SANTA ANA WATERSHED PROJECT AUTHORITY

Alternative Options for the Santa Ana River Basin Headwaters Project

(SAWPA Task Order IERCD387-01)

Commission Meeting
Item No. 6.A

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Santa Ana Watershed Project Authority

August 5, 2025

Background from Last Commission Discussion

At the May 20, 2025, Commission meeting, staff were asked to provide a follow-up presentation on herbicide use, with a specific focus on Glyphosate-based products.

As well as information on other alternative treatment methods.

Recommendation

- It is recommended that the Commission review and discuss the information presented regarding various Arundo Donax treatment methods and direct staff to receive and file.

Options for Moving Forward

- After receiving the following presentation, the options for moving forward are generally -
  - Change scope of project.
  - Discontinue project.
  - Approve change order.
  - Develop plan before proceeding with project.
  - Further research project sites.
  - Conduct other research before taking action.

Bird Blind Constructed by Inland Empire Resource Conservation District Using Dead Arundo Donax

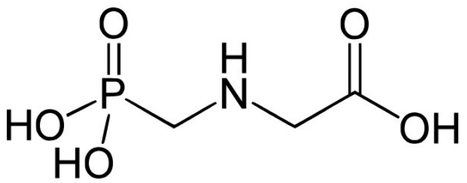
Herbicides and Alternative Methods

- The new information covers –
  - Synthetic herbicides used in current project.
    - Glyphosate-based.
    - Imazapyr-based.
    - Other herbicides (both synthetic and non-synthetic).
    - Local Agency Actions on Synthetic Herbicide.
    - Related Water Quality Regulations.
  - Mechanical Removal
  - Soil Solarization
  - Prescribed Burn
  - Biological Removal
  - Ecological Restoration

Alternative Methods

Glyphosate-Based Herbicide

- This herbicide controls broadleaf weeds and grasses.
- It has been registered as a pesticide in the U.S. since 1974.
- Half-life between 2 and 133 days.
- Not persistent in organisms or the environment (does not bioaccumulate or store itself in tissue).
- Binds to soil.
- On the California Prop 65 List
  - Prop 65 is California’s law for “chemicals that may contribute to an individual's overall lifetime risk of cancer or risk of birth defects or other reproductive harm.”

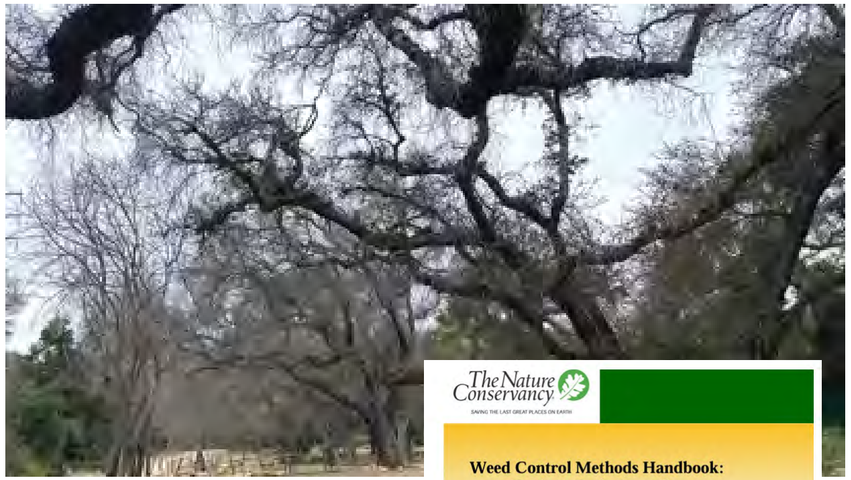


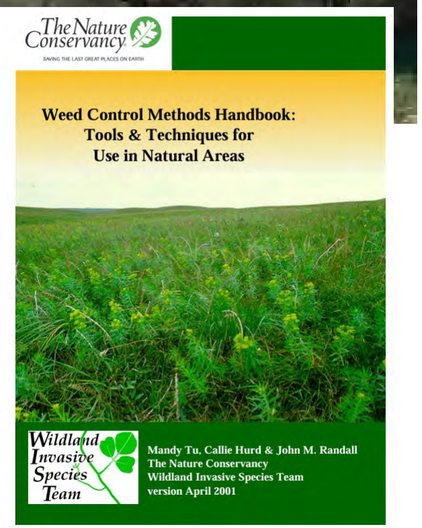
Imazapyr-Based Herbicide

- Not on the Proposition 65 List.
- This herbicide manages grasses and broadleaf weeds, undesirable emergent and floating aquatic vegetation, and many brush and vine species.
- The half life can vary between 10-120 days depending on temperature and moisture.
- Microbes and sunlight break down imazapyr in the environment.
- Plants take up imazapyr through the leaves and roots. Imazapyr is translocated (moved throughout) to other plant parts.

