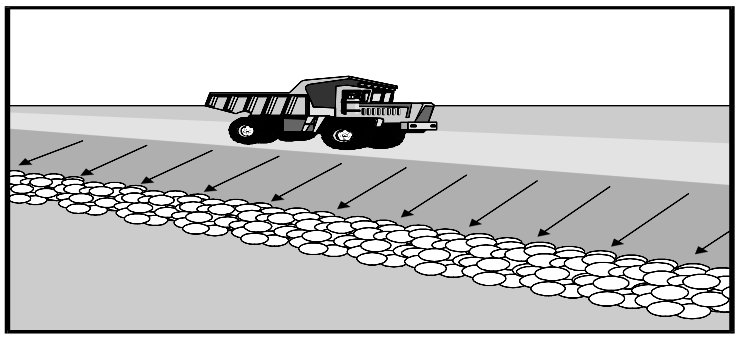
ACTIVITY: Brush or Rock Filters and Continuous Berms

TCP – 16



Targeted Constituents				
● Significant Benefit	◗ Partial Benefit	○ Low or Unknown Benefit		
● Sediment	○ Heavy Metals	○ Floatable Materials	○ Oxygen Demanding Substances	
○ Nutrients	○ Toxic Materials	○ Oil & Grease	○ Bacteria & Viruses	○ Construction Wastes

Implementation Requirements				
● High	◗ Medium	○ Low		
◗ Capital Costs	◗ O & M Costs	○ Maintenance	◗ Suitability for Slopes >5%	○ Training

Description

A rock filter berm is made of rock ¾ to 5 inch (1.9 to 12.7 cm) diameter and placed along a level contour where sheet flow may be detained and ponded, promoting sedimentation. A brush barrier is composed of brush (usually obtained during the site clearing) wrapped in filter cloth and anchored to the toe of the slope. A continuous berm is a berm constructed of a continuous role of fabric that encapsulates sand, rock or native soil. It is generally implemented on site through the use of an extruder pulled behind a tractor.

If properly anchored, brush or rock filters and continuous berms may be used for sediment trapping and velocity reduction. In simpler terms brush or rock filters do not filter the water they slow it down enough for the sediment to settle out of the runoff water. See Check Dam BMP for more information. This management practice is likely to create a significant reduction in sediment. Continuous berms are more effective than silt fences, straw bales, brush barriers and sand bag barriers. The difference in effectiveness is due to the durability and maintenance requirements.

Suitable Applications

- Rock filters are appropriate where a temporary measure is needed to prevent sediments from entering right-of-ways of traffic areas such as near the toe of slopes, incorporated into stabilized construction entrances, or at other locations along the construction site perimeter. Rock filters may also be used as check dams across one or more lanes of construction traffic temporary roads, or unsurfaced rights of way subject to construction traffic.
- Across mildly sloped construction roads (rock filter berms, only).
- Below the toe of slopes.
- Along the site perimeter.
- Along streams and channels.

- Around temporary spoil areas.
- Below other small cleared areas.
- At sediment traps at culvert/pipe outlets.
- Construction projects with disturbed areas during wet season.
- Where contributing tributary areas are less than 5 acres (2 ha) to 10 acres (4 ha).

