# TECHNICAL NOTE

**HYDROLOGY TECHNICAL NOTE NO. 4** **April 23, 2014**

## TILE GUIDELINES FOR PROTECTING WETLAND HYDROLOGY

**Background**

To be eligible for certain USDA Program Benefits, wetland hydrology must not be impacted by new drainage systems or by improvements to pre-December 23, 1985, drainage systems. In order to maintain the wetland hydrology, any new or improved drainage systems must be located so that the inundation or saturation periods as specified by the applicable wetland hydrology criteria are not shortened.

Analytical techniques such as scope and effect equations can be used to evaluate the hydrologic impacts to wetlands. The National Food Security Act Manual (NFSAM) Part 516, and its Appendix, Food Security Act Wetland Identification Procedures (2010), were used in the creation of this document. These sources provide the documentation of the analytical techniques allowed for use in this document. The following techniques are outlined in the National Engineering Handbook Chapter 19, Hydrology Tools for Wetland Delineation Manual:

a. Use of Stream and Lake Gages
b. Runoff Volumes
c. Remote Sensing
d. DRAINMOD
e. Scope and Effect Equations
f. NRCS Drainage Guides
g. Observation Wells

In South Dakota, the scope and effect equation used to evaluate tile systems is the van Schilfgaarde equation by means of the DRAIN program. The DRAIN program is the result of the combined efforts of SD, North Dakota, Minnesota, and Iowa, to achieve consistency between the states in the evaluation of scope and effect on wetland hydrology due to lateral effects of subsurface drainage features. The van Schilfgaarde equation is used to compute tile lateral effect (Le) distances, which is the distance on each side of the tile line that is effectively drained. Lateral effect tables for typical tile sizes and depths with slope adjustments are available in the SD Technical Guide (SDTG) in Section I, Resource Evaluation Tools, 4.Engineering, a.South Dakota Lateral Effect Tables (Ditch & Tile) by County and b.South Dakota Lateral Effect Tables with Slope Adjustment. Slope adjustments for ground surface slope may be made to the lateral effect distance.

## Introduction

Procedures outlined in this technical note are only **guidelines** to ensure protection of wetland hydrology. Whenever possible and/or practical, excavation and tile in and/or near wetlands should be minimized. The final decision of how to maintain wetland hydrology from new and/or improved tiling systems must be done in consultation with any applicable federal laws and regulations, the NFSAM, professional judgment, and experience.

The following sections illustrate wetland protection for typical scenarios that are encountered when tiling near wetlands. The basic requirement for all these typical scenarios is that wetland hydrology must not be impacted by tiling. Lateral Effect (Le) distances should not exceed the boundary of the individual wetland watershed. Therefore, if the Le distance passes the watershed boundary, the tile setback can be set at the watershed boundary.

Please note that these are tile guidelines and are not intended to be used in conjunction with ditches. Though a lot of the guidance for ditches is similar, there are some significant differences. All ditching questions should be addressed to the hydrology specialist or engineer.

Selecting the soil for the Le tables:

- Select the soil adjacent to the wetland. **Do not use the soil in the wetland, but the predominant soil between the wetland and the tile.**
- Use the soil component in the landform position that is most likely to be adjacent to the wetland. Foot slopes are more likely to be adjacent to wetlands than a back slope or shoulder slope.
- If components are so closely intermingled that the position cannot be used, then select the component that gives the most conservative (largest) lateral effect distance.

**Exceptions to the "x1" Lateral Effect distance:**

*A. Discharge Wetlands*

Wetlands that receive a significant portion of their water from groundwater discharging into them are called "discharge" wetlands. In cases where the tile system would intercept the groundwater that would normally reach the wetland, the one lateral effect (Le) distance is multiplied by a factor of 3 (Le x3) to prevent a subsurface diversion. The distance is increased for any side of the wetland where groundwater flow is being intercepted. One way to document that the x3 lateral effect distance is applicable is to document that the wetland is predominantly a groundwater discharge wetland instead of a recharge wetland. A list of groundwater discharge hydric soils is shown in Table 1. Please note that there are other soils not listed in this table that periodically also may act as discharge wetlands. If the investigator questions whether a wetland receives groundwater discharge, a field test with hydrochloric acid can be used to assist with the decision. Consult with a soil scientist for guidance. Examples are shown on Figures 1 and 2.

**Note:** In most cases the discharge hydric soil will be the named wetland soil. This soil only determines if the x3 multiplier is used. The discharge hydric soil is not used to determine the Le setback distance chosen from the Lateral Effect Tables. Use the soil that occurs between the wetland and the proposed tile to choose the setback from the tables.

*B. Perched Water Table*

In some cases the wetland receives groundwater flow from a shallow perched water table from uphill slopes. A shallow impermeable layer (bedrock or a soil with a hydraulic conductivity that is less than the layer above by a factor of 10) causes the perched water table. Therefore, no perforated tile may be installed across the hillside slope, as it would significantly impact the hydrology of the wetland. The lateral effect distances calculated are not applicable for these cases. Examples are shown on Figures 3 and 4.

*C. Adjacent Discharge Soils*

In cases where the wetland receives groundwater flow from adjacent discharge hydric soils, the one lateral effect distance is multiplied by a factor of 3 (Le x3). Placing tile along the base of the slope, in this case, will intercept and divert the groundwater flow. Examples are shown on Figures 5 and 6.

