Table Q-3. Geohydrologic Characterization of Lake-Fringing Wetlands

Georegion and Wetland Site	Spring/ Groundwater Type	Recharge Volume and Seasonality of Freshwater Sources	Water Quality	Sediment Lithology	Sediment Texture	Sediment Salinity/ Alkalinity	Landform	Comments	References
North Mono Shorelands									
Black Point	Gravity water from under Black Point; possibly relict lake water	Low volume; probably fluctuates with seasonal rainfall patterns	Gravity water unknown; below 6,390 ft likely with moderate to high EC and alkalinity as groundwater leaches relict lakebed	Lacustrine sediment overlain in places with colluvial material from Black Point	Fine-grained clays alternating with sandy layers	Saline-alkali, limited leaching below 6,390 ft	Gently sloped lakebed truncated by steep colluvial apron at base of Black Point		Stine pers. comm.
DeChambeau Embayment	Gravity water (principally infiltrated from Rancheria Gulch); deep-fracture artesian spring; relict lake water	High volume from deep-water spring, moderate volume from springlines; fluctuates with season, climate, and the presence/absence of irrigation at DeChambeau Ranch	Gravity water good to fair; above 6,390 ft, 1.0-2.1 mmhos; below 6,390 ft, 5.7-19.5 mmhos; deep-fracture artesian spring, 1.0-3.3 mmhos; B 5.0-11.5 ppm; As 0.2 ppm	Interbedded sandy and clayey lacustrine sediment creating aquaclude-aquifer sequences; overlain in places with aeolian sand	Fine-grained, silty to clayey sediment interbedded with sands and gravels	Moderately saline-alkali; leached above 6,390 ft; highly saline-alkali below 6,390 ft	Downthrust block bound by faults that are perpendicular to shoreline; gently sloped lakebed with littoral springlines at prior highstands	Diverted Wilson Creek water used to irrigate DeChambeau Ranch and likely augmented natural groundwater inflows; extensive alkali flat below 6,381 ft, partial alkali flat between 6,381 ft and 6,390 ft	Balance Hydrologics 1993, Stine pers. comm., Groeneveld 1991a, Los Angeles Department of Water and Power 1987, Parrat 1931
Bridgeport Creek	Gravity water (principally infiltrated from Cottonwood and Bridgeport Creeks); deep-fracture artesian springs; relict lake water	High volume from deep-water springs, moderate volume from springlines; fluctuates seasonally, surface discharge concentrated at small, local springs	Fair, 1.0-2.7 mmhos; B 6.5-16.5 ppm; As 0.06-1.6 ppm	Interbedded sandy and clayey lacustrine sediment creating aquaclude-aquifer sequences; overlain in places with aeolian sand	Fine-grained, silty to clayey sediment interbedded with sands and gravels	Moderately saline-alkali; leached above 6,390 ft; highly saline-alkali below 6,390 ft	Gently sloped shoreline with littoral clifflines at prior highstands; dissected by some faults	Tufa near the 6,428-ft highstand suggests that groundwater has discharged at the site in the past; most discharge is currently from littoral springline at 6,390 ft; extensive alkali flat below 6,381 ft, partial alkali flat between 6,381 ft and 6,390 ft	Stine pers. comm., Groeneveld 1991a, Basham 1988
North Beach	Relict lakewater; minor amounts of gravity water; deep-fracture artesian springs (rare and small)	Low volume along springlines with few small, moderate-volume deep-water springs; fluctuates seasonally	Poor; 3.0-31 mmhos; B 13-240 ppm; As 1.2-8.3 ppm	Interbedded sandy and clayey lacustrine sediment creating aquaclude-aquifer sequences; overlain in places with aeolian sand	Fine-grained, silty to clayey sediment interbedded with sands and gravels	Limited leaching; highly saline-alkali below 6,400 ft	Gently sloped shoreline with littoral clifflines at prior highstands; dissected by some faults	Most discharge as subsurface seepage; principal area of discharge below the 6,390-ft littoral springline; groundwater too saline-alkali for vegetation; extensive alkali flat below 6,390 ft	Groeneveld 1991a, Basham 1988, Stine 1990, Rogers et al. 1992, Rogers and Dreiss 1991
Warm Springs	Gravity water (infiltrated in the Cow Track Mountains); deep-fracture artesian springs; relict lake water	High volume at deep-water springs, moderate from springlines; fluctuates seasonally and with annual climate	Fair; 1.8-3.9 mmhos; B 3.6-16.5 ppm; As 0.3-1.6 ppm	Interbedded sandy and clayey lacustrine sediment creating aquaclude-aquifer sequences; overlain in places with aeolian sand	Fine-grained, silty to clayey sediment interbedded with sands and gravels	Limited leaching; highly saline-alkali below 6,400 ft	Gently sloped shoreline dissected by prominent fault somewhat tangential to current shoreline; lagoons formed behind fault and adjacent littoral embankment when the lake stands above 6,400 ft; with littoral embankments and clifflines	Old tufa remains above and below the 6,328-ft highstand indicates groundwater has discharged at this site for many millenium; extensive alkali flat below 6,381 ft	Groeneveld 1991a, Basham 1988, Stine 1990, Rogers et al. 1992, Sinclair 1988, Los Angeles Department of Water and Power 1987, Parratt 1931
East Beach	Gravity water (principally from Simon's Spring), relict lake water	Moderate to low volume along springlines; fluctuates seasonally and with annual climate	Fair; 1.4-14.0 mmhos; B 4.4-12.6 ppm; As 0.2-0.9 ppm	Lacustrine sediment overlain in places with aeolian sand; stratification undocumented	Interbedded fine sand and coarser tephra sediment; no near-surface clayey aquacludes as at the North Mono Shorelands	Limited leaching; highly saline-alkali throughout	Gently sloped shoreline with littoral clifflines and embankments	Southern portion possibly receives gravity water reinfiltrated from springs in Simon's Spring complex	Groeneveld 1991a, Stine 1993

