Owens Lake: To Dust Bowl and Back?

Bob Harrington, Ph.D. *– Inyo County Water District*

Owens Lake is denoted on many late-twentieth century California maps as "Owens Dry Lake" – "dry lake" being the cartographer's oxymoronic term for a playa. Owens Lake's status as a playa is relatively recent. During the Pleistocene, it was part of a chain of lakes that extended from headwaters in the Sierra Nevada to pluvial Lake Manly in Death Valley. At its full extent, this basin drained from the highest to the lowest elevation in the conterminous United States. Owens Lake last overflowed the Owens Valley as recently as around 3,000 years ago, and the absence of evaporites in the lakebed's deep cores attests that Owens Lake was inundated from at least the mid-Pleistocene until its recent desiccation. At its historic high in 1878, Owens Lake encompassed 110 square miles and was 50 feet deep. Early settlers reported "…ducks were by the square mile, millions of them [and] when shot, a duck would burst open from fatness which was butter yellow." The steamer "Bessie Brady" plied its waters to transport silver bullion en route from mines in the Inyo Mountains to Southern California. Local lore holds that a lost shipment of bullion remains hidden beneath the playa.

Owens Lake is a powerful illustration of the significant environmental consequences that can result from large-scale interbasin water transfers.

Owens Lake began to decline in the late nineteenth century due to diversion of the Owens River for agricultural development in the Owens Valley, and the decline markedly hastened after 1913, when the city of Los Angeles completed construction of the Los Angeles Aqueduct and began exporting water from the Owens Valley to Los Angeles. By 1930, all that remained of Owens Lake was a remnant brine pool in the center of the playa. Soda mining operations sporadically worked the evaporites of the playa surface, but were plagued by intermittent flooding when runoff exceeded the capacity of the Los Angeles Aqueduct and the Los Angeles Department of Water and Power (LADWP) released water onto the playa.

Owens Lake is the terminus of the Owens Valley groundwater flow system, and roughly 50,000 acre-feet per year of groundwater, precipitation, and runoff evapotranspires from the playa surface, brine pool, and salt-tolerant vegetation around the playa margins. Saline groundwater typically is present a few feet below the playa's surface, a mosaic of mobile sand sheet, salt hardpan, and mud flats subject to periodic efflorescences of loose alkaline salts.

Dust emissions from the dry lake surface are an environmental concern, and have presented a huge challenge for land managers and regulators. In 1987, the U.S. EPA pronounced the southern Owens Valley in violation of National Ambient Air Quality Standards (NAAQS) for particulate matter less than 10 microns in diameter (PM10), and in 1993 the area was reclassified as "in serious non-attainment" of PM10 standards. PM10 can penetrate deep into the human respiratory tract and cause a variety of respiratory problems. The NAAQS standard for PM10 is 150 micrograms per cubic meter ($\mu g/m^3$) averaged over 24 hours, or 50 $\mu g/m^3$ averaged annually; PM10 concentrations of over 12,000 $\mu g/m^3$ have been verified at Owens Lake. Owens Lake was recognized as the main point of origin of PM10 violations in the Owens Valley, and was subsequently

Owens Valley under clear (left) and dusty (right) conditions. Photos courtesy of Great Basin Air Pollution Control District.

Owens Lake pre-1914, looking east-southeast. Photo by A.A. Forbes, courtesy of the Eastern California Museum.

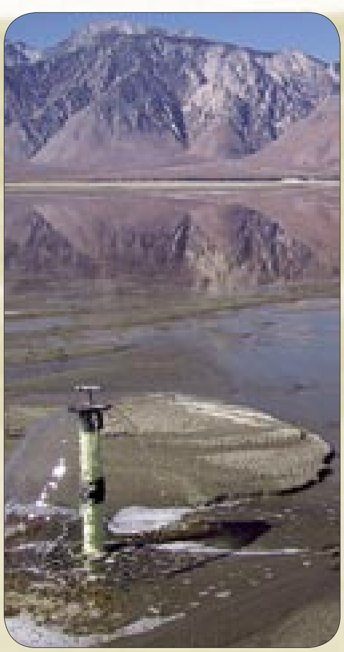
identified as the single largest source of fugitive dust in the United States.

Dust from Owens Lake also has been found to have cadmium and arsenic at levels exceeding the background levels for Owens Valley soils. The EPA required California to produce a plan for achieving NAAQS, and in 1998 the Great Basin Air Pollution Control District (as delegated by the state) and LADWP entered into a memorandum of understanding whereby LADWP would bring the area into NAAQS compliance by 2007. Under the recently revised State Implementation Plan, LADWP is required to implement dust control measures on a 29.8 square-mile area of the playa surface.

Research and practice have proved three strategies are effective for controlling dust from the playa surface: shallow flooding, vegetation management, and applying gravel.

Shallow flooding of the playa to attain saturation or near-saturation of the surface over 75 percent of the dust-emissive area has been shown to be efficient and effective. This method requires 4 feet of irrigation annually.

Salt grass (*Distichlis spicata*) can be established on the saline playa surface if water of sufficient quantity and quality is applied to leach the playa surface. A salt grass cover of 50 percent has been shown to control dust emissions, and test plots confirm that this coverage can be maintained on the playa surface with 2.5 feet of irrigation per year.



Owens Lake dust control. Photo by Ted Schade.

Dust emissions can be controlled with a 4-inch blanket of gravel on the playa surface, using geotextiles to prevent settling of the gravel blanket into the playa. However, the volume of gravel required inhibits widespread use of this strategy.

These control measures have been implemented on 16.5 square miles of the lake bed, and will be implemented on an additional 13.3 square miles to achieve air quality compliance by the deadline. At that time, 20.1 square miles will be under shallow flooding, 9.2 square miles under managed vegetation, 0.37 miles will be pond, and 0.06 square miles will be under gravel. When fully implemented, the project will require more than 50,000 acre-feet of water per year. In order to reduce this amount, return flows from the managed vegetation and shallow flooding areas will be recycled to the shallow flooding areas. LADWP constructed two pipelines from the Los Angeles Aqueduct to Owens Lake to supply the project; in the future, groundwater supplies beneath the playa may be tapped.

Owens Lake is a powerful illustration of the significant environmental consequences that can result from large-scale interbasin water transfers. As one of the first and best-known examples in the western United States of water transfers from agricultural to municipal use, opponents of such transfers often and justifiably refer to the tale of Owens Valley and Los Angeles as a cautionary example. But proponents of such transfers should take heed as well: the challenges and costs of mitigating dust emissions from Owens Lake are tremendous, and the responsibility for mitigation has rightly fallen on the party conducting and benefiting from the water transfer. As similar acts such as transferring Colorado River water from the Imperial Valley to San Diego are contemplated, potential consequences for the land and people left behind need to be carefully considered.

Contact Bob Harrington at bharrington@inyowater.org.