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Blind Inlet

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1. Overview of a blind inlet

A *blind inlet* is an in-field conservation practice that replaces a surface inlet (Figure 1) or drains water from depressional areas on a field. The watershed area that contributes water from the surface into the depressional area can be as large as about 20 acres. The surface area of a blind inlet can be as large as 50 ft by 50 ft.

A blind inlet provides the water-quality benefits of reducing phosphorus and sediment loss. A blind inlet requires occasional maintenance for longevity. With proper installation and maintenance, blind inlets can reduce sediment and soil-attached phosphorus losses. Another benefit of a blind inlet is that it supports farm machinery traffic, so it does not interfere with field operations.

2. Water-quality benefit of blind inlets

A surface inlet (also known as an open inlet) can move sediment and soil-attached phosphorus with water from the surface into the drainage system and eventually into surface water bodies (Flores et al., 2021) (Figure 1). A blind inlet reduces the movement of sediment and particulate P loss into the drainage system by forcing water to pass through a filter material (usually coarse sand).

A blind inlet reduced sediment load by 79% and total phosphorus by 79% compared to a surface inlet in Indiana (Smith & Livingston, 2013). When blind inlets reduce sediment loss, they reduce the loss of the soil-attached phosphorus, thereby reducing the loss of total phosphorus.

Figure 1- Left: A surface inlet before being replaced by a blind inlet. Right: the finished blind inlet (photo credit: Justin L. McBride)

3. Where to use targeted subsurface drainage or a blind inlet

To decide whether you need targeted subsurface drainage (Figure 2) or a blind inlet for a wet spot in the field, determine the source of the excess water. If the source of the excess water is the naturally shallow water table, you need targeted subsurface drainage. If the source of the excess water is mainly surface runoff, a blind inlet is suitable to remove excess water from the soil surface.

In some cases, blind inlets can be added to the existing subsurface drainage system in a poorly drained soil for quicker water removal from the soil surface. When the source of excess water is surface runoff, surface drainage can also be used. With surface drainage, excess water on the soil surface moves by flowing over naturally or artificially sloped ground toward shallow ditches, grassed waterways, or blind inlets (Ghane, 2025).

