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State of California

Ocean Protection Council

Statewide Microplastics Strategy

Report to the Legislature

June 2026

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Acknowledgments

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Solutions

multi-benefit solutions the state can act upon now while the scientific knowledge of microplastics further develops.

- **Pollution Prevention**
  to eliminate plastic waste at the source (products or materials from which microplastics originate)
- **Pathway Interventions**
  to intervene within specific pathways that mobilize microplastics from a specific source into California waters
- **Education**
  to inform the public and industries of microplastics sources, impacts, and solutions

Science to Inform Future Action

research priorities to advance scientific knowledge of microplastics to develop and refine future solutions.

- **Monitoring**
  to understand and identify trends of microplastic pollution statewide
- **Risk**
  to improve understanding of critical thresholds at which aquatic life and humans are adversely impacted by microplastic exposure
- **Sources & Pathways Prioritization**
  to idenitfy and prioritize future management solutions based on predominant ways microplastics enter California waters
- **Evaluating New Solutions**
  to develop and implement potential future solutions

Introduction

Pursuant Senate Bill 1263 (Portantino, 2018), the California Legislature directed the Ocean Protection Council (OPC) to develop a Statewide Microplastics Strategy in coordination with specific state agencies. The Legislature recognized that further research on microplastics and their associated risks would support continuing efforts to reduce microplastic pollution, and that early actions to prevent and reduce known impacts of microplastics could be pursued based on the known impacts and prevalence of microplastics pollution.

In February 2022, OPC adopted the **Statewide Microplastics Strategy**. The Strategy details a two-track approach to manage microplastics in California, while simultaneously advancing key research priorities to improve future management of microplastic pollution. The Solutions track described immediate, multi-benefit solutions to prevent and manage microplastic pollution, while the Science to Inform Future Action track outlined a research strategy to augment and complement the scientific foundation for microplastic monitoring, source and pathway identification, risk assessment, and development of additional management solutions.

Senate Bill 1263 requires the Ocean Protection Council to report on the implementation of the Statewide Microplastics Strategy, scientific findings, and recommendations to the Legislature regarding how California can continue to safeguard communities, environments, and economies against microplastic pollution. This report describes the state of microplastics science in California, recommendations based on research findings and state actions, and key actions the state has taken to implement the Statewide Microplastics Strategy across the 22 early recommend actions and 13 research priorities outlined in the existing Strategy. This report includes three key sections:

- **Recommendations** are provided based on lessons learned from early actions to reduce microplastic pollution, advance action-oriented science, and continue to support multi-benefit solutions.
- **Track 1: Solutions – Implementation Status** describes pollution prevention, pathway intervention, outreach, and education actions that state agencies have accomplished, as well as state legislation that enacted to help prevent ongoing plastic pollution.
- **Track 2: Science to Inform Future Action – Implementation Status** describes science conducted or funded by state agencies and other foundational research relevant to California, including efforts to monitor microplastics, identify risk thresholds, assess risk, characterize sources and pathways, and evaluate the efficacy of solutions.

Finally, the 2022 Statewide Microplastics Strategy and its implementation represent collective action across the state to simultaneously address and better understand microplastic pollution.

California has served as a model to inform and drive similar efforts nationally and globally. The Government of Quebec released a **proposed strategy for the Reduction and Responsible Management of Plastics in Quebec, 2024-2029**, Washington State is in the process of developing a **Puget Sound Microplastics Pollution Strategy**, the Michigan legislature is considering bills to create a statewide microplastics strategy (**MI Senate Bill 505**) and address microplastics in drinking water (**MI Senate Bill 504**), and the New York State legislature is considering the Packaging Reduction and Recycling Infrastructure Act (**NY State Senate Bill S1464**).

State of the Science: Microplastics in California

Microplastic pollution in California is recognized as pervasive and far-reaching, with contamination documented across diverse marine environments, from heavily urbanized coastal regions to remote and protected areas off the coast. While individual studies have shown that microplastic contamination exists everywhere scientists have investigated, including California's coastal and offshore waters, from surface waters to depths of at least 1000 m, in sediment, and in biota[1] (Figure 1; Appendix B), the statewide extent of microplastic pollution in the ocean, especially in California's southernmost Counties and inland aquatic environments remains largely unknown with critical geographic and temporal gaps.

Microplastic pollution is pervasive across both urban and remote coastal environments but is concentrated near cities. Microplastics are generally more abundant in urban-influenced water bodies, such as the San Francisco Bay, the near-shore environment off of Southern California, and Humboldt Bay.[2] However, microplastics are also widespread in remote and protected areas farther from direct human influence, such as National Marine Sanctuaries located off the California Central and Northern coasts.[3] Consistent with these patterns, surveys of more than 80 beaches along the California coast show that microplastics are pervasive and ubiquitous in beach sediments, with higher abundances on urban beaches. This includes beaches in Los Angeles, San Francisco Bay, and the Sacramento-San Joaquin River Delta, although substantial microplastic contamination exists in rural and remote locations.[4]

Stormwater runoff is a major pathway of microplastic pollution from freshwater habitats to the ocean. Freshwater monitoring is much less common but has been conducted in urban-influenced creeks and rivers including watersheds in the San Francisco Bay region, the San Joaquin River in the Delta region, the Los Angeles River, Coyote Creek, and the San Gabriel River.[5] These studies consistently document significant microplastic contamination and demonstrate that urban stormwater runoff is a major pathway delivering microplastics to freshwater systems, which subsequently transport microplastics downstream to estuarine and coastal environments.

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1 Moore et al., 2001; Moore et al., 2002; Lattin et al., 2004; Doyle et al., 2011; Sutton et al., 2016; Choy et al., 2019; Kashiwabara et al., 2021; Marcus et al., 2023.

2 Moore et al., 2002; Lattin et al., 2004; Doyle et al., 2011; Sutton et al., 2019; Zhu et al., 2021; Marcus et al., 2023.

3 Choy et al., 2019; Kashiwabara et al., 2021; Saley et al., 2019; Sutton et al., 2019.

4 Horn et al., 2019; Steele & Miller, 2022; Marcus et al., 2023; Heard, 2024.

5 Moore et al., 2011; Sutton et al., 2016, 2019; Wiggin & Holland, 2019; Rochman et al., 2022.

Microplastics impact marine life and California communities, although further studies are needed to understand the full extent of impacts and to effectively remediate harm. Marine wildlife studies in California have shown that microplastics are ingested by a wide variety of organisms and species ranging from plankton, mollusks, fish, sea birds, and marine mammals. Microplastics can cause harm to aquatic organisms through both physical mechanisms, such as obstructing feeding structures or clogging gills, and chemical mechanisms including immune system, stress, and gut microbiome responses. A growing body of evidence is also demonstrating potentially harmful effects to human health.[6,7] However, the diversity of physical and chemical characteristics of microplastics (e.g., particle size, shape, polymer type, and chemical additives) has resulted in highly variable toxicity outcomes across studies, depending on the size and composition of the particle. For example, smaller particles known as nanoplastics can translocate tissue, enter the bloodstream, and breach the blood brain barrier.

6 Chartres et al., 2024.

7 World Health Organization, 2023.

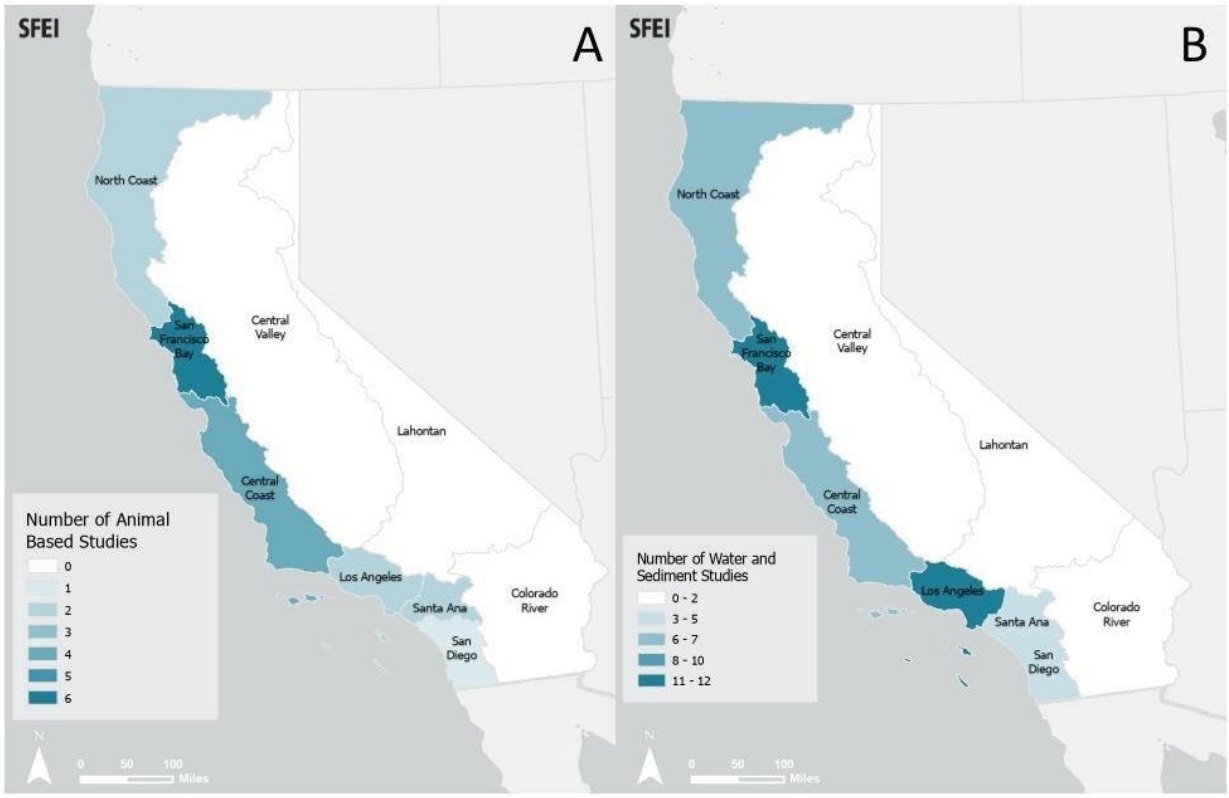


Figure 1. Visual summary of a subset of key California microplastic monitoring studies documented in published and pre-print literature though 2023. Most studies have been conducted within San Francisco Bay and along the California coast. Panel A depicts the number of animal-based studies (e.g., shellfish, fish tissue, sea birds, marine mammals), while panel B depicts the number of water and sediment studies. See Appendix B for a list of references and specific locations. Source: San Francisco Estuary Institute (SFEI).

