R5 response to peer review comments on draft Winter Spreading Technical Guidance

characteristics, whether or not the soil is frozen, and the soil moisture content (United States Army Corps of Engineers 1998). Step 6 in the *Technical Guidance* accounts for all three of these variables in addition to surface storage[2].

Region 5 agrees that soils in the Region are likely to be saturated during the winter and early spring. Moisture will likely exist as a result of fall or winter rains or from snow that melts due to the transfer of heat from soil to the snow pack. While snowmelt due to heat transfer is small on a daily basis, it may equal several inches of water over the winter, an amount that is sufficient to keep the soil saturated (Linsley, *et al.*, 1982). In accordance with the comment, we have written Step 3 to provide for the establishment of a design condition for the moisture content of soil, and to recommend antecedent moisture condition III as the condition.

Region 5 partially disagrees and partially agrees with the comment that spreading manure on frozen ground is not a problem. The United States Army Corps of Engineers (1998) reports that frozen soil inhibits infiltration and produces runoff peak flows and volumes that are greater than unfrozen soil. Gray and Prouse (1992) state that the infiltrability of frozen soil is the single most important factor affecting the apportionment of water between direct runoff and soil waters in most northern regions. Dunne and Black (1971), and Dunne, *et al.*, (1976) reported that the infiltration capacity of soils with concrete frost can be lowered to 0.02 centimeters or less per hour. Thompson, *et al.*, (1979) stated that as little as one inch of concrete frost prevents infiltration. Concrete frost can form in very cold regions with little snow or vegetative cover. Mitchell, *et al.*, (1997) proposed that, for frozen soil, the potential maximum retention after runoff begins, S, is one-tenth of the potential for unfrozen soil.

We disagree to the extent that soil is frozen and there is no snow cover at the moment in time when a CAFO owner or operator applies liquid manure or process wastewater on the surface of the land. To prevent discharges that are not precipitation-related, the *Technical Guidance*

---

[2] The following explains how *Technical Guidance* Equation 5 accounts for surface storage. In the United States Department of Agriculture, Natural Resources Conservation Service, rainfall-runoff relation (1993), the initial abstraction, I_a, equals two-tenths of the potential maximum retention after runoff begins, S. As provided on page 10.5 of the USDA, NRCS, (1993), the initial abstraction consists mainly of interception, infiltration, *and surface storage*. By substitution, USDA, NRCS, included the relation, $I_a = 0.2S$, in the development of the equation that is *Technical Guidance* Equation 5.

characteristics, whether or not the soil is frozen, and the soil moisture content (United States Army Corps of Engineers 1998). Step 6 in the *Technical Guidance* accounts for all three of these variables in addition to surface storage[2].

Region 5 agrees that soils in the Region are likely to be saturated during the winter and early spring. Moisture will likely exist as a result of fall or winter rains or from snow that melts due to the transfer of heat from soil to the snow pack. While snowmelt due to heat transfer is small on a daily basis, it may equal several inches of water over the winter, an amount that is sufficient to keep the soil saturated (Linsley, *et al.*, 1982). In accordance with the comment, we have written Step 3 to provide for the establishment of a design condition for the moisture content of soil, and to recommend antecedent moisture condition III as the condition.

Region 5 partially disagrees and partially agrees with the comment that spreading manure on frozen ground is not a problem. The United States Army Corps of Engineers (1998) reports that frozen soil inhibits infiltration and produces runoff peak flows and volumes that are greater than unfrozen soil. Gray and Prouse (1992) state that the infiltrability of frozen soil is the single most important factor affecting the apportionment of water between direct runoff and soil waters in most northern regions. Dunne and Black (1971), and Dunne, *et al.*, (1976) reported that the infiltration capacity of soils with concrete frost can be lowered to 0.02 centimeters or less per hour. Thompson, *et al.*, (1979) stated that as little as one inch of concrete frost prevents infiltration. Concrete frost can form in very cold regions with little snow or vegetative cover. Mitchell, *et al.*, (1997) proposed that, for frozen soil, the potential maximum retention after runoff begins, S, is one-tenth of the potential for unfrozen soil.

We disagree to the extent that soil is frozen and there is no snow cover at the moment in time when a CAFO owner or operator applies liquid manure or process wastewater on the surface of the land. To prevent discharges that are not precipitation-related, the *Technical Guidance*

---

[2] The following explains how *Technical Guidance* Equation 5 accounts for surface storage. In the United States Department of Agriculture, Natural Resources Conservation Service, rainfall-runoff relation (1993), the initial abstraction, I_a, equals two-tenths of the potential maximum retention after runoff begins, S. As provided on page 10.5 of the USDA, NRCS, (1993), the initial abstraction consists mainly of interception, infiltration, *and surface storage*. By substitution, USDA, NRCS, included the relation, $I_a = 0.2S$, in the development of the equation that is *Technical Guidance* Equation 5.