## Table 1. Groundwater Discharge Hydric Soils (X3)

| | | | |
|---|---|---|---|
| Albaton, Depressional | Fedora | Lute | Playmoor |
| Arlo | Grano[1] | Manfred[1] | Rauville |
| Averson | Harps | Marlake | Regan |
| Badus | Hidewood | Marysland | Rosewood |
| Baltic | Holmquist | Mauvais | Salmo |
| Baltic, Flooded | James | McKenzie | Sedgeville |
| Calco | Lamo, Wet[1] | Minewauken | Southam |
| Canisteo | Lamoure[1] | Minnewasta | Trosky |
| Colvin | Lawet[1] | Obert | Vallers |
| Easby | Lowe | Ojata | Winger |
| Egas | Ludden | Oldham | |
| Elpam | Ludden, Ponded | Orwet | |

[1] Some phases of this series are not hydric.

**Options for Tiling Near Wetlands:**

*A. Tiling Around Depressional Wetlands*

1. Perforated tile may be routed around depressional wetlands instead of through the wetland. The perforated tile must be located beyond the lateral effect distance away from any wetlands. Examples are shown on Figures 7 and 8.

*B. Tiling Through Depressional Wetlands*

1. There are two options for installing tile through wetlands. The first option is to install nonperforated tile through the wetland and the applicable (x1 or x3) lateral effect distance from the wetland. Examples are shown in Figures 9 and 10.
2. The second option is to outlet the tile (nonperforated or perforated) to the wetland on the upstream side. Nonperforated tile may be used on the downstream side with the invert elevation set at the elevation of the existing wetland outlet (or natural overflow elevation if there is no constructed outlet). Perforated tile cannot be used within the applicable (x1 or x3) lateral effect distance on the downstream side. Examples are shown in Figures 11, 12 and 13.
3. If the tile system has surface inlets in the watershed of the wetland, the tile must outlet upstream of the wetland. Examples are shown on Figures 14 and 15.
4. Perforated tile may not be installed below the wetland bottom as illustrated by the example shown on Figure 16.

*C. Outlet Tile in Depressional Wetlands*

1. If the tile outlets into a depressional wetland, nonperforated tile is preferred within the wetland and the applicable (x1 or x3) lateral effect distance from the wetland. An example is shown on Figure 17.
2. The nonperforated tile outlet can be at any elevation below the existing wetland outlet. An example is shown on Figure 18.
3. A perforated tile outlet may be used within the wetland but must be at an elevation above the wetland bottom. It is not acceptable to place perforated tile below the wetland bottom within the wetland and the applicable (x1 or x3) lateral effect distance from the wetland. Perforated tile may only be used on the upstream side of the wetland within the applicable (x1 or x3) lateral effect distance when it outlets into the wetland. Examples are shown on Figures 19, 20 and 21.

D. *Outlet Tile to a Watercourse (perennial or intermittent, i.e.-streams, creeks, etc.)*

1. If the tile outlets through a wetland to a watercourse, nonperforated tile is required within the wetland and the applicable (x1 or x3) lateral effect distance from the wetland. Perforated tile may be used within the Le distance and through the floodplain if it outlets directly to the associated watercourse by the shortest route (perpendicular to the watercourse). Perforated or nonperforated tile may not bypass a watercourse. An example is shown on Figure 22.

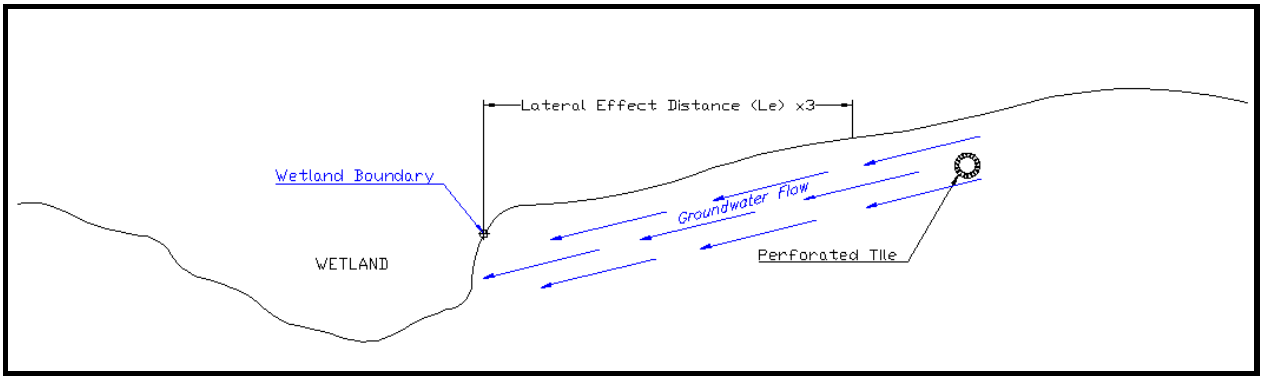


Figure 1 – The Le distance is multiplied by 3 (x3) for discharge wetlands.

