289	360
20	60	105	160	225	300	385	480
25	75	131	200	281	375	481	600
30	90	158	240	338	450	578	720
35	105	184	280	394	525	674	840
40	120	210	320	450	600	770	960
50	150	263	400	563	750	963	1200
60	180	315	480	675	900	1155	1440
70	210	368	560	788	1050	1348	1680
80	240	420	640	900	1200	1540	1920
90	270	473	720	1013	1350	1733	2160
100	300	525	800	1125	1500	1925	2400
110	330	578	880	1238	1650	2118	2640
120	360	630	960	1350	1800	2310	2880
130	390	683	1040	1463	1950	2503	3120
140	420	735	1120	1575	2100	2695	3360
150	450	788	1200	1688	2250	2888	3600
160	480	840	1280	1800	2400	3080	3840
170	510	893	1360	1913	2550	3273	4080
180	540	945	1440	2025	2700	3465	4320
190	570	998	1520	2138	2850	3658	4560
200	600	1050	1600	2250	3000	3850	4800

3 ft. Wide Bottom Ditch with 1:1 Sideslopes

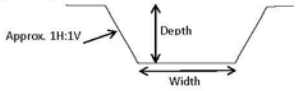
Length (ft.)	Depth (in.) 12	18	24	30	36	42	48
10	40	68	100	138	180	228	280
15	60	101	150	206	270	341	420
20	80	135	200	275	360	455	560
25	100	169	250	344	450	569	700
30	120	203	300	413	540	683	840
35	140	236	350	481	630	796	980
40	160	270	400	550	720	910	1120
50	200	338	500	688	900	1138	1400
60	240	405	600	825	1080	1365	1680
70	280	473	700	963	1260	1593	1960
80	320	540	800	1100	1440	1820	2240
90	360	608	900	1238	1620	2048	2520
100	400	675	1000	1375	1800	2275	2800
110	440	743	1100	1513	1980	2503	3080
120	480	810	1200	1650	2160	2730	3360
130	520	878	1300	1788	2340	2958	3640
140	560	945	1400	1925	2520	3185	3920
150	600	1013	1500	2063	2700	3413	4200
160	640	1080	1600	2200	2880	3640	4480
170	680	1148	1700	2338	3060	3868	4760
180	720	1215	1800	2475	3240	4095	5040
190	760	1283	1900	2613	3420	4323	5320
200	800	1350	2000	2750	3600	4550	5600

4 ft. Wide Bottom Ditch with 1:1 Sideslopes

Length (ft.)	Depth (in.) 12	18	24	30	36	42	48
10	50	83	120	163	210	263	320
15	75	124	180	244	315	394	480
20	100	165	240	325	420	525	640
25	125	206	300	406	525	656	800
30	150	248	360	488	630	788	960
35	175	289	420	569	735	919	1120
40	200	330	480	650	840	1050	1280
50	250	413	600	813	1050	1313	1600
60	300	495	720	975	1260	1575	1920
70	350	578	840	1138	1470	1838	2240
80	400	660	960	1300	1680	2100	2560
90	450	743	1080	1463	1890	2363	2880
100	500	825	1200	1625	2100	2625	3200
110	550	908	1320	1788	2310	2888	3520
120	600	990	1440	1950	2520	3150	3840
130	650	1073	1560	2113	2730	3413	4160
140	700	1155	1680	2275	2940	3675	4480
150	750	1238	1800	2438	3150	3938	4800
160	800	1320	1920	2600	3360	4200	5120
170	850	1403	2040	2763	3570	4463	5440
180	900	1485	2160	2925	3780	4725	5760
190	950	1568	2280	3088	3990	4988	6080
200	1000	1650	2400	3250	4200	5250	6400

Applicability: Sediment traps constructed with track hoe equipment.

Sediment Trap Configuration:



Instructions:

1. Select the appropriate bottom width table.
2. Select the tributary drainage area flowing into the sediment trap.
The acreages are coded by color with minimum trap volumes ($ft.^3$) provided below:

0.25 ac.	0.5 ac.	0.75 ac.	1.0 ac.
(373 $ft.^3$)	(745 $ft.^3$)	(1118 $ft.^3$)	(1490 $ft.^3$)

3. Select any of the corresponding depths and length that fit the color code.

Example: Tributary area to the sediment trap is approximately 0.75 acres
Given: My equipment can dig a 3 ft. wide ditch.

Answer: Use the 3 ft. Wide Bottom Ditch table above & select a yellow box. You can select any of the yellow corresponding depths and lengths. There are several choices. If select 1260 then your sediment trap should be at least 36 inches deep and 70 ft. long or choice 1148 and use 18 inches deep and 170 ft. length.

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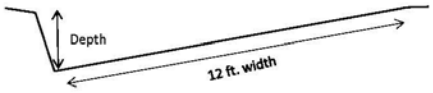
Figure SC-6-3
Diversion Ditch as Sediment Trap

Diversion Ditch As Sediment Trap - Volume Computations

Ditch Length (ft.)	Sediment Trap Volumes (ft.3) Depth (in.) 12	18	24
10	60	90	120
15	90	135	180
20	120	180	240
25	150	225	300
30	180	270	360
35	210	315	420
40	240	360	480
50	300	450	600
60	360	540	720
70	420	630	840
80	480	720	960
90	540	810	1080
100	600	900	1200
110	660	990	1320
120	720	1080	1440
130	780	1170	1560
140	840	1260	1680
150	900	1350	1800
160	960	1440	1920
170	1020	1530	2040
180	1080	1620	2160
190	1140	1710	2280
200	1200	1800	2400
210	1260	1890	2520
220	1320	1980	2640
230	1380	2070	2760
240	1440	2160	2880
240	1440	2160	2880
260	1560	2340	3120
270	1620	2430	3240
280	1680	2520	3360
290	1740	2610	3480
300	1800	2700	3600

Applicability: Sediment traps constructed with motor grader equipment.
(With Standard 12 ft. Wide Motor Grader Blade)

Sediment Trap Cross-Section Configuration:



Instructions:

1. Select the tributary drainage area flowing into the sediment trap.
The acreages are coded by color with minimum trap volumes (ft.3) provided below:

0.25 ac.	0.5 ac	0.75 ac.	1.0 ac.
(373 ft.^{3})	(745 ft.^{3})	(1118 ft.^{3})	(1490 ft.^{3})

2. Select the corresponding depths and lengths that fit the color code.

Example: Tributary area to the sediment trap is approximately 0.50 acres
Given: Motor Grader to cut a depth of 18 inches.

Answer: From the Table, select the green box in the 18 inch column. Move to the left of that green box and you will see the corresponding ditch length is 90 ft. The sediment trap ditch should be a minimum of 90 ft. long and 18 inches deep.

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