



**FUTURE SUPPLY ACTIONS PROGRAM
WEBINAR SERIES
SMART WATERSHED NETWORK PILOT PROJECT
June 15, 2023**





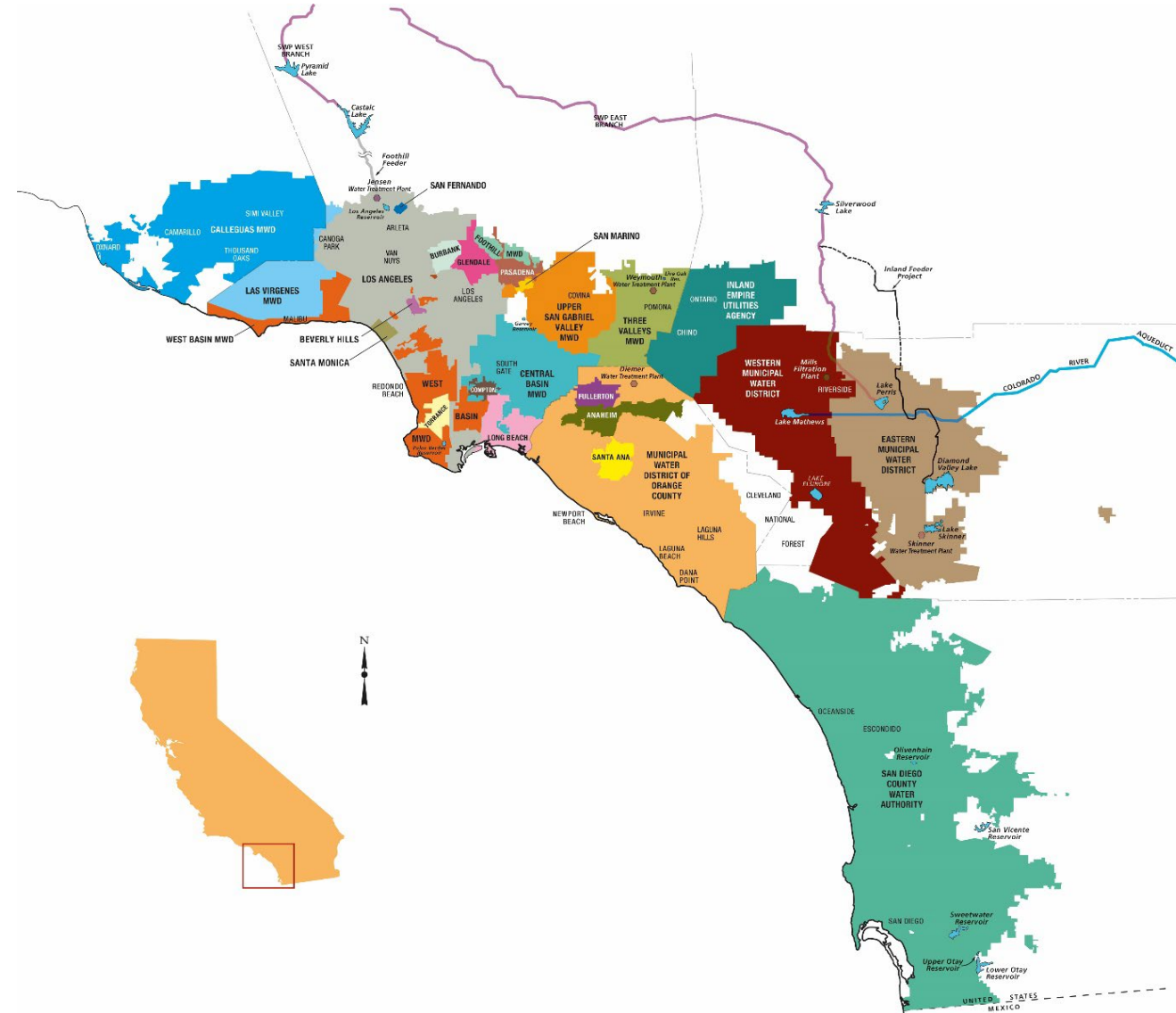
Agenda





The Metropolitan Water District of Southern California

- Nation's largest wholesale water provider
- Service area: 19 million people/5,200 square miles/parts of six counties
- 26 member agencies
- Supports \$1 trillion regional economy
- Imports water from Northern Sierra and the Colorado River, invests in local projects





Metropolitan's Role for Southern CA

The collage consists of six images arranged in a 2x3 grid, each with a green text overlay:

- REGIONAL PROVIDER:** Aerial view of a large water canal in a desert landscape with mountains in the background.
- INNOVATION:** A modern water treatment facility with a sign that reads "A NEW SOURCE OF WATER FOR SOUTHERN CALIFORNIA" and "FOR QUALITY OF LIFE".
- VISION:** A meeting room with a large screen displaying a woman speaking, and a circular logo on the wall.
- VISION:** A black and white historical photograph of workers inside a large tunnel.
- Flexible System:** A laboratory setting with glass flasks and a person working in the background.
- SAFE & RELIABLE:** A green bar at the bottom of the laboratory image.



Future Supply Actions Funding Program

Future Supply Actions established in 2010 IRP

Drive innovation

Pilot new approaches
and technologies

Remove barriers to
supply development

Benefit the region

Local Resources

Groundwater

Stormwater

Reuse

Desalination



Current Program

Member Agency

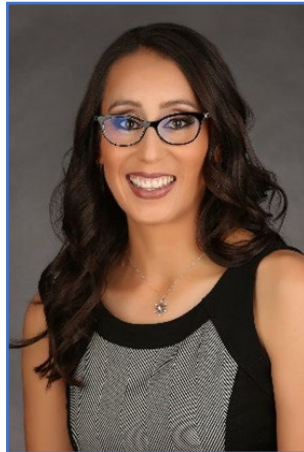
- 14 studies
- \$3.1 million

Water Research Foundation

- 6 potable reuse studies
- 1 agricultural reuse study
- \$975k



Speaker Spotlight



Laura Rocha - Water Resources Manager at Moulton Niguel Water District, leads MNWD's long-range water resources planning, implementing watershed and water supply projects, policy development, and drought response efforts



Austin Orr, P.E. – Civil Engineer at Geosyntec Consultant's water resources practice, specifically stormwater quantity and quality management. Recently focused on building software tools to help bring monitoring, data analysis, and modeling via the web

Presentation Outline

- Background & Study Design
- Primary Work Products
- Watershed Monitoring System
- Data Management and Analytic Tools
- Case Study
- Project Accomplishments and Broader Applicability

Moulton Niguel Water District

- Provide water, recycled water, and wastewater services
- Serving Aliso Viejo, Laguna Niguel, Laguna Hills, Mission Viejo, Dana Point, and San Juan Capistrano
- Serving over 170,000 customers
- Urbanized, planned communities
- AMI Program