Imazapyr Usage Requirements

- In 2024, it was reported that about 400 trees were dead/damaged at parks operated by Ventura County.
  - Ventura County Agricultural Commissioner's office blamed improper use of imazapyr, for impacting oak, sycamore, pine, ash, maple, eucalyptus and walnut trees.
- Ventura concluded Imazapyr is not right to use near "desirable woody species".
- Weed Control Methods Handbook (Nature Conservancy) states "To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy)".





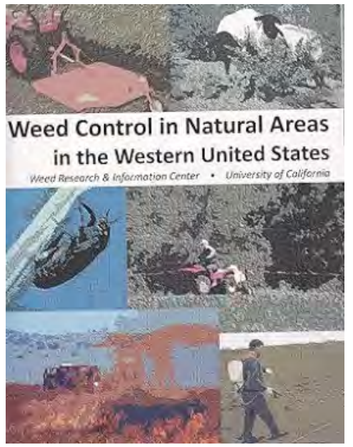
Credit: Ventura County Parks Department

Other Synthetic Herbicides

There are other synthetic herbicides approved in Santa Ana River Watershed Headwaters Areas via a U.S. Forest Service – San Bernardino National Forest federal permitting process.

A. Aminopyralid
B. Chlorosulfuron
C. Clopyralid
D. Fluazifop-P-Butyl and Clethodim
E. Triclopyr

Weed Control in Natural Areas in the Western United States (UC Davis Published Document) and Arundo Donax management guides **don't include these herbicides** as effective for Arundo removal.



Non-Synthetic Herbicides

Examples of non-synthetic herbicides:

- Mix of Caprylic and Capric Acids
- Pelargonic Acid
- Acetic Acid
- D-Limonene
- Clove Oil-Cinnamon Oil
- Clove Oil-Citric Acid

- They are “contact herbicides” and burn the green material; don’t translocate to the roots and subterranean rhizomes.
- None are recommended in guidebooks for effective Arundo removal.
- An example of their use – effective for removing invasive stinknet (annual herb species) underneath low-growing buckwheat (perennial species).
- Typically applied using ~ 5% concentration.

Foliar Application - Herbicide Formulation Used in Project

Component in Herbicide	Mixture %
Glyphosate (Roundup Custom Aquatic)	2% - 5%
Imazapyr (Polaris)	0% - 1%
Surfactant (Rainer EA)	1%
Water	94% - 96%
Total	**100%**

Foliar Application:

Notes: In 10 of the 14 project sites, the mixture of glyphosate and imazapyr is used.
In 4 of the 14 project sites, the mixture with just Glyphosate is used.
All mixtures include surfactant and water. The percentages in the mixture depends on if glysophate and imazapyr are used together; thus ranges are shown in the table above.

Herbicide Components by Project Site

Tributary Name	Project Area (Acres)	Percent Completion	Herbicides Used (Plus Surfactant and Water)
Cajon Creek	876	9%	Imaz + Glyph
Coopers Creek	74	0%	Imaz + Glyph
Devore Community	1,426	5%	Glyph*
Live Oak/Yucaipa Creek	31	58%	Glyph*
Lytle Creek	4,361	0%	Imaz + Glyph
Mill Creek	677	56%	Imaz + Glyph
Morey Arroyo	9	41%	Imaz + Glyph
Noble Creek	167	0%	Imaz + Glyph
Palm Canyon	23	0%	Imaz + Glyph
San Timoteo Canyon	350	78%	Imaz + Glyph
Santa Ana River	1,973	35%	Imaz + Glyph
Waterman Canyon & East Twin Creek	254	0%	Imaz + Glyph
Yucaipa Waterways	42	56%	Glyph*
Zanja	29	17%	Glyph*
TOTAL	**10,292**	**29%**	

*No imazapyr, as there are desirable woody species in close proximity to Arundo in these locations.

