

ATTACHMENT A

Hügelkultur Demonstration Project Grant Application



PASADENA
Water & Power
SERVING THE COMMUNITY SINCE 1906

Hügelkultur Demonstration Project



Water Conservation Field Services Program, Lower Colorado Region Financial Assistance for Fiscal Year 2019

PREPARED FOR:

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September 30, 2019

Pasadena Water & Power
Hügelkultur Demonstration Project



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Steve Madison, Andy Wilson

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(Start 15-page Technical Proposal and Evaluation Criteria)

SECTION 1. TECHNICAL PROPOSAL

A. EXECUTIVE SUMMARY

Date: September 30, 2019

Applicant Name: City of Pasadena Water & Power (PWP) Department

City: Pasadena

County: Los Angeles

State: California

One Paragraph Project Summary. PWP requests \$86,904 in funding from BOR (45% of total project costs) for the proposed Hügelkultur Demonstration Project. The total project cost is estimated at \$193,121. The purpose of the proposed project is to test a centuries-old, European horticultural technique—hügelkultur—for its ability to reduce or eliminate irrigation in municipal landscape settings. PWP has identified three City-owned demonstration sites on which 15 hügels (average size 5' x 25') will be installed and planted with native, drought-tolerant plants, shrubs, and trees. The proposed project will provide funding for project management; procurement of expert consultants who will design and install the hügels and plantings; rigorous quantitative and qualitative data collection and analysis to demonstrate the project's irrigation savings and other outcomes; and outreach and dissemination to the community and to City departments to promote adoption of the technique as a 'best practice' (assuming that the outcome of the demonstration is positive). The project is directly aligned with the objective of this BOR program and the demonstration category: PWP proposes to test a water conservation technique that has not yet been tried by the City. The technique has the potential for significant water savings related to irrigation, which represents more than 50% of water use across residential, commercial, and municipal settings. PWP is under more pressure than ever to encourage the public to save water, and to expand its own water conservation portfolio. The proposed project is a chance for PWP and the City to assess an 'outside of the box' strategy. **Project Timeline.** The project is anticipated to begin in Spring 2020 and will be completed in 24 months.

B. Technical Project Description

TASK AREA COMPONENT: Demonstrating Conservation Project Technologies.

PWP requests funding to test a permaculture technique ('hügelkultur') to assess the technique's potential to reduce or eliminate irrigation requirements in municipal applications such as landscapes, medians, tree plantings, etc. Hügelkultur mimics natural woodland processes and uses existing natural resources to support sustainable landscapes. PWP has never tested or used the technique, but has been encouraged by findings from the Los Angeles Arboretum and Botanical Garden who tested the technique in a small garden that has not been irrigated *in four years*. PWP has outlined a solid data collection and analysis plan to assess

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water use (and other metrics) at three demonstration sites, and to predict potential water savings if the technique were scaled for future widespread use by the City and residents.

Location and Background of Organization

PWP is located in the City of Pasadena, within Los Angeles County in Southern California. PWP was initiated by City Ordinance in 1906, and in 1912 Pasadena municipalized its water service. PWP's water service area covers 26 square miles, with a service area population of 169,868, and 38,000 water accounts resulting in 89.3 gallons-per-capita per day of residential usage. PWP customers use, in total, approximately 27 million gallons of water each day. PWP relies on two main sources of water supply: 1) local groundwater from the Raymond Basin, a 40-square-mile natural aquifer underlying Pasadena and neighboring cities, and 2) imported water purchased from the Metropolitan Water District of Southern California (Metropolitan, letter of support is provided in Section 4). The supply mix has historically averaged 60% imported and 40% local. Rainfall is the main source of water that replenishes the Raymond Basin. PWP and other water agencies only pump water out of the Raymond Basin that is equal to what is naturally replenished. PWP has 17 wells that tap into the Raymond Basin at depths of 300-400 feet, drawing out 13 million gallons of groundwater or more per day, on average. These wells feed groundwater into 14 reservoirs that have a storage capacity of 110 million gallons. The reservoirs also hold purchased water from Metropolitan. Jones Reservoir, PWP's largest reservoir, can hold about 50 million gallons of water and Lida Reservoir is the smallest with a 0.43-million-gallon capacity. PWP also has 19 booster stations, and two treatment plants. Water is disinfected and blended in the reservoirs then distributed to the customers through a pipeline network of 520 miles of mains throughout the city.

Current Water Users. According to PWP's 2015 Urban Water Management Plan, residential water use accounted for 61% of PWP's overall water use (46% single family and 15% multi-family), followed by commercial and industrial uses (29%). Institutional/governmental uses (2%), other uses (1%), and water losses (8%) accounted for the remaining water uses.

Current and Projected Water Demand. In FY 2018, PWP's total water production was 29,465 acre feet (AF), consisting of 19,824 AF of water purchased from Metropolitan (67%) and 9,641 AF produced from groundwater (33%). FY 2018 total production was 13% less than FY 2014 (and similar to demand in the 1950s) due to PWP's aggressive ongoing water conservation efforts. PWP's 2015 Urban Water Management Plan estimates projected water demand through the year 2040 is 33,000 AFY or a 12% increase from FY 2018, which could eliminate gains made to-date.

Potential Shortfalls in Water Supply. California's historic seven-year drought was proclaimed to be officially over as of March 2019. However, due to California's climate, droughts are common and dry conditions should be expected. PWP will remain vigilant and continue to aggressively promote conservation programs and strategies. For example, the City will continue to limit outdoor watering to one day per week during the winter and no more

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than three days per week during the summer. PWP will also continue to identify conservation strategies to add to its portfolio, such as the proposed project.

Purpose and Objectives of the Proposed Project

Purpose and Goal. The purpose of the proposed project is to test a permaculture technique ('hügelkultur') to assess the outcomes (described below) and determine if the technique can be scaled to municipal applications (i.e., landscapes, medians, tree plantings, etc.) to reduce or eliminate the need for irrigation. The project will design and install hügels in three locations (described below), and plant native plants, shrubs, and trees. The project will also include a rigorous data collection and analysis component, and community outreach to disseminate findings and encourage wide-spread adoption of the technique as a 'best practice' (if the technique is determined to be successful).

Objectives.

- 1) Conduct soil and site assessment at the three project sites to inform site-specific design;
- 2) Design and install hügels (totaling approximately 1,875 square feet) at three sites;
- 3) Plant native species of shrubs, flowers, and trees in the hügel beds (the planting window is limited to November through January);
- 4) Install signage at each of the three project sites explaining hügelkultur and expected outcomes and benefits, and include a dynamic element that counts days since the site was last irrigated;
- 5) Conduct monthly maintenance, monitoring, and data collection at each site (include pre-installation baseline data collection);
- 6) Disseminate findings and hügelkultur information and resources among City staff and residents; and
- 7) Promote adoption of hügelkultur as a city-wide 'best practice' first to PWP and later to other City departments.

Project Inclusion in Conservation/Management Plan. The proposed project is aligned with two local planning documents: PWP's Urban Water Management Plan and Water Integrated Resources Plan (WIRP). Though similar, the WIRP is a planning tool solely for Pasadena, while the Urban Water Management Plan is required of all water utilities by the California Department of Water Resources, and helps the state ensure an adequate supply for all California communities. The proposed project is directly aligned with the objectives of PWP's **2015 Urban Water Management Plan**¹ (adopted 2016). Key Objectives of the Plan that are aligned with the proposed project (should it be successful and scaled up citywide) include:

- Reduce baseline daily per capita water use by 20% by 2020;
- Implement water use efficiency programs (active conservation) to balance supplies and demands; and
- Implement additional water conservation best management practices in addition to current conservation efforts.

¹https://ww5.cityofpasadena.net/water-and-power/wp-content/uploads/sites/54/2017/08/2015_Final_UWMP.pdf

The **Water Integrated Resources Plan (WIRP)** adopted by PWP in 2011 is Pasadena's blueprint for ensuring reliable, cost-effective and environmentally responsible water supply for the next 25 years. Key objectives of the WIRP that are aligned with the proposed project's primary outcome of reduced or eliminated irrigation include:

- Protect receiving waters and the environment;
- Maximize efficiency of water use; and
- Reduce energy footprint for water operations.

The WIRP calls for increased local conservation programs within PWP's service area, and recommends measures that are reflected in the demonstration project including:

- Capture of urban storm runoff for groundwater recharge or non-potable use, and onsite irrigation use; and
- Promotion of drought tolerant landscaping.

The WIRP estimated that even moderate levels of conservation have the potential to save over 5,000 AFY by the year 2035.

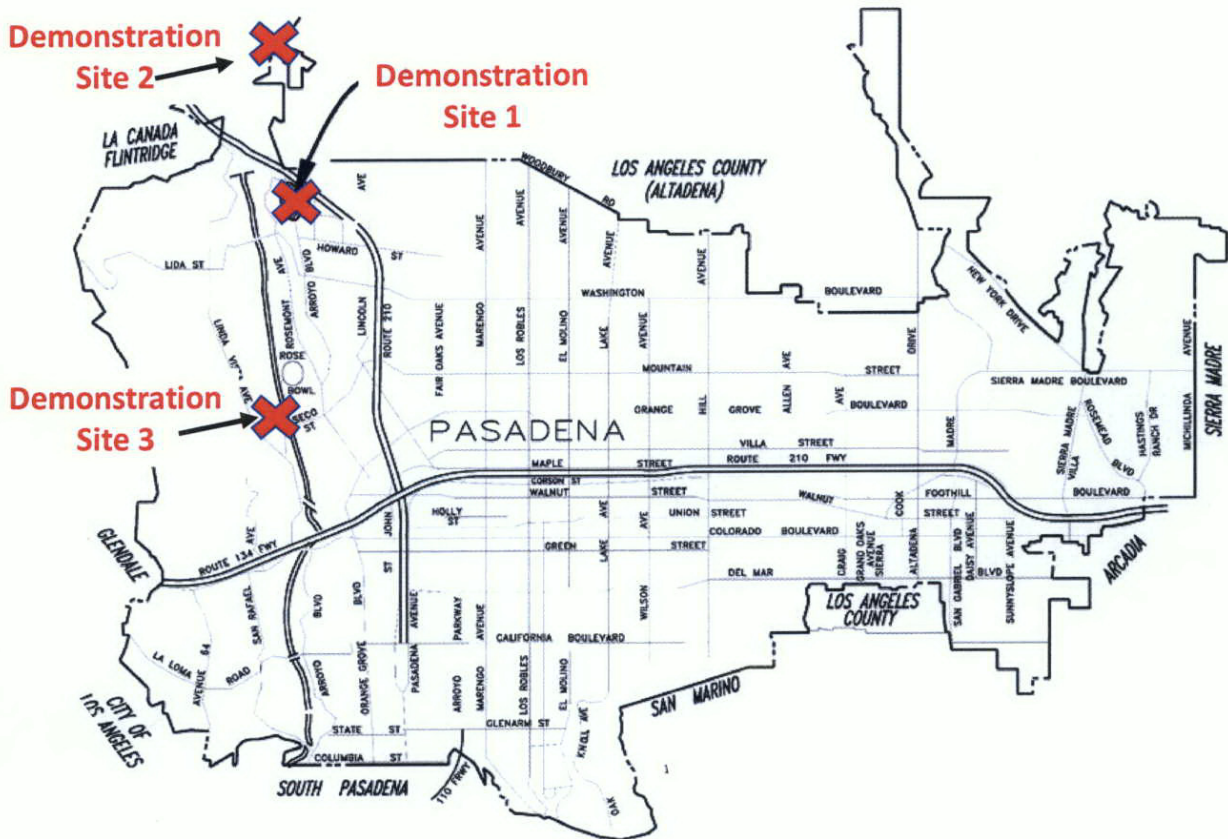
Project Location. The proposed demonstration project will be located at three high-visibility sites in the City of Pasadena (see Fig. 1, below). The City's proposed project will include 15 hügel (approximately 1,875 total square feet) across three demonstration sites. The three proposed project sites are described below; photos are included in Appendix 1.

