TRIBAL ENVIRONMENTAL IMPACT REPORT

GRATON RANCHERIA
BACK OF HOUSE EXPANSION PROJECT

JULY 2019

LEAD AGENCY:

Federated Indians of Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928
(707) 566-2288
www.gratonteir.com

TRIBAL ENVIRONMENTAL IMPACT REPORT

GRATON RANCHERIA
BACK OF HOUSE EXPANSION PROJECT

JULY 2019

LEAD AGENCY:

Federated Indians of Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928
(707) 566-2288
www.gratonteir.com

PREPARED BY:

Analytical Environmental Services
1801 7th Street, Suite 100
Sacramento, CA 95811
(916) 447-3479
www.analyticalcorp.com

TABLE OF CONTENTS

GRATON RANCHERIA BACK OF HOUSE EXPANSION PROJECT DRAFT TRIBAL ENVIRONMENTAL IMPACT REPORT

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

GRATON RANCHERIA BACK OF HOUSE EXPANSION PROJECT

ES.1 PROJECT SUMMARY

The Federated Indians of Graton Rancheria (Tribe) proposes to enlarge employee areas at the existing Graton Resort & Casino (Resort) with the construction of the Back of House Expansion Project (Proposed Project). The Proposed Project would be implemented pursuant to federal law and the Tribal-State Compact (Compact) between the Tribe and the State of California (**Appendix A**). The Environmental Impact Analysis Checklist (Checklist) in **Appendix B** has been used to evaluate potential off-reservation environmental impacts of the Proposed Project.

ES.2 ISSUES OF CONCERN

The Tribe issued a Notice of Preparation (NOP) for the Proposed Project on May 1, 2019, initiating a 30-day comment period that closed on May 31, 2019 (**Appendix C**). The purpose of the NOP was to describe the Proposed Project and solicit public input regarding the scope and content of the TEIR. The NOP was delivered to the California State Clearinghouse and Sonoma County for distribution to interested parties. No comment letters were received in response to the NOP.

ES.3 PROJECT ALTERNATIVE

Under the No Action Alternative, further discussed in **Section 2.3** of this TEIR, the back of house area would not be expanded or substantially modified, and would continue to operate in its current form and capacity. Under the No Action Alternative, the project site would continue to operate as single-story office space and surface parking for the existing Resort.

ES.4 IMPACTS AND MITIGATION

Section 3.0 addresses potentially significant off-reservation environmental impacts of the Proposed Project and discusses feasible mitigation measures, taking into consideration off-reservation jurisdictional constraints. With implementation of the recommended mitigation measures, all potentially significant off-reservation impacts would be reduced to less-than-significant levels. **Table ES-1** presents a summary of potential off-reservation environmental impacts of the Proposed Project and recommended mitigation measures that would avoid or reduce potential off-reservation impacts.

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.2 AESTHETICS			
3.2-1	The Proposed Project would not affect off-reservation scenic vistas.	None warranted	LTS
3.2-2	The Proposed Project would not substantially damage any off-reservation scenic resources, including, but not limited to, trees, rock outcroppings, or historic buildings adjacent to a state scenic highway.	None warranted	NI
3.2-3	The Proposed Project would not create a new source of light or glare that could adversely affect off-reservation day or nighttime views in the area.	**3.2-2** The Tribe shall ensure that the following measures applicable to the Resort are implemented in construction and operation of the Proposed Project to minimize effects of lighting and glare: ▪ To the extent feasible, construction shall not occur prior to 7:00 am or after 10:00 pm. ▪ Floodlights shall be set so as not to cast trespassing light off-site. ▪ Uplighting shall be limited to the main facades of the Proposed Project and shall be focused on structures. ▪ Timers shall be utilized to minimize lighting after a certain hour. ▪ Exterior glass shall be consistent with existing glazing of the Resort.	LTS
3.3 AIR QUALITY			
3.3-1	The Proposed Project would not conflict with or obstruct implementation of applicable air quality plans.	**3.3-1** To further reduce construction emissions, the Tribe may require that construction contractors implement the following best management practices during construction: ▪ The Tribe shall require off-road construction equipment to utilize tier three engines as defined by the USEPA's Vehicle Emission and Fuel Standards Program. In addition, construction equipment shall be operated with a level three diesel particulate filter. ▪ Exposed soil shall be sprayed with water daily as needed. ▪ Dust emissions shall be minimized during transport of fill material or soil by wetting down loads, ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks, and/or covering loads. ▪ Dirt, gravel, and debris piles shall be covered as needed to reduce dust.	LTS
3.3-2	The Proposed Project would not violate air quality standards or contribute to existing or projected air quality violations.	None warranted	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.3-3	The Proposed Project would not create objectionable odors affecting a substantial number of people off-reservation.	None warranted	LTS
3.3-4	The Proposed Project would not expose off-reservation sensitive receptors to substantial CO concentrations.	None warranted	LTS
3.3-5	The Proposed Project would not expose off-reservation sensitive receptors to substantial DPM concentrations.	None warranted	LTS
3.4 BIOLOGICAL RESOURCES			
3.4-1	The Proposed Project could potentially have an adverse impact, either directly or through habitat modifications, on species in local or regional plans, policies, or regulations, or protected by the CDFW or USFWS.	**3.4-1** Silt fencing shall be placed along the edge of the project site and BSA boundary to serve as CTS exclusionary fencing during construction of the Proposed Project, and will also serve to protect off-reservation wetlands from indirect impacts. The fencing protects against the take of CTS by preventing CTS from accessing the project site from the surrounding off-reservation critical habitat. Fencing shall be 8 inches minimum in height, and trenched and backfilled to a depth of 6 inches below the soil surface. Fencing shall allow on-site CTS to move to adjacent habitat off-site. CTS signage shall be placed around the project site, and a qualified biologist will periodically monitor the project site for the presence of CTS. **3.4-2** Should construction activities take place during the nesting period (February 15-September 15), a qualified biologist shall conduct a pre-construction survey for raptor nests within 500 feet of the project site. The survey shall be conducted within 14 days of the start of construction. If construction activities are delayed or suspended for more than 14 days after the pre-construction survey, the area shall be resurveyed. If no active bird nests are identified, no further mitigation is necessary. If active bird nests are identified, an avoidance buffer shall be implemented based on the identified species and as determined by a qualified biologist. Avoidance buffers may vary in size depending on habitat characteristics, project-related activities, and disturbance levels. Avoidance buffers shall remain in place until the end of the general nesting season or upon determination by a qualified biologist that young have fledged or the nest has failed.	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.4-2	The Proposed Project would not have a substantial adverse effect on any off-reservation riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFW or USFWS.	Refer to **Mitigation Measures 3.5-1, 3.7-2,** and **3.8-1**	LTS
3.4-3	The Proposed Project could potentially have an adverse effect on federally protected off-reservation wetlands as defined by Section 404 of the CWA.	Refer to **Mitigation Measure 3.4-1**	LTS
3.4-4	The Proposed Project would not substantially interfere with the movement of native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.	None warranted	NI
3.4-5	The Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.	None warranted	LTS
3.5 GEOLOGY AND SOILS			
3.5-1	The Proposed Project would not expose off-reservation people or structures to substantial adverse effects involving a known earthquake fault, other strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides.	None warranted	LTS
3.5-2	The Proposed Project would not result in substantial off-reservation soil erosion or the loss of topsoil.	**3.5-1** As discussed in **Section 3.8**, a SWPPP shall be prepared for the Proposed Project that identifies best management practices (BMPs) to be implemented during construction of the Proposed Project. Applicable BMPs (**Appendix D**) to reduce the potential for soil erosion include the following: ▪ Spray exposed soil with water/other suppressant as needed to reduce dust. ▪ Stabilize the construction access road through frequent watering or physical covering of gravel or rip-rap. ▪ Exposed stockpiled soils shall be covered and wattles shall be placed at the base of the piles to prevent wind and rain erosion. ▪ Enforce a 15 mile per hour speed limit on unpaved roads.	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
		▪ Silt fencing shall be erected at all on-site stormwater exit points and along the edge of graded areas to stabilized non-graded areas and control siltation of onsite stormwater.	
3.6 GREENHOUSE GAS EMISSIONS			
3.6-1	The Proposed Project would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the off-reservation environment.	**3.6-1** To further reduce construction emissions during construction, diesel-powered equipment shall be properly maintained and idling time shall be minimized when construction equipment is not in use to the extent feasible, unless per engine manufacturer's specifications or for safety reasons.	LTS
3.6-2	The Proposed Project would not conflict with an off-reservation plan, policy, or regulation adopted for the purpose of reducing emissions of greenhouse gases.	None warranted	LTS
3.7 HAZARDS AND HAZARDOUS MATERIALS			
3.7-1	The Proposed Project could create a hazard to the off-reservation public and/or off-reservation environment through routine transport, use, or disposal of hazardous materials during construction.	**3.7-1** If large quantities of potentially hazardous materials are used during construction of the Proposed Project, the Tribe shall ensure that contractors prepare and implement an HMBP in compliance with the California Health and Safety Code.	LTS
3.7-2	The Proposed Project could create a hazard to the off-reservation public and/or off-reservation environment through upset and accident events involving the release of hazardous materials into the off-reservation environment.	**3.7-2** As discussed in **Section 3.8**, a Stormwater Pollution Prevention Plan shall be prepared for the Proposed Project that identifies BMPs to be implemented during construction, and include the following: ▪ Potentially hazardous materials, including fuels, shall be stored away from drainages and secondary containment shall be provided. ▪ A hazardous materials spill prevention, storage, and disposal plan shall be developed and shall identify proper storage, collection, and disposal measures for potential pollutants used onsite, as well as proper cleanup procedures and reporting of spills. The plan shall contain an inventory of hazardous materials stored and used on site, shall maintain emergency response protocols for the release and disposal of unused hazardous materials, and shall provide provisions specifying employee training in safety and emergency response procedures.	LTS
3.7-3	The Proposed Project would not emit hazardous emissions or involve the handling of hazardous materials, substances, or waste within 0.25 miles of an existing or proposed off-reservation school.	None warranted	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.7-4	The Proposed Project would not expose off-reservation people or structures to a significant risk of loss, injury, or death involving wildland fires.	None warranted	LTS
3.8 WATER RESOURCES			
3.8-1	The Proposed Project could violate water quality standards or WDRs during construction but not operation.	Refer also to **Mitigation Measures 3.5-1** and **3.7-2** **3.8-1** A SWPPP will be prepared for the Proposed Project that identifies BMPs to be implemented during construction of the Proposed Project. Applicable BMPs (**Appendix D**) to ensure water quality standards are met include the following: ▪ Should excavation occur during the rainy season, stormwater runoff from the project site shall be regulated through temporary fixtures including silt fencing and/or basins with multiple discharge points to natural drainages and energy dissipaters. ▪ Stockpiles of loose material shall be covered and straw wattles/fiber rolls shall be placed around the base of all stockpiles and runoff diverted away from exposed soil material. ▪ Trapped sediment shall be removed from the basin or silt fencing and placed at a suitable location on-site, away from concentrated flows, or removed to an approved disposal site. ▪ Temporary erosion control measures including straw wattles/fiber rolls and silt fencing shall be provided until perennial revegetation or landscaping is established. ▪ No disturbed surfaces shall be left without erosion control measures in place. ▪ Impervious surfaces including parking lots and rooftops will be designed and constructed so that stormwater runoff will be directed into storm drains that would subsequently direct the flow into existing on-reservation engineered bioswales and stormwater retention basins.	LTS
3.8-2	The Proposed Project would not deplete off-reservation groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or lowering of the local groundwater table.	None warranted	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.8-3	The Proposed Project could substantially alter the existing drainage pattern of the site or area, including through the alteration of a course of a stream or river, in a manner which could result in substantial erosion or siltation off-reservation.	Refer to **Mitigation Measures 3.5-1** and **3.8-1**	LTS
3.8-4	The Proposed Project would not substantially alter the existing drainage pattern of the area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding off-reservation.	None Warranted	LTS
3.8-5	The Proposed Project would not create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff off-reservation.	Refer to **Mitigation Measures 3.5-1, 3.7-2,** and **3.8-1**	LTS
3.8-6	The Proposed Project would not place structures within a 100-year flood hazard area, and therefore would not impede or redirect off-reservation flows.	None Warranted	NI
3.8-7	The Proposed Project would not expose off-reservation people or structures to a significant risk of loss, injury, or death involving flood, including flooding as a result of the failure of a dam or levee.	None Warranted	NI
3.9 LAND USE			
3.9-1	The Proposed Project would not conflict with any off-reservation land use plan, policy, or regulation of an agency adopted for the purpose of avoiding or mitigating an environmental effect.	None warranted	NI
3.9-2	The Proposed Project would not conflict with provisions of an adopted Habitat Conservation Plan or Natural Community Conservation Plan applicable to off-reservation.	None warranted	NI

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.10 NOISE			
3.10-1	The Proposed Project could expose off-reservation individuals to noise levels in excess of standards established in a local general plan or noise ordinance, or applicable standards of other agencies.	**3.10-1** To further reduce impacts from noise associated with the Proposed Project, outdoor construction activities shall be limited to weekdays between the hours of 7:00 am and 10:00 pm to the extent feasible.	LTS
3.10-2	The Proposed Project would not expose off-reservation individuals to excessive groundborne vibration or groundborne noise levels.	None warranted	LTS
3.10-3	The Proposed Project would not result in a substantial permanent increase in ambient noise levels to the surrounding off-reservation area.	None warranted	LTS
3.10-4	The Proposed Project could result in a substantial temporary increase in ambient noise levels to the surrounding off-reservation area.	Refer to **Mitigation Measure 3.10-1**	LTS
3.11 POPULATION AND HOUSING			
3.11-1	The Proposed Project would not induce substantial off-reservation population growth.	None warranted	LTS
3.11-2	The Proposed Project would not displace existing housing, necessitating the construction of replacement housing elsewhere off-reservation.	None warranted	NI
3.12 PUBLIC SERVICES			
3.12-1	The Proposed Project would not result in substantial adverse physical impacts associated with the provision of new or physically altered off-reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the off-reservation public services.	None warranted	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.13 TRANSPORTATION			
3.13-1	The Proposed Project would not conflict with any applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the off-reservation circulation system, taking into account all modes of transportation including mass transit and nonmotorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.	None warranted	LTS
3.13-2	The Proposed Project would not conflict with applicable congestion management programs, including, but not limited to, LOS standards and travel demand measures, or other standards established by the County congestion management agency for designated off-reservation roads or highways.	None warranted	LTS
3.13-3	The Proposed Project would not substantially increase hazards to an off-reservation design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).	None warranted	LTS
3.13-4	The Proposed Project would not result in inadequate emergency access for off-reservation responders.	None warranted	LTS
3.14 UTILITIES AND SERVICE SYSTEMS			
3.14-1	The Proposed Project would not exceed off-reservation wastewater treatment requirements of the Regional Water Quality Control Board.	None warranted	LTS
3.14-2	The Proposed Project would not require the construction of any new water or wastewater treatment facilities, energy facilities, solid waste facilities, or the expansion of existing facilities, the construction of which could cause significant off-reservation effects.	None warranted	LTS

TABLE ES-1: SUMMARY OF IMPACTS AND MITIGATION MEASURES
(PS=POTENTIALLY SIGNIFICANT, NI= NO IMPACT; LTS= LESS THAN SIGNIFICANT)

Impact		TEIR Recommended Mitigation Measure	Level of Significance After Mitigation
3.14-3	The Proposed Project would not require the construction of new stormwater drainage facilities or the expansion of existing facilities, the construction of which could cause significant off-reservation environmental impacts.	None warranted	LTS
3.14-4	The Proposed Project would not result in the determination by an off-reservation wastewater treatment provider that it has inadequate capacity to serve the Proposed Project's projected demand in addition to the provider's existing commitments.	None warranted	LTS
3.15 CUMULATIVE IMPACTS			
3.15-1	The Proposed Project would not result in impacts that are individually limited, but cumulatively considerable off-reservation.	No additional mitigation is warranted	LTS

SECTION 1.0

INTRODUCTION

SECTION 1.0

INTRODUCTION

This document has been prepared to assess potential off-reservation environmental impacts of the proposed Graton Rancheria Back of House Expansion Project (Proposed Project) in accordance with the Tribal-State Compact (Compact) between the Federated Indians of Graton Rancheria (Tribe) and State of California (**Appendix A**) and Environmental Impact Analysis Checklist (Checklist) (**Appendix B**). The Graton Resort & Casino (Resort) is owned by the Tribe and operated pursuant to federal law and the Compact. The conduct of Class III gaming activities and procedures for environmental review are governed by the Compact pursuant to the Indian Gaming Regulatory Act. Section 2.23 of the Compact defines a "project" as any gaming-related activity on tribal land that could result in a direct or reasonably foreseeable indirect physical change in the off-reservation environment (Compact, 2012). Section 11.0 of the Compact governs the preparation of a Tribal Environmental Impact Report (TEIR) prior to commencement of a project (**Appendix A**).

1.1 NOTICE OF PREPARATION

As required by Section 11.8.2 of the Compact, the Tribe issued a Notice of Preparation (NOP) for the Proposed Project on May 1, 2019, initiating a 30-day comment period that closed on May 31, 2019 (**Appendix C**). The purpose of the NOP was to describe the Proposed Project and solicit public input regarding the scope and content of the TEIR. The NOP was delivered to the California State Clearinghouse and the County for distribution to interested parties.

In response to the NOP, one comment letter was received from the Native American Heritage Commission (**Appendix C**). The letter addressed concerns regarding the TEIR's compliance with Assembly Bill 52 (AB52) under CEQA. The TEIR is a tribal document prepared in accordance with the Tribe's Compact (**Appendix A**). Therefore, the Proposed Project and TEIR are not subject to CEQA and AB52. Additionally, potential impacts associated with cultural resources on trust land were addressed in the Environmental Impact Statement (EIS) prepared for the existing Resort in 2009 (AES, 2009). The current Proposed Project is completely within the area studied in this previous EIS.

1.2 DRAFT TEIR

This document serves as the Draft TEIR for the Proposed Project as required by Section 11.8.1 of the Compact, and contains a description of the Proposed Project and surrounding off-Reservation environment, discussions of potential off-Reservation impacts and measures to be implemented to mitigate identified impacts, discussions of any unavoidable or irreversible potentially significant off-Reservation impacts, and analysis of an alternative to the Proposed Project.

Per Section 11.8.3 of the Compact, this Draft TEIR will be submitted to the California State Clearinghouse, the California Department of Justice, and the County, and distributed to local, state, and federal agencies and interested persons who requested in writing the opportunity to review and comment. A Notice of Completion of this Draft TEIR will be made available to the public as required by the Compact.

Submission of this Draft TEIR to the State Clearinghouse and the County will mark the beginning of a 45-day public review and comment period, during which time the Tribe will accept written comments regarding this Draft TEIR at the following address:

Analytical Environmental Services
Attn: Graton Comments
1801 7th St. #100
Sacramento, CA 95811

The Draft TEIR is also available online at gratonteir.com.

1.3 FINAL TEIR

Written comments regarding the Draft TEIR received by the Tribe at the above address within the 45-day comment period will be reviewed and addressed in the Final TEIR, per Section 11.8.4 of the Compact. The Final TEIR will include copies of comments received during the comment period, as well as responses to comments and revisions to the Draft TEIR as warranted. Upon completion, the Final TEIR will be considered by the Tribal Council for approval and certification and will be made available to the County. Pursuant to Section 11.8.4 of the Compact, the Final TEIR will be submitted to the County, City, State Clearinghouse, State Gaming Agency, and the California Department of Justice Office of the Attorney General at least 55 days before finalization of negotiations.

1.4 INTERGOVERNMENTAL AGREEMENT

Section 11.8.7 of the Compact requires the Tribe to commence negotiations with Sonoma County and the City of Rohnert Park regarding an Intergovernmental Agreement (IGA) no later than the issuance of the Final TEIR. The IGA will address Section 11.8.7 of the Compact regarding the mitigation of potentially significant impacts to the off-reservation environment attributable to the Proposed Project. The IGA must also address other subjects listed in the Compact that are not addressed in the Final TEIR. If the Tribe, County, and City have not agreed on the terms and conditions of the IGA within 75 days of the County and City receiving the Final TEIR, the Tribe, County, or City may demand that the terms and conditions of the IGA be determined by arbitration pursuant to the process described in Section 11.8.8 of the Compact (**Appendix A**).

SECTION 2.0

PROJECT DESCRIPTION

SECTION 2.0

PROJECT DESCRIPTION

The Federated Indians of Graton Rancheria (Tribe) is the Lead Agency for the preparation of this Tribal Environmental Impact Report (TEIR) for the proposed Graton Rancheria Back of House Expansion Project (Proposed Project). The Graton Resort & Casino (Resort) is owned by the Tribe and located immediately west of the City of Rohnert Park (City) in Sonoma County (County), California, on the Graton Rancheria (Reservation). The Resort opened in November 2013 and currently includes gaming, dining, a hotel, spa facilities, and associated parking, and was the subject of an Environmental Impact Statement approved by federal agencies in 2010. Revenue from the Resort is used to fund government operations of the Tribe, including social services, housing, and educational, health, and general welfare programs.

Currently, the Resort lacks adequate back of house space (BOH) and office space to sufficiently meet employee needs. The Tribe proposes to expand the Resort's BOH space with the Proposed Project in order to provide additional amenities and space to Resort employees.

2.1 PROJECT LOCATION

The Tribe's reservation is approximately 253-acres in size and located on the Santa Rosa Plain west of Highway 101 in unincorporated Sonoma County (**Figure 2-1**). The Resort is located on the Tribe's reservation at 288 Golf Course Drive, Rohnert Park, California (project site). The Proposed Project would be constructed on-reservation on previously paved and developed land adjoining the Resort. The project site is bounded by Wilfred Avenue/Golf Course Drive to the north, farmland to the west, development to the south, and Labath Avenue to the east (**Figure 2-2**). Topography on the project site is relatively level with slopes less than one percent and elevations ranging from approximately 85 feet above mean sea level (amsl) to 93 feet amsl.

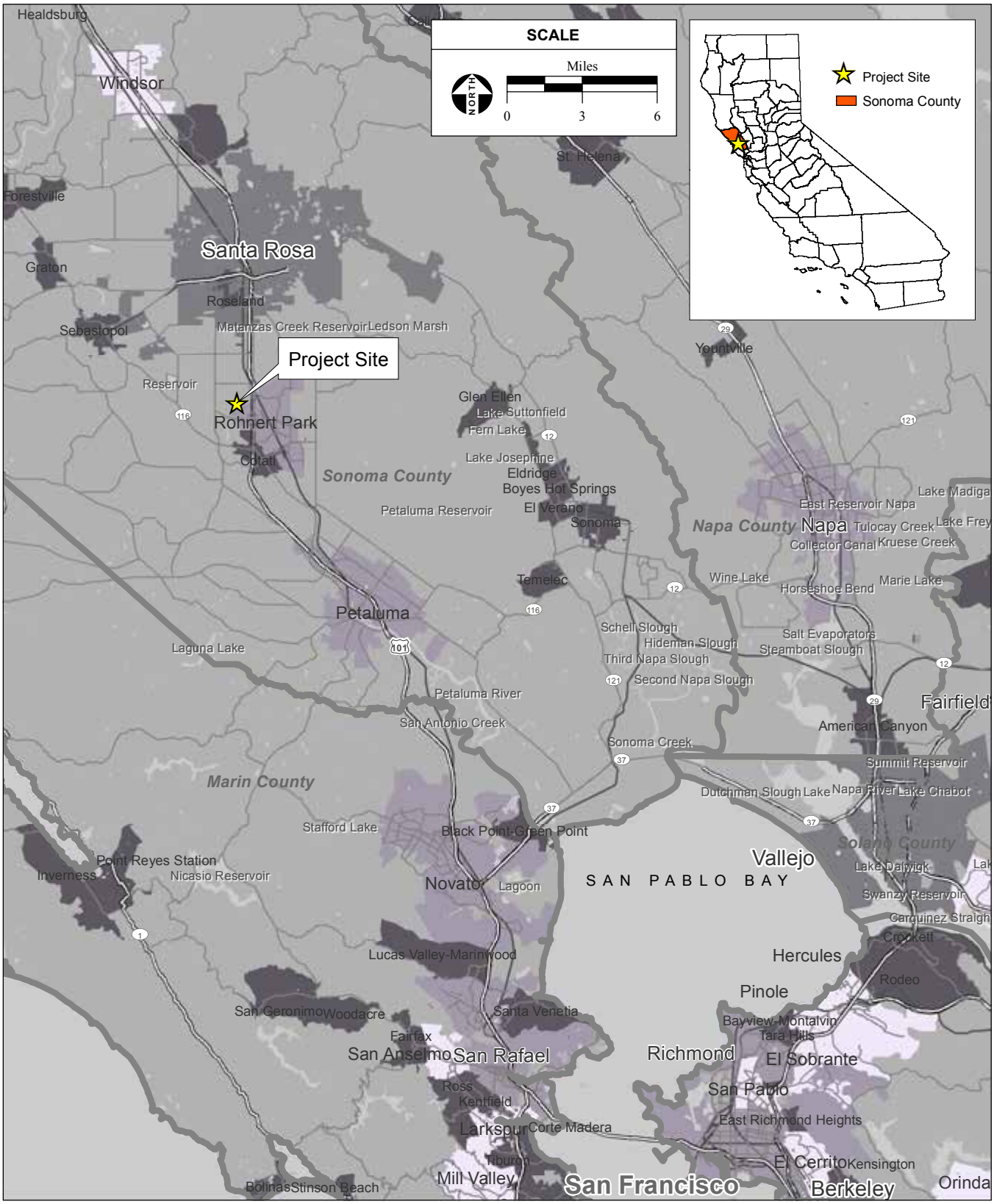
2.2 PROJECT DESCRIPTION

The Proposed Project consists of the expansion of the Resort's BOH space, which involves the demolition of approximately 3,000 square feet (sf) of existing BOH space and the construction of approximately 12,000 sf of new BOH space on the western (back) side of the Resort (**Figure 2-3**). The new BOH space would be used for expanded offices and employee facilities, including an elevator, cubicles, reception areas, storage rooms, conference rooms, and break rooms.

2.2.1 PROJECT UTILITIES

Water Supply

The Proposed Project will continue to utilize groundwater from the existing Resort's well system. The existing water system includes two wells, a water treatment plant (WTP), a 900,000 gallon water storage tank used for domestic water supply and fire protection, and a water distribution pump system. Existing wells have estimated yields of approximately 500 gallons per minute (gpm) and 400 gpm. The Proposed Project would not result in a significant change in water usage, therefore, no changes to the operations of the water system are needed to accommodate the Proposed Project.

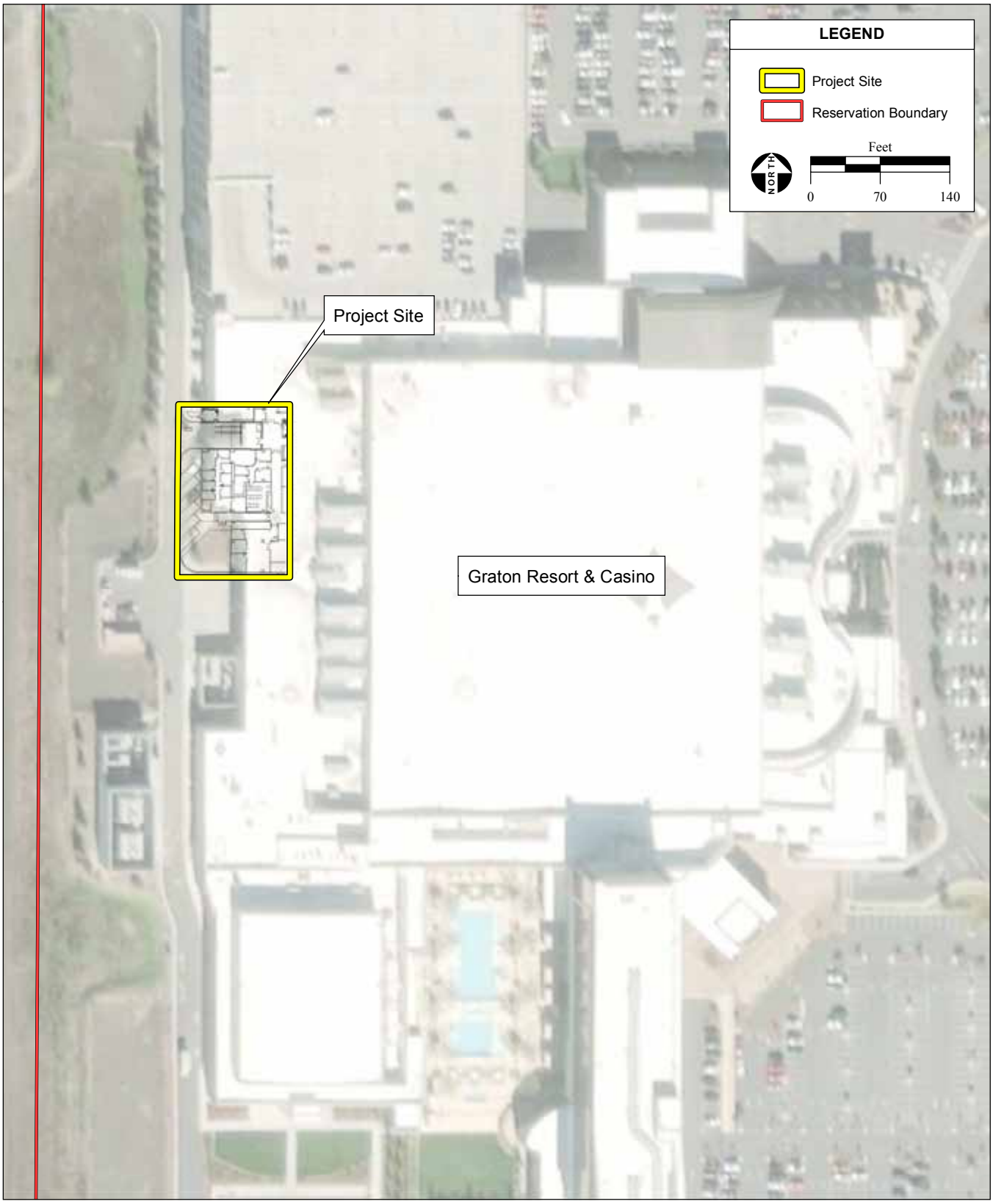


SOURCE: Streetmap North America, 2010; AES, 6/7/2019

Figure 2-1
Regional Location

SOURCE: DigitalGlobe aerial photograph, 9/1/2017; AES, 6/7/2019

Figure 2-2
Aerial Photograph



SOURCE: Friedmutter Group, 3/7/2019; DigitalGlobe aerial photograph, 9/1/2017; AES, 7/17/2019

Figure 2-3
Site Plan

Wastewater

Wastewater generated by the Resort is conveyed to the Rohnert Park sanitary waste system, which conveys the sewage to the Santa Rosa Regional Laguna Wastewater Treatment Plant. The Proposed Project would not result in a significant increase in wastewater, therefore, no changes to this system would be needed to accommodate the Proposed Project.

Gas and Electric

Pacific Gas and Electric (PG&E) provides electricity and natural gas to the Resort and the Proposed Project. The existing power grid and natural gas connection are adequate to serve the Proposed Project.

2.2.2 PROJECT FEATURES

Best Management Practices

Construction of the Proposed Project will incorporate best management practices (BMPs) discussed in **Appendix D** during demolition, building, painting, material use and storage, hazardous waste management, and vehicle and equipment maintenance. Construction activities will adhere to applicable Tribal codes, Section 6.4.2 of the Compact, and other applicable federal laws regarding public health and safety (Compact, 2012).

Building Standards

Construction will adhere to applicable Tribal codes or Section 6.4.2 of the Compact, comparable to the California Building and Public Safety Codes applicable to the County, including, but not limited to, codes for building, electrical, energy, mechanical, plumbing, fire, and safety (Compact, 2012).

Schedule

Construction of the Proposed Project will occur over a period of approximately 4-6 months, beginning in late 2019.

2.3 PROJECT ALTERNATIVE

As an alternative to the Proposed Project, expansion of the Resort's BOH space would not occur. The No Action Alternative was analyzed as required by Section 11.8.1 of the Compact (**Appendix A**). Under the No Action Alternative, the Resort would not be modified, and would continue to operate in its current form and capacity. The Proposed Project would not be developed and the project site would continue to serve as single-level BOH space and surface parking for the Resort. The No Action Alternative would prevent the Resort from adequately accommodating the needs of Resort employees.

SECTION 3.0

ENVIRONMENTAL ANALYSIS

SECTION 3.0

ENVIRONMENTAL ANALYSIS

Pursuant to requirements of the Compact, a good faith effort has been made to identify and mitigate potentially significant adverse off-reservation impacts, taking into consideration off-reservation jurisdictional constraints (Compact, 2012). Potentially significant off-reservation impacts of the Proposed Project are defined by the Compact as changes to the off-reservation environment that are attributable to the Proposed Project. According to the Compact, a "significant effect" would occur if:

- The Proposed Project has the potential to degrade the quality of the off-reservation environment, curtail the range of the environment, or achieve short-term, to the disadvantage of long-term, environmental goals;
- The possible effects on the off-reservation environment of the Proposed Project are individually limited but cumulatively considerable. Cumulatively considerable is defined as incremental effects of the Proposed Project that could be considerable when viewed in connection with the effects of past projects, current projects, and future projects; or
- The off-reservation environmental effects of the Proposed Project would result in substantially adverse effects on individuals, either directly or indirectly.

3.1 INTRODUCTION

Environmental areas were identified for analysis on the basis of the Checklist (**Appendix B**). Significance criteria have been adopted from the Checklist and incorporated into analysis. The following off-reservation issue areas have been identified as having the potential to be impacted by the Proposed Project, and are addressed herein:

- Aesthetics
- Air Quality
- Greenhouse Gas Emissions
- Geology and Soils
- Hazardous Materials
- Water Resources
- Land Use
- Noise
- Population and Housing
- Public Services
- Transportation and Traffic
- Utilities and Service Systems
- Cumulative Impacts

Mitigation measures have been recommended where necessary to avoid or reduce potentially significant off-reservation impacts. Environmental areas where the Proposed Project would not result in potentially significant off-reservation impacts have been eliminated from detailed analysis. These areas include cultural resources, agricultural and forest resources, mineral resources, and recreation.

3.2 AESTHETICS

This section addresses the existing aesthetic resources of the project site and surrounding region, evaluates potential off-reservation environmental impacts that may result from implementation of the Proposed Project, and presents mitigation measures to reduce any identified off-reservation impacts to aesthetic resources. Aesthetic resources include natural and cultural features of the landscape including trees, historic buildings, and night sky conditions that contribute to the public's visual enjoyment of the environment.

3.2.1 REGULATORY FRAMEWORK

Federal

National Scenic Byway Program

The National Scenic Byway Program was established by Congress in 1991 as the Intermodal Surface Transportation Efficiency Act. The Program is administered by the Federal Highway Administration and was established to preserve scenic but less-traveled roadways. A national scenic byway is a road recognized by the U.S. Department of Transportation for one or more of six intrinsic qualities. Intrinsic qualities include archeological, cultural, historic, natural, recreational, and scenic. National scenic byways must already be designated as state scenic byways or must possess all six intrinsic qualities to be nominated (Federal Highway Administration, 2019). No designated national scenic byways occur in viewing range of the project site.

State and Local

The project site is located on trust land and is therefore not subject to State and local laws and regulations concerning aesthetic resources. However, such laws and regulations do apply to off-reservation land in the vicinity of the project site.

State Scenic Highways

In 1963, the State Legislature established the California Scenic Highway Program through Senate Bill 1467 and 1468, provisions of which were added to the Streets and Highways Code. Scenic highway designation does not preclude nearby development; however, the program encourages development that does not degrade the scenic value of the highway corridor. No designated state scenic highways occur in viewing range of the project site.

Sonoma County General Plan

The Land Use Element provides the distribution, location and extent of uses of land for housing, business, industry, open space, agriculture, natural resources, and other uses. For each appropriate land use category, the Sonoma County General Plan includes standards for population density and building intensity. The Open Space and Resource Conservation Element contains policies and goals intended to preserve natural and scenic resources of the County. Scenic resources are divided into three subcategories: Community Separators, Scenic Landscape Units, and Scenic Highway Corridors. Designated scenic resources and corridors provide visual links to recreational areas, access to historic areas, and serve as scenic entranceways to cities. Within the vicinity of the Project Parcels, the Open Space and Resource Conservation Element identifies the Sonoma Mountains as a scenic backdrop to the community. The Element also identifies portions of US-101 as a scenic corridor (Sonoma County, 2016).

Sonoma County Zoning Ordinance

Chapter 26 of the Sonoma County Municipal Code contains the Zoning Ordinance for Sonoma County and regulates the location and uses of structures and land. The Zoning Ordinance establishes various districts within the unincorporated territory of the county and designates lawful permitted uses, and uses which may be approved through the use permit process. Within these districts, it is unlawful to erect, construct, alter or maintain certain buildings, carry on certain trades or occupations, or conduct certain uses of land or buildings. In addition, the Zoning Ordinance designates the limitation of height and bulk of future building, and maintains that certain open areas be required around future buildings.

City of Rohnert Park General Plan

Chapter 2, Land Use and Growth Management, includes goals and policies designed to protect and enhance the City's physical and visual character. The Element also includes policies for increasing neighborhood connectivity and enhancing the visual quality of urban edges. Within the vicinity of the Project Parcels, the Land Use and Growth Management Element designates portions of US-101 as a scenic corridor, and requires adjacent development to maintain setbacks of 30 percent or 200 feet and a 20-foot setback in urban service areas.

City of Rohnert Park Northwest Specific Plan

The Rohnert Park General Plan states that a specific plan process is necessary for the northwest area to plan for land uses. The Northwest Specific Plan was adopted in 2014 and prepared consistent with the City's Municipal Code Chapter 17.06, Article VIII, Sections 17.06.290-450. The Northwest Specific Plan provides development standards that regulate new development concerning height, building setbacks, parking requirements, and other development features. The Northwest Specific Plan area is under the Jurisdiction of the County, but within the City's Sphere of Influence, or land intended to be annexed by the City in the future. The Northwest Specific Plan area is approximately 100 acres in area and is bounded by Dowdell Avenue to the east, Business Park Drive to the south, and Millbrae Avenue to the north. The westerly boundaries vary but go no further than Langner Avenue.

3.2.2 ENVIRONMENTAL SETTING

The project site is located on the west side of the Resort. Currently, the project site is completely developed. Approximately half the site is comprised of an existing building, and the other half ispaved for employee parking. Historically, the area was used for agriculture, cattle grazing, and rural residential purposes. Agricultural land uses are still present to the west of the project site. The Rancho Verde Mobile Home Park is located southeast of the project site, and apartment complexes are located further southeast.

Viewshed

A vista is defined as a visual corridor that is scenic in nature, pleasing to the public eye, and usually interrupted to some extent by landscaping or buildings. Vistas are identified by considering existing and planned land uses of an area. Views of the project site are shown in **Figure 3.2-1.** Viewing locations and directions are shown in **Figure 3.2-2**. The Sonoma Mountains are visible behind the existing Resort, as shown in **Views 1, 2,** and **3** of **Figure 3.2-1**. From the project site, the Sonoma Mountains begin approximately three miles to the east and are approximately 25 miles in length. The Sonoma Mountains peak at approximately 2,286 feet above msl. The viewshed is comprised of one or more vistas. Roadways that offer visuals of the project site to motorists can be used to assess viewshed impacts.

VIEW 1: Northeast View from Rohnert Park Expressway

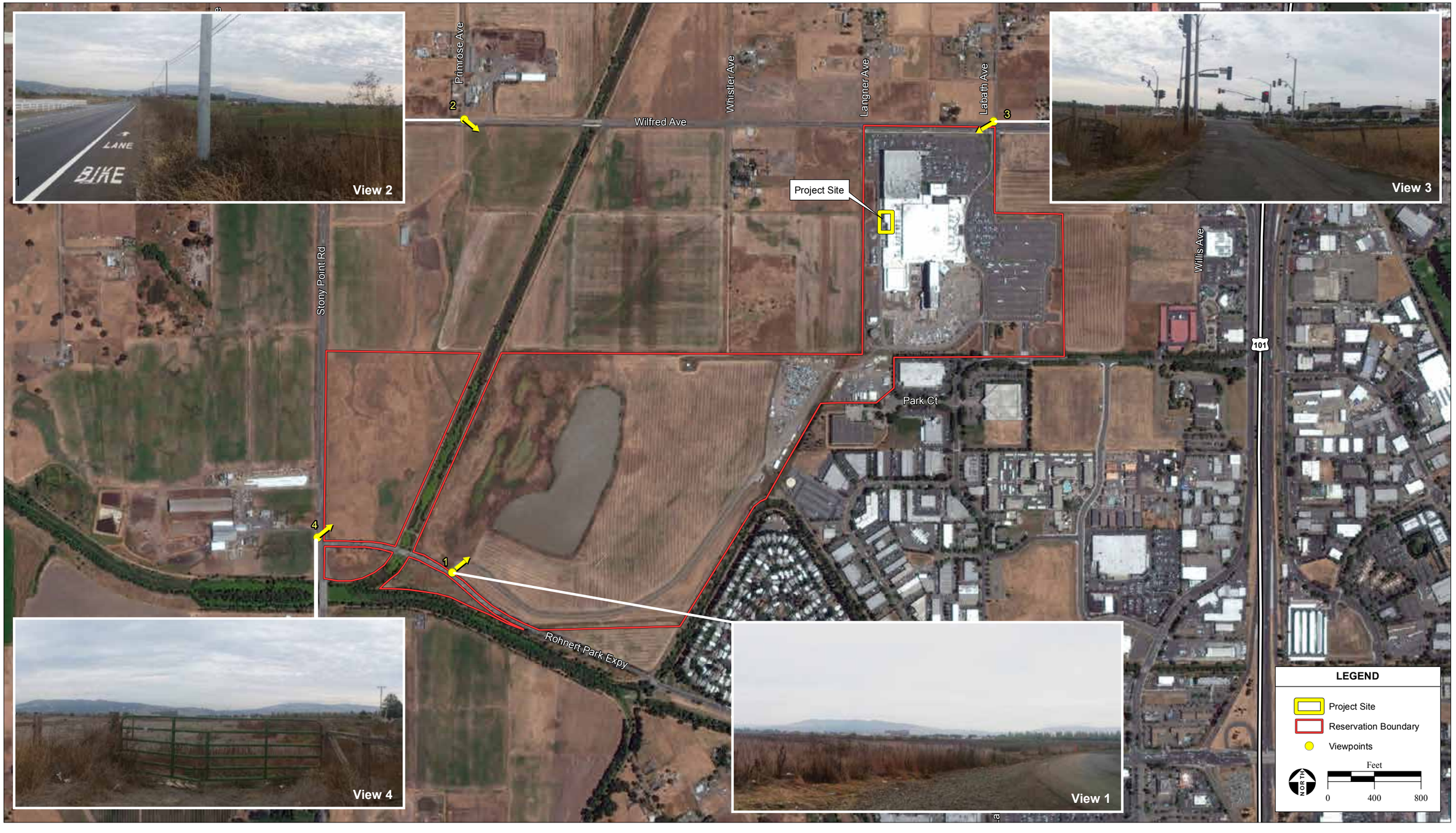
VIEW 2: Northeast view from Stony Point Road and Rohnert Park Expressway

VIEW 3: Southeast view from Wilfred Avenue and Primrose Avenue

VIEW 4: Southwest view from Labath Avenue north of Wilfred Avenue

SOURCE: AES, 5/29/2019

Figure 3.2-1
Viewshed Site Photographs



SOURCE: DigitalGlobe Aerial Photograph, 7/8/2016; AES, 6/11/2019AES, 6/11/2019

Figure 3.2-2
Views of the Project Site

Roadways surrounding the project site that were used to assess viewshed impacts of the Proposed Project from the perspective of passing motorists are discussed below. Duration of views is dependent on traffic conditions, vehicle speed, obstruction due to buildings or landscape, and direction of travel.