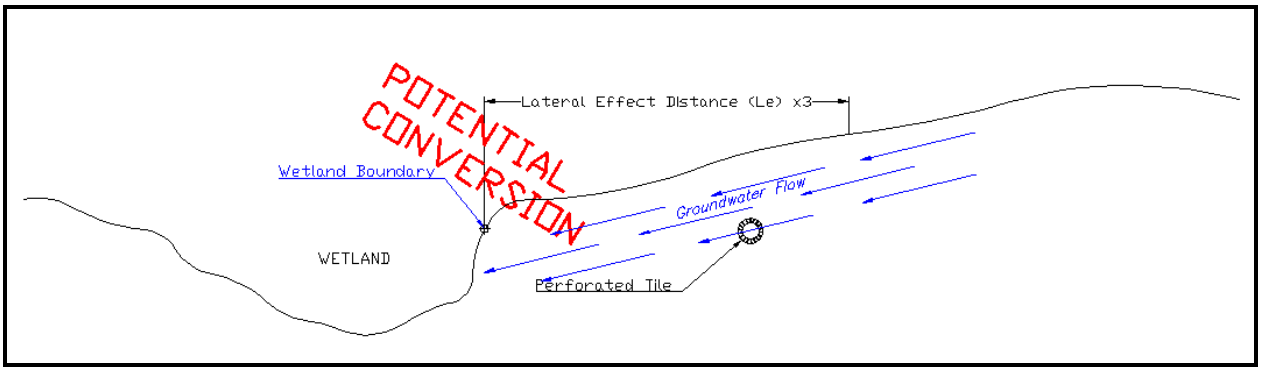


Figure 2 – Tile may not be placed within x3 Le for discharge wetlands.

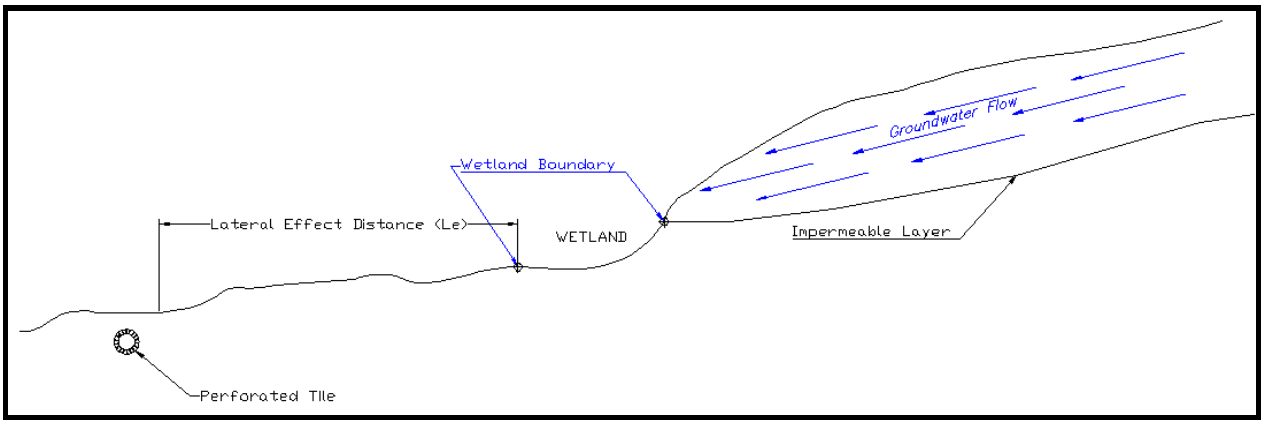


Figure 3 – Tile may only be placed downslope at the Le distance below perched water table wetlands.

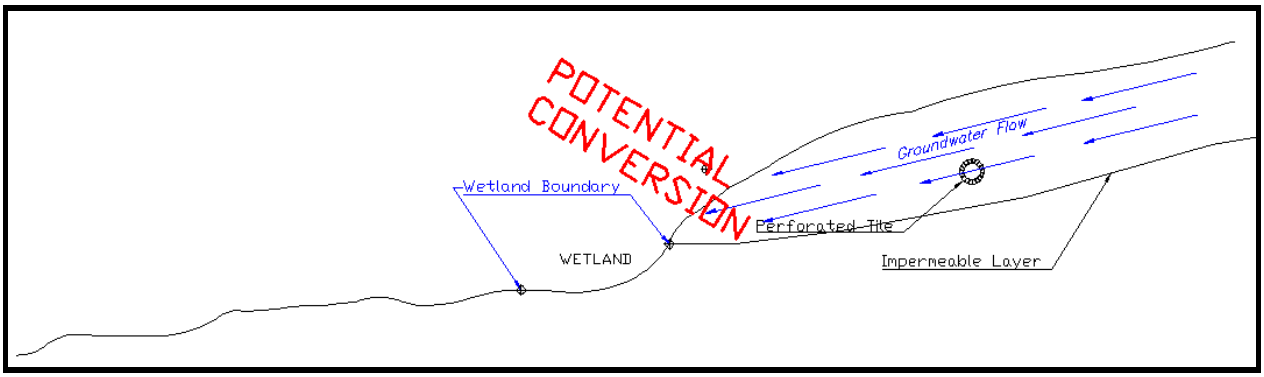


Figure 4 – Tile may not divert perched water table from the wetland.

