Appendix L - Soils and Soil Salinity

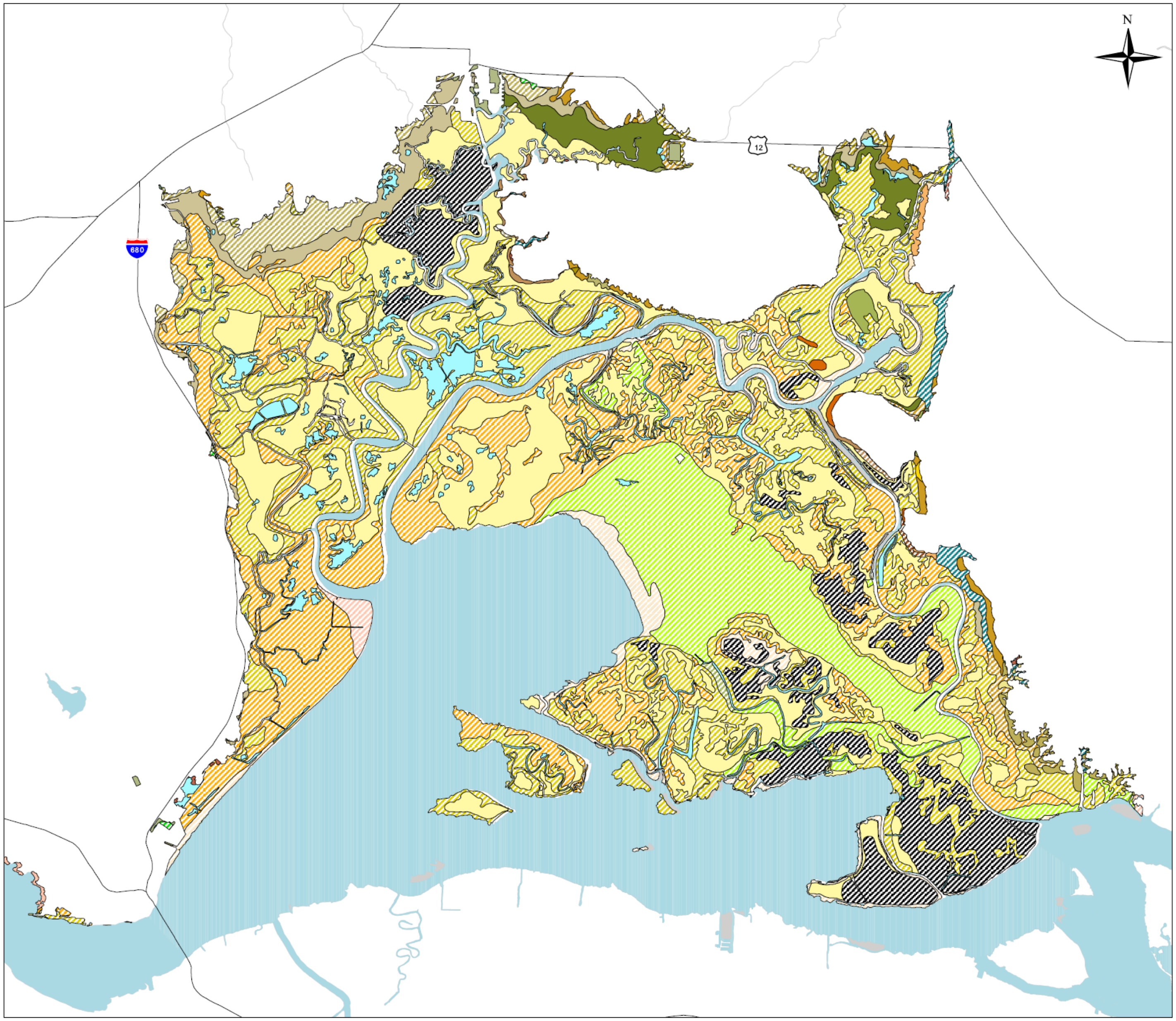
Suisun Marsh soils that were historically inundated by the brackish tides are saline soils (DWR 2001). Soil is always moist in tidal wetlands and the presence of water in the soil combined with the flushing action of tides keeps the salt concentrations at fairly constant levels (DWR 2001). Large areas of managed wetlands in the Marsh have soils isolated from daily tidal inundation resulting in more saline soils (DPW 1931). Dry conditions in the summer cause the salinity of the soil water to increase as water is lost through evaporation and saline water is drawn up from lower areas of the soil profile (DWR 2001). Soil deeper than one foot has a high salt content and acts like a salt bank because capillary action and hydrostatic pressure brings highly saline water to the surface of the soil to replace evaporative water loss (USDA 1975). As a result, to maintain a favorable salt concentration in the soil seasonally flooded ponds must be leached out annually.

