Tujunga Wash Greenway and Stream Restoration
Methodology for Landscape Performance Benefits
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Environmental

Infiltrates up to 118 million gallons of water from the concrete Tujunga Wash flood channel each year, recharging the San Fernando groundwater basin.

According to Richard Gomez, PE County of Los Angeles, DPW Watershed Management Division (September 5, 2012), the average flow rate of water through the intake pipe is 0.5 cubic feet/second (14 liters/second) on average, so:

0.5 cubic feet/second X 31,557,600 seconds/year = 15,768,000 cubic feet/year
15,768,000 cubic feet/year X 7.481 gallon/cubic feet = 117,950,000 gallons

The actual amount being infiltrated depends on the precipitation. In Los Angeles, the average annual precipitation amount (15-17 inches depending on location see Figure 1) is rarely what is gotten. Los Angeles is more likely to experience drought or wet years, than 'average' years. See figure 2 for the hydrograph from a wet year when the hypothetical amount could be infiltrated – then again, most precipitation arrives in a few high precipitation storms each year (which is why there is such a great risk for flooding).

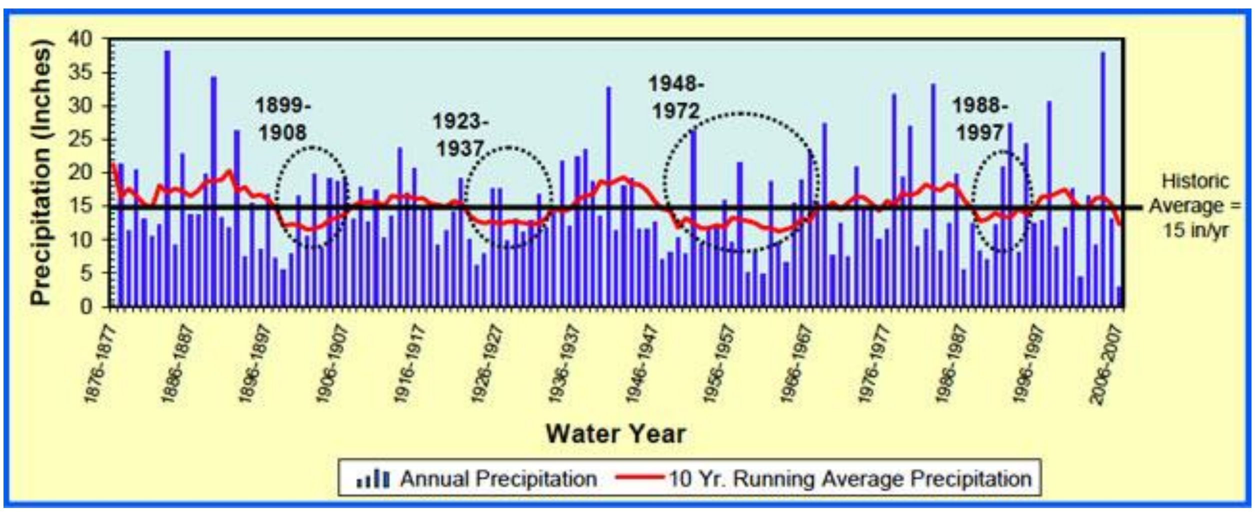


Figure 1: Annual precipitation in Los Angeles from 1876-2007 | Source: Water Replenishment District of Southern California, www.wrd.org/engineering/precipitation-groundwater-los-angeles.php