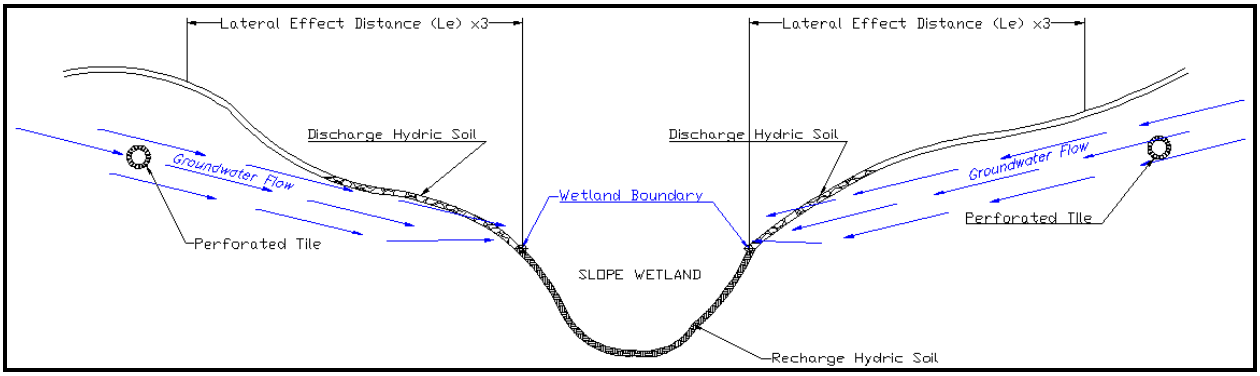


Figure 5 – The Le distance is multiplied by 3 (x3) to prevent diversion of groundwater.

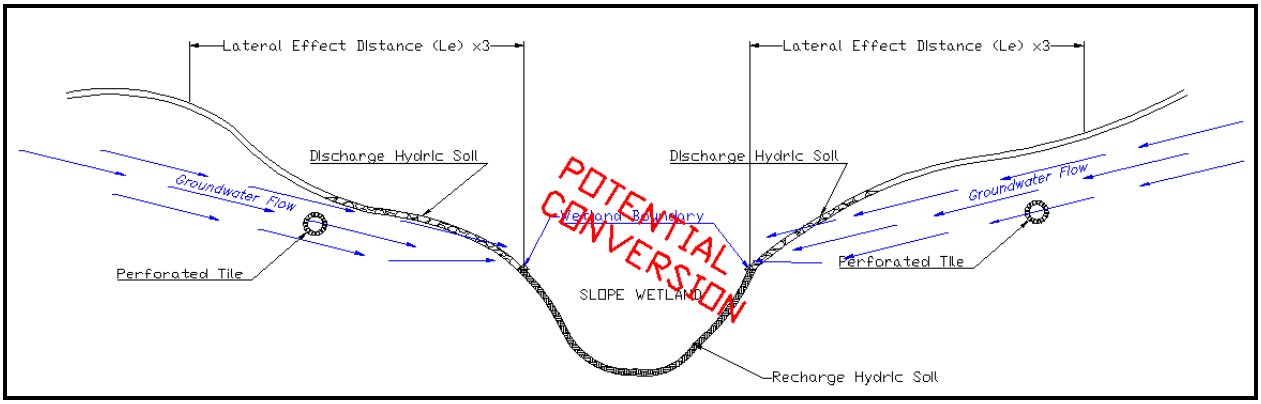


Figure 6 – Tile may not be installed within the tripled (x3) Le distance if there is a groundwater source.

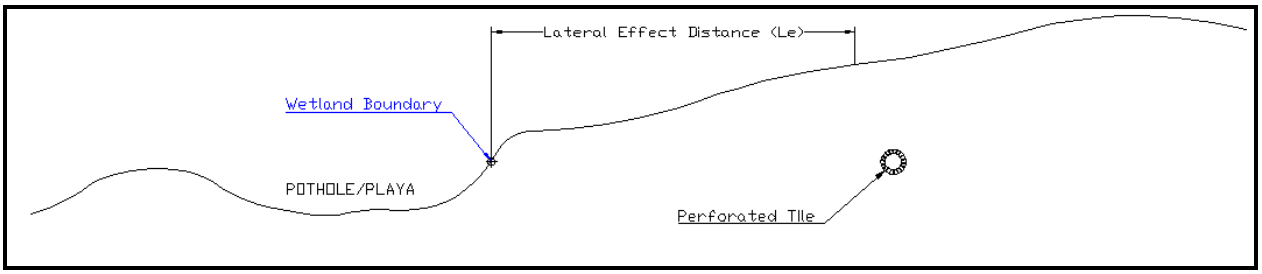


Figure 7 – Route tile around depressional wetlands at or beyond the Le distance.

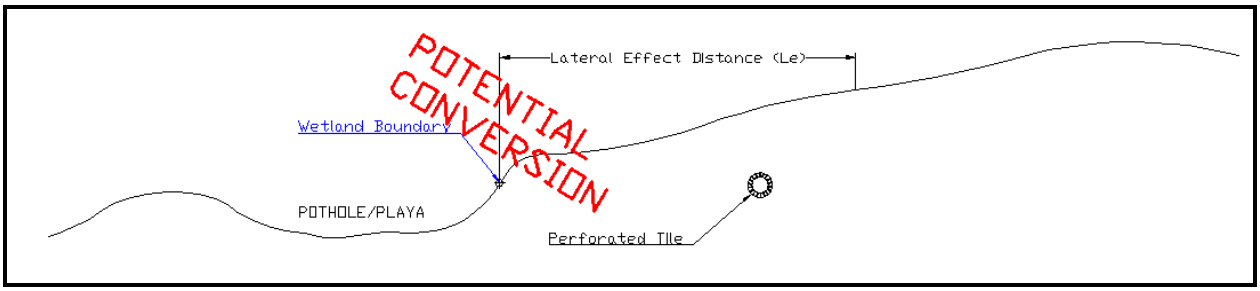


Figure 8 – Tile may not be routed inside the Le distance around depressional wetlands.