1) Sheldon Reservoir Demonstration Garden (North Arroyo Boulevard and Coniston Road). This 20,000-square foot demonstration garden is currently under construction (design plans are provided in Appendix 2), and is located at a local reservoir that is bordered by open green space. The garden will feature four distinct landscape plant palettes: California Native, Mediterranean, Southwest, and Firewise, and will be accessible to the public via a walking trail. The installation at the demonstration garden will include seven hügel and be approximately 875 square feet (all other plantings at the demonstration garden are funded outside of the scope of this project).

2) Arroyo Seco Canyon (North Arroyo Boulevard and Explorer Road, nearest intersection). This site is adjacent to PWP's Behner Water Treatment Plant, and across the road from the campus of Jet Propulsion Laboratories (JPL). Walking and biking trails run alongside the site and are popular with JPL staff and nearby residents. The site is home to the Upper Arroyo Enhancement Program (underway), which aims to restore habitat, increase storm water infiltration, clear brush, and encourage the return of native flora and fauna. The clearing needed to accomplish the program's goals will involve the removal of 20 or more non-native trees which will be used on-site in the proposed hügel instead of being burned (emitting greenhouse gases) or sent to the landfill. The installation at the Arroyo Seco site will include five hügel and be approximately 625 square feet.

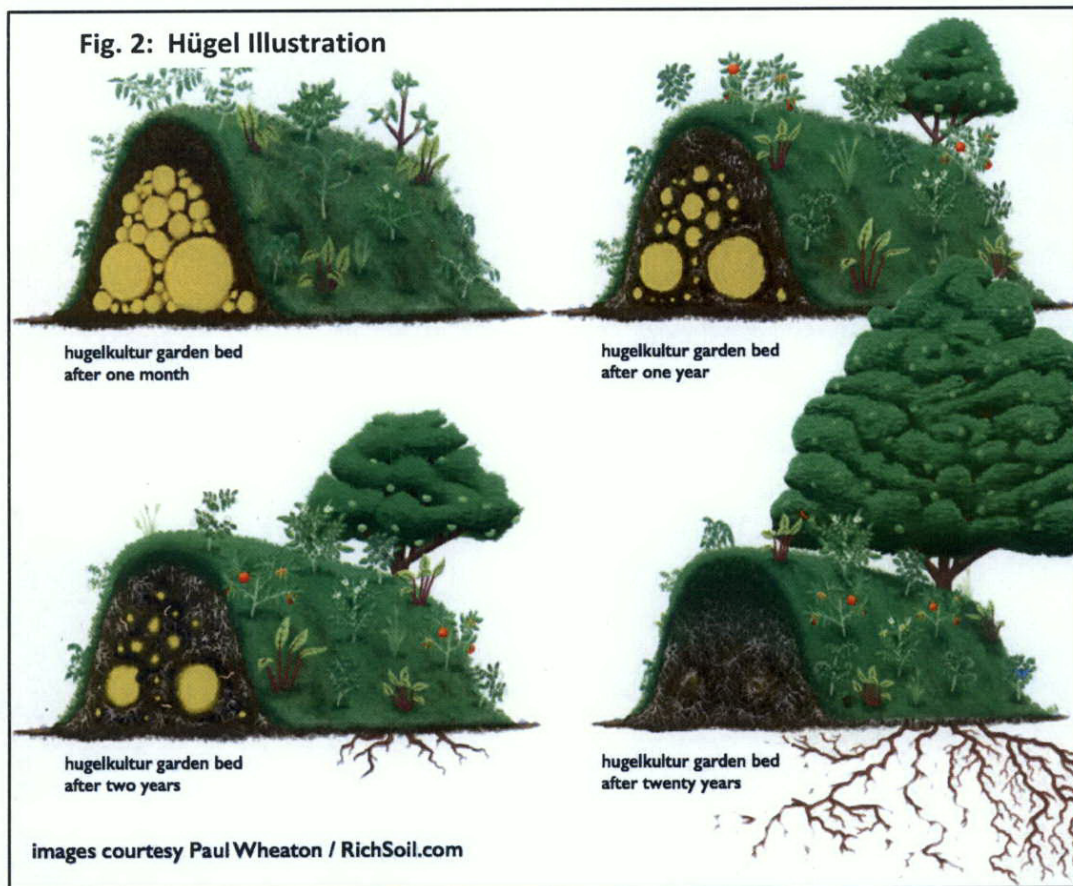
3) Linda Vista Booster Station (Seco Street and West Drive). This high-visibility site is at a PWP booster station located across the street from the Rose Bowl Stadium (seating capacity 92,542). Sidewalks run along the site on both sides of the street, and the area is a popular route for pedestrians. The installation at the Linda Vista site will include three hügel and be approximately 375 square feet.

Fig. 1: Location of Proposed Demonstration Sites



Proposed Technical Work

Background. PWP seeks to test a centuries-old, European horticultural technique—hügelkultur—for its ability to reduce or eliminate irrigation in municipal landscape settings. Hügelkultur is a no-dig technique that utilizes decaying wood debris and other compostable biomass in a raised and mounded bed on which plants, trees, and shrubs can be planted. Hügelkultur needs whole trunk wood as a base to be successful, as this decomposes slowly and steadily, rather than all at once (which is what happens if you only use smaller biomass like twigs and bark chippings). Hügelkultur mimics natural woodland processes where woody debris and other biomass falls to the forest floor, over time becomes sponge-like—soaking up rainfall and slowly releasing it into the surrounding soil—and thus making the moisture available to surrounding flora (see Fig. 2 for an example of a hügel). Of interest to PWP is hügelkultur’s ability to retain significant amounts of moisture. Moisture retention is accomplished through four complementary processes: 1) rainwater capture. The mounded hügel has increased surface area to capture more rainwater. Capture can be maximized with the concurrent usage of bioswales and berms to channel and infiltrate rainwater; 2) the hügel’s “sponge.” The slowly decomposing biomass in the hügel acts as a sponge that retains water over a long period of



time; 3) ongoing condensation that occurs due to the temperature differential between the heat generated by the hügel's slow decomposition and the surface air that is cooled by evaporation; and 4) hügels are an ideal medium for mycorrhizal fungi to flourish, infiltrating the entire bed of piled logs, converting their carbon into nourishment for plants growing above, and distributing moisture horizontally in the area surrounding the hügel. These processes, especially the proliferation of mycorrhiza, significantly improve soil health, further contributing to hügels' ability to produce robust plants, shrubs, trees, and landscape with minimal (or no) irrigation. A local pioneer of hügelkultur implementation is the Los Angeles County Arboretum and Botanical Garden. The Arboretum's Crescent Farm has a five-year-old, flourishing hügel that is home to native flowering shrubs such as Chuparosa (*Justicia californica*), White Sage (*Salvia apiana*), and California Buckwheat (*Eriogonum fasciculatum*), evergreen shrubs such as Sugar Bush (*Rhus ovata*), and trees such as Desert Willow (*Chilopsis linearis*) and Blue Elderberry (*Sambucus nigra* ssp. *caerulea*).

Significantly, Crescent Farm has not irrigated their hügels in more than four years; the hügels are now completely self-sustaining. To confirm their anecdotal findings, the Arboretum sent soil samples of the hügel beds and a control comparison of unamended soil to the Cornell Soil

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Health Analysis Lab. The analysis found that their hügel significantly improved the soil's ability to retain water and provide plant nutrients. Available water capacity, organic matter content, and aggregate stability (i.e., the strength of soil structure) in the hügel beds were vastly improved compared to the unamended soil. The expected benefits of hügelkultur include:

- Reduced or eliminated need for irrigation due to significantly enhanced soil moisture retention;
- Sequestered carbon on-site by burying debris and woody material in the ground;
- Improved soil health;
- Captured and slowed storm water flows, allowing it to infiltrate at its source;
- Increased waste diversion of dead trees and other biomass from landfills;
- Cooling of the ambient air surrounding the hügel; and
- Enhanced biodiversity and habitat value.

Additionally, the proposed project will complement Metropolitan's (provider of the City's imported water supply) current turf removal program, which offers residents \$2 per square foot to remove turf grass and replace with more water-efficient landscaping. Hügel beds are a unique landscape alternative for residents to consider, as they can utilize the removed turf grass as part of the hügel's foundational biomass and avoid disposing of the turf at an off-site location like the landfill. PWP's project will include dissemination of information and resources to residents to illustrate the benefits of hügelkultur and encourage widespread adoption of the technique. All three demonstration sites will provide residents the opportunity to see hügel up-close and monitor their sustainability over time.

Hügelkultur is not revolutionary; it is an example of a vintage, natural technique that has been overlooked amidst the modern world's advanced technology. As climate change and ongoing drought continue to have significant effects on Pasadena, PWP is seeking to think 'outside the box' for water conservation solutions and techniques that are easily implemented with maximum effect. To this effect, PWP will implement a two-year project to design and install the proposed hügel, assess their effectiveness, disseminate findings locally, and prepare for widespread use of the technique citywide. The specific project tasks are described below.

Task 1: Grant Administration and Performance Monitoring

PWP has identified experienced staff to manage the grant and project, including executing the grant agreement, and managing reimbursement requests and semi-annual and final performance reporting to BOR. PWP will monitor project performance throughout the project period, including monitoring critical milestones, the budget, and schedule, and make real-time project implementation adjustments as needed.