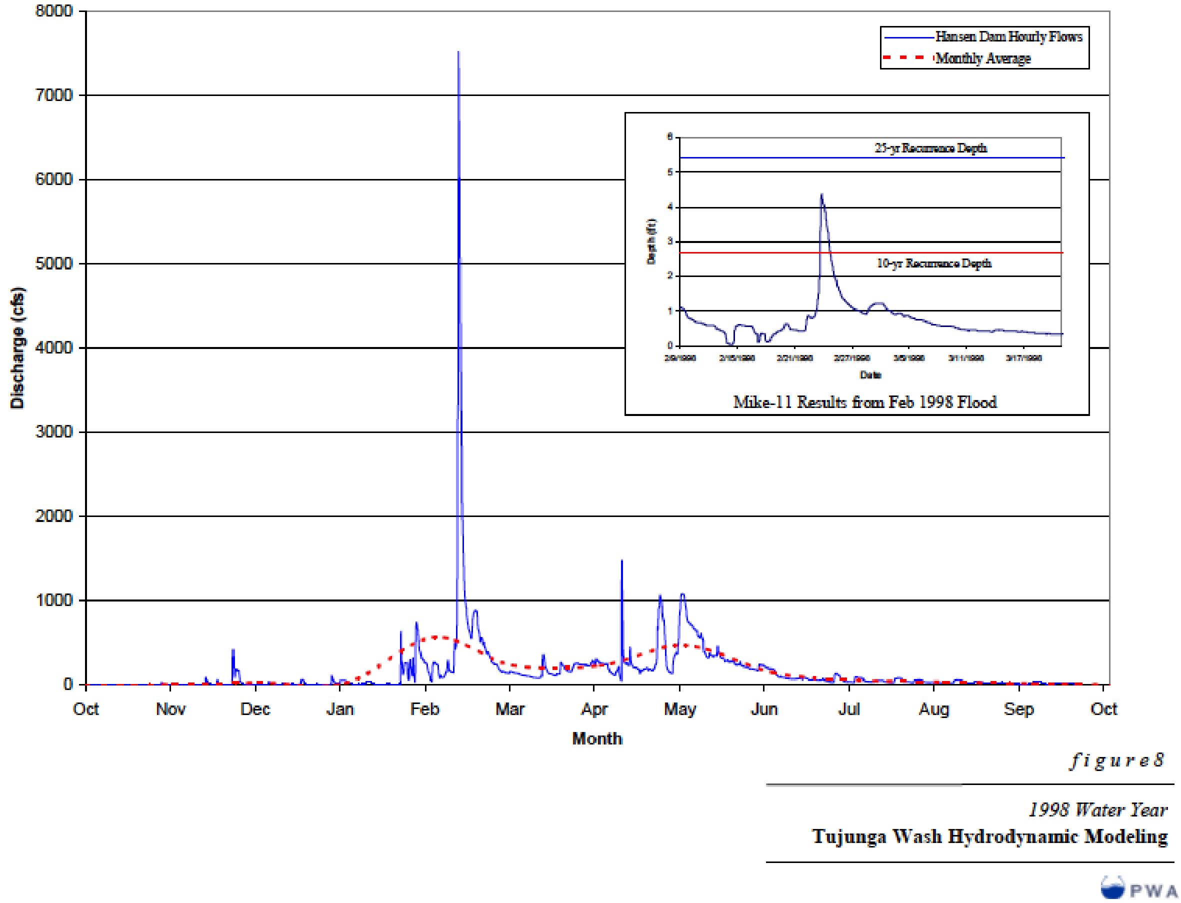


Figure 2: 1998 Water Year | source The RIVER PROJECT/WaterCycle Inc/Philip Williams & Associates, Ltd. (March 2002), 'Hydrodynamic Study for Restoration Feasibility of the Tujunga Wash' A Report to The California Coastal Conservancy and The Los Angeles & San Gabriel Rivers Watershed Council

Los Angeles gets 13-15% of it's municipal water from the San Fernando groundwater basin. Most of the well fields in the San Fernando Valley are north/north east of the site, but there are a few wells to the south near Griffith Park in Glendale. If those wells do not extract the water, it becomes baseflow for the Los Angeles River. Calculated the geohydrology is extremely complex, so there is no definitive means of establishing how much water

Sources

City of Los Angeles Department of Water and Power (May 2008), *Securing L.A.'s Water Supply*. www.lacity.org/mayor/stellent/groups/electedofficials/@myr_ch_contributor/documents/contributor_web_content/lacity_004714.pdf (accessed March 10, 2013)

Pacific Institute (2010), *California's Next Million Acre-Feet: saving water, energy, and money* www.pacinst.org/reports/next_million_acre_feet/next_million_acre_feet.pdf (accessed March 10, 2013)