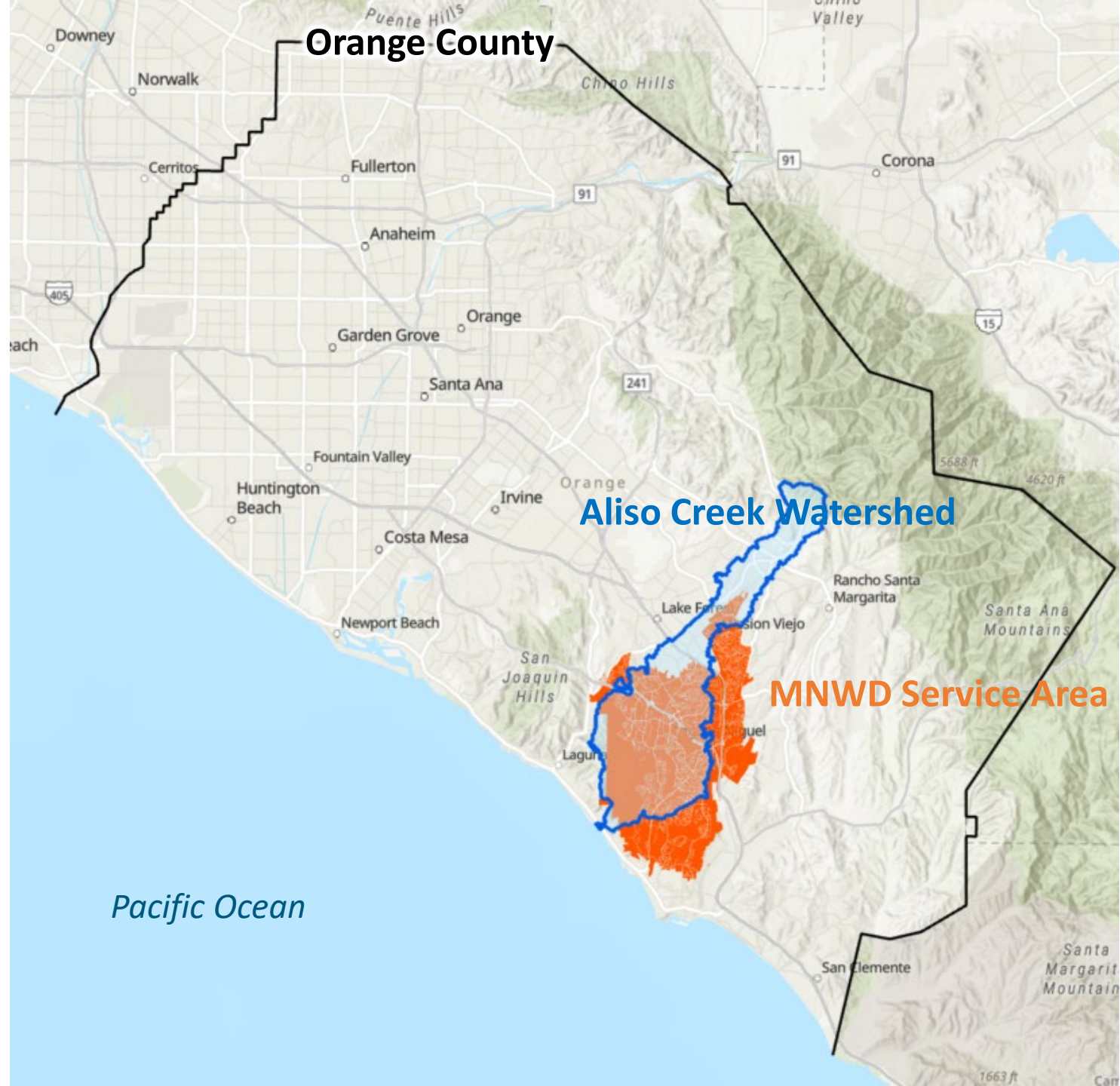
Urban Runoff Collaboration

- Partnership with County, Cities, NGOs
- Data Sharing, Program Development, and Community Outreach
- Reduce Runoff and Improve Watershed Health



Project Area

- Orange County Public Works
 - OC Stormwater Program
 - H2OC is the "brand"
 - Collaborative effort (all 34 cities)
- Aliso Creek Watershed
 - 35-square miles
 - Over 80 storm drain outfalls
 - 70% developed



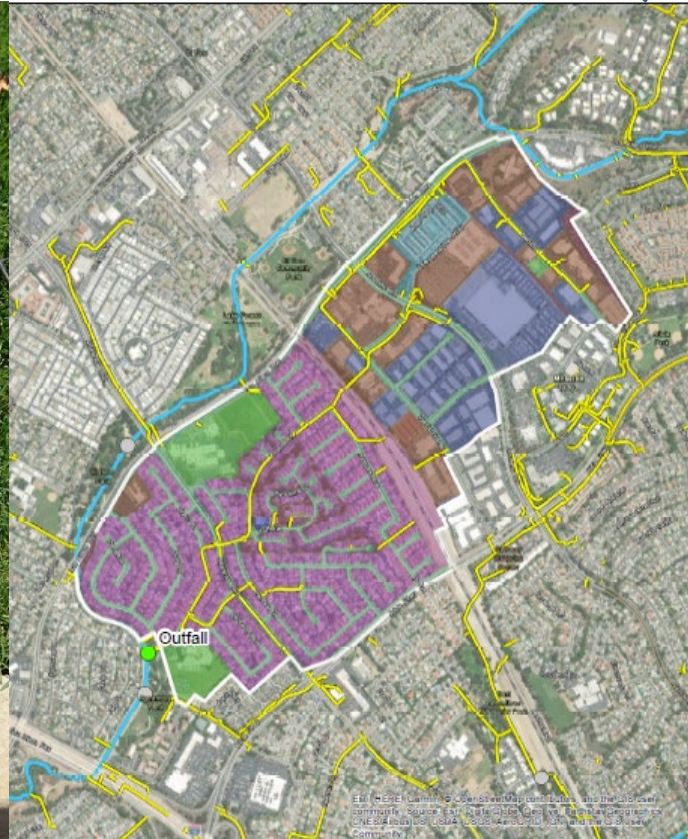
Nuisance Turned Resource

- Dry weather runoff exceeds 1 MG daily in Aliso Creek
- Dry weather discharge changes streamflow and transports pollutants
- Opportunity to augment local supply and increase watershed health



Bridging Infrastructure and Data

Compatible
Systems?



Smart Watershed Network Pilot Project

Primary Objective: Evaluate the sustainable use of urban runoff and stormwater as a potential water supply source

- 1) Pilot use of AMI Network
- 2) Build datasets that fill key knowledge gaps
- 3) Support data analysis, exploration, and management decisions about resource recovery
- 4) Provide transferable lessons

KEY AGENCIES AND INDIVIDUALS



MWDOC
Grant Administrator



MNWD
Co-Program Manager



County of Orange
Co-Program Manager

Technical Expert Consultants



Geosyntec Consultants

Technical Lead, System Design, and Scientific Software Development



NV5

(Formerly Alta Environmental)
Instrumentation and Monitoring Technical Support



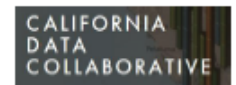
ESA Sitka

(Formerly Sitka Technology Group)
Web Application and Dashboard

Cooperating Partners



LagunaBluebeltCoalition



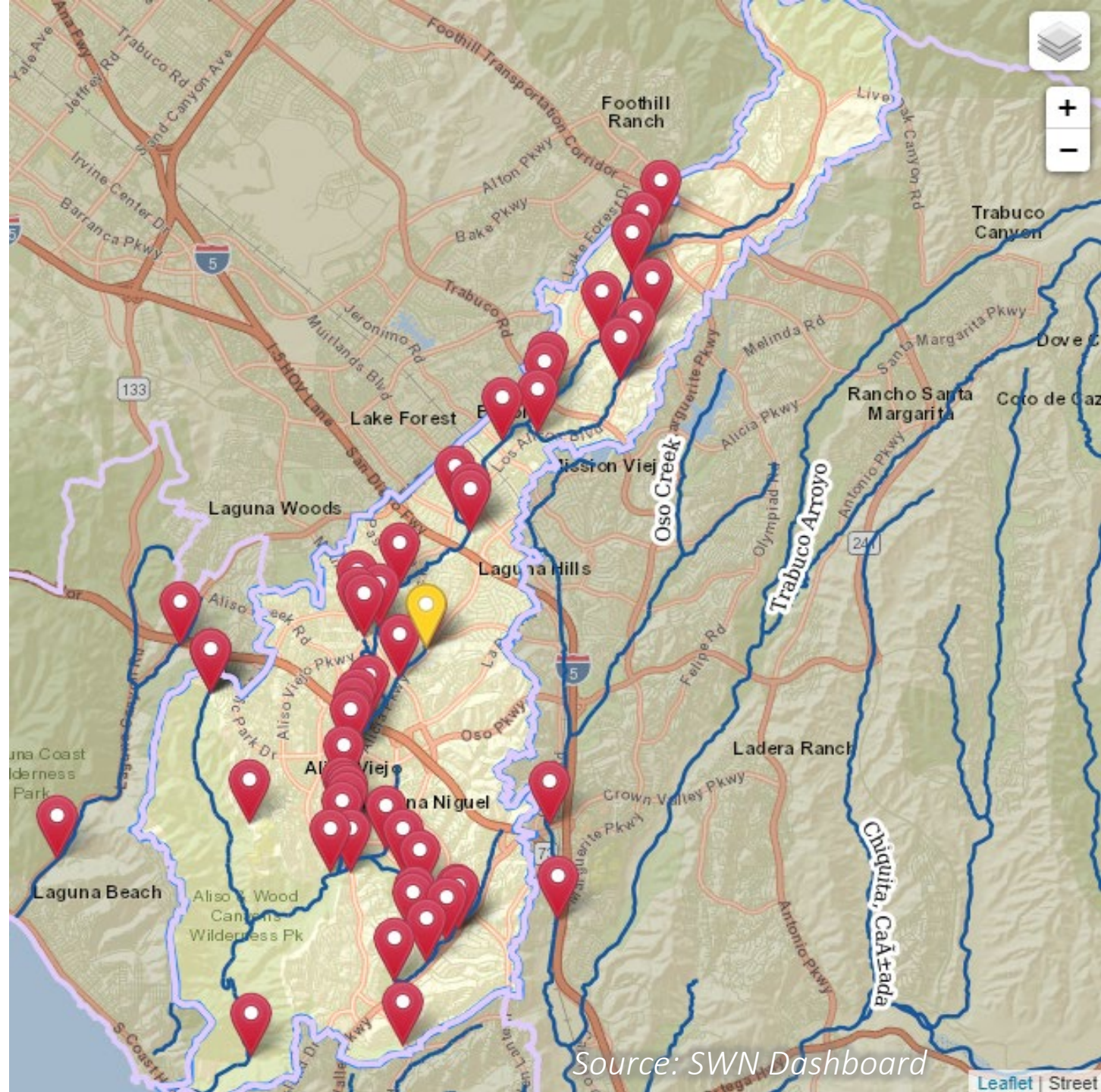
Primary Work Product: Watershed Monitoring System