Task 2: Procurement

PWP will procure the following types of services: 1) site assessment and site-specific design;

2) hügel and plant installation; 3) data collection and analysis; and 4) sign fabrication and installation. These tasks are discussed in more detail below. It is possible and likely that a single qualified vendor may be able to provide all of the required services. PWP maintains a list of pre-qualified vendors who have open purchase orders, and these include those with the expertise and experience needed to successfully complete the proposed project. As required, PWP will request a minimum of three quotes from interested vendors, but selection will skew heavily toward those with knowledge and experience with hügelkultur.

Task 3: Site Assessment and Site-Specific Design

The contractor will be responsible for conducting a thorough assessment of each site's space to test soil conditions, and assess hydrology, slope, and possible site orientation. Each of the three sites will be designed to identify:

- Optimal size (the average hügel is estimated to be 5' x 25' feet) and height;
- Hügel materials (some may require different materials depending on conditions);
- Planting materials (i.e., trees, shrubs, and plants optimal for each site – all plants will be California Natives);
- Orientation relative to nearby slopes and direction of sunlight; and
- Need for complementary installations (swales, berms, etc.).



Fig. 3: Example of a hügel and plantings that could be used in municipal, residential, or commercial settings.

Task 4: Installation and Monitoring

The contractor will be responsible for installation of the 15 hügels at the three demonstration sites, and will be assisted with heavy labor by two PWP City Service Workers and at-risk youth and adults from the local chapter of Outward Bound (their letter of support is provided in Section 4). Major installation subtasks include:

- Identify and acquire materials appropriate for use in the hügels' construction. Some woods are not appropriate such as cedar which is rot-resistant, and black walnut which is known to adversely affect other plants. PWP has begun to compile and save woody debris. Examples of biomass to acquire include:
 - Fallen logs, branches, twigs, and fallen leaves at the demonstration sites, and saved from other sites in the City (e.g., diseased or felled trees); and
 - Top soil (enough to cover the other layers of the bed with a depth of 1 – 2"); turf that is being replaced can be used as the top layer.
- Install the hügels tasks will include:
 - Site preparation including grading, trenching (if needed), and planning for water overflows;
 - Lay the logs (the largest of the biomass debris) down as the first layer, and add a layer of branches, then a layer of small sticks and twigs; these foundation layers

- must be watered well. The more wood inside the hügel, the less water it will need, and possibly no supplemental irrigation after establishment;
- Fill in spaces with leaf litter and other smaller biomass/debris; and
 - Top off the bed with 1 – 2” of top soil and a layer of mulch. The contractor will utilize lasagna/sheet mulching technique, including use of cardboard which supports the growth and proliferation of mycorrhizal fungi, which will support the hügel’s establishment and proliferation.
- Quality control inspections will be conducted before and after hügel installation by a PWP Water System Operator who will ensure that the installation will have no adverse or negative impacts to existing habitat and hydrology.
 - Monitoring will be conducted weekly for the first six months, and monthly thereafter (at the same time as data collection, described below) to check for weeds, pests, assess irrigation needs, and provide irrigation during the establishment period (PWP anticipates that irrigation will only be required for the first 3-5 months).
 - Plant and tree installation will be conducted in November-January after hügel installation. It is ideal to let the hügels “rest” before planting to promote establishment. The plant palette will be identified during the design phase and will be site-specific. The palette will focus on species that are California native and drought-tolerant.

Task 5: Evaluation

The contractor (assisted by PWP staff) will collect and analyze both quantitative (e.g., soil moisture content and irrigation requirements) and qualitative data (e.g., staff notes) to demonstrate the success of the hügels, with the goal of documenting reduced or eliminated irrigation needs. The project team will identify a matched comparison site for each hügel site. The project team will conduct both descriptive and inferential analyses to describe, compare, and contrast the hügel and matched comparison sites, and to make predictions of potential water savings if the hügelkultur technique was scaled for widespread usage by the City and residents. Data collection and analysis will be conducted by the expert contractor, with assistance to be provided by PWP staff. Additional details are included in Section C: Evaluation Criteria.

Task 6: Dissemination and Outreach

The project’s Outreach Coordinator will be responsible for outreach and dissemination tasks including:

Site-Specific Signage. The project will install signage at each demonstration site that explains how the hügel functions, overall benefits, and will include a QR code that allows visitors to quickly access PWP’s website from their smartphone to see the number of days since the hügel was watered (this figure will change over time, and illustrate how little water the hügel requires, e.g., “This hügel garden has not been watered in XXX days”). The signs will be made of metal, placed on wooden posts, and elevated for ease of reading.

Community Outreach. Dissemination will include: Social Media. The project will target PWP’s own social media channels including Facebook (1,500 followers) and Twitter (2,000 followers), as well as those of the City of Pasadena and Metropolitan. PWP’s Twitter account

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just recently retweeted Metropolitan's flyer for their Turf Removal Program, and PWP will seek to cross-promote the hügelkultur project in a similar fashion. Posted and Distributed Flyers. Color flyers will be designed and printed for posting in PWP's offices and other locations, and to distribute to customers who are interested in the program (e.g., to take from PWP's offices or from the technical assistance workshops) or to other entities that wish to promote the project (e.g., City Community Centers). Other Dissemination. Information will also be shared via PWP's *Watts* e-Newsletter, Home Water Reports mailed to residential customers four times per year, and on PWP's web banners. Information will also be included twice per year in the City's *Pasadena-in-Focus* newsletters that are mailed to all residents every two months.

Dissemination to City Staff. Outreach to City staff will be conducted by the Project Director and Project Coordinator. During the course of the proposed project, outreach will focus on staff at PWP. Every six months after the hügel installation, Project Update Reports will be developed that provide updated site-specific outcome data, aggregated outcome data for all sites, photos, and other information to keep staff apprised of project results and support widespread support and adoption of the hügelkultur technique. Project staff will make presentations to PWP staff to share these reports, invite staff to tour the demonstration sites, and work toward a department-wide adoption of hügelkultur as a landscape 'best practice'. Project staff will then focus their efforts on the City's Department of Public Works, whose Parks and Natural Resources Division is responsible for the City's 23 parks comprising more than 1,000 acres of green and open space (the outreach to the Public Works Department will likely happen after the conclusion of the proposed project).

The project is simple and straight-forward, requires no permitting, no engineering, minimal landscape design work, and no new policies or administrative actions to initiate the project. PWP can begin implementation of the proposed two-year project immediately upon grant award. PWP's water conservation program portfolio includes a number of demonstration programs of similar size and scope to the proposed project. PWP will leverage existing procedures, materials, forms, etc., which will accelerate start-up and implementation.

Environmental Compliance. Hügel installations will be performed in locations with previously disturbed ground, and will present no environmental issues or impacts. PWP expects the project to be classified as a "Categorical Exemption." PWP included \$4,000 (approximately 2% of total project costs) in the project budget for costs that will be incurred by BOR and PWP to complete paperwork.

Implementation Plan and Schedule. See Table 1, below. Major project milestones include:

- Environmental Compliance (complete by Month 1)
- Procurement (complete by Month 2)
- Site Assessment and Site-Specific Design (complete by Month 5)
- Hügel Installation at Three Demonstration Sites (during Month 6)
- Planting (November through January after hügel installation - *preferred*)
- Data Collection (Months 5-24) and Final Analysis (Month 24)

- Semi-Annual and Final Performance Reporting (Months 1-24)

C. EVALUATION CRITERIA

Association with Reclamation Project Water Supplies

PWP receives approximately 60% of its water from the Metropolitan Water District of Southern California, which is the designated contractor for the Colorado River Aqueduct and the State Water Project. Both the Colorado River Aqueduct and the State Water Project are Bureau of Reclamation facilities. PWP has an agreement (#22,109) for purchase of system water provided by Metropolitan. The term of the agreement is for 10 years, expiring December 31, 2024.

Water Management Plan is Complete and Updated

The proposed project is directly aligned with the objectives of PWP's **2015 Urban Water Management Plan**² (adopted 2016) which is required of all water utilities by the California Department of Water Resources. The Plan includes an analysis of long-term water supply and demand planning for PWP, including system analysis, reliability assessment, water-use targets, water shortage contingency planning, demand management and climate change impact. As described above, several Key Objectives of the Plan are aligned with the proposed project including implementation of water efficiency and conservation programs, and reduction of baseline daily per capita water use by 20% by 2020. PWP's Urban Water Management Plan will be updated in 2020, as required. PWP also maintains a **Water System Master Plan** that guides long-term investments for the City's water distribution systems, and a **Water Integrated Resources Plan** that is the blueprint for ensuring reliable, cost-effective and environmentally responsible water supply for the next 25 years. In FY2019, PWP began to update the Water System Master Plan and the Water Integrated Resources Plan as a combined document, known as the **Water System and Resources Plan**.

Reasonableness of Cost

- PWP conferred with staff at the Los Angeles Arboretum and Botanical Garden for guidance in estimating costs to ensure that the budget is realistic and appropriate. The Arboretum has a five-year-old hügel at their Crescent Farm, and their staff are familiar with associated costs and requirements (their letter of support is included in Section 4).
- The Arboretum's staff also provided guidance on the work plan and timeline; PWP is confident that the work can be completed successfully within the 24-month time frame.
- If the technique is shown to reduce or eliminate irrigation needs, the benefits could be significant. If the technique were optimally scaled up city-wide (across residential, municipal, and commercial settings), and resulted in even a 5% reduction in irrigation, the cost savings (from imported water from the State Water Project and the Colorado River) would be \$639,254 annually representing 593 AFY saved. The proposed costs are believed to be reasonable and a sound investment of BOR and PWP's resources.