Ongoing efforts to understand and identify areas with the greatest exposure risk in California include recent reports by the University of California, Los Angeles Luskin Center,[8] which **map** (updated October 2025) exposure risk to California communities from facilities involved in the upstream (extraction and refining of fossil fuel raw materials) and downstream (processing and disposal of plastic waste) stages of the plastic supply chain (Figure 2). Additional research is ongoing to quantify exposure risk of these communities from not only environmental exposure, but also ingestion and dermal contact of microplastics.

8 Herrera and Coffee, 2024; Herrera and Coffee, 2025.

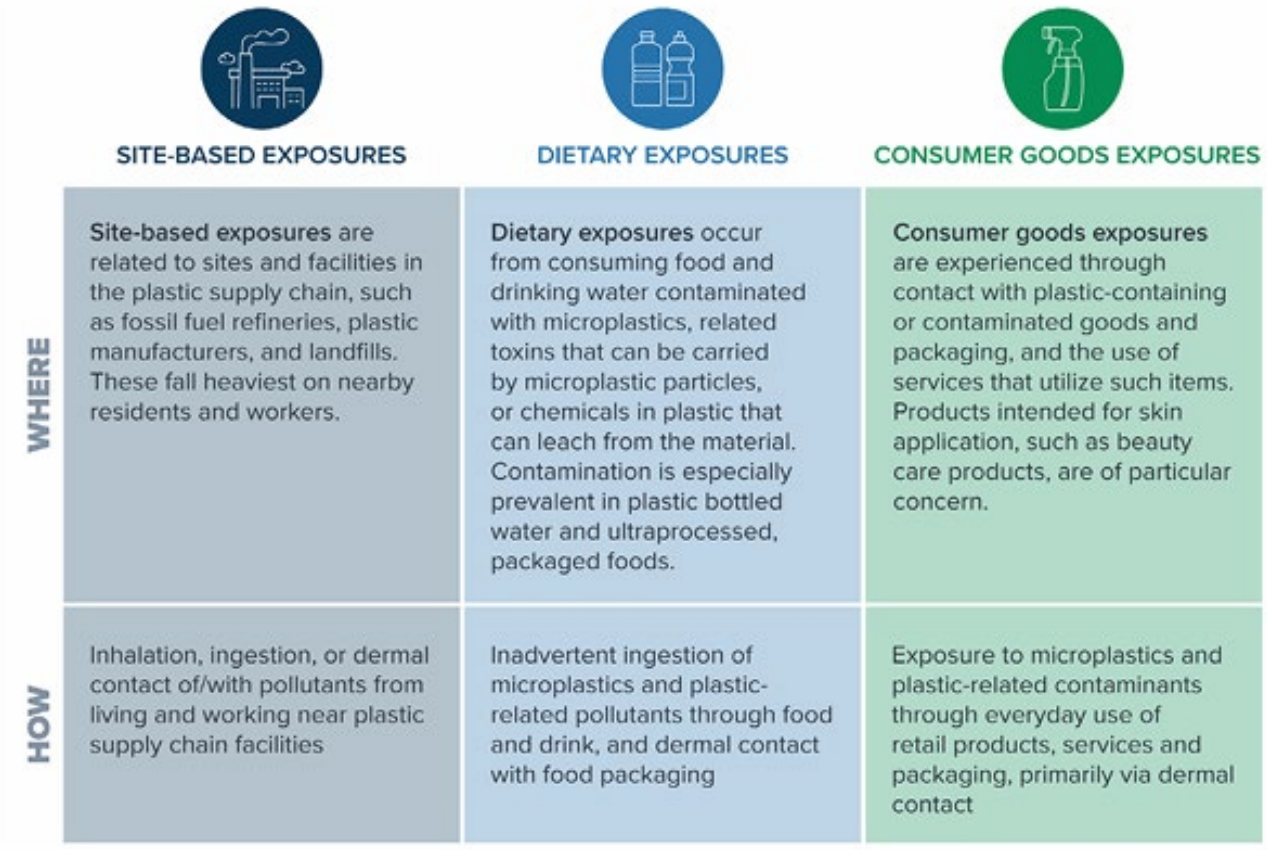


Figure 2. Categories of plastic pollution exposure by California communities. Source: UCLA Luskin Center for Innovation, Herrera & Coffee, Plastic Waste & Environmental Justice in California (Dec 2024).

Understanding the extent and impact of microplastics, as well as pathways into the environment, is critical for effective management, prevention, and mitigation (Figure 3). While substantial progress has been made in California since the adoption of the Statewide Microplastics Strategy in 2022, continued monitoring, especially in freshwater ecosystems that drain to the coast, toxicological studies to inform management thresholds, and the ongoing evaluation and implementation of proactive solutions are necessary to inform efforts to effectively safeguard California environments and communities against microplastic pollution.

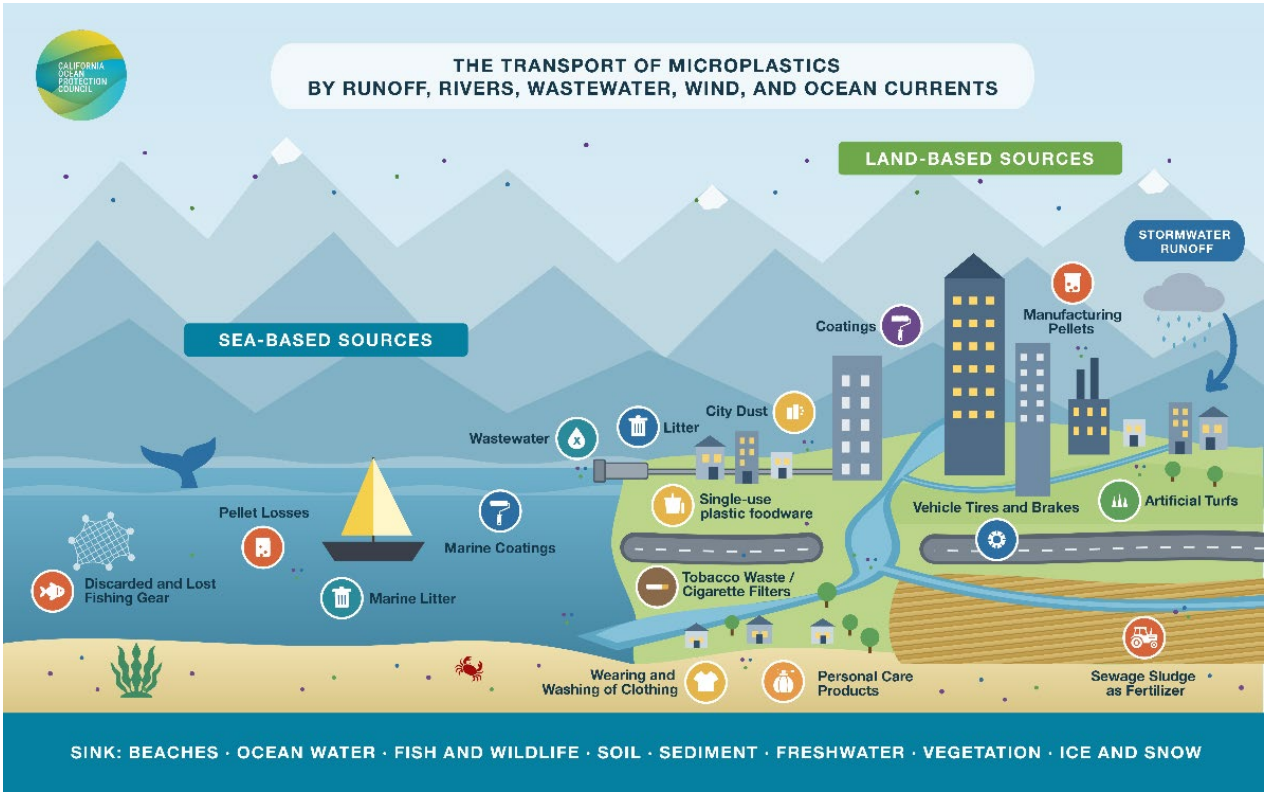


Figure 3. Depiction of known sources, pathways, and sinks of microplastics in California. Illustration adapted from the Collaborating Centre on Sustainable Consumption and Production for the European Topic Center on Circular Economy and Resource Use and the EEA (Saskia et al., 2022).

Recommendations

Restrict Harmful Materials at the Source. This could be achieved by restricting or banning the most harmful and/or commonly littered plastic materials before these items enter circulation and/or leak into the environment. Encourage the use of non-plastic and reusable materials, such as aluminum or glass containers. Simultaneously, establish labeling requirements that prevent false advertisement of materials marketed as biodegradable.

Advance Sector-Specific Reduction Strategies. Continue to identify and advance sector-specific plastic reduction strategies and incentivize a broad range of industry stakeholders to co-develop less toxic, less persistent materials in specific products and sectors. See further details provided under "Sector-Specific Workshop Recommendations" below.

Promote Extended Producer Responsibility. Expand extended producer responsibility and funding mechanisms for materials not covered by existing extended producer responsibility programs to shift more of the burden onto plastic polymer and product producers for a broad range of plastic products and materials not covered by existing programs, while simultaneously engaging manufacturers early in product design to prevent harmful substitutions.

Identify and Prioritize Sources and Pathways. Map the relative contributions of microplastics from different land uses, watersheds, and industries to build a clearer picture of where microplastics originate and how these particles move through the environment. Use that data to model contamination hotspots and direct prevention and mitigation efforts in locations where they will have the greatest impact.

Control Pollution Pathways into Waterbodies. Enhance safeguards across major pathways through which microplastics enter the environment to prevent microplastics from reaching waterways, including stormwater permits and best management practices, wastewater treatment upgrades, and improved biosolids management. Expand research and modeling, consistent with the recommendation above, to identify priority locations, such as high-trafficked roadways, industrial sites, or other dense urban areas with impermeable pavements, to inform the most effective infrastructure interventions for construction and deployment.

