SANTA SUSANA
STORMWATER

At the former Santa Susana Field Laboratory, stormwater that leaves the site follows the natural topography through channels and ponds before leaving the site through drainage locations. Approximately two-thirds of the stormwater that leaves the site flows south towards Bell Creek, a tributary to the Los Angeles River, while approximately one-third of the stormwater flows north to Arroyo Simi, a tributary to Calleguas Creek.

REGULATIONS

Stormwater quality at the site has been monitored since the 1970s. The Los Angeles Regional Water Quality Control Board (Regional Board) oversees Boeing's National Pollutant Discharge Elimination System stormwater monitoring permit. Under that sitewide permit, Boeing collects and samples stormwater when flow is observed at 12 drainage locations, commonly referred to as "outfalls." The samples are analyzed for conventional pollutants including oil, grease and pH; a set of 126 chemical pollutants regulated by the Environmental Protection Agency; and nonconventional pollutants including acute/chronic toxicity, settleable solids and temperature. Some constituents present in stormwater, such as minerals and metals, occur naturally in the local area or result from non-industrial sources, fires or other activities outside of the Santa Susana site. In many cases, the numeric limits in the permit are set below the levels that the state of California deems safe for the water that people drink, even though the water at the site is not used for drinking water.

2 stormwater treatment systems built

1 biofilter installed

Over **106,000** cubic yards of soil excavated

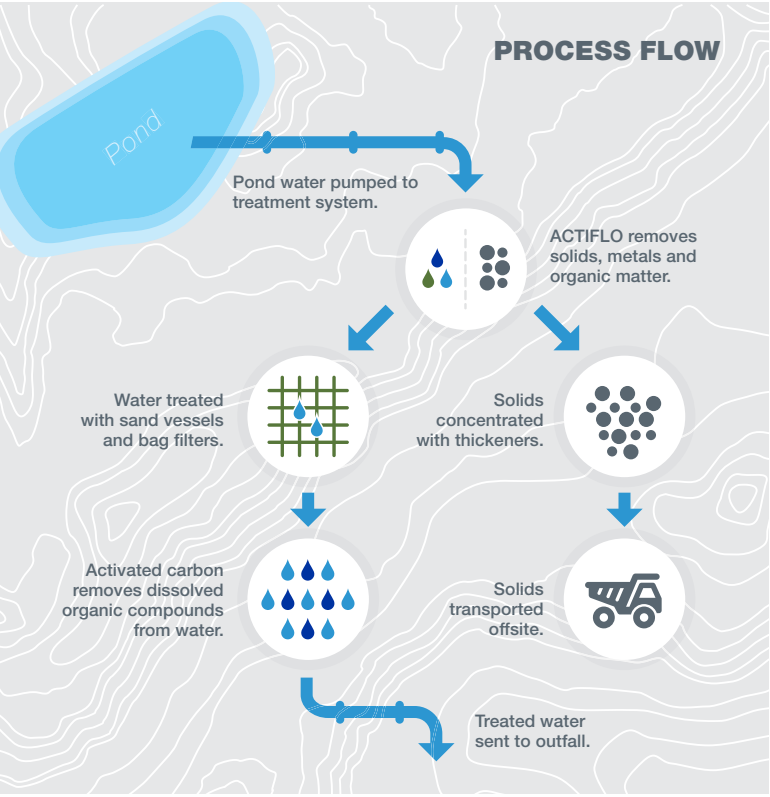
COMPLIANCE

Boeing has instituted a rigorous monitoring program utilizing treatment systems and Best Management Practices (BMPs) in order to meet stormwater quality regulatory standards. For the past decade, even with the permit's stringent limits, Boeing has maintained over 99 percent compliance for stormwater leaving the site. Most of the exceedances that have occurred are generally associated with metals and inorganics attributed to erosion of natural background soils or non-industrial sources. Over the years, Boeing has spent more than $100 million to comply with the stringent permit limits, including;

- Designed and constructed two state-of-the-art storm water treatment systems that use processes and chemicals similar to those used by city and county municipalities to make clean drinking water;
- Installed a biofilter, which received the California Stormwater Quality Association's "Outstanding BMP Implementation" award, and a bioswale that uses a combination of soil, naturally occurring bacteria and native plants to treat the stormwater;
- Removed more than 106,000 cubic yards of soil that may have been adversely affecting stormwater runoff; and
- Worked with an independent team of five internationally recognized experts who provide recommendations on how to best meet compliance standards.