Wilfred Avenue/Golf Course Drive

The existing Resort is visible from Wilfred Avenue/Golf Course Drive looking in a general southerly direction. Wilfred Avenue/Golf Course Drive provides the major entrance to the Resort. **View 3** of **Figure 3.2-1** shows the existing Resort from the intersection of Wilfred Avenue/Golf Course Drive at Primrose Avenue looking southeast, approximately 0.75 miles from the project site. **View 4** offers a closer view of the existing Resort looking from Wilfred Avenue/Golf Course Drive at Labath Avenue in a southwesterly direction, approximately 0.35 miles from the project site. Wilfred Avenue/Golf Course Drive presents only very brief visuals of the project site to passing motorists because the project site is mostly obstructed from view by the existing facilities.

Rohnert Park Expressway

Looking in a northerly direction, the project site is visible from a portion of Rohnert Park Expressway. **View 1** from Rohnert Park Expressway is approximately 0.75 miles from the project site. Rohnert Park Expressway offers motorists a very brief view of the project site, due to obstruction from development directly south of the Resort.

Stony Point Road

Stony Point Road offers passing motorists a distant visual of the project site looking in an easterly direction. **View 2** from Stony Point Road at Rohnert Park Expressway is approximately one mile from the project site.

3.2.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section II of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation environmental impacts of the Proposed Project to off-reservation aesthetics. Such impacts are considered significant if they would:

- Have a substantial adverse effect on a scenic vista;
- Substantially damage off-reservation scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway; or
- Create a new source of substantial light or glare, which would adversely affect day or nighttime views of historic buildings or views in the area.

Methodology

The evaluation of potential impacts of the Proposed Project to off-reservation aesthetics distinguishes between impacts related to construction and operation of the Proposed Project. Construction impacts would be temporary while operational impacts could be permanent. Vantage points from along major roadways are the standard for assessing visual impacts. Potential impacts to off-reservation aesthetics were assessed using field observations, photographic documentation, and site plans. Vistas within the viewshed are described by expressing the strength of the viewing experience.

While viewing experience is subjective, the application of the below criteria allows for an objective, baseline assessment of the visual environment and subsequent visual impacts. The visual experience within each vista is comprised of the following constituent elements:

- Clarity in line of sight: The overall visibility of an object in the viewshed, influenced by factors such as trees, buildings, topography, or other potential visual obstruction within the viewshed.
- Duration of Visibility: The amount of time the object is exposed to viewers within the viewshed. For example, a passing commuter will experience a shorter period of viewing time than a resident within the viewshed.
- Proximity of the Viewer: The effects of foreshortening due to the distance of the viewer from the object will influence the dominance of the object in the perspective of the viewer.
- Number of Viewers: The number of viewers anticipated to experience the visual character of the object in forward-oriented view. A densely populated residential district, or a busy highway within the viewshed of the object would present more viewers than unpopulated areas.

Impact 3.2-1: The Proposed Project would not affect off-reservation scenic vistas.

Construction

Construction of the Proposed Project could temporarily alter views of the project site from several off-reservation vantage points. The project site is located west of the existing Resort, and is partially obstructed from view by existing buildings. Machinery and construction activities would be briefly visible to passing motorists on Wilfred Avenue/Golf Course Drive, Stony Point Road, and a portion of Rohnert Park Expressway. Visibility of construction activities from off-reservation locations would be temporary in nature and would not permanently degrade existing visual characteristics. No construction would occur off-reservation, and construction would take place on areas previously developed or disturbed. Construction activities would not physically obstruct any off-reservation scenic vista. There would be a **less-than-significant impact**.

Operation

Scenic corridors and highways are major routes of travel that offer tourists scenic views. State Route 116 is approximately 2.25 miles from the Resort, is designated by Caltrans as a Scenic Highway, but is not within viewing distance of the project site (Caltrans, 2019). State Route 12 is also designated by Caltrans as a scenic highway, is located approximately eight miles from the Resort, and is also not within viewing distance of the project site (Caltrans, 2019). There are no designated state scenic highways within viewing distance of the project site (Sonoma County, 2019a). The Sonoma Mountains can be viewed beyond the existing Resort when looking in an easterly direction. This vista would be minimally impacted, due to the lateral layout design, small scale of the Proposed Project, and large expanse and high elevation of the Sonoma Mountains. The height of the Proposed Project would remain consistent with the height of the existing Resort. There would be a **less-than-significant impact**.

Impact 3.2-2: The Proposed Project would not substantially damage off-reservation scenic resources, including, but not limited to, trees, rock outcroppings, or historic buildings adjacent to a state scenic highway.

Construction and operation of the Proposed Project would be contained within trust land. No off-reservation scenic resources would be damaged during construction activities or operation of the Proposed Project. No off-reservation trees, outcroppings, or historic buildings would be physically altered by the Proposed Project. There would be **no impact**.

Impact 3.2-3: The Proposed Project would not create a new source of light or glare that could adversely affect off-reservation day or nighttime views in the area.

Construction

Construction of the Proposed Project would occur primarily during daytime hours. On-site construction lighting visible from off-reservation areas during dusk and nighttime hours would be minimal. Implementation of **Mitigation Measure 3.2-1** would further minimize off-reservation light and glare impacts of the Proposed Project by limiting construction hours to the extent feasible. There would be a **less-than-significant impact with mitigation**.

Operation

The Proposed Project would be developed within areas previously developed or disturbed and that are currently lit. Lighting of the Proposed Project would remain consistent with lighting of the existing Resort. The Proposed Project would use downcast, fully shielded, high efficiency lamps for exterior lighting, would avoid the use of exterior neon and flashing lights, and would glaze exterior glass with a non-reflective tinted coating to minimize glare and nighttime illumination, thus maintaining consistency with the adherence of applicable building and safety code standards. Implementation of **Mitigation Measure 3.2-1** would minimize off-reservation light and glare impacts of the Proposed Project through installation of appropriate lighting. There would be a **less-than-significant impact with mitigation**.

Mitigation

3.2-1 The Tribe shall ensure that the following measures applicable to the Resort are implemented in construction and operation of the Proposed Project to minimize effects of lighting and glare:

- To the extent feasible, construction shall not occur prior to 7:00 am or after 10:00 pm.
- Floodlights shall be set so as not to cast trespassing light off-site.
- Uplighting shall be limited to the main facades of the Proposed Project and shall be focused on structures.
- Timers shall be utilized to minimize lighting after a certain hour.
- Exterior glass shall be consistent with existing glazing of the Resort.

3.3 AIR QUALITY

This section addresses air quality of the surrounding region, identifies potential impacts of the Proposed Project on the off-reservation environment, and presents mitigation measures to reduce any identified potentially significant off-reservation impacts. Air quality is defined as the concentration of regulated pollutants, odor, and exposure to sensitive receptors.

3.3.1 REGULATORY FRAMEWORK

Federal

Federal Clean Air Act

The Federal Clean Air Act (CAA) was enacted for the purposes of protecting and enhancing the quality of the nation's air resources to benefit public health, welfare, and productivity. In 1971, the U.S. Environmental Protection Agency (USEPA) developed primary and secondary National Ambient Air Quality Standards (NAAQS). Six pollutants of concern were designated: carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrous oxides (NO_X), lead (Pb), and suspended particulate matter (PM). PM is designated into two size classes, course particulate matter 10 micrometers or less in diameter (PM_{10}) and fine particulate matter 2.5 micrometers or less in diameter ($PM_{2.5}$). The primary NAAQS must "protect the public health with an adequate margin of safety" and the secondary standards must "protect the public welfare from known or anticipated adverse effects (aesthetics, crops, architecture, etc.)". The primary standards consider long-term exposures for the most sensitive groups in the general population. The USEPA allows states the option to develop stricter standards. California elected this option and adopted standards that are more stringent. **Table 3.3-1** shows applicable USEPA standards.

TABLE 3.3-1: NAAQS PRIMARY STANDARDS AND ASSOCIATED VIOLATION CRITERIA

Pollutant	Symbol	Average Time	NAAQS	Violation Criteria
Ozone	O_3	8 hours	0.07 ppm	If exceeded on more than 3 days in 3 years
Carbon monoxide	CO	1 hour	35 ppm	If exceeded on more than 1 day per year
		8 hours	9.0 ppm	If exceeded on more than 1 day per year
Nitrogen dioxide	NO_2	Annual average	0.053 ppm	If exceeded
		1 hour	0.1 ppm	If exceeded on more than 1 day per year
Sulfur dioxide	SO_2	3 hours	0.5 ppm	If exceeded on more than 1 day in 3 years
		1 hour	.075 ppm	If exceeded on more than 1 day per year
Inhalable particulate matter	PM_{10}	24 hours	150 g/m3	If exceeded on more than 1 day per year
Fine particulate matter	$PM_{2.5}$	Annual arithmetic mean	12 g/m3	If exceeded
		24 hours	35 g/m3	If exceeded on more than 1 day per year
Lead particles	Pb	Calendar quarter	1.5 g/m3	If exceeded
NOTES: ppm = parts per million; g/m3 = micrograms per cubic meter SOURCE: USEPA, 2016a.				

Attainment Status

To determine compliance with the NAAQS, states are responsible for providing ambient air monitoring data to the USEPA. The USEPA then determines, using the violation criteria, if the results of the monitoring data indicate compliance with the NAAQS. The USEPA classifies areas in compliance with the NAAQS as being in "attainment". Areas that do not meet the NAAQS are classified as being in "non-attainment" by the USEPA. Once an area meets the NAAQS and the local air district has instituted a 10 year maintenance plan to continue meeting those standards, the area can be re-designated to maintenance, and eventually to attainment by the USEPA.

For O_3, if the air quality within a region is determined by the USEPA to be non-attainment, the region is further classified as a marginal, moderate, serious, severe, or extreme non-attainment area. Areas designated as marginal (the least severe non-attainment group) must implement a permit program and conduct an inventory of ozone-producing emissions. The more severe classifications also require implementation of control measures. Control measures must be implemented to reduce emissions of the two pollutants known to be precursors to ozone. These two pollutants are NO_x and reactive organic gasses (ROGs).

Federal General Conformity

The General Conformity Rule of the CAA implements Section 176(c) and establishes minimum thresholds for volatile organic compounds (VOCs), ozone precursors, CO, and other regulated constituents for non-attainment and maintenance areas. Federal General Conformity was promulgated in order to determine conformity of federal actions to state or federal implementation plans. A federal agency must make a determination that a federal action conforms to the applicable implementation plan before the action is taken. A Conformity Determination is required for each pollutant where a total of direct and indirect emissions in a non-attainment or maintenance area caused by the federal action are greater than *de minimis* thresholds. These thresholds provide simple and direct guidance for federal agencies to assure that they comply with approved State Implementation Plans (SIPs). The General Conformity Rule includes a procedure for determining whether the rule is applicable to the actions of a federal agency. There are two phases to general conformity:

1) The Conformity Review process entails a review of each analyzed alternative to assess whether a full conformity determination is necessary; and
2) The Conformity Determination process, which demonstrates how an action would conform with the applicable implementation plan (usually the SIP).

The first step compares emissions estimates for the project to the appropriate general conformity *de minimis* threshold based on a non-attainment type. If the emission estimates from step one are below the thresholds, then a General Conformity Determination is not necessary and step two is not required. The regulations apply to a proposed federal action that would cause emissions of criteria air pollutants (CAPs) above certain levels to occur in locations designated as non-attainment or maintenance areas for the emitted pollutants. If a federal action occurs in a location designated as attainment or unclassified, the General Conformity regulation does not apply to the project. The San Francisco Bay Area Air Basin (SFBAAB) is listed as marginal non-attainment for O_3 and the associated *de minimis* threshold for ozone precursors (VOC and NO_X) is 100 tons per year.

Federal Hazardous Air Pollutant Program

Title III of the CAA requires the USEPA to promulgate National Emissions Standards for Hazardous Air Pollutants (NESHAP). The NESHAP may differ between major sources and area sources of hazardous air pollutants (HAPs). Major sources are defined as stationary sources with potential to emit more than 10 tons per year (tpy) of any HAP or more than 25 tpy of any combination of HAPs; all other sources are considered area sources. The emissions standards were to be promulgated in two phases. In the first phase (1992–2000), USEPA developed technology-based emission standards designed to produce the maximum emission reduction achievable. For area sources, the standards were different, and were based on generally available control technology. In the second phase (2001–2008), USEPA is required to promulgate health risk–based emissions standards when necessary to address risks remaining after implementation of the technology-based NESHAP standards.

The CAA requires the USEPA to promulgate vehicle or fuel standards to include reasonable controls for toxic emissions, addressing at a minimum benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected U.S. cities (those with the most severe ozone non-attainment conditions) to further reduce mobile-source emissions.

Federal Clean Air Act and Indian Tribes

The CAA authorizes USEPA to issue regulations specifying the provisions of the CAA for which Indian tribes may be treated in the same manner as states. For those provisions specified, a tribe may develop and implement one or more of its own air quality programs under the Act. The USEPA issued its final rule on this issue in 1998. The rule provides that tribes will be treated in the same manner as states for virtually all CAA programs. The rule grants tribes with USEPA-approved CAA programs authority over all air resources within the exterior boundaries of a reservation (including non-Indian owned fee lands). No such program exists for the Federated Indians of Graton Rancheria, and thus the USEPA retains permitting authority for sources of air pollution located on the project site.

Federal Class I Areas

Title 1, Part C of the CAA was established, in part, to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value. The CAA promised to prevent significant deterioration of air quality under the Prevention of Significant Deterioration (PSD) program. The CAA designates all international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres as "Class I areas." There are 156 mandatory Class I areas nationwide. Any major source of emissions within 100 kilometers (km) (62.1 miles) from a federal Class I area is required to conduct a pre-construction review of air quality impacts on the area(s). The PSD Program protects Class I areas by allowing only a small increment of air quality deterioration in these areas by providing for assessment of potential impacts on air quality related values of Class I areas. A "major source" for the PSD program is defined as a facility that will emit (from direct stationary sources) 250 tons per year of regulated pollutant. "Mobile sources (i.e. vehicle emissions) are by definition not stationary sources and are therefore not considered under the PSD program". For certain specific industries, the requirements apply to facilities that emit (through direct stationary sources) 100 tons per year or more of a regulated pollutant. The Proposed Project is within 100 km of the Point Reyes National Seashore. As presented in **Section 3.3.3**, the Proposed Project would not be considered a major source, and no further analysis is required.

State and Local

California Clean Air Act

In 1988, the State legislature adopted the California Clean Air Act (CCAA), which established a statewide air pollution control program. CCAA requirements include annual emission reductions, development and use of low emission vehicles, establishment of the California Ambient Air Quality Standards (CAAQS), and submittal of air quality attainment plans by air districts for incorporation into the California SIP. The California Air Resource Board (CARB) is the state agency responsible for coordinating both state and federal air pollution control programs in California. CARB designated CAAQS for the six federal CAPs and four additional pollutants: vinyl chloride, visibly reducing particles, sulfates, and hydrogen sulfide. CARB designated 15 individual air basins within the State by grouping similar geographic or political (such as a county) areas together that exhibit similar air quality conditions. The project site is located within the SFBAAB (refer to **Section 3.3.2**). Air districts were established for each air basin or similar groups of air basins within California to implement the enforcement provisions of the CCAA and the CAA and to develop individual air quality attainment plans for incorporation into the SIP. The air districts are designated as air quality management districts (AQMDs) or air pollution control districts (APCDs). Both AQMDs and APCDs were given the authority under the CCAA to regulate stationary, indirect, and area sources of air pollution. The off-reservation environment surrounding the project site is governed by the Bay Area Air Quality Management District (BAAQMD).

California SIP

California's SIP is comprised of the State's overall air quality attainment plans to meet the NAAQS as well as the individual air quality attainment plans of each AQMD and APCD. The California SIP is a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), AQMD and APCD rules, state regulations, and federal controls for each air basin and California's overall air quality. Many of the items within the California SIP rely on the same control strategies, such as emissions standards for cars and heavy trucks, fuel regulations, and limitations on emissions from consumer products. AQMDs and APCDs, as well other agencies such as the Bureau of Automotive Repair, prepare draft California SIP elements and submit them to CARB for review and approval. The CCAA identifies CARB as the lead agency for compiling items for incorporation into the California SIP, and submitting the items to the USEPA for approval.

Bay Area Air Quality Management District

The BAAQMD is the responsible air district for regulating off-reservation air quality in the portion of the SFBAAB surrounding the project site. BAAQMD has jurisdiction over all or portions of the nine counties in the Bay Area including the southern portion of Sonoma County. The following BAAQMD rules and regulations apply to the off-reservation environment in the vicinity of the project site:

> *Regulation 1-300–Public Nuisance*: No person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or the public; or which endangers the comfort, repose, health or safety of any such persons or the public, or which causes, or has a natural tendency to cause, injury or damage to business or property. For purposes of this section, three or more violation notices validly issued in a 30 day period to a facility for public nuisance shall give rise to a rebuttable presumption that the violations resulted from negligent conduct.

Regulation 7–Odorous Substances: This Regulation places general limitations on odorous substances and specific emission limitations on certain odorous compounds. A person must meet all limitations of this Regulation, but meeting such limitations shall not exempt such person from any other requirements of the District, state or federal law.

BAAQMD periodically prepares and updates plans to achieve the goal of clean air. Bay Area plans are prepared with the cooperation of the Metropolitan Transportation Commission and the Association of Bay Area Governments. BAAQMD has an Air Toxics Program that consists of several elements that are designed to identify and reduce public exposure to toxic air contaminants (TACs). The three primary control programs are 1) preconstruction review of new and modified sources, 2) the Air Toxics "Hot Spots" program, and 3) air pollution control measures designed to reduce emissions from categories of sources of TACs, statewide Airborne Toxic Control Measures, and NESHAPs.

Sonoma County General Plan

The Open Space and Resource Conservation Element in the Sonoma County General Plan addresses regional air quality. The Element presents policies in accordance with requirements of the Federal and State Clean Air Acts that encourage preservation of air quality to protect human health and preclude crop, plant, and property damage. Projects are generally referred to local air quality districts for review.

Sonoma County Climate Action Plan

The County adopted the Regional Climate Protection Authority's (RCPA) Climate Action Plan (CAP) in 2016 as an implementation measure of the Sonoma County 2020 General Plan. Although the CAP was not upheld in court following litigation, and the certification of the CAP's EIR was rescinded on November 13, 2017, the RCPA backs the research and GHG reduction strategies developed in the CAP for planning purposes.

City of Rohnert Park General Plan

Chapter 6.4 outlines air pollutants of concern and sensitive receptors. Policies and goals are presented to meet federal and state standards as well as improve overall air quality by reducing the generation of air pollutants from stationary and mobile sources. Policies are in cooperation with BAAQMD to achieve emissions reductions for nonattainment pollutants.

3.3.2 ENVIRONMENTAL SETTING

The project site is located on the Santa Rosa Plain, within the larger SFBAAB. The following is a description of climate and air quality of the SFBAAB. To the east, the Santa Rosa Plain is bordered by the Sonoma and Mayacama Mountains, with the San Pablo Bay at the southeast end. To the immediate west are a series of low hills and further west are the Estero Lowlands, which open to the Pacific Ocean. The region from the Estero Lowlands to the San Pablo Bay is known as the Petaluma Gap. This low-terrain area is a major transport corridor allowing marine air to pass into the SFBAAB. A semi-permanent high-pressure area centered over the northeastern Pacific Ocean dominates the summer climate of the West Coast. In winter, the Pacific high-pressure area weakens and shifts southward, upwelling ceases, and winter storms become frequent. Almost all of the Bay Area's annual precipitation occurs in the November through April period. During the winter rainy periods, inversions are weak or nonexistent, winds are often moderate, and air pollution potential is very low. During some periods in winter, when the Pacific high becomes dominant, inversions become strong and often are surface-based; winds are light and pollution potential is high.

Existing Air Quality

CAPs are classified in each air basin, county, or, in some cases, within a specific area. The classification is determined by comparing actual monitoring data with federal and California standards. If a CAP's concentration is lower than the standard or not monitored in an area, the area is classified as attainment, or unclassified. If an area exceeds the standard, the area is classified as non-attainment for that CAP. If an area was previously non-attainment, but is now meeting the standard, it is classified as maintenance and treated as a transitional zone. The maintenance designation is only applicable to the Federal standards, and does not have a California equivalent. The SFBAAB is designated as non-attainment for O_3 under the NAAQS and CAAQS, maintenance for CO under the NAAQS, as well as, non-attainment for $PM_{2.5}$ and PM_{10} under the CAAQS, and therefore these are the pollutants of concern, shown in **Table 3.3-2**.

TABLE 3.3-2: SFBAAB ATTAINMENT STATUS

	NAAQS	CAAQS
O_3, 8-hour	Non-attainment (Marginal)	Non-attainment
PM_{10}	Unclassified	Non-attainment
$PM_{2.5}$	Non-attainment (Moderate)	Non-attainment
CO	Maintenance	Attainment
NO_2	Unclassified/Attainment	Attainment
SO_2	Unclassified/Attainment	Attainment
Pb	Attainment	No Threshold
SOURCE: USEPA, 2016b; BAAQMD, 2017		

Ozone

O_3 is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors, which include ROGs and NO_X, react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem and often the effects of the emitted ROG and NO_X is felt a distance downwind of the emission sources. Ozone is subsequently considered a regional pollutant. Ground-level ozone is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and can cause substantial damage to vegetation and other materials. Ozone can irritate lung airways and cause inflammation much like a sunburn. Chronic ozone exposure can induce morphological changes throughout the respiratory tract, particularly at the junction of the conducting airways and the gas exchange zone in the deep lung.

Particulate Matter

Particle pollution is a mixture of microscopic solids and liquid droplets suspended in air. This pollution, also known as particulate matter, is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). The size of particles is directly linked to their potential for causing health problems. $PM_{2.5}$ micrometer in diameter pose the greatest problems, because they can get deep into lungs and the bloodstream. Exposure to such particles can affect both lungs and heart. Larger particles are of less concern, although they can irritate eyes, nose, and throat. Both long and short-term particle exposures have been linked to health problems.

Emission Sources

California is a diverse state with many sources of air pollution. To estimate the sources and quantities of pollution, CARB, in cooperation with local air districts and industry, maintains an inventory of California emission sources. Sources are subdivided into four major emission categories: stationary sources, area-wide sources, mobile sources, and natural sources. Stationary source emissions are based on estimates made by facility operators and local air districts. Emissions from specific facilities can be identified by name and location. CARB and the local air district estimate area-wide emissions. Emissions from area-wide sources may be from small individual sources, such as residential fireplaces, or from widely distributed sources that cannot be tied to a single location, such as consumer products and dust from unpaved roads. CARB estimates mobile source emissions with assistance from districts and other government agencies. Mobile sources include planes, trains, and automobiles.

Table 3.3-3 summarizes estimated 2015 emissions of key criteria air pollutants from major categories of air pollutant sources. For each pollutant, estimated emissions are presented. The County is similar to many other portions of California and the United States in that a large portion of CO emissions come from on-road mobile sources (76.5 percent), with the majority coming from passenger cars and trucks. NO_X is also dominated by on-road mobile sources (90.7 percent) still coming mostly from passenger cars and trucks, but heavy-duty diesel trucks supply a stronger portion (42.6 percent) of that on-road total. In the County, 80 percent of ROG emissions are divided roughly evenly between area wide and mobile sources. Particulate matter is primarily coming from a category called "miscellaneous processes", which includes a variety of subcategories. In the case of the County's emissions, these subcategories are primarily paved road dust, construction and demolition, and residential fuel combustion.

TABLE 3.3-3: Sonoma County 2015 Emissions Inventory

Source	Pollutant					
	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
	Tons per Day					
Stationary Sources						
Fuel Combustion	0.2	3.2	0.7	0.1	0.3	0.2
Waste Disposal	0.1	0	0	0	--	--
Cleaning And Surface Coatings	2.3	0	0	--	--	--
Petroleum Production And Marketing	0.8	--	--	--	--	--
Industrial Processes	1	0	0	0.1	1.3	0.5
Total Stationary Sources	**4.4**	**3.2**	**0.7**	**0.1**	**1.5**	**0.6**
Area-wide Sources						
Solvent Evaporation	4.3	--	--	--	--	--
Miscellaneous Processes	4.6	21.1	1.3	0.1	11.3	4.2
Total Area-wide Sources	**8.9**	**21.1**	**1.3**	**0.1**	**11.3**	**4.2**
Mobile Sources						
On-road Motor Vehicles	4.9	49.4	10.4	0.1	0.9	0.4
Other Mobile Sources	4.0	29.8	9.2	0.1	0.4	0.4
Total Mobile Sources	**8.9**	**79.2**	**19.6**	**0.2**	**1.3**	**0.8**
Sonoma County Total	**22.2**	**103.5**	**21.6**	**0.4**	**14.1**	**5.6**
SOURCE: CARB 2013						

Regional Stationary Sources

An analysis of the area surrounding the project site using CARB's Facility Search Engine, which allows the user to find emissions data for more than 10,000 facilities in California, shows that there are 8 facilities within a 10-mile radius of the project site that emit more than 10 tons per year of any of the pollutants of concern (ROG, NO_X, $PM_{2.5}$, or PM_{10}). These facilities, their estimated emissions, and their relative distances from the project site are presented in **Table 3.3-4**.

TABLE 3.3-4: EMISSION SOURCES WITHIN 10-MILES OF THE PROJECT SITE GREATER THAN 10 TONS/YEAR

Facility Name and Address	ROG	CO	NO_X	SO_X	PM	PM_{10}	Distance from Project Site
Republic Services of Sonoma County, Inc. 500 Mecham Road Petaluma	17.06	81.44	28.52	3.88	54.17	16.20	4.25 mi SSW
Superior Supplies Inc. 40 Ridgeway Avenue Santa Rosa	0.00	0.00	0.00	0.00	24.55	22.59	6.25 mi N
Sonoma State University 1801 E Cotati Avenue Rohnert Park	0.00	2.82	11.34	0.05	0.24	0.24	3 mi SE
Syar Industries Inc. 260 Todd Road Santa Rosa	0.00	1.86	3.29	1.52	18.98	7.59	1.75 mi N
Hunt And Behrens, Inc. 30 Lakeville Street Petaluma	0.00	0.04	0.16	0.22	47.86	33.51	9.25 mi NW
City of Santa Rosa Wastewater Treatment 4300 Llano Road Santa Rosa	0.00	35.88	10.38	0.05	0.04	0.04	2.25 mi WNW
Soiland Co, Inc. 7171 Stony Point Rd Cotati	0.00	0.00	0.00	0.00	11.31	5.98	2.75 mi NNE
SOURCE: CARB, 2014a							

Odors

Existing odor sources in the area of the project site are primarily limited to those associated with various agricultural activities, including fertilization and scattered cattle grazing activities. During site visits, no significant odors were detected on the project site.

Toxic Air Contaminants

A TAC is defined as an air pollutant that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations. Sources of TACs include industrial processes such as petroleum refining and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust.

According to The California Almanac of Emissions and Air Quality (CARB, 2014b), the majority of estimated health risks from TACs can be attributed to relatively few compounds, including diesel particulate matter (DPM), benzene, formaldehyde, 1,3-butadiene, and acetaldehyde. The most significant of these being particulate matter from diesel-fueled engines. DPM differs from other TACs in that it is not a single substance, but rather a complex mixture of hundreds of substances. CARB's DPM reduction efforts and reductions in public exposure to DPM are of increased importance.

CARB's Risk Reduction Plan to Reduce Particulate Matter Emission from Diesel-Fueled Engines and Vehicles (CARB, 2000) ("Diesel Reduction Plan") calls for all new diesel-fueled vehicles and engines to use catalyzed diesel particulate filters and low-sulfur diesel fuel. The projected emission benefits associated with the full implementation of CARB's plan, including proposed federal measures, are reductions in DPM emissions of 85 percent by 2020.

Sensitive Receptors

Some receptors are considered more sensitive than others to air pollutants. The reasons for sensitivity include pre-existing health problems, proximity to emissions and odor sources, or duration of exposure to air pollutants or odors. Schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because children, elderly people, and the infirm are more susceptible to respiratory distress and other air quality related health problems. Residential areas are considered sensitive to poor air quality, because people usually stay home for extended periods of time, with greater associated exposure to ambient air quality. Recreational uses are also considered sensitive due to the greater exposure to ambient air quality conditions because vigorous exercise associated with recreation places a high demand on the human respiratory system.

The land surrounding the project site is primarily commercial and agricultural. The nearest residences to the project site are located on Wilfred Avenue approximately 0.25 miles northwest of the project site. The closest school, Pathways Charter School, is located approximately 0.66 miles west of the project site on Professional Center Drive. The closest assisted living facility is Brookdale Rohnert Park, which is located approximately 2.0 miles west of the project site on Snyder Lane. The nearest medical facility is Concentra Urgent Care, located 1.15 miles southeast of the project site on State Farm Drive.

3.3.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section III of the Checklist (**Appendix B**) and have been used in this section to evaluate the potential off-reservation impacts of the Proposed Project on air quality. Such impacts are considered significant if they would:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Expose off-reservation sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people off-reservation.

Criteria Air Pollutants

The SFBAAB surrounding the project site is classified as non-attainment for ozone under both the Federal and State standards and non-attainment for PM_{10} and $PM_{2.5}$ under State standards. A significant impact would occur if the Proposed Project would result in emissions of PM_{10}, $PM_{2.5}$ or ozone precursors (ROGs and NO_X) at levels that would conflict with or obstruct an applicable air quality plan, violate an air quality standard, or contribute to an existing or projected air quality violation.

Accordingly, the *de minimis* levels set forth in the Federal General Conformity rule are used to evaluate the significance of the Proposed Project's off-reservation air quality impacts. *De minimis* levels for ozone precursors ROG and NO_X are 100 tons per year each because BAAQMD is designated as marginal non-attainment for ozone under the NAAQS. *De minimis* levels for PM2.5 are 100 tons per year because BAAQMD is designated as moderate non-attainment for PM2.5 under the NAAQS. BAAQMD is designated as unclassified by the USEPA for PM_{10}, and therefore there are no applicable *de minimis* standards, however these emissions are disclosed for informational purposes, because the off-reservation environment is designated as non-attainment.

Although the SFBAAB is classified as maintenance for CO, the corresponding impacts are assessed below to determine if the increase in traffic attributable to the Proposed Project could result in the exceedance of the 1-hour NAAQS of 35 ppm. According to the protocol adopted by the California Department of Transportation (Caltrans), projects that would lead to worsening the level of service (LOS) of a signalized intersection to E or F represent a potential for a CO violation and would require further analysis; projects that do not worsen signalized intersections to LOS E or F would require no more analysis. Projects that significantly increase the delay by 10 seconds or more at an intersection operating at LOS E or LOS F under existing conditions would represent a potential for a CO violation and would require further analysis.

Odor

There are no applicable odor detection thresholds due to the subjective nature of odors and odor sensitivity, therefore potential for significant odor impacts is typically evaluated based on criteria such as historical complaints pertaining to similar sources.

Diesel Particulate Matter

There are no applicable DPM thresholds, the potential for significant DPM impacts is typically evaluated based on the duration of exposure and location and quantity of off-reservation sensitive receptors surrounding the project site.

Methodology

Potential impacts to air quality of the Proposed Project were assessed in terms of construction, operation, carbon monoxide screening procedures, and diesel particulate matter, further detailed below.

Pollutants of Concern

Construction of the Proposed Project would entail demolition, earthwork, grading and building. Construction would produce pollutants of concern resulting from operation of construction equipment, earth-moving activities, and soil hauling. A variety of heavy equipment, including trucks, scrapers, excavators, and graders, would be used to complete construction. Operation of the Proposed Project would not introduce new pollutants of concern.

Carbon Monoxide Screening Procedures

The *Transportation Project-Level CO Protocol* (CO Protocol; UC Davis, 1997) deals with project-level air quality analysis needed for federal conformity determinations, NEPA, and CEQA. In 1997, the USEPA approved the CO Protocol for use as an alternative "hot spot" analysis method in California.

The CO Protocol provides a screening procedure for determining when a project may be of concern for CO violations and identifies a standardized method of using the CALINE4 dispersion model for detailed analysis if necessary. The CO Protocol is the standard method for project-level CO analysis by Caltrans, replacing the *Air Quality Technical Analysis Notes* (Caltrans, 1988). CO concentrates on the ground and does not disperse well, causing localized impacts at major congested intersections. Hotspot analysis is deemed necessary if the Proposed Project involves or worsens a signalized intersection to LOS E or F.

Diesel Particulate Matter

Diesel particulate matter (DPM) emissions from the construction of all alternatives would primarily be produced by diesel-fueled equipment use and earth moving activities. The majority of these emissions would be from on and off-road construction equipment used at the project site.

Impact 3.3-1: The Proposed Project would not conflict with or obstruct implementation of applicable air quality plans.

Air quality impacts potentially associated with the Proposed Project include those resulting from short-term construction activities and from vehicle traffic during construction. Construction-related emissions could include exhaust from construction equipment and fugitive dust from land clearing, earthmoving, movement of vehicles, and wind erosion of exposed soil during construction. Given the small scale of the Proposed Project, it is unlikely that significant emissions of pollutants of concern would be produced during construction or operation. **Mitigation Measure 3.3-1** would be implemented during construction in accordance with the 2017 BAAQMD CEQA Air Quality Guidelines to reduce potential impacts on air quality. The Proposed Project would not conflict with implementation of applicable air quality plans, violate air quality standards, or substantially contribute to air quality violations. There would be a **less-than-significant impact**. To reduce construction emissions even further, **Mitigation Measure 3.3-1** will be implemented during construction:

Mitigation

3.3-1 To further reduce construction emissions, the Tribe may require that construction contractors implement the following best management practices during construction:

- The Tribe shall require off-road construction equipment to utilize tier three engines as defined by the USEPA's Vehicle Emission and Fuel Standards Program. In addition, construction equipment shall be operated with a level three diesel particulate filter.
- Exposed soil shall be sprayed with water daily as needed.
- Dust emissions shall be minimized during transport of fill material or soil by wetting down loads, ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks, and/or covering loads.
- Dirt, gravel, and debris piles shall be covered as needed to reduce dust.

Impact 3.3-2: The Proposed Project would not violate air quality standards or contribute to existing or projected air quality violations.

As discussed in **Impact 3.3.1,** it is unlikely that a significant amount of criteria air pollutants would be produced during construction or operation of the Proposed Project. Therefore, the Proposed Project would not violate an air quality standard or contribute to an existing or projected violation. There would be a **less-than-significant impact**.

Impact 3.3-3: The Proposed Project would not create objectionable odors affecting a substantial number of people off-reservation.

Construction

Construction of the Proposed Project would generate minor odors from heavy equipment and fugitive dust. Construction-related odors would dissipate quickly and would not extend beyond the boundaries of the project site. There would be a **less-than-significant impact**.

Operation

Operation of the Proposed Project would be indoors within the existing Resort, and would not include new facilities that would generally emit odors. Operation-related odors would dissipate quickly and would not extend beyond the boundaries of the Resort. There would be **no impact**.

Impact 3.3-4: The Proposed Project would not expose off-reservation sensitive receptors to substantial CO concentrations.

CO disperses readily into the atmosphere once emitted. Therefore, elevated concentrations of CO, which can have adverse effects on sensitive receptors, tend to occur at intersections that experience high traffic volumes, resulting in long delays and vehicle idling times if the LOS is exceeded for the intersection. As described previously under the significance threshold for CAPs, emissions of CO generated by the Proposed Project would have the potential to cause a violation of short-term standards if implementation of the Proposed Project would result in a decrease in LOS. The concern relating to CO is normally limited to major signalized intersections operating at LOS E or F. No major signalized intersections or roadways near the project site would operate at LOS E or F as a result of the Proposed Project. Therefore, the screening procedures described in the CO Protocol (UC Davis, 1997) do not indicate that microscale CO modeling is necessary (Caltrans, 2014). Implementation of the Proposed Project would not expose off-reservation sensitive receptors to substantial CO concentrations. There would be a **less-than-significant impact**.

Impact 3.3-5: The Proposed Project would not expose off-reservation sensitive receptors to substantial DPM concentrations.

Construction

Construction of the Proposed Project would result in emissions of DPM from heavy equipment use. However, due to the minimal extent of groundbreaking activities and the distance to the nearest sensitive receptor (0.25 miles from construction activities to the nearest residents), exposure of substantial levels of DPM to off-reservation sensitive receptors would not occur. There would be a **less-than-significant impact**.

Operation

The Proposed Project would be operated indoors within the existing Resort. No new emissions sources would be created by operation of the Proposed Project. There would be a **less-than-significant impact**.

3.4 BIOLOGICAL RESOURCES

This section addresses the off-reservation environment associated with biological resources, discusses the impacts of the Proposed Project on off-reservation biological resources, and presents mitigation measures to reduce potentially significant off-reservation environmental impacts associated with the Proposed Project. Biological resources include sensitive habitats such as wetlands and Waters of the U.S., as well as plant and animal species, specifically those that are special-status. Biological surveys have been conducted in surrounding off-reservation areas by AES biologists in 2018 and 2019 to assess and identify biological resources. Plant species identification, nomenclature, and taxonomy followed *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin, 2012). Supplementary background information regarding fishery resources of the Laguna de Santa Rosa was obtained from the 2011 Essential Fish Habitat Assessment (EFHA) by Analytical Environmental Service (AES, 2011). Additional information was obtained from the 2009 Biological Opinion (BO) by the U.S. Fish and Wildlife Service (USFWS) (USFWS, 2009) and the 2006 Biological Assessment (BA) prepared for the existing Resort by Huffman-Broadway Group Inc. (Huffman, 2006).

3.4.1 REGULATORY FRAMEWORK

Federal

Federal Endangered Species Act

Provisions of the Federal Endangered Species Act of 1973 (FESA), as amended (16 United States Code [USC] 1531), protect federally-listed threatened and endangered wildlife and their habitat from take (50 CFR §17.11, 17.12). Under FESA, "take" includes activities that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" as well as any "attempt to engage in any such conduct" (16 USC 1531[3]). The U.S. Fish and Wildlife Service (USFWS) defines the term "harm" to include "significant habitat modification or degradation" (50 CFR §17.3). Additionally, the USFWS and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) implement Section 10(a)(1)(b) of FESA, which allows non-federal entities under consultation with the USFWS and NMFS to obtain incidental take permits for federally listed fish and wildlife. Compliance with Section 10(a)(1)(b) is not required for federally listed plants.

Critical Habitat

Critical habitat is defined under FESA as specific geographic areas within a listed species range that contain features considered essential for the conservation of the listed species. Designated critical habitat for a given species supports habitat deemed by USFWS to be important for the recovery of the species. Under FESA, habitat loss is considered to be an impact to the species. Trust land was federally excluded from being designated as critical habitat for the California tiger salamander (CTS) and special-status plant species.

Migratory Bird Treaty Act

Most bird species, especially those that are breeding, migratory, or of limited distribution, are protected under federal and state regulations. Under the Migratory Bird Treaty Act of 1918 (16 USC §703-711), federally-listed migratory bird species (50 CFR §10.13) and their nests and eggs are protected from injury or death, and project-related disturbances during the nesting cycle must be reduced or eliminated. Only off-reservation impacts to migratory bird species are evaluated in accordance with the Compact.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act was originally enacted in 1940 to protect bald eagles and was later amended to include golden eagles (16 USC Subsection 668-668). This act prohibits take, possession, and commerce of bald and golden eagles and associated parts, feathers, nests, or eggs with limited exceptions. The definition of take is the same as the definition under FESA. The USFWS established five recovery programs in the mid-1970's based on geographical distribution of the species, with California located in the Pacific Recovery Region. Habitat conservation efforts in the Pacific Recovery Region, including laws and management practices at federal, state, and community levels, have helped facilitate bald eagle population increases. Critical habitat for bald and golden eagles was not designated as part of the Pacific Recovery Plan created under FESA. Likewise, critical habitat was not designated by regulation under FESA. In 1995, the USFWS reclassified the bald eagle from endangered to threatened under FESA in the contiguous 48 states, excluding Michigan, Minnesota, Wisconsin, Oregon, and Washington where it had already been listed as threatened (USFWS, 2012). In 2007, the bald eagle was federally delisted under FESA. However, the provisions of the act remain in place for protection of bald eagles and golden eagles.

Wetlands and Other Waters of the United States

Any project that involves discharge of dredged or fill material in off-reservation navigable Waters of the U.S. must first obtain authorization from the U.S. Army Corps of Engineers (USACE), under Section 404 of the Clean Water Act (CWA). Projects requiring a 404 permit under the CWA also require a Section 401 certification from either the U.S. Environmental Protection Agency (USEPA) for trust land, or the Regional Water Quality Control Board (RWQCB) for non-trust land. These two agencies also administer the National Pollutant Discharge Elimination System general permits for construction activities disturbing one acre or more.

The term "Waters of the United States" is defined as:

- All waters currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters subject to the flow of the tide;
- All interstate waters including interstate wetlands; or
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use or degradation of which could affect interstate or foreign commerce including any such waters.

The term "Wetlands" is defined as:

- Waters of the U.S. that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands that meet these criteria during only a portion of the growing season are classified as seasonal wetlands.

State and Local

The project site is located on trust land and is not subject to State or local laws and regulations concerning biological resources. However, such laws and regulations apply to off-reservation land in the vicinity of the project site.

California Endangered Species Act

The California Endangered Species Act (CESA) is similar to FESA, but is limited to species under state jurisdiction listed by the state as threatened or endangered. Under Section 2080 of the California Fish and Game Code, off-reservation take is prohibited. Take is defined as activities that "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Under Section 2081, California Department of Fish and Wildlife (CDFW) can authorize take if an incidental take permit is issued by the Secretary of the Interior or Commerce in compliance with FESA for jointly listed species, or if the director of CDFW issues a permit and impacts are minimized and mitigated for State listed species. In general, CESA does not cover habitat impacts.

California Department of Fish and Game Code

California Fish and Game Codes § 3503, 3503.5, and 3800 prohibit the off-reservation possession, incidental take, or needless destruction of birds, their nests, and eggs. California Fish and Game Code §3511 lists birds or other species that are "fully protected" off-reservation and may not be taken or possessed except under specific permit. Consultation with CDFW may be required if construction would potentially impact off-reservation state-listed species or nesting raptors.

California Fish and Game Code Section 1602

California Fish and Game Code Section 1602 requires notification before beginning off-reservation activities that obstruct or divert the natural flow of an off-reservation river, stream, or lake; change or use of any material from the bed, channel, or bank of an off-reservation river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into an off-reservation river, stream, or lake. California Fish and Game Code Section 1602 applies to off-reservation perennial, intermittent, and ephemeral bodies of water in California.

Tree Protection and Replacement Ordinance

Sonoma County Ordinance Number 4014, the Tree Protection and Replacement Ordinance, was enacted by the Sonoma County Board of Supervisors to preserve certain native tree species in Sonoma County. Protected trees include black oak, blue oak, coast live oak, interior live oak, Oregon oak, oracle oak, valley oak, big-leaf maple, madrone, redwood, and California bay. Protected trees over nine inches in diameter at breast height as measured 4.5 feet above the ground should be identified and measured. The ordinance permits removal up to 50 percent of the arboreal value before mitigation is required.

Santa Rosa Plain Conservation Strategy

In cooperation with the USEPA, USACE, CDFW, and RWQCB, USFWS has developed a strategy to conserve and contribute to the recovery of certain federally listed species of the Santa Rosa Plain and their habitats. The Santa Rosa Plain Conservation Strategy identifies potential habitat and survey guidelines for five special-status species known to occur on the Santa Rosa Plain; CTS, Burke's goldfields, Sonoma sunshine, Sebastopol meadowfoam, and many-flowered navarretia (USFWS, 2005).