Table Q-3. Continued

Georegion and Wetland Site	Spring/ Groundwater Type	Recharge Volume and Seasonality of Freshwater Sources	Water Quality	Sediment Lithology	Sediment Texture	Sediment Salinity/ Alkalinity	Landform	Comments	References
Simon's Spring	Gravity water, deep-fracture artesian springs; relict lake water (likely only consequential below 6,381 ft)	High volume deep-fracture springs and littoral springlines; fluctuates seasonally and with annual climate	Good; from 0.2 to 2.7 mmhos; B 0.2-12 ppm; As 0.1 ppm	Lacustrine sediments inter-bedded with tephra sand, overlain in places with aeolian sand	Interbedded fine sand and coarser tephra sediment; no near-surface clayey aquacludes like at the North Mono Shore-lands	Moderately saline-alkali to neutral and well leached	Gently sloped shoreline with littoral embankments and cliff-lines; bisected by major fault with downthrust fault to west and upthrust block to east	Recharge likely from Cow Track Mountains and Dry Creek; lacks an extensive alkali flat; water temperature and chemistry indicate groundwater circulation in the faults is shallow; extensive tufa hardpan prevents infiltration of springwater and is responsible for the extensive marshes because drainage from rill formation is precluded	Stine 1993, Groeneveld 1991a, Rogers et al. 1992, Basham 1988, Sinclair 1988, Los Angeles Department of Water and Power 1987, Parratt 1931
South Mono Shorelands									
South Beach	Gravity water, deep-fracture artesian springs (small, uncommon)	Both spring types low volume; water table fluctuates seasonally and with annual climate and lake level	Good; 0.1-3.2 mmhos; B 0.4-8 ppm; As 0.1-2.1 ppm	Interbedded tephra and sand layers, overlain in places with aeolian sand	Coarse-grained, highly permeable	Moderately saline-alkali, fairly well leached	Gently sloped shoreline with littoral embankments and cliff-lines, bisected by several faults	Coarse-grained, porous sediments leached rapidly despite limited groundwater inflow; possibly recharged by groundwater infiltrated in the Mono Craters	Rogers et al. 1992, Basham 1988, Sinclair 1988, Stine 1993, Gradek 1983, Groeneveld 1991a, Vorster 1985, Los Angeles Department of Water and Power 1987
South Tufa	Gravity water (infiltrated in Mono Craters); deep-fracture artesian springs	High volume, fluctuates seasonally and with annual climate and lake level	Fair; 1.0-3.2 mmhos; B 2.9-19 gm/l	Interbedded tephra and sand layers, overlain in places with aeolian sand	Coarse-grained, highly permeable	Moderately saline-alkali, fairly well leached	Gently sloped shoreline with littoral embankments and cliff-lines, bisected by a fault	Littoral embankments have slowed drainage from deep-fracture springs, thereby allowing more extensive marshes to form	Rogers et al. 1992, Basham 1988, Sinclair 1988, Stine 1993, Gradek 1983, Vorster 1985, Los Angeles Department of Water and Power 1987
Sierran Delta									
Rush Creek Delta	Gravity water infiltrated from Rush Creek and overbank floodflows; artificial diversions supported some wetlands historically	Low volume at point of reference, historically high volume, fluctuating with creek discharge	No data available; presumably similar to Lee Vining Creek delta	Granodiorite and allied meta-morphic rocks interbedded with Mono Craters tephra and clayey lacustrine strata at depth	Coarse-grained sands with abundant gravel and cobble	None, well leached	Gently sloped delta plain above 6,400 ft with steep delta face below; Rush Creek presently deeply incised into the delta	Incision of Rush Creek drained water table that supported more extensive wetlands before LADWP water exports began	Stine 1993, pers. comm.
Lee Vining Tufa	Gravity water infiltrated from Lee Vining Creek and deltaic artesian springs	High volume; fluctuates seasonally and with annual climate cycles	Good; 0.1-0.4 mmhos	Granodiorite and allied meta-morphic rocks interbedded with Mono Craters tephra; tufa-cemented cobbles	Coarse-grained sands with abundant gravel and cobble	Saline-alkali but moderately well leached above 6,381 ft; saline-alkali below	Narrow, moderately sloped shoreline bisected by numerous parallel faults with alternating upthrust and downthrust blocks	Site of long-term groundwater discharge with wetlands that move downslope with lake level	Stine 1993, pers. comm.; Balance Hydrologics 1993; Basham 1988; Los Angeles Department of Water and Power 1987
Lee Vining Creek Delta	Gravity water infiltrated from Lee Vining Creek and overbank floodflows; deltaic artesian springs; artificial diversions supported some wetlands historically	Low volume at point of reference; historically high volume and fluctuating with creek discharge	Good; 0.3-1.2 mmhos; B 0-2.8 ppm	Granodiorite and allied metamorphic rocks	Coarse-grained sands with abundant gravel and cobble	None, well leached	Gently sloped delta plain above 6,400 ft with steep delta face below Lee Vining Creek presently deeply incised into the delta	Water was historically diverted from Lee Vining Creek to sustain wetlands; incision of Lee Vining Creek drained water table that supported more extensive wetlands before LADWP diversions	Stine 1993, pers. comm.; Basham 1988; Los Angeles Department of Water and Power 1987; Parratt 1931