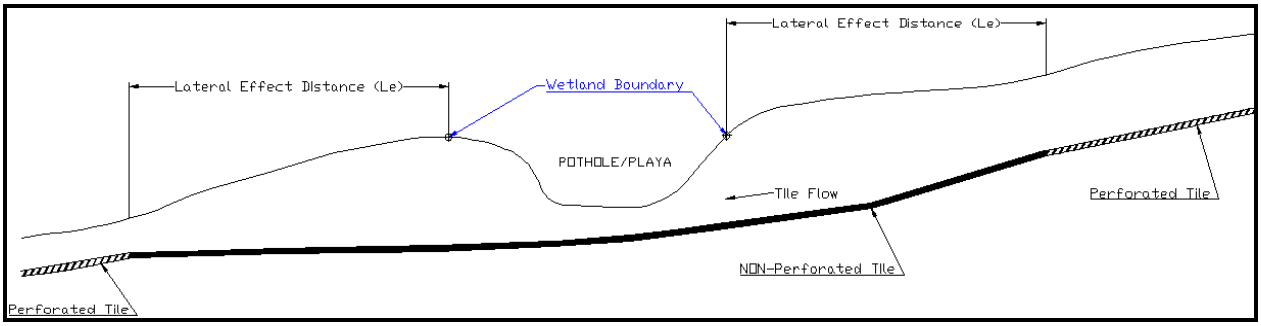


Figure 9 – Nonperforated tile through a wetland and to the Le distance.

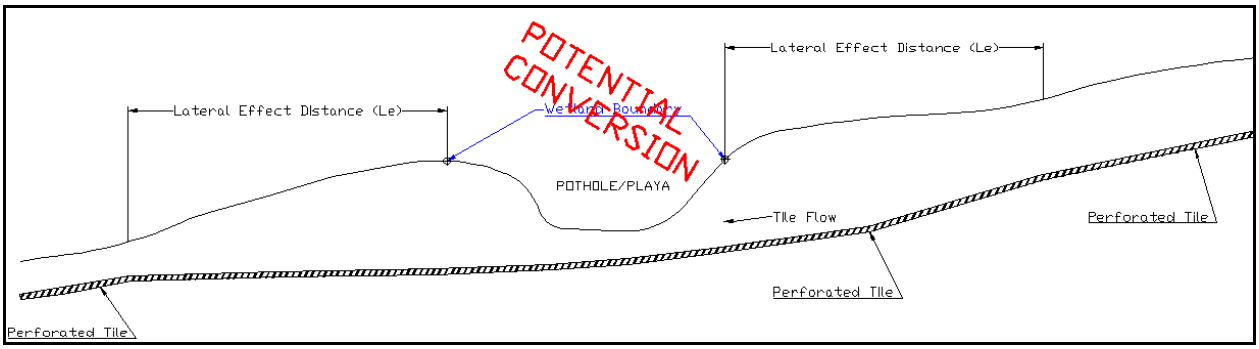


Figure 10 – May not install perforated tile through or underneath a wetland and within the Le distance.

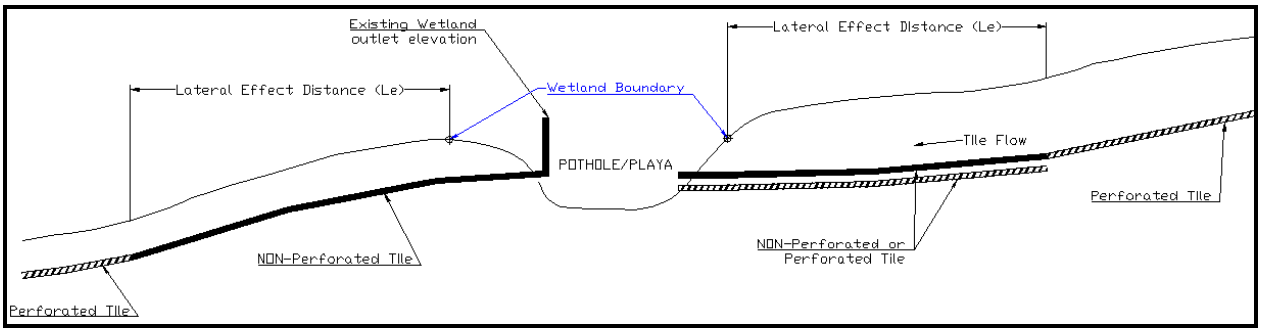


Figure 11 – Outlet the tile into the wetland. Install riser at or above the natural overflow elevation.

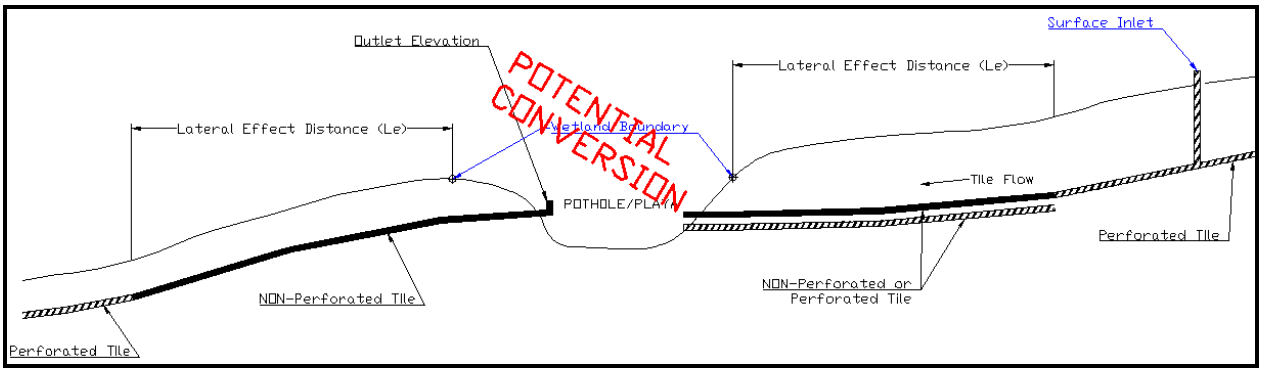


Figure 12 – May not install riser below the natural overflow elevation.