Implement Standardized/Consistent Measurement and Monitoring Methodology. Continue to promote and implement standardized sampling and analysis methods that allow consistent, comparable monitoring across the state. Reduce cost and technical barriers for detection, particularly for smaller particle sizes, to meet regulatory requirements and enable broader data collection, and greater understanding of microplastic impacts.

Establish a Central Information Hub for Microplastics Monitoring Data. Consolidate monitoring data into a public data visualization platform and data repository, similar to

CalEnviroScreen, to visualize plastic pollution and microplastic exposure burdens on California communities and the environment.

Establish Human Health and Ecological Thresholds. Pursue dose-response data and multi-variable toxicity studies needed to establish improved human health and ecological thresholds. Translate that science into actionable guidance, including seafood consumption advisories and bioindicators, to support risk management decisions.

Translate Knowledge into Effective Policy and Management Action. Translate research findings on microplastics into concrete policy decisions, including to inform local assistance funding, and regulatory frameworks to take impactful and effective action to prevent and remediate ongoing microplastic pollution.

Build Public Awareness and Coordinate Governmental Action. Build public awareness through shared agency outreach and education toolkits. Conduct targeted engagement with California Native American tribes and priority populations, including those disproportionately impacted, to ensure cohesive and equitable action to reduce plastic use and exposure across the state. Strengthen knowledge sharing through intergovernmental and interstate coordination.

Sector-Specific Workshop Recommendations

Beginning in 2025, OPC has held individual sector-specific workshops, in coordination with external partners, to advance actions that reduce plastic pollution in these sectors as identified in the Statewide Microplastics Strategy. Workshop summaries for the **textiles** and vehicle **tires** sector-specific workshops contain detailed and comprehensive lists of identified immediate actions, long term policy needs, and research/science gaps to guide recommended sector-specific plastic pollution reduction strategies. Workshop summaries for the Fisheries & Aquaculture workshops held in Spring 2026 will be available in Summer 2026. Key recommendations for each workshop are listed below.

Vehicle Tire Wear

- Support updates to stormwater BMP design manuals to better address microplastics and associated chemicals (6-PPD-Q).
- Expand pilot testing for on-vehicle tire wear collection devices in California to examine potential scalability of this solution to reduce tire wear pollution.
- Reduce use of recycled tires in artificial turf and other applications that increase human and environmental exposure to rubber microplastics, including direct exposure and stormwater runoff.
- Advance stormwater management strategies (including BMPs, permeable pavement, biofiltration, etc.) that have demonstrated success in capturing vehicle tire wear particles.
- Conduct research to identify tire wear emission hotspots in California to prioritize intervention strategies and remediation.

Textiles and Microfiber Pollution

- Research fiber release mechanisms through textile design and develop textile design and manufacturing best practices to reduce microfiber pollution.
- Conduct alternative analyses to identify safer textile chemicals and/or avoid the inclusion of harmful additives in textile fibers.
- Advance policies and actions that reduce textile waste and increase textile circularity in California consistent with the Responsible Textile Recovery Act of 2024 (SB 707, Newman)
- Continue to engage textile stakeholders outside of the apparel industry to co-develop solutions and support research and development.
- Collaborate with state agencies, NGOs, and textile industry stakeholders to develop an Ecodesign for Sustainable Products Regulation (ESPR) policy in California that includes parameters to address fiber release.

Aquaculture & Fisheries

- Support research and development on non-plastic fishing and aquaculture gear and engage with the fishing and aquaculture communities to pilot innovations.
- Support research on the viability and potential impacts of plastic alternatives in these sectors, including evaluation of pollution reduction across the supply chain (e.g., manufacturing, harvesting/production, distribution, end-use).
- Continue to study the impacts of microplastics and associated chemicals to health of seafood species, as well as potential risks to consumers.
- Explore mechanisms for gear manufacturer responsibility for gear end of life processes.
- Continue to identify and advance strategies to prevent lost gear.
- Promote best practices from California aquaculture and fishery practitioners to inform other jurisdictions (e.g., internationally).

Track 1: Solutions – Implementation Status

Recognizing that microplastics are persistent, pervasive, and nearly impossible to remove once they enter the aquatic environment, the Statewide Microplastics Strategy emphasizes early, upstream solutions to prevent and intervene with microplastic pollution before it enters the environment (**Objective 1A: Pollution Prevention**). However, complementary and simultaneous strategies to reduce microplastics transport by intervening with the flow of microplastics from specific pathways, such as stormwater and wastewater, are also necessary to prevent improperly managed plastic waste from reaching California waters (**Objective 2A: Pathway Intervention**). Finally, engaging with the public, including impacted communities, to raise awareness of microplastic pollution and facilitate behavior, policy, systemic, and environmental change serves as a strategic complement to other solutions that directly prevent and reduce plastic production, use, and waste (**Objective 3A: Outreach & Education**).

Specific actions the state has taken to achieve these objectives towards preventing and reducing microplastic pollution in California are ongoing and described below.

Objective 1A. Pollution Prevention

Product & Material Regulations

Implementation of Single-Use Foodware Provided Upon Request (Action 2A.1.1). Implementation of the statewide requirement that single-use foodware and condiments be provided only upon request (AB 1276, Carrillo, 2021) and of statewide guidance to advance refill stations (AB 618, Chui, 2019) is ongoing, with many local jurisdictions imposing specific requirements on food establishments and restaurants to transition from single-use plastics. OPC has supported Los Angeles County's **implementation of a County-wide 2022 ordinance** to reduce the use and waste from single-use plastics and polystyrene in food facilities.

Advanced use of reusable foodware in state purchasing and service contracts (Action 2A.1.2). State Parks developed a **Reusable Foodware Purchasing Guide** to encourage concessionaires to reduce single plastic waste, and in 2025 updated contract language to require concessionaires entering new contracts to implement source reduction and recycling programs for single use foodware.

Enactment of the Plastic Pollution Prevention and Packaging Producer Responsibility Act (Senate Bill 54, Allen, 2022) (Action 2A.1.3). In 2022, California adopted the most comprehensive new extended producer responsibility (EPR) for single-use packaging and single-use plastic food service ware in the nation. The law requires producers of specified materials to be part of a producer responsibility organization (PRO) with a producer responsibility plan approved by CalRecycle, or otherwise individually comply with source reduction targets and recycling rates by January 1, 2023. All producers of these products are responsible for ensuring their products are recyclable or compostable by 2032. Regulations were enacted on May 1, 2026, and can be found on the **CalRecycle webpage**.

This legislation also establishes the Plastic Pollution Mitigation Fund (Public Resources Code section 42064), which requires a producer responsibility organization (PRO) to pay $500 million to the state annually for 10 years, a total of $5 billion, to address and mitigate the environmental impacts of plastic pollution, especially in overburdened and underserved communities.

Additional state legislation enacted since the adoption of the Statewide Microplastics Strategy to support statewide plastic source reduction, reuse, and refill goals (consistent with **Acton 2A.1.3**) include SB 1013 (Atkins, 2022) related to beverage container recycling, SB 1046 (Eggman & Gonzalez, 2022) prohibiting the use of non-compostable check out bags in grocery stores, SB 353 (Dodd, 2023), SB 1053 (Blakespear and Bauer-Kahan, 2024), AB 2236 (Bauer-Kahan and Blakespear, 2024), AB 2511 (Berman, 2024), among other local ordinances.[9]

Prohibition of the Sale and Distribution of Expanded Polystyrene (Action 2A.1.4). SB 54 prohibits producers of expanded polystyrene (commonly known as Styrofoam™) food service ware from selling and distributing these products unless the producer can demonstrate recycling rates of no less than 25% on Jan. 1, 2025, 30% by Jan. 1, 2028, 50% by Jan. 1, 2030, and 65% by 2032. In January 2025, CalRecycle subsequently announced restrictions for the sale, distribution, and importation of expanded polystyrene foodservice ware were statutorily in place because producers of expanded polystyrene did not demonstrate to CalRecycle that the statutorily mandated recycling rates were met for all

9 California Ocean Litter Prevention Strategy Accomplishments Report January 2018 - August 2025.

expanded polystyrene covered material as of January 1, 2025. Furthermore, California's Attorney General issued an enforcement advisory regarding this ban in December 2025.

Efforts to expand the statewide microbead ban to include additional consumer products (Action 2A.1.5). No action to report.

Prohibition of the sale and distribution of single-use plastic-containing tobacco products (Action 2A.1.6). The California Department of Public Health (CDPH) California Tobacco Prevention Program (CTPP) convened a working group to evaluate cellulose acetate cigarette filters, publishing findings in a **white paper** that these filters have no benefit in preventing the adverse health effects of smoking and are the primary source of tobacco waste pollution and litter in the environment. CDPH CTPP also provided frameworks for local communities to change social behavior regarding tobacco use across the state, including ending the sale of plastic filters in cigarettes in the City of Santa Cruz, the City of Capitola, and Santa Cruz County; for ending the sale of tobacco products in the City of Tiburon and the City of Ross; and for ending the sale of electronic smoking devices in 48 cities and/or counties.

Other state actions that support or inform regulating microplastic containing or shedding products and materials, consistent with Objective 1A. Pollution Prevention:

The Department of Toxic Substances Control (DTSC) initiated rulemaking to add microplastics to the Candidate Chemical List in 2025. Furthermore, DTSC's **2024-2026 Priority Product Work Plan** included "products that contain or generate microplastics" for the first time as a product category currently under evaluation, allowing the state to evaluate and potentially identify consumer products that may generate microplastics a Priority Products for regulation. DTSC also hosted a public workshop on **Candidate Chemicals in Artificial Turf** for potential future regulation under the Safer Consumer Products Program and published a **Background Document on Candidate Chemicals in Artificial Turf**, which includes microplastics. Finally, **preliminary research** was conducted on microplastics in specific consumer products (including artificial turf infill, detergents, paints, plastic film mulch, single-use cigarette filters, single-use food contact articles, among others), assessing potential for exposure, potential alternatives, and relevant regulations already in place.

DTSC was instrumental in the Interstate Technology and Regulatory Council (ITRC) effort to develop the Microplastics **technical and regulatory guidance document**, ongoing **online training**, and an **outreach toolkit**. Additionally, DTSC contributed to a special section of the ITRC PFAS technical and regulatory guidance document on **the relationship between microplastics and PFAS**.