Improving Stormwater Quality

Boeing uses two methods for treating stormwater at Santa Susana: active and passive. This water management strategy is a hybrid approach that combines state-of-the-art and natural processes.



ACTIVE TREATMENT

Boeing designed and constructed advanced stormwater treatment systems at Outfalls 011 and 018. These systems employ water treatment processes and chemicals similar to those used by city and county municipalities to make drinking water. The stormwater treatment process flow is outlined here.

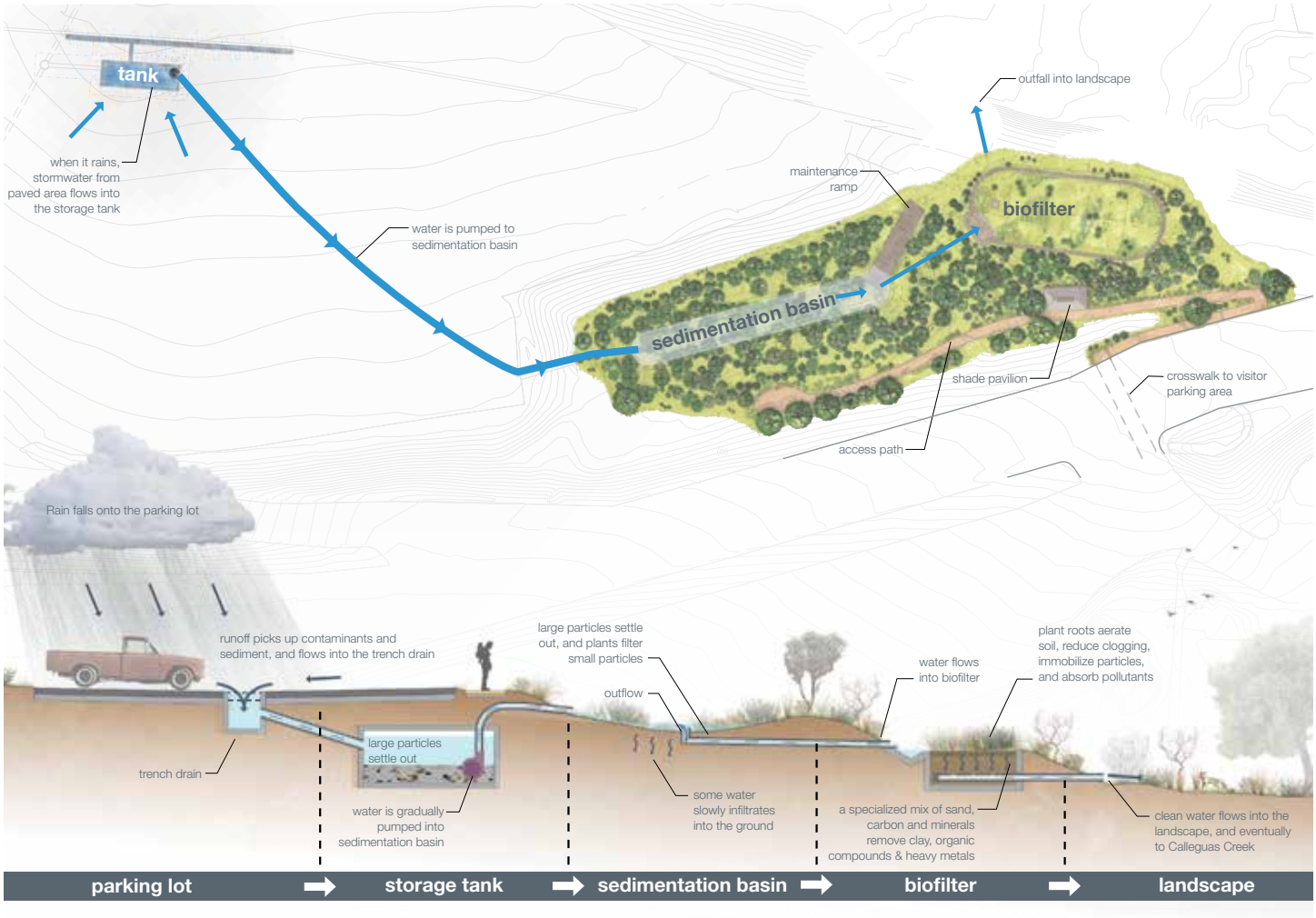
TREATMENT BY THE NUMBERS

2.7 million gallons can be treated during rain events

2.5 swimming pools of water per hour can be treated by Outfall 018 system

Outfall 018 Stormwater Treatment System

BIOFILTER



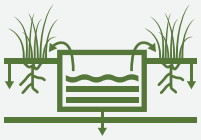
PASSIVE TREATMENT

Boeing utilizes an array of passive stormwater treatment technologies, including drainage culvert modifications, stream bank stabilization, revegetation of disturbed soil areas, installation of detention bioswales and placement of smaller-scale erosion control measures.

For example, Boeing installed a biofilter that treats stormwater runoff by harnessing natural processes. Stormwater is collected in a cistern, pumped to a sedimentation basin and allowed to flow into the adjacent biofilter, which functions as a natural ecosystem where constituents in stormwater are filtered through soil, naturally occurring bacteria and native plants.

Boeing collaborated with the Los Angeles Conservation Corps, Pollinator Partnership and the Wildlife Habitat Council to design the biofilter as part stormwater treatment, part wildlife habitat. It also serves as an educational tool for area schools. The California Stormwater Quality Association recognized the Santa Susana biofilter as a creative solution with an Outstanding BMP Implementation Award.

BIOFILTRATION BY THE NUMBERS



3,200 square foot biofilter

1,800 gallons of runoff per minute

2,000 native plants prevent water pollution

RISK ASSESSMENT

The Regional Board directed Boeing to prepare a Human Health Risk Assessment (HHRA) in response to health concerns expressed by members of the public regarding possible exposures to stormwater runoff exiting the site. The HHRA evaluated potential exposure of individuals who may come into contact with stormwater from the site in drainage areas immediately downstream of the property boundary while hiking, rafting or other similar recreational uses.