Rollins (1973) investigated the effects of applied water salinity on soil water salinity. Rollins' concluded that there was a significant relationship between applied water salinity and the soil water salinity. He also found that leaching with low salinity water reduced soil water salinity. Increases in soil salinity at most monitored sites (monitoring program 1984 to 1995) can be contributed to low Delta outflow, diversion restrictions, and below normal precipitation during the drought years of the monitoring period (DWR 2001). A time lag is apparent between applied water salinity and soil water salinity. Based on the monitoring program data, a direct relationship may be present between the applied water in the fall (October-November) and soil water salinity for the entire year (DWR 2001). In permanently flooded ponds, water must be circulated to remove high salinity water left by evaporation to keep the ponds from acting as salt collection ponds (USDA 1975). A 30-day leach cycle can measurably decrease soil water salinity immediately afterwards although about half of the leached sites had soil water salinities equal to or greater than the salinity before the leach cycle (DWR 2001). It is almost impossible to reduce the salt concentration in soils below levels where water is available for leaching and flushing the ponds (USDA 1975). High concentrations of soil water salinity can lead to salt-scalded bare ground that is toxic to plants (DWR 2001).

DWR (2001) studied the influence of pond water level on soil water salinity. Their analysis found an immediate decrease in soil water salinity as ponds were flooded in the fall when water was initially applied to dry soil. The draining of ponds after the water management season resulted in a decrease of soil water salinity as the water level dropped with an increase in soil water salinity after drainage was complete. Pond and soil water salinity appeared to be independent of flood duration (DWR 2001). DWR's (2001) analysis of spatial trends in soil water salinity found that water management (timing and duration of water application, circulation, and leaching) might play a greater role in determining soil water salinity than the Marsh-wide salinity gradient. For example, western Marsh sites with poor water management generally had the highest soil water salinity of all monitored sites. However, western Marsh sites with preferred water management had lower soil water salinity than some eastern Marsh sites, regardless of the overall salinity gradient.

DWR (2001) data also suggests that soil water salinity is affected by location relative to water control structures such as intakes and circulation ditches. Sites near these structures tended to have lower soil water salinity than more distant sites. If a pond has intakes from different sources, the salinity may vary across the pond relative to the proximity to the different water intakes or if the pond has a freshwater influence from local runoff (DWR 2001).

Proper water control allows managers to perform important leach cycles that help prevent soil salt accumulation. Soil salinity dictates the type of vegetation that may occur within a managed wetland (Burns 2003). [Water] salinity is the primary factor encouraging the growth and seed production of marsh plants (Rollins 1973 and 1981, Michny 1979, Casazza 1995). The ability to move water on and off a property efficiently should help decrease soil salinity and thereby potentially cause an increase in plant diversity (Barthman-Thompson 2005).



Suisun Marsh Soils

- Altamont clay, 2 to 9 % slopes
- Altamont clay, 9 to 30 % slopes
- Altamont-San Ysidro-San Benito complex, 2 to 9 % slopes
- Altamont-Diablo clays, 2 to 9 % slopes
- Alviso silty clay loam
- Antioch-San Ysidro complex, 0 to 2 % slopes
- Antioch-San Ysidro complex, 2 to 9 % slopes
- Antioch-San Ysidro complex, thick surface, 0 to 2 % slopes
- Antioch-San Ysidro complex, thick surface, 2 to 9 % slopes
- Borrow pit
- Capay silty clay loam
- Clear Lake clay, 0 to 2 % slopes
- Clear Lake clay, 2 to 5 % slopes
- Clear Lake clay, saline, 0 to 2 % slopes
- Conejo gravelly loam
- Diablo-Ayar clays, 2 to 9 % slopes
- Diablo-Ayar clays, 9 to 30 % slopes, eroded
- Dibble-Los Osos loams, 2 to 9 % slopes
- Dibble-Los Osos clay loams, 2 to 9 % slopes
- Dibble-Los Osos clay loams, 9 to 30 % slopes
- Dibble-Los Osos clay loams, 30 to 50 % slopes, eroded
- Hambright loam, 15 to 40 % slopes
- Joice muck
- Joice muck, clay subsoil variant
- Made land
- Millsap sandy loam, 0 to 2 % slopes
- Millsap-Los Osos complex, 2 to 9 % slopes
- Millsholm loam, 15 to 30 % slopes
- Millsholm loam, moderately deep variant, 2 to 9 % slopes
- Millsholm loam, moderately deep variant, 9 to 30 % slopes
- Pescadero clay loam
- Reyes silty clay
- Rincon clay loam, 0 to 2 % slopes
- Rincon clay loam, 2 to 9 % slopes
- San Ysidro sandy loam, 2 to 5 % slopes
- Solano loam
- Solano loam, dark surface variant
- Suisun peaty muck
- Sycamore silty clay loam
- Sycamore silty clay loam, drained
- Sycamore silty clay loam, saline
- Tamba mucky clay
- Tidal marsh
- Valdez silty loam drained
- Valdez silty clay loam
- Valdez silty clay loam, wet
- Valdez silty clay loam, clay substratum
- Water
- Yolo loam, clay substratum

Source: USDA Soil Survey Geographic (SSURGO) database

San Francisco Bay-Delta Science Consortium

1 0 1 2 Kilometers