Economic Strategies

Identify Extended Producer Responsibility (EPR) strategies for recycling or disposal of plastic packaging and foodware (Action 2A.1.7). Regulations for the Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54, 2022) were approved on May 1, 2026, and became effective upon filing. Additional existing EPR strategies and programs that address products containing microplastics include: the **Textile Stewardship Program**, the **Pharmaceutical and Sharps Waste Stewardship Program**, the **California Mattress Stewardship Program**, the **California Carpet Stewardship Program**.

Simultaneously, the California Natural Resources Agency, including OPC, Strategic Growth Council (SGC), the California Environmental Protection Agency (CalEPA), and Attorney General's Office are coordinating implementation of the forthcoming **Plastic Pollution Mitigation Fund**, established by SB 54 to address plastic pollution, including efforts to mitigate, reduce, and monitor the environmental and public health impacts of plastic pollution, with a focus on providing benefits to residents in disadvantaged, rural, and tribal communities.

Promote or otherwise require the sale and use of ENERGY STAR condenser dryers and washing machines with specified filtration rates (Action 2A.1.8). No action reported.

Recyclability and Producer Accountability

In recent years, California has taken proactive action to hold producers accountable for recycling claims. California issued the **first-of-its kind lawsuit** to hold petrochemical companies accountable for misleading the public on plastic recyclability and polluting California's environment and communities. The California Attorney General filed a **complaint against Exxon Mobile** in 2024 for allegedly misleading consumers about the recyclability of plastic products, contributing to the plastic pollution crisis and harming human communities and the environment.

The California Attorney General's Office has additionally investigated manufacturer compliance with SB 270 (Padilla, 2014) to examine whether manufacturer claims about the recyclability of "thicker" plastic bags can be substantiated, finding that they are not recyclable and resulted in a $3.35 million settlement with four plastic bag manufacturers. Further, SB 1053 (Blakespear, 2024) was enacted in 2024, strengthening the statewide plastic bag ban.

Los Angeles County is **suing Pepsi and Coca-Cola** for their role in contributing to plastic pollution that is harmful to the environment and human health, as well as their misrepresentation of recyclability of plastic containers.

Additional economic activities include a **study** funded by the CDPH CTPP to develop standardized cigarette waste data collection methods to estimate the economic costs of cigarette pollution. This includes a formula for local jurisdictions to use to determine cost of having tobacco products in local waste streams.

Identifying & Advancing Product Alternatives

Convened representatives from the vehicle tires, textiles, fisheries, and aquaculture industries and identified sector-specific plastic pollution prevention strategies (Action 2A.1.9). OPC hosted a series of sector-specific workshops to develop recommendations to inform California state agency and legislative actions towards preventing, addressing, and researching microplastic pollution in partnership with industry, academia, and non-governmental organizations (NGOs). Reports detailing workshop outcomes and recommendations have been published for the **textiles workshop**, in partnership with Materevolve, and the **tires workshop**, in partnership with the Ocean Science Trust. Workshops for the fisheries and aquaculture industries were held in spring 2026, with workshop reports expected summer 2026. OPC is in the process of identifying key themes and coordinating with key agency and external partners to hold sector-specific workshops on agriculture and single-use plastic products.

Objective 2A. Pathway Interventions

Stormwater

Advancing Green Infrastructure to Effectively Intervene with Microplastics in Stormwater (Actions 2A.1.1 and 2A.2.2). To inform future local, regional, and state investments and other actions, including the potential integration of stormwater best management practices (BMPs) into applicable permits, OPC funded two foundational projects to advance green infrastructure, or low impact development (LID), projects that effectively intervene with the flow of microplastics in stormwater:

> **Project Highlight: Design factors affecting microplastic retention, removal, and generation in structural BMPs**
>
> Researchers from the University of California, Los Angeles (UCLA) examined the impact of environmental, hydrogeologic conditions, and land use characteristics within California urban watersheds that affect the transport or removal of macro- and microplastic loading into the environment with structural LID BMPs.[10] This included evaluating site-specific soil

10 California Sea Grant, 2025.

conditions, bioretention soil media composition, vegetation, and other design factors to inform effective LID design, operations, and management strategies based on the individual conditions of a site. Key questions to inform effective green infrastructure placement and design were evaluated by the research team:

1. **Land use**: How do land-use type (such a proximity to plastic-generating sites or activity areas) and hydrological conditions (such as stormwater flow) affect microplastic loading on a specific BMP?
2. **Management practice**: Do BMPs located in underserved communities accumulate more microplastics than BMPs in other neighborhoods due to plastic trash management?
3. **BMP design**: How do BMP design factors, such as the presence of vegetation that can trap microplastics or pre-treatment designs) affect microplastic transport and retention within a BMP?

Overall, eighteen sites across Los Angeles were examined and findings suggest that microplastics are spread fairly evenly across urban landscapes regardless of neighborhood income or location. While structural or infiltration-based BMPs effectively remove most microplastics from stormwater, laboratory results show that up to 40% of captured particles can be washed out of the infrastructure during storms, reducing BMP effectiveness. Furthermore, design choices are key determinants of performance, with structural BMPs incorporating more plants, deeper soil layers, and finer soil textures retaining microplastics more effectively. These results provide practical guidance for improving how stormwater infrastructure is built and maintained to better protect California's waterways and coastal areas from microplastic pollution.

Project Highlight: Field Monitoring of Microplastics Loading and Accumulation in LID BMPs

Recognizing the lack of design or maintenance guidance for microplastics management in stormwater BMPs, **this project** evaluated LID BMP design to provide recommendations regarding the design, construction, and maintenance of stormwater BMPs. The Southern California Coastal Water Research Project (SCCWRP) collected data from active BMPs used in the Southern California Stormwater Monitoring Coalition regional monitoring network to identify:

1. **Potential for pollution reduction**: Quantify how much microplastic pollution in stormwater may be reduced using filtration LID BMPs in southern California;
2. **BMP design**: Evaluate physical characteristics of engineered filter media that promote microplastic capture using filtration LID –BMP;
3. **BMP maintenance**: Evaluate maintenance needs to support long-term LID BMP performance;
4. **Recommendations for effective BMPs**: Develop evidence-based recommendations for effective LID design, operations, and management strategies to mitigate microplastic pollution from urban runoff.

Overall, researchers monitored biofiltration BMPs across Southern California during rainstorms and found these BMPs removed approximately 72% of microplastics from runoff on average. Biofiltration BMPs with smaller gaps between filter material captured more microplastics, with larger particles were typically fully retained. This research provides cities and regulators with scientific evidence that existing biofiltration BMPs can effectively reduce the amount of microplastic pollution that reaches California's coast, while offering clear recommendations for optimizing future designs. Further research should investigate other BMP types, optimal geographic placement, ability to capture smaller particle sizes, and the ecological and toxicological implications of microplastic reduction in stormwater runoff.

Hydromodification biofilter located along a roadway to filter and intervene with contaminants in stormwater runoff, including microplastics and vehicle tire wear. Photo credit: SCCWRP.

Developed guidelines for stormwater controls for microplastics in coastal development permits (Action 2A.2.3). The California Coastal Commission published **Guidelines for Addressing Plastic Pollution in Coastal Development Permits and Local Coastal Programs**, which formalizes plastic pollution reduction measures in coastal planning and regulatory work. LID BMPs are listed as a potential intervention for addressing plastic pollution from runoff.

Ensured compliance for preproduction plastic pellet (nurdle) discharge prohibitions, consistent with the Trash Provisions and local Trash Total Maximum Daily Loads (TMDLs) (Action 2A.2.4). Actions to ensure compliance with existing nurdle discharge requirements are ongoing. This includes targeted efforts by the Regional Water Boards, State Water Resources Control Board (State Water Board), and U.S. EPA to identifying and regulating facilities handling plastic pellets under industrial stormwater permits, incorporating pellet-specific monitoring requirements into MS4 permits, and conducting inspections and enforcement actions to improve compliance.

Interception of trash and plastic debris with trash receptacles and services (outside of the scope of the Statewide Trash Provisions), especially in trash "hot spots" (Action 2A.2.5). Individual efforts and programs to increase the trash, recyclables, and organics receptacles in high-use recreational areas across the state are ongoing. As one example, the 2022 City of Los Angeles' Zero Waste at City Facilities & Events Ordinance is intended to minimize waste at municipally operated facilities and events by limiting the use of non-recyclable and non-

compostable materials, especially single-use plastics. Furthermore, the 2022 City of Los Angeles **Comprehensive Plastics Reduction Program** includes measures such as improving reuse, recycling, and composting infrastructure.

Ongoing implementation of the Statewide Trash Provisions (Action 2A.2.6). The statewide Trash Provisions adopted in 2015 require the provisions to be incorporated into applicable stormwater permits, including Phase I and Phase II Municipal Separate Stormwater Sewer System (MS4) permits, as they are scheduled for renewal.[11] On June 22, 2022, the State Water Board reissued the Statewide Department of Transportation (CalTrans) General Permit, and reissued the General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities on September 8, 2022. These reissued permits implement the Trash Provisions for CalTrans and construction dischargers.

The Trash Provisions are in the process of being incorporated into Phase I MS4 permits by the Regional Water Quality Control Boards for all regions, including many already adopted and incorporated across the state, to meet the 2030 trash prohibition and other requirements of the Trash Provisions. The Small MS4 permit governing Phase II MS4 Permittees has not yet been updated to include Trash Provisions requirements; however, the provisions apply to these discharges and will be incorporated upon permit reissuance.

Regional Water Board	Permit Status
North Coast Regional Board (Region 1)	The Trash Provisions are actively being incorporated in the Phase I MS4 permit renewal with anticipated consideration of adoption by the Regional Board in early 2027.
San Francisco Bay Regional Board (Region 2)	Trash requirements have been included in the regional Phase I MS4 permit: the Municipal Regional Permit (MRP) since 2015. The majority of the 79 Permittees were required to achieve 100% trash reduction relative to 2009 baseline levels by June 30, 2025.
Central Coast Regional Board (Region 3)	The Statewide Trash Provisions were incorporated into the only Phase I permit, for the City of Salinas, as part of their most recent permit renewal on September 20, 2019.