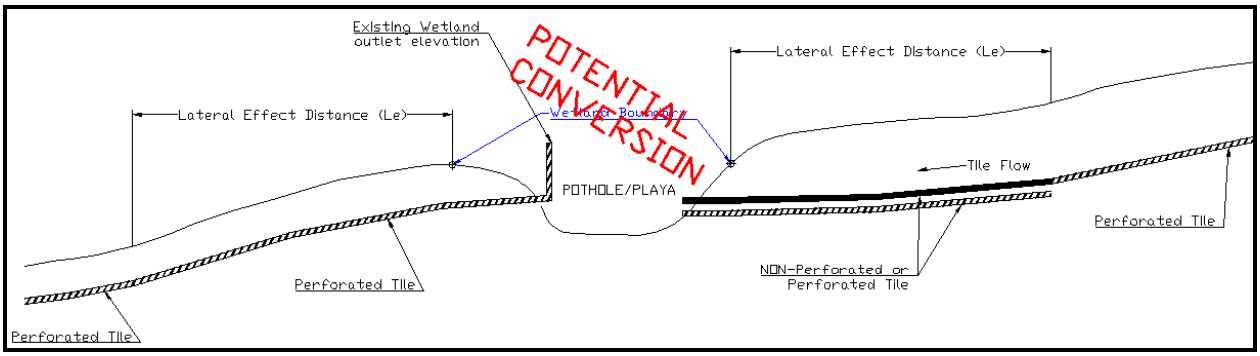


Figure 13 – May not install perforated tile and/or riser on downslope side of wetland within the Le distance.

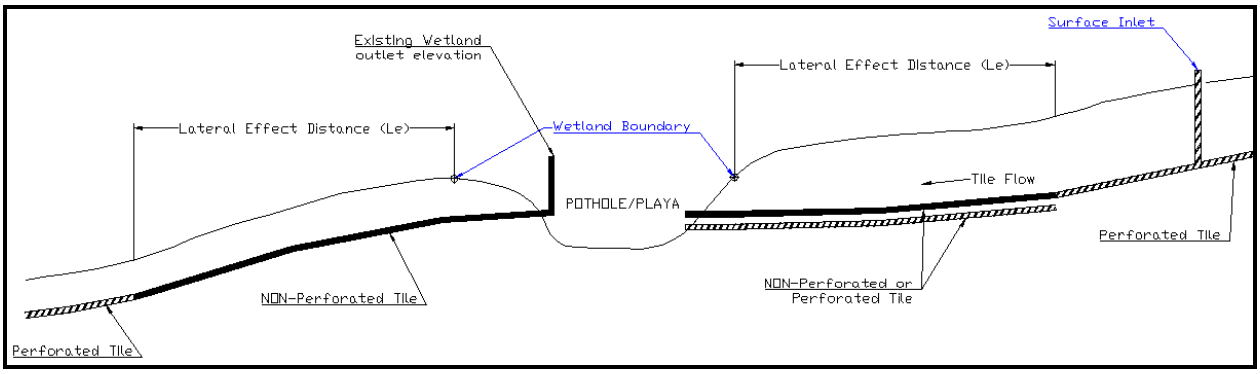


Figure 14 – Upstream surface inlets must outlet into wetland.

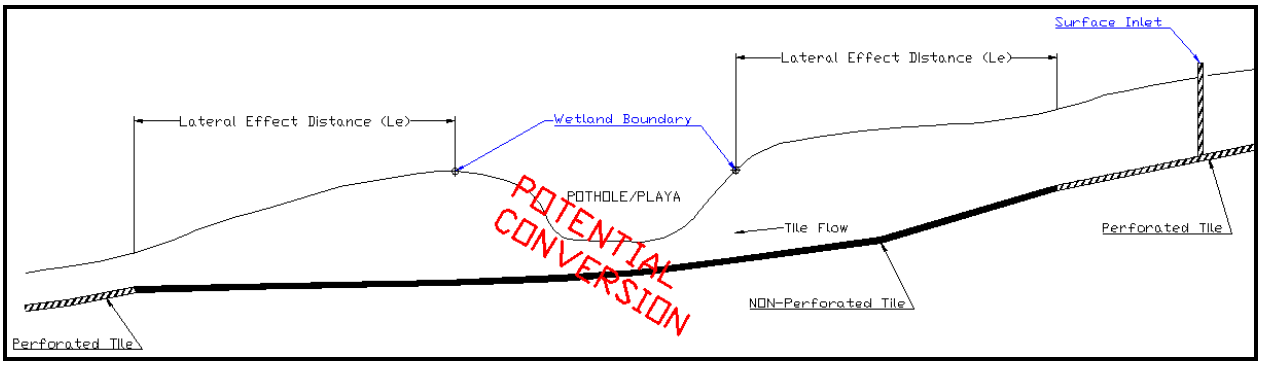


Figure 15 – Upstream surface inlets cannot be routed past the downstream wetland.