²https://ww5.cityofpasadena.net/water-and-power/wp-content/uploads/sites/54/2017/08/2015_Final_UWMP.pdf

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TABLE 1: WORK PLAN AND SCHEDULE (24-Month Project)

No.	Milestone/Task/Activity	Start Date	End Dates
1.0	Grant Administration and Performance Monitoring		
1.1	Executed grant agreement	Month 1	Month 1
1.2	Environmental compliance MILESTONE	Month 1	Month 1
1.3	Grant administration and performance monitoring	Month 1	Month 24
1.4	Submit semi-annual requests for reimbursement	Month 6	Month 24
1.5	Submit semi-annual progress reports MILESTONE	Month 6	Month 24
1.6	Submit final performance report and payment request MILESTONE	Month 23	Month 24
1.7	Records retention (for 3 yrs. after final payment)	Month 25	Month 60
2.0	Procurement		
2.1	Develop and issue Request for Quotes	Month 1	Month 1
2.2	Review proposals, select contractor(s), and execute agreements MILESTONE	Month 2	Month 2
3.0	Site Assessment and Site-Specific Design		
3.1	Conduct site assessment to test soil conditions, etc.	Month 2	Month 4
3.2	Develop site-specific designs, e.g., hügel size, orientation, etc. MILESTONE	Month 4	Month 5
4.0	Installation and Monitoring		
4.1	Identify and acquire materials	Month 4	Month 4
4.2	Install the hügels MILESTONE	Month 4	Month 6
4.3	Conduct quality control inspections	Month 4	Month 6
4.4	Monitoring (weekly for mos. 1-6, then monthly, includes initial irrigation)	Month 6	Month 24
4.5	Plant and tree installation (prefer planting to occur in Nov-Jan after hügel installation) MILESTONE	Month 8	Month 8
5.0	Evaluation		
5.1	Set up MS Excel database	Month 2	Month 2
5.2	Collect baseline and 18 months of data MILESTONE	Month 5	Month 6-24+
5.3	Conduct ongoing descriptive analyses; quarterly reports to PWP	Month 5	Month 6-24+
5.4	Conduct final summary and inferential analyses; final report to PWP MILESTONE	Month 22	Month 24
6.0	Dissemination and Outreach		
6.1	Fabricate and install signage; set up QR code link to PWP's website	Month 2	Month 8
6.2	Create fact sheets; conduct community outreach (e.g., social media, newsletters, etc.)	Month 2	Month 6
6.3	Design and create dissemination reports and slide presentations	Month 10	Month 12
6.4	Disseminate/outreach to senior PWP staff to promote adoption of hügelkultur as a 'best practice'	Month 12	Month 24

- All required budget materials are included in Section 5 (including a detailed budget narrative that provides calculations for each budget line item).
- All project tasks are reflected in the budget, and all costs are eligible per the Funding Opportunity Announcement. 85% of the budget is devoted to the design, installation, monitoring, and evaluation of the hügels.

Proposed Activity Demonstrates Innovative Conservation Technologies

The proposed project will test the ability of an existing permaculture technique called hügelkultur to reduce or eliminate the need for irrigation in municipal applications such as landscapes, medians, tree plantings, etc. Hügelkultur is not new; it is a centuries-old European technique that has been overlooked amidst the modern world's advanced technology. Hügelkultur's implementation has traditionally been used for smaller-scale flower and vegetable gardens. PWP seeks to assess whether the technique can be used in non-traditional settings, e.g., when replacing diseased trees or creating new green medians. Hügelkultur mimics the nutrient cycling found in a natural woodland where woody debris and other biomass that falls to the forest floor become sponge-like, soaking up rainfall, creating its own heat and condensation which cools the landscape on the surface, and releasing moisture slowly into the surrounding soil to the benefit of nearby plants and trees. The technique is a prime example of sustainability: A properly designed and installed hügel can (reportedly) operate optimally for up to 20 years, with little or no irrigation. Few studies have been conducted to study hügelkultur. A 2016 study³ in rural southwest China (where extreme soil loss has exposed the bedrock and reduced the land's ability to sustain life) found that hügels demonstrate high water holding capacity and have serious implications for renewed agricultural productivity. PWP learned of the technique from biologists at the Los Angeles Arboretum and Botanical Garden who have tested a hügel garden for the last five years with little to no need for irrigation and found that outcomes in the hügel beds were vastly improved compared to unamended soil. PWP has outlined a solid data collection and analysis plan to demonstrate the technique's water conservation potential, and has outlined an outreach and dissemination plan to promote the technique for scale-up at applicable future sites throughout the City and to encourage residents to use the technique when converting their turf landscapes, planting new trees, etc. PWP has received strongly positive support for the project from Metropolitan Water District of Southern California, the Los Angeles Regional Water Quality Control Board, and the Los Angeles County Department of Parks and Recreation, all of whom have noted interest in receiving results from PWP's project (letters of support are provided in Section 4).

Federal Funding Would Promote Completion of the Project. As a small-scale demonstration, the project ranks low in terms of priority (and likely funding) from the City. The City's spending related to water conservation is focused on larger-scale implementation projects with known outcomes and results. PWP anticipates that the demonstration project will have positive outcomes related to water conservation, and—if so—is likely to be adopted for widespread use to help the City meet its ongoing water conservation targets (i.e., reduce its per-capita daily water use 20 percent by 2020). In the interim, funding support is needed to demonstrate the benefits of hügelkultur, and promote its widespread adoption. The proposed scope of work (described earlier) includes a task to disseminate the results of the project to illustrate (to city officials and residents) the potential for water savings due to reduced or eliminated irrigation.

³ Laffoon, Megan, "A Quantitative Analysis of Hugelkultur And Its Potential Application On Karst Rocky Desertified Areas In China" (2016). <http://digitalcommons.wku.edu>

Non-Federal Funding of the Required 50% Cost-Share

The total project cost is \$193,121. The Funding Plan in Section 5 shows that PWP will provide all of the non-federal cost share (\$106,217) representing 55% of total project costs which exceeds the minimum 50% required cost share; the funds are secured via PWP's Water Conservation Fund. The funding requested from BOR (\$86,904) represents 45% of total project costs. There are no third party costs, nor funding from other Federal partners.

Addressing Environmental and Cultural Resources

The proposed project will involve three sites, all of which are previously disturbed ground. The hügel installation is ideally a 'no-dig' technique that occurs above ground and no major excavation will be required. The three demonstration sites do not have known tribal or sacred affiliations. PWP anticipates that the project will present no environmental issues or impacts. PWP expects the project to be classified as a "Categorical Exemption," and has included costs in the project budget for BOR and PWP to complete the required paperwork.

Sound Implementation Strategy that Addresses Questions and Methodology for Discovering Outcomes PWP's implementation strategy was strategically developed with significant input from the Los Angeles Arboretum and Botanical Garden. Arboretum staff provided guidance on the development of the scope of work, identification of needed experts, required staffing and resources, the work plan, and anticipated costs. The Arboretum has five years of experience related to hügel design, installation, costs, monitoring, evaluation, etc., in addition to a multitude of years of experience in landscape design, installation, maintenance, and sustainable and regenerative horticultural practices. The Arboretum's hügels have not been irrigated in more than four years, but are green and robust with flowering plants, shrubs, and trees. PWP's evaluation task, which describes the proposed effort to scientifically collect and analyze data from the demonstration sites, is based on recommendations from the Arboretum, who themselves have had their hügels tested by a third-party (Cornell Soil Health Analysis Lab) to assess outcomes. The proposed outreach/dissemination tasks include sharing results with the community, but also specifically to promote the adoption of hügelkultur as a 'best practice' among senior-level PWP staff (assuming the outcomes of the demonstration project are positive). After the project, PWP will disseminate results to other City departments such as Public Works, who are responsible for the City's 1,000 acres of green and open space.

Strategy for Monitoring Performance and Reporting/Disseminating Results.

Project staff will collect and analyze both quantitative and qualitative data to demonstrate the success of the hügels, with the goal of documenting reduced or eliminated irrigation needs. The project team will identify a matched comparison site near each hügel site. The following quantitative data will be collected at each hügel site and its matched comparison site:

- 1) Soil moisture content;
- 2) Amount of applied irrigation;
- 3) Ambient air temperature; and
- 4) Soil nutrients and conditions (i.e., nitrogen, phosphorus, potassium, and pH).

Baseline data will be collected at the hügel and comparison sites prior to installation. In addition to the quantitative measures described above, monthly data collection will include the following qualitative measures: 1) photographs of each hügel and comparison site (taken from an

established marker at each site) to document changes in the sites over time, and 2) written notes documenting staff's other site observations. The project team will conduct both descriptive and inferential analyses to describe, compare, and contrast the hügel and matched comparison sites, and to make predictions of potential water savings if the hügelkultur technique was scaled for widespread usage by the City and residents. PWP anticipates that potentially 18 months of data will be available for analysis, and plans to analyze data and assess interim findings every quarter from month 6 to 24. Data collection and analysis will be conducted by the expert contractor, with assistance to be provided by PWP staff. PWP proposes an outreach and dissemination plan that includes dynamic signage at the demonstration sites, social media and other outreach through multiple channels (to share the water saving potential of the hügelkultur practices to the community), and targeted outreach to city departments to promote adoption of hügelkultur as a 'best practice.'

Department of the Interior Priorities

The proposed project aligns with the following Department of the Interior Priorities:

1. Creating a conservation stewardship legacy second only to Teddy Roosevelt

a. ***Utilize science to identify best practices to manage land and water resources and adapt to changes in the environment.*** The proposed project is an innovative horticultural technique that has been used for centuries, and is only recently been "re-discovered" as a way to reduce irrigation requirements. While the technique may be considered "vintage" technology, the technique is based in science. Hügelkultur exhibits the process of thermal mass (the ability of a material to absorb and store heat energy), mimics the nutrient cycling and decomposition found in a natural woodlands, exhibits ecological facilitation (species interactions that benefit at least one of the participants and cause harm to neither), and benefits from the physics involved in water absorption and retention.

b. ***Review DOI water storage, transportation, and distribution systems to identify opportunities to resolve conflicts and expand capacity.*** The project will demonstrate the ability to reduce or eliminate irrigation, which will reduce water waste and runoff, reduce water demand, and reduce pressure on imported supplies (which are sourced from BOR facilities).

2. Utilizing our natural resources. Hügelkultur uses resources that are naturally present at or near the site (fallen trees and other woody and green debris) to build a water-wise horticultural system that requires less irrigation. More than 50% of water use in Pasadena is related to irrigation; if this technique could be scaled up to widespread residential and municipal use, this "in situ" use of natural resources could help the City lessen its dependence on external resources, i.e., imported water which accounts for 60% of the City's current water supply.

(End 15-page Technical Proposal)

SECTION 2. ENVIRONMENTAL/REGULATORY COMPLIANCE INFORMATION

Impact on Surrounding Environment:

The proposed project will have a positive impact on the air and surrounding animal habitat, and no negative impacts are expected. Anticipated benefits include:

- Reduced or eliminated need for irrigation due to significantly enhanced soil moisture retention;
- Sequestered carbon on-site by burying debris and woody material in the ground;
- Improved soil health;
- Captured and slowed storm water flows, allowing it to infiltrate at its source;
- Increased waste diversion of dead trees and other biomass from landfills;
- Cooling of the ambient air surrounding the hügel; and
- Enhanced biodiversity and habitat value.

Additionally, widespread adoption of this innovative technique by the city and residents could multiply the above-noted benefits to a city-wide scale. Installation of hügel will require only minor soil disturbances, as the technique is ideally 'no-dig' where the hügel are installed on top of the ground. The project will not meet the threshold of cumulative environmental impacts.

Threatened or Endangered Species:

To the best of our knowledge, no species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat will be affected at the three proposed sites.

Impact to Wetlands or Surface Waters:

No wetlands are included within the City of Pasadena. However, there are surface waters within the City of Pasadena including:

- Raymond Basin (the source of the City's groundwater supply);
- Arroyo Seco Watershed and River (the river is a 24.9-mile-long seasonal river); and
- Eaton Wash Watershed.