Sonoma County Agricultural Preservation and Open Space District's Acquisition Plan 2000

In 2000 the Sonoma County Agricultural Preservation and Open Space District (SCAPOSD) adopted a plan to purchase land and easements. The Laguna de Santa Rosa was determined by SCAPOSD to represent a priority riparian and wetland area. In addition, the SCAPOSD recognized the Santa Rosa Plain as a priority greenbelt area.

Laguna de Santa Rosa Protection Plan

The Laguna de Santa Rosa Protection Plan is a partnership of the Sonoma Land Trust and the Laguna de Santa Rosa Foundation, together with the California State Coastal Conservancy (Sonoma Land Trust and Laguna de Santa Rosa Foundation, 2003). The goal of the Laguna De Santa Rosa Protection Plan is to preserve wetlands, vernal pools, valley oak savannah, riparian woodlands, and special-status species. The planners of the Laguna de Santa Rosa Foundation brought together a task force of private organizations and public agencies. The job of the task force was to develop management guidelines within a 21,000-acre core planning area.

Sonoma County General Plan

Chapter 23a consists of implementation of the Environmental Quality Act of 1970 (Act) and CEQA Guidelines. Lead departments are required to retain environmental documents until a project is constructed and required mitigation measures are completed. Acceptable mitigation measures as defined in the County General Plan include impact avoidance, impact minimization, rectifying impacts by repairing or restoring the impacted environment, reducing or eliminating impacts over time, or compensating for impacts by providing substitute resources or environments (Ord. No. 3411 § II.).

City of Rohnert Park General Plan

Section 6.2 outlines local habitats and biological resources, including wetlands, vernal pools, and special-status species. Conservation measures are proposed to protect and enhance valuable biological resources (City of Rohnert Park, 2000).

3.4.2 ENVIRONMENTAL SETTING

The project site is within an unsectioned area of Township 6 North, Range 9 West, Mt. Diablo Baseline and Meridian, of the "Cotati, California" USGS 7.5-minute quadrangle. Topography is relatively flat with slopes less than 1 percent and elevations ranging from approximately 26 to 28.3 meters (m) (85 to 92 feet) above msl. The project site is situated on the Reservation as shown in **Figure 2-1**. Currently, the portion of the Reservation that contains the project site is developed with the existing Resort and associated parking. Agricultural land uses are present to the west of the project site, including a dairy farm and a vineyard.

Biological Study Area

Ongoing biological surveys have been conducted by AES biologists since 2004 in surrounding off-reservation areas to assess and identify biological resources in the vicinity of the project site. The Biological Study Area (BSA) was established based on off-reservation biological resources identified as sensitive and/or having the potential to be directly impacted by the Proposed Project (**Figure 3.4-1**). The two federally jurisdictional wetlands located on-reservation to the west of the project site are monitored and protected through setbacks, as required by a previously issued USACE 404 permit.

Areas that are on-reservation and under Tribal jurisdiction are not included in the BSA. Areas that are paved, developed, heavily disturbed independent of the Proposed Project, or far enough away to be outside of impact range are also eliminated from further analysis. Habitat types of the BSA were characterized and evaluated for the potential to support regionally occurring special-status species and were assessed for the presence of potentially jurisdictional wetlands and waters, wildlife corridors, and other sensitive features. The following habitat types were identified within the BSA (**Figure 3.4-2**).

Ruderal/Disturbed

Ruderal/disturbed habitat within the BSA consists of non-managed areas dominated by non-native plant species. These areas are highly disturbed by surrounding development or agricultural uses but could realistically return to a more natural state if left undisturbed. The ruderal/disturbed portions of the BSA consist of the shoulders of paved roadways, dirt/gravel roadways, and highly disturbed areas that can no longer be classified as another habitat because of such low density or diversity of native plant species. This habitat category typically provides low habitat value for wildlife as it has been so highly disturbed; however, there are sections that may provide marginal habitat for native plants and wildlife. Native plants were generally not present as the non-natives outcompeted them.

Agriculture

Agricultural and farmed lands in the BSA are regularly disked and plowed for purposes of hay production. Seed selection, planting, and management to produce specific hay mixes have resulted in the presence of nonnative plant species. Plant species common in this habitat include perennial ryegrass (*Lolium perenne*), bristly ox-tongue (*Helminthotheca echioides*), curly dock (*Rumex crispus*), field mustard (*Brassica rapa),* orchard grass (*Dactylis glomerata*), and cheeses (*Malva parviflora*). This habitat can provide low to medium habitat value for wildlife but will not provide habitat for native plants as non-native species planted for agriculture are dominant and will outcompete native species.

Wetlands and Waters

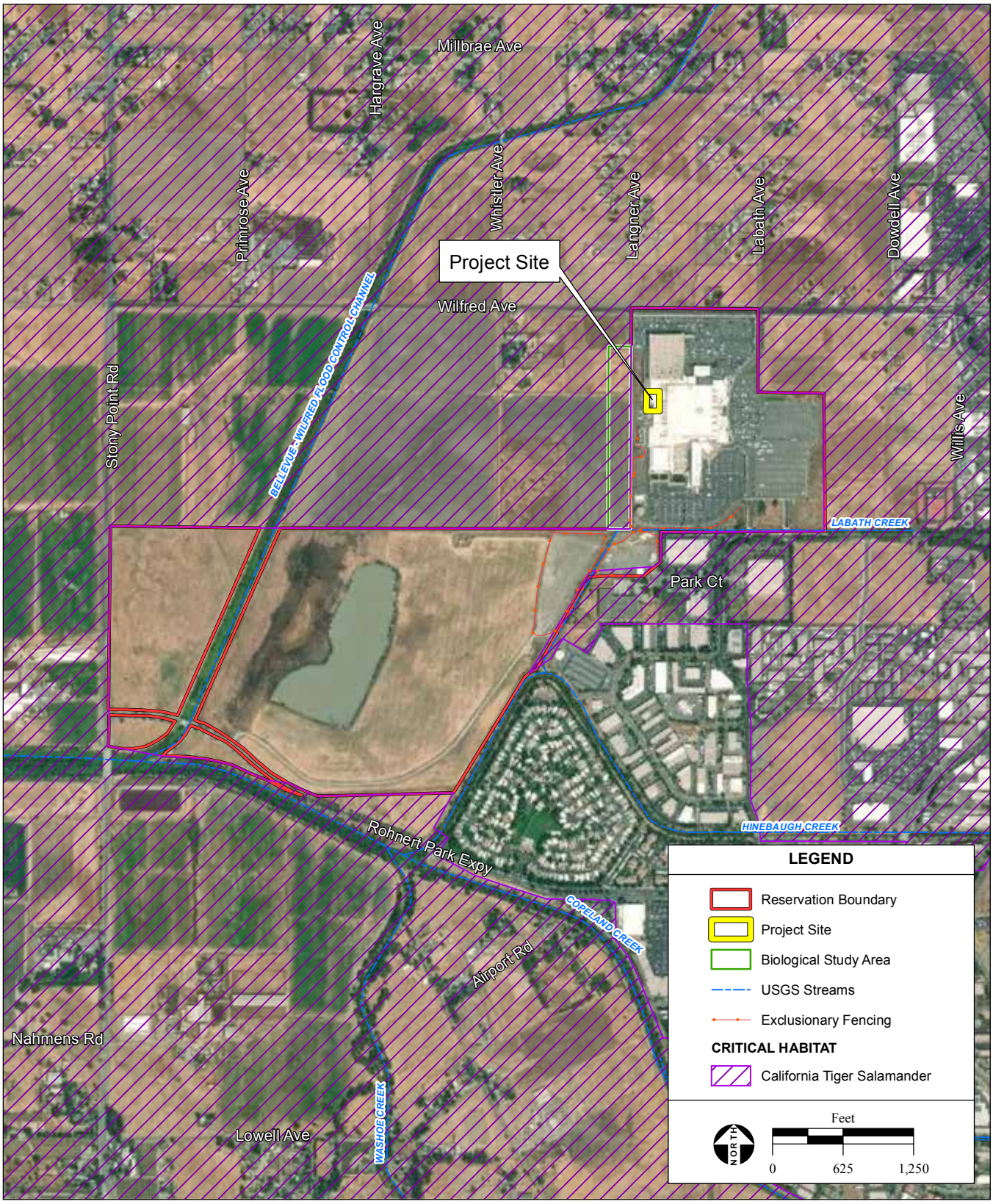
Two federally jurisdictional wetlands are located on-reservation within close proximity to the project site. These areas are protected by federal regulations consistent with the Santa Rosa Plain Conservation Strategy. The USACE issued a 404 permit prior to initial construction of the Resort, which required wetland protection through the use of setbacks and monitoring. Wetland setbacks and monitoring will continue throughout construction of the Proposed Project. Other similar wetland areas are located off-reservation west of the project site on private property. A small man-made drainage ditch occurs in the BSA west of the project site. The drainage ditch runs north to south and carries water after heavy periods of rain. Vegetation is minimal, and comprised of non-native plant species. The drainage ditch lacks hydrologic capacity as well as suitable habitat to support anadromous fish species (AES, 2011).

Special-Status Species

For the purposes of this TEIR, “special-status” is defined to include off-reservation species that are:

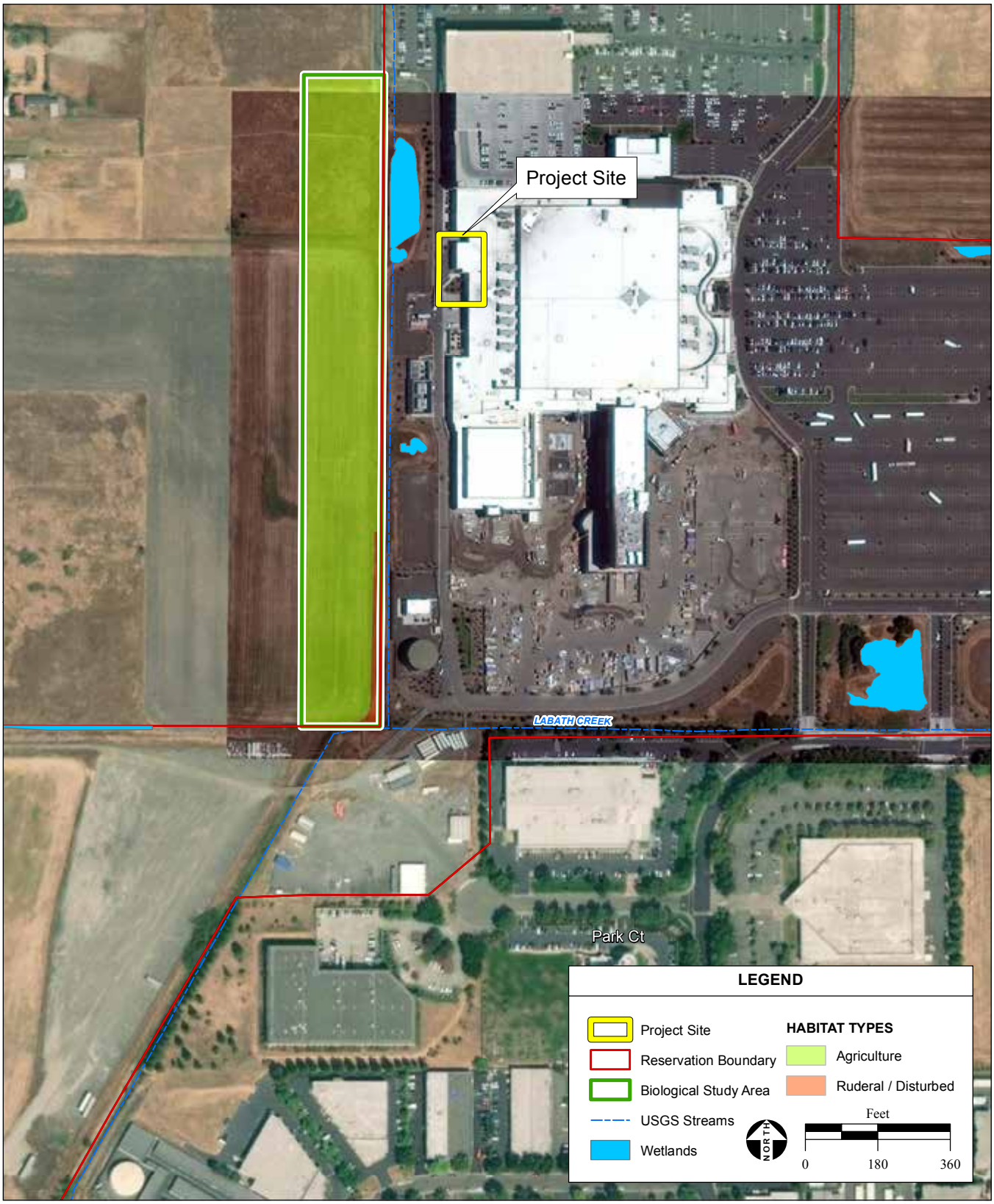
- Listed as endangered or threatened under FESA (or formally proposed as/candidates for listing);
- Listed as endangered or threatened under CESA (or formally proposed as/candidates for listing);
- Designated as endangered or rare, pursuant to CFG Code 1901;
- Designated as fully protected, pursuant to CFG Codes 3511, 4700, or 5050);
- Designated as species of concern by CDFW;
- Defined as rare or endangered under CEQA; or
- Considered by the California Native Plant Society (CNPS) to be “rare, threatened, or endangered in California” (lists 1B and 2).

Off-Reservation special-status species with the potential to occur in the vicinity of the project site were identified based on survey findings, literature review, aerial photographs, topographic maps, and species lists from the USFWS, California Native Diversity Database (CNDDB), and CNPS (**Appendix E**).



SOURCE: Sonoma County Orthophoto, 10/11/2013; AES, 6/21/2019

Figure 3.4-1
Biological Study Area



SOURCE: DigitalGlobe Aerial Photograph, 7/8/2016; AES, 6/21/2019

Figure 3.4-2
Habitat Types of the Biological Study Area

The USFWS list was generated using the Information for Planning and Conservation online program for the BSA. The CNDDB list was developed by querying the online database for special-status species records within the Sonoma 7.5-minute quadrangle.

The CNPS list was obtained by querying the CNPS Online Inventory of Rare and Endangered Plants program for special-status species records within the Sonoma 7.5-minute quadrangle.
Table 3.4-1 lists the name, list status, distribution, habitat requirements, period of identification, and potential to occur within the BSA for each of the regionally occurring special-status species identified in the CNDDB, CNPS, and USFWS species lists. For each species, necessary habitat requirements were assessed and compared with the habitats identified within the BSA (**Figure 3.4-2**). Species that are not addressed further were determined to have no potential to occur in the off-reservation vicinity of the project site based on elevational distribution, specific habitat requirements, soil requirements, and other environmental needs.

Based on the results of biological surveys and the review of regionally occurring special-status species and associated habitat requirements, portions of the BSA may provide potential habitat for six special-status species. To provide a conservative analysis, special-status species with the potential to occur in the on-reservation federally protected wetland areas (**Figure 3.4-2**) were also included. Special-status species with the potential to occur in the BSA are discussed following **Table 3.4-1**, and include the Sonoma sunshine (*B. bakeri),* dwarf downingia (*D. pusilla),* congested-headed hayfield tarplant (*H. congesta ssp. congesta),* Burke's goldfields *(L. burkei),* Sebastopol meadowfoam (*L. vinculans*), and CTS (*A. californiense*). No special-status species have been observed within the BSA during biological surveys. Special-status species that do not have to potential to occur in the BSA due to lack of suitable habitat are not discussed further.

Sebastopol meadowfoam (L. vinculans)

Federal Status – Endangered
State Status – Endangered
Other – CNPS List 1B.1

Sebastopol meadowfoam is associated with wet meadows, wetland areas, and the upper rim of vernal pools and swales. The Sebastopol meadowfoam is known only from a few localities in Sonoma County, principally in the Laguna de Santa Rosa area, and from a single known location in Napa County. Suitable Sebastopol meadowfoam habitat occurs within the federally identified wetlands. These wetlands occur on-reservation, but are protected via setbacks and avoidance. This species was not observed within the BSA or on-reservation wetlands during the biological surveys.

Sonoma sunshine (B. bakeri)

Federal Status – FE
State Status – SE
Other – CNPS List 1B.2

Sonoma sunshine is a small, annual member of the sunflower family indigenous to California. The species provides a yellow display in vernal pools, wetland areas, and annual grasslands of the Santa Rosa Plain and Sonoma areas at elevations of 10 to 110 m above msl. The bloom period for this species is March to May. Suitable habitat occurs within the federally identified wetlands. These wetlands occur on-reservation, but are protected via setbacks and avoidance. This species was not observed within the BSA or on-reservation wetlands during the biological surveys.

TABLE 3.4-1 - REGIONIALLY OCCURRING SPECIAL-STATUS SPECIES

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Plants					
Alopecurus aequalis ssp. sonomensis Sonoma alopecurus	FE/--/1B	Known to have fewer than five native occurrences in Marin and Sonoma counties.	Found in freshwater marshes and swamps, and riparian scrub. Elevations 5 to 210 m.	May-July	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Allium peninsulare var. franciscanum Franciscan onion	--/--/1B.2	Known to occur in Marin and Sonoma counties.	Found in freshwater marshes and swamps, and riparian scrub. Elevations 5 to 365 m.	April-June	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys
Amorpha californica var. napensis Napa false indigo	--/--/1B.2	Know to occur in Monterey, Marin, Napa, and Sonoma counties.	Found in broad-leaf upland forest, chaparral, and cismontane woodland. Elevations 120-2000 m.	April-July	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Astragalus claranus Clara Hunt's milkvetch	FE/Ct/1B.1	Known to occur in Napa and Sonoma counties.	Found in chaparral (openings), cismontane woodland, and valley and foothill grassland habitats. Found in serpentinite or volcanic, rocky, and clay soils. Elevations 75-275 m.	March-May	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Balsamorhiza macrolepis big-scale balsamroot	--/--/1B.2	Known to occur in Alameda, Amador, Butte, Colusa, El Dorado, Lake, Mariposa, Napa, Placer, Santa Clara, Shasta, Solano, Sonoma, Tehama, and Tuolumne counties.	Open grassy open slopes, and sometimes serpentinite. Chaparral, cismontane woodland, and valley and foothill grasslands. Elevations 45-1555 m.	March-July	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Brodiaea leptandra narrow-anthered brodiaea	--/--/1B.2	Know to occur in Lake, Napa and Sonoma counties.	Found in mixed-evergreen forest, broad-leafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, and valley and foothill grassland habitats. Usually on gravelly soils. Elevations 40-1220 m.	May-July	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Blennosperma bakeri Sonoma sunshine	FE/CE/1B.1	Known to occur in the Laguna de Santa Rosa and Sonoma areas of Sonoma county.	Found in wetland areas, vernal pools and mesic grassland. Elevations 10-110 m.	March-May	Yes. This species may occur in the federally identified wetlands. This species was not observed during surveys.

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Ceanothus sonomensis Sonoma ceanothus	--/--/1B.2	Known to occur in Napa and Sonoma counties.	Found in chaparral (sandy, serpentinite, or volcanic soils). Elevations 215-800 m.	February-April	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Chloropyron molle ssp. molle soft bird's-beak	FE/CR/1B.2	Known to occur in Contra Costa, Marin (may be extirpated), Napa, Sacramento (may be extirpated), Solano, and Sonoma counties (may be extirpated).	Found in marshes and swamps (coastal salt). Elevations 0-3 m.	July-November	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Chorizanthe valida Sonoma spineflower	FE/CE/1B.1	Known to occur in a single locality at Point Reyes National Seashore, Marin county.	Found in sandy coastal prairies. Elevation 10-305 m.	June-August	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Clarkia imbricata Vine Hill clarkia	FE/CE/1B.1	Known only from two extant occurrences in Sonoma county.	Found in acidic sandy loam in clearings within chaparral, valley and foothill grassland, and roadsides. Elevations 50-75 m.	June-August	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Cordylanthus tenuis ssp. capillaris Pennell's bird's-beak	FE/CR/1B.2	Known only to Sonoma county.	Found growing on serpentine within closed-cone coniferous forest or habitats. Elevations 45-305 m.	June-September	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Delphinium bakeri Baker's larkspur	FE/CE/1B.1	Known from Marin and Sonoma counties (though may be extirpated)	Broadleafed upland forest, Coastal scrub, and Valley and foothill grassland/decomposed shale, often mesic. Elevations 80-305 m.	March-May	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Delphinium luteum yellow larkspur	FE/CR/1B	Known to occur in Marin and Sonoma counties.	Found in chaparral, coastal prairie, and rocky coastal scrub. Elevations 0-100 m.	March-May	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Downingia pusilla dwarf downingia	--/--/2B.2	Known to occur in Fresno, Merced, Napa, Placer, Sacramento, San Joaquin, Solano, Sonoma, Stanislaus, Tehama, and Yuba counties.	Found in wetland areas, mesic grasslands, and vernal pools. Elevations 0-445 m.	March-May	Yes. This species may occur in the federally identified wetlands. This species was not observed during surveys.

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Eryngium constancei Loch Lomond button-celery	FE/CE/1B.1	Known to occur in Lake, Napa, and Sonoma counties.	Found in vernal pools. Elevations 460-855 m.	April-June	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Hemizonia congesta ssp. Congesta congested-headed hayfield tarplant	--/--/1B.2	Known to occur in Mendocino, Marin, San Francisco, San Mateo and Sonoma counties.	Found on roadsides and grasslands. Elevations 20 to 560 m.	April-November	Yes. The BSA may provide potential habitat for this species. This species was not observed during surveys.
Horkelia tenuiloba thin-lobed horkelia	--/--/1B.2	Known to occur in Mendocino, Marin, and Sonoma counties.	Found in mesic openings, sandy soils. Broadleafed upland forest, chaparral, and valley and foothill grassland. Elevations 50-500 m.	April-August	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Lasthenia burkei Burke's goldfields	FE/CE/1B	Known to occur in southern Mendocino county, southern Lake county, and northeastern Sonoma county.	Found in wetland areas, vernal pools, and moist meadows. Elevations 15-600 m.	April-June	Yes. This species may occur in the federally identified wetlands. This species was not observed during surveys.
Lilium pardalinum ssp. pitkinense pitkin marsh lily	FE/CE/1B.1	Known to occur only within the vicinity of Sebastopol, Sonoma county.	Found in cismontane woodland, valley-oak scrub, meadows and seeps, and marshes and swamps. Elevations 35-65m.	June-July	Yes. This BSA may provide potential habitat for this species, but is presumed extinct. This species was not observed during surveys.
Limnanthes vinculans Sebastopol meadowfoam	FE/CE/1B	Known to occur in Sonoma county and one occurrence in Napa county.	Found in vernal pools, vernally moist sites in meadows, and grassland. Elevations 15-305 m.	April-May	Yes. This species may occur in the federally identified wetlands. This species was not observed during surveys.
Lupinus sericatus Cobb Mountain lupine	--/--/1B.2	Known to occur in Colusa, Lake, Napa, and Sonoma counties.	Found on slopes of open broad-leafed upland forest, chaparral, cismontane woodland, and lower montane coniferous forest. Elevations 275-1525 m.	March-June	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Lupinus tidestromii Tidestrom's lupine	FE/CE/1B.1	Known to occur in Marin, Monterey, and Sonoma counties.	Found in coastal sand dunes. Elevation 0 to 100 m.	April-June	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Navarretia leucocephala ssp. plieantha many-flowered navarretia	FE/CE/1B.2	Known to occur in Lake and Sonoma counties.	Found in vernal pools. Has an affinity for substrates that originated from volcanic ash flows. Elevations 30-1100 m.	May-June	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Potentilla hickmanii Hickman's cinquefoil	FE/CE/1B.1	Known to occur in Monterey and San Mateo counties.	Found in coastal bluff scrub, closed-cone coniferous forest, meadows and seeps, marshes and swamps. Elevations 10-135 m.	April-August	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Sidalcea oregana ssp. valida Kenwood Marsh checkerbloom	FE/CE/1B.1	Known to occur in Sonoma county.	Perennial rhizomatous herb found in marshes and swamps (freshwater). Elevations 115-150 m.	June-September	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Animals					
Mammals					
Antrozous pallidus pallid bat	--/CSC/--	Known to occur throughout California with the exception of the high Sierra Nevada from Shasta to Kern counties, and from Del Norte and western Siskiyou counties to northern Mendocino county.	Found in shrublands, woodlands, and forests from sea level up through mixed conifer forests, generally below 2000 m. Most common in habitats with rocky areas for roosting. Roosts also include cliffs, abandoned buildings, bird boxes, exfoliating bark, and under bridges.	All Year	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Crustaceans					
Syncaris pacifica California freshwater shrimp	FE/CE/--	Known to occur in Marin, Napa, and Sonoma counties.	Found in low gradient, perennial coastal streams typically 1-3 feet deep, with exposed live roots along undercut banks and overhanging woody debris or vegetation.	All Year	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Fish					
Oncorhynchus mykiss steelhead – central California coast ESU	FT/CH/--	Federal listing includes all runs in coastal basins from the Russian River south to Soquel Creek including San Francisco and San Pablo bays.	Found in permanent or nearly permanent water in a wide variety of habitats.	Consult Agency	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Amphibians					
Ambystoma californiense California tiger salamander	FT/CSC/--	Known to occur in western California from Sonoma County in the north to Santa Barbara County in the south.	Breeds in vernal pools and ponds of grassland and open woodland of low hills and valleys. Will utilize burrows for refuge.	November-February (adults) March 15-May15 (larvae)	Yes. The BSA may provide potential habitat for this species. This species was not observed during surveys. Critical habitat occurs in the BSA.
Dicamptodon ensatus California giant salamander	--/CSC/--	Known to occur in Mendocino, Lake, Glenn, Sonoma, Marin, San Mateo, Santa Cruz and historically Monterey counties.	Found in wet coastal forests near streams and seepages.	All Year	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Rana aurora draytonii California red-legged frog	FT/CSC/--	Known to occur in Butte and Mendocino County, California southward to Baja, Mexico west of the Sierra Nevada, Peninsular Mountain axis.	Found in lowlands and foothills in or near permanent or late-season sources of water with dense, shrubby, or emergent vegetation.	May-November	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Rana boylii foothill yellow-legged frog	--/CSC/--	Known to occur in the Oregon Cascades south to the Sierra San Pedro Martir, Baja California, Mexico; including the Sierra Nevada, North Coast ranges, and San Gabriel Mountains.	Found in partly shaded shallow streams and riffles with a rocky substrate.	May-November	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Emys marmorata western pond turtle	--/CSC/--	Known to occur in western Washington to Baja California, Mexico west of the Cascade, Sierra Nevada, and Peninsular Mountain axis.	Found in permanent or nearly permanent water in a wide variety of habitats. Requires basking sites. Nests found up to 0.5 miles from water.	Consult Agency	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Birds					
Coccyzus americanus occidentalis western yellow-billed cuckoo	FT/CE/--	Known to occur in isolated pockets in the San Francisco Bay region, Mojave Desert, and San Diego region of California; south to Mexico.	Found in lowland riparian habitats. Nest and seek cover in densely foliaged, deciduous trees and shrubs, especially willows.	June-September	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.

SCIENTIFIC NAME COMMON NAME	FEDERAL/STATE/ CNPS LIST	DISTRIBUTION	HABITAT REQUIREMENTS	PERIOD OF IDENTIFICATION	POTENTIAL TO OCCUR IN BSA
Cypseloides niger black swift	--/CSC/--	Breeds in central and southern Sierra, coastal cliffs and mountains of San Mateo, Santa Cruz, and Monterey counties, the San Gabriel, San Bernardino, and San Jacinto mountains of southern California, and in the region of the Cascade Range.	Found on steep cliffs or ocean bluffs with ledges, cavities or cracks for nesting along ocean shore, inland deep canyons and often behind waterfalls. Forages in a wide variety of habitats including forests, canyons, valleys, and plains. Breeding elevations range from 0 to 2285 m.	May-July	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Melospiza melodia samuelis San Pablo song sparrow	--/CSC/--	Distributed in marshes around San Pablo Bay from Gallinas Creek and throughout the extensive marshes along the Petaluma, Sonoma, and Napa rivers.	Found in saltmarshes, brackish marshes, and fringe areas, where marsh vegetation is limited to edges of dikes, landfills, or other margins of high ground bordering salt or brackish water areas.	All Year	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.
Riparia riparia bank swallow	--/CT/--	About 50-60 colonies remain along the middle Sacramento River and 15-25 colonies occur along the lower Feather River. Other colonies persist along the central coast from Monterey to San Mateo counties, and northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties.	Found nesting primarily in riparian scrub, riparian woodland, and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig a nest.	All year	No. The BSA does not provide suitable habitat for this species. This species was not observed during surveys.

SOURCE: **Appendix E**

STATUS CODES

Federal: U.S. Fish and Wildlife Service
FE Federally Endangered
FT Federally Threatened
FC Candidate for Federal Listing

State: California Department of Fish and Game
CE California Listed Endangered
CT California Listed Threatened
CR California Rare
CSC California Species of Special Concern

CNPS: California Native Plant Society
1A Plants Presumed Extinct in California
1B Plants Rare, Threatened, or Endangered in California and Elsewhere
2B Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

CNPS Threat Ranks:
0.1 – Seriously Threatened in California
0.2 – Fairly Threatened in California

Dwarf downingia (D. pusilla)

Federal Status – none
State Status – none
Other – CNPS List 2B.2

Dwarf downingia is an annual herb and a member of the bellflower family. Found in vernal pools and other wet areas in valley and foothill grasslands, it grows at elevations of up to 450 m above msl. The bloom period for this species is March to May. Its known range includes Fresno, Merced, Napa, Placer, Sacramento, San Joaquin, Solano, Sonoma, Stanislaus, Tehama, and Yuba Counties. Suitable habitat occurs within the federally identified wetlands. These wetlands occur on-reservation, but are protected via setbacks and avoidance. This species was not observed within the BSA or on-reservation wetlands during the biological surveys.

Congested-headed hayfield tarplant (H. congesta ssp. congesta)

Federal Status – none
State Status – none
Other – CNPS List 1B.2

Congested-headed hayfield tarplant is an annual herb that occurs in coastal scrub and valley and foothill grassland habitats at elevations that range from 20 to 560 m above msl. This species blooms from April through November and is often observed growing along roadsides and in fallow fields. The known range of the hayfield tarplant includes Mendocino, Marin, San Francisco, San Mateo, and Sonoma counties. Suitable habitat occurs within the BSA in the agricultural field. This species was not observed within the BSA during the biological surveys.

Burke's goldfields (L. burkei)

Federal Status – Endangered
State Status – Endangered
Other – CNPS List 1B.1

Burke's goldfields is an annual herb that occurs in wet habitats including meadows and seeps and in vernal pools at elevations that range from 15 to 600 m above msl. This species blooms from April through July. It is known for having an unusual pappus that is composed of one long awn and several short scales. Suitable habitat occurs within the federally identified wetlands. These wetlands occur on-reservation, but are protected via setbacks and avoidance. This species was not observed within the BSA or on-reservation wetlands during the biological surveys.

California tiger salamander (A. californiense)

Federal Status – Threatened
State Status – Species of Concern

The Sonoma County population of CTS is a genetically distinct population listed as a federally endangered species. The species is found in grassland, savanna, and oak woodland habitats often where stock ponds, natural ponds, vernal pools, and intermittent streams occur from sea level to approximately 1,097 m above msl. Breeding occurs between December and March. Aquatic breeding ponds are usually found in grassland habitats, and the species is threatened by the loss of breeding ponds and the conversion of upland aestivation habitat for agricultural use and urban development. CTS cannot dig or maintain their own burrows, and consequently require the presence of burrowing mammals for burrow construction and maintenance.

Suitable CTS habitat occurs within the BSA in the wetlands, as well as designated critical habitat. This species was not observed within the BSA or on-reservation wetlands during the biological surveys.

Critical Habitat

Designated critical habitat for CTS occurs within the BSA in accordance with the Santa Rosa Plain Conservation Strategy. The closest known occurrence for the species is the outer northeastern corner of the Reservation, outside the BSA. The next closest occurrence for the species was located near the corner of Stony Point Road and Wilfred Avenue/Golf Course Drive. There are at least nine other reported findings within 1.5 miles of the project site. The adjacent off-reservation areas are within a floodplain west of the project site and outside of the BSA. This area is designated as dispersal area for CTS. Farmland north and east of the project site outside of the BSA is classified as potential estivation habitat for CTS. No recent occurrences of CTS have been documented in the BSA.

3.4.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section IV of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation environmental impacts of the Proposed Project to off-reservation biological resources. Such impacts are considered significant if they would:

- Have a substantial adverse impact, either directly or through habitat modifications, on any species in local or regional plans, policies, or regulations, or by the CDFW or USFWS;
- Have a substantial adverse effect on any off-reservation riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or protected by the CDFW or USFWS;
- Have a substantial adverse effect on federally protected off-reservation wetlands as defined by Section 404 of the CWA;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

Methodology

Assessment of existing off-reservation biological resources was based upon biological field surveys conducted to document existing habitat types and determine the potential for occurrence of special-status species. Special-status species include those listed as endangered, threatened, or candidates for listing under federal and state agencies. Biological surveys have been conducted in the BSA and surrounding off-reservation parcels in 2018 and 2019. The BSA was assessed for the presence of waters of the U. S., isolated wetlands, and other biologically sensitive features. Survey goals consisted of identifying habitat types, sensitive habitats, wetlands and Waters of the U.S, special status species, and wildlife movement corridors. Surveys were conducted by walking meandering transects throughout and around the area. Data was collected via a Trimble Geo XH hand-held GPS receiver. Habitat requirements of special-status species were compared to habitats present based on survey results and aerial photographs. Habitat types were determined using the Sonoma County Vegetation Map (Sonoma County, 2019) and were further modified based on field observations.

Supplementary background information regarding fishery resources of the Laguna de Santa Rosa was obtained from the EFHA (AES, 2011). Additional information was obtained from the BO (USFWS, 2009) and BA (Huffman, 2006).

Impact 3.4-1: The Proposed Project could potentially have an adverse impact, either directly or indirectly through habitat modifications, on species in local or regional plans, policies, or regulations, or protected by the CDFW or USFWS.

A list of regionally occurring special-status species was compiled based on a review of pertinent literature and the results of database queries (USFWS, CNDDB, and CNPS) of reported occurrences of special-status species in the Sonoma, California USGS quadrangle (**Appendix E**). Habitat requirements for each special-status species were assessed and compared to the habitats occurring within the BSA.

California Tiger Salamander

Designated critical habitat for CTS occurs within the BSA (**Figure 3.4-1**). The closest known occurrence for the species is the outer northeastern corner of the Reservation, outside of the BSA. The next closest known occurrence for the species is located near the corner of Stony Point Road and Wilfred Avenue/Golf Course Drive. The grassland portions of the BSA may provide suitable upland habitat for aestivating adult CTS. Construction of the Proposed Project could result in potential impacts to CTS should CTS wander onto the project site from adjacent areas. Implementation of **Mitigation Measure 3.4-1** would reduce potential impacts to CTS via the installation of exclusionary silt fencing along the project site. There would be a **less-than-significant impact with mitigation**.

Nesting and Migratory Birds

Marginal potential foraging and nesting habitat for migratory bird and raptor species is present in the BSA. The Proposed Project will not impact off-reservation foraging habitat; however construction activities may involve increased machinery, noise levels, and disturbances which have the potential to adversely affect off-reservation nesting migratory bird and raptor species. Implementation of **Mitigation Measure 3.4-2** would reduce potential impacts to nesting and migratory birds should they nest within 500 feet of the project site prior to the start of construction. There would be a **less-than-significant impact with mitigation.**

Mitigation

3.4-1 Silt fencing shall be placed along the edge of the project site and BSA boundary to serve as CTS exclusionary fencing during construction of the Proposed Project, and will also serve to protect off-reservation wetlands from indirect impacts. The fencing protects against the take of CTS by preventing CTS from accessing the project site from the surrounding off-reservation critical habitat. Fencing shall be 8 inches minimum in height, and trenched and backfilled to a depth of 6 inches below the soil surface. Fencing shall allow on-site CTS to move to adjacent habitat off-site. CTS signage shall be placed around the project site, and a qualified biologist will periodically monitor the project site for the presence of CTS.

3.4-2 Should construction activities take place during the nesting period (February 15-September 15), a qualified biologist shall conduct a pre-construction survey for raptor nests within 500 feet of the project site. The survey shall be conducted within 14 days of the start of construction. If construction activities are delayed or suspended for more than 14 days after the pre-construction survey, the area shall be resurveyed.

If no active bird nests are identified, no further mitigation is necessary. If active bird nests are identified, an avoidance buffer shall be implemented based on the identified species and as determined by a qualified biologist. Avoidance buffers may vary in size depending on habitat characteristics, project-related activities, and disturbance levels. Avoidance buffers shall remain in place until the end of the general nesting season or upon determination by a qualified biologist that young have fledged or the nest has failed.

Impact 3.4-2: The Proposed Project would not have a substantial adverse effect on any off-reservation riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFW or USFWS.

Construction and operation of the Proposed Project will occur on-reservation in a previously disturbed area. Construction activities associated with the Proposed Project have the potential to result in off-reservation stormwater runoff, further discussed in **Sections 3.5, 3.7,** and **3.8**. Prior to and during construction of the Proposed Project, the General Construction NPDES permit from the USEPA under federal requirements of the CWA shall be complied with. Per the NPDES, a SWPPP shall be prepared and implemented prior to construction, and will contain applicable BMPs to reduce impacts associated with stormwater runoff that could potentially affect off-reservation sensitive habitats. Implementation of **Mitigation Measures 3.5-1, 3.7-2,** and **3.8-1** would decrease off-reservation impacts associated with stormwater runoff. There would be a **less-than-significant impact with mitigation.**

Impact 3.4-3: The Proposed Project could potentially have an adverse effect on federally protected off-reservation wetlands as defined by Section 404 of the CWA.

Wetlands have been fully avoided through the use of setbacks. Avoidance is consistent with requirements of the BO originally issued for the development of the Resort. Potential waters of the U.S. within the BSA include a drainage. Implementation of **Mitigation Measure 3.4-1** would reduce potential impacts to off-reservation wetlands and waters. There would be a **less-than-significant impact with mitigation**.

Impact 3.4-4: The Proposed Project would not interfere substantially with the movement of native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

The Proposed Project does not involve components that would interfere with the movement of native resident or migratory fish or wildlife species. There are no wildlife corridors within the BSA. There are no native wildlife nursery sites in the BSA. The movement of native resident or migratory fish or wildlife species, resident or migratory wildlife corridors, and native wildlife nursery sites would not be impacted as a result of construction or operation of the Proposed Project. There would be **no impact.**

Impact 3.4-5: The Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

No biological resources protected by the provisions of an adopted HCP, NCCP, or other approved local, regional, or state HCP would be impacted as a result of construction or operation of the Proposed Project. The Proposed Project is in accordance with the Santa Rosa Plain Conservation Strategy, although this is not a formally adopted HCP or NCCP. There would be **a less-than-significant impact.**

3.5 GEOLOGY AND SOILS

This section discusses the off-reservation environment associated with geological features, analyzes impacts of the Proposed Project regarding off-reservation geological features, and presents mitigation measures to reduce potentially significant off-reservation impacts on geological features. Geological features include topography, soils, geology, and seismicity.

3.5.1 REGULATORY FRAMEWORK

Federal

National Earthquake Hazards Reduction Program

The Earthquake Hazards Reduction Act of 1977 (Public Law 95-124, 42 United States Code 7701 et. seq.), as amended in 2004 (Public Laws 101-614, 105-47, 106-503, and 108-360), established the National Earthquake Hazards Reduction Program. This program was designed to develop measures for earthquake hazards reduction and improve the understanding of earthquakes and effects (FEMA, 2004).

State and Local

The Proposed Project is located on trust land and is not subject to state or local laws and regulations concerning geological features. However, such laws and regulations apply to off-reservation land in the vicinity of the Proposed Project.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act), signed into law December 1972, requires the delineation of zones along active and potentially active faults in California. The California Geological Survey (CGS) defines an "active" fault as one that exhibits evidence of activity during the last 11,000 years. Faults that exhibit evidence of quaternary activity are considered to be "potentially active." The purpose of the Alquist-Priolo Act is to regulate development on or near fault traces to reduce the hazard of fault rupture and to prohibit the location of most structures for human occupancy across these traces (CGS, 2019).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act (DOC, 2019) was enacted in 1991 to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. This act requires a state geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within the portions of the zones over which they have jurisdiction. Before a development permit is granted by a city, county, or other local permitting agency for a site within a seismic hazard zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures must be incorporated into the project's design.

Sonoma County General Plan

The Public Safety Element describes geologic hazards specific to the County (Sonoma County, 2016). Applicable geologic hazards include seismic hazards, fault movement, ground shaking, and ground failure. Reducing risks of geologic hazards to acceptable levels requires special permit review procedures and construction standards. Construction must meet reasonable standards for seismic resistance, site stability, grading, and geologic studies.

City of Rohnert Park General Plan

The Rohnert Park General Plan 2020 is the guiding document for development within Rohnert Park (City) limits and the City Sphere of Influence, which include the Dowdell Property. The General Plan is a document required by state law and adopted by the City Council that is a comprehensive, long-term plan for the physical development and growth of the City (City of Rohnert Park, 2000). Section 7.1 discusses geology and soils and seismic hazards. Applicable geologic and seismic hazards are similar to those identified in the Sonoma County General Plan 2020.

City of Rohnert Park Northwest Specific Plan

The Rohnert Park General Plan states that a specific plan process is necessary for the northwest area to plan for land uses. The Northwest Specific Plan was adopted in 2014 and prepared consistent with the City's Municipal Code Chapter 17.06, Article VIII, Sections 17.06.290-450. Policies provide development standards concerning height, building setbacks, parking requirements, and changes in land use. The Northwest Specific Plan Area is approximately 100 square acres bounded by Dowdell Avenue to the east, Business Park Drive to the south, and Millbrae Avenue to the north. The Specific Plan envisions a primarily mixed-use development with regional commercial and industrial uses. The Northwest Specific Plan Area is identified in the City's General Plan as an area of expansion, and was annexed by the City in 2015.

Chapter 6 of the Northwest Specific Plan discusses the circulation system, improvements, and alternative modes of transportation. The majority of roadways within the Specific Plan Area are two-lane streets with minimal to no shoulders and surface drainage ditches on each side. Nearby resources that provide local and regional access include US-101, multi-use pathways, bike lanes, sidewalks, the Caltrans Roberts Lake Road Park-and-Ride, and bus transit lines. The Wilfred/Dowdell Village Specific Plan applies to approximately 20.19 acres generally south of Wilfred Avenue. The Specific Plan was approved by the City in 2008. The Wilfred/Dowdell Village Specific Plan has a 2020 General Plan designation of Regional Commercial (City of Rohnert Park, 2000).

3.5.2 ENVIRONMENTAL SETTING

The project site is located within the Santa Rosa Plain. To the east, the Santa Rosa Plain is bordered by the Sonoma and Mayacama Mountains, with the San Pablo Bay at the southeast end. To the immediate west are a series of low hills and further west are the Estero Lowlands and the Mendocino Range, which open to the Pacific Ocean. The region from the Estero Lowlands to the San Pablo Bay is known as the Petaluma Gap. The geomorphology of surface features of the Santa Rosa Plain is characterized by fluvial and alluvial deposits, as well as basin sediment.

Topography surrounding the project site includes developed areas in the cities of Rohnert Park and Santa Rosa to the east and north, and flat agricultural land with sparse residential development to the west. With the exception of depressed drainage channels for flood control, the project site and surrounding lands are generally flat and level with slopes of less than 1 percent and elevations ranging from approximately 85 feet above msl to 93 feet above msl. The major drainage depressions occur at the Bellevue-Wilfred Channel and the Laguna de Santa Rosa. The Bellevue-Wilfred Channel spans west of the Resort in a northeasterly direction, and bisects a portion of the southwestern Reservation property. The Laguna de Santa Rosa forms a portion of the southern boundary of the Reservation and converges with the Bellevue-Wilfred Channel at the southwest corner of the Reservation. Labath Creek runs along the southern boundary of the existing Resort.