The report considered possible ways individuals could have direct exposure to the surface water, such as incidental ingestion, skin contact and inhalation. The HHRA concluded that potential recreational exposures to Constituents of Potential Concern (COPCs) in surface water runoff exiting the Santa Susana site via Outfalls 001, 002, 008, 009, 011, 018, and 019 are below levels of concern as established by Cal-EPA and USEPA. This includes those COPCs that have had NPDES permit limit exceedances. Both the Regional Board and the California Office of Environmental Health Hazard Assessment (OEHHA) agreed with this conclusion. Every year, the independent stormwater expert panel reviews stormwater monitoring data. These annual reviews continue to show that the human health risk assessment findings have not changed.

MEET THE EXPERTS

The Santa Susana Stormwater Expert Panel is an independent committee of five internationally recognized experts who have been providing guidance to Boeing and the Regional Board since 2008. Their recommendations have included best management practices and measures that include the biofilter and bioswales, culvert modifications, soil and pavement removal, erosion controls and channel restoration.

Robert Gearheart, Ph.D,
Humboldt State University

Professor Emeritus Bob Gearheart's professional interests focus on water quality management and hazardous waste management, and more specifically on water treatment through constructed wetlands.

Jonathan Jones, P.E. D.WRE,
Wright Water Engineers

CEO Jonathan Jones has extensive experience working on projects involving stormwater quantity and quality, flood-plain management, surface water hydrology and watershed modeling.

Retired
Michael Josselyn, Ph.D,
Wetlands Research Associates

Co-founder and President Mike Josselyn manages wetland restoration and mitigation projects, land use planning studies, federal and state permitting projects, and remedial action plans for wetlands in hazardous waste sites. He is a Professor Emeritus at San Francisco State University.

Robert Pitt, Ph.D., P.E., D.WRE, BCEE,
University of Alabama

Bob Pitt, professor of Civil and Environmental Engineering, has conducted research for the U.S. EPA, Environment Canada, Ontario Ministry of the Environment, states, and local governments concerning the effects, sources and control of urban runoff for more than 35 years.

Michael Stenstrom, Ph.D., P.E., BCEE,
UCLA

Mike Stenstrom, professor in the Civil and Environmental Engineering Department, conducts research focused on process development for water and wastewater treatment systems, including mathematical modeling and optimization.

For more information, please visit the Santa Susana Stormwater Technical Library:
www.boeing.com/santasusana

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