The proposed project will have a positive impact on all of these surface waters by eliminating irrigation-related run-off which picks up pollutants that accumulate on the ground like dirt, bacteria, pesticides and fertilizer, trash, and motor oil, and flow into the nearest storm drain or local surface waters.

Age of Water Delivery System:

The City began providing municipal water services in 1912. The oldest components of the water delivery system were constructed in 1888 (i.e., Sunset Reservoir). The most recent upgrades (FY2018) to the system include replacement of approximately two miles of water

mains, replacement of 2,650 water meters, and replacement of 110 water meter boxes and vaults.

Modification of or Effects to an Irrigation System:

No modifications or negative effects are anticipated. PWP expects that the proposed project will reduce or eliminate the need for irrigation at the three proposed sites. Thus, municipal irrigation systems at the sites will be utilized less, less maintenance will be required, and—overall—the project will positively affect the longevity of these systems.

Buildings, Structures, or Features on the National Register of Historic Places:

The proposed project will not affect any public buildings, structures, or features that are listed or eligible for listing on the National Register of Historic Places because all activities will occur in established outdoor landscapes on municipal properties.

Archeological Sites:

There are no known archeological sites at the three proposed demonstration sites.

Adverse Effects on Low-Income or Minority Populations:

The proposed project will not have any negative or adverse effect on low income or minority populations. In fact, future adoption of the technique (and concomitant replacement of turf grass) by the City's low-income and minority populations would result in noticeable savings on their water bill and produce ambient cooling of their yards and landscapes.

Access to and Use of Indian Sacred Sites or Tribal Impacts:

There will be no impact to sacred or tribal land, as the three demonstration sites are not sacred nor tribal sites. All sites are owned by the City of Pasadena, and are sites that have been previously disturbed.

Noxious Weeds and Invasive Species:

The proposed project will not contribute to noxious weeds or invasive species. The project will use native and non-invasive plant and tree species, and the City will provide the palette to BOR in advance of planting. In fact, the increased health of the landscape at the three demonstration sites will help prevent growth and proliferation of noxious/invasive weed species. The three demonstration sites will be monitored monthly, and all weeds will be removed.

SECTION 3. REQUIRED PERMITS OR APPROVALS

No permits or approvals will be required for the City to work on landscape on City-owned properties. The three demonstration sites are on previously disturbed land.

SECTION 4. LETTERS OF PROJECT SUPPORT



September 20, 2019

Commissioner Brenda Burman
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 25007
Denver, CO 80225

Subj: Letter of Support for the City of Pasadena Water and Power Department's
Application to the Bureau of Reclamation

Dear Commissioner Burman:

The Los Angeles County Arboretum and Botanic Garden is pleased that our experimentation with hügelkultur, at our Crescent Farm demonstration site, has inspired the City of Pasadena Water and Power Department (PWP) to apply this valuable technique in a municipal setting. We strongly support their proposed demonstration project, which we are confident will show positive water conservation outcomes based on our own results. Hügelkultur is a horticultural approach practiced in Germany and Eastern Europe for hundreds of years that is being revitalized as a sustainable solution for contemporary landscapes. It is essentially a replication of the natural processes that richly replenish soils in forested areas. The Arboretum's Crescent Farm has a five-year-old hügel garden that has:

- Retained moisture on site through rainwater capture that has reduced the need for irrigation;
- Sequestered carbon on site by burying debris and woody material in the ground;
- Improved soil health due to an increase of nutrients from the decaying wood and the subsequent increase of mycorrhizal fungi and other organisms in the soil food web;
- Captured and slowed the flow of storm water, allowing it to infiltrate at its source; and
- Enhanced biodiversity and habitat value.

Pasadena Water & Power
Hügelkultur Demonstration Project

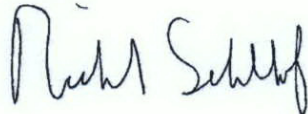
Commissioner Burman, Page 2

The Arboretum first experimented with hügelkultur as a way to recycle several trees that were damaged in the 2011 windstorm. Today, hügelkultur is one of several soil building processes used at Crescent Farm that reduce the need for irrigation while enhancing soil fertility and health.

The Arboretum's Crescent Farm team sent soil samples from the hügel beds and a control comparison of unamended soil to the Cornell Soil Health Analysis Lab. The analysis found that hügel soil exhibited enhanced ability to retain water and provide plant nutrients. Available water capacity, organic matter content, and aggregate stability (i.e., the strength of soil structure) in the hügel beds were improved compared to the unamended soil.

The Arboretum strongly supports applying organic matter to the soil as an essential practice that promotes thriving plants and landscapes in a changing climate and with ongoing drought. We hope you will give PWP the opportunity to demonstrate the use of this innovative water conservation technique. We believe their project will spur interest in hügelkultur throughout the County, and thereby contribute to significant gains in regional water conservation.

Sincerely,



Richard Schulhof
CEO, Los Angeles County Arboretum

Pasadena Water & Power
Hügelkultur Demonstration Project



THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

Office of the General Manager

September 20, 2019

Commissioner Brenda Burman
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 25007
Denver, CO 80225

Support for the City of Pasadena's Application to BOR's Water Conservation Field Services Program

Dear Commissioner Burman:

The Metropolitan Water District of Southern California (Metropolitan) is pleased to support the City of Pasadena Water and Power Department's (PWP) proposed project to test and analyze "hügelkultur," a no-dig, permaculture technique that utilizes decaying wood debris and other compostable biomass in a raised and mounded bed. Metropolitan is aware that the City is interested in testing the technique for possible wide-spread implementation. That is of particular interest to Metropolitan, as the technique has been shown to reduce or even eliminate the need for irrigation of trees and other landscape. The technique's other multiple benefits (e.g., soil regeneration and aeration, providing long-term plant nutrients, carbon sequestration in the soil, storm water retention, soil warming, and air cooling) make this a very attractive endeavor.

Additionally, the project dovetails nicely with Metropolitan's current turf removal program, which was launched last year, to encourage and incentivize swapping turf grass for more water-efficient landscaping. Hügel beds are a unique landscape alternative for residents to consider, as they can utilize the removed turf grass as part of the hügel's foundational biomass and avoid disposing of the turf at an off-site location like the landfill. The PWP's project will include hügel beds in their new demonstration garden at Sheldon Reservoir which will illustrate the significant benefits of the technique to visitors. Metropolitan's program has been extremely successful thanks, in part, to PWP and our other partner agencies who devise and implement complementary programs (like the proposed project) that maximize the potential of our efforts.

Metropolitan is a regional wholesaler that delivers water to 26 member public agencies which, in turn, provide water to more than 19 million people in Los Angeles (including Pasadena), Orange, Riverside, San Bernardino, San Diego, and Ventura counties. We currently deliver an average of 1.7 billion gallons of water per day to a 5,200-square-mile service area. We also help our member agencies develop water recycling, storage and other local resource programs to provide additional supplies and conservation programs to reduce regional demands. PWP's proposed project is directly aligned with Metropolitan's water conservation and resource sustainability goals and objectives.

700 N. Alameda Street, Los Angeles, California 90012 • Mailing Address: Box 54153, Los Angeles, California 90054-0153 • Telephone (213) 217-6000

Pasadena Water & Power
Hügelkultur Demonstration Project

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

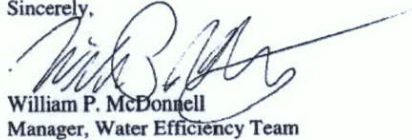
Commissioner Brenda Burman

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September 20, 2019

For this reason, we strongly support PWP's proposed project and urge you to provide favorable consideration to their grant request.

Sincerely,



William P. McDonnell
Manager, Water Efficiency Team

KR:rh

Pasadena Water & Power
Hügelkultur Demonstration Project



Los Angeles Regional Water Quality Control Board

September 25, 2019

Commissioner Brenda Burman
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 25007
Denver, CO 80225

RE: LETTER OF SUPPORT FOR THE CITY OF PASADENA'S BUREAU OF RECLAMATION "HÜGELKULTUR" DEMONSTRATION PROJECT

Dear Commissioner Burman:

On behalf of the Los Angeles Regional Water Quality Control Board (Board), please accept this letter of support for the City of Pasadena (City) Water and Power Department's Hügelkultur Demonstration Project. Responsibility for the protection of surface water and groundwater quality in California rests with the State Water Resources Control Board and nine Regional Water Quality Control Boards. The City's proposed project is directly aligned with and supports several objectives outlined in our Basin Plan (i.e., Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties) which seeks to preserve and enhance water quality and protect the beneficial uses of all regional waters.

The Hügelkultur Demonstration Project has the potential to have a positive impact on local water quality. Hügelkultur is an alternative to traditional landscaping that could reduce and/or eliminate irrigation, which would have a significant positive effect on runoff and mitigate water pollution during dry weather conditions. In traditional irrigated landscapes, irrigation runoff picks up and carries pollutants and deposits them into storm drains, lakes, rivers, wetlands, groundwater, and other inland and coastal waters. Several municipalities and watershed management groups in our region have identified residential irrigation as a source of pollutants during dry weather. Local water management efforts such as the proposed project may be small in scope, but collectively, these types of local projects can have larger-scale impacts.

In addition, the project will contribute to other local and regional efforts to ensure the long-term sustainability of local water supplies. The Los Angeles region's dependence on imported water leaves it vulnerable during periods of drought. The City's proactive efforts

IRMA MUÑOZ, CHAIR | RENEE PURDY, EXECUTIVE OFFICER

320 West 4th St., Suite 200, Los Angeles, CA 90013 | www.waterboards.ca.gov/losangeles

Pasadena Water & Power
Hügelkultur Demonstration Project

Commissioner Burman
Bureau of Reclamation

- 2 -

September 25, 2019

to identify innovative water conservation techniques is the type of forward thinking that will help us meet the State's water demand reduction goals. The Board strongly supports Pasadena's project, and we thank you, in advance, for your support.

Sincerely,



Chris Lopez, P.E.
Water Resources Control Engineer

Pasadena Water & Power
Hügelkultur Demonstration Project



COUNTY OF LOS ANGELES
DEPARTMENT OF PARKS AND RECREATION

"Parks Make Life Better!"

John Wicker, Director

Norma E. Garcia, Chief Deputy Director

September 26, 2019

Commissioner Brenda Burman
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 25007
Denver, CO 80225

Dear Commissioner Burman:

**LETTER OF SUPPORT FOR THE BUREAU OF RECLAMATION GRANT PROPOSAL
FOR THE PASADENA DEPARTMENT OF WATER AND POWER TO IMPLEMENT
HÜGELKULTUR DEMONSTRATION PROJECTS**

On behalf of the County of Los Angeles Department of Parks and Recreation (LACDPR), we have reviewed the Pasadena Department of Water and Power's proposal for the Hügelkultur Demonstration Project through the Bureau of Reclamation's Grant Program opportunity and are pleased to provide this letter of support.