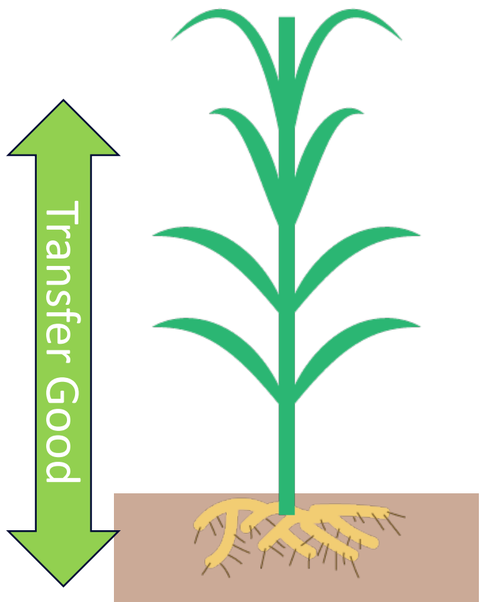
Cost Increase If Just Imazapyr is Used

- Imazapyr is not as effective on its own, and is used in this Project as part of the herbicide formula for 10 of the 14 Project Sites.
- Imazapyr disrupts protein synthesis and accumulates in the meristem region (active grow region) of plants.
- Glyphosate inhibits plant's synthesis of amino acids. It binds in soil, effectively inactivating its herbicidal properties.

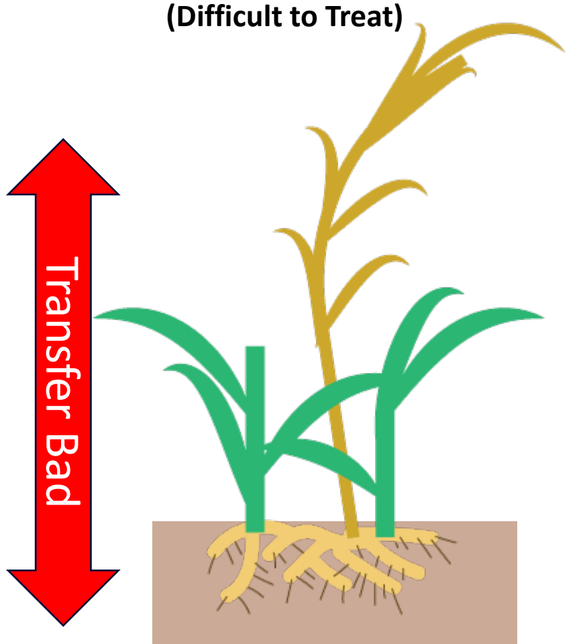
First Treatment Event Important

- Imazapyr and Glyphosate together hinder different portions of the plant's growth system.
- Timing treatment during the plant's growth timeline is important.
- Re-treating after a bad initial treatment (that was done with just one herbicide) is difficult because the green material does not transfer the herbicide to the rhizomes as effectively.

Mature Previously Untreated Arundo
(Better Condition to Treat)



Early Stage Arundo After a Poor Treatment that Did Not Fully Inhibit Rhizomes
(Difficult to Treat)