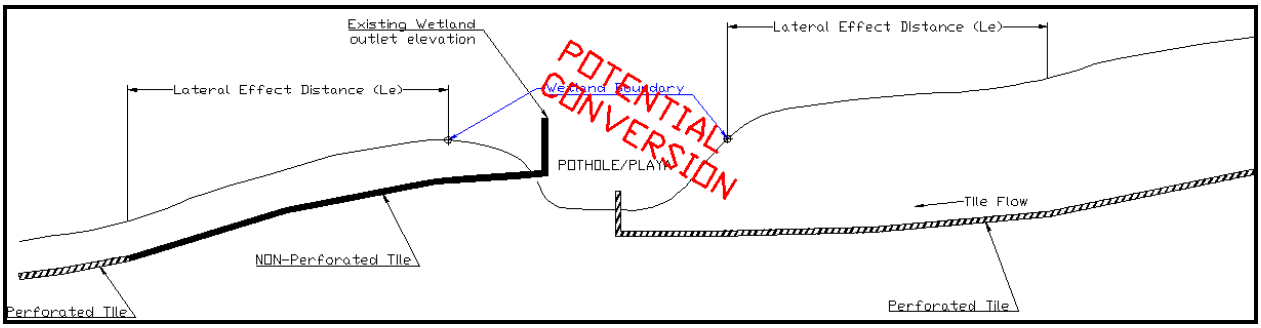


Figure 16 – Perforated tile may not be installed below the wetland bottom elevation.

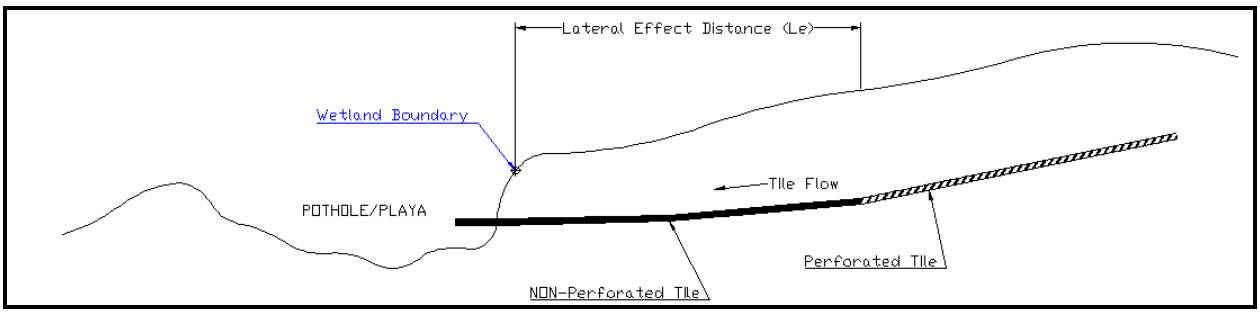


Figure 17 – Nonperforated tile may outlet into a depressional wetland at any elevation.

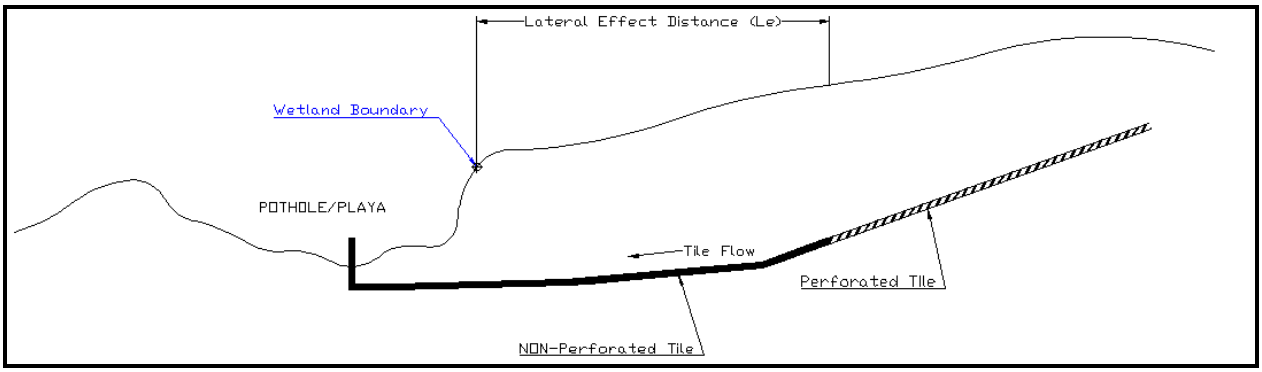


Figure 18 – Nonperforated tile may outlet into a depressional wetland at any elevation below the existing outlet.