Monitoring Locations

52 New Flow Monitoring Sites

- 39 priority outfalls
- 13 receiving water locations

20 New Conductivity Monitoring Sites



Field Instrumentation

Depth Sensor



Supplemental Solar Power



Ultrasonic Sensor



Sensus AMI Transmitter

Calibration and Rating Curves

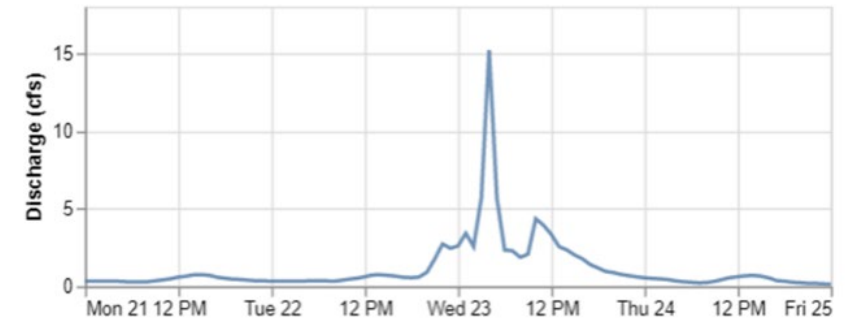
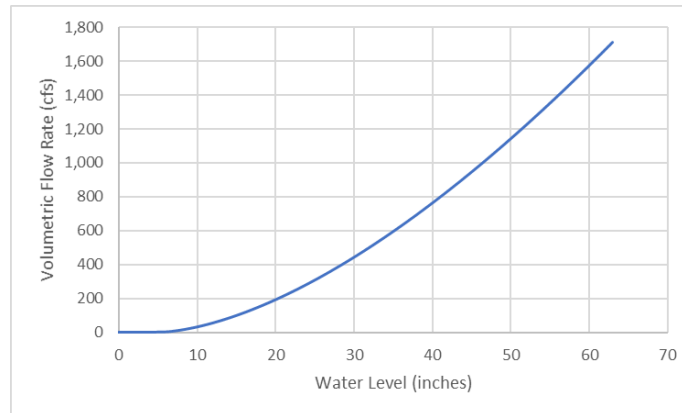
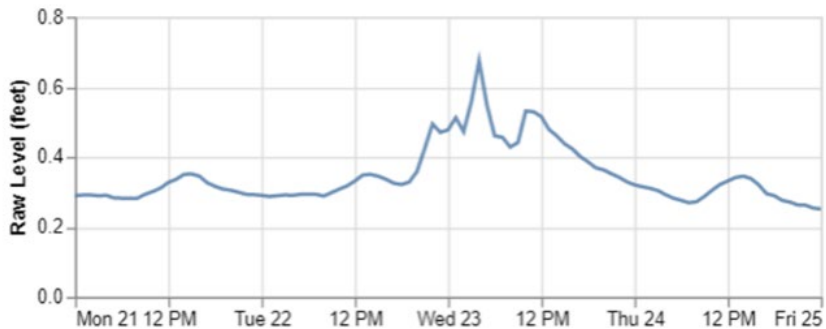
Raw sensor data
(depth, feet)



Site specific rating
curve

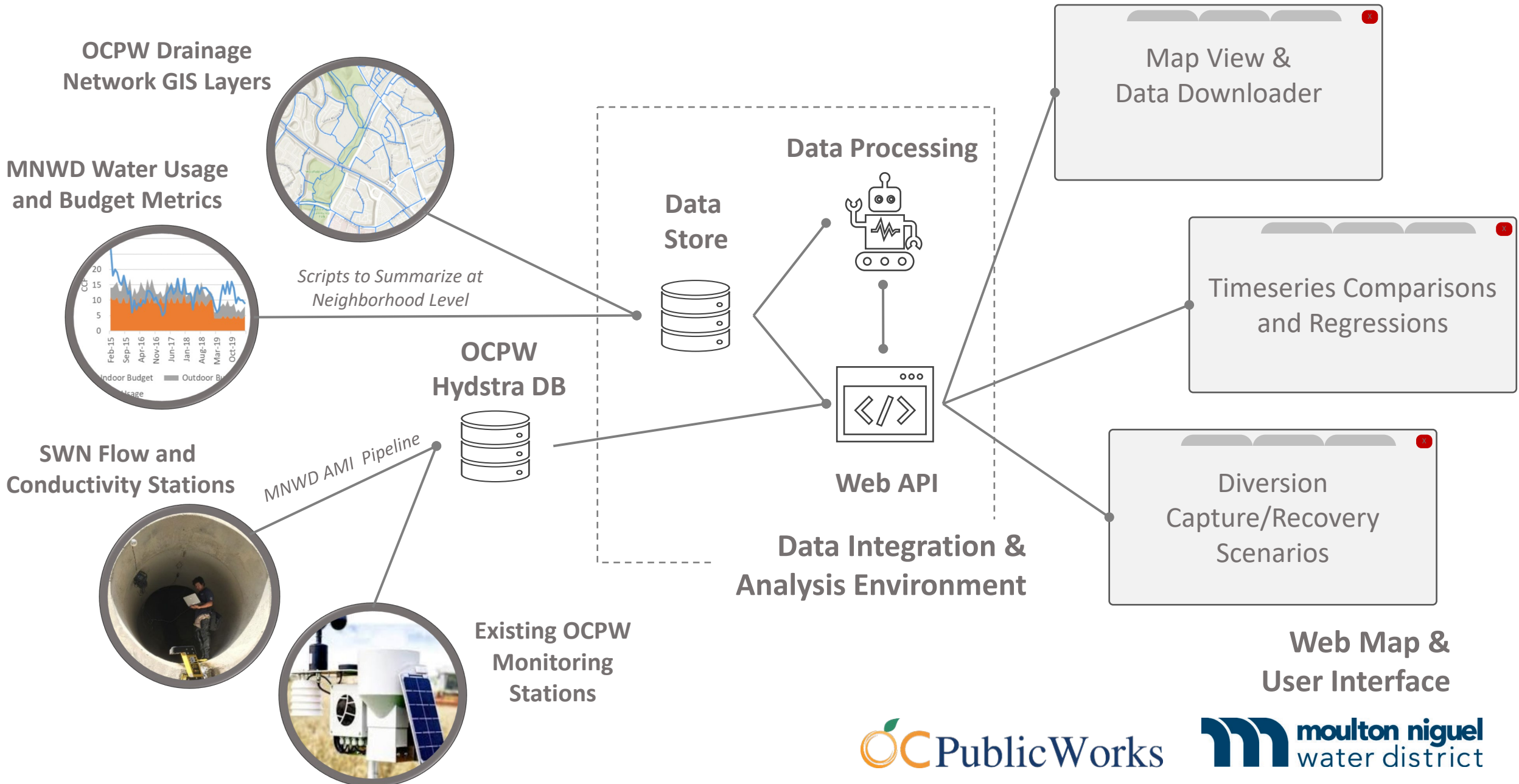


Discharge
(flow, cfs)

