Appendix H Criteria for locating infiltration systems near bridge foundations, structural walls, and reinforced soil slopes

Infiltration systems, including infiltration basins or other Best Management Practices (BMPs), should be situated on projects where these features perform their intended purpose without adverse impact to other constructed works. While there may be sites where it is desirable to place infiltration features close to structures due to project constraints, some of these locations are not reasonable or prudent given their proximity to and interaction with the foundations and structural systems of bridges, walls, and slopes.

Placement of infiltration systems too close to structures may result in unanticipated performance issues through a number of mechanisms. As an example, additional water could be introduced into the backfill soils due to the relatively high permeability of these materials. This additional water could result in additional pressure behind walls and bridge substructures or may result in weeps, seeps, and flows that are structurally problematic or aesthetically undesirable. This type of interaction also compromises the performance of the infiltration system, as the water may not percolate into native soils and recharge ground moisture, but instead would be captured by structural drainage systems and routed through weep holes and on to sidewalks and roadways or possibly routed directly into storm sewer systems.

Saturation of the structural backfill adjacent to or below bridge foundations and structural walls and reinforced soil slopes (RSS) is to be avoided. The unintended accumulation of hydrostatic pressure may result in distress, damage, or failure of structures; often excess water creates performance and maintenance problems. While drain tiles or weep holes are used to collect and remove groundwater, increasing the flow beyond that which is normally anticipated is to be avoided- unless case specific mitigation strategies are incorporated into the design and properly constructed to address these considerations.

If infiltration systems are placed too close to the front of reinforced slope or reinforced wall systems, similar impacts could also be seen, principally with respect to ‘shortcutting’ the drainage through the free-draining soils below and adjacent to these structures. In some instances, adverse effects can also result from ponds being constructed too close to footing elements resulting in insufficient ground cover for frost protection or allowing for ‘soft ground’ conditions at the toe of the wall or bridge substructure.

Recommended placement and design criteria for infiltration systems adjacent to structures:

- Infiltrate only into native soils or engineered materials designed to facilitate infiltration.
- Do not infiltrate into structural backfill or foundation bearing soils associated with bridge abutments, pier foundations, reinforced soil slopes (RSS), or structural elements including the reinforced zone behind MSE walls or the structural backfill behind cantilever walls.
- Do not increase subsurface flows toward structures. Avoid flows to the structure drainage system.
- Do not increase hydrostatic pressure behind a wall, RSS, or foundation.
- Do not install infiltration systems adjacent to a wall, RSS, or foundation. Minimum distances of separation are provided in the figures below.

Two diagrams (plan and profile) are provided on the following pages, showing the minimum lateral offsets between infiltration systems and structures for typical sections of walls and reinforced slopes; these offsets have been established to reduce the likelihood of poor structural performance. Note that the exclusion zones apply to bridge abutments and piers (even in level fill cases); each side of a pier element is considered a 'front face.' The offsets also apply to structures supported on deep foundation systems.

It is recognized that each project site is different and generalizations may not be appropriate for every situation. The elevation of the water table, types of soil and rock, material properties (including hydraulic conductivity), direction of ground water flow, geometry and stratigraphy of the site, and location of the structure with respect to the infiltration systems will impact the risks associated with use and placement of infiltration systems near structures and structural backfill.

Situations where there is a limited volume of water being infiltrated or where there is an adequate vertical and/or horizontal distance between the structure and the infiltration area usually present relatively low risk to a structure's performance.

Higher risk conditions may exist, such as where:

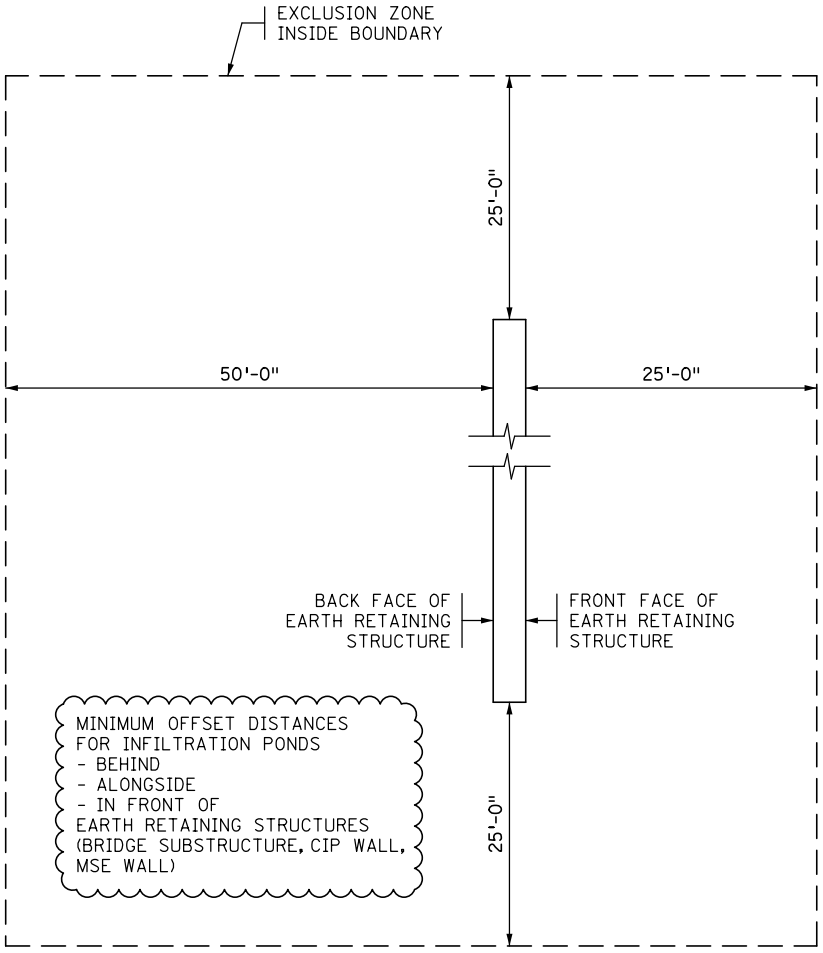
1) Significant volumes of surface water or groundwater will be collected and transported near foundations where water is likely to enter foundation and backfill soils rather than native soils.

2) Large or deep infiltration systems are constructed in close proximity to structures that support critical infrastructure or have tight design tolerances.

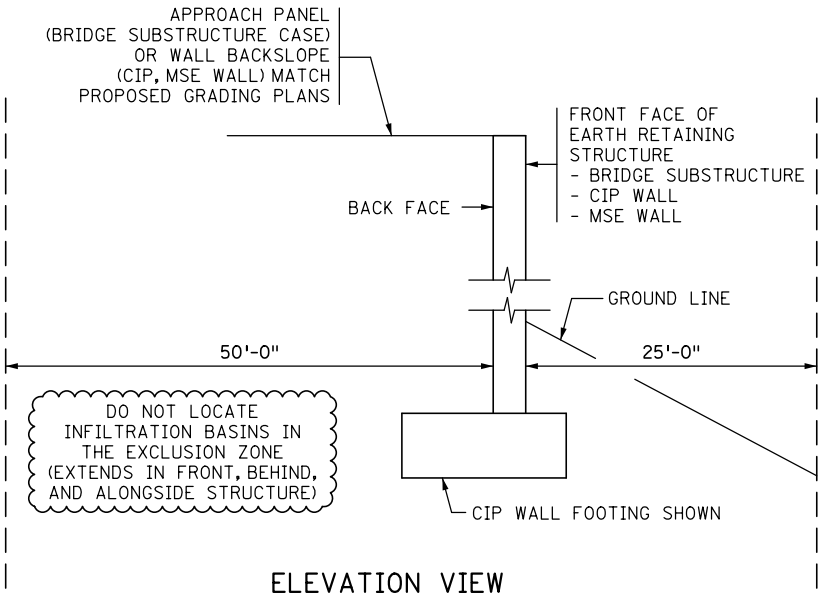
3) Infiltration systems are located near structures where water transport may contribute to deleterious effects [i.e. salts from pavement runoff or other deleterious leachate transported through metallic reinforcement areas].

4) Sites where it is uncertain if infiltrated water will affect the local groundwater in a way that will impact a structure adversely (due to changes in pressure, effective stress, or impact on processes such as clogging or frost heave).

The Geotechnical Section should be consulted for a case-specific review if these or other similar conditions exist. A specialty design for the adjacent infiltration feature, the structure, or both systems may be necessary. Specialty designs may consist of additional drainage features, cutoff walls, changes in material property requirements, or similar design element modifications to ensure proper performance of all project design components.