11 Phase I MS4 Permits, California State Water Resources Control Board.

Los Angeles Regional Board (Region 4)	Statewide Trash Provisions are incorporated into the regional MS4 Permit. This permit includes eleven Trash TMDLs.
Central Valley Regional Board (Region 5)	This Region is in the process of renewing the regionwide MS4 Permit, which will incorporate the Trash Provisions. The permit is scheduled to appear before the Regional Board for approval in August 2026.
Lahontan Regional Board (Region 6)	This Region has not yet incorporated the Statewide Trash Provisions into its regional permit, though incorporation is anticipated in a forthcoming permit update.
Colorado River Basin Regional Board (Region 7)	This Region is in the process of renewing their MS4 Phase I permit by 2027, which will incorporate the Trash Provisions.
Santa Ana Regional Board (Region 8)	On March 1, 2024, a tentative regional MS4 Permit (NPDES No. CAS618000) was released for public comment.
San Diego Regional Board (Region 9)	This region's MS4 permit is due for reissuance, and the new version will incorporate the Trash Provisions. In the meantime, the Trash Provisions are being implemented through a water code 13383 letter.

Wastewater

Completion of Microplastic Removal Efficacy Study in Wastewater Treatment Plants (2A.2.7) OPC funded SCCWRP to examine and characterize **microplastic concentrations in wastewater treatment plants**, including the levels and composition of microplastics at various stages of the treatment process. Microplastics levels in untreated wastewater were variable across facilities, although findings demonstrated that relative to influent concentrations, wastewater treatment plants remove 95.3, 99.1, and 99.9% of microplastics with primary, secondary, and tertiary treatment processes, respectively. Microplastics were also observed in biosolids, although some collected solids from the treatment process are incinerated or landfilled, which affects the fate of microplastics that are filtered through the treatment process depending on the waste management practices of the facility. See also **Science to Inform Future Action, Action 2B.1.3**.

The State of California, through State Water Board programs and financing, is supporting tertiary wastewater treatment upgrades, including through the ongoing promotion of water recycling, at publicly owned treatment works around the state. Advancing wastewater recycling and promoting tertiary wastewater treatment are examples of multi-benefit actions that can improve water quality and support California's water recycling goals. While these efforts are

not currently undertaken specifically to address microplastic pollution, tertiary and advanced treatment processes have been shown to reduce microplastic concentrations levels, providing meaningful co-benefits.

Other state actions to advance wastewater pathway interventions:
San Francisco Bay Region National Pollution Discharge Elimination System (NPDES) dischargers are required to conduct receiving water monitoring for microplastics individually or collectively by supporting the San Francisco Bay Regional Monitoring Program (RMP).

Aerial Transport

See Economic Strategies: 2A.1.8

The California Air Resources Board (CARB) Mobile Source Emissions Research Program is measuring and analyzing **vehicle brake and tire particle emissions** to inform health and air quality effects studies and solutions across the state.

Objective 3A. Outreach & Education

Ongoing engagement with California Native American tribes in outreach, education, and plastic reduction efforts (Action 2A.3.1). State programs are increasingly partnering with California Native American tribes on priority outreach, education, and source reduction efforts. This includes ongoing outreach and consultation with tribes to inform the implementation of the $5 billion **California Plastic Pollution Mitigation Fund** established by the Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54, 2022) to ensure the design and funding of future programs to reduce the environmental and public health impacts of plastic pollution on California Native American tribes.

Additionally, the CDPH CTPP supported the Tribal Community Coordinating Center **Tribal Environmental Campaign** and **Tribal Anti-Vaping Campaign** to create series of anti-vaping and vape-derived litter awareness videos and radio ads, highlighting tribal voices.

Engaged underserved or communities disproportionately burdened by environmental injustice in outreach and education efforts (Action 2A.3.2) to increase awareness of microplastic pollution, and to facilitate behavior, policy, systemic, and environmental change (Action 2A.3.3). Ongoing outreach, engagement, and education is taking place across the state, including **public efforts** to inform the implementation of the $5 billion **California Plastic Pollution Mitigation Fund** established by the Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54, 2022) and ensure the Fund benefits low-income and rural communities disproportionately impacted by plastic pollution.

OPC, in partnership with California Sea Grant and University of Southern California Sea Grant, has continued to expand efforts to meaningfully engage in plastic outreach, education, and research. This included an **analysis** to identify geographic and social gaps in participation in the stakeholder-informed **California Ocean Litter Strategy** (OLS), which includes numerous actions to reduce large plastic pollution and understand microplastics in California. Notably, participation was low from tribal governments and organizations, socio-environmental non-profits, and place-based (or community-based) non-profits, attributed to a lack of awareness of the Strategy, misaligned priorities, financial burden, or lack of capacity for engagement.

In 2023, OPC and California Sea Grant provided $1.9 million to **fund five research projects** addressing microplastics in California. These projects were selected through two competitive research calls focused on 1) improved understanding of aquatic microplastic contamination sources and ecological sensitivity, and 2) microplastic removal efficacy of low-impact development structural best management practices. In advancing this research, OPC and California Sea Grant encouraged all funded projects to describe how proposed activities would broaden the participation of underrepresented groups and how individual communities would benefit from project outcomes. This resulted in a number of workforce development opportunities, including training and professional development for students at local universities, high schools, and Minority Serving Institutions (MSIs), and one project including the paid participation of community members in the scientific study. A **public webinar** was also held in November 2025 to publicly share findings from these research projects.

Specific to tobacco waste and related microplastic pollution, CDPH CTPP launched the **Exhale Campaign**, a storytelling initiative with **videos** that amplifies diverse California voices, including tribes, and their actions to reduce tobacco use and its harms, including microplastic pollution, to both people and the environment (also advances **Action 2A.3.1**). The Department's UNDO Program also launched **The Little Big Lie** campaign to educate Californians about the impacts of microplastic waste from cigarette filters to human health and the environment, and has published several articles aiming to educate the public about the environmental and health effects of microplastics from cigarettes and e-cigarettes, as well as the disproportionate burdens on low-income communities (also advances **Action 2A.3.2**).[12]

Promoted informal and formal education programs to educate K-12 students of microplastics sources, impacts, and solutions (Action 2A.3.4). Educational campaigns are ongoing across the state. The State Parks Interpretation and Education Division coordinates the delivery of marine debris educational programs to the public. Statewide outreach is conducted by interpretive staff in parks and online through the Parks Online Resources for Teachers and Students (PORTS)

12 UNDO 2022, UNDO 2023a, UNDO 2023b, UNDO 2023c.

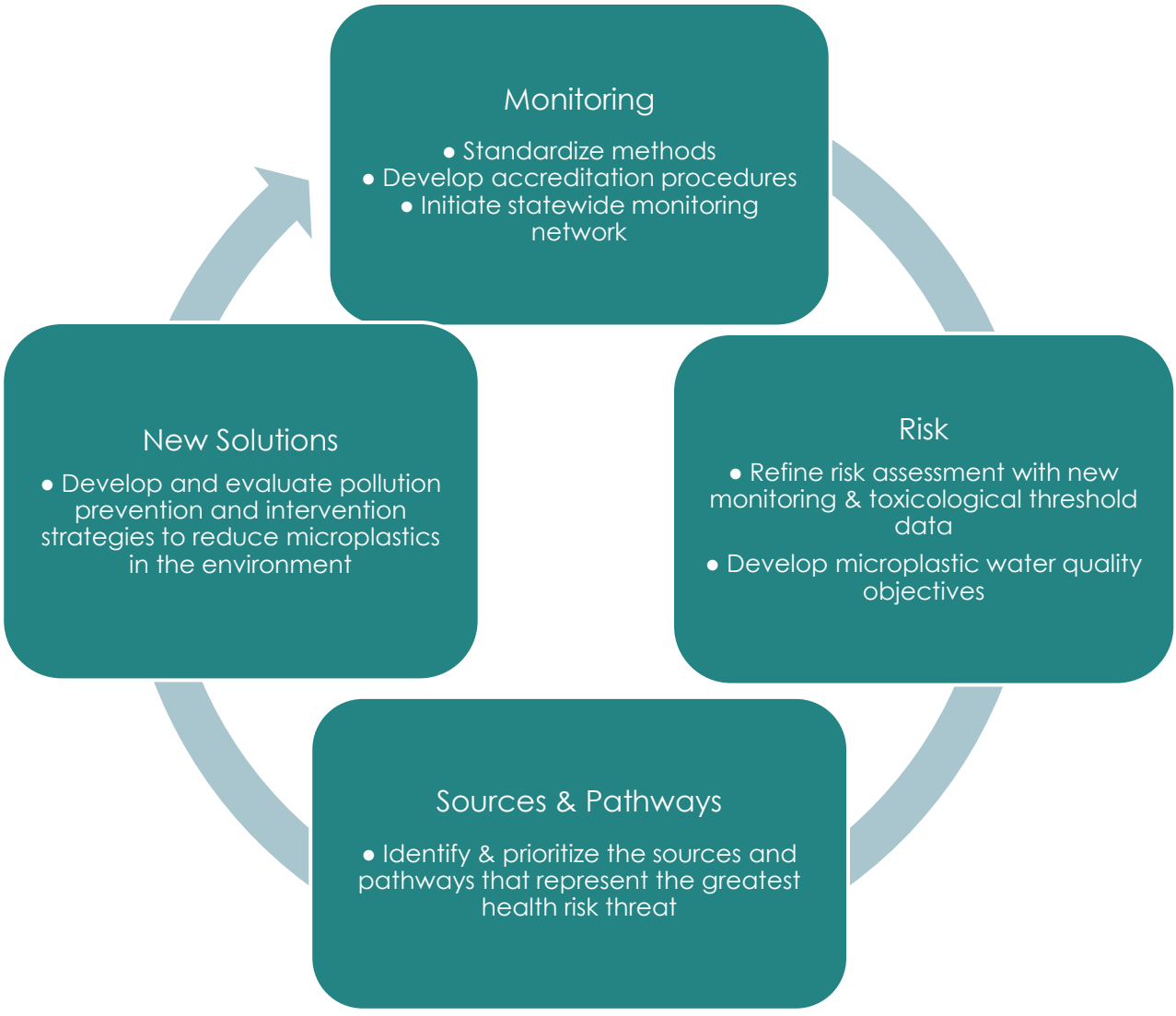
Program, the Marine Protected Area Outreach & Education Program, and the California Boating Clean and Green Program (BC&GP). The California Coastal Commission has also increased inclusion of microplastics in pre-existing outreach and education efforts, including Coastal Cleanup Day and the Whale Tail Grant Program (also contributes to **Action 2A.3.2**). Finally, OPC funded public education and outreach based on completed research regarding microplastics impacts on the marine food web at the Los Angeles Natural History Museum.