In addition to infiltration, the stream restoration/wetland provides some flood storage capacity. Estimated flood storage capacity is calculated as:

Stream Depth: between 0-2 feet (assume average 1 foot) (.3 m)
Stream Width: approximately 5 feet (1.5 m)
Stream Length: 5280 feet (1609 m)

Depth X Width X Length = 1 X 5 X 5,280 = 26,400 cubic feet (750 m^3)
= 197,500 gallons of storage

However, this storage volume is now severely reduced by the high sedimentation of the channel, which all but fills the streambed (to a depth of 18 to 24") along most of the greenway. Periodic removal of the sediments is necessary, as the velocity of the flow is insufficient to scour the channel to restore the storage capacity.

Reduces potential landscape water use by 70-80% by using all native plants. This saves $8,000-$20,000 per year in irrigation water costs.

The City of Santa Monica's Garden/Garden study (see references below) shows that planting California native plant species as compared to "traditional" gardens (mostly plants from the temperate climates requiring 40-60 inches of water per year) can provide an 80% water savings. Over six years, the traditional gardens in this study have consumed 482,330 gallons H2O as compared to the native garden's 92,673 gallons.

No water meter data for the Tujunga Creek Project were made available to the CSI. Therefore, we can only speculate on the actual performance of the project based on the planting list provided.

Based on data provided from the City of Lakewood, where they are supplying 45" of irrigation to their park per year, we can roughly extrapolate irrigation usage (and the water costs) for Tujunga Wash. Note there are significant differences in climate between the coastal location of Lakewood and the inland valley climate along Tujunga Wash.

	Formulas		***Units***
	Irrigated Area	**6.58**	Acres
	Acres x 43,560 Ft2/Acre	**286,625**	Ft2
Average annual irrigation rate		**45.00**	Inches H2O
	Area x irrigation rate / 12 / 100	**10,800**	HCF
	Total H2O x $1.07 (reclaimed H2O per HCF)	**$11,556**	cost
	Total H2O x $2.63 (potable H20 rate per HCF)	**$28,490**	cost
Native plants reduction factor		**70%**	
		3,240	HCF
Estimated actual irrigation costs	**Reclaimed H20**	**$3,467**	cost
	Potable H20	**$8,547**	cost
	Cost saving	**$(8,089)**	Reclaimed H20
		$(19,943)	Potable H20

Table 3: Analysis of the Irrigation Costs for Tujunga Wash Greenway and Stream

The irrigation cost range reflects the difference between potable water and reclaimed water in Southern California. The actual costs will depend on the actual amount of irrigation applied, the actual rate for the water (and if it's reclaimed or potable), the area under irrigation, and the weather.

Water diverted from Tujunga Wash for infiltration provides a significant portion of the water required by the vegetation. There is no data available about how often there is surface water present, nor about the extent of the flow. The vegetation at the Northern end of the project appears to be significantly larger then specimens of similar species down stream (or on the eastern bank) – this can be attributed to greater amount of water available nearer to the head works.

<u>Irrigation Comparative Information</u>

http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Landscape/gg%20Comparison%20A%202004_2010.pdf

City of Santa Monica, Office of Sustainability and the Environment. Landscape: Garden-Garden
http://www.smgov.net/Departments/OSE/Categories/Landscape/Garden-Garden.aspx

Sustainable Sites Initiative. 2008. Garden/garden: A Comparison in Santa Monica.
http://www.sustainablesites.org/cases/show.php?id=1

<u>Other Resources</u>

Aird, Janet. 2008. *Making the Most of Small Spaces; Two flood-control projects have collateral benefits.* Stormwater: The Journal for Surface Water Quality Professionals. October. http://www.stormh2o.com/october-2008/sun-valley-tujunga.aspx

Water Quality Analysis

Claim:
The recreated riparian zone and stream improves water quality.

Evaluation Methodology:
In September 2012, 500 ml samples were collected from the headworks and ¼ mile downstream at station 205+00, however the lab wasn't able to process them before they expired.