We understand the project will consist of Hügelkultur Demonstration Projects throughout the City of Pasadena by implementing a no-dig technique that utilizes decaying wood debris and other compostable biomass in raised and mounded beds in which plants, trees, and shrubs can be planted. Furthermore, these projects will serve to test this permaculture technique in order to assess, analyze, and determine if the technique can be scaled to municipal applications (i.e., landscapes, medians, tree plantings, etc.) and reduce or eliminate the need for irrigation.

As the Department's Chief of Development and Sustainability Officer, I oversee multiple projects and programs focused on conservation and sustainability. These include conservation incentive programs, innovative technology, recycling and waste programming, and sustainability planning. The City of Pasadena's proposed demonstration projects are directly aligned with and support of the LACDPR's overall sustainability efforts including water and energy conservation, carbon footprint reduction, and the use of natural processes to achieve sustainability.

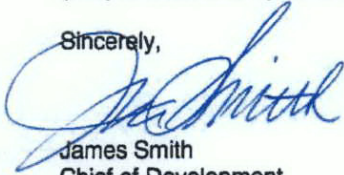
Planning and Development Agency • 1000 S. Fremont Avenue, Unit #40, Alhambra, CA 91803 • (626) 588-5322

Pasadena Water & Power
Hügelkultur Demonstration Project

Commissioner Burman
September 26, 2019
Page 2

If you have any questions, please feel free to contact me at (626) 588-5347 or by email at jsmith@parks.lacounty.gov or Ms. Bertha Ruiz-Hoffmann of my staff at (626) 588-5310 or by email at bruiz@parks.lacounty.gov.

Sincerely,



James Smith
Chief of Development
Sustainability Officer

JS:MRH:nm

Pasadena Water & Power
Hügelkultur Demonstration Project



OUTWARD BOUND ADVENTURES
626-564-0844 www.obainc.org P.O. Box 202, Pasadena, CA 91102

September 20, 2019

Commissioner Brenda Burman
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 25007
Denver, CO 80225

Re: Letter of Support and Commitment for the City of Pasadena Water and Power
Department's Hügelkultur Demonstration Project

Dear Ms. Burman:

On behalf of Outward Bound Adventures, please accept this letter of support and commitment for the City of Pasadena Water and Power's (PWP) grant application to establish demonstration installations of hügelkultur. Outward Bound Adventures is a non-profit organization that provides experiential education through a network of regional schools and a variety of programming opportunities, especially in outdoor and wilderness settings. Outward Bound Adventures counts among its desired outcomes the development of self-awareness, self-confidence, leadership skills, environmental and social responsibility. Outward Bound Adventures works with families, veterans, at-risk youth, and others who seek growth through active learning, character development, and teamwork.

Outward Bound Adventures has committed to working with PWP to establish their planned demonstration garden at Sheldon Reservoir, assisting with site preparation and other non-technical landscaping tasks. We have now learned about the planned use of hügelkultur (a more labor-intensive horticultural project) at that site and others throughout Pasadena, and our team of youth and adults is interested in assisting with those sites, as well. Learning about this innovative technique, while providing the labor needed by PWP and their consultant, will greatly serve our at-risk youth and adults. We have asked PWP to contact us as soon as they receive notice of an award so Outward Bound Adventures can pre-position our students to participate in a way that is meaningful for their growth while assisting the City with this important water conservation project. The City's project has multiple water and ecological benefits; please consider that the project will also have benefits for an at-risk youth or veteran who needs hands-on work to help them move through and past trauma, and toward a productive and fulfilling life. If you have any questions about Outward Bound Adventures, and how our students can help with other BOR projects, please contact me at 626-564-0844.

Sincerely,

Jorge Cortez
Director of Operations, Outward Bound Adventures

Outward Bound Adventures, Inc. P.O. Box 202 Pasadena, Ca. 91102 (626) 564-0844 www.obainc.org

SECTION 5. PROJECT BUDGET

A. FUNDING PLAN

PWP's Water Conservation Fund will provide all of the non-federal cost share (\$106,217) representing 55% of total project costs. The funding requested from BOR (\$86,904) represents 45% of total project costs of \$193,121.

- There are no third party in-kind costs in the Funding Plan.
- No costs have been incurred to-date.
- There are no funding partners in the Funding Plan.
- There are no funds from other Federal partners in the Funding Plan.

TABLE 2: SUMMARY OF NON-FEDERAL AND FEDERAL FUNDING SOURCES

Funding Sources	Funding Amount
1. Non-Federal Entities	
Pasadena Water & Power Water Conservation Fund (55%)	\$106,217
<i>Non-Federal subtotal</i>	\$106,217
2. Other Federal Entities	
NONE	\$0
<i>Other Federal subtotal</i>	\$0
3. Requested Reclamation Funding (45%)	\$86,904
Total Project Funding	\$193,121

B. LETTERS OF COMMITMENT

Not applicable. There are no third-party funding sources for the proposed project.

Pasadena Water & Power
Hügelkultur Demonstration Project

C. BUDGET PROPOSAL

TABLE 3: BUDGET PROPOSAL

Budget Item Description	Computation			Total Cost
	\$/Unit	Unit	Quantity	
Salaries and Wages				
Project Director (PWP Conservation Programs Manager) URSULA SCHMIDT	\$ 61.79	Per Hour	96	\$ 5,932
Project Coordinator (PWP Conservation Programs Analyst) PRISCILLA ECHEVERRY	\$ 34.22	Per Hour	192	\$ 6,570
Installation Worker (PWP City Service Worker) CHRISTIAN COX	\$ 16.81	Per Hour	135	\$ 2,269
Installation Worker (PWP City Service Worker) JONATHAN MORALES	\$ 18.29	Per Hour	135	\$ 2,469
Quality Control Inspector (PWP Water System Operator) NORMAN LARA	\$ 47.90	Per Hour	15	\$ 719
Outreach Coordinator (PWP Public Information Specialist) RENAE BOWERS	\$ 27.67	Per Hour	20	\$ 553
Fringe Benefits				
Project Director	\$ 29.97	Per Hour	96	\$ 2,877
Project Coordinator	\$ 12.52	Per Hour	192	\$ 2,404
Installation Worker	\$ 1.83	Per Hour	135	\$ 247
Installation Worker	\$ 1.98	Per Hour	135	\$ 267
Quality Control Inspector	\$ 26.97	Per Hour	15	\$ 405
Outreach Coordinator	\$ 11.15	Per Hour	20	\$ 223
Equipment				
None				
Supplies/Materials				
None				
Contractual/Consultant				
Site Assessment and Design (for all three sites): analysis, ecological and site assessment, installation and planting design, irrigation design, installation plan	\$ 30,000	Lump Sum	1	\$ 30,000
Soil and Horticultural Testing and Analysis (for all three sites) at baseline and for 18 months - 19 monthly samples X 3 sites X 4 hours per site	\$ 130	Per Hour	228	\$ 29,640
Hügel Installation (\$5,150 per hügel) - includes materials, initial irrigation, technical labor and demonstration to city staff	\$ 5,150	Per Hügel	15	\$ 77,250
Plant/Tree Installation (\$1,000 per hügel) - includes materials and labor	\$ 1,000	Per Hügel	15	\$ 15,000
Outward Bound - labor to install hügel	\$ 7,796	Lump Sum	1	\$ 7,796
Signage - including dynamic element that tracks how long since last irrigation - \$1,500 per site	\$ 1,500	Per Site	3	\$ 4,500
Environmental				
BOR Filing of Required Compliance Paperwork	\$ 4,000	Lump Sum	1	\$ 4,000
Other				
None				
Total Project Costs				\$ 193,121

D. BUDGET NARRATIVE

Salaries and Wages

The labor rates noted below represent the actual labor rates of the identified personnel. Total salaries of \$18,512 are anticipated for the following staff over the two-year project period:

- 1) **Project Director - Ursula Schmidt (PWP Water Conservation Programs Manager)** – Ms. Schmidt will spend 2.3% of her time (approximately 4 hours per month) to provide executive-level oversight to the project. She will supervise the Project Coordinator who will have day-to-day responsibility for the project; oversee project monitoring activities and advise on implementation adjustments as needed; provide oversight for procurement; lead dissemination efforts to upper-level PWP staff; and serve as the main point of contact with BOR. Anticipated cost: \$61.79 per hour x 96 hours = \$5,932 over two years.
- 2) **Project Coordinator – Priscilla Echeverry (PWP Water Conservation Programs Analyst)** – Ms. Echeverry will spend approximately 4.6% of her time on day-to-day project monitoring and coordination. She will monitor and track the project budget and schedule; implement procurement activities and supervise vendors and consultants; and assist with dissemination efforts to upper-level PWP staff.
Anticipated cost: \$34.22 per hour x 192 hours = \$6,570 over two years.
- 3) **Installation Worker – Christian Cox (PWP City Service Worker)** – Mr. Cox will spend 3.2% of his time working with the contractor to assist with site preparation, securing materials (i.e., existing biomass that will be used in hügel construction), installation, and monitoring. The assistance is estimated at 9 hours per hügel x 15 hügels = 135 hours.
Anticipated cost: \$16.81 per hour x 135 hours = \$2,269 over two years.
- 4) **Installation Worker – Jonathan Morales (PWP City Services Worker)** – Mr. Morales will spend 3.2% of his time working with the contractor to assist with site preparation, securing materials (i.e., existing biomass that will be used in hügel construction), installation, and monitoring. The assistance is estimated at 9 hours per hügel x 15 hügels = 135 hours.
Anticipated cost: \$18.29 per hour x 135 hours = \$2,469 over two years.
- 5) **Quality Control Inspector – Norman Lara (PWP Water System Operator)** – Mr. Lara will spend less than 1% of his time conducting quality control inspections before and after the hügel installation to ensure that there are no negative impacts to the sites.
Anticipated cost: \$47.90 per hour x 15 hours = \$719 over two years.
- 6) **Outreach Coordinator – Renea Bowers (PWP Public Information Specialist)** – Ms. Bowers will spend less than 1% of her time coordinating and implementing community outreach activities and designing and implementing the signage at each site, including the signs' QR code link to PWP's website for up-to-date information on the last time each hügel was irrigated. Ms. Bowers will work under the direction of the Project Director.
Anticipated cost: \$27.67 per hour x 20 hours = \$553 over two years.

Fringe Benefits

Fringe benefits for the identified staff total \$6,423. Fringe benefits include health insurance, group term life coverage, education reimbursement, childcare and assistance reimbursement, and employee discounts.