Additional efforts include the school-based, Next Generation Science Standards (NGSS) by One Cool Earth in partnership with NOAA Marine Debris Program, which aligned **marine debris education programs** and expanded its reach to 29 schools as of 2024. Their goal is to reach 11,000 students per year with at least seven lessons per student, plus other hands-on activities. The curriculum provides fundamental concepts related to waste lifecycles, natural systems as well as provides hands-on activities for students to understand and intervene to prevent marine debris.

Promoted industry engagement and outreach to advance sector-specific microplastic pollution prevention strategies (Action 2A.3.5). See Action 2A.1.9.

Track 2: Science to Inform Future Action – Implementation Status

The Statewide Microplastics Strategy outlines a comprehensive research strategy to ensure that California takes informed, effective action to reduce microplastic pollution based on the best available science. Building on prior advancements in microplastic science, California agencies have supported research to enhance foundational microplastic monitoring (Objective 1B), which is critical to identify the primary sources of microplastic pollution (Objective 2B), conduct risk assessments (Objective 3B), and develop effective management solutions (Objective 4B). This ongoing and connected suite of actions will help the state identify priority locations and actions to shape the next generation of solutions – and ultimately reduce the environmental and public health impacts of microplastic pollution.



Objective 1B. Monitoring

Standardized Monitoring Methods for Sample Collection and Analysis (Action 2B.1.1.). California has completed interlaboratory studies on environmental collection and laboratory analysis methods to measure microplastics in wastewater, treated drinking water, sediment, and biological tissue (such as fish tissue or shellfish) with method validation and accreditation pending.[13] Analytical methods have been developed for ambient water and stormwater flows, although improvements are required for some of these methods for accreditation. Collection methods for both ambient water and stormwater are in development and expected to be published in 2026. Consistent with SB 1422 (Portantino, 2018), analytical methods have been developed and accredited[14] by the State Water Board for treated drinking water, and collection and sample processing methods have been evaluated.[15] The five-year Southern California Bight Regional Monitoring Program was the first to apply collection methods for microplastics in sediment and fish tissue in 2023 with results anticipated to be published in 2026.

Microplastic Sampling and Analysis Challenges

Challenges: Current microplastic analysis methods are expensive (~$2K per sample), labor intensive, and time intensive, which makes microplastics monitoring challenging to incorporate into routine monitoring. Furthermore, most current laboratory methods are accredited for only particles >20 or 50 µm (although FTIR has the capability to measure particles >20 µm, and Raman, can measure the 5-10 µm range). This remains problematic because smaller particles are typically more harmful to human and wildlife health due to their potential to translocate between organs (e.g., cross the blood-brain barrier or enter the placenta); thus inability to detect these small particles hinders ability to assess risks to human health. Therefore, there is a strong need to improve technology to enable detection of microplastics below the current limit of detection.

Solutions: New methods are being analyzed and require further development and validation to reduce costs and measure smaller particles, including ultrasonic and combustion methods. Automating steps in the particle analysis is also being piloted to reduce cost.

13 Standard Operating Procedures for: sediment and aquatic biota collection, sediment and biota analysis, wastewater collection, wastewater analysis, ambient water analysis.

14 Wong and Weisberg, 2024.

15 Protocols for: drinking water collection, drinking water analysis (using infrared spectroscopy, vibrational spectroscopy, Raman spectroscopy, and laboratory intercalibration).

Monitoring Plan Development

Effective management of microplastics begins with understanding the extent of microplastic pollution within the state. The San Francisco Estuary Institute, supported by OPC, **developed a Statewide Plastics Monitoring Strategy and Planning Framework (Monitoring Strategy) to support a statewide monitoring program (Action 2B.1.2).** This document outlines a coordinated, science-based approach to quantifying and tracking both macro- and microplastics across California's aquatic environments. By quantifying the amount of plastic in the environment, how that changes over time, and by identifying major sources and transport mechanisms of plastics, the state can better understand how humans and aquatic ecosystems might be impacted, where to prioritize source reduction and remediation efforts, and track how well management actions are reducing plastic pollution.

The Monitoring Strategy describes priorities for pilot and long-term monitoring programs in California aquatic systems. As stormwater is a major pathway for plastic pollution, monitoring stormwater runoff, especially in urban areas, is a priority to inform state management actions. The Monitoring Strategy also recommends **leveraging ongoing efforts that regularly monitor stormwater runoff or wastewater, including MS4 and wastewater treatment plant permittees (Actions 2B.1.3 and 2B.1.4).** Using standardized monitoring methods **(Action 2B.1.1)**, the best available science, and guided by the Monitoring Strategy, next steps include the implementation of a pilot monitoring program in 2027. To advance this ongoing need, OPC intends to support the State Water Board Surface Water Ambient Monitoring Program (SWAMP) to implement pilot monitoring of California aquatic ecosystems **(Action 2B.1.5).** The Plastic Pollution Mitigation Fund may also contribute to future statewide monitoring efforts, consistent with California Public Resources Code section 42064, to identify priority locations for investment and track the efficacy of this new law in reducing plastic pollution.

Microplastics Monitoring Efforts: Special Studies

- In 2023, OPC funded the Los Angeles Natural History Museum to use museum fish specimens to trace microplastic pollution in Southern California waters from the 1940s to today. Fish gut contents were analyzed to identify long-term patterns of microplastic ingestion. Preliminary findings reveal that microplastics were present in fish as early as 1949 and were widespread across species by the 1970s, regardless of diet or habitat. Not every fish contained microplastics, indicating individuals may clear contaminants from their digestive systems or avoid consuming them. This work establishes the first long-term baseline for microplastic pollution in Pacific coastal waters and potentially informs both resource management and consumer seafood choices. Future research should assess microplastics in other fish tissues (e.g., those that are consumed by humans) and evaluate how efficiently microplastics are cleared from digestive systems.

- A University of California Riverside research group is advancing observation- and modeling-based investigations of plastic transport from watersheds to coastal waters, supported by the NOAA Marine Debris Program.[16]
- OPC and California Sea Grant (CASG) additionally funded the California Marine Sanctuary Foundation to quantify microplastics across the Monterey Bay watershed and coastal ecosystems, filling a critical knowledge and geographic gap within a rural, agricultural-dominated watershed in Central California. Particles were identified and characterized across rivers, beaches, coastal waters and marine wildlife, including blue whales. Preliminary findings reveal that beaches act as major long-term pollution sinks and sources, especially for expanded polystyrene, with concentrations approximately thirty times higher than river or ocean waters. Across all sampling locations, microfibers, consistent with textile sources like denim, were the most common. Analysis of blue whale samples reveals the presence of numerous synthetic fibers, indicating microplastic transfer within marine food webs. Finally, preliminary risk assessment (using the framework described below in **Action 2B.2.2**) suggest that microplastic levels sampled in this study in most areas were of little to no concern, using thresholds **published in 2022**, while microplastic levels in beach sand were potentially of elevated concern, warranting the investigation of upstream mitigation strategies. Identification of most common sources and microplastic "hot spots", combined with risk assessments, could help guide state prioritization of management and mitigation actions towards safeguarding California's coastal ecosystems and communities.
- In March 2026, CTPP launched the **Tobacco Product Waste (TPW) mobile app** and data dashboard, which was developed through a contract with San Francisco Estuary Institute (SFEI). The mobile app standardizes and simplifies the collection of tobacco and nicotine waste data, ensuring reliable and comparable results across campaigns and regions. It is built on the scientifically validated methods from the OCP-funded **California Trash Monitoring Methods and Assessments Playbook** developed by SFEI and SCCWRP. The accompanying dashboard lets users explore data collected through the app, including local results, trends, and submissions from CTPP-funded projects statewide. The app was developed through continuous collaboration with CTPP-funded projects from 2023 to 2026, incorporating feedback along the way.

16 Cowger et al., 2021; Cowger et al., 2022**;** Cowger et al., 2024**;** Karapetrova et al., 2024; Murphy-Hagan et al., 2025a; Murphy-Hagan et al., 2025b; Singh et al., 2025.

Objective 2B. Risk Threshold & Assessment

Synthesized toxicological studies to help provide greater certainty of microplastic risk threshold for marine life and human health (Action 2B.2.1). A risk-based management framework, including initial thresholds to measure microplastic impacts in marine wildlife, was **published** in 2022. Experts subsequently released the **Toxicity of Microplastics Explorer (ToMEx) 2.0** – a tool designed to facilitate analysis of microplastic toxicity data and support risk assessment and hazard characterization, helping to inform health-based thresholds used in policies to protect both human and aquatic ecosystem health **(Action 2B.2.2)**. However, significant data gaps remain, including the need for improved understanding of the mechanisms of adverse ecological effects, more high-quality toxicity tests, information regarding chemical absorption, and dose-response information for environmental and human health. Furthermore, the Office of Health Hazard Assessment (OEHHA) conducted a **scientific study** on the potential human health impacts of recycled tires used as crumb rubber in synthetic turf, finding no evidence of significant health risk based on currently available data.

Updated existing microplastic risk assessment framework and executed risk assessments that incorporate local environmental loads of microplastics and risk thresholds to quantify the risk of microplastics to marine life and human health (Action 2B.2.2). Microplastics experts proposed a **tiered management framework** that uses health-based thresholds for microplastics in aquatic ecosystems, ranging from no concern (e.g., no regulatory action needed) to highest concern (e.g., need for measures to mitigate microplastic emissions). This **framework** was applied to San Francisco Bay, and results determined that levels of microplastics ranged from low to elevated concern. Furthermore, OEHHA staff updated the existing **ecological risk assessment** framework to account for variabilities and uncertainties in species sensitivities and monitoring data and applied the framework for both marine and freshwater ecosystems to inform decision-making.