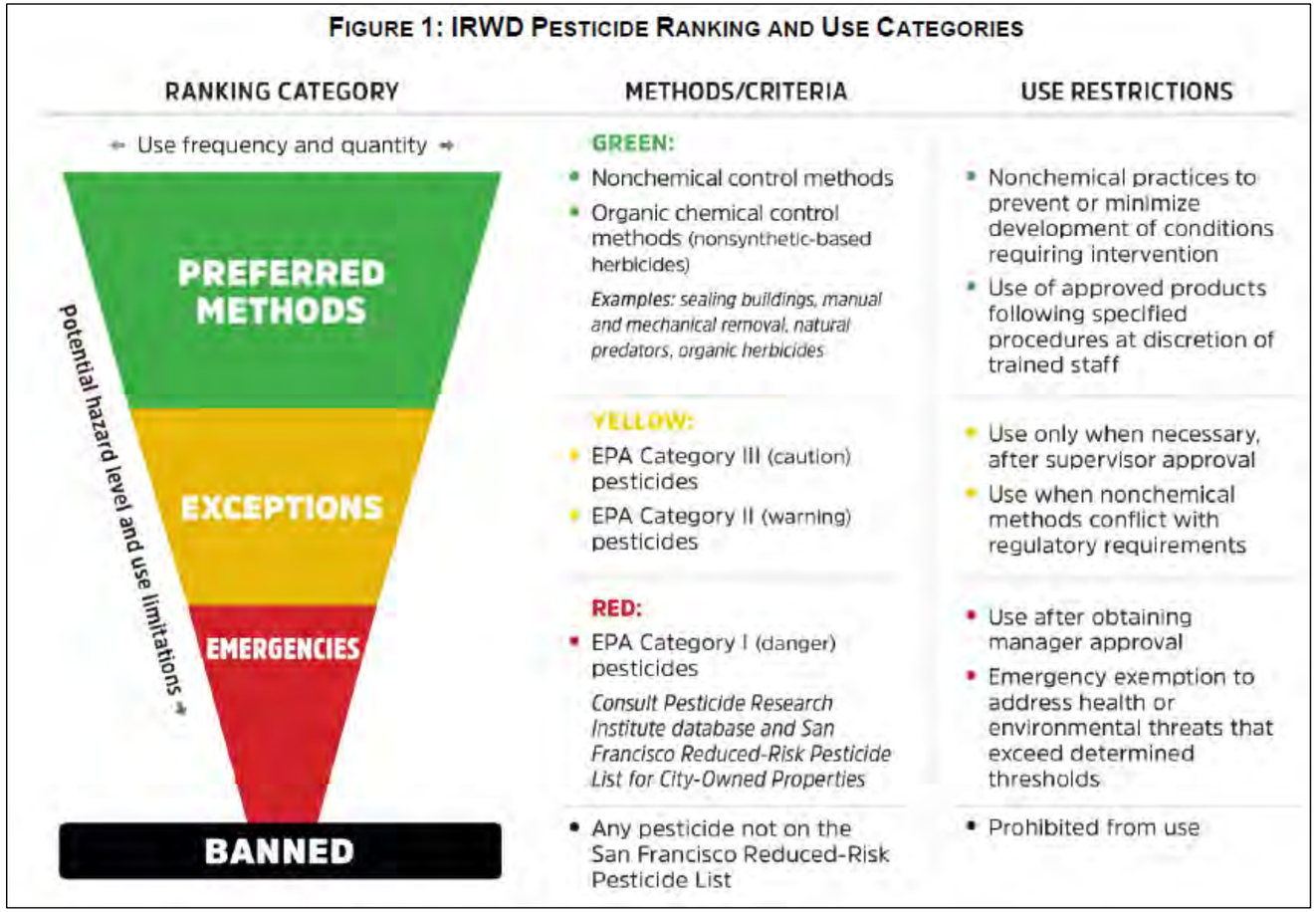


Local Agency Actions (Examples)

- **Herbicide Prohibition** (1979) - Mendocino County, CA – One of the first local municipalities to pass a pesticide ordinance, prohibiting aerial application of phenoxy herbicides.
- **Herbicide Prohibition** (2014) - Takoma Park, MD – First local municipality to generally restrict the use of cosmetic lawn pesticides on both private and public property within city jurisdiction. Exceptions exist for the control of certain noxious weeds, invasive species, and public health pests.
- **Synthetic Herbicides as Last Resort** (~2019) - Irvine Ranch Water District, Irvine City and Irvine Unified School District developed Integrated Pest Management (IPM) Plans. San Franciso City/County follows a similar approach and has a Reduced Risk Pesticide List.

IRWD Integrated Pest Management Plan

- The local agency has Integrated Pest Management (IPM) plan that effectively identify some “herbicides as a last resort.”
- Glyphosate is within the red category; imazapyr in the yellow category.



Local Agency Actions - San Francisco

- The municipality has an integrated pest management plan and grants exemptions for pesticides on its Reduced-Risk Pesticide List.
- The document states it is “San Francisco-specific, and not recommended for other local agencies.”

