2009-10 Soil Water Conditions

The Water Agreement established procedures to determine which LADWP pumping wells can be operated based on soil water and vegetation measurements. Staff from ICWD regularly monitors depth to groundwater and soil water content at 25 sites in wellfields and eight sites in control areas. Three wellfield sites are not used to determine the operational status of nearby pumping wells but are monitored to continue the data record. Seven sites were in On-status through the 2009-10 runoff year. Three additional sites went into On–status (LW3, SS1, and SS3) during the winter. No sites went into Off status. The soil water, vegetation water requirement, water table depth, and On/Off status are presented in Figures 1-29.

The purpose for the On/Off procedures is to manage pumping to protect plant communities that require periodic access to the water table for long-term survival. Generally, the sites with On-status have wet soil and shallow water tables, and sites in Off-status have dry soil and deep water tables. The On/Off procedures rely on assumptions for some parameters (e.g. available soil water limited to a root zone depth of 2 or 4 m) and are based on an incomplete accounting of the soil water balance. Sometimes On-status sites are those with a deep water table and low plant cover. Conversely, a site with adequate water table depth may be in Off-status if the water table occurs just below the root zone and/or plant cover is high.

A more fundamental question than the calculation of the On/Off status at a monitoring site is whether groundwater is accessible to plant roots. Water is drawn into the soil above the water table by capillarity where it is held in soil pores or adsorbed to soil particles. Fluctuations in the water table affect the water content in the overlying soil: falling water levels cause some soil pores to drain, a rising water table brings shallower soil within reach of capillarity. Also, plant water uptake during the summer creates a gradient in soil water profile. When transpiration decreases in the fall, water will flow into drier soil in the root zone from the moist soil above the water table (if present). Repeated soil water and water table measurements can be examined to determine the depth where soil water content is coupled to groundwater. The relationship is most apparent during winter when plant uptake is minimal and water tables in the Owens Valley usually rise. Infiltration from rain and melting snow also affects soil water, but it is generally limited to depths shallower than 1 m. At most monitoring sites, it is possible to discriminate deeper soil affected by water table fluctuations from soil near the surface affected by infiltration even when precipitation is above average as in 2009-10.

How well plant roots can access groundwater also depends on the vegetation type. In similar soils, a shallower water table is necessary to supply groundwater to grasses than shrubs because of the shallower roots of the grasses. For management purposes, shrub-dominated sites are assigned a root zone of 4 m (13.1 ft.); grass-dominated or mixed grass and shrub assemblages are assigned a root zone of 2 m (6.6 ft.). These are the approximate rooting depths of the dominant shrub and grass species. The assigned values are not the actual rooting depth at a particular monitoring site, but they are useful to compare with the depth at which soil receives inputs from groundwater.

The depth at each monitoring location where soil water content increased due to capillarity from below or simply due to a rising water table are provided in Table 1. The values are not constant across some monitoring sites because of soil variability, local topography, and groundwater gradient. Also, the water table data in Table 1 are the values measured in the associated test well and have not been corrected for elevational differences between the well and monitoring site. At two sites, TA5 and BG2 the determination was problematic. Soil at these sites is moist but relatively static. Water table fluctuations or recovery when plant uptake ceases are not clearly reflected in the soil water profile, probably due to the relatively stable water levels and low plant cover.

The wellfield monitoring sites were grouped into simple categories to summarize the connection between the root zone and the water table. Brief descriptions of the three categories are given below:

1. Connected: Water table fluctuations caused soil water changes in the top half of the root zone at most monitoring locations. Eight sites were placed in this category.

2. Weakly connected: Water table fluctuations caused soil water changes in the bottom half of the root zone at most monitoring locations. Eight sites occur in this category. Sites TA5, TS3, TS6, SS1, and BG2 have ample soil water stored in the soil profile.

3. Disconnected: No recharge from lower depths is occurring in the root zone. Nine sites occur in this category. Site L2 has retained soil water available to plants but the water table at the beginning of the 2010 growing season is too deep to recharge the root zone. Soil at the other sites is dry.

At the beginning of the 2010 growing season, the water table was capable of supplying water to the root zone at 16 monitoring sites located in wellfields (see map). This is one more site than last year reflecting the similar or slightly shallower water levels at most sites in the connected and weakly connected categories. Most sites in these categories had moist soil in all or much of the root zone. One site in the disconnected category still retains soil water following water table decline beginning in 2007. The remaining eight sites have dry soil throughout the root zone.

Table 1. Shallowest soil depth where increasing soil water content can be attributed to capillarity derived from groundwater. Values for groundwater recharge depth are provided for each soil water monitoring location at a site. Values are depth below ground surface.

Site	Dominant plant species	Root Zone	Spring 2010 water table	Groundwater recharge depth
		(m)	(m)	(m)
LW1	greasewood	4	7.1	>3.9, >3.9, 3.3
LW2	alk. sacaton, greasewood, saltbush	2	6.5	>3.9 at all five locations
LW3	alk. sacaton, saltgrass	2	4.9	0.9, 0.7, 0.9, 0,9, 1.3, 1.3
BP1	saltbush, greasewood	3	4.2	3.1, 2.1, 1.1, 1.5, 1.3
BP2	saltbush, rabbitbrush	4	5.6	>4.2, 3.7, >3.9
BP3	greasewood, rabbitbrush	4	4.1	3.7, 3.3, 3.5
BP4	saltbush, greasewood	4	4.6	1.9 at all three locations
TA1	alk. sacaton, saltbush	2	1.6	<1.3^
TA2	alk. sacaton, saltbush, greasewood, rabbitbrush	2		0.9
TA3	saltbush, alk. sacaton, sagebrush	2	5.3	2.1, 2.7, 3.3^^
TA4	rabbitbrush, alk. sacaton	2	2.4	0.9, 0.9, 1.5
TA5	greasewood, alk. sacaton	2	4.0	-
TA6	saltbush, rabbitbrush	2	4.0	2.9 at all three locations
TS1	weeds, alk. sacaton	2	5.7	>3.9, >3.9, 3.3, >3.9, >3.9
TS2	sagebrush, saltbush, alk. sacaton	2	4.0	2.7, 3.5, >3.3
TS3	saltgrass, alk. sacaton	2	2.2	<0.9, <1.5, <1.1, 1.5, 1.1, 1.3
TS4	greasewood, alk. sacaton, saltbush, saltgrass	2	2.4	<0.9 at all four locations
TS6	alk. sacaton, saltbush, saltgrass	2	3.0	1.1
IO1	rabbitbrush, alk. sacaton, saltbush	2	3.3	<1.1, 0.9, <1.1
IO2	saltbush	4	6.5	4.1, >3.9, >3.9
SS1	saltbush, greasewood	4	3.8	3.3, 2.5, 2.1
SS2	saltbush	4	6.3	4.3, >3.9, >3.9
SS3	saltbush	4	3.0	1.9 at all three locations
SS4	saltbush	4	6.6	2.3, >3.9, 2.9
BG2	inkweed, saltbush	4	4.5	-

^: Less than symbols denote locations where both infiltration and groundwater recharge may contribute to increasing soil water content above the depth indicated.

^^: Soil water content at these depths increases slightly during winter but deeper soil remains approximately constant suggesting that the recharge mechanism is not simple capillary rise above the water table.