Characterizing and Optimizing the Water Quality Benefits of In-Channel Vegetation

Scientific Studies Program

Fiscal Year 2026-2027

ULAR, LLAR

USC Dornsife Public Exchange

Josh West & Alex Robinson

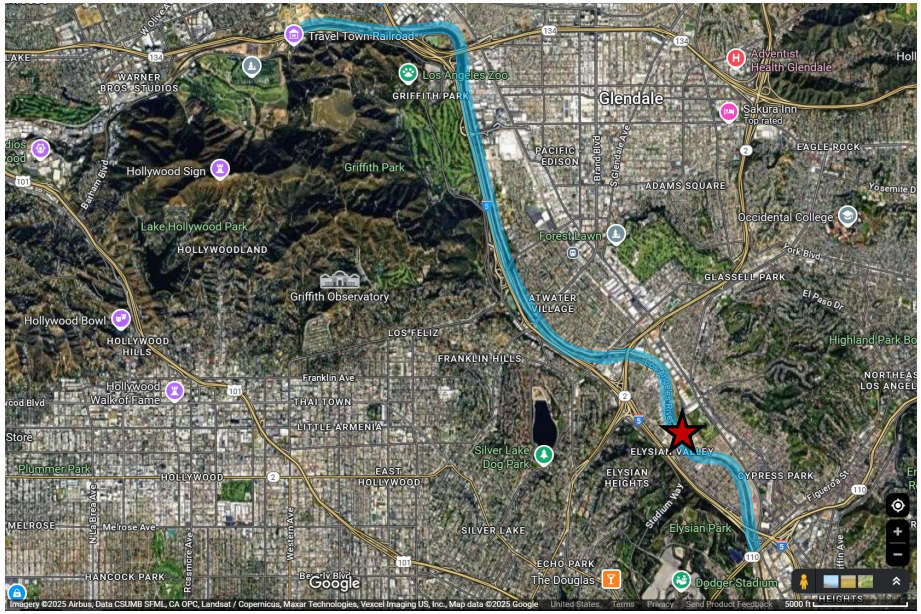
Study Overview

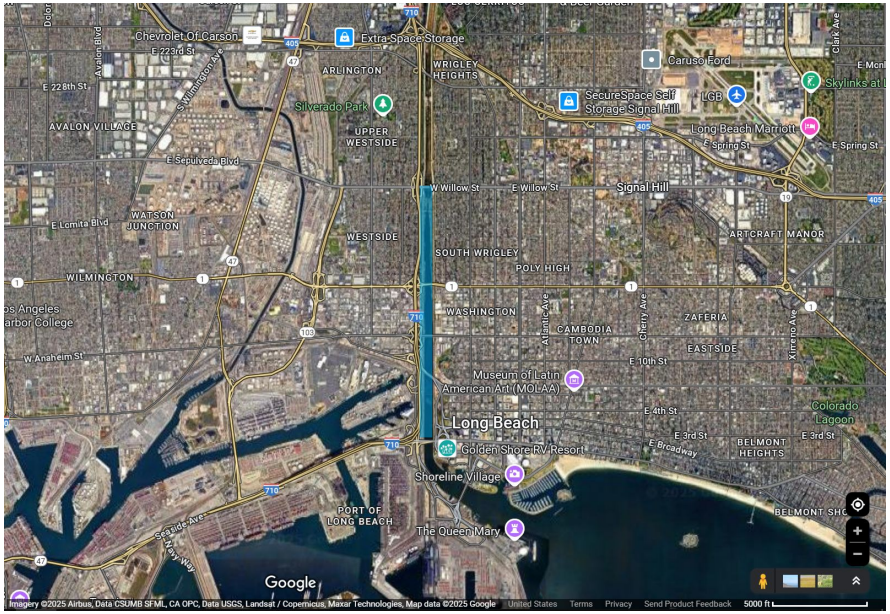
Quantify how in-channel vegetation functions as a nature-based biofilter in the Los Angeles River

Vegetation can provide a nature-based solution for improving water quality. But we do not know how effective it is and under what conditions (e.g., baseflow vs. stormflow, native vs. invasive, etc).

This study will use advanced instrumentation and modeling to **quantify the role of vegetation in filtering pathogens, nutrients, and metals**, providing the knowledge needed for optimized management. By directly linking vegetation to water quality improvements, the study supports regulatory compliance and advances multi-benefit stormwater strategies across Southern California's soft-bottomed and naturalizing channels.

Study Location





Left: The proposed project will focus along the soft-bottom Glendale Narrows section of the upper Los Angeles River. The star highlights the Taylor Yard section of the river, for which the team has existing vegetation surveys and flow data.

Right: Expanded study efforts in years 3 & 4 will also target the lower Los Angeles River.