Examples from Reduced-Risk Pesticide List

Product Name	Ingredients	Pesticide Hazard Tier	Use Limitation Type	Use Instructions & Limitations
Roundup Custom	Glyphosate	Most Hazardous (Tier 1)	Most Limited	Use only for situations where root translocation or residual effect on sensitive areas makes other alternatives infeasible.
Nufarm Polaris	Imazaphyr	More Hazardous (Tier II)	More Limited	Alternative to Tier 1 herbicides. Use caution with adjoining desirable vegetation.

Herbicide Regulations and This Project

- Information on IERCD:
  - The glyphosate being used on this SAWPA-funded project is a small portion of the overall glyphosate IERCD staff uses on their total amount of invasive species removal projects.
  - IERCD puts staff through herbicide training and have control steps in place.
  - IERCD regularly works with County Agriculture Commissioner on compliance with State regulations, such as the Department of Pesticide Regulation codes.

California Department of Pesticide Regulation

Application and California Regulations

- Application/use of herbicides near water sources must follow strict guidelines in California per California Code of Regulations (Title 3. Food and Agriculture) – Division 6. Pesticides and Pest Control Operations.
  - Chapter 4: Environmental Protection (Groundwater Protection).
  - Chapter 5: Surface Water.
- There is language in these regulations on wind speed, weather, runoff, etc.

Initial Proposed Project Budget
(with Change Order No. 1)

Task	Task Description	Original Task Order	Change Order No. 1	Total
1	Access Agreements, Right of Entry, Encroachment	$10,775	$38,348	$49,123
2	Surveying and Mapping	$16,357	$16,954	$33,311
3	Invasive Species Removal, Herbicide Application, Retreatment, and Restoration	$107,097	$361,720	$468,817
4	Admin - Environmental Review, Project Management, Administration, and Reporting	$13,548	$51,246	$64,794
Totals		**$147,777**	**$468,268**	**$616,045**

Initial Proposed Project Budget
(With No Glyphosate Option – High Level Estimate)

Task	Current Task Order	Initial Change Order	No Glyphosate Change Order	Total Range
1	$10,775	$38,348	$38,348	$49,123
2	$16,357	$16,954	$16,954	$33,311
3	$107,097	$361,720	2x or 3x increase $723,440 to $1,085,159	$468,817 to $1,085,159
4	$13,548	$51,246	$51,246	$64,794
Totals	**$147,777**	**$468,268**	**$829,988 to $1,91,708**	**$616,045 to $1,339,485**

A 2x to 3x cost increase for Task 3 could occur as additional site visits will likely be needed to ensure effective removal of Arundo with just imazapyr. And in some cases, Arundo cannot be removed with imazapyr due to proximity to desirable vegetation.

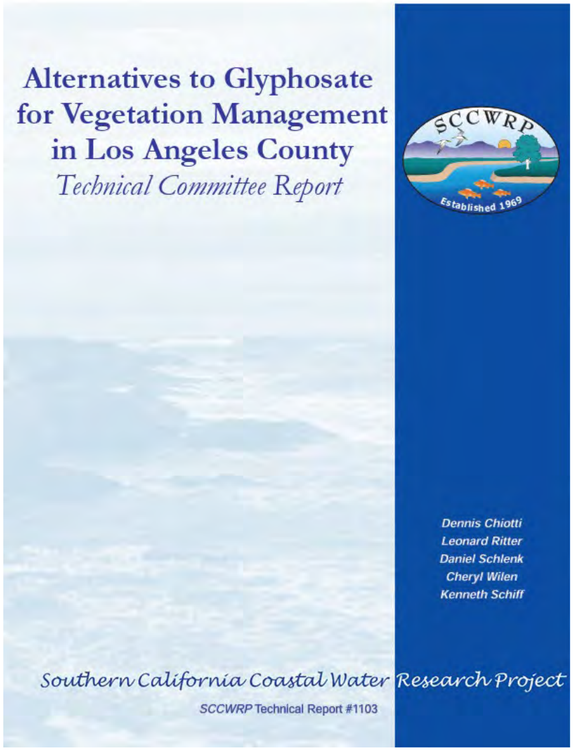
Not shown is the cost estimate of using neither glyphosate or imazapyr.

As of April 30, 2025 there is $718,790 remaining in the special project fund for Arundo Removal.