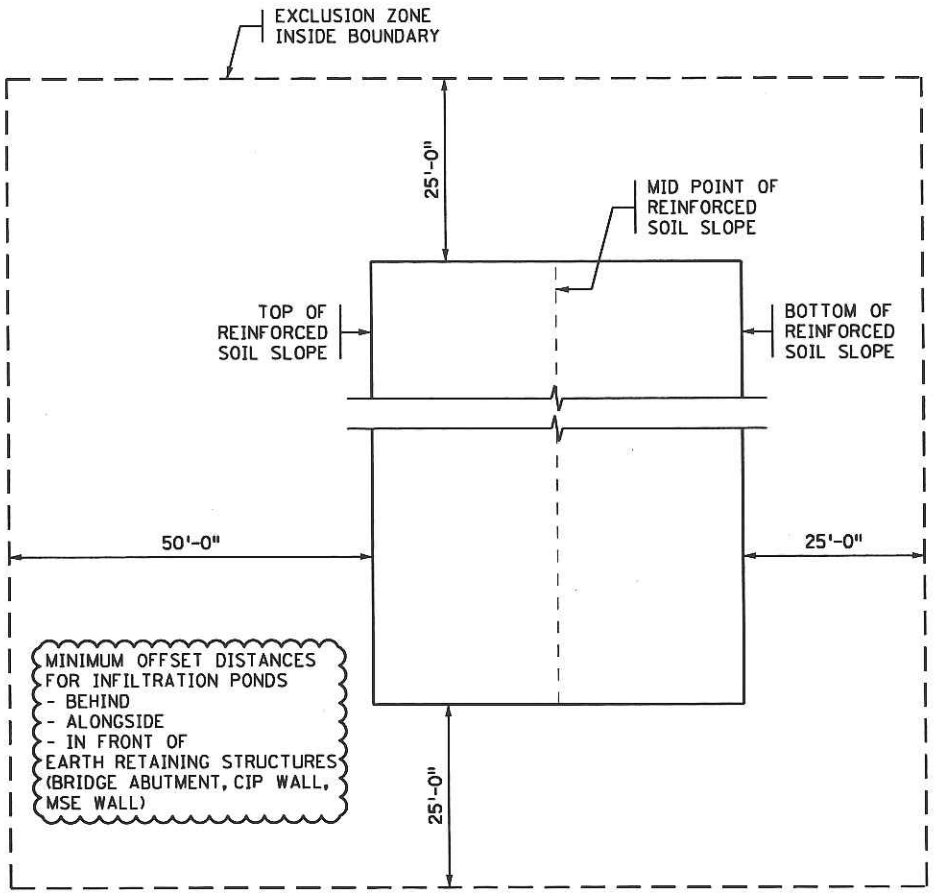


PLAN VIEW



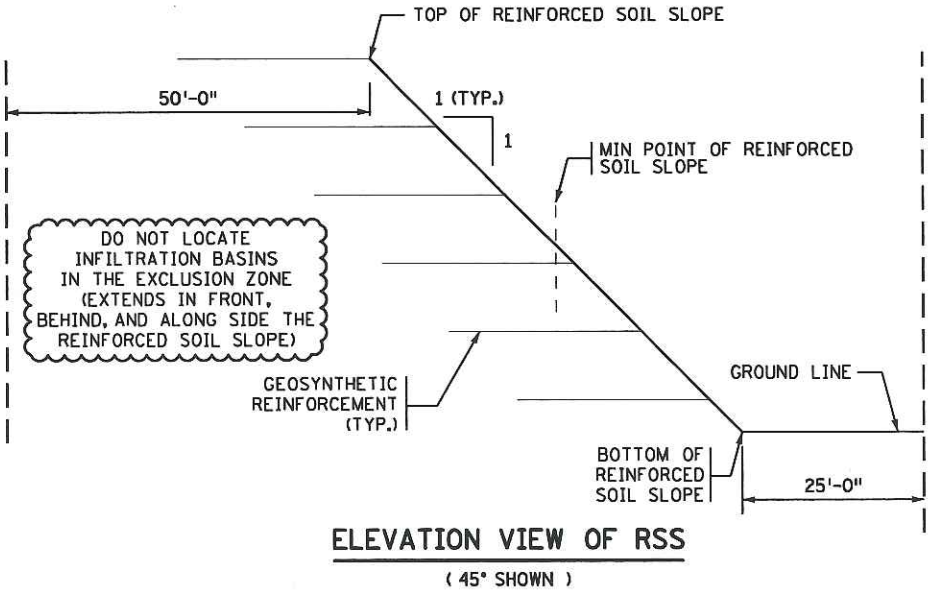
ELEVATION VIEW

FIGURE 1: EXCLUSION ZONE NEAR EARTH RETAINING STRUCTURES



PLAN VIEW OF RSS

(RSS MAY BE CONSTRUCTED AT ANGLES OTHER THAN 45°)



ELEVATION VIEW OF RSS

(45° SHOWN)

FIGURE 2: EXCLUSION ZONE NEAR REINFORCED SOIL SLOPES (RSS)