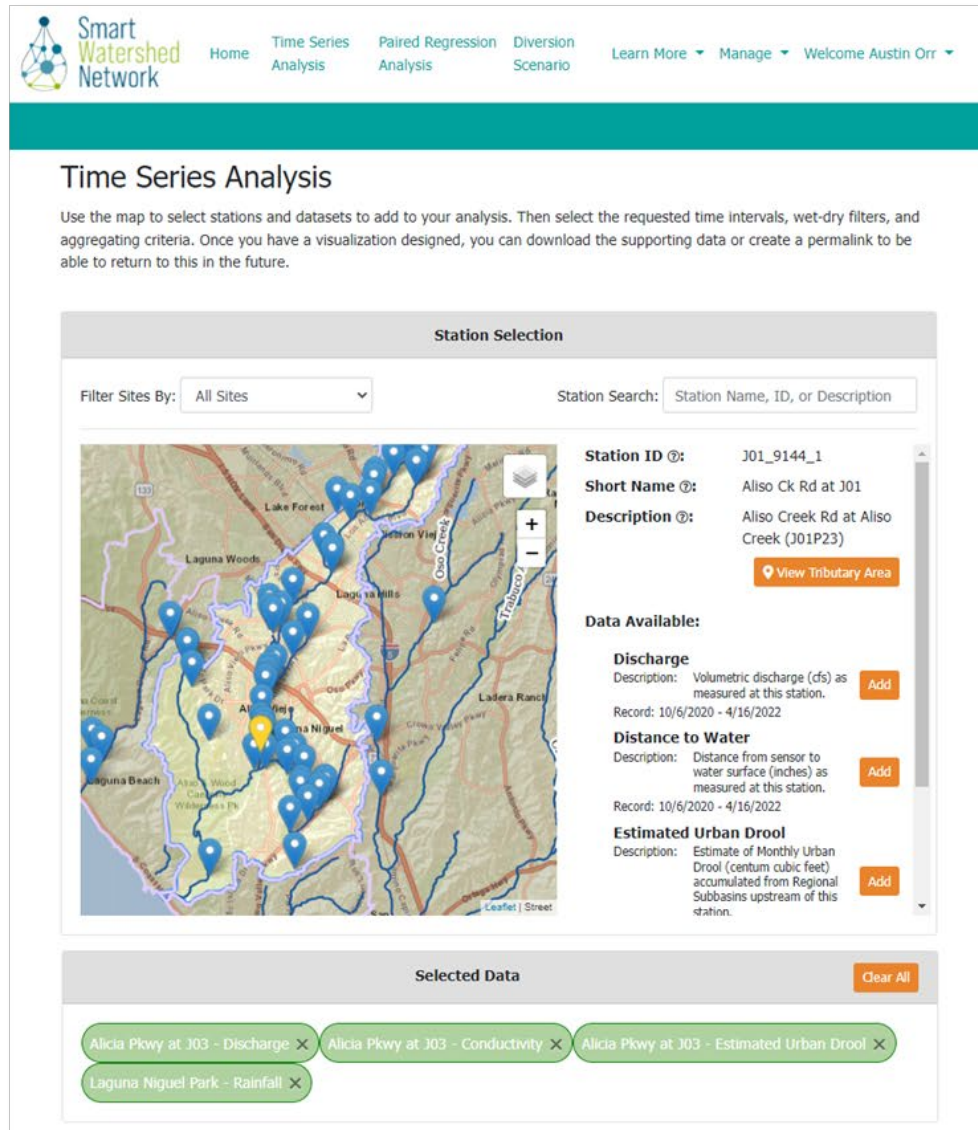


Primary Work Product: Data Management and Analytic Tools

Data Management and Analysis System



Smart Watershed Network Dashboard



The screenshot shows the 'Time Series Analysis' page of the Smart Watershed Network dashboard. At the top, there is a navigation bar with the logo and links for Home, Time Series Analysis, Paired Regression Analysis, Diversion Scenario, Learn More, Manage, and a user welcome message for Austin Orr. The main heading is 'Time Series Analysis', followed by a brief instruction on how to use the map to select stations and datasets. Below this is a 'Station Selection' section with a map of the watershed and a list of available data for a selected station (J01_9144_1). The data list includes Discharge, Distance to Water, and Estimated Urban Drool, each with a description and an 'Add' button. At the bottom, there is a 'Selected Data' section with a 'Clear All' button and a list of selected items: Alicia Pkwy at J03 - Discharge, Alicia Pkwy at J03 - Conductivity, Alicia Pkwy at J03 - Estimated Urban Drool, and Laguna Niguel Park - Rainfall.

Smart Watershed Network Home Time Series Analysis Paired Regression Analysis Diversion Scenario Learn More Manage Welcome Austin Orr

Time Series Analysis

Use the map to select stations and datasets to add to your analysis. Then select the requested time intervals, wet-dry filters, and aggregating criteria. Once you have a visualization designed, you can download the supporting data or create a permalink to be able to return to this in the future.

Station Selection

Filter Sites By: All Sites Station Search: Station Name, ID, or Description

Station ID @: J01_9144_1
Short Name @: Aliso Ck Rd at J01
Description @: Aliso Creek Rd at Aliso Creek (J01P23)
[View Tributary Area](#)

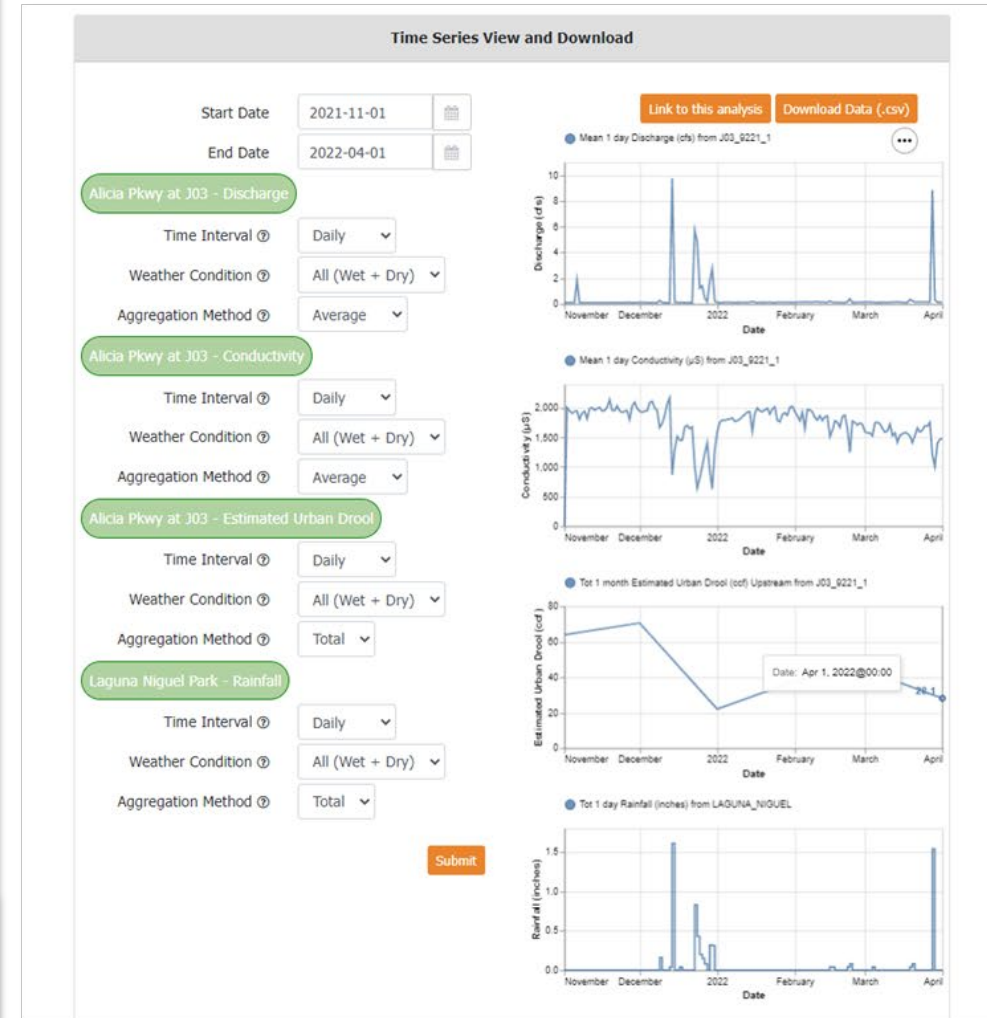
Data Available:

- Discharge**
Description: Volumetric discharge (cfs) as measured at this station. [Add](#)
Record: 10/6/2020 - 4/16/2022
- Distance to Water**
Description: Distance from sensor to water surface (inches) as measured at this station. [Add](#)
Record: 10/6/2020 - 4/16/2022
- Estimated Urban Drool**
Description: Estimate of Monthly Urban Drool (centum cubic feet) accumulated from Regional Subbasins upstream of this station. [Add](#)

Selected Data

[Clear All](#)

- Alicia Pkwy at J03 - Discharge
- Alicia Pkwy at J03 - Conductivity
- Alicia Pkwy at J03 - Estimated Urban Drool
- Laguna Niguel Park - Rainfall



The screenshot shows the 'Time Series View and Download' interface. It features a control panel on the left with dropdown menus for Start Date (2021-11-01), End Date (2022-04-01), Time Interval (Daily), Weather Condition (All (Wet + Dry)), and Aggregation Method (Average). Below this, there are four data series selected in green boxes: Alicia Pkwy at J03 - Discharge, Alicia Pkwy at J03 - Conductivity, Alicia Pkwy at J03 - Estimated Urban Drool, and Laguna Niguel Park - Rainfall. Each series has its own set of controls for Time Interval, Weather Condition, and Aggregation Method. A 'Submit' button is located at the bottom right of the control panel. On the right side, there are four line and bar charts showing the time series data for each series from November 2021 to April 2022. The charts are: Mean 1 day Discharge (cfs), Mean 1 day Conductivity (µS), Tot 1 month Estimated Urban Drool (cfd) Upstream from J03_9221_1, and Tot 1 day Rainfall (inches) from LAGUNA_NIOUEL. A 'Link to this analysis' and 'Download Data (.csv)' button are located at the top right of the chart area.

Time Series View and Download

Start Date: 2021-11-01 End Date: 2022-04-01

Alicia Pkwy at J03 - Discharge
Time Interval: Daily Weather Condition: All (Wet + Dry) Aggregation Method: Average

Alicia Pkwy at J03 - Conductivity
Time Interval: Daily Weather Condition: All (Wet + Dry) Aggregation Method: Average

Alicia Pkwy at J03 - Estimated Urban Drool
Time Interval: Daily Weather Condition: All (Wet + Dry) Aggregation Method: Total

Laguna Niguel Park - Rainfall
Time Interval: Daily Weather Condition: All (Wet + Dry) Aggregation Method: Total

[Link to this analysis](#) [Download Data \(.csv\)](#)

Discharge (cfs) Conductivity (µS) Estimated Urban Drool (cfd) Rainfall (inches)

Submit

SWN Dashboard – Time Series Analysis Tool

Start Date: 2021-01-01

End Date: 2022-03-01

J06 d/s at Moulton - Discharge

Time Interval: Monthly

Weather Condition: Dry

Aggregation Method: Average

J06 d/s at Moulton - Estimated Urban Drool

Time Interval: Monthly

Weather Condition: All (Wet + Dry)

Aggregation Method: Total

Moulton Pk Rptr - Rainfall

Time Interval: Daily

Weather Condition: All (Wet + Dry)

Aggregation Method: Total


[Link to this analysis](#) [Download Data \(.csv\)](#)


The dashboard displays three time series plots from January 2021 to March 2022. The first plot, 'Mean 1 month Dry Weather Discharge (cfs) from DAIRYFORK_MOULTON', is a line graph showing discharge values ranging from 0.0 to 2.5 cfs. The second plot, 'Tot 1 month Estimated Urban Drool (ccf) Upstream from DAIRYFORK_MOULTON', is a line graph showing drool values from 0 to 150 ccf. The third plot, 'Tot 1 day Rainfall (inches) from MOULTON_PEAK', is a bar chart showing daily rainfall from 0 to 3 inches.

[Submit](#)

This plot shows monthly dry weather flow, over-budget water usage in the tributary drainage area, and daily precipitation.

