Stormwater Best Management Practice

Check Dams

Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Runoff Control

Description

Check dams are relatively small, temporary structures constructed within concentrated-flow areas such as swales, channels and ditches. Check dams are primarily an erosion and sediment control practice and are most effective when combined with other erosion and sediment control practices.

Applicability

Check dams are appropriate where temporary or permanent channels are not yet vegetated, or channel lining is infeasible. Placing dams at regular intervals—so that the base of the upstream dam is at the same elevation as the top of the downstream dam—can reduce a conveyance feature's effective slope (SPU, 2017). Check dams reduce erosion by reducing flow velocities. Sediment trapping can occur at lower flow velocities, but construction staff should not use check dams solely for this purpose.

Siting and Design Considerations

Construction staff can build check dams using a variety of materials: most commonly rock, sand- or gravel-filled bags, or fiber logs. They should not use straw bales or silt fences, which are not suitable for concentrated-flow areas (MPCA, 2019). They should use check dams in concentrated-flow areas that drain areas of 10 acres or less (WES, 2008) and where velocity exceeds 4 feet per second as measured during a 2-year, 24-hour storm event (MDE, NRCS, & MASCD, 2011).

Check dam dimensions depend on slope and expected flow velocities. When installing them in series, construction staff should space check dams so the crest of the downstream dam is at the same elevation as the toe of the upstream dam (MPCA, 2019). A check dam should extend from bank to bank, with a center lower than the banks, to create a weir. The center of the dam should not be more than 24 inches high and should be at least 6 inches lower than the check dam edges (MDE, NRCS, & MASCD, 2011). To make dams more stable,

A rock check dam in a channel.
Credit: Kort Kirkeby for USEPA, 2012

construction staff can implant the material at least 6 inches into the sides and bottom of the channel. Combining check dam materials with stabilization measures, such as geotextile lining, can prevent further erosion.

Before installing check dams, construction staff should impound and bypass upstream flow away from the work area. They should not install check dams in streams (SPU, 2017) or other waterways without approval from an appropriate regulatory agency.

Limitations

Check dams mainly serve to slow stormwater flow in a channel—they are not suitable as standalone substitutes for other erosion and sediment-trapping devices. Ponded water above check dams may kill established vegetation or prevent vegetation from establishing. Check dams may reduce the hydraulic capacity of the channel and create turbulent flow downstream, which may increase erosion unless the channel is protected with geotextile fabric or riprap (WES, 2008).

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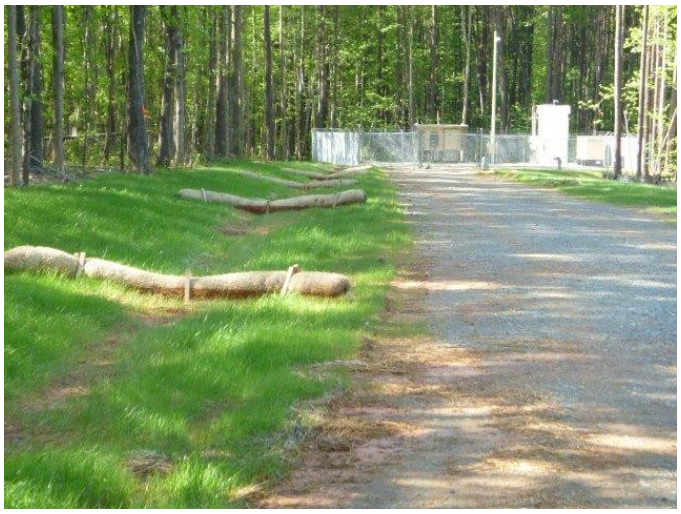

A series of filter sock check dams placed in a grass swale.
Credit: Jared Richardson for USEPA, 2015

Maintenance Considerations

Construction staff should inspect check dams after each storm event to ensure their structural integrity and to look for scour underneath the check dam and bypass on the sides. If the center of a check dam is not lower than its edges, staff may need to add additional stone to restore the correct height. During inspection, they should remove large debris, trash and leaves (MPCA, 2019). When sediment has reached about one-third the original height of the dam (measured at the center of the upstream side), staff should remove the accumulated sediment (WES, 2008). If significant erosion occurs between check dams, they should install a geotextile fabric liner or riprap in that portion of the channel (SPU, 2017).

Before removing a check dam, construction staff should completely stabilize the contributing area and remove all accumulated sediment. When removing check dams, staff should take care to remove all dam materials to ensure proper flow within the channel. Immediately after removal, they should stabilize any disturbed area with seed, soil stabilization matting or sod (MDE, NRCS, & MASCD, 2011).

Effectiveness

For long channels, check dams are most effective when used in series. They effectively prevent erosion in concentrated-flow regimes but have limited sediment settling capacity. If sediment transport is a concern, construction staff can use check dams in conjunction with other practices. Check dams are relatively easy to install (WES, 2008).

Cost Considerations[1]

Check dams are generally inexpensive (WES, 2008). The cost of a check dam depends on its composition and the width of the dammed channel. A 1-foot-deep rock check dam constructed using the minimum dimensions specified by MDE, NRCS and MASCD (2011) requires roughly 2 cubic yards of stone. With an installed cost for stone or gravel ranging from $50 to $200 per cubic yard (RSMeans, 2019), the resulting material cost alone is at least $100 to 400, which does not include excavation, maintenance or removal. By comparison, the Minnesota Department of Transportation's 2014 summary of average bid prices for awarded projects indicated an average cost per rock check dam of $1,400. Smaller versions or check dams using different materials may cost much less. For example, sediment control logs varied in price from $2.52 to $13.25 per linear foot (MPCA, 2019).

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

[1] Prices updated to 2019 dollars. Inflation rates obtained from the Bureau of Labor Statistics CPI Inflation Calculator website: https://data.bls.gov/cgi-bin/cpicalc.pl.

References

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