NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SEDIMENT BASIN

(No.)

CODE 350

DEFINITION

A basin constructed with an engineered outlet, formed by an embankment or excavation or a combination of the two.

PURPOSE

To capture and detain sediment laden runoff, or other debris for a sufficient length of time to allow it to settle out in the basin.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to urban land, construction sites, agricultural land, and other disturbed lands:

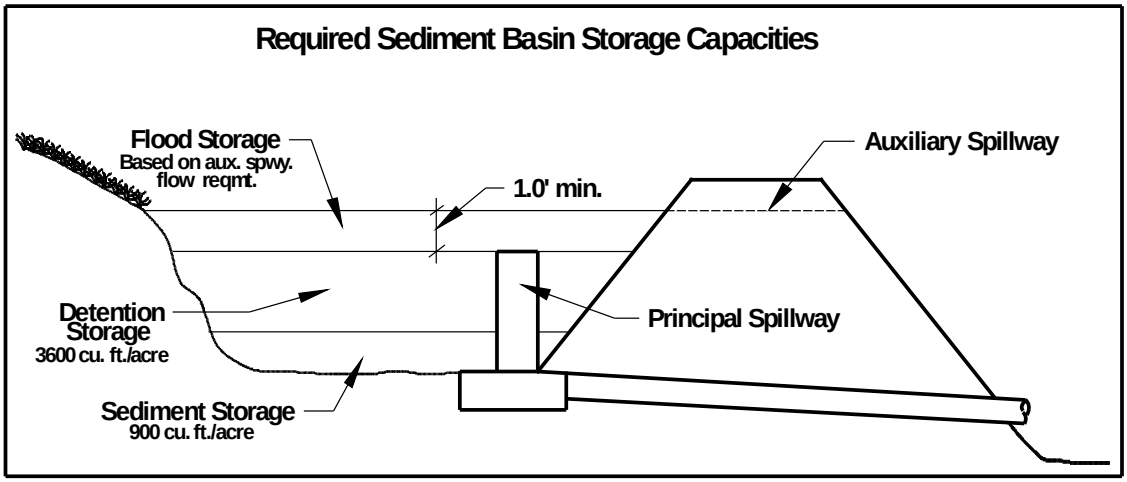
- Where physical conditions or land ownership precludes treatment of a sediment source by the installation of erosion-control measures.
- Where a sediment basin offers the most practical solution.
- Where failure of the basin will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway.
- The effective height of the dam is 35 feet or less. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.
- The Hazard Class of the dam is Low.

CRITERIA

Sediment basin design and construction must comply with all applicable federal, state and local laws and regulations.

Location. Sediment basins are the last line of defense for capturing sediment when erosion has already occurred. When possible construct basins prior to soil disturbance in the watershed. Choose the location of the sediment basin so that it intercepts as much of the runoff as possible from the disturbed area of the watershed. Choose a location that minimizes the number of entry points for runoff into the basin and interference with construction or farming activities. Do not locate sediment basins in perennial streams.

Basin Capacity. The sediment basin must have sediment storage capacity, detention storage and temporary flood storage capacities. For maximum sediment retention, design the basin so that the detention storage remains full of water between storm events. However, if site conditions, safety concerns, or local laws preclude a permanent pool of water, design all or a portion of the detention and sediment storages to be dewatered between storm events.



Precipitation Runoff Areas
Design Capacity. Sediment basins shall be designed to trap at least 65 percent of the sediment from a 10-year-24-hour storm on the contributing area. Erosion can be estimated using the Revised Universal Soil Loss equation (RUSLE) as appropriate when field measurements are not available. The sediment delivery ratio to the basin site and basin capacity can be determined using Idaho Appendix #10 to Chapter 10 of the Engineering Field Handbook.

Irrigation Runoff Areas
Design Capacity. Seasonal sediment yields can be made from one of the following methods: (1) Measured discharge and sediment concentrations during irrigations averaged throughout the irrigation season. Sediment measurements can be made using the modified Imhoff cone or filtering techniques (2) Estimate the sediment yield using Idaho Agronomy Technical Note 32 “Predicting Irrigation Induced Soil Loss on Surface Irrigated Cropland” for the crop sequence producing the highest sediment yield: For basins with a 1 year interval for cleanout of sediment use, the crop with the highest soil loss. For basins with more than 1 year storage capacity can be designed for the crop sequence applicable to the years of storage.

Flood storage is based on the required design storm for the auxiliary spillways. Flood storage is calculated between the crest of the principal spillway and the crest of the auxiliary spillway.

A minimum of 1 foot in elevation is required between the principal and auxiliary spillways.

Principal and Auxiliary Spillway Design

Design the principal spillway to carry long-duration, continuous, or frequent flows without discharge through the auxiliary spillway. The diameter of the principal spillway pipe must be 6 inches or greater.

The principal spillway can be designed to remove only water from the temporary flood storage or it can be designed to dewater all or part of the detention storage. Design the principal spillway to drawdown the temporary flood storage within 24 hours. Drawdown times for the detention storage can be longer to improve sediment trapping.

Design the auxiliary spillway to pass large storms without damage to the basin. Refer to NRCS Conservation Practice Standard 378, Ponds for the required design storm and design criteria for the auxiliary spillways.

The outlet of the principal spillway must be stable for anticipated design flow conditions.

Basin Shape. To get maximum trap efficiency, the reservoir length shall be at least 4 times the average width, unless calculations show that the proposed length is adequate to trap at least 65

percent of the suspended particles. Length is defined as the shortest distance from where particles enter the ponded area to the outlet leaving the pond. Idaho Appendix #10 to

Chapter 10 of the Engineering Field Handbook may be used to determine sediment basin dimensions where it is applicable. Where inlets are located other than the opposite end of the basin from the outlet, the minimum distance between the inflow and outflow shall be no less than determined from Idaho Appendix #10.