Soils

The project site is currently paved, and has been built up with an engineered fill of soil acquired from a nearby location on-reservation, and is consistent with the requirements of the 2009 Environmental Impact Statement prepared for the existing Resort (AES, 2009). Below the engineered fill the project site consists of Clear Lake clay (CeA) (NRCS, 2019). The Clear Lake series generally consists of clays formed under conditions of poor drainage. Beneath the upper layers are usually alluvial strata comprised of basic and sedimentary rock. The Clear Lake series is often found on plains and in flat basins. Clays in the Clear Lake series are characterized by slow permeability, slow runoff, and present a slight erosion hazard.

Soil erosion is the removal of soil materials from the ground surface and the transportation of those soil materials to a remote location where they are deposited. Mechanisms of soil erosion include natural phenomena such as stormwater runoff and wind, and human activities such as changes in drainage patterns, removal of vegetation, and physical disturbance from construction. Factors that influence soil erosion include physical properties of the soil, topography, slope, and the quantity and intensity of rainfall. Erosion is further discussed in **Section 3.8**.

Geological Hazards

The Santa Rosa Plain is located in the southeastern section of the Northern Coast Range geomorphic province (Coast Range) (CSUN, 2016). The eastern portion of the Coast Range is characterized by parallel ridges and valleys, creating terrain consisting of moderate to very steep uplands and terraces. Quaternary and cretaceous geologic formations make up the majority of rocks in the Coast Range, including sandstone, mudstone, and conglomerates, with some volcanoclastic rocks (USGS, 2019a).

Seismicity

For this analysis, potentially active faults are faults that have shown signs of seismic activity during the last 1.6 million years. The closest fault zone to the project site is the Rodgers Creek fault zone, located approximately five miles northeast of the project site. This fault zone has known activity within the last 1.6 million years. This strike slip fault is a portion of the Hayward fault system in the east Bay Area and is predicted to be capable of a 5.8 maximum magnitude fault rupture (USGS, 2019b). There are no faults designated by the Alquist-Priolo Act within the vicinity of the project site (DOC, 2010).

The Modified Mercalli Intensity (MMI) scale is used to measure earthquake effects and ground shaking. MMI values range from I (earthquake not felt) to XII (damage nearly total). MMI values ranging from IV to X could cause moderate to significant structural damage (refer to **Table 3.5-1**). The damage level represents the estimated overall level of damage that will occur for various MMI levels (Bolt, 1988). The California Geological Survey (CGS), in coordination with USGS, creates models of seismic hazards based on the physical and mechanical properties of the Earth's crust. Based on these models, the CGS determines the peak horizontal ground acceleration, defined as the fastest measured change in speed for a particle at ground level. Shaking intensity at a site can vary depending on the overall magnitude of the earthquake, the distance from the epicenter, and the type of geologic material (USGS, 2019c).

Surface ruptures occur when movement along both sides of a fault located deep underground produces enough energy to cause a fracture on the surface. The project site and its immediate vicinity are not located within an Alquist-Priolo Earthquake Fault Zone or in a Seismic Hazard Zone as defined by the Seismic Hazards Mapping Act.

TABLE 3.5-1: MODIFIED MERCALLI INTENSITY SCALE

INTENSITY VALUE	INTENSITY DESCRIPTION	AVERAGE PEAK ACCELERATION
I.	Not felt except by a very few persons under especially favorable circumstances.	< 0.0015g
II.	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	< 0.0015g
III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many persons do not recognize it as an earthquake. Standing cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.	< 0.0015g
IV.	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.	0.015g-0.02g
V.	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.	0.03g-0.04g
VI.	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.	0.06g-0.07g
VII.	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.	0.10g-0.15g
VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.	0.25g-0.30g
IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.50g-0.55g
X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	> 0.60g
XI.	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 0.60g
XII.	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 0.60g

NOTES: *g* = gravity = 9.8 meters per second squared.
SOURCE: Bolt, 1988.

Landslides

The primary cause of a landslide is a steep slope that becomes over-burdened by weight, although the point at which instability is reached is based on a number of factors including saturation (by snowmelt or heavy rains) and seismic activity (USGS, 2008).

The nearest landslide hazard area is east of the project site in Annadel State Park and the surrounding mountains (Sonoma County, 2016). Landslides pose little natural hazard in the areas surrounding the project site due to the relatively flat topography of the Santa Rosa Plain (City of Rohnert Park, 2000).

Liquefaction

When subjected to energy associated with the shaking intensity of a considerably sized earthquake (MMI VIII and above), certain soils when saturated with water may lose their solid structure and act as liquids. Ground subject to liquefaction may sink or pull apart. Soils comprised of sand and sandy loams in areas with high groundwater tables or rainfall are subject to liquefaction during intense seismic shaking events. Soils on the project site and surrounding lands are well drained, with a depth to water table of greater than 80 inches, and do not contain high quantities of sand (NRCS, 2019).

3.5.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section VI of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation impacts of the Proposed Project on geological features. Such impacts are considered significant if they would:

- Expose off-reservation people or structures to substantial adverse effects, including the risk of loss, injury, or death involving:
    i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
    ii) Strong seismic ground shaking;
    iii) Seismic- related ground failure, including liquefaction; or
    iv) Landslides
- Result in substantial off-reservation soil erosion or the loss of topsoil;

Methodology

Off-Reservation impacts of the Proposed Project with respect to geological features were analyzed based on existing soil types and topography of the project site and surrounding vicinity, proximity of the project site to known faults, and potential of the Proposed Project to impact existing off-reservation geological features.

Impact 3.5-1: The Proposed Project would not expose off-reservation people or structures to substantial adverse effects involving a known earthquake fault, other strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides.

The Proposed Project is located approximately five miles from the Rodgers Creek fault zone and would be confined to trust land and built in accordance with the Compact, which requires the construction of the Proposed Project be built to applicable building codes (Compact, 2012). Implementation of the Proposed Project would not increase the exposure of off-reservation people or structures to adverse effects in the event of fault rupture or ground shaking. The Proposed Project does not involve off-reservation construction or activities that would expose people or structures to seismic-related ground failure.

Soils on the project site are not subject to liquefaction and the topography is level and is not subject to landslides. The project site is on previously disturbed land. Earthwork, including excavation, fill, and building-pad construction will be monitored by a geotechnical engineer. There would be a **less-than-significant impact.**

Impact 3.5-2: The Proposed Project would not result in substantial off-reservation soil erosion or the loss of topsoil.

Construction of the Proposed Project would include minimal earth-moving activities. Limited soil would be excavated to install foundations. The Proposed Project would be constructed over existing paved and disturbed areas, and excavated soil would be disposed of on-reservation through balanced cut and fill. **Mitigation Measure 3.5-1** would be implemented to further minimize the potential for erosion to occur on the project site in addition to implementation of the required SWPPP discussed in **Section 3.8**. There would be a **less-than-significant impact with mitigation.**

Mitigation

3.5-1 As discussed in **Section 3.8**, a SWPPP shall be prepared for the Proposed Project that identifies best management practices (BMPs) to be implemented during construction of the Proposed Project. Applicable BMPs (**Appendix D**) to reduce the potential for soil erosion include the following:

- Spray exposed soil with water/other suppressant as needed to reduce dust.
- Stabilize the construction access road through frequent watering or physical covering of gravel or rip-rap.
- Exposed stockpiled soils shall be covered and wattles shall be placed at the base of the piles to prevent wind and rain erosion.
- Enforce a 15 mile per hour speed limit on unpaved roads.
- Silt fencing shall be erected at all on-site stormwater exit points and along the edge of graded areas to stabilized non-graded areas and control siltation of onsite stormwater.

3.6 GREENHOUSE GAS EMISSIONS

This section addresses the greenhouse gas (GHG) emissions associated with the Proposed Project, evaluates potential off-reservation environmental impacts that may result from implementation of the Proposed Project, and presents mitigation measures to reduce potentially significant off-reservation impacts. GHGs are defined as gases that contribute to climate change when emitted into the atmosphere.

3.6.1 REGULATORY FRAMEWORK

Federal

National Environmental Policy Act

The National Environmental Policy Act (NEPA) directs federal agencies to assess potential environmental impacts of proposed actions that could significantly affect the human environment. The Council on Environmental Quality (CEQ) was established as part of NEPA to coordinate federal environmental efforts. There is no federal guidance related to the consideration of climate change impacts in NEPA documents as the former 2016 CEQ guidance memorandum was withdrawn with issuance of Executive Order 13783. However, the withdrawal of the guidance does not change laws, regulations, or other legally binding requirements.

Clean Air Act

In *Massachusetts et al.* vs. *Environmental Protection Agency et al.* (April 2, 2007), the US Supreme Court ruled that the Clean Air Act (CAA) authorizes the U.S. Environmental Protection Agency (USEPA) to regulate CO_2 emissions from new motor vehicles. The Court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances where the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change.

On December 15, 2009, the USEPA issued a final endangerment and cause finding (74 FR 66496), stating that high atmospheric levels of GHGs "are the unambiguous result of human emissions, and are very likely the cause of the observed increase in average temperatures and other climatic changes." The USEPA further found that "atmospheric concentrations of greenhouse gases endanger public health and welfare within the meaning of Section 202 of the Clean Air Act." The finding itself does not impose any requirements on industry or other entities.

State and Local

Assembly Bill 1493 (AB 1493)

AB 1493 of 2002 requires California Air Resources Board (CARB) to develop and adopt the nation's first GHG emission standards for automobiles. These standards are also known as Pavley I. The new standards would cover model years 2012 to 2016 and would raise passenger vehicle fuel economy to a fleet average of 35.5 miles per gallon by 2016.

Executive Order S-3-05 (EO S-3-05)

EO S-3-05 was signed by the Governor on June 1, 2005. EO S-3-05 established the following statewide emission reduction targets:

- Reduce GHG emissions to 2000 levels by 2010;
- Reduce GHG emissions to 1990 levels by 2020; and
- Reduce GHG emissions to 80 percent below 1990 levels by 2050.

EO S-3-05 created a "Climate Action Team" (CAT) headed by the California Environmental Protection Agency and including several other state agencies. The CAT is mandated by EO S-3-05 to outline the effects of climate change on California and recommend an adaptation plan. The CAT is also mandated with creating a strategy to meet the emission reduction target required by the EO. In April 2006 the CAT published an initial report that accomplished these two tasks. Subsequent CAT reports discussed the progress and supplemental recommendations to ensure the targets of EO S-3-05. The 2010 CAT Report to the Governor and the Legislature was issued in December 2010 (CalEPA, 2010).

California Global Warming Solutions Act of 2006 (Assembly Bill 32 [AB 32])

Signed by the Governor on September 27, 2006, AB 32 codifies a key requirement of EO S-3-05, specifically the requirement to reduce statewide GHG emissions to 1990 levels by 2020. AB 32 mandates CARB with monitoring state sources of GHGs and designing emission reduction measures to comply with the law's emission reduction requirements. However, AB 32 also continues the CAT's efforts to meet the requirements of EO S-3-05 and states that the CAT should coordinate overall state climate policy. AB 32 required that CARB prepare a comprehensive "scoping plan" that identifies all strategies necessary to fully achieve the required 2020 emissions reductions. Consequently, in early December 2008 CARB released its scoping plan to the public, which was approved by CARB on December 12, 2008. The first update to the scoping plan was released in May 2014. The scoping plan calls for an achievable reduction in California's carbon footprint. Reduction of GHG emissions to 1990 levels are proposed, which equates to cutting approximately 30 percent of emissions estimated for 2020. The scoping plan relies on existing technologies and improving energy efficiency to achieve the 30 percent reduction in GHG emission levels by 2020. The scoping plan provides the following key recommendation to reduce GHG emissions:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a state-wide renewable energy mix of 33 percent;
- Developing a state-wide cap-and-trade program that links with other WCI partner programs to create a regional market system;
- Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long term commitment to AB 32 implementation.

Executive Order S-01-07 (EO S-01-07)

EO S-01-07 was signed by the Governor on January 18, 2007. It mandates a statewide goal to reduce the carbon intensity of transportation fuels by at least 10 percent by 2020. This target reduction was identified by CARB as one of the AB 32 early action measures identified in their October 2007 report.

Executive Order B-30-15 (EO B-30-15)

EO B-30-15 was signed by the Governor on April 29, 2015. It sets interim GHG targets of 40 percent below 1990 by 2030, to ensure California will meet its 2050 targets set by AB 32. It also directs the CARB to update the Climate Change Scoping Plan.

Senate Bill 350 (SB 350)

SB 350 codifies the GHG targets for 2030 set by EO B-30-15. To meet these goals, SB 350 also raises the renewable portfolio standard from 33 percent renewable generation by 2020 to 50 percent renewable generation by December 31 2030.

Sonoma County General Plan

The Open Space and Resource Conservation Element in the Sonoma County General Plan addresses regional air quality. The Element presents policies in accordance with requirements of the Federal and State Clean Air Acts that encourage preservation of air quality to protect human health and preclude crop, plant, and property damage. Projects are generally referred to local air quality districts for review.

Sonoma County Climate Action Plan

The County adopted the Regional Climate Protection Authority's (RCPA) Climate Action Plan (CAP) in 2016 as an implementation measure of the Sonoma County 2020 General Plan. Although the CAP was not upheld in court following litigation, and the certification of the CAP's EIR was rescinded on November 13, 2017, the RCPA fully backs all research and GHG reduction strategies developed in the CAP for planning purposes.

City of Rohnert Park General Plan

Chapter 6.4 outlines air pollutants of concern and sensitive receptors. Policies and goals are presented to meet federal and state standards as well as improve overall air quality by reducing the generation of air pollutants from stationary and mobile sources. Policies are in cooperation with BAAQMD to achieve emissions reductions for nonattainment pollutants.

3.6.2 ENVIRONMENTAL SETTING

Climate Change

Certain gases in the earth's atmosphere, classified as GHGs, play a critical role in determining the earth's surface temperature. As defined in California Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, discussed in detail below, GHGs include all of the following: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (Health & Safety Code §38505[g]). The greenhouse effect is the process of solar radiation entering the earth's atmosphere from space; a portion of the radiation is absorbed by the earth's surface and a smaller portion of this radiation is reflected back toward space. The absorbed radiation is then emitted from the earth, not as high-frequency solar radiation, but lower-frequency infrared radiation. Most solar radiation passes through GHGs; however, infrared radiation is selectively absorbed by GHGs.

As a result, infrared radiation released from the earth that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the "greenhouse effect," is responsible for maintaining a habitable climate on Earth.

In addition to natural sources, human activities are exerting a substantial and growing influence on climate by changing the composition of the atmosphere and by modifying the land surface through deforestation and urbanization reducing carbon capture and decreasing albedo (IPCC, 2007). In particular, increased consumption of fossil fuels has substantially increased atmospheric levels of GHGs. Emissions of these gases are attributable to human activities associated with the industrial/manufacturing, utilities, transportation, residential, and agricultural sectors (CEC, 2005).

Global warming potential (GWP) is a measure of how much a given mass of GHG is estimated to contribute to global warming. It is a relative scale, which compares the gas in question to that of the same mass of CO_2 (which has a GWP of 1). Thus, for example, CH_4 has a GWP of 21 and N_2O has a GWP of 310 (ENVIRON, 2013). Consequently, using each pollutant's GWP, emissions of CO_2, CH_4, N_2O, CFCs and ozone depleting CFCs, and HFCs can be converted into CO_2 equivalents (CO_2e). GHG sources are both anthropogenic and natural. Some examples of anthropogenic sources are combustion of fossil fuel, evaporation of synthetic chemicals, agriculture, and combustion of coal. Natural sources include water vapor and naturally occurring N_2O, CO_2, O_3, and CH_4. Because GHGs are relatively stable in the atmosphere and essentially uniformly dispersed throughout the troposphere and stratosphere, the climatic impact of GHG emissions does not depend on the location of the emissions.

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme. IPCC's mission is to assess scientific, technical, and socioeconomic information relevant to the understanding of climate change, including the potential impacts and options for adaptation and mitigation. It is anticipated that the average global temperature could rise 1.5 degrees Celsius (º C) (2.7 degrees Fahrenheit [º F]) to 4.0º C (7.2º F) between the years 2000 and 2100 (IPCC, 2013).

Fossil fuel combustion removes carbon stored underground (as, for example, coal, oil, or natural gas) and releases it into the active carbon cycle, thus increasing concentration of GHGs in the atmosphere. The IPCC Fifth Assessment Report (report) concludes emissions of GHGs in excess of natural ambient concentrations are extremely likely (defined as 95 to 100 percent confidence) to be responsible for the enhancement of the greenhouse effect and contribute to what is termed "global warming," a trend of unnatural warming of the Earth's climate. Increases in these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates, and temperatures near the surface. Climate change is a global problem and GHGs are global pollutants, unlike criteria air pollutants (such as ozone, carbon monoxide, and particulate matter) and toxic air contaminants, which are pollutants of regional and local concern.

The report incorporates findings of the current effects of global climate change. The report further concludes, an enhanced greenhouse effect will generate new patterns of microclimate and will have significant impacts on economies, the environment, and transportation infrastructure and operations due to increased temperatures, intensity of storms, sea level rise, and changes in precipitation. Impacts may include flooding of tunnels, coastal highways, runways, and railways, buckling of highways and railroad tracks, submersion of dock facilities, and a shift in agriculture to areas that are now cooler. Such prospects will have strategic security as well as transportation implications. The report also notes that climate change also affects public health and the environment. Increased smog and emissions, respiratory disease, reduction in the water supply, extensive coastal damage, and changes in vegetation and crop patterns have been identified as effects of climate change. The impacts of climate change are broad-ranging and interact with other market failures and economic dynamics, giving rise to many complex policy problems.

Emission Sources

California is a diverse state with many sources of GHG emissions. Sources are subdivided into four major emission categories: energy, mobile, water transport, and solid waste disposal. In 2014, transportation generated 37 percent of California's GHG emissions, followed by the industrial sector (24 percent), electricity generation in state (12 percent), electricity generation imports (8 percent), commercial and residential (11 percent), agriculture and forestry (8 percent), and other sources (1 percent) (CARB, 2016). Emissions of CO_2 and N_2O are byproducts of fossil fuel combustion, among other sources. CH_4 results from off-gassing associated with agricultural practices and landfills. Sinks of CO_2 include uptake by vegetation and dissolution into the world's ocean.

Energy sources are the consumptive use of electricity and natural gas. The amount of CO_2e depends on the proportion of renewable energy generated by the power provider. Mobile sources are generated from both on and off-road vehicles. Emissions from water transport are generated from the energy demands of serving water and are affected by both the renewable mix of the power provider and the service delivery distance. Emissions from solid waste disposal are comprised of landfill biogas, composting, and land treatment. Climate change could impact California's natural environment in the following ways (CEC, 2012):

- Rising sea levels along the California coastline, particularly in San Francisco and the Sacramento-San Joaquin River Delta due to ocean expansion;
- Extreme heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent;
- An increase in heat-related human deaths and infectious diseases and a higher risk of respiratory problems caused by deteriorating air quality;
- Reduced snow pack and stream flow in the Sierra Nevada mountains, affecting winter recreation and water supplies;
- Potential increase in the severity of winter storms, affecting peak stream flows and flooding;
- Changes in growing season conditions that could affect California agriculture, causing variations in crop quality and yield; and
- Changes in distribution of plant and wildlife species due to changes in temperature, competition of colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

These changes in California's climate and ecosystems could occur at a time when California's population is expected to increase from 34 million to 59 million by the year 2040 (CEC, 2005). Consequently, if actions are not taken to reduce GHG emissions, the anticipated increase in population would also lead to increases in the amount of anthropogenic GHG emissions and the number of people potentially affected by climate change in California. Climate changes for global warming could affect agriculture, the fishing industry, California's coastline, ecosystems, and affect energy production (CAT, 2006).

Table 3.6-1 summarizes the Sonoma County Regional Climate Protection Authority's (RCPA) 2015 Emissions Inventory Update which supports the Sonoma County Climate Action Plan (CAP). The RCPA met on November 13, 2017 and the certification of the Environmental Impact Report associated with the CAP was rescinded due to litigation, thereby eliminating enforceability of the CAP (Casey, 2017; RCPA, 2018). On May 8, 2018, the Sonoma County Board of Supervisors adopted the Climate Change Action Resolution (Resolution) to help create countywide consistency and clear guidance about coordinated implementation of the greenhouse gas reduction measures.

The Resolution reaffirmed the County's intent to reduce GHG emissions and adopt the local implementation measures identified in the CAP.

The County is similar to many other areas within California and the United States in general in that a large portion of the GHG emissions comes from on-road transportation sources (58.9 percent). The second and third largest sources of GHG emissions in the County are building energy consumption and production and emissions from the fertilizer and livestock industry (22.7 and 10.0 percent). The remaining sources comprise less than ten percent of County-wide emissions.

TABLE 3.6-1: 2015 EMISSIONS INVENTORY

SECTOR	TONS OF GHGS ($MTCO_2E$)	PROPORTION OF EMISSIONS[1]
On-Road Transportation	2,126,000	58.9%
Building Energy	821,000	22.7%
Fertilizer & Livestock	361,000	10.0%
Solid Waste	213,000	5.9%
Off-Road Equipment	75,000	2.1%
Water and Wastewater	16,000	0.4%
County Total	**3,612,000**	**100%**

[1]Percentages may not add to 100% due to rounding. SOURCE: RCPA, 2018

Climate change in the County could have three major effects: change in rainfall, increases in temperature, and increased threat of wildfire (NBCAI, 2014). Temperatures are forecasted to increase from between 2.8 degrees Fahrenheit (^{o} F) and 5.8^o F (CEC, 2016). As a result water supplies may be adversely affected by drought and energy prices may spike as a result of increased demand.

3.6.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section VII of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation environmental impacts of the Proposed Project related to GHGs. Such impacts are considered significant if they would:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the off-reservation environment; or
- Conflict with any off-reservation plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

Methodology

The project site consists of a paved parking lot and developed areas. The Resort currently contributes to GHG emissions from mobile emissions associated with employees and patrons, as well as emissions associated with using electricity, natural gas, and water. The Proposed Project would not generate additional vehicle trips from patrons or employees. As discussed in **Section 3.13**, the Proposed Project would temporarily generate additional vehicle trips from construction. Primary GHG emissions sources from the Proposed Project include construction equipment use, energy use, and mobile sources.

Impact 3.6-1: The Proposed Project would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the off-reservation environment.

The Proposed Project would result in GHG emissions related to construction, mobile sources (trips generated), and electrical power generation. Given the small scale of the Proposed Project, significant emissions of GHGs would not be produced during construction or operation. To further reduce construction emissions, **Mitigation Measure 3.6-1** would be implemented during construction in accordance with the 2017 BAAQMD CEQA Air Quality Guidelines. Generation of GHG emissions, either directly or indirectly from the Proposed Project, would not have a significant impact on the off-reservation environment. There would be a **less-than-significant impact with mitigation**.

Mitigation

3.6-1 To further reduce construction emissions during construction, diesel-powered equipment shall be properly maintained and idling time shall be minimized when construction equipment is not in use to the extent feasible, unless per engine manufacturer's specifications or for safety reasons.

Impact 3.6-2: The Proposed Project would not conflict with an off-reservation plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

The immediate off-reservation areas in the County and the City are not governed by adopted CAPs, however off-reservation land is subject to the CARB Updated 2020 Scoping Plan (Scoping Plan). Adjacent CAPs in Marin County and the City of Santa Rosa are evaluated by their consistency with the Scoping Plan. Given the small scale of the Proposed Project, it is unlikely that significant emissions GHGs would be generated during construction or operation. The Proposed Project would be consistent with adjacent CAPs and the Scoping Plan and would not conflict with an off-reservation plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. There would be a **less-than-significant impact**.

3.7 HAZARDS AND HAZARDOUS MATERIALS

This section addresses the off-reservation environment associated with hazards and hazardous materials, analyzes potential off-reservation impacts of the Proposed Project, and presents mitigation measures to reduce any identified off-reservation impacts. A hazard is defined as a danger or risk to the public, such as a wildfire. A material is considered hazardous if it appears on a list of hazardous materials prepared by a federal, state, or local agency, or if it has characteristics defined as hazardous by such an agency.

3.7.1 REGULATORY FRAMEWORK

Federal

United States Environmental Protection Agency

The United States Environmental Protection Agency (USEPA) administers numerous statutes pertaining to human health and the environment at the federal level. In the absence of Tribal ordinances or plans generally the USEPA standards would apply to the land held in Trust for the Tribe by the federal government.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act of 1976 (RCRA) establishes framework for the proper management of hazardous and nonhazardous solid waste. The USEPA regulates the comprehensive program at active and future facilities to ensure that hazardous waste is managed safely during generation, transportation, and recycling, treatment, storing, and/or disposal, or from "cradle to grave." "Cradle-to-grave" requires detailed documentation and recordkeeping in order to ensure proper accountability for violations of applicable regulations in CFR Titles 29, 40, and 49 (USEPA, 2018a).

Toxic Substances Control Act

The Toxic Substances Control Act of 1976 (TSCA) provides the USEPA with authority to require reporting, recordkeeping, and testing requirements, and restrictions related to chemical substances and/or mixtures. TSCA addresses the production, importation, use, and disposal of specific chemicals, including polychlorinated biphenyls, asbestos, radon, and lead-based paint (USEPA, 2018b). The Food and Drug Administration regulates food additives and contaminants, drugs, medical devices, and cosmetics. The Federal Insecticide, Fungicide, and Rodenticide Act provides federal regulation of pesticide distribution, sale, and use, and addresses the certification and training of pesticide applicators (USEPA, 2018b).

Comprehensive Environmental Response Compensation and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund, provides funds to clean up uncontrolled, closed, or abandoned hazardous waste sites, as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. The USEPA cleans up orphan sites when potentially responsible parties cannot be identified or located, or when they fail to act (USEPA, 2018c).

Clean Water Act

The Clean Water Act (CWA; 33 USC §1251-1376), as amended by the Water Quality Act of 1987, is the major federal legislation governing water quality. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The United States Environmental Protection Agency (USEPA) is delegated as the administrative agency under the CWA (USEPA, 2002). Relevant sections of the CWA are as follows:

Sections 303 and *304* provide for water quality standards, criteria, and guidelines. Section 303(d) requires states to identify impaired off-reservation water bodies, rank these impaired bodies based on severity of contamination and uses for the waters, and develop water quality management strategies, usually in the form of total maximum daily loads (TMDLs) for the contaminant(s) of concern.

Section 401 (Water Quality Certification) requires an applicant for any federal permit that proposes an activity that may result in a discharge to waters of the United States, to obtain certification from the EPA, for on-trust land activities, or the state, for off-reservation activities, that the discharge will comply with other provisions of the CWA.

Section 402 establishes the National Pollutant Discharge Elimination System (NPDES), a permitting system for the discharge of any pollutant (except for dredged or fill material) into waters of the United States. Each NPDES permit contains limits on concentrations of pollutants discharged to surface waters to prevent degradation of water quality and protect beneficial uses.

Anti-degradation Policy

Federal policy (Code of Federal Regulations [CFR], Title 40, Part 131.6) specifies that each state must develop, adopt, and retain an anti-degradation policy to protect the minimum level of off-reservation surface water quality necessary to support existing uses. Each state must also develop procedures to implement the anti-degradation policy through water quality management processes. Each state anti-degradation policy must include implementation methods consistent with the provisions outlined in 40 CFR §131.12. On trust land, these issues are addressed by the USEPA (USEPA, 2012).

Safe Drinking Water Act

Minimum national drinking water standards and guidelines for groundwater protection are established through the 1974 Safe Drinking Water Act (amended in 1986 and 1996). Contaminants of concern relevant to domestic water supply are defined as those that pose a public health threat or that alter the aesthetic acceptability of the water. The USEPA regulates contaminants through the development of national primary and secondary Maximum Contaminant Levels for drinking water (USEPA, 2018d).

State and Local

The project site is located on trust land, and is therefore not subject to the following state or local laws and regulations concerning hazardous materials, substances, or wildland fires. However, such laws and regulations apply to off-reservation land in the vicinity of the project site.

California Code of Regulations, Title 22

This section of the CCR, commonly referred to as "Title 22," is a broad set of regulations dealing with social issues. Title 22 Divisions 4 and 4.5 address off-reservation environmental and public health issues such as hazardous waste, medical waste, and the protection of drinking water. Chapter 3 establishes the acceptable uses of treated wastewater and wastewater treatment requirements for each use. Under Title 22, the highest level of wastewater treatment is disinfected tertiary recycled water, which may be used for the full range of non-potable uses (DTSC, 2019).

California Environmental Protection Agency

The California Environmental Protection Agency (CalEPA) oversees and coordinates the activities of the Office of Environmental Health Hazard Assessment, the SWRCB, the Air Resources Board (ARB), the Department of Pesticide Regulation, Department of Toxic Substances Control (DTSC), and the Department of Resources Recycling and Recovery. The DTSC takes enforcement actions against violators, oversees hazardous wastes on contaminated properties, makes decisions on permit applications from companies that want to store, treat, or dispose of hazardous waste, and protects consumers against toxic ingredients in everyday products (CalEPA, 2018).

California Health and Safety Code

California Health and Safety Code, Division 20, Chapter 6.95 requires off-reservation businesses to plan and prepare for a chemical emergency through the preparation of a Hazardous Materials Inventory and a Hazardous Materials Business Plan (HMBP). The local Certified Unified Program Agency conducts routine inspections at off-reservation businesses required to submit HMBPs via California's Environmental Reporting System website.

Hazardous Waste Control Act

The Hazardous Waste Control Act (HWCA) of 1972 established the basis for the California Hazardous Waste Control Program within the California Department of Public Health. Included in the HWCA are definitions for what is considered to be a "hazardous waste," the definition of "hazardous," and what is required for appropriate handling, processing, and disposal of hazardous and extremely hazardous waste in areas over which the state has jurisdiction in a manner that protects the public, livestock, and wildlife. The HWCA also established a tracking system for the off-reservation handling and transportation of hazardous waste from the point of waste generation to the point of ultimate disposition, as well as a system of fees to cover the costs of operating the hazardous waste management program. The HWCA is California's implementation of the RCRA cradle to grave tracking requirement. The USEPA used several components of the HWCA when CERCLA was first introduced in 1980. The primary State entity that oversees the cradle-to-grave regulations is the DTSC.

3.7.2 ENVIRONMENTAL SETTING

Operation of the existing Resort involves a minimal amount of hazardous materials and the generation of wastewater. Potentially hazardous materials that may be used and stored at the Resort for maintenance purposes include paints, polishes, cleaning products, oils, and automotive products. As stated in the 2012 National Indian Gaming Commission Final Environmental Impact Statement (NIGC FEIS), operation of the Resort is in compliance with federal regulations relating to hazardous materials.

The Tribe developed a Hazardous Materials Management Plan (HMMP) in compliance with *Hazardous Materials Mitigation Measure Q* in the NIGC FEIS prior to construction of the existing Resort. The HMMP is intended to reduce the volume and toxicity of hazardous waste generated on the Reservation, ensure proper handling of hazardous materials, and ensure the safe and legal disposal of hazardous material generated. The HMMP is designed to be a living document that adapts as new information is collected to determine whether objectives are being met. Construction associated with the Proposed Project is also included in the HMMP, and current monitoring required by the HMMP has concluded that no new sources of hazardous materials are anticipated. Proper handling, use, storage, and disposal of hazardous wastes are necessary to help minimize present and future threats to human health and the environment.

The Resort's existing water supply system includes two water supply wells, a water treatment plant (WTP), a water storage tank, and a water distribution pump system. These facilities are located on-reservation. The WTP removes iron and manganese and includes a disinfection system in compliance with USEPA standards and the Federal Safe Drinking Water Act. The disinfection system uses sodium hypochlorite (AEG, 2016).

3.7.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section VIII of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation environmental impacts of the Proposed Project with respect to hazards and hazardous materials. Such impacts are considered significant if they would:

- Create a significant hazard to the off-reservation public or the off-reservation environment through the routine transport, use, or disposal of hazardous materials.
- Create a significant hazard to the off-reservation public or the off-reservation environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or involve handling hazardous or acutely hazardous materials, substances, or waste within 0.25 miles of an existing or proposed off-reservation school; or
- Expose off-reservation people or structures to a significant risk of loss, injury, or death involving wildland fires.

Methodology

The off-reservation impact assessment was based on a review of the existing Resort's operation and the significance criteria presented above. Aerial imagery and site photographs were used to assess the Property and surrounding areas, in addition to review of reconnaissance survey results.

Impact 3.7-1: The Proposed Project could create a hazard to the off-reservation public and/or off-reservation environment through routine transport, use, or disposal of hazardous materials during construction.

Construction

Limited quantities of miscellaneous hazardous substances such as fuels, solvents, oils, and paint would be used and stored on the project site during construction. Construction could rely on the use of temporary above-ground storage tanks, storage sheds, and/or trailers for fueling and maintenance purposes. Fueling and oiling of construction equipment would be performed only as needed. Non-biodegradable wastes and residual materials would be transported off-site in closed containers. Additionally, implementation of **Mitigation Measures 3.7-1** would decrease off-reservation impacts associated with the storage and use of hazardous materials in construction of the Proposed Project. There would be a **less-than-significant impact with mitigation**.

Operation

The use of above-ground storage tanks, storage sheds, and/or trailers for fueling and maintenance used during construction would not remain during operation of the Proposed Project. The routine transport, use, or disposal of hazardous materials associated with operation of the Proposed Project would not affect the off-reservation public and environment. There would be a **less-than-significant impact.**

Mitigation

3.7-1 If large quantities of potentially hazardous materials are used during construction of the Proposed Project, the Tribe shall ensure that contractors prepare and implement an HMBP in compliance with the California Health and Safety Code.

Impact 3.7-2: The Proposed Project could create a hazard to the off-reservation public and/or off-reservation environment through upset and accident events involving the release of hazardous materials into the off-reservation environment.

Construction

Potentially hazardous materials such as fuels, solvents, and paints would be used during construction of the Proposed Project. As with any liquid and solid, the handling and transfer from one container to another has the potential for an accidental release. The presence of hazardous materials on the project site during construction could create a significant off-reservation impact if spilled in such a way as to flow off-reservation. If properly used, stored, and disposed of, these materials would not be a hazard to the off-reservation public and environment. The following standard operating procedures will be implemented, as recommended by the HMMP, to reduce potential impacts associated with accidental release:

1. To reduce the potential for accidental releases, fuel, oil, and hydraulic fluids shall be transferred directly from a service truck to construction equipment and shall not otherwise be stored on the project site. Paint, thinner, solvents, cleaners, sealants, and lubricants used during construction shall be stored in a locked utility building, handled per the manufacturers' directions, and replenished as needed.
2. In the event that contaminated soil and/or groundwater or other hazardous materials are encountered during construction-related earth-moving activities, all work shall be halted until a qualified individual can assess the extent of contamination. If contamination is determined to be significant, representatives of the Tribe shall consult with the USEPA to determine the appropriate course of action, including the development of a sampling plan and remediation plan if necessary.
3. The amount of hazardous materials used in construction and operation shall be kept at the lowest required volumes.
4. The least toxic material capable of achieving the intended result shall be used to the extent practicable. Non-toxic alternatives shall include garden care products and organic non-toxic cleaners when feasible.
5. Personnel shall follow written standard operating procedures for filling and servicing construction equipment and vehicles.

Implementation of **Mitigation Measures 3.7-1** and **3.7-2** would further decrease off-reservation impacts associated with the storage and use of hazardous materials during construction of the Proposed Project. There would be a **less-than-significant impact with mitigation**.

Operation

Potentially hazardous materials used during construction would not remain during operation of the Proposed Project. Additionally, operation of the Proposed Project would occur indoors. Therefore, operation of the Proposed Project would not pose a significant hazard to the off-reservation public and environment. There would be a **less-than-significant impact.**

Mitigation

3.7-2 As discussed in **Section 3.8**, a Stormwater Pollution Prevention Plan shall be prepared for the Proposed Project that identifies best management practices (BMPs) to be implemented during construction, and include the following:

- Potentially hazardous materials, including fuels, shall be stored away from drainages and secondary containment shall be provided.
- A hazardous materials spill prevention, storage, and disposal plan shall be developed and shall identify proper storage, collection, and disposal measures for potential pollutants used onsite, as well as proper cleanup procedures and reporting of spills. The plan shall contain an inventory of hazardous materials stored and used on site, shall maintain emergency response protocols for the release and disposal of unused hazardous materials, and shall provide provisions specifying employee training in safety and emergency response procedures.

Impact 3.7-3: The Proposed Project would not emit hazardous emissions or involve the handling of hazardous materials, substances, or waste within 0.25 miles of an existing or proposed off-reservation school.

The nearest off-reservation school is Pathways Charter School, approximately 0.85 miles southeast of the project site. The distance from the Proposed Project to the nearest off-reservation school is greater than 0.25 miles, and no significant off-reservation hazardous emissions or off-reservation handling of hazardous materials are anticipated as a result of the Proposed Project. Construction materials would be delivered to the project site via Rohnert Park Expressway on a separate construction access road located on-reservation. Implementation of the Proposed Project would not result in off-reservation hazardous emissions or off-reservation handling of hazardous materials. There would be a **less-than-significant impact**.

Impact 3.7-4: The Proposed Project would not expose off-reservation people or structures to a significant risk of loss, injury, or death involving wildland fires.

Construction

The equipment used during construction of the Proposed Project has the potential to induce sparking. However, the project site is currently developed and disturbed and is surrounded by pavement, urbanized land, and maintained agriculture. Therefore, immediate risk of sparks igniting dry grass or vegetation leading to off-reservation wildfires is minimal. In addition, the BIA has an agreement with Calfire to compensate the State for providing fire response services to trust land in California. There would be a **less-than-significant impact.**

Operation

The Proposed Project would adhere to applicable Tribal codes or Section 6.4.2 of the Compact, comparable to the California Building and Public Safety Codes applicable to the County (Compact, 2012). Applicable fire protection features would be incorporated into design. In addition, the Tribe has existing agreements with the City and County that address fire services to the Resort. These agreements will apply to operation of the Proposed Project. There would be a **less-than-significant impact.**

3.8 WATER RESOURCES

This section addresses water resources of the project site and surrounding region, evaluates potential off-reservation environmental impacts that may result from implementation of the Proposed Project, and presents mitigation measures to reduce identified off-reservation impacts to water resources, hydrology, and water quality. Water resources include both surface and groundwater.

3.8.1 REGULATORY FRAMEWORK

Federal

Clean Water Act

The Clean Water Act (CWA; 33 USC §1251-1376), as amended by the Water Quality Act of 1987, is the major federal legislation governing water quality. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The United States Environmental Protection Agency (USEPA) is delegated as the administrative agency under the CWA. Relevant sections of the CWA include Sections 303 and 304, Section 401, Section 402, and Section 404.

CWA Anti-degradation Policy

Federal policy (Code of Federal Regulations [CFR], Title 40, Part 131.6) specifies that each state must develop, adopt, and retain an anti-degradation policy to protect the minimum level of surface water quality necessary to support existing uses. Each state anti-degradation policy must include implementation methods consistent with the provisions outlined in 40 CFR §131.12. On trust land, these issues are addressed by the USEPA.

Safe Drinking Water Act

Minimum national drinking water standards and guidelines for groundwater protection are established through the 1974 Safe Drinking Water Act (amended in 1986 and 1996). Contaminants of concern relevant to domestic water supply are defined as those that pose a public health threat or that alter the aesthetic acceptability of the water. The USEPA regulates contaminants through the development of national primary and secondary Maximum Contaminant Levels for drinking water.

NPDES Permitting Program

Facilities discharging pollutants from point-sources into waters of the United States must obtain a discharge permit under the National Pollutant Discharge Elimination System (NPDES) program. In order to ensure compliance with the CWA anti-degradation policy, USEPA must consider the status of the regional water quality before issuing an individual facility NPDES permit for discharge into impaired waterways. After reviewing an application for an individual facility permit, the permitting authority will issue a permit with specific effluent limits, or Waste Discharge Requirements (WDRs). Construction projects disturbing one or more acres of soil must be covered under the NPDES general permitting process. For tribal projects on trust land, the Tribe proposing the project must apply for coverage under the USEPA's Stormwater General NPDES Permit for Construction Activities. The USEPA's Stormwater General NPDES Permit for Construction Activities also requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must list Best Management Practices that address stormwater runoff rates and quality.

Disaster Relief Act

The Disaster Relief Act of 1974 created the Federal Emergency Management Agency (FEMA), which is responsible for determining flood elevations and floodplain boundaries based on U.S. Army Corps of Engineers (USACE) studies. FEMA is also responsible for distributing Flood Insurance Rate Maps, which are used in the National Flood Insurance Program. These maps identify the locations of special flood hazard areas, including 100-year floodplains. FEMA allows non-residential development in a floodplain; however, construction activities are restricted within the flood hazard areas, depending upon the potential for flooding within each area.

State and Local

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code [Water Code]) provides the basis for surface water and groundwater quality regulation within California. This act established the authority of the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs). The Porter Cologne Act (§13242) requires that a TMDL program of implementation be developed in the Regional Water Quality Control Plans for water bodies listed under Section 303 of the CWA that describes how water quality objectives will be attained.

RWQCB's Anti-degradation Policy

The Porter-Cologne Act requires the State to designate beneficial uses of surface water and groundwater, and to specify water quality objectives designed to protect those uses. These water quality objectives are presented in the *Regional Water Quality Control Plans* (basin plans). Basin plans are developed and periodically reviewed to fulfill the State's requirements of the anti-degradation policy of the CWA. Each basin plan provides a technical basis for determining WDRs and regulatory enforcement action.

California Water Code

The California Water Code designates the California Department of Public Health (CDPH) as the lead agency responsible for developing uniform statewide recycling criteria for each type of use of treated wastewater for the protection of public health. The CDPH and the RWQCBs are directed under the Water Code to regulate treated wastewater production and use. The CDPH has jurisdiction over the production of treated wastewater and the enforcement of California Code of Regulations (CCR) Title 22 for treated wastewater criteria. The RWQCB is responsible for issuing treated wastewater use requirements.

California Code of Regulations, Title 22

This section of the CCR, commonly referred to as "Title 22," is a broad set of regulations dealing with social issues. Title 22 Divisions 4 and 4.5 address environmental and public health issues such as hazardous waste, medical waste, and the protection of drinking water. Chapter 3 establishes the acceptable uses of treated wastewater and wastewater treatment requirements for each use. Under Title 22, the highest level of wastewater treatment is disinfected tertiary recycled water, which may be used for the full range of non-potable uses.

Sustainable Groundwater Management Act

The intent of the Sustainable Groundwater Management Act ([SGMA]; Water Code § 10720 et seq.) is to "enhance local management of groundwater consistent with rights to use or store groundwater… [and] to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater." The SGMA states that "any local agency or combination of local agencies overlying a groundwater basin may elect to be a groundwater sustainability agency for that basin" (Water Code § 10723).

Sonoma County General Plan

The Water Resources Element includes goals, policies, and implementation actions to conserve and protect water resources and water quality. Section 2 discusses water rights regulations, hydrologic systems, major streams and drainage basins, the role of vegetation in the water cycle, and natural underground water storage. Section 3 discusses the County's goals, objectives, and policies related to water resources. Implementation programs are described in Section 4.

City of Rohnert Park General Plan

Chapter 5.4 discusses wastewater and sewer services. Chapter 5.5 discusses water supply and conservation, as well as projected water demand and capacity. Chapter 6.3 discusses water quality, regulations, and pollution. Chapter 7.2 discusses drainage, erosion, stormwater, and flooding. Goals and policies of each chapter are designed to conserve water and protect water quality.