Installation/ Application Criteria

- A rock filter consists of open graded rock installed at the toe of a slope, along the perimeter of a developing or disturbed area, and as a check dam across construction roads. Their purpose is to intercept sediment laden runoff from disturbed areas of the site, allow the runoff to pond, promote sedimentation behind the filter, and slowly release the water as sheet flow.
- Rock filters are less costly than other temporary barriers, and are relatively efficient at sediment removal when installed and maintained properly.
- Brush filters trap and filter sediments in a manner similar to other barriers in this handbook (e.g., silt fence, straw bale barrier, rock filter), but have the advantage of being constructed from brush cleared from the site and usually disposed off-site at a cost.
- Use principally in areas where sheet or rill flow occurs.
- For rock filter, use larger rock and place in a staked, woven wire sheathing if placed where concentrated flows occur.
- Rock filters should be placed along a level contour to intercept sheet flow.
- Allow ample room for ponding, sedimentation, and access by sediment removal equipment between the berm and the toes of slopes.
- Flow through the filter should occur as sheet flow into an undisturbed or stabilized area.
- Leave area behind berm where runoff can pond and sediment can settle.
- Brush shall consist of site-cleared brush.
- Stakes: 1.5 in. x 1.5 in. (38 mm x 38 mm) wooden stake, or metal stake with equal holding capabilities.
- Rock: open-graded rock, 1- to 3-in. (2.5- to 7.6-cm) stone reinforced with 8- to 12-in. (20.3- to 30.5-cm) stone as illustrated in Figure TCP-16-1 for concentrated flow applications.
- Woven wire sheathing: 1-in. (25-mm) diameter, hexagonal mesh, galvanized 20 gauge (used with rock filters in areas of concentrated flow).

- In Non-Traffic Areas:

  - Maximum flow-through rate per square foot (0.1 m^2) of filter = 60 gpm (3.8 x 10^{-3} m^3/s)
  - Height = 18 inches (45.7 cm) minimum
  - Top width = 24 inches (61 cm) minimum
  - Side slopes = 2:1 (H:V) or flatter
  - Woven wire sheathing (poultry netting) is recommended in areas of concentrated flow. The wire should be 1-inch (2.5-cm) diameter hexagonal mesh, galvanized 20 gauge.
  - Build the filter on a level contour.
  - Rock: ¾ to 3 inches (1.9 to 7.6 cm) open graded for sheet flow, 3 to 5 inches (7.6 to 12.7 cm) open graded for concentrated flow.

- In construction traffic areas, maximum rock berm heights shall be 12 in. (300 mm). Multiple berms should be constructed every:

  - 300 ft (94.3 m) on slopes less than 100:5 (H:V) (5%)
  - 200 ft (62.9 m) on slopes between 100:5 (H:V) (5%) and 100:10 (H:V) (10%)
  - 100 ft (31.4 m) on slopes greater than 100:10 (H:V) (10%).

Steps in Construction of a Brush Filter:

1. Stack the brush at the toe of a slope or along the perimeter of the site just outside the limits of clearing and grubbing. The brush may be stacked up to 15 ft. (4.7 m) high and 15 ft. (4.7 m) wide.
2. Construct a trench 1 to 3 ft. (0.3 to 0.9 m) deep immediately upslope from the brush.
3. Place filter fabric over the brush filter and in the trench, extending 1 to 2 ft (0.3 to 0.6 m) upslope of the trench.
4. Backfill the trench with aggregate or compacted soil. The trench should be deep enough and backfill material sufficient to hold the barrier in place during a storm.

Maintenance

- Installation in stream beds requires large rock, staking of woven wire sheathing, and daily inspection.

- Inspect berms before and after each significant rainfall event, and weekly throughout the rainy season.

- Reshape berms as needed and replace lost or dislodged rock, brush and/or filter fabric.

- Inspect for sediment accumulation and remove sediments when depth reaches one-fourth of the berm height or 12 in. (300 mm), whichever occurs first.

- Filter berms should be removed upon completion of construction activities.

Limitations

- Cost

  - Brush filter: Low to moderate cost if debris from on-site clearing and grubbing

is used.
- Rock filter: Expensive, since off-site materials, hand construction and demolition/removal are usually required.

- Not appropriate for contributing drainage areas greater than 5 acres (2 ha).
- Requires sufficient space for ponded water.
- Not effective for diverting runoff since filters allow runoff to slowly seep through.
- Performance of brush filters relatively unpredictable.
- Rock filter berms are difficult to remove when construction is complete.