Table Q-3. Continued

Georegion and Wetland Site	Spring/ Groundwater Type	Recharge Volume and Seasonality of Freshwater Sources	Water Quality	Sediment Lithology	Sediment Texture	Sediment Salinity/ Alkalinity	Landform	Comments	References
Mill-Wilson Creek Delta	Gravity water infiltrated from creeks and overbank flood-flows; deltaic artesian springs	High volume on Wilson Creek delta; fluctuates seasonally and with annual climate cycles	Good; 0.1-0.3 mmhos; B 0.04-0.17 ppm	Granodiorite and allied metamorphic rocks	Coarse-grained sands with abundant gravel and cobble	Well leached except below 6,390 ft, where moderately alkali from lakebed sediments	Moderately sloped delta with incised creek; sloped gently to shoreline	Substantial groundwater discharge at the mouth of Mill Creek before LADWP diversions; incision of Wilson Creek breached clayey aquacludes draining delta water table in places; tufa towers evidence of underwater discharge in the past	Basham 1988, Stine 1993, Los Angeles Department of Water and Power 1987
Sierran Front									
Horse Creek Embayment	Gravity water; deep-fracture artesian springs; groundwater historically augmented by artificial irrigation in upslope area	Low to high volume; lowermost littoral springline with highest levels	No data available; presumably similar to Sierran Escarpment	Granodiorite and allied metamorphic rocks interbedded with Mono Craters tephra	Coarse-grained sands with abundant gravel and cobble	Well leached except below 6,390 ft, where moderately alkali from lakebed sediments	Somewhat steep shoreline within sheltered embayment with littoral clifflines	Site of historical discharge from upslope irrigation; natural groundwater sources fluctuate with lake level	Stine 1993, pers. comm.
Sierran Escarpment	Fractured rock gravity springs that charge downslope gravity water springs	High volume; fluctuates seasonally and with annual climate cycles	Good; 0.1-1.0 mmhos; B 0.3-6.8 ppm; As 0.2-0.3 ppm	Granodiorite and allied metamorphic; tufa-cemented cobbles above 6,385 ft	Coarse-grained sands with abundant gravel and cobble	Highly leached, except below 6,390 ft, where moderately to highly saline-alkali	Steeply sloped shoreline of colluvial and alluvial deposits above 6,390 ft; highly fractured and faulted	Freshwater inflows with such head that they drive saline lake - water below the lake level, allowing freshwater to seep at the shoreline	Basham 1988, Stine 1993, Winkler 1977, Rogers et al. 1992, Groeneveld 1991a, Los Angeles Department of Water and Power 1987
County Park	Fractured rock gravity springs, deep-fracture artesian springs; sustained in part by irrigation of Conway Ranch	High volume; fluctuates seasonally and with annual climate cycles	Good; 0.3 mmhos; B 1.2 ppm; As 0.2 ppm	Granodiorite and allied metamorphic; some tufa-cemented cobbles	Coarse-grained sands with abundant gravel and cobble	Highly leached, except below 6,390 ft, where moderately to highly saline-alkali	Moderately sloped shoreline with littoral clifflines; faulted	Spring discharge from the tops of tufa towers ceased in 1980s; discharge partially related to diversion structures and weirs in feeder creeks	Basham 1988, Stine 1993, Winkler 1977, Rogers et al. 1992, Groeneveld 1991a, Los Angeles Department of Water and Power 1987
Mono Islands									
Paoha Island	Gravity water, deep-fracture artesian springs, relict lake water	High volume at deep-fracture springs; low volume at springline	Poor; 1.9-2.2 mmhos; As 1.6-78.9 gm/l	Lacustrine sediment; interbedded fine-grained lacustrine sediment and Mono Craters tephra	Fine-grained sediment with clayey aquacludes	Highly saline-alkali	Moderately sloped shoreline with littoral embankments and clifflines	Springwater possibly a mix of deep-fracture aquifer water and lake water	Basham 1988, Los Angeles Department of Water and Power 1987