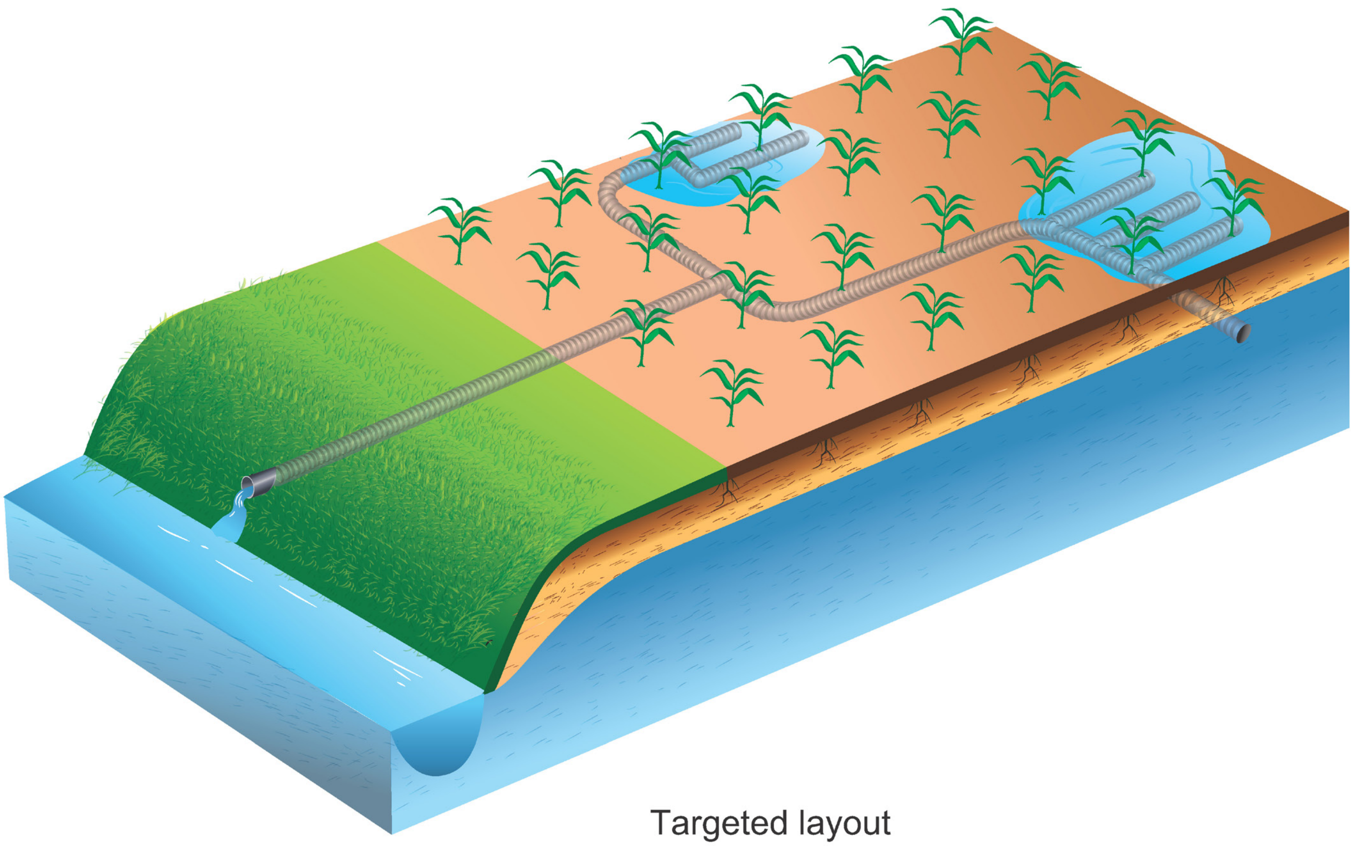

Figure 2- A diagram of a targeted drainage layout (Ghane, 2025).

4. Installation of blind inlets

A blind inlet should be designed to adequately remove excess water to prevent crop damage. The following are the general steps for installing a blind inlet:

a. Excavate a trench.

b. Fill the bottom two inches of the trench with coarse material (gravel, limestone, pea gravel). The purpose of the coarse material is to give structural support to the collection pipes, so they do not get damaged by farm machinery traffic.

c. Place the perforated collection pipes on top of the 2-inch-thick coarse material. Connect the outlet of the collection pipes to the lateral drain or main pipe of the drainage system. Another option is to carry water away with a solid pipe to the drainage ditch without connecting to an existing drainage system. See Figure 3 for an example of the pipe pattern.

d. Add the coarse material until the perforated pipes are completely covered.

e. In soils with good stability (for example, clay, silty clay, sandy clay), place a nonwoven geotextile fabric on top of the coarse material, and cover it with a minimum of 12 inches of sand to reach the ground surface. Soils with high clay and organic matter have good stability (soil particles stick together). Placing the geotextile fabric on top of the coarse material keeps the sand from moving down into the coarse material (Figure 4). Then, you can replace only the sand layer when it gets clogged instead of replacing the entire structure.

f. In soils with poor stability (for example, loamy sand, sandy loam), wrap a nonwoven geotextile fabric around the coarse material (that is, top, sides, and bottom) to keep sediment from the adjacent soil profile from moving into the blind inlet (Figure 3). Then, cover the geotextile fabric with a minimum of 12 inches of sand to reach the ground surface.

Contact your local NRCS engineer for detailed information about design and installation (USDA-NRCS, 2019).