Rohnert Park California Municipal Code

Title 13 of the Rohnert Park Municipal Code defines water and sewer usage regulations for the City and establishes stormwater discharge of the City. Chapters 13.08 through 13.52 are specific to sewer usage, and include provisions for control of sewer construction, source control of toxic substances, and the monitoring and control of the quality and quantity of industrial wastes. Chapter 13.64 is specific to stormwater discharge, and includes provisions to protect and enhance water quality of water bodies consistent with the Federal Clean Water Act (33 U.S.C. § 1251 et seq.) and National Pollutant Discharge Elimination System (NPDES) Phase II stormwater regulations for small municipal storm sewer systems.

3.8.2 ENVIRONMENTAL SETTING

Groundwater

The project site is located in the Laguna de Santa Rosa watershed within the Santa Rosa Valley Basin (Basin). The Basin consists of three sub-basins: the Santa Rosa Plain Sub-Basin, the Healdsburg Area Sub-Basin, and the Rincon Valley Sub-Basin. The project site is located in the Santa Rosa Plain Sub-Basin (Sub-Basin). Several thousand wells pump from the Sub-Basin, including agricultural wells, municipal wells, and rural domestic wells. Water is supplied in the off-reservation vicinity of the project site by private domestic wells, irrigation wells, and local water suppliers. Water suppliers in the area include the City, Sonoma Water, Sonoma State University, the City of Cotati, and Penngrove Water Company (KOMEX, 2007). Direct infiltration of precipitation and infiltration from streams are major sources of groundwater recharge in the Sub-Basin, with minor sources of recharge including infiltration from septic tanks, leaking water pipes, irrigation water in excess of crop requirements, and crop-frost protection applications.

Surface Water

The Laguna de Santa Rosa transects the southwestern portion of the Reservation from east to west. The Laguna de Santa Rosa is the Russian River's largest tributary and one of the larger freshwater wetlands in northern California (Sonoma Land Trust and Laguna de Santa Rosa Foundation, 2003). The Bellevue-Wilfred Channel contains gently flowing water year-round and flows into the Laguna de Santa Rosa. The Bellevue-Wilfred Flood Control Channel and the Laguna de Santa Rosa are classified by the County and the City as flood control channels and are managed by Sonoma Water (NMFS, 2008).

A portion of the southwest area of the Reservation is within a 100-year floodplain, however no structures or buildings are located in this area. The general drainage pattern on the project site flows in a southwesterly direction towards the Laguna de Santa Rosa. Stormwater from the existing Resort and parking lot drains into previously engineered bioswales thence retention basins on-reservation. The bioswales and retention basins can hold a maximum of 14 af of stormwater, which can then be metered into Labath Creek. A small man-made drainage ditch occurs west of the project site. The drainage ditch runs north to south along Langner Avenue to Labath Creek and carries water after heavy periods of rain.

Water Quality

In compliance with the CWA, the North Coast RWQCB (NCRWQB) has established water quality objectives for inland surface waters within its jurisdiction. The Laguna de Santa Rosa is currently on the list of CWA 303(d) impaired waterbodies. The NCRWQCB has placed limitations on the discharge of treated wastewater into the Laguna de Santa Rosa by the Santa Rosa Sub-Regional Wastewater Treatment Plant (WWTP) based on flows of the Russian River.

Wells in the Cotati Basin measured from 2007 to 2010 ranged from 241 to 638 mg/L of total dissolved solids (USGS, 2013). These concentrations compare to the secondary maximum contaminant level (MCL) of 500 mg/L, with one well measuring above these levels in 2007 (USEPA, 2019). MCLs are USEPA standards set for allowable levels of constituents in drinking water. Primary standards, developed to protect public health, are legally enforceable. Secondary standards, generally for the protection of aesthetic qualities such as taste, odor, appearance, etc., are generally non-enforceable (DWR, 2016).

The Tribe has been monitoring groundwater in the vicinity of the Resort since 2012 to determine baseline water levels and assess potential groundwater impacts of the Resort on the groundwater basin and surrounding wells. The program involves monthly monitoring of groundwater elevations in up to 12 monitoring wells within 2 miles of the Resort. The monitoring wells were also sampled for contaminants. Monitoring data has shown that the groundwater basin in the vicinity of the Reservation is currently stable.

Water and Wastewater Infrastructure

The Resort's existing water supply system includes two water supply wells (Well 1 and Well 2), a water treatment plant (WTP), a water storage tank, and a water distribution pump system, as discussed in **Section 2.2.1**. These facilities are located on-reservation. Well 1 is located approximately 1,600 feet southwest of the WTP and Well 2 is located within the WTP.

The Resort's wastewater disposal, as described in Section 2.2.1, is conducted pursuant to the existing Joint Exercise of Powers Agreement (JEPA) between the City and the Tribe (City of Rohnert Park & Federated Indians of Graton Rancheria, 2012).

Pursuant to Sections 4.4 and 11.8.7 of the Compact and the JEPA, the City provides wastewater treatment and disposal services to the Resort (Compact, 2012; City of Rohnert Park, 2012). The wastewater produced by the Resort is gravity-collected in a sanitary sewer system and directed to a lift station. The lift station pumps the sewage through a force sewer main off-reservation to the City's sanitary sewer system, which conveys the sewage to the Laguna WWTP operated by the City of Santa Rosa.

3.8.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section IX of the Checklist (**Appendix B**) and have been used in this section to evaluate the potential off-reservation impacts of the Proposed Project on off-reservation water resources, hydrology, and water quality. Such impacts are considered significant if they would:

- Violate any off-reservation water quality standards or WDRs;
- Substantially deplete off-reservation groundwater supplies or interfere substantially with groundwater recharge such that there should be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion of siltation off-reservation;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding off-reservation;
- Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff off-reservation;
- Place within a 100-year flood hazard area structures, which would impede or redirect off-reservation flood flows; or
- Expose off-reservation people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Methodology

Assessment of potential impacts to water resources relied on previously gathered data and ongoing well level monitoring data. Analysis relied on existing water use and wastewater generation data.

Impact 3.8-1: The Proposed Project could violate water quality standards or WDRs during construction but not operation.

Construction

As discussed in **Section 3.7**, a hazardous material spill or leak could pose a temporary hazard to off-reservation water quality during construction of the Proposed Project. Prior to and during construction of the Proposed Project, the General Construction NPDES permit from the USEPA under federal requirements of the CWA shall be complied with. The NPDES permit will contain specific WDRs based on water quality or available technology limitations (USEPA, 2019).

Per the NPDES, the required SWPPP would be prepared and implemented prior to construction of the Proposed Project, and would contain applicable BMPs to reduce off-reservation impacts associated with stormwater runoff and water quality. The SWPPP would ensure the flow of stormwater on the project site into the engineered bioswales is appropriately filtered before flowing into the on-reservation stormwater retention basins. Implementation of **Mitigation Measures 3.5-1, 3.7-2,** and **3.8-1** would decrease off-reservation impacts associated with water quality and discharge. There would be a **less-than-significant impact with mitigation.**

Operation

Operation of the Proposed Project would occur indoors within the existing Resort. Therefore, off-reservation water quality would not be affected. In addition, the Tribe currently implements a comprehensive water monitoring program that entails sampling for contaminants in surface and groundwater and monitoring to ensure Resort activities do not endanger water supply or water quality. There would be a **less-than-significant-impact.**

Mitigation

3.8-1 A SWPPP will be prepared for the Proposed Project that identifies BMPs to be implemented during construction of the Proposed Project. Applicable BMPs (**Appendix D**) to ensure water quality standards are met include the following:

- Should excavation occur during the rainy season, stormwater runoff from the project site shall be regulated through temporary fixtures including silt fencing and/or basins with multiple discharge points to natural drainages and energy dissipaters.
- Stockpiles of loose material shall be covered and straw wattles/fiber rolls shall be placed around the base of all stockpiles and runoff diverted away from exposed soil material.
- Trapped sediment shall be removed from the basin or silt fencing and placed at a suitable location on-site, away from concentrated flows, or removed to an approved disposal site.
- Temporary erosion control measures including straw wattles/fiber rolls and silt fencing shall be provided until perennial revegetation or landscaping is established.
- No disturbed surfaces shall be left without erosion control measures in place.
- Impervious surfaces including parking lots and rooftops will be designed and constructed so that stormwater runoff will be directed into storm drains that would subsequently direct the flow into existing on-reservation engineered bioswales and stormwater retention basins.

Impact 3.8-2: The Proposed Project would not deplete off-reservation groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or lowering of the local groundwater table.

Project components include the expansion of employee office areas and associated facilities to support existing employees. Therefore, the Proposed Project would not result in an increase in water use. The Resort is currently supplied water from two groundwater production wells located on-reservation that will continue to operate and serve the Proposed Project. There would be a **less-than-significant impact.**

Impact 3.8-3: The Proposed Project would not alter the existing drainage pattern of the site or area, including through the alteration of a course of a stream or river, in a manner that would result in substantial erosion or siltation off-reservation.

Construction of the Proposed Project would include minor earth-moving activities. Minimal grading would occur on the project site and limited soil would be excavated. The Proposed Project would be constructed over existing paved and disturbed level areas, and any excavated soil would be disposed of on-reservation through balanced cut and fill. Implementation of **Mitigation Measures 3.5-1** and **3.8-1** would further decrease off-reservation impacts associated with potential erosion and siltation. There would be a **less-than-significant impact with mitigation.**

Impact 3.8-4: The Proposed Project would not substantially alter the existing drainage pattern of the area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding off-reservation.

The general drainage pattern on the project site flows in a southwesterly direction towards the Laguna de Santa Rosa. The southeastern corner of the project site drains to the southwest, ultimately discharging to Labath Creek immediately south of the project site. The Proposed Project would be constructed over existing paved and disturbed areas, and would not alter the existing drainage pattern of the surrounding area. There would be a **less-than-significant impact**.

Impact 3.8-5: The Proposed Project would not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff off-reservation.

The Proposed Project would be constructed over existing paved and disturbed areas, and would not alter the existing drainage pattern of the area or increase impervious surface area. As discussed in **Section 3.7**, a hazardous material spill or leak could pose a temporary hazard to off-reservation water quality during construction of the Proposed Project.

Prior to and during construction of the Proposed Project, the General Construction NPDES permit from the USEPA under federal requirements of the CWA would be complied with. Per the NPDES, the required SWPPP would be prepared and implemented for the Proposed Project, and would contain applicable BMPs to reduce off-reservation impacts associated with stormwater runoff and water quality. Implementation of **Mitigation Measures 3.5-1, 3.7-2,** and **3.8-1** would decrease off-reservation impacts associated with water quality. There would be a **less-than-significant impact with mitigation.**

Impact 3.8-6: The Proposed Project would not place structures within a 100-year flood hazard area, and therefore would not impede or redirect off-reservation flows.

The project site is not located within a 100-year floodplain. No flood control channels would be impacted by the Proposed Project. There would be **no impact**.

Impact 3.8-7: The Proposed Project would not expose off-reservation people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a dam or levee.

The Proposed Project would not result in development within a 100-year floodplain. No flood control dams or levees are located within the vicinity of the project site, and the Proposed Project would not result in disturbance to off-reservation dams or levees. The Proposed Project would not contribute significant additions of surface water that could potentially affect downstream levees or other flood control devices. Therefore, the Proposed Project would not result in an increased risk of flooding, including flooding as a result of failure of a dam or levee. There would be **no impact**.

3.9 LAND USE

This section addresses the existing land uses and zoning of the surrounding region and evaluates potential off-reservation environmental impacts that may result from implementation of the Proposed Project. Land use is defined as the manner at which land is used and modified by its corresponding community. Zoning is the process by which a county or city is divided into areas, each of which are designated with characteristic land use types and corresponding restrictions.

3.9.1 REGULATORY FRAMEWORK

State and Local

The Proposed Project is on trust land and is not subject to State or local land use laws and regulations. However, such laws and regulations apply to off-reservation land in the vicinity of the project site.

Williamson Act

The California Land Conservation Act of 1965, better known as the Williamson Act, enables local governments to enter into contracts with private land owners to maintain agriculture or open space on properties in exchange for lower property tax assessments. Land uses compatible with agricultural production are determined by the county or city administering the contract. Contracts have a term of at least 10 years and are automatically renewed unless a notice of cancelation is given (CDC, 2017).

Santa Rosa Plain Conservation Strategy

US Fish and Wildlife Service (USFWS), in cooperation with the US Environmental Protection Agency (USEPA), US Army Corps of Engineers (USACE), California Department of Fish and Wildlife (CDFW), and the Regional Water Quality Control Board (RWQCB), have developed a strategy dedicated to conserving and contributing to the recovery of certain federally listed species of the Santa Rosa Plain and their habitats. The Santa Rosa Plain Conservation Strategy identifies potential habitat and survey guidelines for five special-status species known to occur within the Santa Rosa Plain; CTS, Burke's goldfields, Sonoma sunshine, Sebastopol meadowfoam, and the many-flowered navarretia (USFWS, 2005a). The Santa Rosa Plain Conservation Strategy accomplishes conservation in a manner that protects stakeholders' (both public and private) land use interests, and supports issuance of an authorization for incidental take of CTS and special-status plants that may occur in the course of carrying out project activities on the Santa Rosa Plain.

Laguna de Santa Rosa Protection Plan

The project site is within the core of the Laguna de Santa Rosa Protection Plan. Public concern for the protection and management of biological resources of the Laguna de Santa Rosa and adjacent Santa Rosa Plain has resulted in several planning efforts culminating with the establishment of the Laguna de Santa Rosa Protection Plan. The Laguna de Santa Rosa Protection Plan is a partnership of the Sonoma Land Trust and the Laguna de Santa Rosa Foundation, together with the California State Coastal Conservancy (Sonoma Land Trust and Laguna de Santa Rosa Foundation, 2003). The goal of the Laguna De Santa Rosa Protection Plan is to preserve wetlands, vernal pools, on oak savannah, riparian woodlands, and special-status species.

Sonoma County General Plan

The Land Use Element provides the distribution, location and extent of uses of land for housing, business, industry, open space, agriculture, natural resources, and other uses. For each appropriate land use category, the plan includes standards for population density and building intensity. The Land Use Element and its policies serve as framework for the development and use of land through 2020. The County recognizes that the policies of the plan represent a legislative balance between individual rights of property owners and the health, safety, and welfare of the community. Decisions made pursuant to the plan shall further community goals and objectives while not unconstitutionally abridging property rights.

Sonoma County Zoning Ordinance

Chapter 26 of the Sonoma County Municipal Code contains the Zoning Ordinance for the County and regulates the location and uses of structures and land. The Zoning Ordinance establishes various districts within the unincorporated territory of the County and designates lawful permitted land uses. Within these districts, it is unlawful to erect, construct, alter or maintain certain buildings, carry on certain trades or occupations, or conduct certain uses of land or buildings. In addition, the Zoning Ordinance designates the limitation of height and bulk of future building, and maintains that certain open areas be required around future buildings.

The purpose of the Zoning Ordinance is to promote and protect the public welfare, to provide for the orderly and beneficial land use of the County, to protect economic stability of agricultural, residential, commercial, industrial and other communities within the County, to protect and conserve the scenic resource characteristics of the County, and to provide for the orderly processing of development projects as anticipated by the California Permit Streamlining Act. According to the Agricultural Resources Element, the purpose of Agricultural zones and policies is to "ensure the stability and productivity of the County's agricultural lands and industries" (Sonoma County, 2008).

3.9.2 ENVIRONMENTAL SETTING

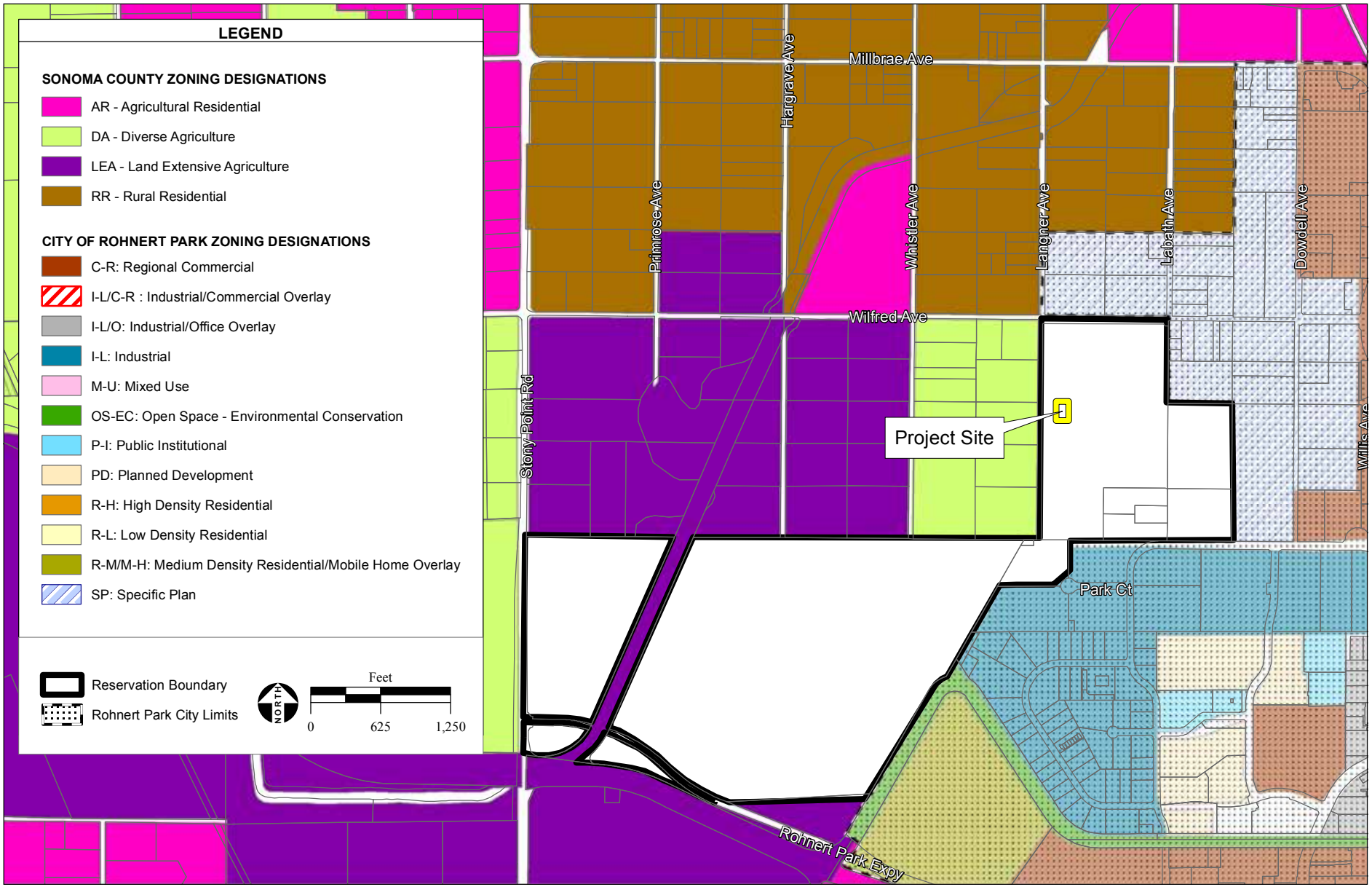
The Tribe's Reservation is situated within the Santa Rosa Plain, also known as the Cotati Valley, which is bounded by the Sonoma Mountains to the east, and the Mayacama Mountains to the west. The project site consists of a portion of the existing Resort as well as previously paved and disturbed areas used for employee parking. Adjacent land uses to the west of the project site include agricultural land and open space and rural residential beyond that.

The Reservation is bordered to the west by areas under jurisdiction of the County (**Figure 3.9-1**). Much of the County's unincorporated area are zoned for various intensities of agricultural uses. Adjacent County zoning designations to the project site include Land Extensive Agriculture (LEA), Diverse Agriculture (DA), and Rural Residential (RR).

3.9.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section X of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation impacts of the Proposed Project on off-reservation land use. Such impacts are considered significant if they would:



SOURCE: Sonoma County ActiveMap GIS Data for General Plan, 2016; City of Rohnert Park General Plan, updated 1/2017; AES, 6/11/2019

Figure 3.9-1
Surrounding Zoning

- Conflict with any off-reservation land use plan, policy, or regulation of an agency adopted for the purpose of avoiding or mitigating an environmental effect.
- Conflict with any applicable habitat conservation plan or natural community conservation plan covering off-reservation lands.

Methodology

Impact analysis compares existing conditions to foreseeable changes likely to result from implementation of the Proposed Project. The evaluation of off-reservation environmental impacts associated with land use consisted of field observations, a review of planning documents, and a review of site plans of the Proposed Project.

Impact 3.9-1: The Proposed Project would not conflict with any off-reservation land use plan, policy, or regulation of an agency adopted for the purpose of avoiding or mitigating an environmental effect.

The Proposed Project would be constructed and operated on trust land, and would not impact off-reservation land uses. The Proposed Project would not result in changes to off-reservation land use, and, as such, would remain consistent with local plans and policies. The Proposed Project would not conflict with off-Reservation land use plans, policies, or regulations adopted by agencies for the purpose of avoiding or mitigating an environmental impact. There would be **no impact**.

Impact 3.9-2: The Proposed Project would not conflict with provisions of an adopted Habitat Conservation Plan (HCP) or Natural Community Conservation Plan (NCCP) applicable to off-reservation lands.

No formally adopted HCP, NCCP, or state HCPs have been adopted that are applicable to the Proposed Project. The Proposed Project would be constructed and operated on trust land in areas previously developed and disturbed. There would be **no impact**.

3.10 NOISE

This section addresses potential noise issues of the project site, evaluates potential off-reservation impacts that may result from implementation of the Proposed Project, and presents mitigation measures to reduce any identified impacts to off-reservation sensitive receptors. Noise is defined as unwanted sound. Sensitive receptors include residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, parks, and other outdoor recreation areas that are considered more sensitive to noise than commercial and industrial land uses.

3.10.1 REGULATORY FRAMEWORK

Federal

Federal regulations establish noise limits for medium and heavy trucks (defined as a vehicle weighing more than five tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR) 205 (B). The federal truck pass-by noise standard is 80 decibels (dB) at 50 feet from the vehicle pathway centerline. Federal regulations governing truck manufacturing implement these controls.

The U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) provides noise standards to encourage the control of noise at its source in cooperation with other Federal departments and agencies, and encourage land use patterns for housing and other noise sensitive urban needs that will provide a suitable separation between them and major noise sources. HUD considers an acceptable noise level for residential units to be 65 dB (24 CFR Part 51).

The Federal Interagency Committee on Noise

The Federal Interagency Committee on Noise (FICON) provides guidance in how to assess noise impacts resulting from aircraft operations, shown in **Table 3.10-1** below. However, although FICON recommendations were specifically developed to assess aircraft noise impacts, these criteria have been applied to other sources of noise similarly described in terms of cumulative noise exposure metrics.

TABLE 3.10-1: SIGNIFICANCE OF CHANGES IN NOISE EXPOSURE LEVELS

AMBIENT NOISE LEVEL WITHOUT PROJECT, LDN	INCREASE REQUIRED FOR SIGNIFICANT IMPACT
< 60 dB	+ 5.0 dB or more
60 to 65 dB	+ 3.0 dB or more
> 65 dB	+ 1.5 dB or more
SOURCE: FICON, 1992	

State and Local

The Proposed Project is located on trust land and is therefore not subject to State or local laws and regulations. However, such laws and regulations apply to off-reservation land in the vicinity of the Proposed Project. The State of California establishes noise limits for vehicles licensed to operate on off-reservation public roads (CHP, 2015). For heavy trucks, the State pass-by noise standard is equal to the federal standard (80 dB). The State pass-by standard for light trucks and passenger cars (defined as a vehicle weighing less than three tons, gross vehicle weight rating) is also 80 dB at 15 m from the centerline.

These standards are implemented in two ways: (1) controls on vehicle manufacturers; and (2) legal sanctions from state and local law enforcement officials against off-reservation vehicle operators in violation of the standards. The State has also established noise insulation standards for new off-reservation multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (CNIS; Title 24, CCR). The CNIS set forth an off-reservation interior day-night average noise level (Ldn) standard of 45 dB in any habitable room. They require an acoustical analysis demonstrating how off-reservation dwelling units have been designed to meet this interior standard where such units are proposed in off-reservation areas subject to noise levels greater than 60 dB Ldn.

Sonoma County General Plan

The Noise Element of the plan provides a policy framework for addressing potential noise impacts encountered in the planning process. The Noise Element is intended to provide ways to reduce existing and future noise conflicts. It includes policies and measures to achieve noise compatibility between land uses. In accordance with State law and guidelines, the Noise Element identifies noise sources and noise sensitive land uses. It quantifies noise levels using noise exposure contours for current and projected conditions within the County. This noise exposure information serves as a basis for achieving land use compatibility within each community and provides baseline levels and noise source identification for use in a noise control ordinance or during the review of proposed development projects. Additionally, the plan provides maximum allowable noise exposures, shown in **Table 3.10-2** below.

TABLE 3.10-2: MAXIMUM ALLOWABLE EXTERIOR NOISE EXPOSURES FOR NON-TRANSPORTATION NOISE SOURCES

HOURLY NOISE METRIC[1], DBA	DAYTIME (7 AM TO 10 PM)	NIGHTTIME (10 PM TO 7 AM)
L50 (30 minutes in an hour)	50	45
L25 (15 minutes in an hour)	55	50
L08 (4 minutes 48 seconds in an hour)	60	55
L02 (72 seconds in an hour)	65	60
[1]The sound level exceeded n% of the time in any hour. For example, the L50 is the value exceeded 50% of the time or 30 minutes in any hour; this is the median noise level. The L02 is the sound level exceeded 1 minute in any hour.		
SOURCE: Sonoma County, 2008		

3.10.2 ENVIRONMENTAL SETTING

Acoustical Background

Noise is often defined as unwanted sound. Pressure variations that occur frequently (at least 20 times per second) for the human ear to detect are called sound. The number of pressure variations per second is the frequency of sound, and is expressed as cycles per second in units of hertz (Hz). The perceived loudness of sound is dependent on factors related to sound pressure level and frequency content. The decibel scale measures sound levels using the hearing threshold (20 micropascals of pressure) as the point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum (20 Hz to 20,000 Hz). As a result, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes frequencies below 1,000 Hz and above 5,000 Hz to better represent the human ear's sensitivity to mid-range frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard method of frequency de-emphasis and is typically applied to community noise measurements. In practice, the level of a sound source is measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. All noise levels reported herein are A-weighted unless otherwise stated. The effects of noise on individuals can be divided into three categories:

1. Subjective effects of annoyance, nuisance, dissatisfaction;
2. Interference with activities such as speech, sleep, and learning; and
3. Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the third category. There is no completely satisfactory way to measure subjective effects of noise or corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists, and different noise tolerances develop (Caltrans, 2013). Generally, most noise is generated by transportation systems, primarily motor vehicles, aircraft, and railroads. Poor urban planning may also give rise to noise pollution, since juxtaposing industrial and residential land uses can adversely affect residential acoustic environments. Prominent sources of indoor noise include office equipment, factory machinery, appliances, power tools, lighting hum, and audio entertainment systems. A method of predicting human reaction to a new noise environment is comparison to the existing environment (or ambient noise) to which one is accustomed to. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be to those hearing it. With regard to increases in A-weighted noise level, the following relationships occur (Caltrans, 2013):

- Under controlled conditions in an acoustics laboratory, the trained ear is able to discern changes in sound levels of 1 dBA;
- Outside such controlled conditions, the trained ear can detect changes of 2 dBA in normal environmental noise;
- It is widely accepted that the average human ear, however, can barely perceive noise level changes of 3 dBA;
- A change in level of 5 dBA is a readily perceptible increase in noise level; and
- A 10-dBA change is recognized as twice as loud as the original source.

Noise levels are measured on a logarithmic scale. On a logarithmic scale, the sum of two noise sources of equal loudness is 3 dBA greater than noise generated by only one noise source. To apply this formula to a specific noise source, in areas where existing levels are dominated by traffic, a doubling in traffic volume will increase ambient noise levels by 3 dBA. Similarly, a doubling in heavy equipment use would also increase ambient noise levels by 3 dBA. A 3 dBA increase is the smallest change in noise level detectable to the average individual. A change in ambient sound of 5 dBA can begin to create concern. A change in sound of 7 to 10 dBA typically elicits extreme concern (Caltrans, 2013).

An individual's noise exposure is a measure of noise over a period of time. Community noise is the product of multiple distant noise sources, which constitute a relatively stable background noise exposure. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. The addition of short duration noise sources such as aircraft flyovers, moving vehicles, and sirens makes community noise constantly variable throughout a day. These successive additions of sound to the community noise environment vary the community noise level, requiring the measurement of noise exposure over a period of time to characterize a community noise environment and evaluate cumulative noise impacts.

Nighttime ambient noise levels are typically lower than daytime ambient noise levels. For this reason, and because of the potential for sleep disturbance, individuals tend to be more sensitive to increased noise levels at night. Therefore, increases in nighttime noise have a greater impact on the community noise environment than increases in daytime noise.

Stationary "point" sources of noise, including heating, ventilation, and air conditioning systems (HVAC) and stationary mobile sources such as idling vehicles, decrease at a rate of 6 dBA to 9 dBA per doubling of distance from the source, depending on environmental conditions (i.e., atmospheric conditions and noise barriers, either vegetative or manufactured, etc.) (Caltrans, 2013). Widely distributed noises, such as a large industrial facility spread over many acres or a street with moving vehicles (a "line" source), would typically attenuate at a lower rate, approximately 4 to 6 dBA per doubling distance from the source (Caltrans, 2013). Noise from large construction sites (with heavy equipment moving dirt and trucks entering and exiting the site daily) would have characteristics of both "point" and "line" sources. Attenuation would generally range between 4.5 and 7.5 dBA per doubling of distance.

Table 3.10-3 shows maximum noise levels of typical construction equipment. Stationary point sources of construction noise decrease at a rate of 6 to 9 dBA per doubling of distance from the source, depending on environmental conditions. An attenuation factor of 3.0 dBA per doubling of distance is appropriate for this analysis given the flat topography and lack of vegetation surrounding the project site. Not all equipment listed may be used for construction of the Proposed Project.

TABLE 3.10-3: STANDARD CONSTRUCTION EQUIPMENT NOISE

Type of Equipment	Maximum Level, dB at 50 feet
Backhoe	78
Compactor	83
Air Compressor	78
Dozer	82
Dump Truck	76
Excavator	81
Generator	81
Jackhammer	89
Pneumatic Tools	85
SOURCE: FWHA, 2006.	

Vibration

The effects of groundborne vibration typically cause only a nuisance to individuals, but at extreme vibration levels, damage to buildings may occur. Although groundborne vibration can be felt outdoors, it is typically an annoyance only indoors where the associated effects of the building shaking can be notable. Groundborne noise is an effect of groundborne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may consist of the rattling of windows or dishes on shelves.

Peak particle velocity (PPV) is often used to measure vibration. PPV is the maximum instantaneous peak (inches per second) of the vibration signal. Scientific studies have shown that human responses to vibration vary by the source of vibration, which is either continuous or transient. Continuous sources of vibration include construction, while transient sources include truck movements.

Generally, the thresholds of perception and annoyance are higher for transient sources than for continuous sources. Structural damage can occur when PPV values are 0.5 inches per second or greater. Annoyance can occur at levels as low as 0.1 inches per second and become strongly perceptible at approximately 0.9 inches per second (Caltrans, 2004). **Table 3.10-4** shows PPV vibration levels caused by representative construction equipment, as published by the Federal Transit Administration (FTA).

TABLE 3.10-4: VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

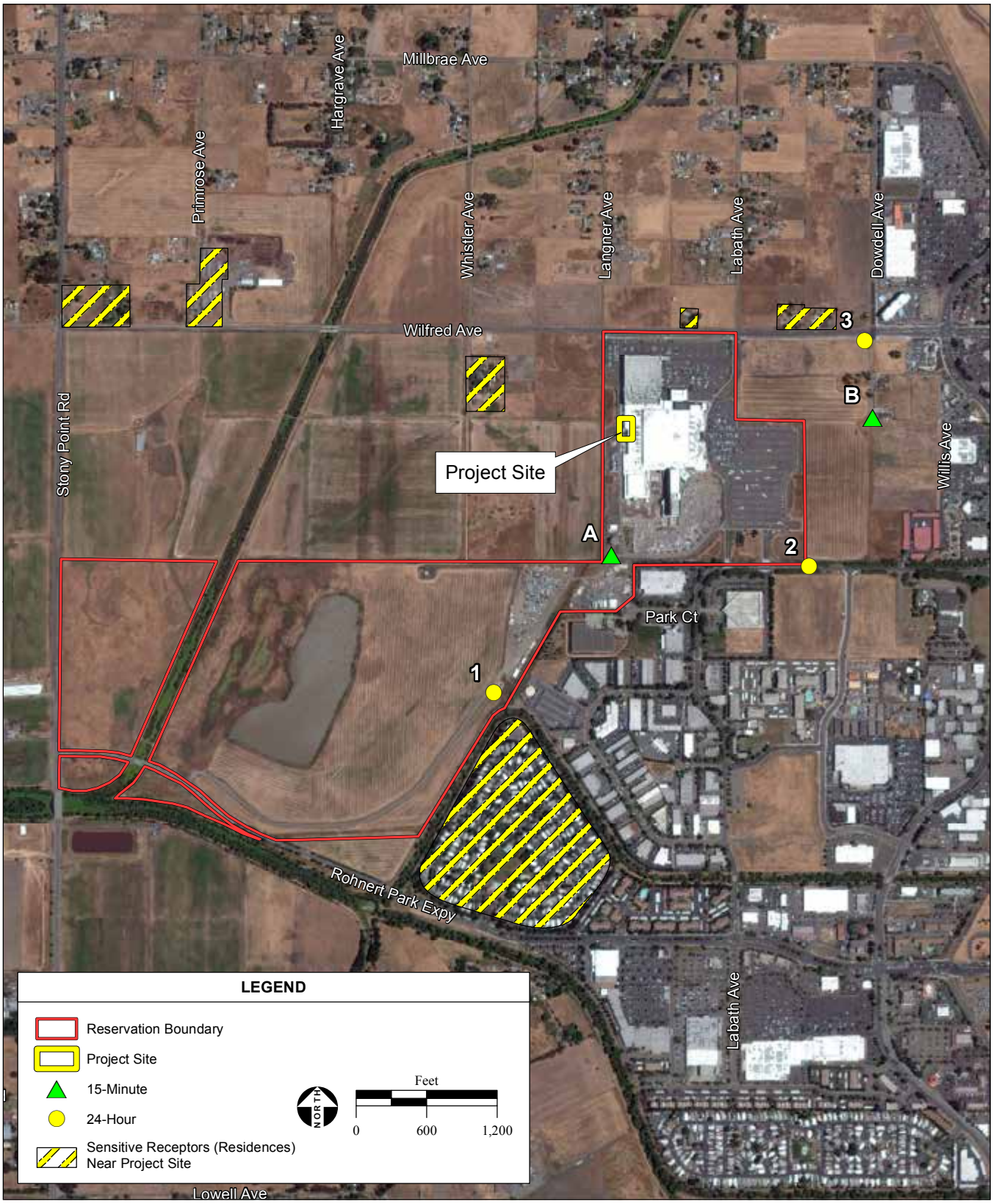
EQUIPMENT	PPV AT 25 FEET (IN/SEC)
Large bulldozer	0.089
Excavator	0.089
Scraper	0.089
Loaded trucks	0.076
Small bulldozer	0.003
SOURCE: FTA, 2006.	

Noise Environment

The noise environment of the project site and adjacent areas is primarily influenced by Resort activity and HVAC systems. The off-reservation area surrounding the project site is primarily agricultural land and rural residential. In order to characterize existing ambient noise conditions in the off-reservation area surrounding the project site, three 24-hour and two 15-minute noise measurements were conducted using Quest Sound Pro SE/DL sound level meters. Monitoring locations are shown in **Figure 3.10-1**. An acoustical calibrator was used to calibrate the Quest Sound Pro SE/DL sound level meters before and after use. Instrumentation satisfies the Type II (precision) requirements. As shown in **Table 3.10-5**, monitoring data indicates that lower noise levels are located furthest from road intersections.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others, sensitivity being a function of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and other outdoor recreation areas are considered more sensitive to noise than commercial and industrial land uses, and are referred to as sensitive receptors.



SOURCE: DigitalGlobe aerial photograph, 7/8/2016; AES, 5/29/2019

Figure 3.10-1
Noise Measurement Locations

TABLE 3.10-5: EXISTING NOISE LEVELS OF SURROUNDING AREA

SITE	MONITORING LENGTH	AVERAGE L_{DN} (DB)
1	24-Hour	49.6
2	24-Hour	69.6
3	24-Hour	65.6
A	15-Minute	53.7
B	15-Minute	48.0
SOURCE: AES, 2018		

Figure 3.10-1 shows sensitive receptor locations relative to the project site. The nearest residences to the project site are located on Whistler Avenue, approximately 0.25 miles northwest of the project site where groundbreaking would occur. Additionally, Fiori Estates and the Reserve at Dowdell are approximately 0.40 miles from the project site and 0.50 miles from the construction access road. As shown in **Table 3.10-5**, data indicates that noise levels increase further from the project site and nearer to US-101. The project site and existing Resort have lower noise levels when compared to noise levels of surrounding commercial buildings and US-101.

3.10.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section XII of the Checklist (**Appendix B**) and have been used in this section to evaluate the potential impacts of the Proposed Project on the off-reservation ambient noise level. Accordingly, an impact is considered significant if it would result in:

- Exposure of off-reservation individuals to noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of off-reservation persons to excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the off-reservation vicinity of the Proposed Project;
- A substantial temporary or periodic increase in ambient noise levels in the off-reservation vicinity of the Proposed Project;

A noise impact from a transportation-related source is considered significant if the incremental increase in noise is greater than 5.0 dBA Leq in a noise environment of 60 dBA CNEL or less, greater than 3.0 dBA Leq in a noise environment between 60 and 65 dBA CNEL, or greater than 1.5 dBA Leq in a noise environment over 65 dBA CNEL (FICON, 1992). An impact would be considered significant if the Proposed Project were to increase ambient noise levels in off-reservation areas by more than 1.5 dBA, 3.0 dBA, or 5.0 dBA, depending on the baseline ambient noise level at each location analyzed.

HUD provides an acceptable noise threshold as 65 dB for residential noise receptors. Community noise exposures of less than 50 dBA during the daytime and 45 dBA during nighttime hours (both at an hourly noise metric of L50) are considered acceptable by the County (**Table 3.10-2**). The County's significance threshold for sensitive receptors is lower than HUD's significance threshold of 65 dBA. An audible increase in the day/night noise level of over 50 dBA Ldn at the nearest off-reservation sensitive receptor would be considered potentially significant.

Excessive groundborne vibrations are defined as 0.5 PPV or greater at the nearest off-reservation non-residential structure, and exceeding 0.1 PPV at the nearest off-reservation residence (Caltrans, 2004). Therefore, an off-reservation impact is considered potentially significant if construction and/or operation of the Proposed Project would result in an increase of 0.5 PPV at the nearest off-reservation non-sensitive structure, or 0.1 PPV at the nearest off-reservation sensitive receptor.

Methodology

Noise measurement results described in **Section 3.10.2** were used to identify off-reservation baseline noise levels. The off-reservation baseline noise levels were then compared to applicable significance thresholds. Federal Highway Administration (FHA) guidelines were used to determine off-reservation noise levels along roadways in the vicinity of the Project site.

Impact 3.10-1: The Proposed Project could expose off-reservation individuals to noise levels in excess of standards established in a local general plan or noise ordinance, or applicable standards of other agencies.

Construction

Construction of the Proposed Project would consist of ground clearing, earthwork, demolition, foundation construction, erection of buildings, and finishing work. Construction would be conducted on-reservation using standard construction equipment. Noise levels for standard construction equipment are shown in **Table 3.10-3**. Construction noise impacts would be significant if extensive nighttime operations were to occur or if excessively loud equipment was regularly used.

Noise from large construction sites (with heavy equipment and trucks entering and exiting the project site daily) would have characteristics of both "point" and "line" sources. Attenuation would range between 4.5 and 7.5 dBA per doubling of distance. A conservative attenuation factor of 3.0 dBA per doubling of distance is appropriate given the flat topography and lack of obstructing vegetation in the vicinity of the project site. Based on **Table 3.10-3**, the maximum projected construction noise level on the project site would be conservatively approximately 89 dBA. However, not all equipment would be used simultaneously or on a daily basis. Thus, the average noise level would be significantly lower.

Using an attenuation factor of 3.0 dBA Leq per doubling of distance, maximum average sound levels at the nearest sensitive receptors (approximately 0.25 miles northwest of construction activity) would be approximately 77.75 dBA Leq. This level is higher than the County threshold of 50 dBA Leq for construction noise and HUD's threshold of 65 dBA for nearby sensitive receptors. However, construction activity would be temporary, and would occur during daylight hours. To further reduce construction noise levels, **Mitigation Measure 3.10-1** will be implemented during construction. There would be a **less-than-significant impact with mitigation.**

Operation

Baseline noise measurements show that ambient noise levels are greater nearer to US-101 and further from the project site (**Table 3.10-5**). The project site is currently developed, therefore, operational noise would not exceed existing ambient noise levels at nearby sensitive receptors and would not result in increases to ambient noise levels above applicable standards. Operation of the Proposed Project would occur indoors within the existing Resort. Therefore, operation of the Proposed Project would not generate off-reservation noise that would exceed applicable federal, State, or County noise standards or ordinances discussed in **Section 3.10.1**. There would be a **less-than-significant impact**.

Mitigation

3.10-1 To further reduce impacts from noise associated with the Proposed Project, outdoor construction activities shall be limited to weekdays between the hours of 7:00 am and 10:00 pm to the extent feasible.

Impact 3.10-2: The Proposed Project would not expose off-reservation individuals to excessive groundborne vibration or groundborne noise levels.

Construction

Construction activities for the Proposed Project would generally consist of standard earthmoving equipment shown in **Table 3.10-3**. Excessive vibration is usually only an issue when construction requiring the use of equipment with high vibration levels (i.e., compactors, large dozers, etc.) occurs within 25 to 100 feet of an existing structure. The nearest off-reservation sensitive receptors are located approximately 0.25 miles from the project site. **Table 3.10-6** provides estimated construction vibration levels at these distances.

TABLE 3.10-6: PREDICTED PPV AT 1,300 FEET FROM CONSTRUCTION

EQUIPMENT	REFERENCE PPV (INCHES/SECOND) AT 25 FEET	PREDICTED PPV (INCHES/SECOND) AT 0.25 MILES (1,320 FEET)
Large bulldozer	0.089	0.00023
Excavator	0.089	0.00023
Scraper	0.089	0.00023
Loaded Truck	0.076	0.00019
Small bulldozer	0.003	0.000007

NOTES: PPV was predicted using the equation $PPV_{predicted} = PPV_{ref}(D_{ref} / D_{source})^{1.5}$
SOURCE: FTA, 2006.

The predicted PPV levels for construction of the Proposed Project would be below the significance thresholds of 0.5 PPV for non-residential structures and 0.1 PPV for off-reservation residences. There would be a **less-than-significant impact**.

Operation

Operation of the Proposed Project would occur indoors within the existing Resort, and would not include significant sources of groundborne vibrations. Therefore, the Proposed Project would not expose individuals to excessive groundborne vibrations. There would be a **less-than-significant impact.**

Impact 3.10-3: The Proposed Project would not result in a substantial permanent increase in ambient noise levels to the surrounding off-reservation area.

Baseline noise measurements show that ambient noise levels are greater nearer to US-101 and further from the project site (**Table 3.10-5**). Operation of the Proposed Project would occur indoors within the Resort. Resort activity and the number of permanent employees would not change with implementation of the Proposed Project. Therefore, the Proposed Project would not result in a substantial permanent increase in ambient noise levels to off-reservation areas. There would be a **less-than-significant impact**.

Impact 3.10-4: The Proposed Project could result in a substantial temporary increase in ambient noise levels to the surrounding off-reservation area.

