

# Green Remediation Focus

Minimizing the environmental footprint of site cleanup

## A Profile in Using Green Remediation Strategies

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**NASA Jet Propulsion Laboratory (JPL)**  
Pasadena, CA

**Federal Facility  
Superfund NPL**

**Cleanup Objectives:** Treat groundwater and soil through (1) on-facility soil vapor extraction to remove volatile organic compounds (VOCs) in the source area soil, (2) on-facility extraction, treatment, and reinjection to treat VOCs and perchlorate in source area groundwater, and (3) pumping of groundwater to an existing onsite treatment plant and a new off-facility municipal treatment plant for removal of residual VOCs and perchlorate

**Green Remediation Strategy:** Optimize pumping operations and treatment processes to be used by the off-facility municipal plant (funded by NASA) and implement green construction techniques for the plant through a partnership with the City of Pasadena

- Collaborate with the City of Pasadena during the project's conceptual design phase, which allowed sufficient time to incorporate green strategies into design and construction
- Offer a 1% contractor incentive for efforts supporting greening goals of Executive Order 13423
- Use Leadership in Energy and Environmental Design (LEED) construction criteria to plan stormwater management, outdoor lighting, waste management, materials reuse/recycling, and environmentally friendly material purchasing
- Modify pumping configurations to reduce elevation changes and pipeline friction along the water transfer corridor between the production wells and the proposed water treatment facility
- Optimize the proposed treatment system (liquid-phase granular activated carbon, ion exchange, filtration, and disinfection units) by negotiating with the water treatment vendor to remove post-filtration cartridge filters
- Evaluate renewable energy options for the existing, co-located Windsor Reservoir facility owned by Pasadena Water and Power, including (1) an in-line micro-hydro turbine system for the pressure-reducing station and (2) a photovoltaic (PV) system
- Evaluate more opportunities for reducing water intensity of well operations/flushing and treatment unit backwash, taking into account the high economic value of Los Angeles Basin water
- Coordinate with Pasadena Water and Power to optimize decision-making regarding options such as a power purchase agreement, green power purchasing, peak shaving, peak shifting, and emergency power for the co-located facilities

### Results:

- Reduced the proposed water treatment system's pressure head as a result of optimization, which allowed integration of smaller pumps with lower energy demands
- Reduced capital costs for the new municipal water treatment plant by \$400,000 due to elimination of the original water treatment process involving post-filtration cartridge filters
- Avoided \$50,000/year and 330,000 pounds/year of greenhouse gas emissions due to reconfigured pumping and optimization, when compared to the original construction plan
- Recycled 95% of the waste generated during construction of the municipal treatment plant, including 744 tons of rock, 48 tons of concrete, 8 tons of steel, and 5 tons of mixed debris
- Used native, drought-tolerant plant species to landscape the new treatment plant, which included perimeter trees serving as a visual and noise buffer between the facility and nearby residences

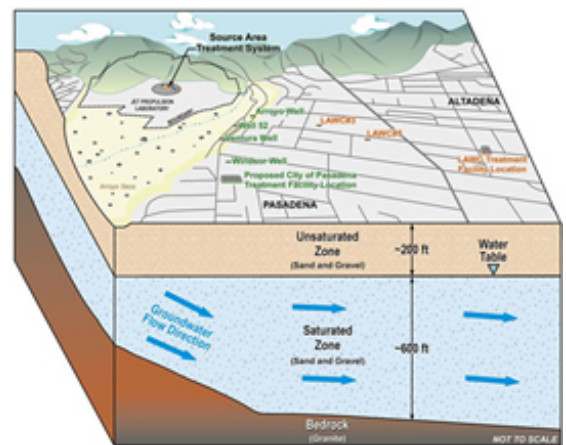
- [City of Pasadena] Began operating the new plant (known as the Monk Hill Transfer Station) at a location in the approximate center of the contaminated groundwater plume; since October 2011 startup, the plant has treated groundwater at a rate reaching 7,000 gallons per minute
- Treating the plant wastewater (generated from periodic flushing and backwashing) and discharging it to an onsite spreading basin rather than discharging untreated wastewater to the sanitary sewer; this results in an estimated aquifer recharge of nearly 100 acre-feet each year
- [City of Pasadena] Completed installation of a 564 kW roof-top PV system in May 2011 at the Windsor Reservoir facility adjacent to the Monk Hill Transfer Station; under a 20-year power purchase agreement, the PV system is expected to annually generate 869,158 kWh of energy (approximately 20% of the treatment system's electricity consumption, or the equivalent power used by 100 to 125 average Pasadena homes)
- Contributing to sustainable environmental stewardship of the Los Angeles Basin, which suffers from VOC and perchlorate contamination caused by multiple sources