SWN Dashboard – Regression Analysis Tool

Start Date 2021-01-01 



End Date 2022-03-01 

Time Interval  Monthly 


Weather Condition  Dry 

Regression Method  Linear 

J06 d/s at Moulton - Estimated Urban Drool

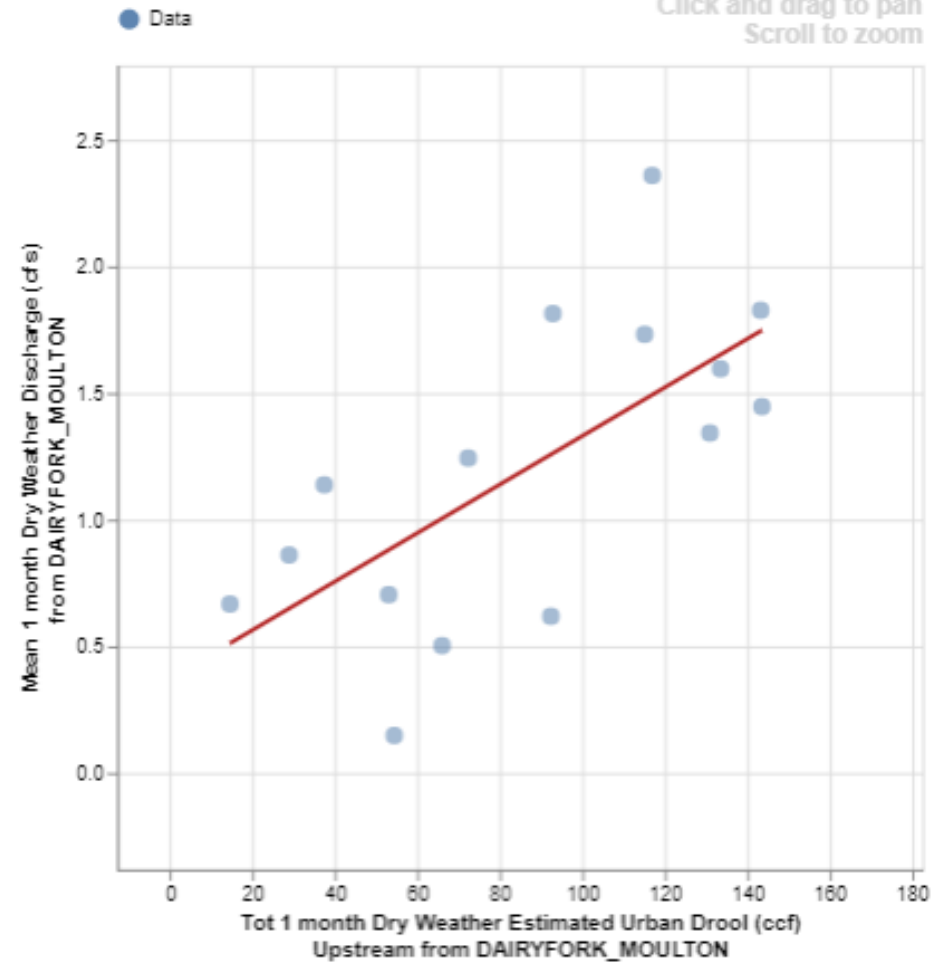
Aggregation Method  Total 

J06 d/s at Moulton - Discharge

Aggregation Method  Average 

Submit

[Link to this analysis](#) [Download Data \(.csv\)](#)



R²: 0.46

Equation: $y = 0.3749 + 0.0096x$

This regression shows a relationship between monthly dry weather flow and the corresponding over-budget water usage in the tributary drainage area.

SWN Dashboard – Diversion Scenario Analysis Tool

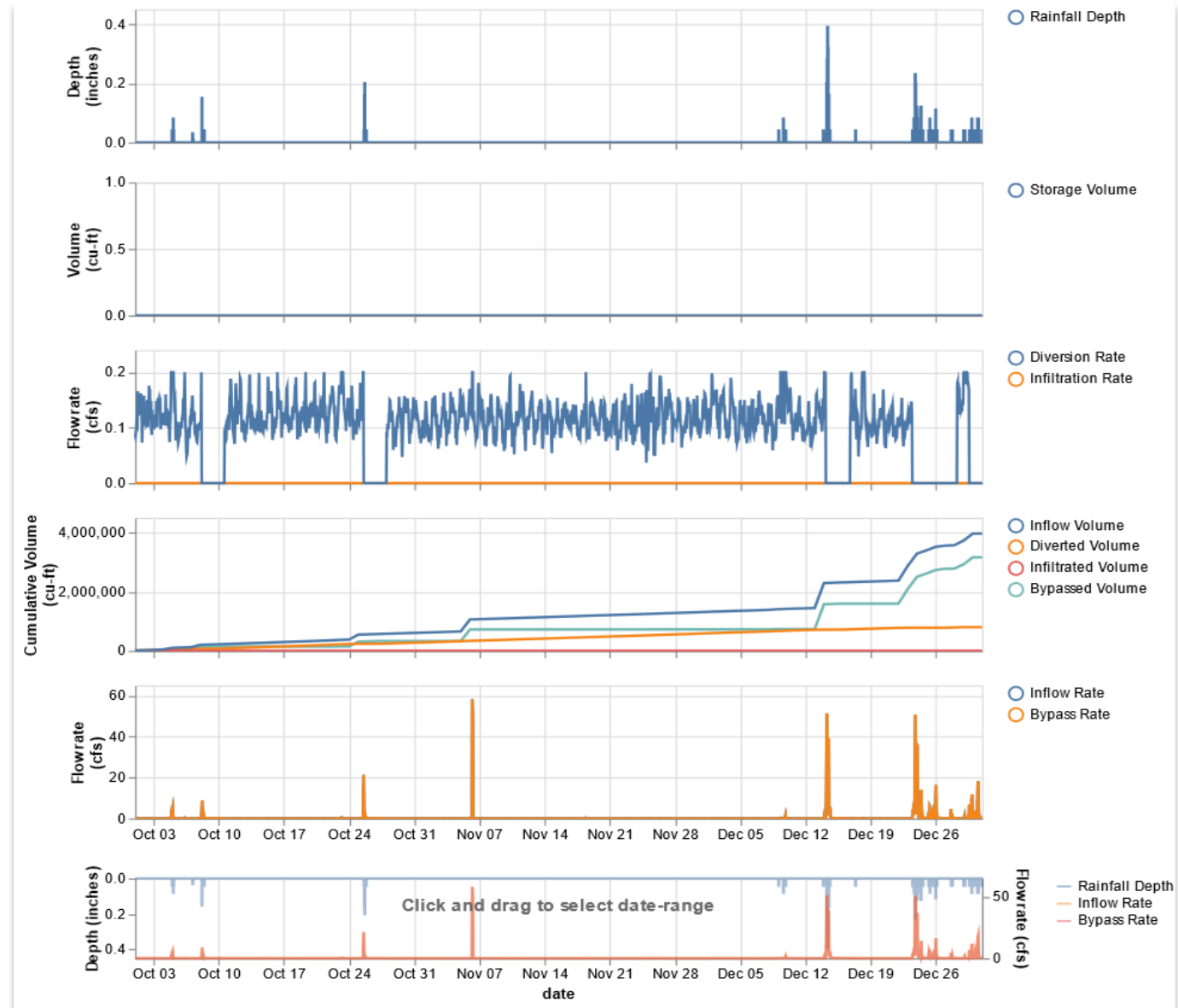
Start Date	<input type="text" value="2022-01-18"/>
End Date	<input type="text" value="2022-04-18"/>
Diversion Rate (cfs) ⓘ	<input type="text" value="0.15"/>
Storage Max Depth (ft) ⓘ	<input type="text" value="2"/>
Storage Initial Depth (ft) ⓘ	<input type="text" value="0"/>
Storage Area (sqft) ⓘ	<input type="text" value="200000"/>
Infiltration Rate (in/hr) ⓘ	<input type="text" value="0"/>
Shutdown Diversion During Rain Events ⓘ	<input checked="" type="radio"/> True <input type="radio"/> False
Rainfall Event Depth Threshold (inches) ⓘ	<input type="text" value="0.1"/>
Event Separation Time (hours) ⓘ	<input type="text" value="6"/>
Resume Diversion After Delay (hours) ⓘ	<input type="text" value="72"/>
Nearest Rainfall Station ⓘ	<input type="text" value="Aliso Creek @ Jeronimo"/>
Months Active ⓘ	<input type="text" value="January × +11 more"/>
Weekdays Active ⓘ	<input type="text" value="Sunday × +6 more"/>
Hours Active ⓘ	<input type="text" value="12 AM × 1 AM × +22 more"/>