As discussed in **Impact 3.10.1**, construction of the Proposed Project would result in a temporary increase in off-reservation noise levels. The conservative analysis described in **Impact 3.10.1** concluded that maximum construction noise levels could reach approximately 77.75 dBA Leq. This level is higher than the County threshold of 50 dBA Leq for construction noise and HUD's threshold of 65 dBA for nearby sensitive receptors. However, not all equipment would be used simultaneously, and not all equipment would be used on a daily basis. Thus, the actual noise level would be lower. Implementation of **Mitigation Measure 3.10-1** would further reduce noise impacts to off-reservation sensitive receptors. There would be **a less-than-significant impact with mitigation**.

3.11 POPULATION AND HOUSING

This section addresses the existing population and housing of the project site and surrounding region and evaluates potential off-reservation growth-inducing effects that may result from implementation of the Proposed Project. Growth inducing effects are effects that foster economic or population growth, which could result if a project established substantial new permanent employment opportunities or resulted in housing displacement, necessitating the construction of replacement housing elsewhere.

3.11.1 REGULATORY FRAMEWORK

State and Local

The project site is located on trust land and is not subject to State or local laws and regulations concerning population and housing. However, such laws and regulations apply to off-reservation land in the vicinity of the project site.

Sonoma County General Plan

Government Code Section 65580 declares that local and state governments have a responsibility to facilitate housing development and to make "adequate provision for the housing needs of all economic segments of the community." The Housing Element of the plan presents goals, objectives, policies, and supporting information related to the provision of housing for existing and future residents of the County. The Housing Element policies promote housing consistent with the various designations set forth in the Land Use Element.

City of Rohnert Park General Plan

The City of Rohnert Park General Plan 2020 provides a comprehensive long-term plan for the physical development and growth of the City. Chapter 2 consists of Land Use and Growth Management. Chapter 5 consists of Open Space, Parks, and Public Facilities. Chapter 9 consists of Housing. Development goals intend to maintain community character and limit urbanization of open space outside the City.

3.11.2 ENVIRONMENTAL SETTING

Population

Nearby off-reservation communities include the City of Rohnert Park, Sebastopol, Cotati, and Santa Rosa. Table **3.11-1** shows regional populations. As shown in **Table 3.11-1**, a large proportion of the regional population resides in unincorporated Sonoma County, with the City of Santa Rosa ranking as the largest city, more than double the population of the next largest city.

The population of Sonoma County grew from 458,614 in 2000 to about 494,431 in 2015, an increase of 7.8 percent. Rohnert Park's population decreased 0.64 percent between 2000 and 2015. Sebastopol decreased at a faster rate of 3.65 percent between 2000 and 2015. The population of Cotati increased 14.34 percent, a faster rate than Sonoma County as a whole. Unincorporated Sonoma County decreased at a rate of 1.9 percent. The population of Sonoma County is estimated to reach 507,735 2020 by 2020.

TABLE 3.11-1: REGIONAL POPULATION

LOCATION	POPULATION		
	2000	2015	2020*
Sonoma County (Total)	**458,614**	**494,431**	**507,735**
Cloverdale	6,831	8,618	9,138
Cotati	6,471	7,399	7,600
Healdsburg	10,722	11,681	12,137
Petaluma	54,548	59,322	61,048
Rohnert Park	42,236	41,967	43,149
Santa Rosa	147,595	171,827	176,549
Sebastopol	7,774	7,490	7,680
Sonoma	9,128	11,202	11,735
Windsor	22,744	27,221	27,856
Unincorporated County	150,565	147,704	150,843
State of California (Total)	**33,871,648**	**39,255,883**	**40,619,346**

NOTE: * Projected estimate
SOURCE: California Department of Finance, 2019

Employment

Table 3.11-2 displays labor force participation and unemployment rates for Sonoma County and Rohnert Park. The labor force is defined as the number of members of a population who are able to work. A portion of the labor force in Sonoma County commutes to jobs in the San Francisco Bay Area. Sonoma County had a labor force of 261,600 in 2018, with approximately 65 percent of the total population over the age of 16. Unemployment rates are relatively low throughout the region. The 2018 unemployment rates in Sonoma County and Rohnert Park were between 2.6 percent and 4.2 percent, while San Francisco County unemployment rate was approximately 2.8 percent. This is 0.2 percent higher than the 2000 unemployment rate of 2.6 percent; the lowest unemployment rate since 1990. As shown in **Table 3.11-3**, Sonoma County mirrors employment by industry for the State of California.

TABLE 3.11-2: 2018 LABOR FORCE PARTICIPATION AND UNEMPLOYMENT RATES

LOCATION	TOTAL POPULATION OVER 16[1]	LABOR FORCE	LABOR FORCE PARTICIPATION RATE[2]	UNEMPLOYMENT RATE
Sonoma County	322,463	261,600	81.1%	2.6%
Rohnert Park	29,621	23,696	80.0%	4.2%
San Francisco County	620,966	569,271	91.7%	2.8%

NOTES: [1] Assumes that the age distribution is not changing for the percentage of population over age 16.
[2] Labor force participation rate equals the labor force divided by the total population over age 16.
SOURCE: U.S. Bureau of Labor Statistics, 2019; U.S. Census Bureau, 2019

Housing

As shown in **Table 3.11-3**, there were approximately 205,000 housing units in Sonoma County as of 2019. Due in part to a strong economy and recent fires and associated loss of housing in the County, vacancy rates are extremely low. As shown in **Table 3.11-4**, 9.1 percent of housing was vacant in Sonoma County in 2019. The City of Rohnert Park had a vacancy rate of 4.2 percent in 2019.

TABLE 3.11-3: 2019 REGIONAL HOUSING ESTIMATES

LOCATION	TOTAL HOUSING UNITS*
Sonoma County (Total)	**204,527**
Cloverdale	3,481
Cotati	3,209
Healdsburg	5,025
Petaluma	23,543
Rohnert Park	17,067
Santa Rosa	68,927
Sebastopol	3,517
Sonoma	5,687
Windsor	9,713
Unincorporated County	64,807

*Projected estimate. Figures do not include seasonal, recreational, or occasional use residences.
SOURCE: California Department of Finance 2019

TABLE 3.11-4: HOUSING VACANCY RATES

LOCATION	HOUSING VACANCY RATE (PERCENT)				
	2015	2016	2017	2018	2019
Sonoma County	7.5	7.4	9.1	9.1	9.1
Cloverdale	5.3	5.2	6.2	6.6	6.6
Cotati	7.0	7.1	4.9	4.3	4.3
Healdsburg	8.0	7.9	8.2	8.4	8.4
Petaluma	2.8	2.7	4.1	4.3	4.3
Rohnert Park	1.9	1.7	3.9	4.2	4.2
Santa Rosa	3.6	3.5	5.4	5.7	5.7
Sebastopol	4.6	4.6	5.0	5.2	5.2
Sonoma	10.7	10.7	10.2	9.9	9.9
Windsor	6.5	6.5	5.9	6.2	6.2
Unincorporated County	14.4	14.3	16.9	16.6	16.6

NOTES: These figures do not include seasonal, recreational, or occasional use residences.
SOURCE: California Department of Finance 2019

3.11.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section XIII of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation impacts of the Proposed Project to off-reservation population and housing. Such impacts are considered significant if they would:

- Induce substantial off-reservation population growth; or

- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere off-reservation.

Methodology

Information on regional population and housing conditions was obtained from governmental agencies and census data. Agencies consulted include the U.S. Census Bureau, Department of Finance, and California Employment Development Department.

Impact 3.11-1

The Proposed Project would not induce substantial off-reservation population growth.

The Proposed Project would be a source of temporary employment during construction. The majority of workers are expected to reside locally or stay at regional hotels. Operation of the Proposed Project would not result in a change to the number of employees working at the Resort, and would therefore not induce population growth in the region of the project site. There would be a **less-than-significant impact.**

Impact 3.11-2

The Proposed Project would not displace existing housing, necessitating the construction of replacement housing elsewhere off-reservation.

Construction and operation of the Proposed Project would occur on trust land, and do not involve the displacement of existing housing. It is expected that the majority of the temporary construction employees already reside locally, and the number of permanent employees would not change. Vacant housing is available if temporary relocation must occur during construction. Therefore, construction of replacement housing elsewhere off-reservation would not be necessary. There would be **no impact.**

3.12 PUBLIC SERVICES

This section addresses the off-reservation environment associated with public services and discusses potential impacts of the Proposed Project on off-reservation public services. The public services discussed in this section include fire protection facilities, police protection and law enforcement facilities, public schools, and the other public facilities described below. Because the Proposed Project would not result in regional population growth or a subsequent increase in housing (**Section 3.11**), there would be no impact to schools, libraries, and parks, and these facilities are not analyzed further.

3.12.1 REGULATORY FRAMEWORK

State and Local

The project site is located on trust land and is not subject to state or local laws and regulations concerning off-reservation governmental facilities and public services. However, such laws and regulations apply to off-reservation areas and public service systems if implementation of the Proposed Project were to interfere with and/or increase or decrease the demand on certain public services.

Sonoma County General Plan

The Public Safety Element provides information pertaining to the protection of the community from unreasonable risks. It includes maps of known hazards as well as evacuation routes, water supply needs, road widths, and other items related to potential disastrous events. Additionally, the plan outlines policies intended to avoid development that would affect future residents and cause financial burdens.

City of Rohnert Park General Plan

The Open Space, Parks, and Public Facilities Element address the City's valuable resources and scenic settings and identifies city standards for these resources. The Healthy and Safety Element addresses emergency preparedness and assesses community protection from risks.

3.12.2 ENVIRONMENTAL SETTING

Fire Protection and Police Services

The Tribe entered into a Memorandum of Understanding (MOU) with the City and provides annual payments to compensate for increases in demand on local public safety services due to Resort activity (City of Rohnert Park, 2013). The Tribe also entered into an agreement with the County, (Intergovernmental Mitigation Agreement [IGA]), to provide fire and police services to the Reservation (Sonoma County, 2012). In addition, the BIA has an agreement with Calfire to serve trust land in California.

As specified in the MOU, the Tribe committed to funding law enforcement services before construction of the Resort. The Tribe has contributed over $2,000,000 in funding to a Special Enforcement Activities Unit (SEA) within the Rohnert Park Department of Public Safety. The Rohnert Park Department of Public Safety provides police, fire and medical services to the City of Rohnert Park. The SEA helps fund law enforcement efforts against gangs, drugs, and repeat offenders. The Tribe's contributions have also provided funding for a canine unit.

Off-reservation areas within City limits are under the jurisdiction of the Rohnert Park Department of Public Safety. Members of the department have minimally been trained to the level of medical first responder and several are certified Emergency Medical Technicians (EMTs). City police officers are cross-trained in both police and fire functions to provide safe and efficient fire suppression and rescue operations in addition to enforcing to the law (City of Rohnert Park, 2016a).

Unincorporated areas in the vicinity of the Reservation are within the jurisdiction of the Rincon Valley Fire Protection District (RVFPD) and the Sonoma County Sheriff's Office (SCSO). The RVFPD and SCSO respond to emergency incidents in the unincorporated areas between Santa Rosa and the City, including both on and off-reservation. The nearest fire station to the Reservation is approximately two miles north and located at 207 Todd Road, in Santa Rosa (Central Fire Authority of Sonoma County, 2016).

Emergency Medical Services

Through contractual agreements with Sonoma County, American Medical Response (AMR) maintains a paramedic-staffed advanced life support ambulance at a facility in the center of Rohnert Park. This ambulance is staffed 24-hours every day of the year. Backup ambulances are deployed on a dynamic basis from adjacent jurisdictions. AMR also provides ambulance services in Santa Rosa and unincorporated areas of the County. Emergency facilities that serve the City and areas in the vicinity of the Reservation include the following:

- Concentra Urgent Care, located 1.15 miles southeast of the Reservation at 6174 State Farm Drive, Rohnert Park;
- The Santa Rosa Memorial Hospital, located approximately six miles north of the Reservation at 1165 Montgomery Drive, Santa Rosa;
- The Petaluma Valley Hospital located approximately nine miles southeast of the Reservation at 400 N McDowell Blvd, Petaluma; and
- The Sutter Santa Rosa Regional Hospital located approximately nine miles north of the Reservation at 30 Mark West Springs Road, Santa Rosa.

The hospital used for emergency incidents at the Reservation would depend on the extent of injury and preference of the individual. Santa Rosa Memorial Hospital would be used for trauma and cardiac emergencies.

3.12.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section XIV of the Checklist (**Appendix B**) and have been used in this section to evaluate potential off-reservation impacts of the Proposed Project to off-reservation public services. Because the Proposed Project would not result in regional population growth or a subsequent increase in housing (**Section 3.11**), there would be no impact to schools, libraries, and parks. An impact is considered significant if it would:

- Result in substantial adverse physical off-reservation impacts associated with the provision of new or physically altered off-reservation governmental facilities, the construction of which could cause significant off-reservation environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for fire protection, police protection, schools, or other off-reservation public facilities.

Methodology

Existing police, fire, and emergency services were assessed and compared to any foreseeable change in demand attributable to the Proposed Project. The MOU between the City and the Tribe and the IGA between the County and the Tribe were consulted regarding fire and emergency services (Sonoma County, 2012; City of Rohnert Park, 2013).

Impact 3.12-1: The Proposed Project would not result in substantial adverse physical impacts associated with the provision of new or physically altered off-reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the off-reservation public services.

Fire Protection

Risks associated with wildland fires are addressed in **Section 3.7**. The equipment used during construction of the Proposed Project has the potential to create sparks. However, the project site is currently developed or disturbed and surrounded by urbanized land and maintained agricultural land. Therefore, the Proposed Project would have no immediate risk of sparks igniting dry grass or vegetation and construction of the Proposed Project is unlikely to generate calls to off-reservation fire protection services. Additionally, the Proposed Project would adhere to applicable Tribal codes and Section 6.4.2 of the Compact, which are comparable to the California Building and Public Safety Codes applicable to the County (Compact, 2012). Applicable fire protection features would be incorporated into the design of the Proposed Project. There would be a **less-than-significant impact**.

Police Protection

The Proposed Project would not result in an increase in patronage or employees. Therefore, police services would not be impacted with implementation of the Proposed Project. The Tribe would continue to pay the annual fee for police services per the MOU and the IGA (Sonoma County, 2012) (City of Rohnert Park, 2013), and will continue to coordinate with local law enforcement agencies regarding services on and off-reservation. There would be a **less-than-significant impact**.

Schools and Other Public Facilities

The Proposed Project would not result in regional population growth or a subsequent increase in housing, as discussed in **Section 3.11**. Therefore, the Proposed Project would not result in an increase in demand to off-reservation public schools or other public facilities. There would be **no impact**.

3.13 TRANSPORTATION AND TRAFFIC

This section addresses the off-reservation environment associated with transportation and traffic, discusses the impacts of the Proposed Project on off-reservation transportation and traffic, and presents mitigation measures to reduce identified off-reservation impacts on transportation and traffic.

3.13.1 REGULATORY FRAMEWORK

Regulation of the off-reservation roadway network in the vicinity of the project site falls under the jurisdiction of Caltrans, Sonoma County (County), the Sonoma County Transportation Authority (SCTA), and the City of Rohnert Park (City).

State and Local

The project site is located on trust land and is not subject to State or local laws and regulations. However, such laws and regulations apply to off-reservation roadways in the vicinity of the project site.

California Department of Transportation

The California Department of Transportation (Caltrans) manages interregional transportation, including the management and construction of the California highway system. In addition, Caltrans is responsible for the permitting and regulation of state roadways. The area surrounding the Proposed Project is located in Caltrans District 4 and includes two major roadways that fall under Caltrans' jurisdiction; U.S. Highway 101 (US-101) and State Route 116 (SR 116). Caltrans requires permits for off-reservation transportation of oversized loads, transportation of certain materials, and for construction-related traffic disturbances on such roadways.

Sonoma County Transportation Authority

SCTA acts as the County-wide planning and programming agency for transportation. SCTA was formed in 1990 and serves as the coordinating and advocacy agency for transportation funding for the County. Since 2004, "Measure M" funds generated within the County through a local sales tax have been used toward transportation projects and roadway improvements within the County. SCTA partners with other agencies to improve transportation in the County, including US-101, local roadways, public transit, and bicycle and pedestrian facilities. Joint planning by the City and the County through SCTA has resulted in improvements to US-101, including additional High Occupancy Vehicle lanes.

Sonoma County General Plan

The Circulation and Transit Element addresses the location and extent of planned transportation routes and includes goals, objectives, and policies affecting the mobility of future residents, businesses, and visitors. The Circulation and Transit Element is correlated with the Land Use Element to assure that the transportation system serves future travel demand and helps attain the desired land use plan.

Rohnert Park General Plan

Section 4.0 includes the Transportation Element, which identifies future circulation needs for long-term planning. The Transportation Element addresses issues from City-wide to neighborhood scales in regards to traffic.

3.13.2 ENVIRONMENTAL SETTING

Transportation Study Area

The project site is not adjacent to any public road. It can only be access via the Resort parking lot and perimeter driveway. Off-reservation roadways in the vicinity of the project site include Golf Course Drive/Wilfred Avenue, Langner Avenue, and Whistler Avenue. The following is a description of the roadways and intersections that provide access to the project site.

Wilfred Avenue

Wilfred Avenue is an east to west County rural major collector running from Labath Avenue to west of Stony Point Road. Wilfred Avenue becomes Golf Course Drive north of the Resort as it approaches the City, thus the two roadways are used synonymously in some cases. The posted speed limit is 35 mph.

Golf Course Drive

Golf Course Drive is an east to west secondary arterial that connects the northeastern portions of Rohnert Park to US-101 and the western city limits. Golf Course Drive becomes Wilfred Avenue as it approaches the Resort from the City, thus the two roadways are used synonymously in some cases. The posted speed limit is 35 mph.

Labath Avenue

Labath Avenue is a north to south minor collector that becomes an access driveway to the Resort between Golf Course Drive and Business Park Drive. The posted speed limit is 35 mph.

Langner Avenue

Langner Avenue is a north to south local road that provides access to the Resort's parking garage just south of Golf Course Drive. The posted speed limit is 30 mph.

Traffic Conditions

In 2016, a Traffic Impact Analysis (TIA) was prepared for the Graton Rancheria Hotel Expansion Project by Transpedia Consulting Engineers. The hotel expansion project was substantially larger than the currently proposed BOH Expansion Project. The TIA evaluated traffic operations on roadways and intersections surrounding the Resort. Traffic operations were evaluated in terms of intersection operations according to *Highway Capacity Manual* (HCM) methodology and Institute of Transportation Engineers (ITE) trip generation (ITE, 2012). Results of the TIA indicate that surrounding intersections operated at acceptable levels of service based on established significance criteria, and would continue to operate at acceptable levels with implementation of the Graton Rancheria Hotel Expansion Project (Transpedia, 2016).

3.13.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section XVI of the Checklist (**Appendix B**) and have been used to evaluate potential off-reservation impacts of the Proposed Project to transportation and traffic. Such impacts are considered significant if they would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the off-reservation circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;
- Conflict with an applicable congestion management program, including, but not limited to, LOS standards and travel demand measures, or other standards established by the County congestion management agency for designated off-reservation roads or highways;
- Substantially increase hazards to an off-reservation design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);
- Result in inadequate emergency access for off-reservation responders.

Methodology

Aerial photographs, site plans, and maps were utilized to assess potential impacts to off-reservation roadways and intersections.

Impact 3.13-1: The Proposed Project would not conflict with any applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the off-reservation circulation system, taking into account all modes of transportation including mass transit and nonmotorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.

Operation of the Proposed Project would not result in additional employees or increased traffic. Construction of the Proposed Project would temporarily result in a negligible increase in traffic. Construction vehicles would utilize the construction access road from Rohnert Park Expressway to the extent feasible. Vehicular trips from construction would consist of worker trips and deliveries of equipment and materials to and from the project site. The expected increase in traffic would occur weekdays between the hours of 7:00 am and 6:00 pm. The maximum estimated increase in trips along Rohnert Park Expressway would be less than 50 one-way trips per day, over a period of 4 to 6 months, based on an assumed 25 workers. Workers are expected to reside locally in the Santa Rosa/Rohnert Park vicinity or within the nearby Bay Area region. Off-reservation pedestrian and bicycle paths and facilities would not be altered or affected. The Proposed Project would not generate substantial additional traffic that would conflict with applicable plans or ordinances. There would be a **less-than-significant impact.**

Impact 3.13-2: The Proposed Project would not conflict with applicable congestion management programs, including, but not limited to, LOS standards and travel demand measures, or other standards established by the County congestion management agency for designated off-reservation roads or highways.

The Proposed Project would not result in an increase in permanent employees, and would therefore not alter the number of trips associated with Resort operations. No significant impacts to applicable level of service standards or restrictions to emergency access would occur. The Proposed Project would not result in indirect or cumulative growth impacts that would facilitate additional traffic.
There would be a **less-than-significant impact.**

Impact 3.13-3: The Proposed Project would not substantially increase hazards to an off-reservation design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

The Proposed Project would not modify the design of existing roadways and would not include operational features that would impact traffic or increase hazards. There would be a **less-than-significant impact**.

Impact 3.13-5: The Proposed Project would not result in inadequate emergency access for off-reservation responders.

The Proposed Project would not introduce factors that would generate new or unanticipated long-term changes in traffic. Construction impacts to traffic are negligible and temporary, and construction staging would occur on-site. Implementation of the Proposed Project would not significantly impact emergency response or evacuation routes in the vicinity of the project site. There would be a **less-than-significant impact.**

3.14 UTILITIES AND SERVICE SYSTEMS

This section addresses the off-reservation environment associated with utilities and service systems, discusses potential impacts of the Proposed Project on off-reservation utilities and service systems, and presents mitigation measures to reduce potentially significant off-reservation environmental impacts. Utilities and service systems include water/wastewater systems, solid waste, and energy.

3.14.1 REGULATORY FRAMEWORK

Federal, State, and local laws and regulations applicable to off-reservation utilities and service systems are discussed in **Section 3.8.1.**

3.14.2 ENVIRONMENTAL SETTING

Water and Wastewater

Refer to **Section 3.8** for a detailed discussion on water supply, drainage, and wastewater management. The Resort's existing water supply system includes two water supply wells (Well 1 and Well 2), a water treatment plant (WTP), a water storage tank, and a water distribution pump system. The Resort's wastewater disposal is conducted pursuant to the existing Joint Exercise of Powers Agreement (JEPA) between the City of Rohnert Park (City) and the Tribe (City of Rohnert Park & Federated Indians of Graton Rancheria, 2012). Pursuant to Sections 4.4 and 11.8.7 of the Compact and the JEPA, the City supplies wastewater treatment and disposal services to the Resort.

Gas and Electric

Pacific Gas and Electric (PG&E) provides electricity and natural gas to the Resort. The Resort uses energy efficient appliances where feasible.

Solid Waste

The Tribe developed a Solid Waste Management Plan (SWMP) for the existing Resort in accordance with the 2013 Memorandum of Understanding (MOU) between the Tribe and the City (City of Rohnert Park, 2013) and the 2012 Intergovernmental Agreement (IGA) between the Tribe and the County of Sonoma (Sonoma County, 2012). The SWMP describes measures of solid waste management, including the collection, storage, and disposal of solid waste, source reduction strategies, and recycling and composting activities. The Resort's solid waste is currently hauled off-reservation by Recology.

3.14.3 IMPACT ANALYSIS

Significance Criteria

The following criteria are established by Section XIII of the Checklist (**Appendix B**) and have therefore been used in this section to evaluate the potential off-reservation impacts of the Proposed Project on utilities and service systems. Such an impact is considered significant if it would:

- Exceed off-reservation wastewater treatment requirements of the applicable Regional Water Quality Control Board;
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant off-reservation environmental effects;

- Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant off-reservation environmental effects; or
- Result in a determination by an off-reservation wastewater treatment provider (if applicable), which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.

Methodology

Assessment of potential hydrology impacts relied on previously gathered data and ongoing well level monitoring data. Analysis relied on existing water use and wastewater generation data. Analysis of other utilities compares existing conditions and utilities to foreseeable increase in demands on off-reservation utilities attributable to the Proposed Project.

Impact 3.14-1: The Proposed Project would not exceed off-reservation wastewater treatment requirements of the Regional Water Quality Control Board.

Pursuant to Sections 4.4 and 11.8.7 of the Compact and the JEPA, the City provides wastewater collection services to the Resort for an annual fee (Compact, 2012; City of Rohnert Park, 2012). As discussed in **Section 3.8**, the Proposed Project would not result in an increase in wastewater. There would be a **less-than-significant-impact.**

Impact 3.14-2: The Proposed Project would not require the construction of any new water or wastewater treatment facilities, energy facilities, solid waste facilities, or the expansion of existing facilities, the construction of which could cause significant off-reservation environmental effects.

As discussed in **Section 3.8**, the Proposed Project would not result in an increase in water usage or wastewater. No expansion of off-reservation water or wastewater facilities would be required for the Proposed Project. Energy needs of the Proposed Project would be accommodated by the existing power grid and natural gas connection through PG&E. In addition, the Proposed Project's solid waste will continue to be hauled off-reservation by Recology. There would be a **less-than-significant impact.**

Impact 3.14-3: The Proposed Project would not require the construction of new stormwater drainage facilities or the expansion of existing facilities, the construction of which could cause significant off-reservation environmental impacts.

Refer to **Section 3.8** for a detailed discussion on drainage. Surface water from the existing Resort and parking lot drains into bioswales thence retention ponds and drainage ditches on-reservation. The Proposed Project would be constructed over existing paved or disturbed areas, and would not impact the drainage pattern of the area. There would be a **less-than-significant impact.**

Impact 3.14-4: The Proposed Project would not result in the determination by an off-reservation wastewater treatment provider that it has inadequate capacity to serve the Proposed Project's projected demand in addition to the provider's existing commitments.

Pursuant to Sections 4.4 and 11.8.7 of the Compact and the JEPA, the City currently provides collection services to the Resort for an annual fee (Compact, 2012; City of Rohnert Park, 2012). As discussed in **Section 3.8**, the Proposed Project would not result in an increase in wastewater. There would be a **less-than-significant-impact.**

3.15 CUMULATIVE IMPACTS

Cumulative impacts are defined as the effects "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." (CEQA Section 15355). The purpose of a cumulative analysis is to ensure that off-reservation consequences of the Proposed Project as defined in the Compact are acknowledged and evaluated.

Potential off-reservation cumulative impacts of environmental categories identified as having the potential to be adversely effected by the Proposed Project are addressed herein. Because the Proposed Project would not result in regional population growth or a subsequent increase in housing (**Section 3.11**), there would be no cumulatively considerable impacts on schools, libraries, or parks. Therefore, these facilities are not analyzed further.

3.15.1 REGULATORY FRAMEWORK

Cumulative impact analysis for the Proposed Project was based on the Sonoma County General Plan 2020 (County General Plan) (Sonoma County, 2016), the City of Rohnert Park General Plan (City General Plan) (Rohnert Park, 2000), the Compact (Compact, 2012), and growth projections within the Association of the Bay Area Government's (ABAG) Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) travel forecast model (ABAG, 2013).

3.15.2 IMPACT ANALYSIS

Significance Criteria

The following criterion is established by Section XVIII of the Checklist (**Appendix B**) and has been used in this section to evaluate potential off-reservation cumulative impacts of the Proposed Project:

- Have impacts that are individually limited, but cumulatively considerable off-reservation.

Methodology

Known proposed, commenced, and completed development projects in the vicinity of the project site were considered in determining cumulative off-reservation environmental impacts of the Proposed Project. Cumulatively considerable projects in the vicinity of the project site are shown in **Table 3.15-1**.

TABLE 3.15-1: CUMULATIVELY CONSIDERABLE PROJECTS IN THE VICINITY OF THE PROJECT SITE

PROJECT	SIZE	DISTANCE	ADDRESS	PROJECT DESCRIPTION
Station Avenue	32 acres	1.4 miles	US-101 and Rohnert Park Expressway	460 apartments, 130,000 sf of retail, 120,000 sf office, and 156-room hotel
Bella Creek	2.26 acres	1.4 miles	Corner of Commerce Boulevard and Avram Ave.	90 residential units in five residential buildings
Residences at Five Creeks	32.8 acres	<1 miles	Corner of Labath Ave. and Carlson Ave.	135 unit apartment complex, 0.65-acre park, 132 room hotel, and 34,300 sf shopping center
KG Technologies	1.49 acres	<1 miles	State Farm Dr., southeast of Professional Center Dr.	10,000 sf building for headquarter offices and warehousing for an electronic distribution center
Clearwater at Sonoma Hills	90 Units	2.5 miles	At Rohnert Park Expressway and Snyder Lane	90 unit assisted living and memory care facility.

Aesthetics

As discussed in **Section 3.2**, the Proposed Project would have a **less-than-significant impact** on off-reservation aesthetic resources. **Mitigation Measure 3.2-1** would minimize visual impacts of the Proposed Project. There are no other foreseeable projects in the same viewshed as the Proposed Project that are in conflict with the regulatory setting presented in **Section 3.2**. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation aesthetics.

Air Quality

The California Air Resources Board (CARB) does not project emissions for Sonoma County beyond the year 2035; therefore, 2040 Proposed Project emissions were compared to 2035 County-wide emissions. This is considered a conservative comparison, as emissions of criteria air pollutants (CAPs) have decreased over the last 10 years and are anticipated to continue to decrease over time due to more stringent mobile emission requirements and a trend toward fuels with lower emissions. **Table 3.15-2** shows the 2035 Sonoma County emissions inventory for pollutants of concern.

TABLE 3.15-2
2035 EMISSIONS INVENTORY FOR SONOMA COUNTY

Sources	Pollutant of Concern				
	ROG	NO_X	CO	$PM_{2.5}$	PM_{10}
	Tons per Year				
Stationary	1,862	256	1,351	292	767
Area	3,468	584	9,271	1,752	4,453
Mobile	1,898	3,139	19,783	256	438
Total Emissions	**7,227**	**3,979**	**30,405**	**2,300**	**5,658**
SOURCE: CARB, 2013					

As discussed in **Section 3.3,** the Proposed Project would not result in higher than existing carbon monoxide (CO) concentrations or emit objectionable odors or toxic air contaminants. The Proposed Project would result in the generation of ozone precursors (ROG and NO_X), CO, PM_{10}, and $PM_{2.5}$ during the construction phase. Due to improvements in energy efficiency and fuel standards, it is anticipated that cumulative emissions in the year 2040 would be less than those in the buildout year. Project-related emissions would be temporary during construction and emissions would not exceed *de minimis* levels. **Mitigation Measure 3.3-1** would be implemented to further reduce impacts associated with air quality. Other projects in the vicinity of the project site would also be required to implement similar measures during construction. Therefore, the Proposed Project would not have a cumulatively significant impact.

Biological Resources

As discussed in **Section 3.4**, **Mitigation Measures 3.4-1** and **3.4-2** would be implemented to reduce potential impacts to biological resources. Projects in the cumulative environment would result in similar impacts to biological resources during construction, and the City and County would similarly require other projects to comply with federal, State, and local regulations and ordinances protecting biological resources to reduce cumulative impacts to less-than-significant levels. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to biological resources.

Geology and Soils

As discussed in **Section 3.5**, **Mitigation Measure 3.5-1** would reduce the potential for erosion and stormwater pollution. The Santa Rosa Plain in Sonoma County constitutes the geographic area for analysis of cumulative impacts to land resources, and is relatively flat in topography. The project site is relatively level and development would not alter off-reservation topography. Local permitting requirements for construction would address regional geotechnical, seismic, or mining hazards. It is anticipated that other approved projects would follow appropriate permitting procedures. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation geology and soils.

Greenhouse Gases

As discussed in **Section 3.6**, the Proposed Project would have a less-than-significant impact with respect to greenhouse gas (GHG) emissions after incorporation of **Mitigation Measure 3.6-1**. Equipment use, energy use, and mobile sources would result from the temporary construction phase and would not be significant. Other projects in the vicinity of the project site would also be required to implement measures to reduce potential GHG impacts. Therefore, potential GHG impacts would not be cumulatively significant.

Hazards and Hazardous Materials

As discussed in **Section 3.7**, the Proposed Project would have a less-than-significant impact with respect to hazards and hazardous materials. **Mitigation Measures 3.7-1** and **3.7-2** would decrease off-reservation impacts associated with storage and use of hazardous materials on the project site. Foreseeable projects in the vicinity of the project site would be required to comply with applicable federal, state, and local regulations concerning hazardous materials management. Therefore, potential impacts associated with hazardous materials would not be cumulatively considerable.

Water Resources

As discussed in **Section 3.8**, the Proposed Project would have a less-than-significant impact on off-reservation water resources with implementation of **Mitigation Measure 3.8-1**. The Proposed Project would not result in increased water usage. Construction of the Proposed Project would obtain coverage under and comply with a National Pollutant Discharge Elimination System (NPDES) Permit. As part of that permit, the Proposed Project would be subject to a SWPPP, which would include BMPs to protect water quality. Other projects in the vicinity of the project site would be required to implement similar measures to protect water quality. Therefore, the Proposed Project would not result in cumulatively considerable impacts concerning water resources.

Land Use

As discussed in **Section 3.9**, the Proposed Project would not impact off-reservation land use. The Proposed Project does not include off-reservation development and would not result in a change in land use. Other off-reservation development projects in the vicinity of the project site would be required to adhere to the County General Plan or the City General Plan and applicable zoning requirements. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation land use.

Noise

As discussed in **Section 3.10**, the Proposed Project would have a **less-than-significant impact** to off-reservation sensitive receptors with respect to noise levels. Operation of the Proposed Project would not result in additional employees, patrons, or increased traffic. Construction of the Proposed Project would temporarily result in a negligible increase in traffic. This would not lead to a significant increase in ambient noise levels to off-reservation sensitive receptors. **Mitigation Measure 3.10-1** would reduce off-reservation noise impacts during construction. Other projects in the vicinity of the project site would be required to implemented similar measures and abide by designated noise thresholds. Additionally, other projects are also expected to be constructed during daylight hours. Therefore, the Proposed Project would not contribute to permanent cumulative noise effects.

Population and Housing

As discussed in **Section 3.11**, the Proposed Project would have a **less-than-significant impact** on off-reservation population and housing. Operation of the Proposed Project would not result in additional employees, patrons, or increased traffic. Construction would be temporary, and workers would reside locally or stay in local hotels if necessary. Planning documents for the region would continue to designate land uses for businesses, industry, and housing, as well as plan public services that would anticipate and accommodate growth in the region. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation population and housing.

Public Services

As discussed in **Section 3.12**, the Proposed Project would have a **less-than-significant impact** on off-reservation public services. Existing police, fire, and emergency services were assessed and compared to foreseeable increases in demand attributable to the Proposed Project. The Proposed Project would not result in regional population growth, and would not result in an increase in employees or patrons. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to schools or other public facilities.

Transportation and Traffic

As discussed in **Section 3.13**, the Proposed Project would have a less-than-significant impact to off-reservation roadways and circulation. Operation of the Proposed Project would not result in additional employees, patrons, or increased traffic. The maximum estimated increase in trips along Rohnert Park Expressway would be less than 50 one-way trips per day, over a period of 4 to 6 months, based on an assumed 25 workers. This would not lead to a significant increase in traffic to off-reservation roadways, and the Proposed Project would not contribute to cumulative trip generation and would therefore have no impact on regional trip generation over the long-term. Increases in daily trips would be minimal and restricted to the temporary construction phase only.

The Proposed Project would not result in significant increased demand in alternative transportation. Additionally, the Proposed Project would not adversely affect pedestrian or bicycle networks under the Cumulative plus Proposed Project conditions. The Tribe has an Intergovernmental Mitigation Agreement with the County (Sonoma County, 2012) and a Memorandum of Understanding with the City (City of Rohnert Park, 2013) in which a non-reoccurring payment was provided to each to compensate for potential traffic impacts prior to construction of the Resort. Therefore, the Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation transportation and traffic.

Utilities and Service Systems

As discussed in **Section 3.14**, the Proposed Project would have a less-than-significant impact on off-reservation utilities and service systems. The Proposed Project would not alter the existing water runoff volumes or drainage pattern of the area, and there would be no increase to existing on-reservation water demand or wastewater generation. Other utilities would not be significantly impacted. Future land uses in the region would be subject to approval by local governments and would include provisions associated with public services. The Proposed Project would not result in cumulatively considerable impacts with respect to off-reservation utilities and service systems.

No Action Alternative

As an alternative to the Proposed Project, expansion of the Resort's back of house operations would not occur. The No Action Alternative was analyzed as required by Section 11.8.1 of the Compact (**Appendix A**). Under the No Action Alternative, the Resort would not be modified, and would continue to operate in its current form and capacity. The Proposed Project would not be developed and the project site would continue to serve as surface parking and existing back of house for the existing Resort. Positive cumulative impacts of the Proposed Project include the generation of temporary employment during the construction phase in Sonoma County and Rohnert Park areas, thus providing an economic benefit off-reservation. The No Action Alternative would not result in cumulative impacts, nor the economic benefits of the Proposed Project, and would prevent the existing Resort from properly facilitating its operational and employment needs.

SECTION 4.0

REPORT AUTHORS

SECTION 4.0

REPORT AUTHORS

ANALYTICAL ENVIRONMENTAL SERVICES
1801 7th Street, Suite 100
Sacramento, CA 95811
(916) 447-3479
www.analyticalcorp.com

Principal: David Zweig, P.E.

Technical Staff: Kt Alonzo
Kelli Raymond
Zachary Carpenter
Joshua Goodwin
Dana Hirschberg
Glenn Mayfield

SECTION 5.0

BIBLIOGRAPHY

SECTION 5.0

BIBLIOGRAPHY

Analytical Environmental Services (AES), 2009. Graton Rancheria Casino and Hotel Final Environmental Impact Statement. February 2009.

AES, 2011. Essential Fish Habitat Assessment, Graton Rancheria. Prepared by Analytical Environmental Services. September 2011.

AES, 2018. Noise Monitoring Results. Prepared by Analytical Environmental Services. October 2016 and January 2018.

Applied Engineering and Geology (AEG), 2016. Evaluation of Water Supple and Wastewater Management Feasibility and Potential Off-reservation Impacts to Water Quality and resources for Graton Rancheria Hotel and Casino Expansion Project.

Association of Bay Area Government (ABAG), 2013. Plan Bay Area – Regional Transportation Plan and Sustainable Communities Strategy for the San Francisco Bay Area 2013–2040. Available online: http://files.mtc.ca.gov/pdf/Plan_Bay_Area_FINAL/Plan_Bay_Area.pdf.

Baldwin, B.G. et al. 2012. The Jepson manual: vascular plants of California. University of California Press.

Bay Area Air Quality Management District (BAAQMD), 2017. Air Quality Standards and Attainment Status. Available online: http://www.baaqmd.gov/research-and-data/air-quality-standards-and-attainment-status.

Bolt, Bruce A., 1988. Abridged Modified Mercalli Intensity Scale, Earthquakes-Newly Revised and Expanded, Appendix C, W.H. Freeman and Co. 1993, 331 pp.

Bureau of labor Statistics, 2019. Overview of BLS Statistics on Employment. Available online: https://www.bls.gov/bls/employment.htm.

California Air Resources Board (CARB), 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. Available online: https://www.arb.ca.g-ov/diesel/documents/rrpfinal.pdf.

CARB, 2013. Almanac Emission Projection Data 2015 Estimated Annual Average Emissions Sonoma County. Available online: https://www.arb.ca.gov/app/emsinv/emseic1_query.php.

CARB, 2014a. Facility Search Results. Available online: https://www.arb.ca.gov/aqd/almanac/-almanac13/almanac13.htm.

CARB, 2014b. The California Almanac of Emissions and Air Quality - 2013 Edition. Available online: https://www.arb.ca.gov/aqd/almanac/almanac13/almanac13.htm.

CARB 2016. Greenhouse Gas Quantification Methodology for the California State Transportation Agency Transit and Intercity Rail Capital Program. Available online: https://www.arb.ca.gov/cc/-capandtrade/auctionproceeds/tircp_qm_16-17.pdf.

California Department of Conservation (DOC), 2010. Fault Activity Map of California. Available online: http://maps.conservation.ca.gov/cgs/fam/.

California Department of Economic Development, 2019. Employment by Industry Data. Available online: https://www.labormarketinfo.edd.ca.gov/data/employment-by-industry.html.

California Department of Finance, 2019. E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2019 with 2010 Census Benchmark. Available online: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/.

California Department of Transportation (Caltrans), 1988. Air Quality Technical Analysis Notes. Available online: http://www.dot.ca.gov/research/researchreports/1981-1988/air_quality_tech_analysis.pdf.

Caltrans, 2004. Transportation- and Construction-Induced Vibration Guidance Manual. June 2004. Available online: http://www.dot.ca.gov/hq/-env/noise/pub/vibrationmanFINAL.pdf.

Caltrans, 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. Available online: http://www.dot.ca.gov/hq/env/noise/pub/TeNS-_Sept_2013B.pdf.

Caltrans, 2019. Scenic Highways Mapping System. Available online: http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/.

California Department of Water Resources (DWR), 2016. California's Groundwater Bulletin 118. 2016. Available online: https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118.

California Environmental Protection Agency (CalEPA), 2019. Available online: https://calepa.ca.gov/.

CalEPA, 2010. Climate Action Team Report to Governor Schwarzenegger and the California Legislature. Available online: https://www.energy.ca.gov-/2010publications/CAT-1000-2010-005/CAT-1000-2010-005.PDF.

California Energy Commission (CEC), 2005. Global Climate Change and California In Support of the 2005 Integrated Energy Policy Report. Available online: http://www.energy.ca.gov/2005p-ublications/CEC-600-2005-007/CEC-600-2005-007-SF.PDF.

CEC, 2012. Our Changing Climate 2012 Vulnerability & Adaptation to the Increasing Risks from Climate Change in California. Available online: https://www.energy.ca.gov/2012publications-/CEC-500-2012-007/CEC-500-2012-007.pdf.

CEC, 2016. CalAdapt Local Climate Snapshots – Sonoma County. Available online: http://cal-adapt.org/tools/factsheet/.

California Geological Survey (CGS), 2019. The Alquist-Priolo Earthquake Fault Zoning Act. Available online: https://www.conservation.ca.gov/cgs/alquist-priolo.

California Highway Patrol (CHP), 2015. 2015 Vehicle Code. Available at: https://www.chp.ca.gov/-ProtectiveServicesDivisionSite/Documents/2015%20Vehicle%20Code.pdf.

Casey, 2017. Telephone correspondence between AES and Lauren Casey, RCPA director. Nov. 7, 2017.

California State University, Northridge (CSUN), 2016. Geomorphic Regions of California. Available online: https://www.csun.edu/science/sierras/geomorphic-regions/index.html.

Central Fire Authority of Sonoma County, 2016. Stations. Available online: http://www.cscfire.org-/about-central-fire/stations/.

City of Rohnert Park, 2000. General Plan. Available online: https://www.rpcity.org/UserFiles/Servers-/Server_3037789/File/Planning/General%20Plan%20and%20Specific%20Plans/General%20Plan%202020/8th%20Edition%20_%20Final%20PDF.pdf.

City of Rohnert Park, 2013. First Amended and Restated Memorandum of Understanding by and between the City of Rohnert Park and the Federated Indians of Graton Rancheria. Available online at http://ww.rpcity.org/Modules/ShowDocument.aspx?documentid=9363.

City of Rohnert Park, 2014. City of Rohnert Park Northwest Specific Plan. Available online: http://ww.rpcity.org/Modules/ShowDocument.aspx?documentid=13759.

City of Rohnert Park, 2016a. Public Safety. Available online: http://www.ci.rohnertpark.ca.u-s/city_hall/departments/public_safety.

City of Rohnert Park, 2018. Economic Development Board City Profile and Projections Report. Available online: http://sonomaedb.org/Search-Results/?q=rohnert%20park.