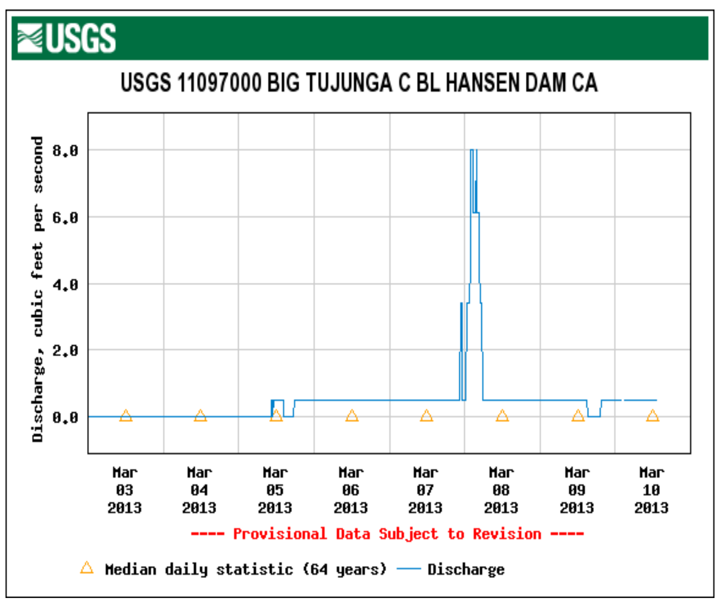


Figure 5: Hydrograph from March 2013 for Tujunga Creek approximately 5 miles upstream from project | source USGS

In 2013, field measurements of pH/conductivity were taken on 3/7 and again on 3/9 after a late winter storm (Figure 5). On 3/7, there was just a residual pool of water in the stream restoration adjacent to the head works structure (Site #1 in Figure 6), with the rest of the streambed dried out with no wet mud or evidence of moisture downstream. Water at site #1 was standing in shallow pools 1 to 2-inches deep, over a bottom surface of light colored fine silt and sediment, interspersed by medium sized cobbles.

On the return visit on March 9th at 11am, there was evidence of recent flows (moist mud and sediments) to approximately 150' downstream from the head works. The last traces of surface water were about 100’ downstream from the head works (about 20’ upstream from the stone and concrete weir). Samples were collected from 2-inch deep standing water mixed with organic debris (leaves, sticks) over a light colored sandy bottom with areas of dark organic muck. Both sites were shaded under a 15 to 25-foot high tree canopy, with a sparse shrub layer, minimal emergent vegetation, and clear signs of foot traffic and trash. Much of the emergent vegetation and many of the trees were still dormant from winter.

Field analysis of water quality was made using an Extech Instruments ExStik® II EC500 pH/Conductivity Meter (see Figure 7 for specifications). The EC500 was selected for it’s low cost (~$150) and the range of parameters it measures. Meters that can detect nutrients such as ammonia and nitrates are significantly more expensive, so weren’t viable with the limited budget available.

20ml samples were collected from the deepest pools with care taken to avoid stirring up bottom sediments and to reject floating debris. Samples were analyzed at each site following the instructions provided with the EC500 by gently stirring the sample with the meter to clear any air bubbles first. The meter and sample cup were rinsed between samples with two changes of distilled water, and the meter was rinsed before the initial sample to clear any pH buffering solution keeping the sensor moist. Data was recorded after the EC500 readout stabilized (between 5 to 30 seconds) per parameter. The meter’s TDS conversion ratio was set at 0.7, and the salinity ration at 0.5. The meter was brand new and this was the first set of samples analyzed with it.

Figure 6: Sample sites | image credit: Google Earth.