Submit

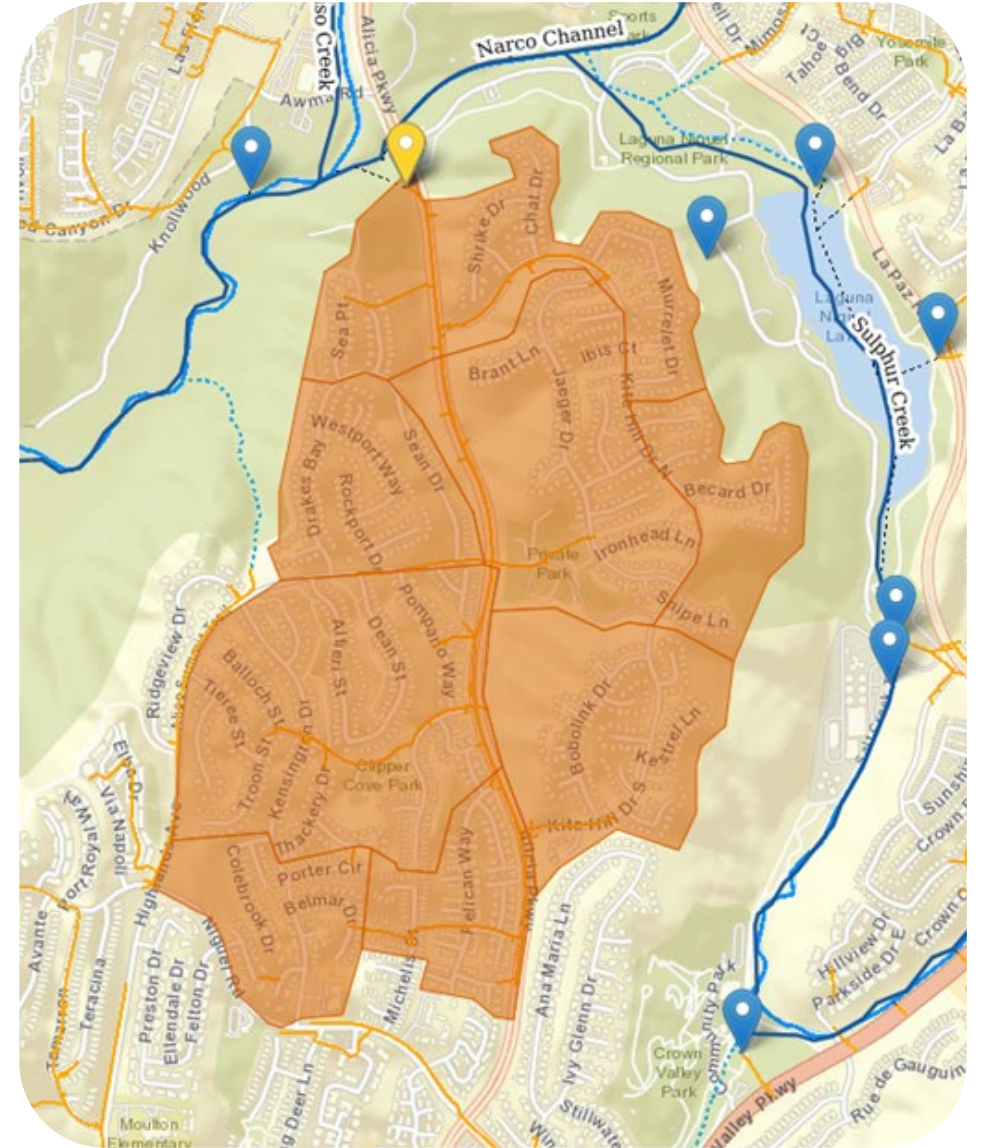
User interface to set design and operational parameters.

SWN Dashboard – Diversion Scenario Analysis Tool

Scenario results are shown as time series and summarized in a table.



Case Study



Urban Runoff Capture Analysis @ Alicia Parkway & Sulphur Creek

- Predominantly residential watershed
- Monitoring location has both flow and conductivity data
- Full dataset available for period from November 2021 – March 2022



Station Selection

Filter Sites By: All Sites Station Search: Station Name, ID, or Description

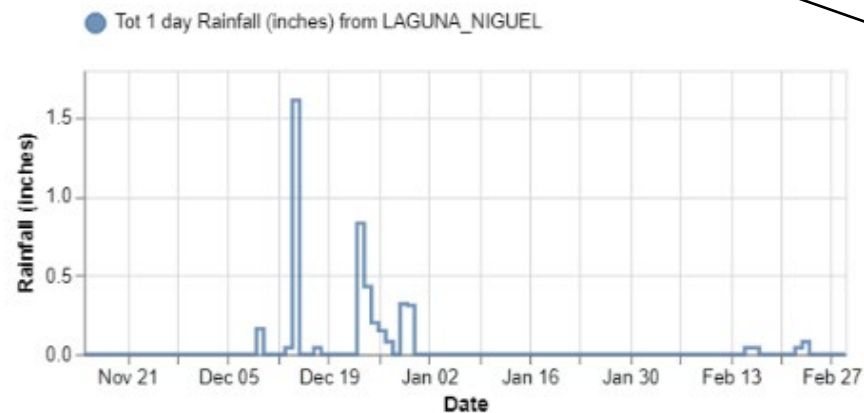
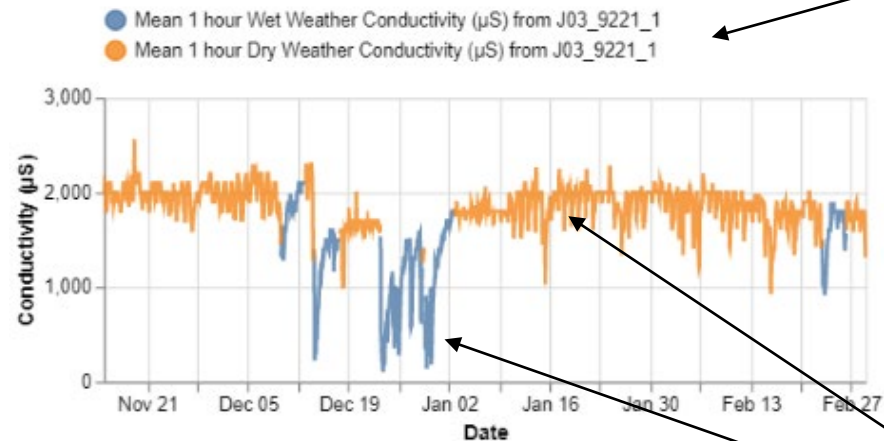
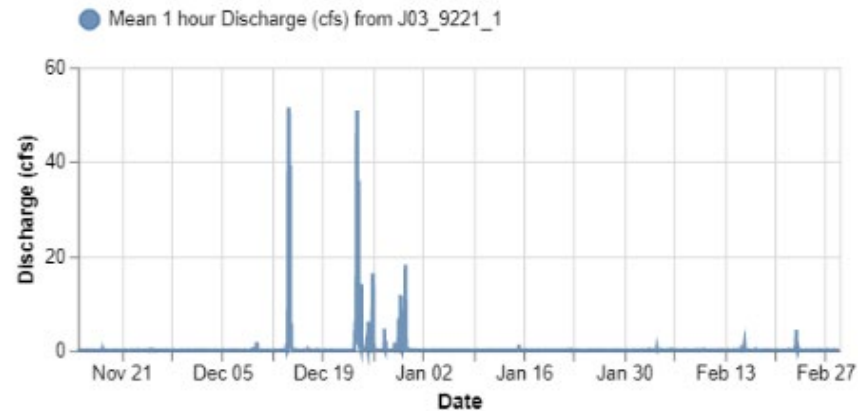
Station ID @: J03_9221_1
Short Name @: Alicia Pkwy at J03
Description @: Alicia Pkwy at Sulphur Creek (J03P02)
[Zoom to Tributary Area](#)

Data Available:

- Discharge**
Description: Volumetric discharge (cfs) as measured at this station. [Add](#)
Record: 10/22/2020 - 4/18/2022
- Distance to Water**
Description: Distance from sensor to water surface (Inches) as measured at this station. [Add](#)
Record: 10/22/2020 - 4/18/2022
- Conductivity**
Description: Conductivity (μS) as measured at this station. [Add](#)
Record: 11/1/2021 - 4/18/2022
- Estimated Urban Drool**
Description: Estimate of Monthly Urban Drool (centum cubic feet) accumulated from Regional Subbasins upstream of this station. [Add](#)
Record: 1/31/2015 - 3/31/2022
- Rainfall**
Description: Rainfall (inches) as measured at this station or the nearest rainfall gauge. [Add](#)
Gage: Laguna Niguel Park
Record: 5/29/1991 - 4/19/2022

Time Series Analysis @Alicia Parkway & Sulphur Creek

- Review conductivity sensor readings from November 2021 – February 2022
- Identify wet and dry weather conditions
- Note temporal co-occurrence of changing conductivity with other variables



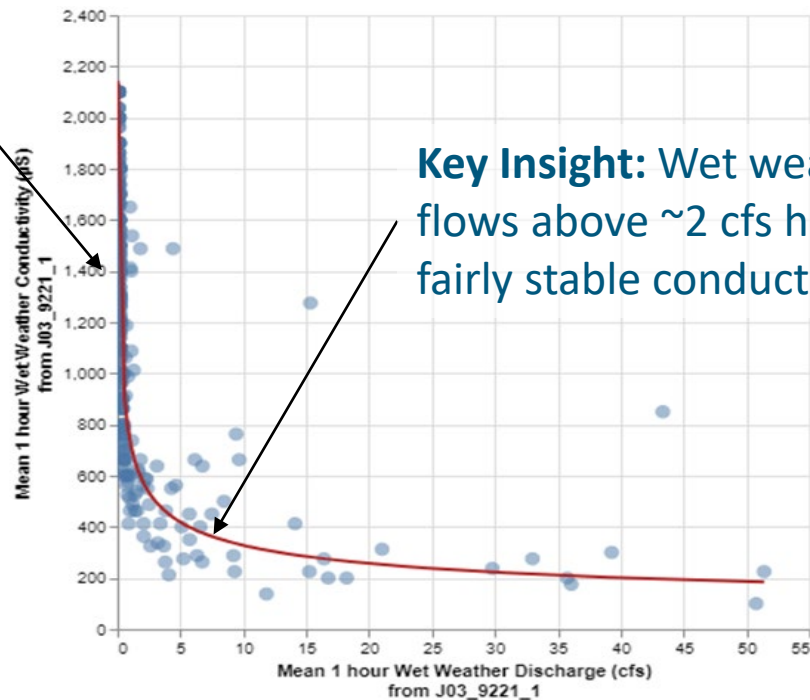
Identify and visually separate wet and dry weather observations