Alternative Methods

- Mechanical Removal
- Soil Solarization
- Prescribed Burn
- Biological Control
- Ecological Restoration

Much Of The Following Information Comes from This Report



Mechanical Removal

- Description – mechanical includes
  - Cutting and digging: Repeated cutting combined with careful excavation of rhizomes.
  - Mechanical mulching or mowing: Using machines to mulch the biomass, but must be followed up with consistent removal of regrowth.
  - Excavation: Removing both stems and rhizomes with heavy machinery (best during low-flow periods). This is the most effective non-chemical method but costly.

  - SAWPA has identified information that mechanical removal with excavator $40 per hour, operator (1 staff) $100 per hour, fuel $10 per hour; total $150 per hour.
  - IERCD Technical Crew (4 staff) are $112 per hour plus $19 per hour of equipment (PPE and Herbicide Formulation); total of $131 (for crew and PPE/Herbicide).

  - These costs do not include permit/planning/mitigation and project management costs.

Pros/Cons Mechanical Removal

- Pros:
  - Avoids herbicide use.
  - Immediate reduction in biomass.
- Cons:
  - Labor-intensive and expensive.
  - Can stimulate regrowth if rhizomes are left.
  - Any rhizome fragments left behind can resprout even when buried at depths up to ten feet.
  - Additional permit requirements from California Department of Fish and Wildlife, Regional Water Quality Control Board and U.S. Army Corps.

Soil Solarization

- Description - Using clear plastic to trap heat energy from the sun to bring about physical, chemical, and biological changes in the soil that will kill soil pathogens and weed seed.
- Applicable to a variety of sites, especially with little wind or cloud cover.

Pros/Cons Soil Solarization

- Pro –
  - Provides safe and effective control of weed seed and plant pathogens to a depth of 6 inches if done correctly with sufficient radiant heat energy from the sun
- Cons –
  - Does not work on perennial plants (Arundo is a perennial grass)
  - Labor intensive to install and maintain
  - Ultraviolet resistant plastic must be used, which is not readily available
  - Kills beneficial microbes and insects as well as any native seeds in the seed bank
  - Effective only at warm times of the year

Prescribed Burn

- Description - Burn mature stands in coordination with fire departments.
  - Weather, topography, and available fuel determine the temperature and intensity of the prescribed burns.

Pros/Cons Prescribed Burn

- **Pros:**
  - Reduces biomass quickly.

- **Cons:**
  - New sprouts will quickly emerge from the rhizomes post fire. New canes grow rapidly and recolonize the disturbed area, outcompeting the native vegetation and likely entrenching Arundo in the burned area.
  - Needs permits and planning.
  - Not effective on rhizomes alone.

Biological Control

- Description - Use of animals, fungi, or other microbes to feed upon, parasitize or otherwise interfere with a targeted pest species. Successful biocontrol programs usually significantly reduce the abundance of the pest, but in some cases, they simply prevent the damage caused by the pest.
- The U.S. Department of Agriculture has released this strategy against Arundo in some areas, however, there are mixed reports of their success. At best, any biocontrol agent will suppress invasive populations, rather than eliminating them completely.
- Examples
  - The Arundo wasp (Tetramesa romana) and Arundo scale (Rhizaspidiotus donacis) are under evaluation for use in California.

Arundo Wasp

Pros/Cons Biological Control

- **Pros:**
  - Long-term control potential.
  - Low cost after initial implementation.

- **Cons:**
  - Still under research and regulatory approval.
  - Risk of unintended ecological impacts.

Ecological Restoration

- After mechanical removal, plant fast-growing native riparian species like mulefat (*Baccharis salicifolia*), willows (*Salix* spp.), or sedges to outcompete *Arundo*.
- Healthy riparian plant communities help resist reinvasion.
- Can require irrigation of native plants without water source.

Pros/Cons Ecological Restoration

- **Pros:**
  - Prevents reinfestation
  - Supports ecosystem recovery

- **Cons:**
  - Requires careful planning and ongoing monitoring

SAWPA's Unique Role

- SAWPA is undertaking this project in order to use long-term funding from the Proposition 13 Water Bond.
- Unlike the three Irvine-based agencies, we are not performing weed (in this case Arundo) management on long-term managed properties.
- Closest comparison is Irvine Ranch Water District (IRWD), as it is doing projects near some waterbodies like San Joaquin Marsh.
- Note – Unliked IRWD, SAWPA does not own or lease the Headwaters Projects properties.

