FINAL

Caltrans Stormwater Program Guidance
Bridge Design and Retrofit

July 2025

California Department of Transportation
HQ Office of Hydraulics and Stormwater Design

Introduction

This document contains guidance on stormwater treatment strategies for new bridge design and bridge retrofit projects. Under the National Pollution Discharge Elimination System (NPDES) Statewide Stormwater Permit and Waste Discharge Requirements for State of California Department of Transportation, Order 2022-0033-DWQ NPDES No. CAS000003 (Caltrans Permit), highway projects in the state right-of-way creating 10,000 square feet (5,000 square feet for non-highway facilities) or more of New Impervious Surface (NIS) area, as described in Section 4.3 of the Project Planning and Design Guide (PPDG), must implement post-construction Treatment Best Management Practices (TBMPs). The Caltrans Permit's TBMP requirement can be especially challenging for bridge projects, this guide details compliance considerations and documentation requirements if TBMPs are not feasible.

Water quality treatment requirements

The PPDG details the Caltrans' TBMPs design consideration and selection process. TBMPs are used to treat runoff generated from a contributing drainage area. The contributing drainage area is the surface area that drains to the TBMP, it can be comprised of both impervious and pervious surfaces. However, only impervious areas may be considered for treatment. As impervious areas with typically limited pervious areas within the contributing drainage area, bridges may provide a unique opportunity to meet project's treatment requirement more efficiently. See the PPDG Section 4.2 to evaluate the project's treatment requirement and Section 5 for TBMP strategy considerations when treatment is required.

Any BMP under consideration must be technically feasible. Caltrans must be able to implement the BMP within the context of the state highway system. Feasibility also includes health, safety, and maintainability concerns. BMPs that substantially increase the risk to Caltrans staff and/or the public are considered infeasible. According to the Caltrans NPDES Permit, municipal stormwater dischargers are required to comply with technology-based standard to reduce the discharge of pollutants to the maximum extent practicable (MEP) pursuant to Clean Water Act (CWA) section 402(p)(3)(B)(iii). The State Water Resources Control Board stated that the CWA and its implementing regulations do not define MEP but its use in the context of other laws indicates that the focus is mostly on technical feasibility, but cost is also a relevant factor. If a permittee employs all applicable BMPs except those where it can show that they are not technically feasible, or the cost would exceed any benefit to be derived, it would have met the MEP standard.

Consistent with the discretion afforded to permittees under the MEP standard to select technically feasible and cost-effective permit compliance approaches, the Water Code prohibits regulatory agencies from specifying the design, location, or method of compliance. As stated in Division 7 Section 13360(a), "No waste discharge requirement or other order of a regional board or the state board of a court issued under this division shall specify the design, location, type of construction, or particular manner in which compliance may be had with that requirement, order, or decree, and the person so ordered shall be permitted to comply with the order in any lawful manner." In parallel, the California Streets and Highways Code 90 authorizes and directs Caltrans to design all state highways.

Challenges to bridge water quality treatment

Bridge projects present unique challenges to water quality treatment design for several reasons:

1. Most existing bridges were not designed with stormwater collection systems but use scuppers to drain water directly to the water body below. Changing the flow patterns on an existing structure is not a simple undertaking. It would require a hydraulic analysis of the structure to determine any potential danger to the traveling public due to changing the flow pattern. For instance, spread of the water into the traveled way, concentrated flows across traffic, or potential icy conditions. Additionally, analysis of the structure would be required to determine if the structure can safely handle the added stress from any drainage systems.
2. Topography adjacent to many bridges may not allow the construction of infiltration/detention basins, or other types of TBMPs.
3. Bridge abutments and the areas adjacent may be within the 100-year flood plain, severely restricting the deployment of TBMPs. It is not permissible to deploy any type of TBMPs within the 100-year flood plain as they may be unmaintainable and could affect flood water elevations. Working within the flood plain of any jurisdictional water will trigger the need for a U.S. Army Corps of Engineer's 408 permit, and possibly others, which can take years to obtain. Consider deploying TBMPs that require little, or no maintenance, such as Design Pollution Prevention Infiltration Areas (DPPIAs) when possible.
4. Water conveyed to abutments and concentrated for treatment may create an increased risk of erosion at the discharge points.
5. On deck or below deck point TBMPs, if available, are difficult to maintain and increase the exposure of Maintenance Staff to traffic hazards, which is not acceptable.
6. In general, the criteria for setting soffit elevation for Caltrans bridges is to pass the greater of the 50-year event with 2 feet of freeboard or the 100-year event without freeboard. For existing bridges with soffit elevations set at the 100-year flood event, the implementation of on-bridge TBMPs is technically infeasible as they are likely to be ineffective due to inundation during such events.
7. Most on-bridge TBMPs add significant permanent load increasing seismic inertial forces, potentially increasing demands on columns, abutments, and foundations. Retrofitting structural elements on existing bridges to accommodate higher seismic loads may be infeasible.
8. TBMP locations are needed to evaluate infiltration abilities to aid in selecting TBMPs. Soil adjacent to water bodies may have increased clay content, which typically are not capable of infiltrating without soil amendments.