**Property End Use:** Ongoing missions of the National Aeronautics and Space Administration

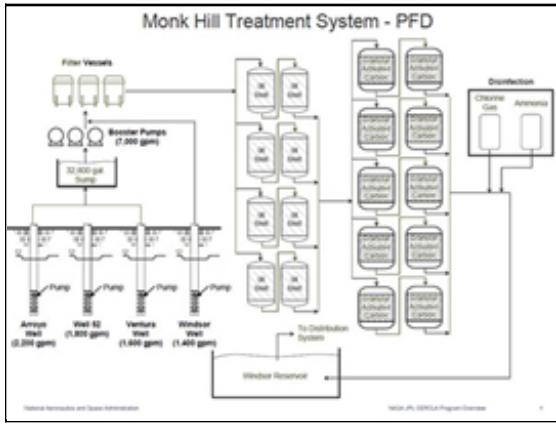
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JPL is located in the upper Los Angeles River Basin, which provides 6% of California's habitable land and only 0.06% of the state's stream flow - but 45% of the state's population.



Conceptual plans for addressing the contaminant plumes involved extracting groundwater through four offsite wells downgradient of the JPL source area and pumping it to the city of Pasadena's Monk Hill Transfer Station for treatment.



JPL worked extensively with Pasadena Water and Power to identify opportunities for optimizing energy- and water-intensive operations of the treatment facility to be constructed at the city's "Monk Hill" Transfer Station.

**Estimating Energy Cost - Baseline**

Description	Total Sump (\$/Year)	Total Wells (\$/Year)
Customer/Meter Charge	\$1,923	\$2,891
Distribution Charge	\$94,255	\$69,459
Transmission Charge	\$18,591	\$13,746
<b>Energy Service Charge</b>		
Summer On-Peak (noon-8PM)	\$36,753	\$26,626
Summer Off-Peak (8PM to noon)	\$68,302	\$52,229
Winter On-Peak (6AM-10PM)	\$24,727	\$18,388
Winter Off-Peak (10PM-6AM)	\$23,747	\$18,072
Power Cost Adjustment	\$23,180	\$17,139
Public Benefit Charge	\$19,240	\$14,226
<b>Annual Total (\$543,492)</b>	<b>\$310,718</b>	<b>\$232,774</b>

Assumptions and Notes:  
 • Utilizes current PWP rates (effective October 1, 2007) schedules L-1 and M-1.  
 • NASA pays energy costs for sump pumps, PWP pays energy costs for production wells.

Electricity consumption of the optimized Monk Hill treatment system totals 1,949 kWh per million gallons of water treated in contrast to the original baseline of 2,150 kWh per million gallons of water treated.



The grid-connected PV system consists of 2,772 silicon PV modules covering more than 50,000 square feet of the roof above the "Windsor Well" pumping station.



The new municipal water treatment plant handles contaminated groundwater extracted by the four previously closed and now upgraded water production wells.

**NASA Jet Propulsion Laboratory (JPL)**

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[http://www.cluin.org/greenremediation/profiles/subtab\\_d24.cfm](http://www.cluin.org/greenremediation/profiles/subtab_d24.cfm)



**United States Environmental Protection Agency  
 Office of Solid Waste and Emergency Response (5202P)**

**For more information:**  
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