Primary References

California Storm Water Best Management Practice Handbooks, CDM et.al. for the California SWQTF, 1993.

Caltrans Storm Water Quality Handbooks, CDM et.al. for the California Department of Transportation, 1997.

Subordinate References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

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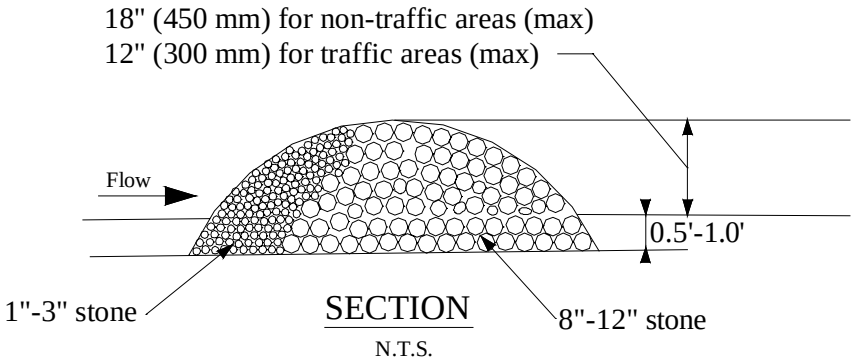

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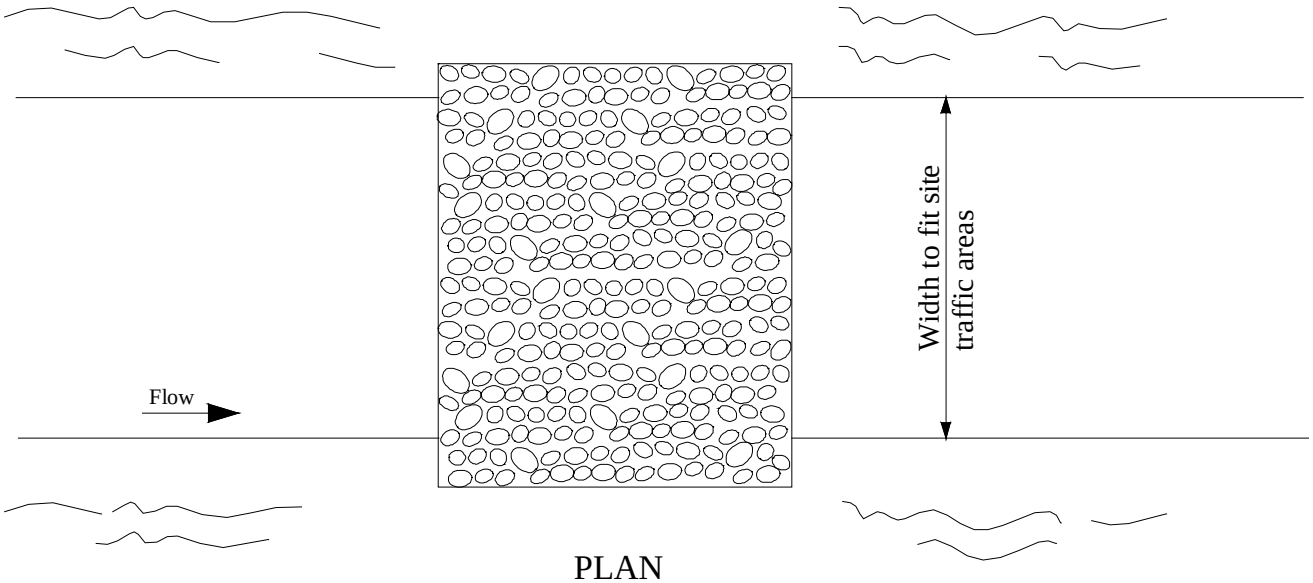