Consider adding TBMPs off the structure, within the same watershed, instead of treating the runoff from the deck. This is almost always the preferred alternative. This alternative is also recommended in NCHRP Report 1117: On-Bridge Stormwater Treatment Practice: A Guide (2024) which states in the Foreword that "*NCHRP Report 778: Bridge Stormwater Runoff Analysis and Treatment Options concluded that treatment of runoff from a comparable section of highway on land is preferable to treatment of runoff from the bridge deck*."

In many cases, stormwater collection and treatment from bridge decks will not be fiscally or technologically feasible, especially in the general case where no specific pollutant of concern or environmental hazard associated with the runoff has been defined. However, to meet the requirements of the Caltrans Permit, stormwater treatment of bridge deck runoff must be considered when the bridge deck meets the definition of New Impervious Area as defined in the current edition of the PPDG. Where collection and treatment are infeasible, the reason should be documented in the Stormwater Data Report (SWDR), placed in the Project File, and communicated to both the District/Regional Design

Stormwater Coordinator and the District/Regional NPDES Coordinator. Per table 4-1 of the PPDG where the Bridge Deck runoff is deemed to be infeasible it is considered EIA.

From the PPDG Section 5.3.2:

"Sites requiring extraordinary plumbing to collect and treat runoff (e.g., jacking operations under a highway, bridge deck collection systems) may be considered infeasible due to their associated costs. Sites requiring extraordinary features or construction practices (e.g., retaining walls, shoring) may be infeasible due to their associated costs relative to the cost of the BMP itself. The PE must use engineering judgment and collaborate with the PDT."

Water quality treatment principles for bridge projects

Each bridge site and its associated water crossing is unique; therefore, it is impossible to make hard and fast statements about what is and what is not feasible. Other environmental regulations (e.g., 401 Certifications) may require mitigation in addition to the Caltrans Permit requirements depending on the classification of the water body. However, designers should consider some basic stormwater quality principles for their bridge projects, especially if the water body crossed is 303(d) listed.

1. **Bridge Replacement:** If possible, bridge deck runoff should be conveyed to an appropriate TBMP, off the structure, if site topography and regulatory agencies allow. If a stormwater conveyance system cannot be installed without re-designing the structural components of the bridge, exposing staff and/or the traveling public to danger, be maintainable, and the cost is fiscally prohibitive, then treatment is considered to be either technically, and/or fiscally, infeasible. It is critical to coordinate with the Division of Engineering Services (DES) early in the project.
2. **Bridge Retrofit:** If a stormwater conveyance system cannot be installed without re-designing the structural components of a bridge retrofit project, then document the infeasibility and place the documentation in the Project File. The District/Regional NPDES Coordinator needs to be informed as soon as the infeasibility is determined in case an Alternative Compliance Plan (ACP) is required for the project. If an ACP is deemed necessary, TBMPs should be located within the same receiving water body watershed whenever possible.
3. **General:** If infiltration, or detention based TBMPs are infeasible due to site topography or regulatory agency restrictions, it may be advisable to evaluate the feasibility of conveying runoff to the abutments and installing appropriate Design Pollution Prevention BMPs (downdrains, hard surfacing, energy dissipation, etc.). If it is currently on a 303d list, then the designer can consider how they might be able to treat them now if feasible.
4. **General:** Strategies to minimize water quality issues relating to the bridge deck should be considered. For example, Highway Design Manual 837.3(2) recommends intercepting roadway drainage prior to the bridge deck and intercepting runoff from the bridge deck on the downstream side. This strategy minimizes the amount of water running onto the deck and requiring treatment.

Known stormwater quality requirements affecting bridge design should be conveyed to Structures Design at the time of the original submission of the Advanced Planning Study Request.

References

American Association of State Highway and Transportation Officials (AASHTO), 2023. AASHTO LRFD Bridge Design Specifications 8th ed. with California Amendments, December 2023

California Department of Transportation (Caltrans), 2016. Statewide Stormwater Management Plan, July 2016

California Department of Transportation (Caltrans), 2023. Stormwater Quality Handbooks: Project Planning and Design Guide (PPDG), June 2023

California Department of Transportation (Caltrans), 2023b. Measurements and Reporting Manual, December 2023

California Department of Transportation (Caltrans), 2023c. Highway Design Manual 7th Edition, September 2023

California State Water Resources Control Board ORDER 2022-0033-DWQ, NPDES NO. CAS000003 for State of California Department of Transportation Statewide Storm Water Permit, referred to as "Caltrans Permit"

National Cooperative Highway Research Program, 2024, Research Report 1117, On-Bridge Stormwater Treatment Practices

National Cooperative Highway Research Program, 2002, Research Report 474, Assessing Impacts of Bridge Deck runoff Contaminants in Receiving Waters