Questions

- The options for moving forward are generally -
  - Change scope of project.
  - Discontinue project.
  - Approve change order.
  - Develop plan before proceeding with project.
  - Further research project sites.
  - Conduct other research before taking action.

Thank You

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SANTA ANA WATERSHED PROJECT AUTHORITY

Santa Ana River Conservation and Conjunctive Use Program – Water Use Efficiency Program Finalization

SAWPA Commission
Item Number 6.B

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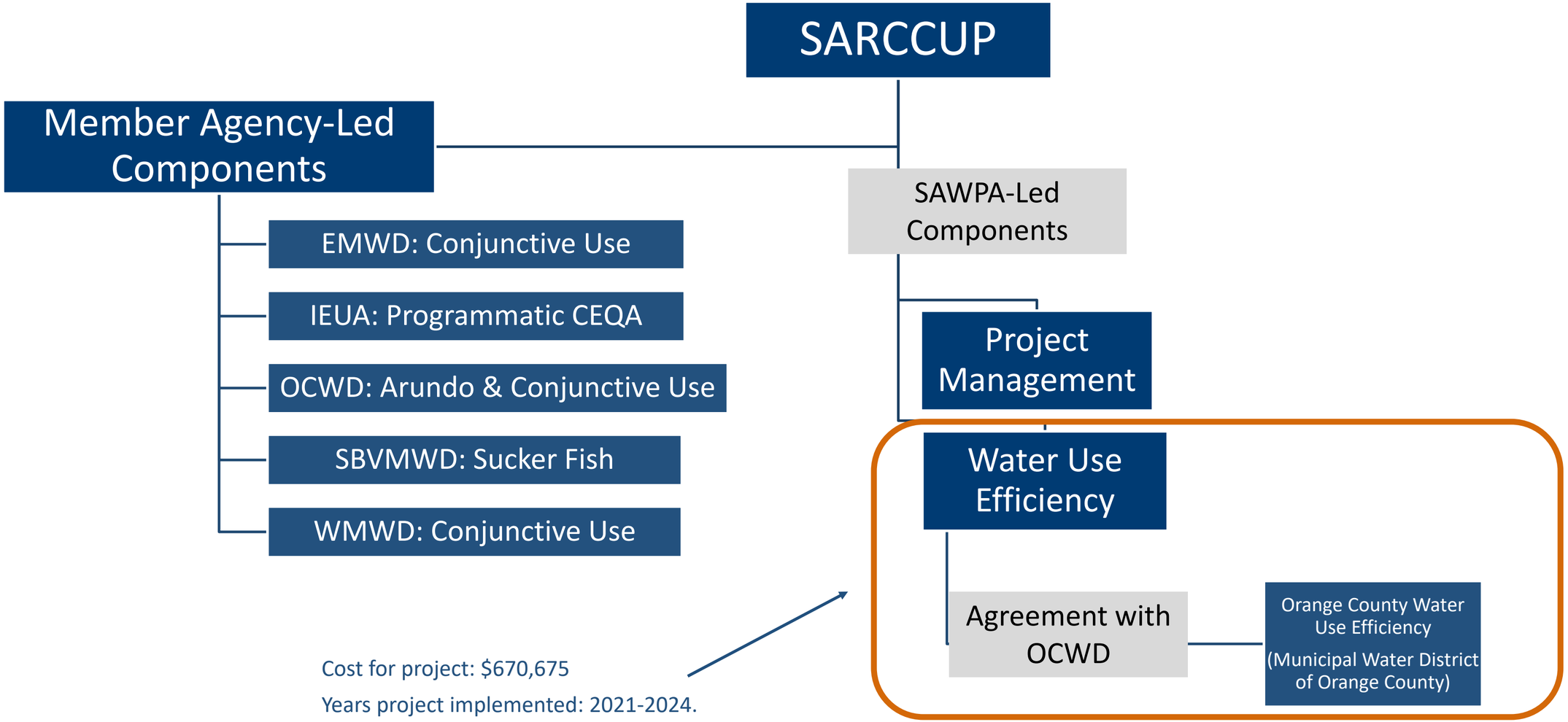
August 5, 2025

Water Use Efficiency Portion of SARCCUP



Purpose of Water Use Efficiency Implementation

- Work with retail water agencies in the watershed to create efficiency-based water budgets.
- Efficiency based budget deliverables provided to partners include landscape feature (trees, shrubs, etc.) measurement data and weather (evapotranspiration rate) information.
- Efficiency budgets provided over **1,200 acre-feet** over a three-year period (i.e. 400 AFY).