Study Team

Mitul Luhar, Associate Professor, Civil and Environmental and Aerospace and Mechanical Engineering, USC
- Expert in environmental fluid mechanics and hydrology, particularly vegetated systems
- Published 65+ peer-reviewed journal, conference papers, and book chapters

Alex Robinson, Associate Professor, USC School of Architecture, Landscape Architecture + Urbanism Program
- Expert in nature-based infrastructure: critical infrastructure that also provides robust landscape values
- Author of two books; (co-)founder of Integrated Infrastructure Design Lab and Los Angeles River Observatory

Josh West, Professor, Earth Sciences and Environmental Studies, USC
- Expert in water chemistry, including trace metals and other contaminants in hydrological systems
- Published over 100 peer-reviewed journal papers and multiple book chapters

Carling Monder, Project Manager, USC Public Exchange
- Manages complex, multi-stakeholder projects in collaboration with academic partners, government agencies, and community organizations

Kate Weber, Project Advisor, Executive Director, USC Public Exchange
- Oversees strategic partnerships and research translation efforts connecting USC faculty with public and private sector needs

Dan Angelescu, Founder and CEO, Fluidion
- Founded Fluidion in 2012 focusing on breakthrough water quality and environmental sensor technologies.
- Previously Professor of nano- and microtechnology, ESIEE Paris - Université Paris-Est, and Senior Research Scientist at Schlumberger pioneering the company's first microfluidic platform for extreme environments
- Holder of 30+ patents, 50+ journal publications, and 3 book publications

Joyce Wong, Principal Scientist, Fluidion US Inc.
- Expertise in microfluidics and sensors, with focus on water quality and environmental applications
- Previously Principal Research Scientist at Schlumberger and Visiting Associate at Caltech, collaborating with multi-disciplinary teams on micro- and nanosensor development

Study Details

Problem Statement: Flood-control agencies and planners lack quantitative data on how in-channel vegetation influences pollutant removal and flow behavior, making it difficult to address tradeoffs and potential synergies between flood protection, water quality improvement, and habitat provision. Current monitoring methods (grab sampling, lab-only bacteria analysis) are too infrequent to capture rapid pollution dynamics and identify the role of vegetation.

Study Objective: Generate high-frequency, in-situ water quality data for both microbiological and chemical pollutants to determine vegetation's role in improving water quality and inform adaptive management.

Goals & Outcomes:

- Quantify effects of vegetation on microbial indicators, nutrients, turbidity, and metals.
- Validate rapid analyzers for EPA site-specific approval.
- Develop predictive models linking vegetation type, hydrology, and pollutant dynamics.
- Inform SCWP and regulatory programs with scalable, data-driven recommendations.

Regional Collaboration:

This spans the Upper and Lower Los Angeles River Watershed Areas and aligns with ongoing SCWP efforts:

- Complements the Regional Pathogen Reduction Study by adding high-frequency microbial and chemical data to improve temporal resolution and inform risk modeling.
- Leverages USC's LA River Observatory and studies to integrate UAV mapping, hydrologic modeling, & groundwater analyses.
- Establishes a shared monitoring & data framework across watersheds to accelerate adoption of nature-based infrastructure evaluation tools.

Study Methodology:

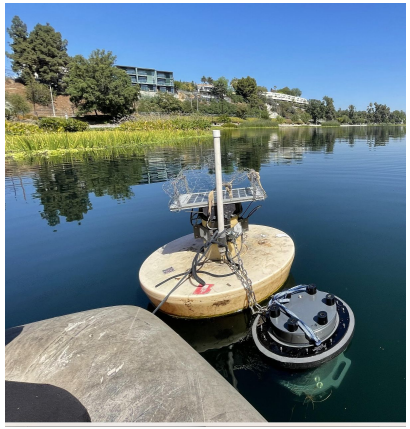
Fluidion Instrumentation - *high-frequency data collection*

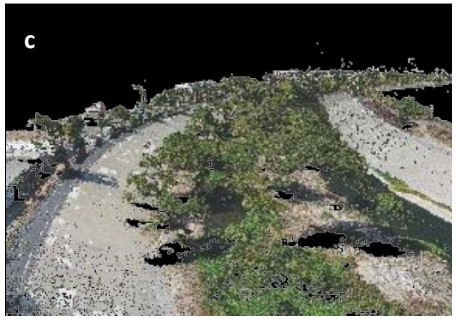
- ALERT systems: in-situ and handheld rapid microbiological analyzers (E. coli, coliforms).
- e-Chem systems: autonomous analyzers (nutrients + metals)
- Complementary sensors for flow, turbidity, dissolved oxygen, and temperature.