Key Insight: Conductivity appears to drop during periods of increased discharge associated with rainfall events

Regression Analysis – Discharge vs Conductivity @Alicia Parkway & Sulphur Creek

Key Insight: As flow regimes transition from wet to dry weather flow-rates, the conductivity increases

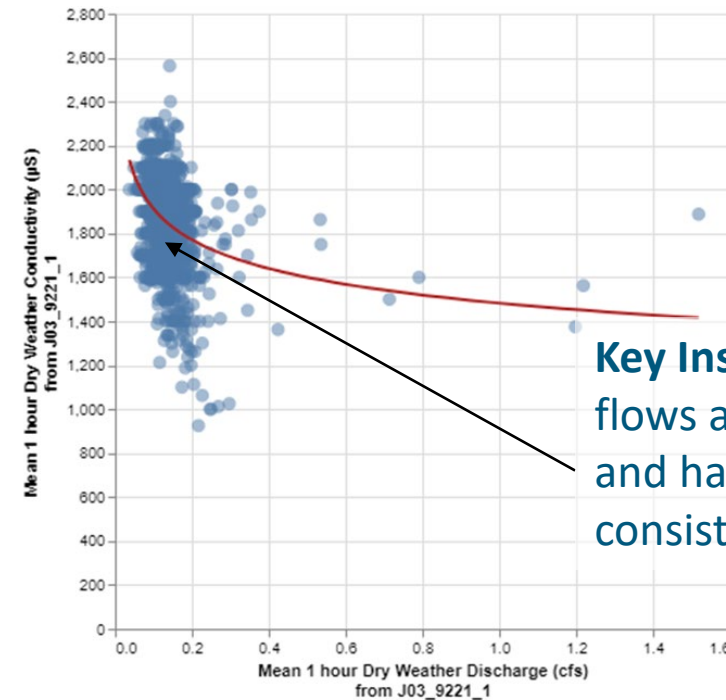
Wet Weather Conditions Only



Key Insight: Wet weather flows above ~2 cfs have fairly stable conductivity

$R^2: 0.77$
Equation: $y = 736.9239 * x^{-0.3515}$

Dry Weather Conditions Only



Key Insight: Dry weather flows are under ~0.2 cfs, and have relatively consistent conductivity

$R^2: 0.08$
Equation: $y = 1482.4752 * x^{-0.1105}$

Regressions of Discharge vs Conductivity from November 2021 – February 2022

Diversions Scenario Analysis

@Alicia Parkway & Sulphur Creek

Key Insight: Rapidly assess multiple scenarios to iterate on various system configurations and operational decisions

Key Insight: As system continues to collect data, these diversion scenarios may be easily revisited to assess performance during other flow regimes and weather conditions, e.g., during summer months

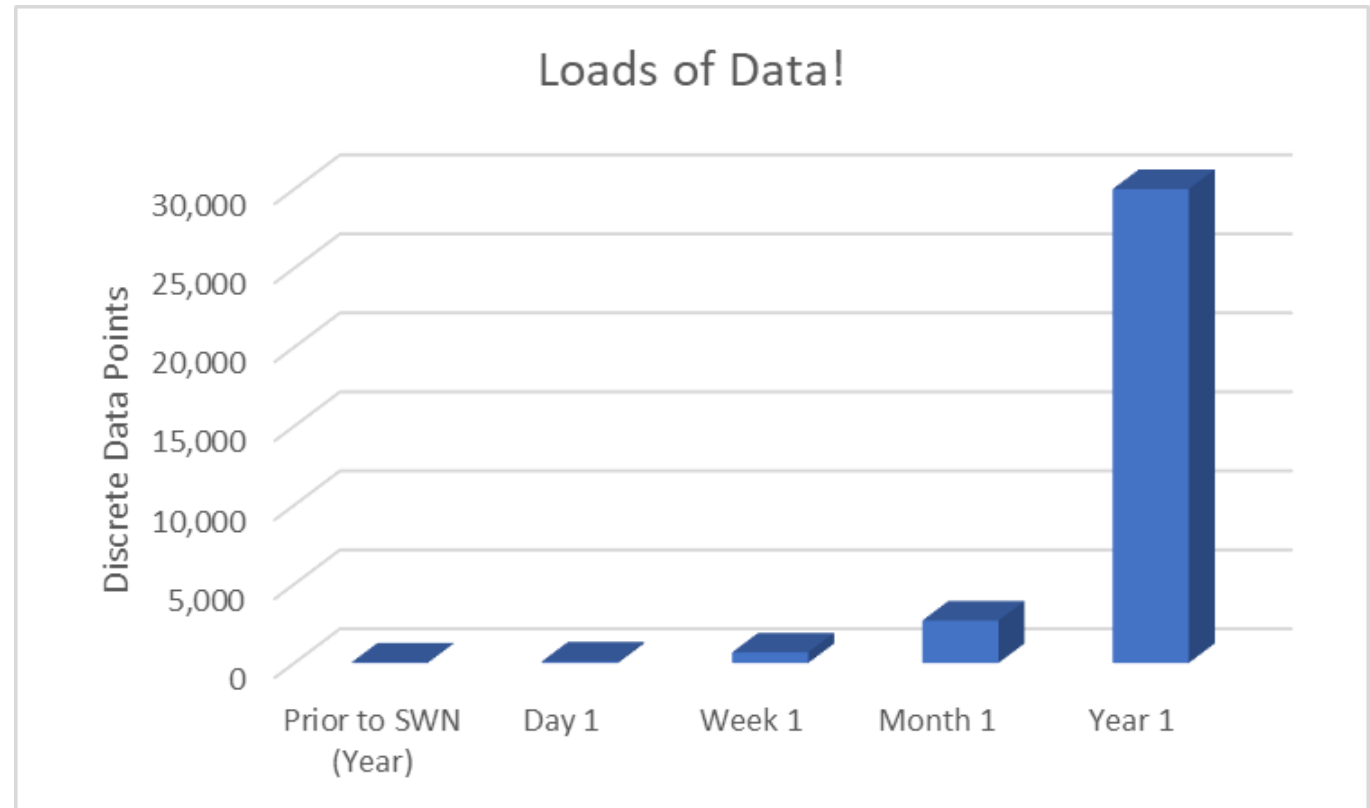
Input/Result	Scenario 1	Scenario 2	Scenario 3				
			Base	Base + double diversion rate	Base + double storage volume	Base + double storage, double diversion rate	Base + full time diversion
Operating Rule	Dry only	Full time	Dry only	Dry only	Dry only	Dry only	Full time
Operating delay	48 hrs	NA	48 hrs	48 hrs	48 hrs	48 hrs	NA
Storage Volume	0	0	3.5 ac-ft	3.5 ac-ft	7 ac-ft	7 ac-ft	3.5 ac-ft
Diversions Rate	0.2 cfs	1 cfs	0.5 cfs	1 cfs	0.5 cfs	1 cfs	0.5 cfs
% of Inflow Diverted	23%	36%	43%	44%	52%	56%	52%
Approx. dry weather volume diverted, ac-ft	22	22	22	22	22	22	22
Approx. wet weather volume diverted, ac-ft	0	12	19	20	28	31	28
Approximate conductivity of diverted water, uS/cm	1800	1290	1150	1130	1020	980	1020

Scenarios were evaluated for period from October 1, 2021 – January 15, 2021

Project Accomplishments and Broader Applicability

Project Accomplishments

- Piloted AMI for new watershed data use
- Developed Integrated Analysis Dashboard
- >2 Years of Continuous Data
- Grant Funded
- Open-Source Dashboard