- 1) Project Director (Schmidt): 96 hours x \$29.97 (48% fringe rate) = \$2,877
- 2) Project Coordinator (Echeverry): 192 hours x \$12.52 (37% fringe rate) = \$2,404
- 3) Installation Worker (Cox): 135 hours x \$1.83 (11% fringe rate) = \$247
- 4) Installation Worker (Morales): 135 hours x \$1.98 (11% fringe rate) = \$267
- 5) Quality Control Inspector (Lara): 15 hours x \$26.97 (56% fringe rate) = \$405
- 6) Outreach Coordinator (Bowers): 20 hours x \$11.15 (40% fringe rate) = \$223

Travel – Not applicable.

Equipment – Not applicable. If heavy equipment (e.g., skid steer) is needed for installation purposes, the project will utilize the City's existing equipment at no charge to the project.

Supplies and Materials – Not applicable.

Contractual/Consultant

Total costs for contractual/consultant work is estimated at \$164,186. It is possible and likely that a single qualified vendor may be able to provide all of the required services. PWP maintains a list of pre-qualified vendors who have open purchase orders, and these include those with the expertise and experience needed to successfully complete the proposed project. As required, PWP will request a minimum of three quotes from interested vendors, but selection will skew heavily toward those with knowledge and experience with hügelkultur.

- 1) Site Assessment and Design. The contractor will conduct site assessment and design at all three demonstration sites to include site analysis, ecological site assessment, design for installation and planting, irrigation planning, etc.
 - Anticipated Cost: \$30,000
 - How Cost Was Estimated: Staff from the Los Angeles Arboretum and Botanical Garden (letter of support is provided in Section 4) provided guidance to PWP on costs for this task. The Arboretum has a five-year-old hügel installation at their Crescent Farm which they designed and installed.
- 2) Soil and Horticultural Testing and Analysis. The contractor will be responsible for data collection and analysis at the three demonstration sites. Data collection will include both quantitative (e.g., soil moisture content) and qualitative (e.g., photographs) measures. They will provide user-friendly outcome reports each quarter for outreach and dissemination purposes.

Pasadena Water & Power
Hügelkultur Demonstration Project

- **Anticipated Cost:** \$29,640. The contractor will take baseline and 18 months of samples from each site: 19 monthly samples x 3 demonstration sites x 4 hours per site x \$130/hour. The costs include data collection, analysis, and reporting.
 - **How Cost Was Estimated:** Staff from the Los Angeles Arboretum and Botanical Garden provided guidance to PWP on costs for this task. The Arboretum has a five-year-old hügel installation at their Crescent Farm for which they have monitored various metrics over the years including soil moisture content, amount of applied irrigation, ambient temperature, etc.
- 3) **Hügel Installation.** The contractor will be responsible for the installation. The cost includes site preparation (e.g., grading), materials such as top soil, actual installation, and demonstrations to City staff on best practices. The City is already stockpiling felled and diseased trees and other biomass debris for use in the hügels which represents a cost savings to the project. Wherever possible, the contractor will also use existing biomass debris at the demonstration sites. The contractor will have the assistance of approximately six laborers whose costs are described above and further below including two City Service Worker, three at-risk youth and/or adults from Outward Bound Adventures described below, and an Outward Bound Crew Leader.
- **Anticipated Cost:** \$77,250 = 15 hügels x \$5,150 per hügel installation for the contractor's materials and costs only.
 - **How Cost was Estimated:** Staff from the Los Angeles Arboretum and Botanical Garden provided guidance to PWP on costs for this task. The Arboretum has a five-year-old hügel installation at their Crescent Farm which they designed and installed.
- 4) **Plant/Tree Installation.** The plant palette will be determined during the site assessment and design phase, as the selection must be specific to each site's unique conditions. All plants, shrubs, and trees will be California native and drought tolerant. The contractor will be responsible for purchasing and selecting plants and trees from the palette, and installing them in the hügels. As advised by the Arboretum, planting should occur during November-January.
- **Anticipated Cost:** \$15,000 = 15 hügels x \$1,000 per hügel for plant and tree installation
 - **How Cost was Estimated:** Staff from the Los Angeles Arboretum and Botanical Garden provided guidance to PWP on costs for this task. The Arboretum selected and planted California native plants, shrubs, and trees in their hügels.
- 5) **Outward Bound Adventures.** The local chapter of Outward Bound Adventures will provide three crew members and a crew leader to assist the contractor with hügel installation. Outward Bound Adventures is a non-profit organization that provides experiential education through a network of regional schools and a variety of programming opportunities, especially in outdoor and wilderness settings. Outward Bound works with families, veterans, at-risk youth, and others who seek growth through active learning, character development, and teamwork.

Pasadena Water & Power
Hügelkultur Demonstration Project

- Anticipated Cost: \$7,796
Crew Leader: \$18/hour x 9 hours per hügel x 15 hügel = \$2,430
Crew: \$13.25/hour x 9 hours per hügel x 15 hügel x 3 crew members = \$5,366
- How Costs were Estimated: Staff from Outward Bound Adventures provided hourly rates for their crew and crew leader. Staff at the Arboretum worked with PWP to identify staffing needs for the hügel installation task.

6) Signage. A vendor will fabricate and install the signs. PWP will use an existing approved design for the signs that is used in other landscapes in the City (i.e., metal signs placed on wooden poles). The content will be determined by the Outreach Coordinator in consultation with the Project Director and Project Coordinator. The signs will describe the design, function, and outcomes of the hügel, and will include a QR code that allows visitors to quickly access PWP's website which will indicate the number of days since the hügel were irrigated and provide other facts and information.

- Anticipated Cost: \$4,500 = 3 demonstration sites x 1 sign per site x \$1,500 per sign
- How Costs were Estimated: Costs are based on PWP's experience purchasing signs of this same approved design from local vendors.

Environmental and Regulatory Compliance Costs – Total = \$4,000

Hügel installations will be performed in locations with previously disturbed ground, no (or minimal) excavation will be required, and will present no environmental issues or impacts. PWP expects the project to be classified as a "Categorical Exemption." PWP is including \$4,000 (approximately 2% of total project costs) in the project budget for costs that will be incurred by BOR and PWP to complete paperwork, as recommended in the Funding Opportunity Announcement, p. 13.

Other Expenses – Not applicable.

Indirect Costs – Not applicable.

Total Costs - Total project costs including the Federal and non-Federal cost-share amounts are estimated to be \$193,121.



APPENDIX 1: DEMONSTRATION SITE PHOTOS

Demonstration Site 1: Sheldon Reservoir Demonstration Garden



Fig. 1: The proposed site will be in the Sheldon Reservoir Demonstration Garden (the Garden is a larger project that is outside of the scope of this project; construction is currently underway, see green shaded area). The Garden is located in a residential neighborhood that is adjacent to a low-income disadvantaged community. The area already has high levels of pedestrian and bicycle activity; the demonstration garden will bring even more activity to the area with the walkway that will be installed to lead visitors through the garden (the walkway installation is outside of the scope of the proposed project). The hügels will be one of many installations at the Garden; signage throughout the site will explain the hügels, and the different garden landscapes (California Native, Mediterranean, Southwest, and Firewise). The City will engage local residents by hosting onsite volunteer planting workshops (conducted outside of the scope of this project). The proposed project will engage high-risk youth and adults from Outward Bound to also assist with the non-technical aspects of hügel installation.

APPENDIX 1: (CONTINUED)

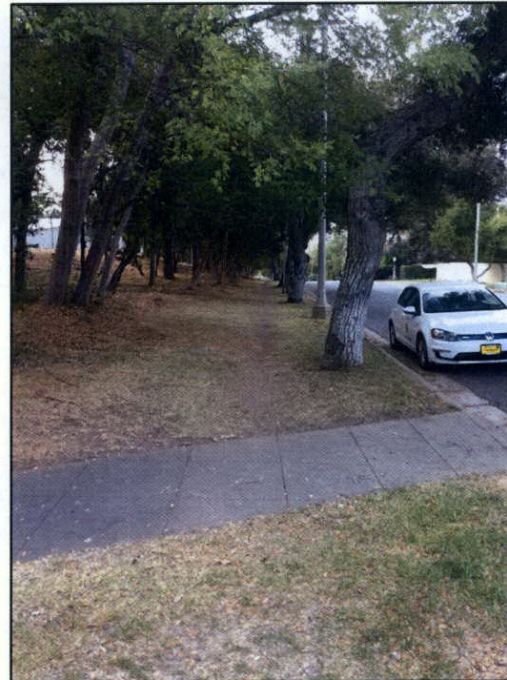


Demonstration Site 1: Sheldon Reservoir Demonstration Garden



Figs. 2 and 3 (above): The Coniston Road section of the Sheldon Reservoir Demonstration Garden is shown; the proposed hügels will be planted along the slope (pictured on the left of the photos).

Figs. 4 and 5 (below): The North Arroyo Boulevard section of the Demonstration Garden is shown. The hügels will be installed along the slope pictured on the left side of the photos. Design plans for the Demonstration Garden are provided Appendix 2.



APPENDIX 1: (CONTINUED)
Demonstration Site 2: Arroyo Seco Canyon



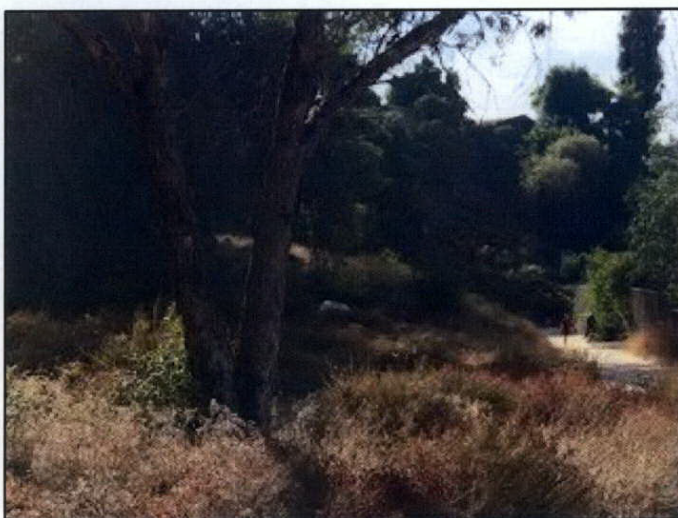
Figs. 6 and 7 (above): The second proposed site is located in Arroyo Seco Canyon, adjacent to PWP’s Behner Water Treatment Plant and across from the campus of NASA’s Jet Propulsion Laboratory (JPL). The Arroyo Seco is a mostly dry river canyon that cuts through western Pasadena on its way from the San Gabriel Mountains to the Los Angeles River. The Canyon is the largest remaining wild space in the western San Gabriel Valley. The proposed site will be adjacent to the Gabrielino Trail, which is a popular trail for nearby residents and JPL employees.