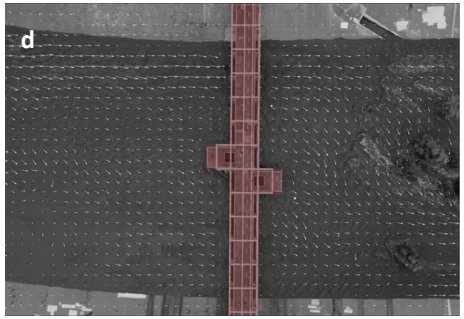
Approach

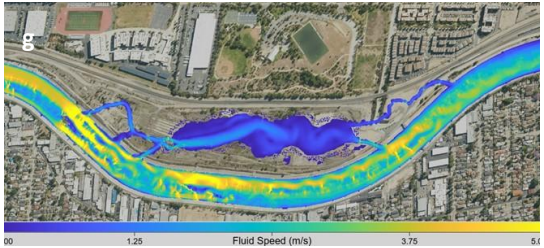
- High-frequency in-channel monitoring (hydrological + microbial + chemical)
- Drone-based vegetation and sediment mapping (LiDAR + 3D photogrammetry).
- Data integration with machine learning and HEC-RAS modeling for scenario predictions
- Community-based monitoring using handheld analyzers to expand local engagement and data access.

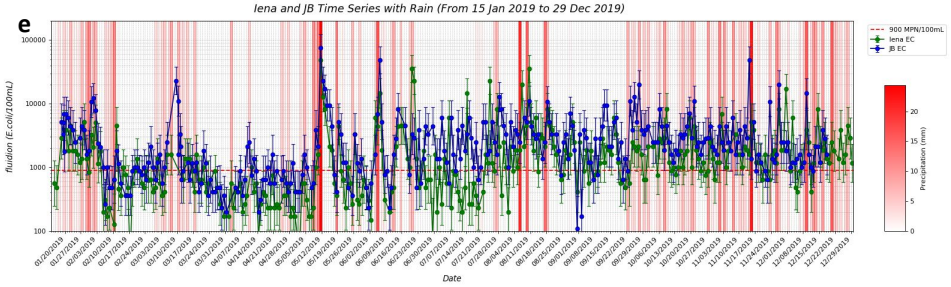
Study Details











Images showing capabilities and synergies: (a) fluidion ALERT systems to be used in this study; (b) autonomous ALERT v2 system in Echo Park lake (LASAN); (c) drone-based vegetation mapping; (d) drone-based flow sensing; (e) long-term high frequency pathogen monitoring using ALERT v2 systems in Seine River (Paris); (f) community outreach and interaction; (g) interactive simulation capabilities; (h) existing student-led field measurements of stage and temperature in Taylor Yard.

Cost & Schedule

Phase	Description	Cost	Completion Date
Pre-Study and Work Planning	Monitoring plan, installation, and testing protocols, preliminary field measurements, selection of priority monitoring locations, advisory committee establishment	**$267,475**	12/31/2027
Study Implementation	Implementation of study hardware, chemical analysis protocols and e-Chem instrumentation, drone based mapping, in-situ water quality monitoring (ULAR & LLAR), grab sampling and analysis, wet weather event analysis, dry season analysis, vegetation typology assessment and classification, water quality modeling, pollutant reservoir modeling, machine learning modeling, scenario modeling, quarterly advisory committee meetings, engagement with communities and educational institutions, collaboration and coordination with other SCWP projects, data sharing and integration, periodic reporting and dissemination	**$982,050**	09/30/2030
Post-Study	Final scenario modeling, final data sharing and integration, final reporting and dissemination summarizing data collection and modeling activities, highlighting key findings and recommendations for future management	**$105,245**	12/31/2030
TOTAL		**$1,354,770**	

Funding Request

WASC	Year 1	Year 2	Year 3	Year 4
LLAR	$0	$0	$43,522	$42,098
ULAR	$267,475	$231,087	$391,705	$378,883
TOTAL	**$267,475**	**$231,087**	**$435,227**	**$420,981**

Summary of Benefits

Water Quality

- First high-resolution assessment of in-channel vegetation as a natural biofilter
- Fills critical data gap to inform BMPs, TMDL compliance, and MS4 reporting
- Quantifies reductions in bacteria & pathogens in vegetated sections of ULAR and LLAR
- Complements upcoming microbial monitoring efforts in neighboring watersheds (e.g., Los Cerritos Channel)

Water Supply

- Informs watershed-based planning and stormwater management under EWMPs and other adaptive management strategies
- Improves understanding of pollutant reduction processes that enhance local water resilience resilience

Community Investment

- Enables community-based monitoring using rapid microbiology analyzers
- Assesses vegetation as a low-cost, multi-benefit solution for water quality, habitat & flood resilience
- Guides agencies & nonprofits in targeting vegetation-based investments

Education and Outreach

- Provides financial support, skills-based training, and networking opportunities for multiple PhD students
- Provides hands-on research training and networking opportunities for undergraduate students
- Creates community-based citizen science programs


Questions?
Josh West
Alex Robinson