Baffles to divert the flow in the basin can be used to lengthen the flow path of incoming water to achieve the required length to width ratio.

Embankment and Side Slopes. If the sediment basin includes an embankment, it must be constructed of well compacted soil with stable side slopes. Refer to NRCS Conservation Practice Standard 378, Pond for design requirements for the embankment.

Above the permanent water line, the side slopes of the pool area must be 3 horizontal to 1 vertical or flatter. Side slopes below the permanent water line can be as steep as 2 horizontal to 1 vertical.

Vegetation. Establish vegetation on the embankment and side slopes of the basin and pool area immediately after construction. Refer to NRCS Conservation Practice Standard 342, Critical Area Planting for criteria for the establishment of vegetation. If construction takes place during a time period that is not conducive to establishing vegetation, protect the embankment by mulching or other methods. Refer to NRCS Conservation Practice Standard 484, Mulching for mulching criteria.

If arid climatic conditions do not allow for the establishment of vegetation other means of reducing erosion may be used.

Safety. Sediment basins are often installed in developing areas and can be an attractive nuisance and safety hazard to the public. Design with the safety of the public in mind. Where appropriate, include safety features such as fencing to limit access to the pool area and embankment, signs to warn of danger and a safety ledge below the water level 6 feet wide and 4 horizontal to 1 vertical (4:1) or flatter around the edge of the permanent pool.

CONSIDERATIONS

A large sediment basin may have an effect on the peak discharge rate from a watershed. Planners should consider this, and take steps to mitigate any potential negative effects this may have on riparian habitat downstream from the structure.

In many cases the use of a sediment basin alone may not provide sufficient protection for offsite sedimentation problems. To work most effectively, the sediment basin should be the last practice in a series of erosion control and sediment capturing practices installed in the disturbed area. This incremental approach will reduce the load on the basin and improve effectiveness of the overall effort to prevent offsite sedimentation problems.

The efficiency of sediment removal in a basin is affected by the detention time of runoff, the type of dewatering device, the presence of a permanent pool in the basin, a decrease in turbulence in the basin and soil particle size. The uses of the following techniques are particularly effective if there is a need to remove clay and other fine grained particles.

- Detention time can be increased by increasing the storage volume in the basin. Increased storage along with a properly designed dewatering device can significantly improve the efficiency of sediment capture.
- Dewatering should be done in a manner which removes the cleaner water above the sediment storage, without removing the sediment laden water found deeper in the basin. One dewatering device that has been very successful is a skimming device that floats on the surface of the water and rises and falls with the water level in the basin. Use of this type of dewatering device should improve the quality of the water leaving the basin. Details for this type of dewatering device can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- Maintaining a permanent pool also improves sediment trapping by reducing the re-suspension of sediment in the basin. This can be accomplished by only dewatering the temporary flood storage or

only a portion of the detention storage. Removal of sediment from the basin before it reaches the sediment storage elevation will maintain the pool volume and improve trapping efficiency.

- Turbulence in the basin can be reduced by constructing porous baffles that extend across the entire basin. The baffles slow down flows and force water to spread across the entire width of the basin. A thorough discussion and design criteria for porous baffles can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- For very fine grained sediments, flocculants can be added to the runoff before it enters the basin. One commonly used flocculant is anionic polyacrylamide (PAM). Do not use cationic polyacrylamide because it can be toxic to aquatic life.

Since the sediment basin must be designed to handle all of the contributing drainage whether it is from disturbed areas or not, diverting runoff from undisturbed areas away from the basin will improve the function of the basin. The design storm for diversion measures should be equal to the design storm for the auxiliary spillway of the basin.

The use of forebays that are separate from the main basin and easily accessible for cleanout will reduce turbulence and will allow larger particles to settle out of the runoff before it enters the main basin.

Because the sediment storage capacity of a basin is finite, choose a location that will allow access for sediment removal when the storage capacity is full.

Visual aesthetics may be a concern, especially in urban or suburban areas. To address these concerns, design the basin to blend with the surrounding topography, or use plantings to screen the view from surrounding homes or buildings.

In some situations, after they have served the sediment capture function, sediment basins may remain in place to function as stormwater detention or wildlife ponds. This will require appropriate planning during the design phase to ensure that the basin can function for a different use. In addition, significant modifications to outlet structures may need to be made as well as removal of accumulated sediment to convert it to a new use.

If the basin will be used by wildlife, the use of native species is recommended to provide food and habitat diversity. Also, consider wildlife use of the basin when scheduling maintenance activities that may disrupt wildlife life cycles or negatively impact pollinators.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for sediment basins that describe the requirements for applying the practice according to this standard. Include as a minimum, the following in the plans and specifications:

1. A plan view of the layout of the sediment basin.
2. Typical cross sections of the basin.
3. Details of the outlet system
4. Seeding requirements if needed.
5. Construction specifications that describe in writing site specific installation requirements of the sediment basin.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in the operation and maintenance plan are:

1. Periodic inspections and maintenance of the embankment, principal and auxiliary spillways and dewatering device especially following significant runoff events.
2. Prompt repair or replacement of damaged components.
3. Prompt removal of sediment when it reaches pre-determined storage elevations.
4. Periodic mowing of vegetation to control of trees, brush and invasive species.
5. Periodic inspection of safety components and immediate repair if necessary.

REFERENCES

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