APPENDIX 1: (CONTINUED)
Demonstration Site 2: Arroyo Seco Canyon



Figs. 8 and 9 (above): The proposed site (pictured above) is included in an area targeted by the City's Upper Arroyo Enhancement Program that is seeking to restore habitat in the undeveloped areas of the 1,000-acre canyon. As part of that effort, the City is clearing the brush and non-native trees pictured above to support the return of native plants, shrubs, and trees. The biomass that will be cleared from the site will be used (recycled) in the hügel installation.

Figs. 10 and 11 (below): The area is home to walking and biking trails that run adjacent to the site. Signage will inform passersby about the purpose, function, and benefits of the hügel. All project signage will include a dynamic element that enumerates the number of days since the hügel was last irrigated.





APPENDIX 1: (CONTINUED)

Demonstration Site 3: Linda Vista Booster Station



Figs. 12 and 13 (above): The proposed site is located on West Drive near the intersection with Seco Street, and will be installed in front of PWP's Linda Vista Booster Station. Sidewalks run along West Drive on both sides of the street, and signage at the site will explain the purpose and benefits of the hügel.

Fig. 14 (below): The site is across the street from Rose Bowl Stadium and Brookside Park (athletic fields, courts, outdoor fitness equipment, and playground), and within 0.5 miles of other high visibility destinations (e.g., Rose Bowl Flea Market, Rose Bowl Aquatic Center, the Pirate Park, and more) that will bring pedestrians, bicyclists, etc., to the site.



APPENDIX 2: Design Plans for the Sheldon Reservoir Site (N. Arroyo Blvd. Section)

CALIFORNIA DROUGHT TOLERANT PLANTS



Shepherdia microcarpa
Red Hawthorn



Ceanothus velutinus
Blueberry Ceanothus



Myoporum laetifolium Pinal Creek
Creeching Myoporum



Erigeron speciosus Golden
New Gold Larkspur



Salix lasiolepis
Alpha Willow



Arctostaphylos Emerald Carpet
Carpet Matronia



Arctostaphylos
Creeching Juniper



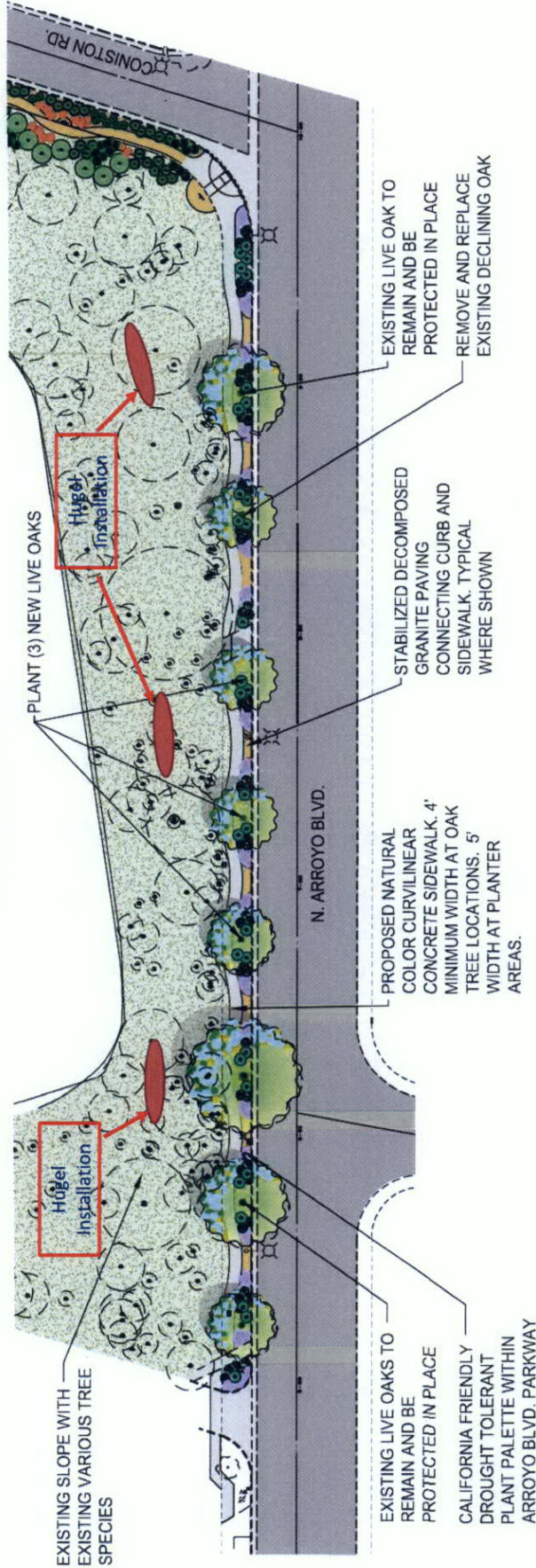
Prosopis juliflora
Prosopis Rosemary



Hesperaloe parviflora
Torch Red Yucca

N. ARROYO BLVD. PLANT IMAGES

SHELDON RESERVOIR SITE



PRELIMINARY LANDSCAPE PLAN - NORTH ARROYO BOULEVARD

Sheldon Reservoir

Pasadena, California

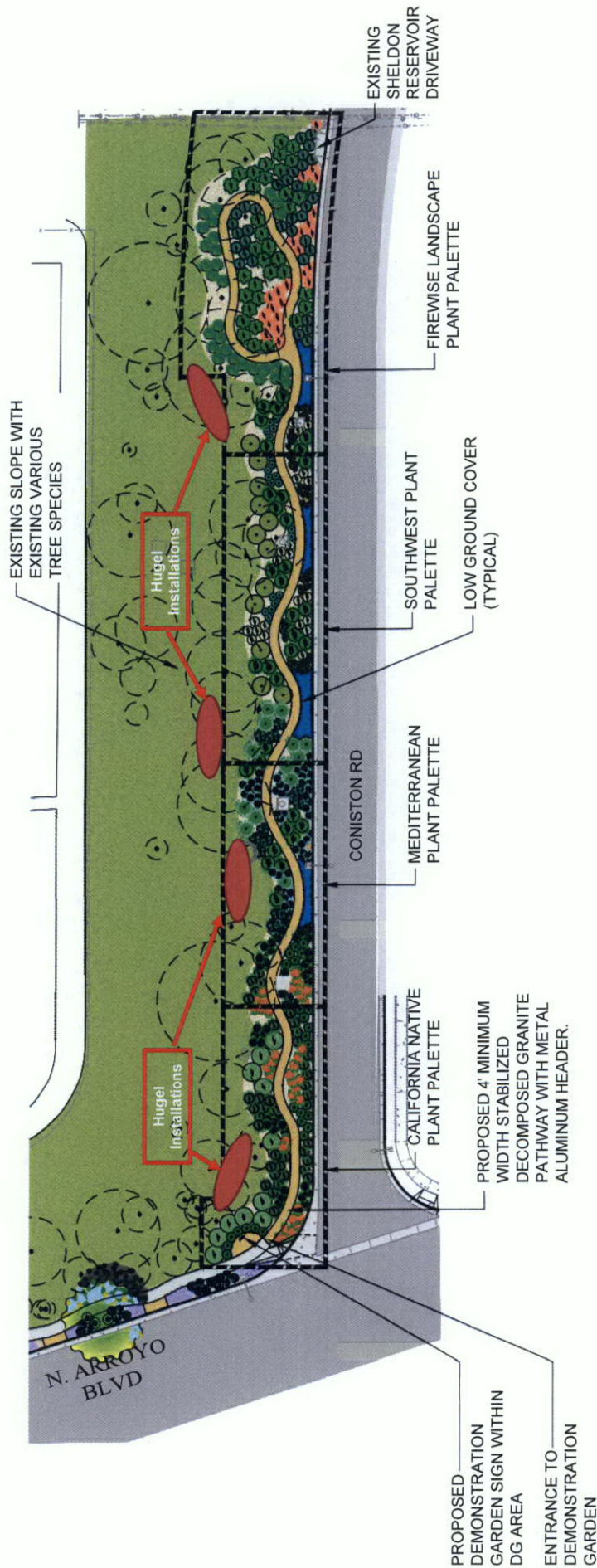
Pasadena Water and Power Department



Wheeler Company
February 1, 2019

APPENDIX 2: Design Plans for the Sheldon Reservoir Site (Coniston Road Section)

SHELDON RESERVOIR SITE



Whitaker Consulting
August 27, 2019

PRELIMINARY LANDSCAPE PLAN - CONISTON ROAD
Sheldon Reservoir

Pasadena, California
Pasadena Water and Power Department

SOUTHWEST PLANTS



Hesperaloe parviflora
Red Yucca



Penstemon
Penstemon



Salvia greggii
Autumn Sage



Panicum capillare
Deer Grass



Aloe filifera
Fibre DF Aloe



Chrysanthemum
Yellow Bell



Leucophyllum frutescens
Texas Ranger



Cassipouira pulcherrima
Red Bird of Paradise



Agave desmetiana
Shoo-ee Agave



Leavenworthia
Island Tree Mallow

MEDITERRANEAN PLANTS



Salvia leucophylla
Purple Sage



Aloe striata
Coral Aloe



Olea europaea 'Little Olive'
Little Olive Dwarf Olive



Chamaecrista
Blue Chalkstick



Agave attenuata
Fossil Agave



Chrysanthemum
New Gold



Rosmarinus officinalis
Rosemary



Bougainvillea
Bougainvillea



Callistemon 'Little John'
Little John Dwarf Bottlebrush



Echium candicans
Pride of Madras



Cistus parviflorus
Dotted Rockrose



Salvia clevelandii
Cleveland Sage



Lavandula stoechas
Spanish Lavender

CONISTON ROAD PLANT IMAGES
Sheldon Reservoir
 Pasadena, California
 Pasadena Water and Power Department

CALIFORNIA NATIVE PLANTS



Ceanothus Species
California Lilac



Salvia greggii
Autumn Sage



Salvia leucophylla
Purple Sage



Nematodeschilus Species
Marzamita



Eriogonum affinis
Island Tree Mallow



Bouteloua gracilis
Blue Grama



Eriobotrya speciosa
Firechufflower Gooseberry



Rosa californica
California Wild Rose



Mimulus aurantiacus
Sticky Monkey-flower

FIREWISE PLANTS



Lantana Species
Lantana



Baccharis pilularis 'Twin Peaks'
Dwarf Coyote Brush



Baccharis pilularis
Bolda Herbster



Limonium Species
Ice Plant



Agave attenuata
Foxtail Agave



Cornus amomum
Bearberry Cotoneaster



Erodia californica
California Verticillium



Sarcocolla mundulicoides
Blue Chalksticks



Limonium perezii
Sea Lavender



Myoporum laetifolium
Punaeh Creeper



Prunus ilicifolia
Hollyleaf Cherry

CONISTON ROAD PLANT IMAGES
Sheldon Reservoir
 Pasadena, California
 Pasadena Water and Power Department