Specifications:	Range	Max Resolution	Basic Accuracy
Conductivity:	0 to 199µS/cm, 200 to 1999µS/cm, 2.00 to 19.99mS/cm	0.1µS/cm	±2%FS
TDS/Salinity:	0 to 99.9ppm(mg/L), 100-999ppm(mg/L 1.00 to 9.99ppt	0.1ppm (mg/L)	±2%FS
pH:	0.00 to 14.00pH	0.01pH	±0.01pH
Temperature:	32° to 149°F (0 to 65°C)	0.1°F/°C	±1.8°F/1°C

Figure 7: EC500 ExStik® II specifications | source: Extech Instruments www.extech.com/instruments/resources/datasheets/EC500.pdf

Figure 8: Site #2 looking North towards headworks and Site #1

Site	Date	pH	ppm S	TDS mg/l	µS	°F
1	3/7	8.22	726	1618	1442	61.9
1	3/9	7.98	110	171	247	61.9
2	3/9	7.30	253	271	390	61.9

Table 2: Water quality data from March 2013

Discussion:
The high(er) pH right at the headworks may be influenced by the concrete channel and pipe leading to the site. The higher readings on March 7th are clearly influenced by the dry weather preceding the measurement (the prior precipitation event was a few weeks earlier) causing higher concentrations from evaporation.

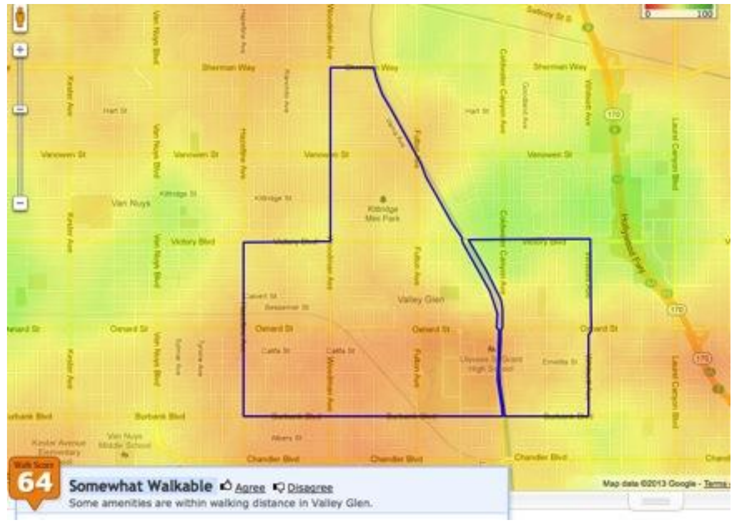
The hypothesis of water quality improving further downstream along the stream restoration can't be evaluated from the limited data at this time. Additional samples are required along the entire length of the project, and that needs higher water flows like those observed in September 2012. Sedimentation of the streambed may also be preventing water flow along the project that interferes with being able to measure water quality.

Conclusion:
The research team hopes to periodically revisit to the site to observe changes and analyze the water quality to be able to conclusively determine if there are observable benefits.

Social

Creates 2.4 miles (3.9 km) of off-street multi-use trails in a car-dominated neighborhood with providing connections to the regional trail network.

The neighborhood 'Walk Score' of the neighborhood



(www.walkscore.com/CA/Los_Angeles/Valley_Glen) is 64 'Somewhat Walkable' and ranked as the 46th most walkable neighborhood in Los Angeles (Figure 3). However, their algorithm doesn't factor in the narrow sidewalks adjacent to fast traffic, long distances between cross walks, or long traffic signal cycles at the cross walks across Vanowen Blvd, Victory Blvd, Coldwater Canyon Ave, or Oxnard Blvd. Then there is that many of the neighborhood businesses are located in strip malls with several hundred feet of parking separating their front doors from the streets. This is not a good pedestrian environment!

Figure 3: Walkability in Valley Glen from Walkscore.com

South of Oxnard Blvd, the Tujunga Greenway path continues 3/4th of a mile along Tujunga Wash past to campuses of Los Angeles Valley College/Monarch High School to connects with the 'Class 1' bicycle route along Chandler Avenue/Orange Line Busway (Figure 4). This connects the Valley Glen neighborhood to regional destinations including the Sepulveda Basin, Griffith Park, and points south along the Los Angeles River Trail. There are still substantial gaps in the bicycle network around Valley Glenn. Note that the Greenway is not designated an official bicycle route.