City of Rohnert Park & Federated Indians of Graton Rancheria, 2012. Joint Exercise of Powers Agreement by and Between City of Rohnert Park and Federated Indians of Graton Rancheria for Wastewater Services. https://www.rpcity.org/UserFiles/Servers/Server_3037789/File/Admin-/City%20Management/Casino%20Mitigation/Wastewater%20JEPA%20with%20Side%20Letter%20Agreement.pdf.

Climate Action Team (CAT), 2006. Climate Action Team Report to Governor Schwarzenegger and the Legislature, 2006. Available online: file:///C:/Users/jgoodwin/Desktop/2006-04-03_FINAL_CAT_REPORT.PDF.

Compact, 2012. Tribal-State Compact between the State of California and the Federated Indians of Graton Rancheria. Enacted March, 2012.

Department of Toxic Substances Control (DTSC), 2019. California Code of Regulations, Title 22. Available online: https://dtsc.ca.gov/title22/.

DOC, 2019. Seismic Hazards Mapping Act. Available at https://www.conservation.ca.gov/cgs/shma.

Environmental Data Resources, Inc. (EDR), 2012. The EDR Radius Map Report with GeoCheck.

Federal Emergency Management Agency (FEMA), 2004. Earthquake Hazards Reduction Act of 1977, As Amended. Available online at https://www.fema.gov/media-library/assets/documents/12521.

Federal Highway Administration (FHWA), 2006. Construction Noise Handbook. Available online: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm.

FHWA, 2019. National Scenic Byways Program. Available online: https://www.fhwa.dot.gov/discretionary/nsbp2011selc.cfm.

Federal Interagency Committee on Noise (FICON), 1992. Federal Agency Review of Selected Airport Noise Analysis Issues. Available online: ftp://ftp.agl.faa.gov/Materials%20Released%-20Related%20to%20the%20OM%20EIS/3-312005%20World%20Gateway%20Related%20Documents/787_122.pdf.

Federal Transit Administration (FTA), 2006. Transit Noise and Vibration Impact Assessment. Available online: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf.

Huffman-Broadway Group, Inc., 2006. Biological Assessment: Proposed Gaming Facility Sonoma County, California.

HydroScience, Inc., 2007. Graton Tribe Rohnert Park Project Water and Wastewater Feasibility Study. Prepared by HydroScience Engineers, Inc. for Station Casinos. September 2007.

Institute of Transportation Engineers (ITE), 2012. Trip Generation Manual, 9th ed.

Intergovernmental Panel on Climate Change (IPCC), 2007. Climate Change 2007: Working Group I: The Physical Science Basis. Combining Evidence of Anthropogenic Climate Change. Available online: https://www.ipcc.ch/report/ar4/wg1/.

IPCC, 2013. IPCC Fifth Assessment Report, 2013. Summary for Policymakers. Available online: http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf.

KOMEX, Inc., 2007. Groundwater Study Proposed Graton Rancheria Casino and Hotel. Rohnert Park, Sonoma County, California. Report No. N0410C. January 2007.

National Marine Fisheries Service (NMFS), 2008. Section 7 Biological Opinion Issued for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the USACE, the SCWA and the MCRRFC and the WCID in the Russian River Watershed.

Natural Resources Conservation Service (NRCS), 2019. Soil Survey of Sonoma County. Natural Resources Conservation Service Web Soil Survey (WSS).

North Bay Climate Adaptation Initiative (NBCAI), 2014. Climate Ready Sonoma County: Climate Hazards and Vulnerabilities. Available online: http://rcpa.ca.gov/wp-content/uploads/2016/-03/Climate-Ready_Hazards_Vulnerabilities-FINAL.pdf.

RCPA, 2018. Sonoma County Greenhouse Gas Inventory Report 2015 Update. July 2018. Available online: https://rcpa.ca.gov/wp-content/uploads/2018/08/Sonoma-County-GHG-Inventory-Update-2015-070618.pdf.

Sonoma County, 2008. Sonoma County General Plan 2020 Available at: http://sonomacounty.ca.-gov/PRMD/Long-Range-Plans/General-Plan/.

Sonoma County, 2012. Intergovernmental Mitigation Agreement. Available online: sonomacounty.c-a.gov/WorkArea/DownloadAsset.aspx?id=2147505430.

Sonoma County, 2016. Landslide Hazard Areas. Sonoma County Hazard Mitigation Plan. Available online: http://www.sonoma-county.org/prmd/docs/hmp_2011/figures/8_11.pdf.

Sonoma County, 2019a. Active Map. Available online: http://imsportal.sonoma-county.org/ActiveMap//.

Sonoma County, 2019b. Sonoma County Vegetation and Habitat Map. Available online: http://sonomavegmap.org/map_gallery/.

Sonoma County Regional Climate Protection Authority (RCPA), 2016. Climate Action 2020 and Beyond – Sonoma County Climate Action Plan. Available online: https://rcpa.ca.gov/wp-content/uploads/2016/07/CA2020_Plan_7-7-16_web.pdf.

Sonoma Land Trust and Laguna de Santa Rosa Foundation, 2003. Laguna de Santa Rosa: Resource Atlas and Protection Plan. May 2003.

Transpedia, 2016. Traffic Impact Analysis for Graton Casino's Hotel Expansion Project. Prepared by Transpedia Consulting Engineers, Santa Rosa, CA 95404. October 3, 2016.

United States Geological Survey (USGS), 2008. The Landslide Handbook—A Guide to Understanding Landslides. Available online: https://pubs.usgs.gov/circ/1325/.

USGS, 2013. Hydrologic and Geochemical Characterization of the Santa Rosa Plain Watershed, Sonoma County, California. Available online: https://pubs.usgs.gov/sir/2013/5118/pdf/sir20135118.pdf.

USGS, 2019a. Mineral Resources On-Line Spatial Data. Available online: https://mrdata.usgs.gov-/mrds/map-us.html.

USGS, 2019b. U.S. Quaternary Faults. Available online: https://usgs.maps.arcgis.com/apps/-webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf.

USGS, 2019c. Earthquake Hazards Program: The Modified Mercalli Intensity Scale. Available online: https://earthquake.usgs.gov/learn/topics/mercalli.php.

University of California, Davis (UC Davis), 1997. Transportation Project-Level Carbon Monoxide Protocol. Available online: http://www.dot.ca.gov/hq/env/air/documents/COPr-otocol_searchable.pdf.

U.S. Census, 2019. Quickfacts: San Francisco County, Sonoma County, Rohnert Park City. Available online: https://www.census.gov/quickfacts/fact/table/sanfranciscocountycalifornia,-sonomacountycalifornia,rohnertparkcitycalifornia/PST045218.

USEPA, 2002. Clean Water Act. U.S Environmental Protection Agency (USEPA). Available at https://www-.epa.gov/sites/production/files/2017-08/documents/federal-water-pollution-control-act-508full.pdf.

USEPA, 2012. Water Quality Standards Handbook, Chapter 4: Antidegredation. U.S. Environmental Protection Agency (USEPA). Available at https://www.epa.gov/sites/production/files/2014-10/documents/handbook-chapter4.pdf.

USEPA, 2016a. NAAQS Table. Available online: https://www.epa.gov/criteria-air-pollutants/naaqs-table.

USEPA, 2016b. Current Nonattainment Counties for All Criteria Pollutants. Available online: https://www3.epa.gov/airquality/greenbook/ancl.html. Updated 2019.

USEPA, 2018a. Resource Conservation and Recovery Act. Available online: https://www.epa.gov/rcra-/resource-conservation-and-recovery-act-rcra-overview.

USEPA, 2018b. Toxic Substances Control Act. U.S. Environmental Protection Agency (USEPA). Available at https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act.

USEPA, 2018c. Comprehensive Environmental Response Compensation, and liability Act of 1980. U.S. Environmental Protection Agency (USEPA). Available at https://www.epa.gov/laws-regulations/summary-comprehensive-environmental-response-compensation-and-liability-act.

USEPA, 2018d. Safe Drinking Water Act. U.S. Environmental Protection Agency (USEPA). Available at https://legcounsel.house.gov/Comps/Safe%20Drinking%20Water%20Act-(Title%20Xiv%20Of%20Public%20Health%20Service%20Act).pdf.

USEPA, 2019. Secondary Drinking Water Standards: Guidance for Nuisance Chemicals. Available online: https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals.

U.S. Fish and Wildlife Service (USFWS), 2005. Santa Rosa Plain Conservation Strategy. U.S. Fish and Wildlife Service (USFWS). Sacramento, CA. December 1, 2005.

USFWS, 2009. Biological Opinion on the Proposed Graton Rancheria Casino and Hotel Project, City of Rohnert Park, Sonoma County, California. U.S. Fish and Wildlife Service (USFWS), Sacramento Fish and Wildlife Office. February 3, 2009.

USFWS, 2012. Bald Eagle. Available online: https://ecos.fws.gov/ecp0/profile/speciesProfile-?spcode=B008.

APPENDICES

APPENDIX A

TRIBAL-STATE COMPACT BETWEEN THE STATE OF CALIFORNIA AND THE FEDERATED INDIANS OF GRATON RANCHERIA; SECTION 11.0

TRIBAL-STATE COMPACT

BETWEEN

THE STATE OF CALIFORNIA

AND THE

FEDERATED INDIANS OF GRATON RANCHERIA

SECTION 11.0. OFF-RESERVATION ENVIRONMENTAL AND ECONOMIC IMPACTS.

Sec. 11.8.1.[1] Tribal Environmental Impact Report.

(a) Before the commencement of any Project as defined in section 2.23 herein, the Tribe shall cause to be prepared a comprehensive and adequate tribal environmental impact report ("TEIR"), analyzing the potentially significant off-reservation environmental impacts of the Project pursuant to the process set forth in this section 11.0; provided, however, that information or data which is relevant to such a TEIR and is a matter of public record or is generally available to the public need not be repeated in its entirety in the TEIR, but may be specifically cited as the source for conclusions stated therein; and provided further that such information or data shall be briefly described, that its relationship to the TEIR shall be indicated, and that the source thereof shall be reasonably available for inspection at a public place or public building. The TEIR shall provide detailed information about the Significant Effect(s) on the Environment which the Project is likely to have, including each of the matters set forth in

[1] Sections 11.1 through 11.7 have been deliberately omitted.

Appendix B, shall list ways in which the Significant Effects on the Environment might be minimized, and shall include a detailed statement setting forth all of the following:

(1) A description of the physical environmental conditions in the vicinity of the Project (the environmental setting and existing baseline conditions), as they exist at the time the notice of preparation is issued;

(2) All Significant Effects on the Environment of the proposed Project;

(3) In a separate section:

(A) Any Significant Effect on the Environment that cannot be avoided if the Project is implemented;

(B) Any Significant Effect on the Environment that would be irreversible if the Project is implemented;

(4) Mitigation measures proposed to minimize Significant Effects on the Environment, including, but not limited to, measures to reduce the wasteful, inefficient, and unnecessary consumption of energy;

(5) Alternatives to the Project; provided that the Tribe need not address alternatives that would cause it to forgo its right to engage in the Gaming Activities authorized by this Compact on its Indian lands;

(6) Whether any proposed mitigation would be feasible;

(7) Any direct growth-inducing impacts of the Project; and

(8) Whether the proposed mitigation would be effective to substantially reduce the potential Significant Effects on the Environment.

(b) In addition to the information required pursuant to subdivision (a), the TEIR shall also contain a statement indicating the reasons for

determining that various effects of the Project on the off-reservation environment are not significant and consequently have not been discussed in detail in the TEIR. In the TEIR, the direct and indirect Significant Effects on the Environment, including each of the items on Appendix B, shall be clearly identified and described, giving due consideration to both the short-term and long-term effects. The discussion of mitigation measures shall describe feasible measures which could minimize significant adverse effects, and shall distinguish between the measures that are proposed by the Tribe and other measures proposed by others. Where several measures are available to mitigate an effect, each should be discussed and the basis for selecting a particular measure should be identified. Formulation of mitigation measures should not be deferred until some future time. The TEIR shall also describe a range of reasonable alternatives to the Project or to the location of the Project, which would feasibly attain most of the basic objectives of the Project and which would avoid or substantially lessen any of the Significant Effects on the Environment, and evaluate the comparative merits of the alternatives; provided that the Tribe need not address alternatives that would cause it to forgo its right to engage in the Gaming Activities authorized by this Compact on its Indian lands. The TEIR must include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison. The TEIR shall also contain an index or table of contents and a summary, which shall identify each Significant Effect on the Environment with proposed measures and alternatives that would reduce or avoid that effect, and issues to be resolved, including the choice among alternatives and whether and how to mitigate the Significant Effects on the Environment. Previously approved land use documents, including, but not limited to, general plans, specific plans, and local coastal plans, may be used in cumulative impact analysis. The Tribe shall consider any recommendations from the County concerning the person or entity to prepare the TEIR.

Sec. 11.8.2. Notice of Preparation of Draft TEIR.

(a) Upon commencing the preparation of the draft TEIR, the Tribe shall issue a Notice of Preparation to the State Clearinghouse in the State Office of Planning and Research ("State Clearinghouse") and to the County for distribution to the public. The Tribe shall also post the Notice on its website. The Notice shall provide all Interested Persons,

as defined in section 2.19, with information describing the Project and its potential Significant Effects on the Environment sufficient to enable Interested Persons to make a meaningful response or comment. At a minimum, the Notice shall include all of the following information:

(1) A description of the Project;

(2) The location of the Project shown on a detailed map, preferably topographical, and on a regional map; and

(3) The probable off-reservation environmental effects of the Project.

(b) The Notice shall also inform Interested Persons of the preparation of the draft TEIR and shall inform them of the opportunity to provide comments to the Tribe within thirty (30) days of the date of the receipt of the Notice by the State Clearinghouse and the County. The Notice shall also request Interested Persons to identify in their comments the off-reservation environmental issues and reasonable mitigation measures that the Tribe will need to have explored in the draft TEIR.

Sec. 11.8.3. Notice of Completion of Draft TEIR.

(a) Within no less than thirty (30) days following the receipt of the Notice of Preparation by the State Clearinghouse and the County, the Tribe shall file a copy of the draft TEIR and a Notice of Completion with the State Clearinghouse, the State Gaming Agency, the County, the City, and the California Department of Justice, Office of the Attorney General. The Tribe shall also post the Notice and a copy of the draft TEIR on its website. The Notice of Completion shall include all of the following information:

(1) A brief description of the Project;

(2) The proposed location of the Project;

(3) An address where copies of the draft TEIR are available; and

(4) Notice of a period of forty-five (45) days during which the Tribe will receive comments on the draft TEIR.

(b) The Tribe will submit ten (10) copies each of the draft TEIR and Notice of Completion to the County, which will be asked to post public notice of the draft TEIR at the office of the County Board of Supervisors and to furnish the public notice to the public libraries serving the County. The County shall also be asked to serve in a timely manner the Notice of Completion to all Interested Persons, which Interested Persons shall be identified by the Tribe for the County, to the extent it can identify them. In addition, the Tribe will provide public notice by at least one of the procedures specified below:

(1) Publication at least one time by the Tribe in a newspaper of general circulation in the area affected by the Project. If more than one area is affected, the notice shall be published in the newspaper of largest circulation from among the newspapers of general circulation in those areas; or

(2) Direct mailing by the Tribe to the owners and occupants of property adjacent to, but outside, the Indian lands on which the Project is to be located. Owners of such property shall be identified as shown on the latest equalization assessment roll.

Sec. 11.8.4. Issuance of Final TEIR.

The Tribe shall prepare, certify and make available to the County, the City, the State Clearinghouse, the State Gaming Agency, and the California Department of Justice, Office of the Attorney General, at least fifty-five (55) days before the completion of negotiations pursuant to section 11.8.7 a Final TEIR, which shall consist of:

(a) The draft TEIR or a revision of the draft;

(b) Comments and recommendations received on the draft TEIR either verbatim or in summary;

(c) A list of persons, organizations, and public agencies commenting on the draft TEIR;

(d) The responses, which shall include good faith, reasoned analyses, of the Tribe to significant environmental points raised in the review and consultation process; and

(e) Any other information added by the Tribe.

Sec. 11.8.5. Cost Reimbursement to County.

The Tribe shall reimburse the County for copying and mailing costs resulting from making the Notice of Preparation, Notice of Completion, and Draft TEIR available to the public under this section 11.0.

Sec. 11.8.6. Failure to Prepare Adequate TEIR.

The Tribe's failure to prepare an adequate TEIR when required shall be deemed a breach of this Compact and furthermore shall be grounds for issuance of an injunction or other appropriate equitable relief.

Sec. 11.8.7. Intergovernmental Agreement.

(a) Before the commencement of a Project, and no later than the issuance of the Final TEIR to the County, the Tribe shall offer to commence negotiations with the County and the City, and upon the County's and/or the City's acceptance of the Tribe's offers, shall negotiate with the County and the City and shall enter into enforceable written agreements (hereinafter "intergovernmental agreements") with the County and the City with respect to the matters set forth below:

(1) The timely mitigation of any Significant Effect on the Environment (which effects may include, but are not limited to, aesthetics, agricultural resources, air quality, biological resources, cultural resources, geology and soils, hazards and hazardous materials, water resources, land use, mineral resources, traffic, noise, utilities and service systems, and cumulative effects), where such effect is attributable, in whole or in part, to the Project unless the parties agree that the particular mitigation is infeasible, taking into account economic, environmental, social, technological, or other considerations.

(2) Compensation for law enforcement, fire protection, emergency medical services and any other public services to be provided by the County or the City and its special districts to the Tribe for the purposes of the Gaming Operation, including the Gaming Facility, as a consequence of the Project.

(3) Reasonable compensation for programs designed to address gambling addiction.

(4) Mitigation of any effect on public safety attributable to the Project, including any compensation to the County or the City as a consequence thereof.

(b) The Tribe shall not commence a Project until the intergovernmental agreements with the County and the City specified in subdivision (a) are executed by the parties or are effectuated pursuant to section 11.8.8.

(c) If the Final TEIR identifies traffic impacts to the State highway system or facilities that are directly attributable in whole or in part to the Project, and the intergovernmental agreements with the County or the City do not otherwise provide for mitigation of such impacts, then before the commencement of a Project, and no later than the issuance of a Final TEIR to the State Gaming Agency, the Tribe shall negotiate with the California Department of Transportation or the State Designated Agency (if one is designated) and shall enter into an intergovernmental agreement with the California Department of Transportation or the State Designated Agency to provide for timely mitigation of all traffic impacts on the State highway system and facilities directly attributable to the Project, and to pay the Tribe's fair share of cumulative traffic impacts.

(d) Nothing in this section 11.8.7 requires the Tribe to enter into any other intergovernmental agreements with a local governmental entity other than as set forth in subdivision (a).

Sec. 11.8.8. Arbitration.

In order to foster good government-to-government relationships and to assure that the Tribe is not unreasonably prevented from commencing a Project and benefiting therefrom, if an intergovernmental agreement with the County or the City is not entered within seventy-five (75) days of the submission of the Final TEIR, or such further time as the Tribe and the County or the City (for purposes of this section "the parties") may agree in writing, any party may demand binding arbitration before a single arbitrator, who shall be a retired judge, pursuant to the Comprehensive Arbitration Rules and Procedures of JAMS (or if those rules no longer exist, the closest equivalent), as set forth herein with respect to any remaining disputes arising from, connected with, or related to the negotiation:

(a) The arbitration shall be conducted as follows: Each party shall exchange with each other within five (5) days of the demand for arbitration its last, best written offer made during the negotiation pursuant to section 11.8.7. The arbitrator shall schedule a hearing to be heard within thirty (30) days of his or her appointment unless the parties agree to a longer period. The arbitrator shall be limited to awarding only one of the offers submitted, without modification, based upon that proposal which best provides feasible mitigation of Significant Effects on the Environment and on public safety and most reasonably compensates for public services pursuant to section 11.8.7, without unduly interfering with the principal objectives of the Project or imposing environmental mitigation measures which are different in nature or scale from the type of measures that have been required to mitigate impacts of a similar scale of other projects in the surrounding area, to the extent there are such other projects. The arbitrator shall take into consideration whether the Final TEIR provides the data and information necessary to enable the County or the City to determine both whether the Project may result in a Significant Effect on the Environment and whether the proposed measures in mitigation are sufficient to mitigate any such effect. If the respondent does not participate in the arbitration, the arbitrator shall nonetheless conduct the arbitration and issue an award, and the claimant shall submit such evidence as the arbitrator may require therefore. Review of the resulting arbitration award is waived.

(b) In order to effectuate this section, and in the exercise of its sovereignty, the Tribe agrees to expressly waive, and also waive its

right to assert, sovereign immunity in connection with the arbitrator's jurisdiction and in any action to (i) enforce the other party's obligation to arbitrate, (ii) enforce or confirm any arbitral award rendered in the arbitration, or (iii) enforce or execute a judgment based upon the award.

(c) The arbitral award will become part of the intergovernmental agreements with the County or the City required under section 11.8.7.

Section 11.8.9. TEIR for Preferred Action.

Notwithstanding anything to the contrary in this section 11.0, the Final Environmental Impact Statement prepared by the NIGC pursuant to the National Environmental Policy Act of 1969 to assess the environmental consequences of the NIGC's approval of a management contract between the Tribe and SC Sonoma Management, LLC for the Graton Rancheria Casino and Hotel Project and noticed on February 27, 2009 (74 Fed. Reg. 9007), together with Attachments 3 through 7 to "National Indian Gaming Commission Record of Decision, Approval of Management Contract for Gaming Facility at the Wilfred Site in Sonoma County, California, for the Federated Indians of the Graton Rancheria," dated October 1, 2010, and noticed on October 15, 2010 (75 Fed. Reg. 63517) (hereinafter "NIGC Record of Decision"), constitutes a TEIR within the meaning of section 11.8.1, and satisfies the requirement under sections 11.8.1 through 11.8.5 with respect to construction of the initial Gaming Facility in accordance with the preferred action alternative (Variant H-sub1, hereinafter "Preferred Action") identified in the NIGC Record of Decision, whether constructed singularly or in phases; provided, however, that nothing herein eliminates the Tribe's obligation to prepare a TEIR with respect to any Project other than the Preferred Action, including any significant modifications to the initial Gaming Facility; provided further that nothing herein eliminates the requirements that the Tribe enter into intergovernmental agreements with the County, the City, and, if required, the California Department of Transportation prior to commencement of the Preferred Action as set forth in section 11.8.7. For purposes of section 11.8.8, with respect to commencement of the Preferred Action only, if the intergovernmental agreements with the County or the City have not been entered into within ninety (90) days after execution of this Compact, or such further time as the Tribe and the County or the City may agree in writing, any party may demand binding arbitration pursuant to section 11.8.8.

APPENDIX B

OFF-RESERVATION ENVIRONMENTAL IMPACT ANALYSIS CHECKLIST

APPENDIX B

Off-Reservation Environmental Impact Analysis Checklist

I. Aesthetics

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage off-reservation scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Create a new source of substantial light or glare, which would adversely affect day or nighttime views of historic buildings or views in the area?	☐	☒	☐	☐

II. Agricultural and Forest Resources

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Involve changes in the existing environment, which, due to their location or nature, could result in conversion of off-reservation farmland to non-agricultural use or conversion of off-reservation forest land to non-forest use?	☐	☐	☐	☐

III. Air Quality

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☒	☐	☐
b) Violate any air quality standard or contribute to an existing or projected air quality violation?	☐	☐	☒	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
d) Expose off-reservation sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people off-reservation?	☐	☐	☒	☐

IV. Biological Resources

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Have a substantial adverse impact, either directly or through habitat modifications, on any species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any off-reservation riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
c) Have a substantial adverse effect on federally protected offreservation wetlands as defined by Section 404 of the Clean Water Act?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒	☐

V. Cultural Resources

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of an off-reservation historical or archeological resource?	☐	☐	☐	☐
b) Directly or indirectly destroy a unique off-reservation paleontological resource or site or unique off-reservation geologic feature?	☐	☐	☐	☐
c) Disturb any off-reservation human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☐

VI. Geology and Soils

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Expose off-reservation people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic- related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial off-reservation soil erosion or the loss of topsoil?	☐	☒	☐	☐

VII. Greenhouse Gas Emissions

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the offreservation environment?	☐	☒	☐	☐
b) Conflict with any off-reservation plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

VIII. Hazards and Hazardous Materials

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Create a significant hazard to the off-reservation public or the off-reservation environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the off-reservation public or the off-reservation environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within onequarter mile of an existing or proposed off-reservation school?	☐	☐	☒	☐
d) Expose off-reservation people or structures to a significant risk of loss, injury or death involving wildland fires.	☐	☐	☒	☐

IX. Water Resources

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete off-reservation groundwater supplies or interfere substantially with groundwater recharge such that there should be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion of siltation off-site?	☐	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding off-site?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff off-reservation?	☐	☒	☐	☐
f) Place within a 100-year flood hazard area structures, which would impede or redirect off-reservation flood flows?	☐	☐	☐	☒

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
g) Expose off-reservation people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒

X. Land Use

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Conflict with any off-reservation land use plan, policy, or regulation of an agency adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
b) Conflict with any applicable habitat conservation plan or natural communities conservation plan covering offreservation lands?	☐	☐	☐	☒

XI. Mineral Resources

Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Result in the loss of availability of a known off-reservation mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state?	☐	☐	☐	☐
b) Result in the loss of availability of an off-reservation locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☐

XII. Noise

Would the project result in:	Potentially Significant Impact	Less Than Significant With Mitigation Incorporation	Less than Significant Impact	No Impact
a) Exposure of off-reservation persons to noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Exposure of off-reservation persons to excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in	☐	☐	☒	☐

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
the off-reservation vicinity of the project?				
d) A substantial temporary or periodic increase in ambient noise levels in the off-reservation vicinity of the project?	☐	☒	☐	☐

XIII. Population and Housing

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Induce substantial off-reservation population growth?	☐	☐	☒	☐
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere off-reservation?	☐	☐	☐	☒

XIV. Public Services

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered off-reservation governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the off-reservation public services:				
Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☒	☐
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

XV. Recreation

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Increase the use of existing off-reservation neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☐

XVI. Transportation / Traffic

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the off-reservation circulation system, taking into account all modes of transportation including mass transit and nonmotorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated off-reservation roads or highways?	☐	☐	☒	☐
c) Substantially increase hazards to an off-reservation design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d) Result in inadequate emergency access for off-reservation responders?	☐	☐	☒	☐

XVII. Utilities and Service Systems

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Exceed off-reservation wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant off-reservation environmental effects?	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant off-reservation environmental effects?	☐	☐	☒	☐
d) Result in a determination by an off-reservation wastewater treatment provider (if applicable), which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐

XVIII. Cumulative Effects

Would the project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less than Significant Impact*	*No Impact*
a) Have impacts that are individually limited, but cumulatively considerable off-reservation? "Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past, current, or probable future projects.	☐	☐	☒	☐

APPENDIX C

NOTICE OF PREPARATION AND COMMENT LETTERS

NOTICE OF PREPARATION

DATE: May 1, 2019

TO: Responsible Agencies, Trustee Agencies, and Interested Persons

FROM: Federated Indians of Graton Rancheria
Attn: NOP Comments
6400 Redwood Drive, Suite 300
Rohnert Park, CA 94928

SUBJECT: Notice of Preparation of a Tribal Environmental Impact Report
Graton Rancheria Back of House Expansion Project

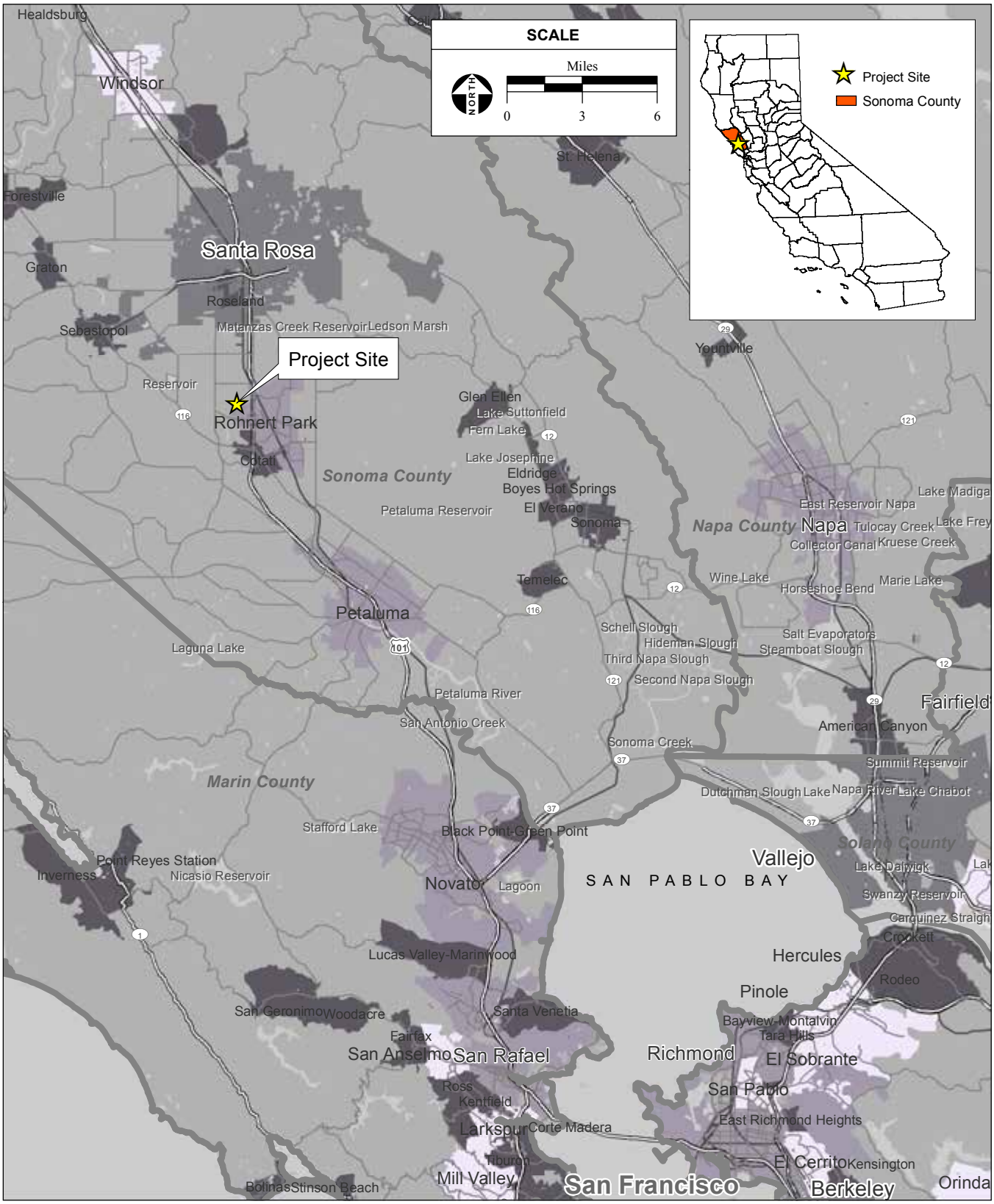
COMMENT PERIOD: May 1, 2019 to May 31, 2019

The Federated Indians of the Graton Rancheria (Tribe) is the responsible agency for the preparation of a Tribal Environmental Impact Report (TEIR) for the proposed Graton Rancheria Back of House Expansion Project (Proposed Project). This Notice of Preparation (NOP) has been prepared to describe the Proposed Project and associated TEIR as well as to solicit public input regarding the scope and content of the TEIR. The TEIR will examine potential off-reservation environmental effects of the Proposed Project. Comments should identify potential off-reservation environmental issues and reasonable mitigation measures to be addressed in the TEIR, and are due to the Tribe at the above address by 5 pm on May 31, 2019.

PROJECT DESCRIPTION

The Graton Resort & Casino (Resort) is owned by the Tribe and operated pursuant to federal law and the Tribal-State Compact between the Tribe and the State of California (Compact). The Compact sets forth procedures for environmental review. The Resort opened in November 2013 and currently includes the gaming, dining, hotel, spa facilities, and associated parking, and was the subject of an exhaustive Environmental Impact Statement approved by federal agencies in 2010.

The project site is located adjacent to the Resort on the Tribe's Reservation at 288 Golf Course Drive, Rohnert Park, California (**Figures 1** and **2**). The Tribe proposes to expand the Resort's back of house space (BOH) with the Proposed Project, which includes the demolition of approximately 3,000 square feet (sf) of existing BOH space and the development of approximately 12,000 sf of new space at the west (back) side of the existing casino building. The new space would be used for expanded offices and employee facilities (**Figure 3**). Potential off-reservation impacts of the Proposed Project will be evaluated in the TEIR.

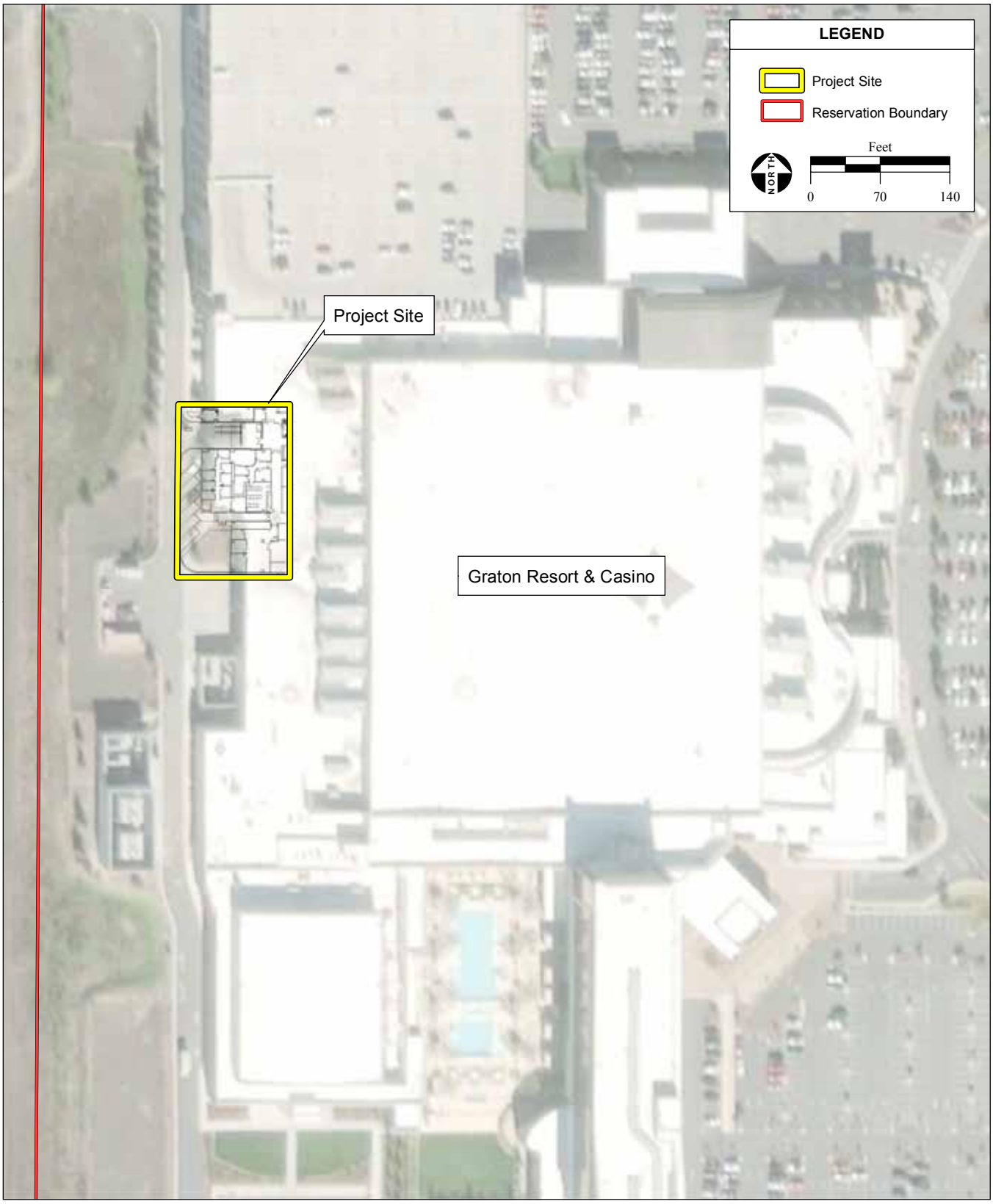


SOURCE: Streetmap North America, 2010; AES, 4/17/2019

Figure 1
Regional Location

SOURCE: DigitalGlobe aerial photograph, 9/1/2017; AES, 4/17/2019

Figure 2
Aerial Photograph



SOURCE: Friedmutter Group, 3/7/2019; DigitalGlobe aerial photograph, 9/1/2017; AES, 7/18/2019

Figure 3
Site Plan

TEIR SCOPE

Initial analysis of potentially significant off-reservation environmental impacts was conducted using the Off-reservation Environmental Impact Analysis Checklist in Appendix B of the Compact. Areas where the Proposed Project will not result in potentially significant off-reservation impacts will be eliminated from detailed discussion in the TEIR. These areas include cultural resources, agricultural and forest resources, mineral resources, and recreation.

The following off-reservation issue areas have been identified as having the potential to be impacted by the Proposed Project, and will be addressed within the TEIR:

- Aesthetics
- Air Quality
- Greenhouse Gas Emissions
- Geology and Soils
- Hazardous Materials
- Water Resources
- Land Use
- Noise
- Population and Housing
- Public Services
- Transportation and Traffic
- Utilities and Service Systems
- Cumulative Impacts

AESTHETICS

Aesthetic resources include scenic vistas, trees, rock outcroppings, historic buildings within a state scenic highway, and night sky conditions. The Proposed Project has the potential to result in changes to the visual character of the area. The TEIR will include a profile view of the Proposed Project, and will assess potential impacts on existing visual characteristics of the off-reservation area. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to aesthetics.

AGRICULTURAL RESOURCES

Agricultural resources include off-reservation areas used to produce, grow, and harvest crops and farmed products. The Proposed Project will be constructed on an area that has been previously paved and developed. No off-reservation impacts to agricultural resources would occur. The TEIR will not discuss agricultural resources further.

AIR QUALITY

Air quality is defined as the concentration of regulated pollutants, odor, and exposure to sensitive receptors. The Proposed Project has the potential to generate short-term emissions during the construction phase. The TEIR will assess off-reservation impacts of the Proposed Project associated with air quality, including consistency with applicable air quality standards and impacts to sensitive receptors from pollutant emissions. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to air quality.

BIOLOGICAL RESOURCES

Biological resources include sensitive habitats, wetlands and waters of the U.S., and protected plant and animal species. The Proposed Project will be constructed on an area that has been previously paved and developed, and therefore habitat quality on the project site is expected to be low. The TEIR will assess off-reservation environmental impacts of the Proposed Project. The previously issued Biological Opinion for the development of the existing Resort required exclusionary fencing to minimize potential impacts to off-reservation special-status species. This mitigation measure is anticipated to be implemented for the Proposed Project. The TEIR will identify additional mitigation measures, if necessary, to address potentially significant off-reservation impacts to biological resources.

CULTURAL RESOURCES

Cultural resources include prehistoric and historic properties and items, buildings, bridges, infrastructure, paleontological resources, and resources of importance to the Tribe. The Proposed Project will be constructed on an area that has been previously disturbed by prior development, and these areas have been previously surveyed for cultural resources. Because no off-reservation areas will be disturbed by the Proposed Project, cultural resources will not be further addressed in the TEIR.

GREENHOUSE GASES

Greenhouse gases (GHGs) are gases that contribute to climate change. The Proposed Project may result in short-term GHG emissions associated with construction. This could contribute to cumulative effects associated with climate change. The TEIR will assess off-reservation impacts of the Proposed Project associated with GHG emissions, including consistency with applicable GHG standards. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts due to GHGs.

GEOLOGY AND SOILS

Geology and soils include effects from earthquakes, ground shaking, seismic ground failure, landslides, or erosion as a result of the Proposed Project. The Proposed Project will be constructed on-reservation and will meet applicable earthquake safety standards. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts associated with geology and soils.

HAZARDS AND HAZARDOUS MATERIALS

Hazardous materials are those that appear on a list of hazardous materials prepared by a federal, state, or local agency, or that possess characteristics defined as hazardous by such an agency. Certain hazardous materials would be used during construction and operation of the Proposed Project. The TEIR will assess off-reservation impacts associated with hazards and hazardous materials attributable to the Proposed Project. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts associated with hazards and hazardous materials.

WATER RESOURCES

Water resources include water usage, wastewater generation, water and wastewater treatment, and water quality. The Proposed Project has the potential to result in increased water use and wastewater generation. Construction of the Proposed Project may increase the potential for erosion and direct or indirect discharge of sediment and other materials into off-reservation drainages near the project site.

The TEIR will assess off-reservation impacts of the Proposed Project on water resources, including compliance with applicable plans, standards, laws, and regulations relating to water resources, off-reservation groundwater supplies and quality, alteration of off-reservation drainage patterns, and off-reservation flood hazards. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to water resources.

LAND USE

Land use is defined as the manner at which land is used and modified by its corresponding community. The Proposed Project would not introduce new or alter existing off-reservation land use in the surrounding area. The Proposed Project would be constructed on-reservation, therefore, off-reservation land use plans, policies, habitat conservation plans, or natural community conservation plans would not apply to the Proposed Project. The TEIR will assess the Proposed Project's off-reservation impact on surrounding land uses, habitat conservation plans, and natural community preservation plans. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to land use.

NOISE

Noise is defined as unwanted sound. Construction and operation of the Proposed Project may increase off-reservation noise levels. The TEIR will assess the Proposed Project's off-reservation noise impacts. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to noise.

MINERAL RESOURCES

Mineral resources are defined as the concentration or occurrence of natural, solid, inorganic or fossilized organic material of such grade or quality that it has reasonable prospects for economic extraction. The Proposed Project would be constructed on-reservation and would not impact off-reservation mineral resources. The TEIR will not discuss mineral resources further.

POPULATION AND HOUSING

Population and housing includes the potential for population growth or displacement of housing. The Proposed Project would be constructed on-Reservation and would not displace existing housing. Construction employees would reside within commuting distance of the project site. The TEIR will assess the Proposed Project's impact on off-reservation population growth. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts associated with population and housing.

PUBLIC SERVICES

Public services include fire protection, emergency medical services, and law enforcement. The TEIR will assess whether the Proposed Project would generate the need to construct or alter existing fire, medical, police, or other public facilities. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to public services.

RECREATION

Recreation areas include public parks and other public facilities. The Proposed Project will be built on-reservation in an area previously paved and developed. Therefore, the Proposed Project would not impact off-reservation recreation areas. The TEIR will not discuss recreation further.

TRANSPORTATION AND TRAFFIC

Transportation and traffic include vehicular transportation, public transportation, and alternative modes of transportation, such as bicycles and walkways. The Proposed Project would generate additional short-term vehicular use of roads during construction. The TEIR will assess the Proposed Project's impacts on City, County, and state roads during construction and operation of the Proposed Project. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts associated with transportation and traffic.

UTILITIES AND SERVICE SYSTEMS

Utilities and service systems include water supply systems, wastewater, solid waste, and energy services. The existing water supply system and treatment plant on the reservation can accommodate the Proposed Project. Stormwater would be discharged into the existing drainage system. The TEIR will assess the Proposed Project's impacts on off-reservation water and wastewater treatment and drainage facilities. The TEIR will identify mitigation measures, if necessary, to address potentially significant off-reservation impacts to utilities and service systems.

CUMULATIVE IMPACTS

Cumulatively considerable off-reservation environmental impacts of the Proposed Project are those that are considerable when viewed in connection with past, current, or probable future projects. The TEIR will analyze whether the Proposed Project has the potential to result in cumulatively considerable off-reservation impacts.