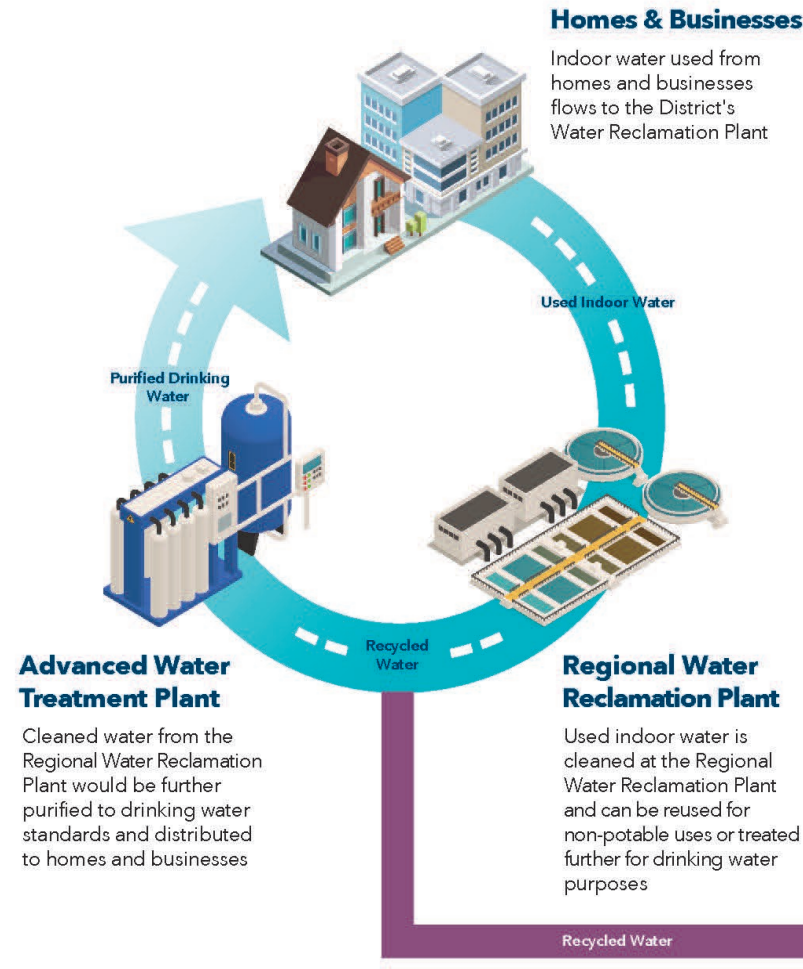
Next Steps

- Drive Project Planning
- Data Use by Several Agencies
- Non-Structural Strategies
Evaluation
- Provide Guidance on Target
Areas



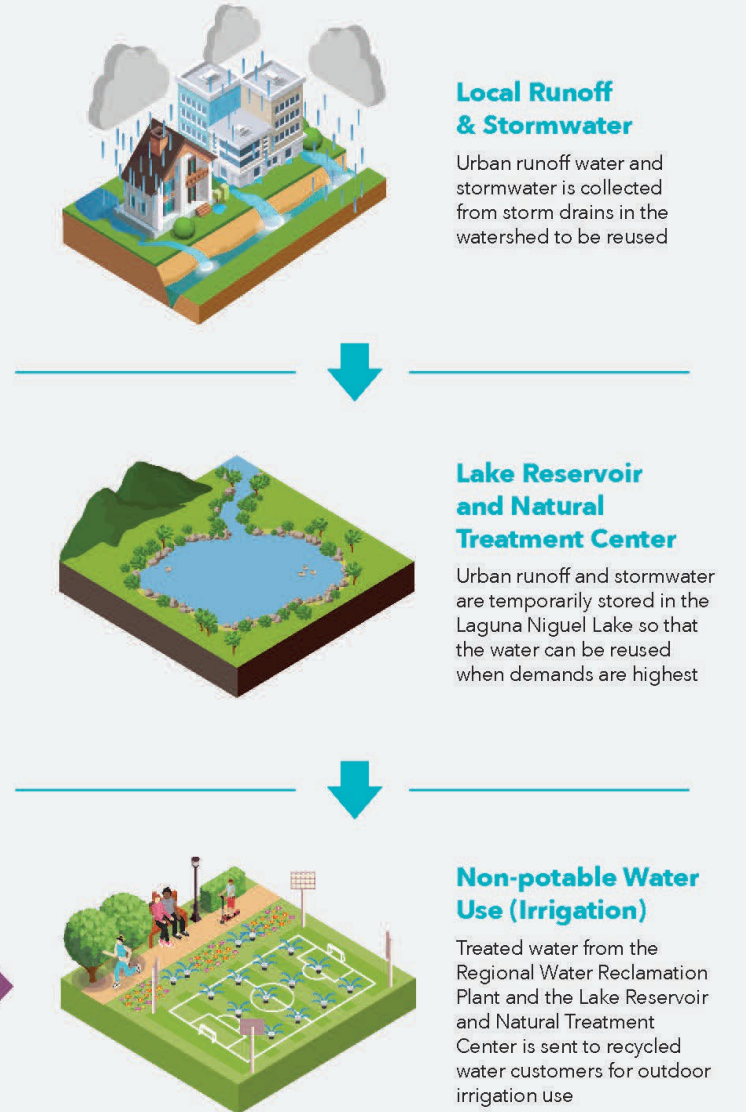
Optimized, Adaptive, Sustainable, and Integrated Supply (OASIS) Treatment Center

DIRECT POTABLE REUSE DRINKING WATER



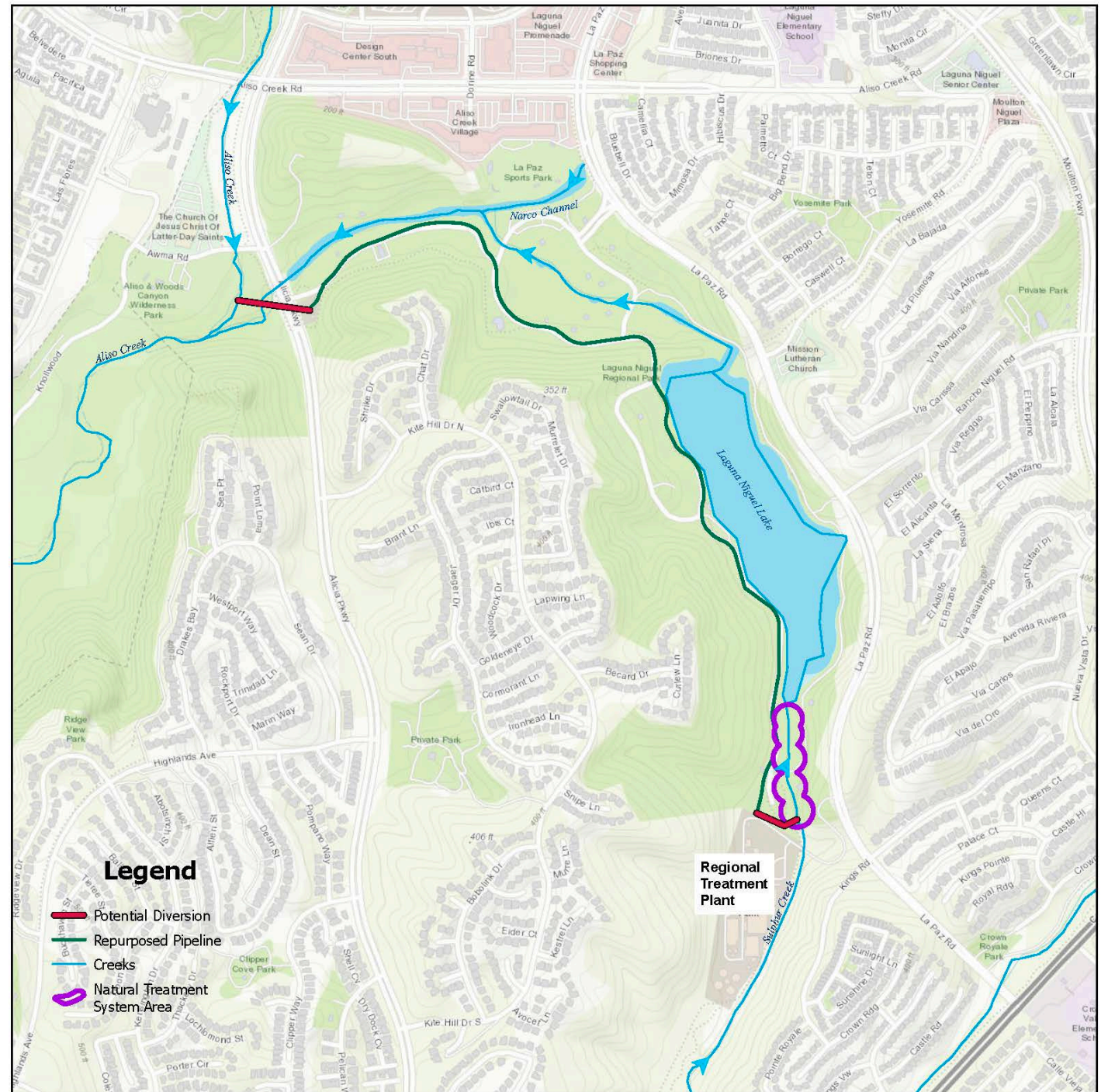
*Potable Water = Drinking Water

RUNOFF DIVERSION RECYCLED WATER



Potential OASIS Facilities

- Runoff Diversion Structure
- Repurposed Pipeline
- Natural Treatment System
- Direct Potable Reuse
- Education Center



OASIS Planning Activities

- Grant Funding Opportunities
 - \$1.5M Building Resilient Infrastructure Communities (FEMA)
- DPR Concept Study
- Demonstration Plant
- Runoff Diversion Study
- Water Quality Monitoring Plan
- Regional Partnerships
- Stakeholder Coordination and Outreach



Thanks to the Team!

MNWD – Program Manager

Laura Rocha
Drew Atwater
Monobina Mukherjee
Anudeep Vanjavakam
Alex Thomas
Lindsey Stuvick

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Camille Adler
Kathleen Kelly

Geosyntec Consultants

Aaron Poresky
Austin Orr

NV5

Garth Engelhorn

ESA Sitka

John Burns
Kathleen Elmquist

California Data Collaborative

Chris Tull

Kisters (Hydstra)

Dylan Evans

Sensus (AMI)

Chris Berg



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