

**SUBSURFACE DENITRIFYING BIOREACTOR
(CODE 605)**

DESCRIPTION

A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow via enhanced denitrification.

PURPOSE

This practice is applied to achieve the following purpose:

- Improve water quality by reducing the nitrate nitrogen content of subsurface agricultural drainage flow.

CONDITION

This practice applies to sites where there is a need to reduce nitrate nitrogen concentration in subsurface drainage flow.

This practice does not apply to underground outlets from practices, such as terraces, where the drainage source is primarily from surface inlets.

POLICIES

1. NRCS Standards and Specifications for Denitrifying Bioreactor (Code 605) shall be followed when applying this practice either alone or as part of a system.
2. Drainage area calculations must be based solely on runoff from the agricultural parcel upon which the bioreactor will be constructed.
3. As much as possible, maintain the drainage water flow to the extent the bioreactor functions optimally.
4. If required, a Drainage Water Management plan (code 554) must be followed.
5. Design the bioreactor media for an expected life of at least 10 years. To create a longer lifespan, provide provisions for periodic renewal of the media.
6. Design the bioreactor inlet and outlet water control structures to provide the required capacity and hydraulic retention time. Use the criteria in Conservation Practice Standard (CPS) Code 587, Structure for Water Control, for the design.
7. Select or design water control structures that control the upstream water elevation and provide a safe bypass of flows in excess of the design capacity.
8. Select a design water surface elevation at the upstream water control structure that will prevent upslope crop damage from an elevated water table.

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9. Provide a low elevation orifice or opening of some type on the outlet structure to assure the media chamber drains in a maximum of 48 hours during periods of no-drain flow.
10. Provide an outlet that will completely drain the media chamber to facilitate bioreactor management and maintenance.
11. Protect the bioreactor from intermittent surface storm flows that could result in flushing out of the bioreactor media.
12. To prevent compaction of the bioreactor media, identify the bioreactor location with appropriate signage or fence the site to avoid equipment travel over the bioreactor. If there will be equipment traffic for mowing or other purposes, provide adequate cover to prevent damage to the bioreactor.
13. Protect all disturbed non-crop construction areas by seeding or mulching within 14 days of construction.
14. The criteria for seed selection, seedbed preparation, fertilizing, and seeding see CPS Code 342, Critical Area Planting. For installation of the denitrifying bioreactor in an existing filter strip or other conservation practice, revegetate disturbed areas according to the seeding requirements of the conservation practice disturbed by construction.
15. Other practices and management systems can achieve a reduction of nitrate nitrogen levels separately or in conjunction with the denitrifying bioreactor. Examples include CPS Codes 590, Nutrient Management; and 340, Cover Crop.
16. Situating the bioreactor on a low bench will minimize interference with the drainage needs of the area served during the growing season.
17. Exclude surface water from the bioreactor as much as possible by selecting a location away from areas that will pond surface water during storm events.
18. Be aware of the effects on downstream flows or aquifers that would affect other water uses or users. For example, the initial flow from the bioreactor at start up may contain undesired contaminants.
19. If site topography is such that planned elevated water table upstream of the bioreactor might negatively affect crop performance, manage water levels at the upstream end of the bioreactor according to criteria in CPS Code 554, Drainage Water Management.
20. Consider measures to reduce the potential for root plugging of distribution lines by woody species. Set planted trees back far enough that distribution lines will not be under the drip line of mature tree canopies. Plant herbaceous species in areas over distribution lines. If the riparian area is currently in trees, either clear the trees or establish an herbaceous zone outside the tree line for the water distribution area.

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21. The applicant and the farm's Nutrient Management Plan must be in compliance with Maryland's Nutrient Management regulations (COMAR 15.20.08) at the time of Application. No Applications will be approved without a Nutrient Management Plan Certification Form submitted with the Application (SECTION III, #30).
22. It is the owner's responsibility to contact MDE and/or the Corps to make a determination whether a permit will be required before a new practice can be installed.
23. This practice must be properly maintained for a minimum of ten (10) years. The applicant agrees to provide all equipment, labor, and materials needed to meet this requirement. Financial assistance may be provided for repairs if a BMP previously installed with MACS support was damaged due to an unpredictable act of nature and not due to the applicant's negligence or poor maintenance.
24. For cost-effectiveness, consider locating the saturated buffer where it will intercept a subsurface drain outlet draining at least 15 acres.
25. Cost share **is authorized** for the following:
 - a. *Lined Outlet (code 468)*
 - b. *Structure for Water Control (code 587)*
 - c. *Subsurface Drain (code 606)*
 - d. *Underground Outlet (code 620)*
26. Cost share **is not authorized** for the following:
 - a) *Vertical Drain*
 - b) *Field drainage lateral(s)*
 - c) *Media Replacement / Replenishment during projects maintenance life.*

OPERATION AND MAINTENANCE

Provide an operation and management (O&M) plan and review this with the land manager. Specified actions should include normal repetitive activities in the application and use of the practice, along with repair and upkeep of the practice. The plan must be site-specific and include, but not be limited to, a description of the following:

- Planned water level management and timing.
- Inspection and maintenance requirements of the bioreactor and contributing drainage system, especially upstream surface inlets.
- Requirements for monitoring the status of the bioreactor media and replacement/ replenishment of media as needed.
- Monitoring and reporting criteria that demonstrate system performance.
- Monitoring information to improve the design and management of this practice as needed.

COST-SHARE RATE

The State cost-share payment, alone or when combined with any other cost-share program, shall not exceed 100% of the total eligible cost, not to exceed \$150,000 per project.

ATTACHMENTS

Applicant(s) with an outstanding Unsatisfactory On-Farm Status Review of BMP Maintenance and Use of previous project(s) may be ineligible for MACS Cost-Share funding. When a previous project expires with outstanding unsatisfactory status, the applicant is ineligible for any future MACS funding.

The following items are needed:

1. A copy of a recorded deed(s) for the parcel(s) where the BMP is located. If the current, appropriate deed is already on file in the MACS Office, then record both the agreement number of the file where the deed is kept and the liber/folio numbers in the General Comments section of the application.
2. A copy of the Real Property Data Search page from the Maryland Department of Assessments and Taxation's website (www.dat.maryland.gov) indicating the Maryland Property View Account ID Number and owner information.
3. An aerial photograph indicating the property lines as well as all existing and proposed BMPs. In addition, indicate drainage area and direction of flow.
4. A plan view sketch of the area indicating the location of the proposed BMP and graphically demonstrating the layout of the components and details of the project.
5. Nutrient Management Plan Certification Form shall be submitted with the Application (SECTION III, #30).
6. Provisions for Subsurface Denitrifying Bioreactor.