Analyzed water body impairments in the 2024 California Integrated Report (**Action 2B.2.6**)**.** In 2024, the State Water Board adopted the 2024 California Integrated Report, prepared every two years by the State Water Board pursuant the federal Clean Water Act, which included the first-ever assessment of microplastics in San Francisco Bay and listed 105 waterbodies as impaired due to trash, including the San Francisco Bay, Santa Monica Bay, coastal wetlands, and shoreline across the state. Three waterbodies were evaluated for microplastics and placed in Category 3 to indicate the need for ongoing investigation due to insufficient data to make a beneficial use support determination, although recognized that beneficial uses are potentially threatened by microplastics.

Objective 3B. Sources & Pathways Prioritization

Quantified and characterized relative inputs of microplastics from wastewater and stormwater (Action 2B.3.1). See Action 2A.2.8 for further information regarding **funded research** by OPC to evaluate and characterize microplastics in influent, effluent, and biosolids from seven wastewater treatment plants in California to estimate how much is entering the environment and the removal efficiency of wastewater treatment plants. Additionally, SCCWRP conducted a study to **quantify and characterize microplastics in urban river systems** (Los Angeles), finding that a major pathway of microplastics to the ocean is stormwater. This complements similar findings from **previous studies** completed in the San Francisco Bay area. The Bight Regional Monitoring Program (2023) additionally measured the extent and magnitude of microplastic contamination in sediment and mussels. Completion of analysis is expected in 2026. (See **Action 2B.1.1**). See **Objective 2A, Stormwater** for additional studies.

Investigation to assess clothes dryer as a source of microplastic pollution and inform solutions (Action 2B.3.1). In 2023, OPC and CASG funded SFEI, the Desert Research Institute, and the 5 Gyres Institute to assess whether electronic clothing dryers (commercial and residential) are a significant source of microplastic pollution in the San Francisco Bay and determine whether secondary dryer filters are an effective solution to capture microfibers. Preliminary findings show that dryer emissions are a major source of microfibers to urban stormwater runoff to the San Francisco Bay. All commercially available secondary dryer filters tested significantly reduced microplastic emissions. This research provides critical data to inform industry standards and potential policy interventions aimed at reducing microfiber emissions at the source.

Objective 4B. Evaluating New Solutions

Foundational monitoring and targeted evaluation of specific infrastructure projects, such as low impact development and biofiltration BMPs, and other local actions are needed to inform priority locations and evaluate the efficacy of local projects and actions, or otherwise identify compliance with local and statewide regulations designed to prevent plastic pollution in California communities and waterways.

Individual actions have included research funded by OPC and the Southern California Stormwater Monitoring Coalition to evaluate whether biofiltration BMPs effectively remove microplastics from stormwater in urban and rural areas. This study, described under **Action 2A.2.1**, demonstrated that microplastics behave similar to other types of particulate matter, and BMPs thus show great promise for capturing microplastics (>20 µm). Previously, the **Bight Regional Monitoring Program (2018)** found a significant decrease in plastic bags observed in

Southern California watersheds after Senate Bill 270 (Padilla, 2024) was implemented in 2016, demonstrating the potential success of statewide prohibitions of the sale and distribution of plastic products. Ongoing monitoring, source identification, and risk assessments can further evaluate and track how well local and statewide efforts reduce plastic pollution and remediate associated harm to the environment.

Conclusion

Significant progress has been made across the state to implement this two-track strategy since 2022. With the advancement of early actions to curb microplastic pollution, the state has taken action to tackle the problem at the source, aiming to reduce the amount of microplastics entering the environment. With investment in advancing microplastic research and monitoring, the state has increased the ability to evaluate areas of the state most impacted by plastic pollution, as well as actions that are making measurable progress to reduce microplastics across the state. California remains committed to making progress to address and prevent microplastic pollution, with a continued emphasis on upstream source control measures and management actions.

Resources

State Reports & Resources

- Statewide Microplastics Strategy
- Statewide Plastics Monitoring Strategy and Planning Framework
- Exploring Solutions for Tire Wear Pollution: Workshop Summary
- California Statewide Microplastic Strategy Workshop: Textile Sector Summary Report
- Reusable Foodware Purchasing Guide
- 2018 Ocean Litter Prevention Strategy: Addressing Marine Debris from Source to Sea
- The California Ocean Litter Prevention Strategy Accomplishments Report June 2018-August 2025
- Tobacco Product waste in California: A White Paper
- Department of Toxic Substances Control Safer Consumer Products Program: Three-Year 2024-2026 Priority Product Work Plan 2024-2026
- Department of Toxic Substances Control Background Document on Candidate Chemicals in Artificial Turf
- California Attorney General's complaint against Exxon Mobile
- Guidelines for Addressing Plastic Pollution in Coastal Development Permits and Local Coastal Programs
- California Air Resources Board's analysis of vehicle brake and tire particle emissions
- California Plastic Pollution Mitigation Fund
- 2024 California Integrated Report
- California Department of Public Health: UNDO Program
- UNDO Exhale Campaign Videos
- UNDO: The Little Big Lie

Extended Producer Responsibility Programs

- **Plastic Pollution Prevention and Packaging Producer Responsibility Program**
- **Textile Stewardship Program**
- **Pharmaceutical and Sharps Waste Stewardship Program**
- **California Mattress Stewardship Program**
- **California Carpet Stewardship Program**

Environmental Justice Resources

- **Map of California's Plastic Burdened Communities**
- **What Defines a Plastic-burdened Community? - Part I: An Environmental Justice Framework for Identifying Exposure Disparities and Informing Mitigation Investment**
- **What Defines a Plastic-Burdened Community? - Part II: Plastic, Fossil Fuels, and Inequitable Site-based Exposure Risks**
- **Tribal Community Coordinating Center's Tribal Environmental Campaign**
- **Tribal Community Coordinating Center's Tribal Anti-Vaping Campaign**
- **Advancing Effective Ocean Litter Solutions for California**

Microplastics Strategy Initiatives and Legislation in other Subnational Governments

- **Puget Sound Microplastics Pollution Strategy development**
- The New York State legislature is considering the Packaging Reduction and Recycling Infrastructure Act (**NY State Senate Bill S1464**)
- The Government of Quebec released a **proposed strategy for the Reduction and Responsible Management of Plastics in Quebec, 2024-2029**
- The Michigan legislature is considering bills to create a statewide microplastics strategy (**MI Senate Bill 505**) and address microplastics in drinking water (**MI Senate Bill 504**)

Science Tools

- **Toxicity of Microplastics Explorer (ToMEx) 2.0**
- **Ecological risk assessment framework for marine and freshwater ecosystems to inform decision-making**
- **Tiered management framework that uses health-based thresholds for microplastics in aquatic ecosystems**
- **Tobacco Product Waste Cleanups and Cost**
- **Interstate Technology Regulatory Council: Priority Topics for PFAS and Microplastics**

Outreach, Education, and Training Resources

- **Interstate Technology Resources Council: Microplastics Training**
- **Interstate Technology Resources Council: Microplastics**
- **Interstate Technology Resources Council: Microplastics Outreach Toolkit**
- **Tribal Community Coordinating Center: Tribal Environmental Campaign**
- **Tribal Community Coordinating Center: Tribal Anti Vaping Campaign**
- **Advancing Effective Ocean Litter Solutions for California**
- **One Cool Earth Marine Debris Education Programs**
- **One Cool Earth Marine Debris Prevention Best Practices Manual**

Appendix A: 2022 Statewide Microplastic Strategy Actions

SOLUTIONS: RECOMMENDED EARLY ACTIONS

Each of the recommended early actions are suggested below to address microplastic pollution in California as multi-benefit, 'no regrets' actions.

Objective 1. Pollution Prevention

Product & Material Regulations

- **2A.1.1** Implement the statewide requirement that single-use foodware and condiments be provided only upon request, consistent with Assembly Bill 1276 (Carrillo, 2021) by 2022.
- **2A.1.2** Encourage state purchasing and service contracts to require reusable foodware whenever feasible and reduce the state's reliance on single-use foodware by 2022.
- **2A.1.3** Enact comprehensive statewide plastic source reduction, reuse, and refill goals by 2023.
- **2A.1.4** Prohibit the sale and distribution of expanded polystyrene foodware and packaging by 2023.
- **2A.1.5** Expand the statewide microbead ban enacted by Assembly Bill 888 (Bloom, 2015) to include microplastics that are intentionally added to specific consumer products, such as cosmetics, household and industrial detergents, and cleaning products by 2023.
- **2A.1.6** Prohibit the sale and distribution of single-use tobacco products that demonstrably contribute to tobacco product plastic pollution, including but not limited to cigarette filters, electronic cigarettes, plastic cigar tips, and unrecyclable tobacco product packaging by 2022.

Economic Strategies

- **2A.1.7** Identify Extended Producer Responsibility (EPR) strategies for recycling or disposal of plastic packaging and foodware by 2022.
- **2A.1.8** Promote, or otherwise require, the sale and use of ENERGY STAR condenser dryers and washing machines with filtration rates of 100 microns or smaller and develop a program to incentivize post-market retrofits or purchases through rebates and other mechanisms by 2024.

Identifying & Advancing Product Alternatives

- **2A.1.9** Convene representatives from targeted industries (e.g., vehicle tires, textiles, agriculture, foodware and packaging, and/or fisheries & aquaculture) and scientific experts to identify alternative products and other sector-specific plastic pollution prevention strategies by 2023.

Objective 2. Pathway Interventions

Stormwater

- **2A.2.1** Promote the multiple benefits of green infrastructure by prioritizing LID retrofit projects for existing development that generate or have the potential to generate microplastic loading in receiving waters beginning in 2022.
- **2A.2.2** Evaluate microplastic removal efficacy of LID structural Best Management Practices, including operations & maintenance strategies, and identify sites where LID implementation should be required based on environmental characteristics and available co-benefits by 2023.
- **2A.2.3** Consistent with findings of microplastic removal efficacy under **2A.2.2**, consider inclusion of LID requirements for new and redevelopment projects to address microplastic loading in municipal, industrial, construction, and highway water quality permits, in local coastal programs, and in coastal development permits adopted or reissued after December 31, 2023.
- **2A.2.4** Prioritize compliance assurance, and conduct enforcement actions as necessary, for preproduction plastic pellets ('nurdles') discharge prohibitions consistent with the Trash Provisions and local Trash TMDLs beginning in 2022.
- **2A.2.5** Prioritize the interception of trash and plastic debris with trash receptacles and trash services in 'trash hot spots' (high use beaches, recreational areas, & encampments adjacent to waterways) outside of the scope of the statewide Trash Provisions beginning in 2022.
- **2A.2.6** Implement the statewide Trash Provisions and assure compliance with the final deadline of no trash in state surface waters by 2030.