The Orange Line Busway provides express transit service to Downtown Los Angeles and regional employment centers, connections to regional rail service, and is supplemented by sporadic local bus service on most major streets. (www.metro.net/riding_metro/bus_overview/images/901.pdf)

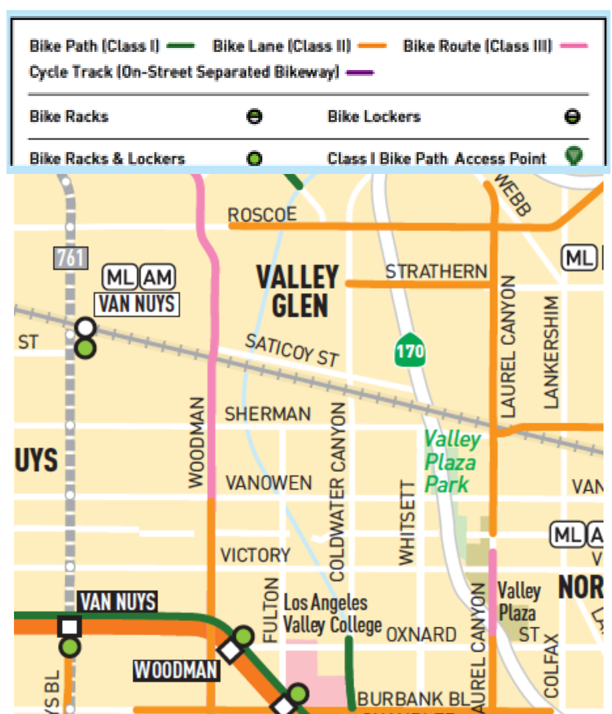


Figure 4 Bicycle routes & connectivity | source: (www.metro.net/riding_metro/bikes/images/la_bike_map.pdf)

Increases public park space by 21% in a park-poor community with 70,000 residents within one mile (1.6 km). The Greenway increases the ratio of park space to 1.23 acres per 1,000 residents, and is expected to improve quality of life of users and walkability within the neighborhood.

The area within a one-mile (1.6 km) radius of the project previously had 1 acre (.4 hectares) of park space per 1,000 residents. The addition of the Tujunga Wash park space increased the ratio to 1.23 acres (.5 hectares) per 1,000 residents -- a 21% increase. A community with less than 3 acres (1.2 hectares) of park space per 1,000 residents is considered park-poor under the California Legislation AB 31.

- Previous population calculations were used to create the before-and-after park acreage per person calculations within the one mile radius.
  - Before: 71 acres / (69,940 residents / 1,000) = 1 acres per 1,000 residents
  - After: 86 acres / (69,940 residents / 1,000) = 1.23 acres per 1,000 residents
  - Increase: (86 acres - 71 acres) / 71 acres = 21.% increase in park acres
- Los Angeles parks per 1,000 people is calculated from figures published in The Trust for Public Land's "2011 City Park Facts" publication.
  - 23,938 acres / (3,831,868 residents / 1,000) = 6.25 acres of park space per 1,000 residents

- A 2010 TIGER/Line shapefile of US Census Block Groups available through the US Census Bureau was used as the data source for geospatial analysis performed in ESRI's ArcMap 10.
- 2010 population density was determined for each block group by using the Calculate Geometry function in the block group shapefile's attribute table, then inserting the following equation into a new field using the Field Calculator function:
- Block Group Population / Area = Population Density (per square mile or square kilometer)
- A shapefile for Tujunga Wash was generated by tracing a Bing Maps satellite imagery base layer using ArcMap Editor tools.
- A one-mile (1.6km) radius was created around the park's boundaries using the Buffer Tool.
- The shapes and attributes (2010 Census Data) were extracted from the block groups within the one-mile radius by using the Clip Tool.
- Population of block groups within the one mile (1.6km) radius were calculated by inserting the following equation into a new field (where "Clipped Population" represents the number of people living in portions of block groups that fall within a one mile radius of the park, "Population Density" equals Original Block Group Population / Original Area, and "Clipped Area" equals the area of the block group that falls within the one mile radius):
- Clipped Population = Population Density x Clipped Area
- The clipped block group populations were then summed using the Statistics function to provide the total population within the one-mile radius.