Dedicated Landscape Meter Customer Example

<u>How the work was implemented:</u>

- SAWPA and its consultant, NV5, collaborated with eight retail water agencies located in the upper watershed (Riverside and San Bernardino counties).
- In Orange County, SAWPA has an agreement with the OCWD, which in turn has a separate agreement with the Municipal Water District of Orange County (MWDOC).

Regulatory-Driven Project

- By January 1, 2025, retail water agencies (over a certain size) had to report out their retail-wide water efficiency budget. Their budget includes water needed for dedicated landscape meters, residential customers, and other factors.
- Overall compliance for these regulations begin in 2027.
- The first step was reporting the data as accurately as possible by January 1, 2025.

Water Use Efficiency Implementation Status Update (Upper Watershed)

Retail Partner*	Efficiency Budgets Created	Official Start of Partnership	Deliverables Submitted to Partner
Chino Hills City	135	November 2021	August 2024
Hemet City	140	August 2021	November 2023
Jurupa Community Services District	408	May 2022	November 2023
Loma Linda City	107	March 2022	November 2023
Monte Vista Water District	168	June 2021	November 2023
Perris City	11	August 2021	April 2024
Riverside City	490	June 2021	November 2023
San Bernardino City	190	November 2021	January 2024
Total Dedicated Irrigation Meters Budgets Created	**1,649**		

*Per direction from SAWPA member agencies, two retailers per member agency were to partner on this effort. With four member agencies in the Upper Watershed that led to 8 total partners.

Water Use Efficiency Implementation Status Update (Upper Watershed)

- Total efficiency budgets created were for 1,649 dedicated irrigation meter customers.
- Amounts were different for retail partners due to the amount of usable customer data (i.e. with items like meter location and meter type) they were able to share with SAWPA consultant NV5.
- All retailers initially offered 190 customers.
- Some retailers were able to do more, which SAWPA approved in certain circumstances when other retailers were determined to not have enough usable customer data.

Dedicated Landscape Meter Customer Example

Next Steps for Upper Watershed Partners

- Each retail partner* had access to WaterView Portal for the customers included in this project.
- This tool is custom designed to help water professionals meet the efficiency requirements established under retail water use efficiency budget regulations.
- Eagle Aerial Solutions (a sub-contractor to NV5) is the portal developer.

Images: Eagle Aerial Solutions

**Except Perris as they had 11 customers with usable customer data and the cost to utilize WaterView CII per retailer was $10,000.

Water Use Efficiency Implementation Status Update (Orange County)

- Utilized 2020, 3”, 4-band aerial imagery through the Orange County Data Acquisition Partnership (OCDAP) to classify and measure dedicated irrigation meter (DIM) landscapes.
- Cost-share model with OC retailers, Metropolitan, and SAWPA/OCWD.
- Measured **all** landscapes associated with dedicated irrigation meters for participating retailers.

Water Use Efficiency Implementation Status Update (Orange County)

Retail Partner	Efficiency Budgets Completed (i.e. water agency customer properties)
City of Brea	254
City of Fountain Valley	131
City of Fullerton	263
City of Newport Beach	85
City of Orange	214
City of Santa Ana	326
City of Seal Beach	41
City of Tustin	105
Total	**1,419**

Lessons Learned

- The organization of OCWD/MWDOC taking the lead, and each member agency receiving two retail partners in the upper watershed worked well.
- Providing the data deliverables in readily-available user formats was helpful to retail agencies.
- Having the right contact at each retail agency was key to ensuring progress.
- Other retail agencies, that haven’t partnered on this project, are working on mapping their dedicated landscape meters.
  - Some regional agencies have provided “some seed” funding for water use efficiency.

Thank You

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