Wastewater

- **2A.2.7** Based on the results of existing studies regarding microplastic removal efficacy in wastewater treatment plants, further promote recycling of tertiary-treated wastewater that would otherwise be discharged to the ocean beginning in 2022.
- **2A.2.8** Based on the results of existing studies and the following completion of the ongoing SCCWRP study on wastewater treatment plant process removal efficacy, further develop microplastics reduction strategies, and monitoring recommendations based on each level of treatment, including primary, secondary, tertiary, and advanced treatment beginning in 2023.
- **See Pollution Prevention, Product and Material Regulations: 2A.1.5** Expand the microbead ban to include microplastics that are intentionally added to specific consumer products, such as cosmetics, household and industrial detergents, cleaning products, and paints by 2023.
- **See Pollution Prevention, Economic Strategies: 2A.1.8** Promote, or otherwise require, the sale and use of washing machines with a filtration rate of 100 microns or smaller and develop a program to incentivize post-market retrofits or purchases by 2024.

Aerial Transport

- **See Pollution Prevention, Economic Strategies: 2A.1.8** Promote, or otherwise require, the sale and use of ENERGY STAR condenser dryers and develop a program to incentivize post-market retrofits or purchases by 2024.

Objective 3. Outreach & Education

- **2A.3.1** Engage with California Native American Tribes to initiate outreach, monitoring, and immediate plastic and microplastic pollution reduction efforts beginning in 2022.
- **2A.3.2** Engage with underserved or communities disproportionately burdened by environmental injustice to ensure inclusion in decision-making processes, and to identify and pursue immediate solutions to reduce plastic and microplastic pollution beginning in 2022.
- **2A.3.3** Develop a public campaign to raise awareness of microplastic pollution, and to facilitate behavior, policy, systemic, and environmental change by 2023.
- **2A.3.4** Promote informal and formal educational programs with updated principles, concepts, standards, teacher training efforts, and/or curricula to educate K-12 students of microplastic sources, impacts, and solutions by 2024.
- **2A.3.5** Promote industry engagement and outreach to advance sector-specific microplastic pollution prevention strategies by 2024.

SCIENCE TO INFORM FUTURE ACTION
RESEARCH PRIORITIES

Each research priority and action presented below are contingent upon available funding and personnel resources.

Objective 1. Monitoring

- **2B.1.1** Establish standardized microplastic monitoring methods (sampling and analysis of environmental samples, including marine, river, and estuarine waters, sediment, and fish tissue) with accreditation by 2023.
- **2B.1.2** Develop a model microplastics monitoring program and establish an ongoing integrated statewide ambient monitoring network to quantify microplastic occurrence and effectiveness of management actions for microplastic pollution by 2024.
- **2B.1.3** Based on the results of existing studies regarding microplastic removal efficacy in wastewater treatment plants, require microplastic monitoring for California wastewater treatment plant permittees, as needed, as permits are renewed or revised beginning in 2024.
- **2B.1.4** Following completion of standardized monitoring methods and accreditation, require microplastic monitoring for municipal stormwater permittees as permits are renewed or revised beginning in 2024.
- **2B.1.5** Following completion of standardized monitoring methods, implement a pilot monitoring program to evaluate microplastics in agricultural soils, biosolids, and runoff, beginning in 2024.

Objective 2. Risk Thresholds & Assessment

- **2B.2.1** Develop toxicological studies that provide greater certainty of microplastics risk thresholds for marine life and human health, and determine recommended actions when thresholds are exceeded by 2024.
- **2B.2.2** Update the existing microplastics risk assessment framework and execute risk assessments that incorporate local environmental loads of microplastics and risk thresholds to quantify the risk of microplastics to marine life and human health by 2025.
- **2B.2.3** Engage with California Native American Tribes to conduct a risk assessment of microplastic pollution exposure and impacts to ancestral lands and waters, tribal cultural resources, and tribal beneficial uses to inform and prioritize future solutions by 2025.
- **2B.2.4** Engage with California communities disproportionately burdened by environmental injustice, underserved, and/or economically disadvantaged to conduct a risk assessment of microplastic pollution exposure and impacts to inform and prioritize future solutions by 2025.
- **2B.2.5** Prioritize the development of microplastic water quality objectives for state ocean waters, estuarine waters, and freshwaters beginning in 2024.
- **2B.2.6** Identify water body impairments in the California Integrated Report based on best available science, known thresholds, and available data beginning in 2024.

Objective 3. Sources & Pathways Prioritization

- **2B.3.1** Quantify and characterize relative inputs from the primary pathways (e.g., urban stormwater, agricultural runoff, wastewater, aerial deposition) of microplastics statewide to the ocean by 2024.
- **2B.3.2** Create a source emissions inventory to quantify the most prevalent California-specific sources (i.e., specific materials and products) contributing microplastics into the environment to inform future regulatory action by 2024.

Objective 4. Evaluating New Solutions

- **2B.4.1** Based on findings from actions completed under Science to Inform Future Action (**Chapter 2B**), provide additional policy recommendations consistent with subsection (g)(2) of Senate Bill 1263 by December 2025.

Appendix B: Summary of Key California Microplastics Monitoring Studies

Table 1: Summary of a subset of key microplastic monitoring studies conducted in California from studies published between 2002 and 2024.

Reference	Location	Matrices	Microplastic Size Range	Most Common Microplastic Type
Barrows et al. (2018)	Coastal California Waters (nearshore)	Marine surface waters	100 µm - 5 mm	Fibers
Brandon et al. (2019)	Northern California Current (offshore)	Zooplankton, marine surface waters	5 - 333 µm	Fibers
Carr et al. (2016)	Los Angeles	Wastewater	45 - 400 µm	Fragments
Choy et al. (2019)	Monterey Bay	Pelagic water column (marine waters)	20 µm - 5 mm	Not reported
Cowger et al. (2022)	Los Angeles	Fresh surface waters (river)	20 µm - 5 mm	Not reported
Donohue et al. (2019)	San Miguel Island	Northern fur seal feces	1 - 10 mm	Fibers and fragments
Doyle et al. (2011)	Southern California Coast	Zooplankton, marine surface waters	1 - 10 mm	Fragments
Dronjak et al. (2024)	San Francisco Bay Area	Sediment (surface and cores)	25 µm - 5 mm	Fibers
Dyachenko et al. (2017)	San Francisco Bay Area	Wastewater	125 - 355 µm	Fragments

Gaston et al. (2020)	Channel Islands	Air (indoor & outdoor)	20 - 8961 µm	Fibers and fragments
Gilbreath et al. (2019)	El Cerrito	Stormwater	125 - 355 µm	Fibers
Gilfillan et al. (2009)	San Diego Coastal area	Zooplankton, marine surface waters	0.505 - 3.5 mm	Not Reported
Hamilton et al. (2021)	Monterey Bay	Crustacean, fish, mollusk, jellyfish, zooplankton	0.1 - 5mm	Fibers
Heard et al. (2024)	Central California Coast	Coastal beaches	2 - <25mm	Cigarette butts and hard plastic fragments
Horn et al. (2019)	California Coast	Sediment (beaches), crabs	>300 µm	Fibers
Hung et al. (2020)	San Francisco Bay Area	Marine surface waters	20 - 500 µm	Fibers
Kashiwabara et al. (2021)	Monterey Bay	Marine surface water (nearshore & offshore)	25 µm - 5 mm	Fibers
Klasios et al. (2021)	San Francisco Bay Area	Mussels and clams	25 - 125 µm	Fibers
Lattin et al. (2004)	Santa Monica Bay	Marine surface waters	>333 µm	Not reported
Law et al. (2019)	Coastal California Waters	Marine surface waters	>355 µm	Fragments

Leviner and Perrine (2023)	Morro Bay	Terrestrial birds (gastrointestinal track)	>2.5 µm	Fibers
Marcus et al. (2023)	Humboldt Bay	Marine surface waters and tidal sediment	0.5 - 5.0 mm	Fibers and fragments
Michishita et al. (2023)	Monterey Bay	Anchovy, sea birds, marine surface waters	119 - 500 µm	Fibers
Miller et al. (2018)	Channel Islands, Los Angeles, Santa Barbara, Ventura	Beach sediments (sand)	<5 mm	Fibers and fragments
Moore et al. (2002)	Long Beach (coastal)	Zooplankton, marine surface waters	0.355 - >4.75 mm	Fragments
Moore et al. (2011)	Los Angeles	Freshwater (urban river)	1 - 5 mm	Fragments
Rochman et al. (2022)	Sacramento Delta, compared to Lake Ontario and Chesapeake Bay	Agricultural runoff, wastewater, urban runoff	>125 µm	Fibers and fragments
Saley et al. (2019)	Bodega Marine Reserve, Sonoma County	Benthic organisms, marine surface waters, sediment (sand), snails	36 - >180 µm	Not reported
SCCWRP Technical Report 1378 (2024)	Coastal California	Wastewater, biosolids	53 - 500 µm	Fragments and fibers

Steele and Miller (2022)	Channel Islands	Beach sediments (sand)	<5 mm	Not reported
Sutton et al. (2019)	San Francisco Bay Area	Stormwater, wastewater, marine surface water, sediment, prey fish	125 - 355 µm	Fibers and black rubbery fragments
Sutton et al. (2016)	San Francisco Bay Area	Marine surface water, treated wastewater, prey fish	0.333 - 4.75 mm	Fibers
Werbowski et al. (2021)	San Francisco Bay Area	Urban stormwater	125 µm - 1 mm	Fibers and black rubbery fragments
Wiggin and Holland (2019)	Los Angeles	Freshwater (urban river)	3 - 1000 µm	Fibers
Zhu et al. (2021)	San Francisco Bay Area	Stormwater, wastewater, marine surface water, sediment, prey fish	0.333 - 4.75 mm	Fibers and black rubbery fragments