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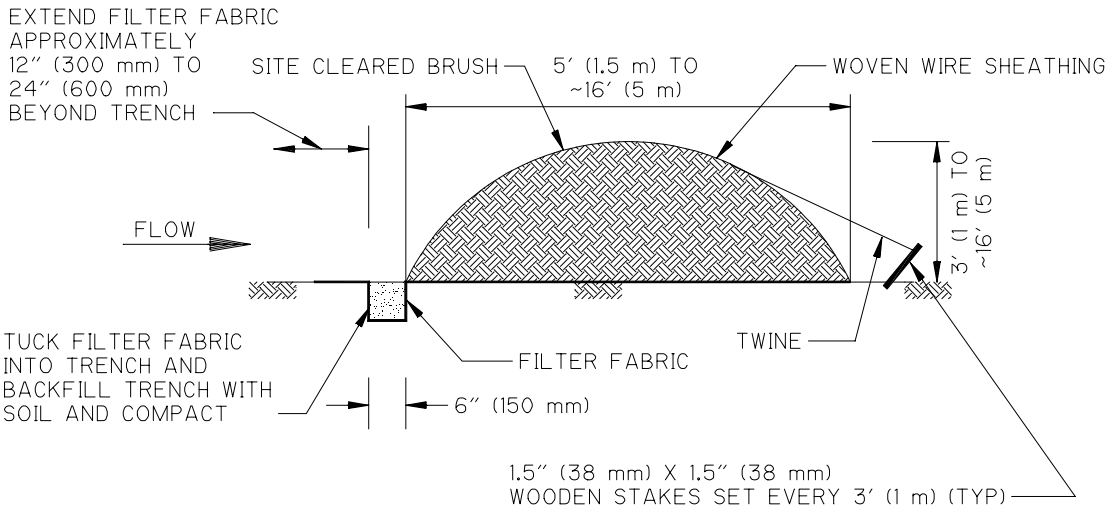
Figure TCP-16-1
Rock Filter Construction



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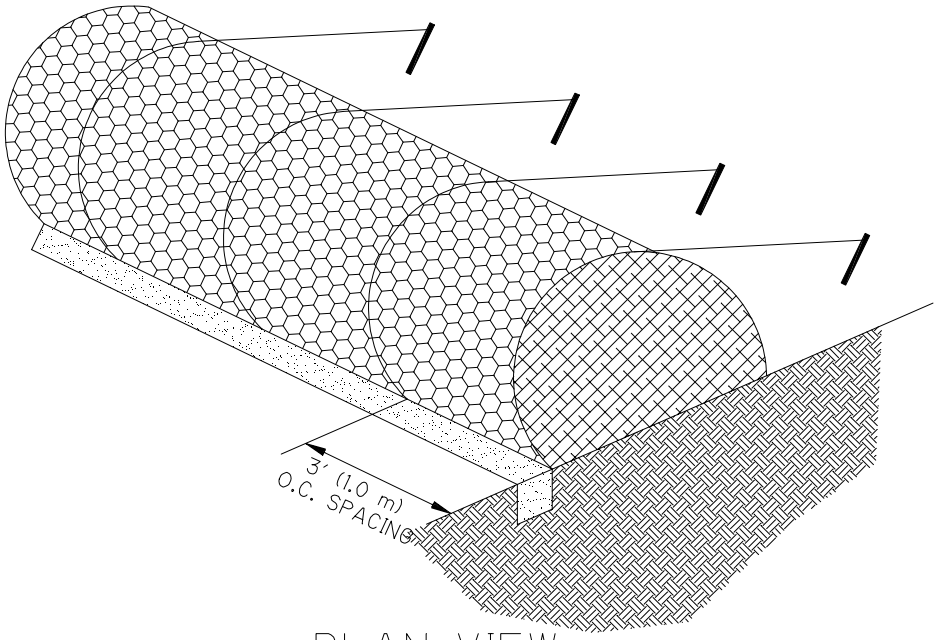

PLAN VIEW

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Figure TCP-16-2
Brush Filter Construction