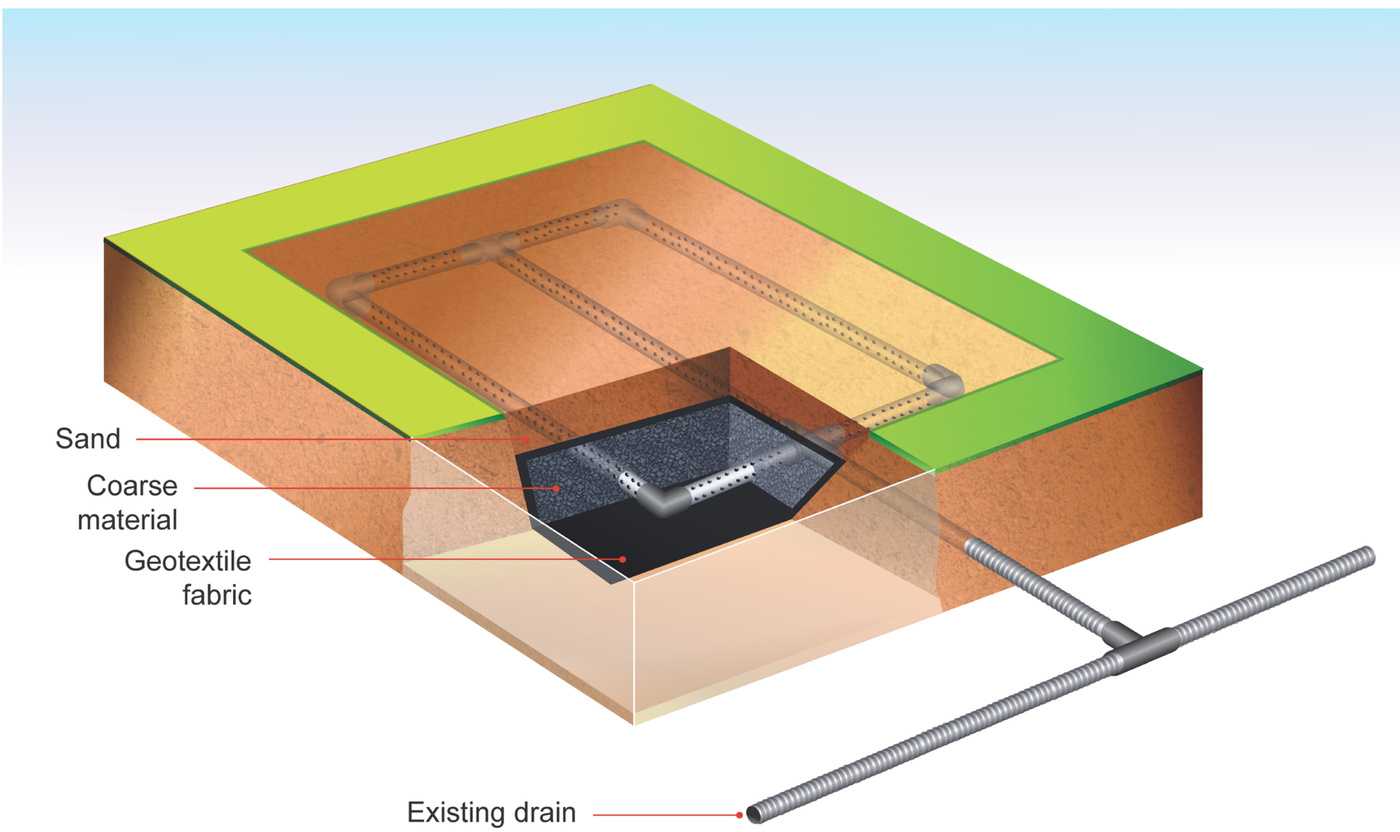

Figure 3- Diagram of a blind inlet where the nonwoven geotextile fabric is wrapped around the coarse material.

Figure 4- Top: Coarse gravel being poured over the perforated collection pipe. Bottom: Sand being poured over the nonwoven geotextile fabric (photo credit: Justin L. McBride).

5. Maintenance of blind inlets

When sediment and residue build up over the sand filter layer, remove them to allow proper entry of water from the surface into the blind inlet. Over time, the sand layer clogs with sediment. For longevity of the blind inlet, replace the sand layer down to the geotextile fabric once the sand layer is clogged (Ohio State University Extension, 2020).

6. Life expectancy of blind inlets

The life expectancy of blind inlets depends on the amount of sediment generated from farm practices, but it can have a useful service life of up to 10 years. Tillage and soil disturbance in the vicinity of this practice reduces its lifespan due to soil erosion, thereby clogging the sand filter layer. Reduced tillage, cover crops, manure or compost, and diverse rotations improve soil health, thereby reducing soil erosion. Therefore, increase the lifespan of blind inlets by improving soil health.

7. Alternative designs for blind inlets

7.1. Steel slag as the coarse material

If steel slag is used instead of limestone to backfill around the perforated pipes, blind inlets will remove dissolved phosphorus in addition to sediment and particulate phosphorus (Figure 5) (Penn et al., 2020). The cost of the steel slag should be comparable to gravel or limestone if locally sourced. The installation cost of a blind inlet with locally sourced steel slag was about $1,500 in northeastern Indiana, which is about the same cost if limestone had been used (Gonzalez et al., 2020).

The longevity of phosphorus removal in a blind inlet with steel slag is expected to be up to five years. After this period, replace the steel slag with new material. The exhausted slag can be used like gravel on dirt roads, filling potholes, and construction. If the steel slag is not replaced, the blind inlet will continue to remove sediment and particulate phosphorus until the sand filter layer is clogged. Another coarse material is steel shavings, which are cheap and effective in phosphorus removal.

7.2. Woodchips as the coarse material

A 3-to-1 mixture of pea gravel and woodchips can be used instead of limestone to backfill around the perforated pipes (Figure 5). In that case, the blind inlet removes nitrate in addition to sediment and particulate phosphorus. Woodchips provide enough flow capacity to drain the depressional area. Preliminary results show that about 90% of sediment and 36% to 60% of nitrate can be removed (personal communication, Christopher G. Wilson, 2020).

Figure 5- Top: Blind inlet backfilled with steel slag (photo credit: Chad J. Penn). Bottom: Blind inlet backfilled with woodchips. The slotted pipe of the surface inlet was replaced with a solid PVC pipe. (photo credit: Christopher G. Wilson).

8. Summary and recommendations

Blind inlets are an in-field conservation drainage practice meant for reducing surface ponding, sediment, and soil-attached phosphorus. Blind inlets require occasional maintenance for longevity. If steel slag or some other phosphorus sorption material is used as the coarse material, it also removes dissolved phosphorus. If woodchips are used as the coarse material, it also removes nitrate. If woodchips are the coarse material covered with a mix of sand and a phosphorus sorption material, it will remove both nitrate and dissolved phosphorus. Select the material based on your goal of reducing nitrogen or phosphorus.

Acknowledgment

The cover photo is credited to Justin L. McBride.

Expert Reviewed

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