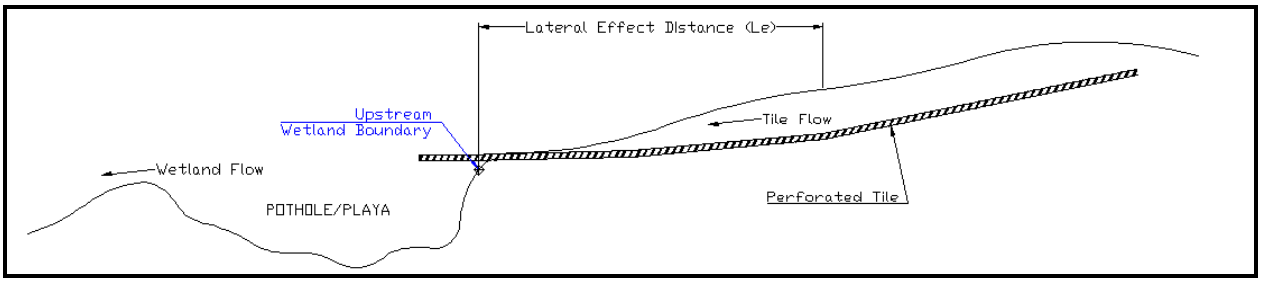


Figure 19 – Perforated tile may outlet into a depressional wetland above the natural wetland boundary.

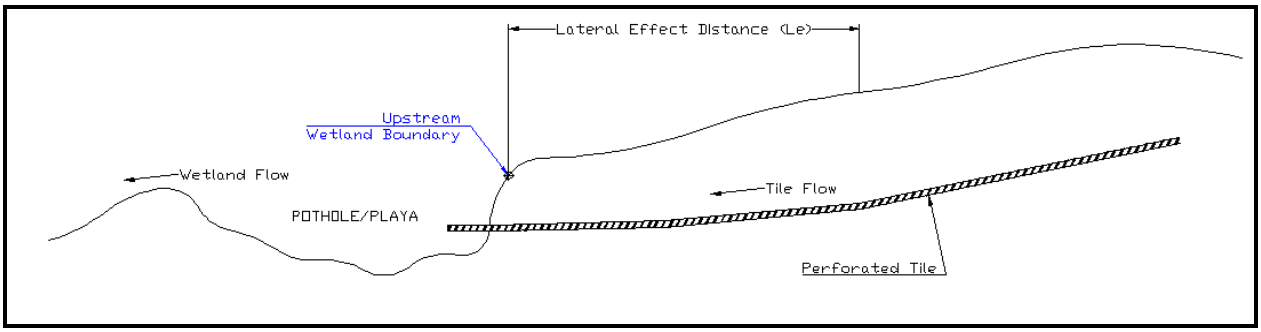


Figure 20 – Perforated tile may outlet into a depressional wetland above the bottom.

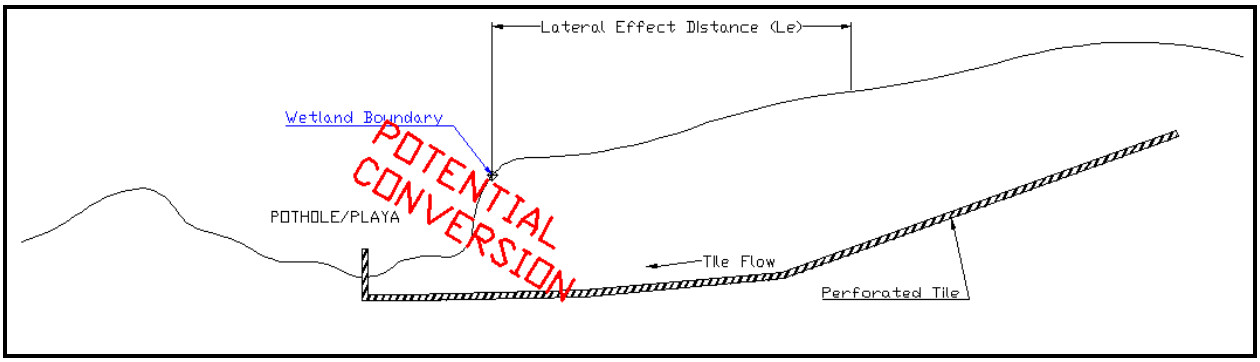


Figure 21 – Perforated tile may not outlet into a depressional wetland below the bottom.

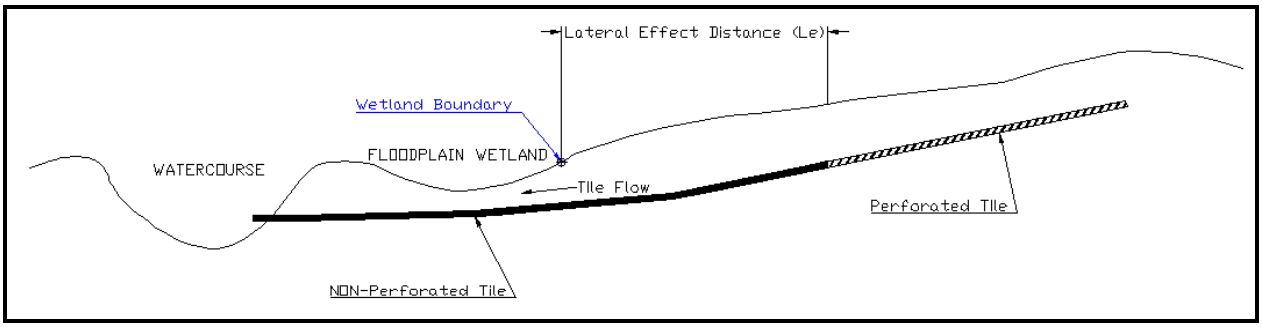


Figure 22 – Perforated tile may be used within the Le distance and through the floodplain if it outlets directly to the associated watercourse by the shortest route (perpendicular to the watercourse). Perforated or nonperforated tile may not bypass a watercourse.