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691 Phone (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

May 17, 2019

Pete Bontadelli
Federated Indians of the Graton Rancheria
6400 Redwood Drive, Suite 300
Rohnert PArk, CA 94928

RE: SCH# 2019059004 Graton Rancheria Back of House Expansion Project, Sonoma County

Dear Mr. Bontadelli:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements.** If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
   a. A brief description of the project.
   b. The lead agency contact information.
   c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
   d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).
   a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
   a. Alternatives to the project.
   b. Recommended mitigation measures.
   c. Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
   a. Type of environmental review necessary.
   b. Significance of the tribal cultural resources.
   c. Significance of the project's impacts on tribal cultural resources.
   d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
   a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
   b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
    a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
    b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
        i. Planning and construction to avoid the resources and protect the cultural and natural context.
        ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
        i. Protecting the cultural character and integrity of the resource.
        ii. Protecting the traditional use of the resource.
        iii. Protecting the confidentiality of the resource.
    c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).
    e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
    f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
    b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search **will** determine:
    a. If part or all of the APE has been previously surveyed for cultural resources.
    b. If any known cultural resources have already been recorded on or adjacent to the APE.
    c. If the probability is low, moderate, or high that cultural resources are located in the APE.
    d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
    b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
    a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
    b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
    c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Steven.Quinn@nahc.ca.gov.

Sincerely,

for Steven Quinn
Associate Governmental Program Analyst

cc: State Clearinghouse

APPENDIX D

BEST MANAGEMENT PRACTICES

Section 3
Erosion and Sediment Control BMPs

3.1 Erosion Control

Erosion control is any source control practice that protects the soil surface and prevents soil particles from being detached by rainfall, flowing water, or wind. Erosion control is also referred to as soil stabilization. Erosion control consists of preparing the soil surface and implementing one or more of the BMPs shown in Table 3-1, to disturbed soil areas.

Table 3-1 Erosion Control BMPs

BMP#	BMP Name
EC-1	Scheduling
EC-2	Preservation of Existing Vegetation
EC-3	Hydraulic Mulch
EC-4	Hydroseeding
EC-5	Soil Binders
EC-6	Straw Mulch
EC-7	Geotextiles & Mats
EC-8	Wood Mulching
EC-9	Earth Dikes and Drainage Swales
EC-10	Velocity Dissipation Devices
EC-11	Slope Drains
EC-12	Streambank Stabilization
EC-13	Polyacrylamide

All inactive soil-disturbed areas on the project site, and most active areas prior to the onset of rain, must be protected from erosion. Soil disturbed areas may include relatively flat areas as well as slopes. Typically, steep slopes and large exposed areas require the most robust erosion controls; flatter slopes and smaller areas still require protection, but less costly materials may be appropriate for these areas, allowing savings to be directed to the more robust BMPs for steep slopes and large exposed areas. To be effective, erosion control BMPs must be implemented at slopes and disturbed areas to protect them from concentrated flows.

Some erosion control BMPs can be used effectively to temporarily prevent erosion by concentrated flows. These BMPs, used alone or in combination, prevent erosion by intercepting, diverting, conveying, and discharging concentrated flows in a manner that prevents soil detachment and transport. Temporary concentrated flow conveyance controls may be required to direct run-on around or through the project in a non-erodible fashion. Temporary concentrated flow conveyance controls include the following BMPs:

- EC-9, Earth Dikes and Drainage Swales
- EC-10, Velocity Dissipation Devices
- EC-11, Slope Drains

3.2 Sediment Control

Sediment control is any practice that traps soil particles after they have been detached and moved by rain, flowing water, or wind. Sediment control measures are usually passive systems that rely on filtering or settling the particles out of the water or wind that is transporting them.

Sediment control practices include the BMPs listed in Table 3-2.

Table 3-2 Temporary Sediment Control BMPs

BMP#	BMP Name
SE-1	Silt Fence
SE-2	Sediment Basin
SE-3	Sediment Trap
SE-4	Check Dam
SE-5	Fiber Rolls
SE-6	Gravel Bag Berm
SE-7	Street Sweeping and Vacuuming
SE-8	Sandbag Barrier
SE-9	Straw Bale Barrier
SE-10	Storm Drain Inlet Protection
SE-11	Chemical Treatment

Sediment control BMPs include those practices that intercept and slow or detain the flow of stormwater to allow sediment to settle and be trapped. Sediment control practices can consist of installing linear sediment barriers (such as silt fence, sandbag barrier, and straw bale barrier); providing fiber rolls, gravel bag berms, or check dams to break up slope length or flow; or constructing a sediment trap or sediment basin. Linear sediment barriers are typically placed below the toe of exposed and erodible slopes, down-slope of exposed soil areas, around soil stockpiles, and at other appropriate locations along the site perimeter.

A few BMPs may control both sediment and erosion, for example, fiber rolls and sand bag barriers. The authors of this handbook have classified these BMPs as either erosion control (EC) or sediment control (SC) based on the authors opinion on the BMPs most common and effective use.

Sediment control BMPs are most effective when used in conjunction with erosion control BMPs. The combination of erosion control and sediment control is usually the most effective means to prevent sediment from leaving the project site and potentially entering storm drains or receiving waters. Under most conditions, the General Permit requires that the discharger implement an effective combination of erosion and sediment controls.

Under limited circumstances, sediment control, alone may be appropriate. For example, applying erosion control BMPs to an area where excavation, filling, compaction, or grading is currently under way may not be feasible when storms come unexpectedly. Use of sediment controls by establishing perimeter control on these areas may be appropriate and allowable under the General Permit provided the following conditions are met.

- Weather monitoring is under way.
- Inactive soil-disturbed areas have been protected with an effective combination of erosion and sediment controls.

- An adequate supply of sediment control materials are stored on-site and there are sufficient forces of labor and equipment available to implement sediment controls on the active area prior to the onset of rain.
- The SWPPP adequately describes the methods to protect active areas.

3.3 Wind Erosion Control

Wind erosion control consists of applying water or other dust palliatives to prevent or alleviate dust nuisance. Wind erosion control best management practices (BMPs) are shown in Table 3-3.

Table 3-3 Wind Erosion Control BMPs

BMP#	BMP Name
WE-1	Wind Erosion Control

Other BMPs that are sometimes applied to disturbed soil areas in order to control wind erosion are BMPs EC-2 through EC-7, shown in Section 3.1 of this Manual. Be advised that many of the dust palliatives may contain compounds that have an unknown effect on stormwater. A sampling and analysis protocol to test for stormwater contamination from exposure to such compounds is required in the SWPPP.

3.4 Tracking Control BMPs

Tracking control consists of preventing or reducing the tracking of sediment off-site by vehicles leaving the construction area. Tracking control best management practices (BMPs) are shown in Table 3-4.

Table 3-4 Temporary Tracking Control BMPs

BMP #	BMP Name
TR-1	Stabilized Construction Entrance/ Exit
TR-2	Stabilized Construction Roadway
TR-3	Entrance/Outlet Tire Wash

Attention to control of tracking sediment off site is highly recommended, as dirty streets and roads near a construction site create a nuisance to the public and generate constituent complaints to elected officials and regulators. These complaints often result in immediate inspections and regulatory actions.

3.5 Erosion and Sediment Control BMP Fact Sheet Format

A BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the above activities are provided in Section 3.6.

The fact sheets also contain side bar presentations with information on BMP objectives, targeted constituents, removal effectiveness, and potential alternatives.

EC-xx Example Fact Sheet

Description and Purpose

Suitable Applications

Limitations

Implementation

Costs

Inspection and Maintenance

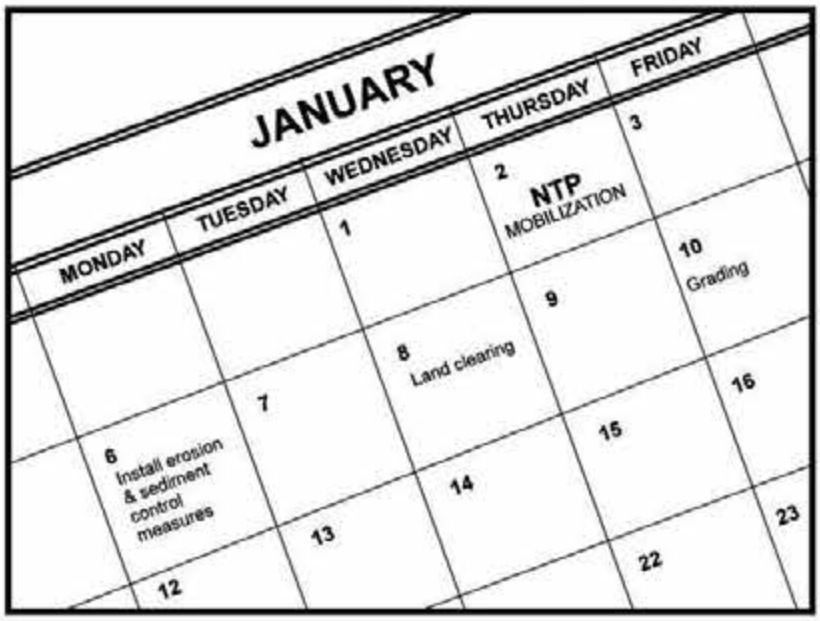
References

Figure 3-1
Example Fact Sheet

3.6 BMP Fact Sheets

BMP fact sheets for erosion, sediment, wind, and tracking controls follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusion in SWPPPs. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook web site at www.cabmphandbooks.com.

Scheduling EC-1



Objectives

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates to soil

disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

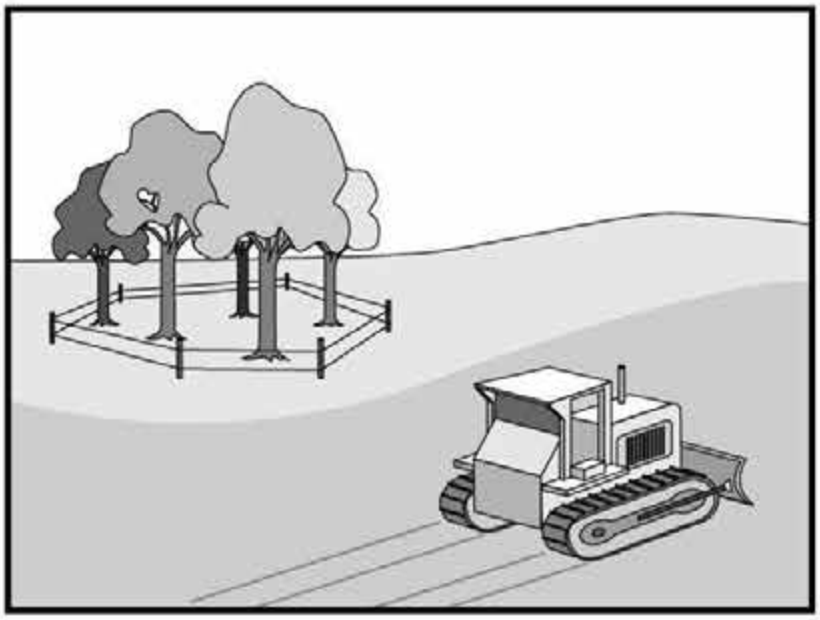
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

EC-2 Preservation Of Existing Vegetation

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

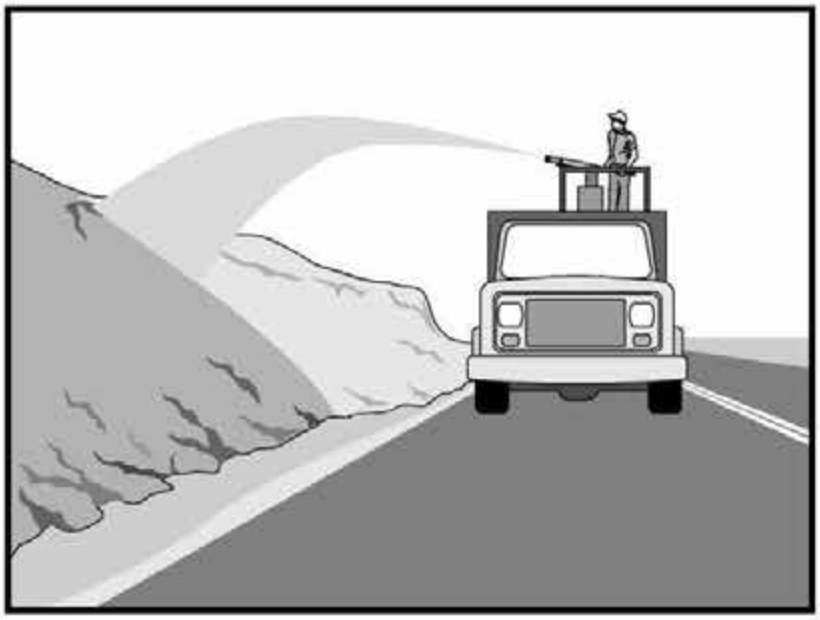
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch EC-3



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

Description and Purpose

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

Suitable Applications

Hydraulic mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

Wood fiber hydraulic mulches are generally short lived and need 24 hours to dry before rainfall occurs to be effective. May require a second application in order to remain effective for an entire rainy season.

Implementation

- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

- Paper based hydraulic mulches alone shall not be used for erosion control.

Hydraulic Mulches

Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 lb/acre. Wood fiber mulch is manufactured from wood or wood waste from lumber mills or from urban sources.

Hydraulic Matrices

Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area: 2,000 to 4,000 lb/acre wood fiber mulch, and 5 to 10% (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)

Bonded Fiber Matrix

Bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 lb/acre to 4,000 lb/acre based on the manufacturer's recommendation. A biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Costs

Average cost for installation of wood fiber mulch is $900/acre. Average cost for installation of BFM is $5,500/acre.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.

References

Controlling Erosion of Construction Sites Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

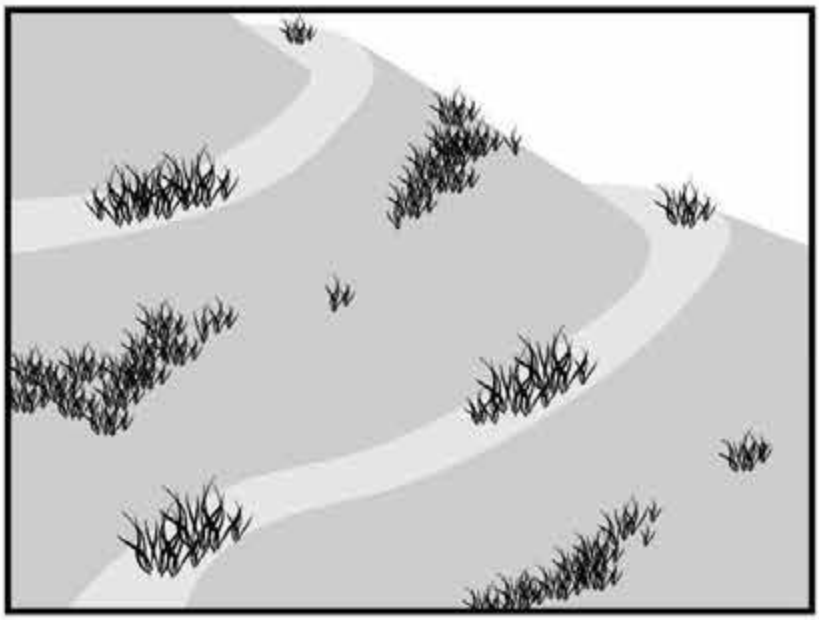
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily protect exposed soils from erosion by water and wind.

Suitable Applications

Hydroseeding is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short term inactivity.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Implementation

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps shall be followed for implementation:

- Avoid use of hydroseeding in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow up applications shall be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average cost for installation and maintenance may vary from as low as $300 per acre for flat slopes and stable soils, to $1600 per acre for moderate to steep slopes and/or erosive soils.

Hydroseeding		Installed Cost per Acre
High Density	Ornamentals	$400 - $1600
	Turf Species	$350
	Bunch Grasses	$300 - $1300
Fast Growing	Annual	$350 - $650
	Perennial	$300 - $800
Non-Competing	Native	$300 - $1600
	Non-Native	$400 - $500
Sterile	Cereal Grain	$500

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

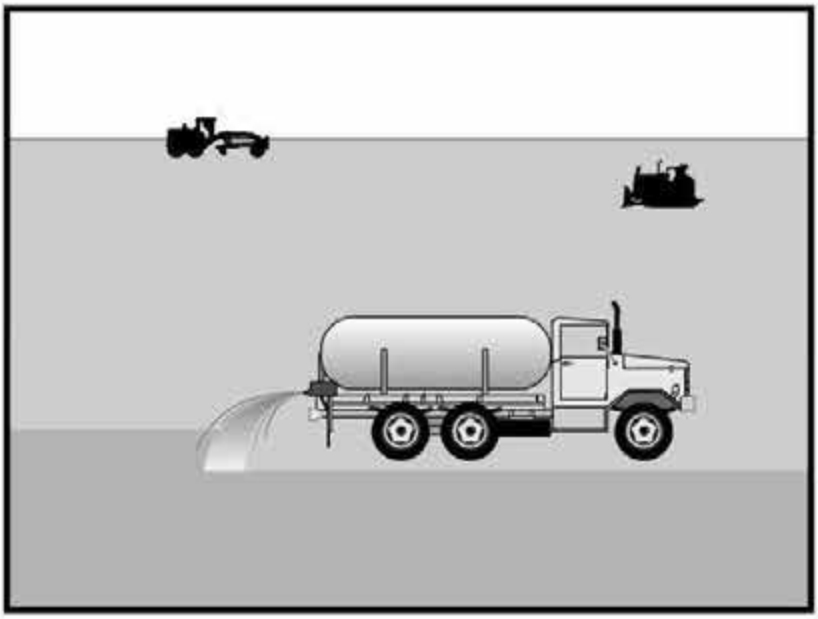
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems shall be inspected for complete coverage and adjusted as needed to maintain complete coverage.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders EC-5



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water induced erosion of exposed soils on construction sites. Soil binders also prevent wind erosion.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring short term temporary protection. Because soil binders can often be incorporated into the work, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are also suitable for use on stockpiles.

Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.

- Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup.
- A sampling and analysis plan must be incorporated into the SWPPP as soil binders could be a source of non-visible pollutants.

Implementation

General Considerations

- Regional soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces. Soil binders should not pollute stormwater.
- Some soil binders may not be compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this BMP. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could

lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

Plant-Material Based (Short Lived) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	40	45	50	60	70

Psyllium: Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

Starch: Starch is non-ionic, cold water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

- For clayey soil: 5 parts water to 1 part emulsion
- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

Acrylic Copolymers and Polymers: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

Liquid Polymers of Methacrylates and Acrylates: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:2 to 1:1	10.0 – 20.0

Poly-Acrylamide and Copolymer of Acrylamide: Linear copolymer polyacrylamide is packaged as a dry flowable solid. When used as a stand alone stabilizer, it is diluted at a rate of 11lb/1,000 gal of water and applied at the rate of 5.0 lb/acre.

Hydro-Colloid Polymers: Hydro-Colloid Polymers are various combinations of dry flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

Gypsum: This is a formulated gypsum based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd² or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd².

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate costs:

Soil Binder	Cost per Acre
Plant-Material Based (Short Lived) Binders	$400
Plant-Material Based (Long Lived) Binders	$1,200
Polymeric Emulsion Blend Binders	$400 (1)
Cementitious-Based Binders	$800

(1) $1,200 for Acrylic polymers and copolymers

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

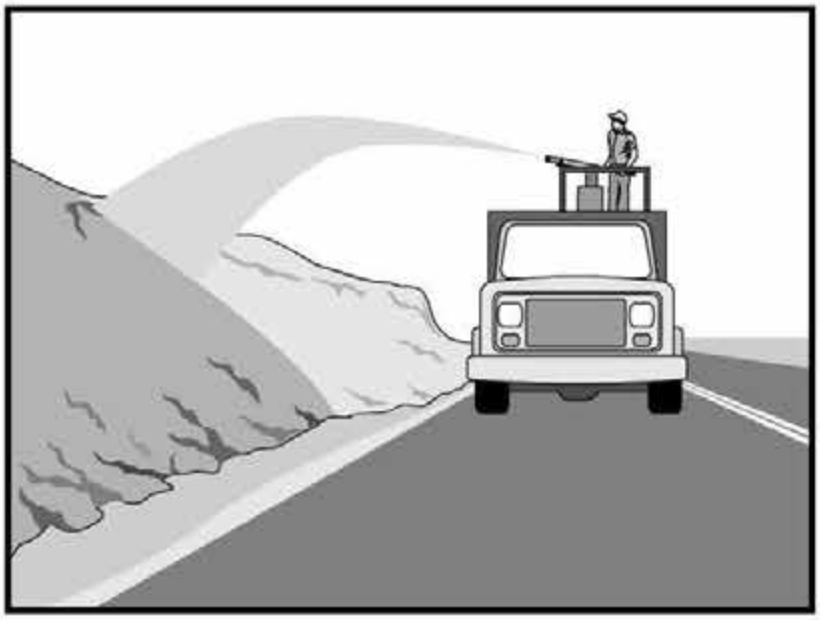
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
Relative Cost	Low	Low	Low	Low
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

Straw Mulch EC-6



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch is typically used for erosion control on disturbed areas until soils can be prepared for permanent vegetation. Straw mulch is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Limitations

- Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- There is a potential for introduction of weed seed and unwanted plant material.
- When straw blowers are used to apply straw mulch, the treatment areas must be within 150 ft of a road or surface capable of supporting trucks.
- Straw mulch applied by hand is more time intensive and potentially costly.

- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.

Implementation

- Straw shall be derived from wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw shall be used.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.
- In San Diego, use of straw near wood framed home construction has been frowned on by the Fire Marshall.

Application Procedures

- Apply straw at a minimum rate of 4,000 lb/acre, either by machine or by hand distribution.
- Roughen embankments and fill rills before placing the straw mulch by rolling with a crimping or punching type roller or by track walking.
- Evenly distribute straw mulch on the soil surface.
- Anchor straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating). Alternatively, use a tackifier to adhere straw fibers.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - On small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper".
  - On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes as described in EC-7, Geotextiles and Mats.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place. A tackifier is

typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is $2,500 per acre. Application by hand is more time intensive and potentially costly.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

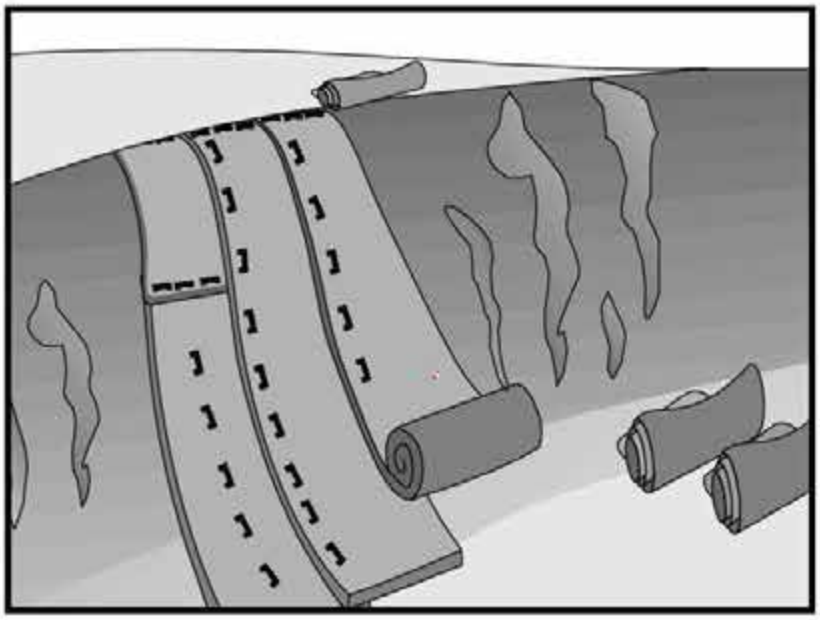
Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Geotextiles and Mats EC-7



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	3
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-8 Wood Mulching

Description and Purpose

Mattings of natural materials are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, matting may be used to stabilize soils until vegetation is established.

Suitable Applications

Mattings are commonly applied on short, steep slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks where moving water at velocities between 3 ft/s and 6 ft/s are likely to wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. Matting may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). Erosion control matting should be considered when the soils are fine grained and potentially erosive. These measures should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop
- Channels with flows exceeding 3.3 ft/s

- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs)

Limitations

- Properly installed mattings provide excellent erosion control but do so at relatively high cost. This high cost typically limits the use of mattings to areas of concentrated channel flow and steep slopes.
- Mattings are more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- Installation is critical and requires experienced contractors. The contractor should install the matting material in such a manner that continuous contact between the material and the soil occurs.
- Geotextiles and Mats may delay seed germination, due to reduction in soil temperature.
- Blankets and mats are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until alternative measures, such as seeding and mulching, may be installed.
- Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.
- Not suitable for areas that have heavy foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.

Implementation

Material Selection

Organic matting materials have been found to be effective where re-vegetation will be provided by re-seeding. The choice of matting should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

The following natural and synthetic mattings are commonly used:

Geotextiles

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil.

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.

  - **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, ±10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples

should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd^2. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

- **Plastic netting** is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Bonded synthetic fibers** consist of a three dimensional geomatrix nylon (or other synthetic) matting. Typically it has more than 90 percent open area, which facilitates root growth. It's tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket

installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. When using jute matting on a seeded area, apply approximately half the seed before laying the mat and the remainder after laying the mat. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots are made of glass fiber strips, excelsior matting strips or tight folded jute matting blanket or strips for use on steep, highly erodible watercourses. The check slots are placed in narrow trenches 6 to 12 in. deep across the channel and left flush with the soil surface. They are to cover the full cross section of designed flow.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the friable seedbed made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

Anchoring

- U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft.

- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2.

Installation in Channels

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 3 in. above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 3 in. overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.

- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement)

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

Temporary Soil Stabilization Removal

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Relatively high compared to other BMPs. Biodegradable materials: $0.50 - $0.57/yd². Permanent materials: $3.00 - $4.50/yd². Staples: $0.04 - $0.05/staple. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre
Biodegradable	Jute Mesh	$6,500
	Curled Wood Fiber	$10,500
	Straw	$8,900
	Wood Fiber	$8,900
	Coconut Fiber	$13,000
	Coconut Fiber Mesh	$31,200
	Straw Coconut Fiber	$10,900
Non-Biodegradable	Plastic Netting	$2,000
	Plastic Mesh	$3,200
	Synthetic Fiber with Netting	$34,800
	Bonded Synthetic Fibers	$50,000
	Combination with Biodegradable	$32,000

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.
- Check that disturbed areas are seeded.

References

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

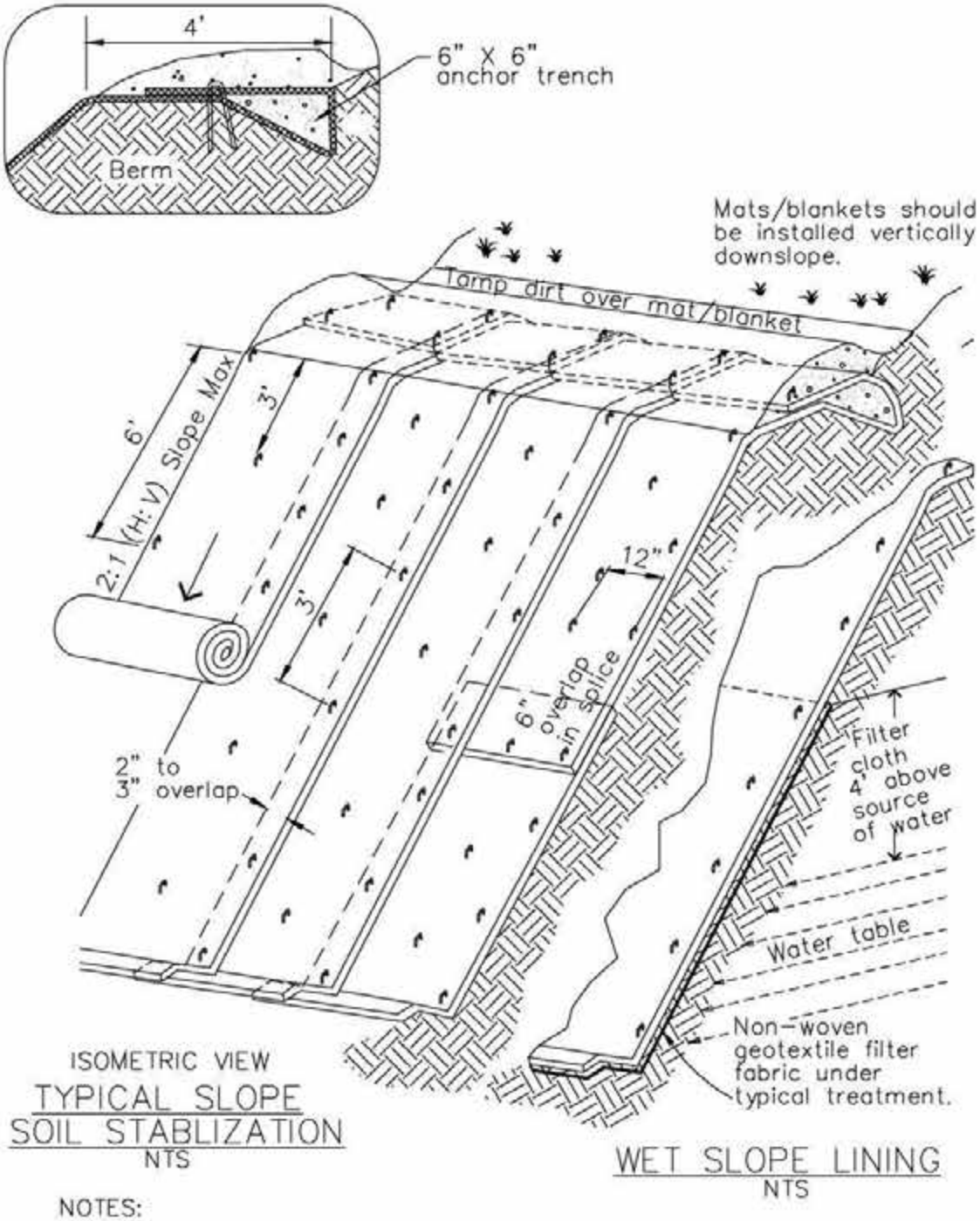
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



ISOMETRIC VIEW

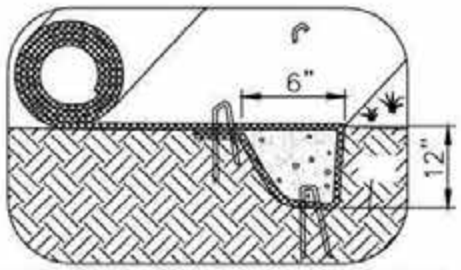
TYPICAL SLOPE
SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS

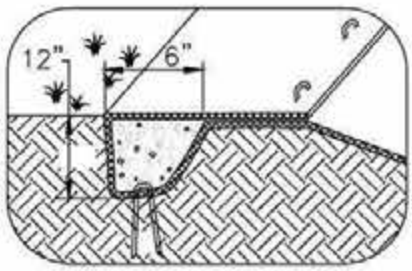
NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

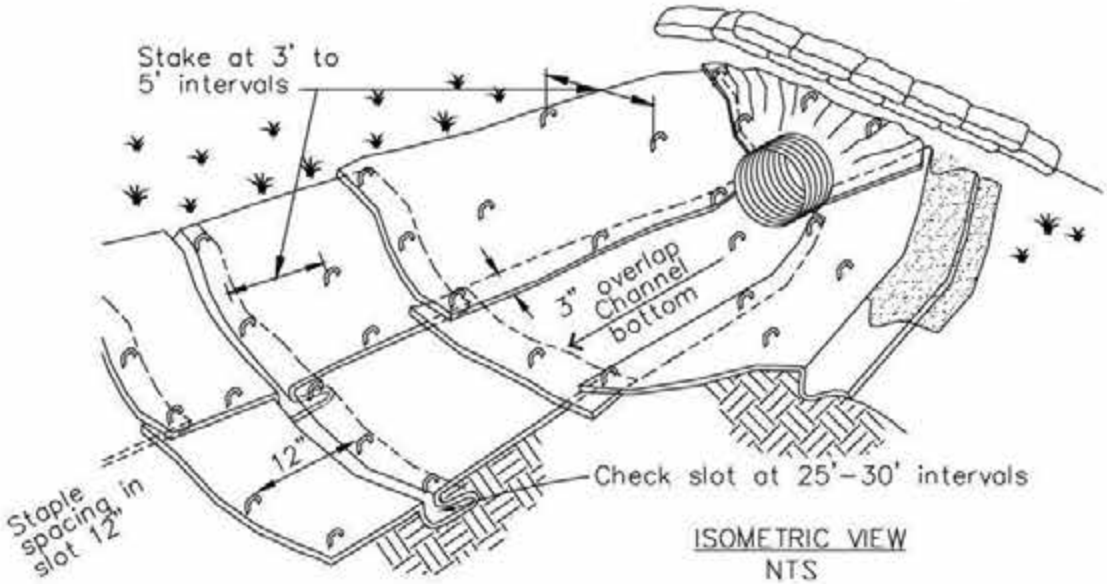
TYPICAL INSTALLATION DETAIL



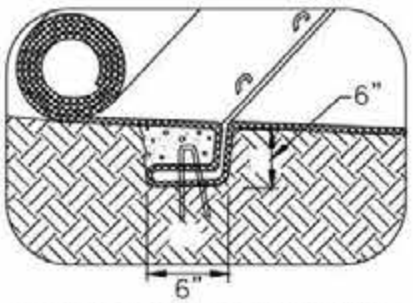
INITIAL CHANNEL ANCHOR TRENCH
NTS



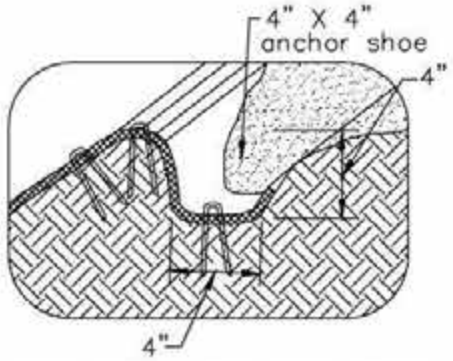
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
NTS



ISOMETRIC VIEW
NTS



INTERMITTENT CHECK SLOT
NTS



LONGITUDINAL ANCHOR TRENCH
NTS

NOTES:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL

Wood Mulching EC-8

Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats

Description and Purpose

Wood mulching consist of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

Limitations

- Not suitable for use on slopes steeper than 3:1 (H:V). Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter.
- Wood mulch and compost may introduce unwanted species.
- Not suitable for areas exposed to concentrated flows.
- May need to be removed prior to further earthwork.

Implementation

Mulch Selection

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such

as a punching type roller or by track walking. The construction application procedures for mulches vary significantly depending upon the type of mulching method specified. Two methods are highlighted here:

- Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is around $4,000 per acre, but cost can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Regardless of the mulching technique selected, the key consideration in inspection and maintenance is that the mulch needs to last long enough to achieve erosion control objectives. If the mulch is applied as a stand alone erosion control method over disturbed areas (without seed), it should last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

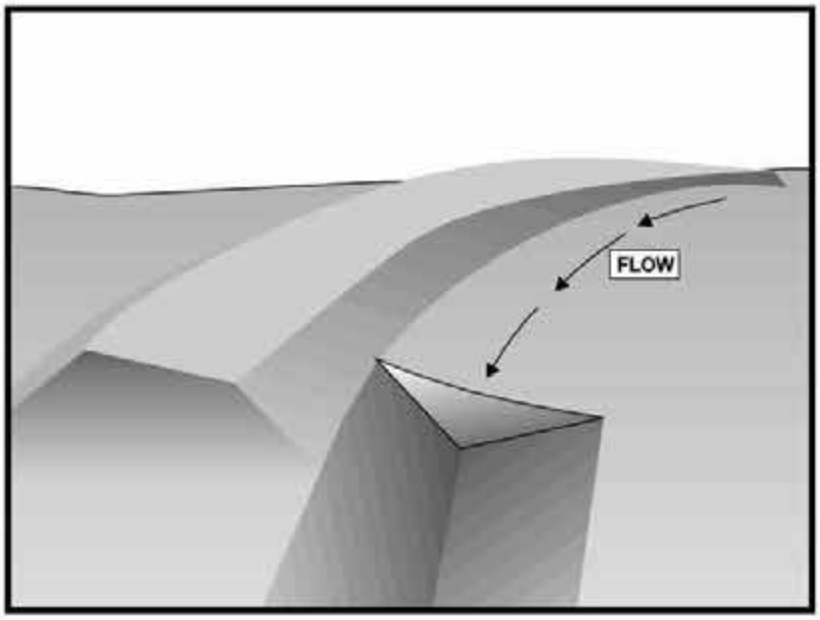
Sedimentation and Erosion Control, An Inventory of Current Practices Draft, U.S. EPA, April 1990.

Soil Erosion by Water Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Earth Dikes and Drainage Swales EC-9



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and

compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd^3.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

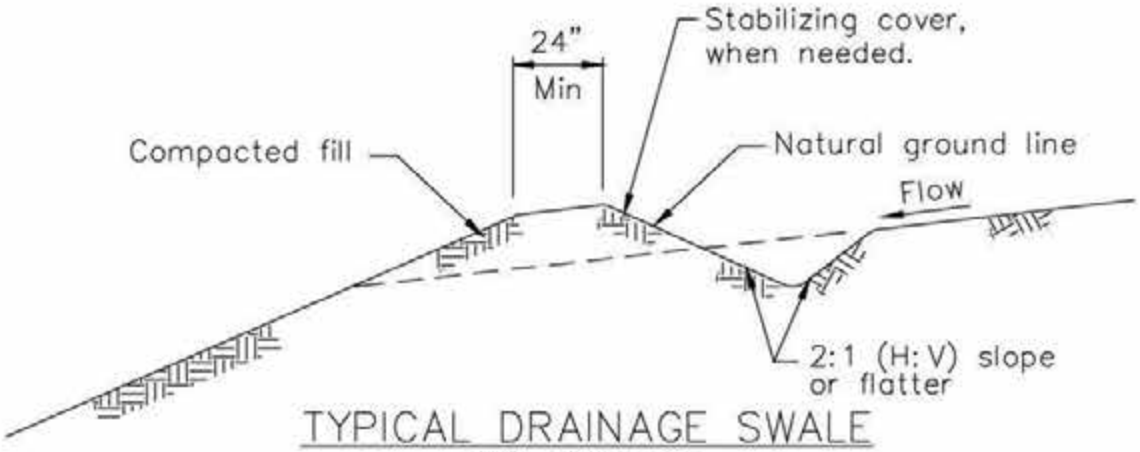
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

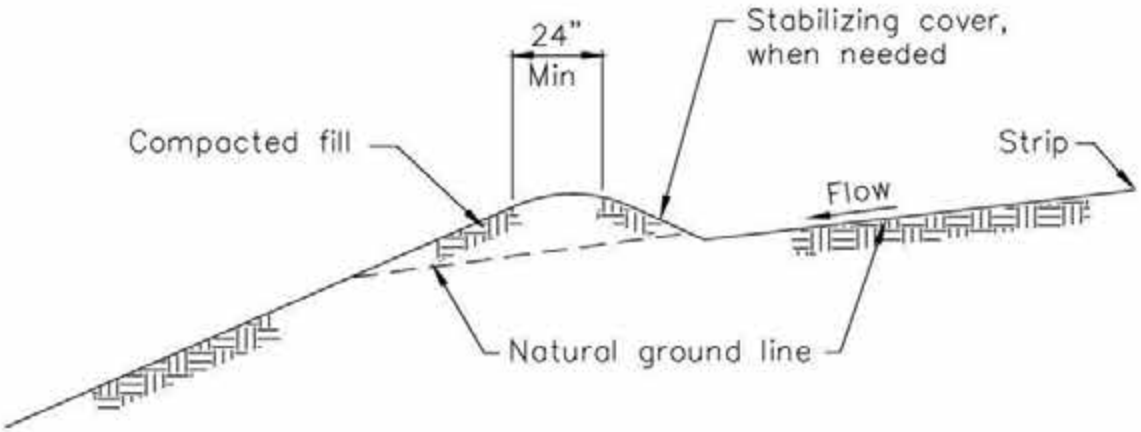
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL DRAINAGE SWALE
NOT TO SCALE

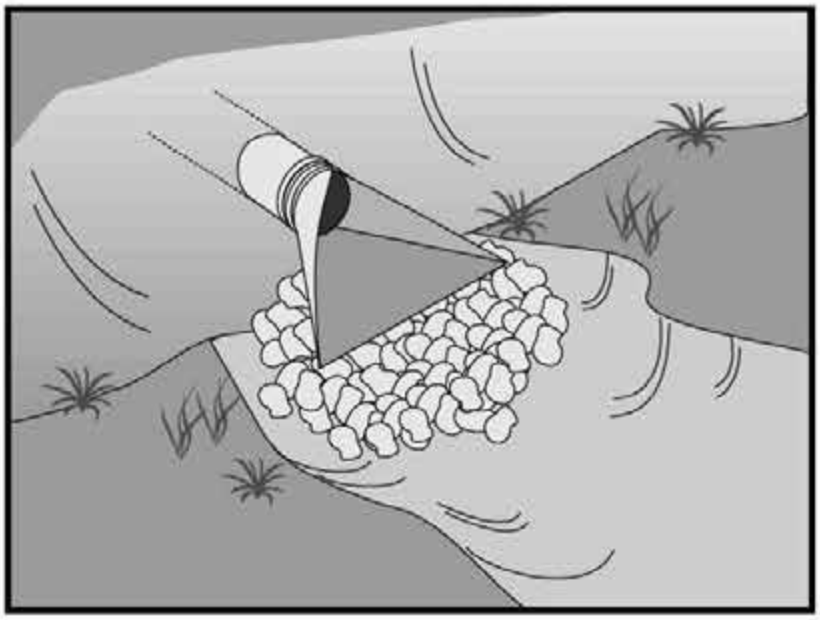
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.
  - Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
  - Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- For proper operation of apron: Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

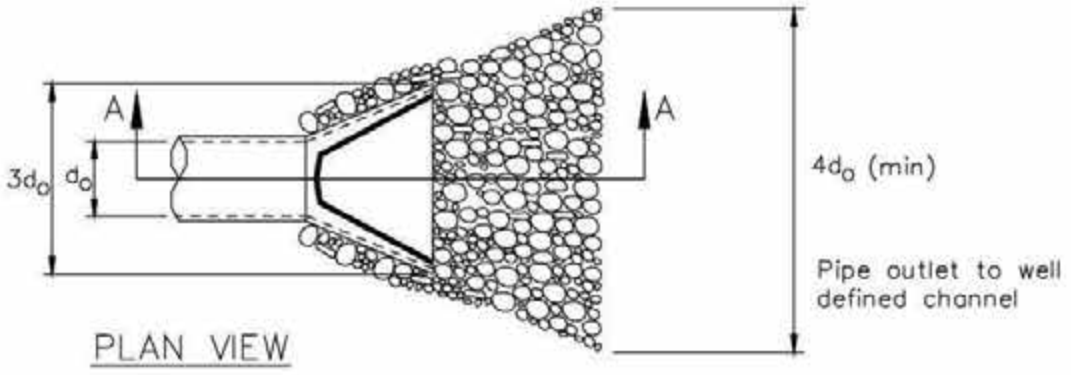
Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

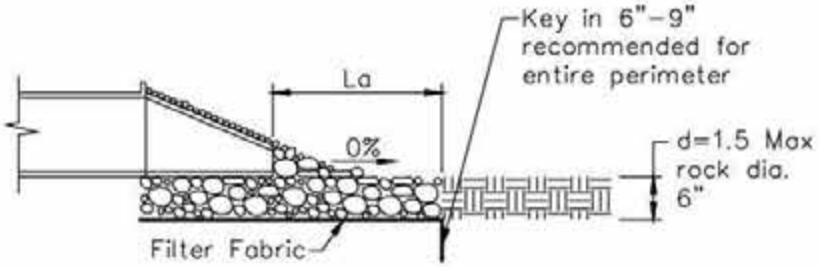
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, state of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



PLAN VIEW



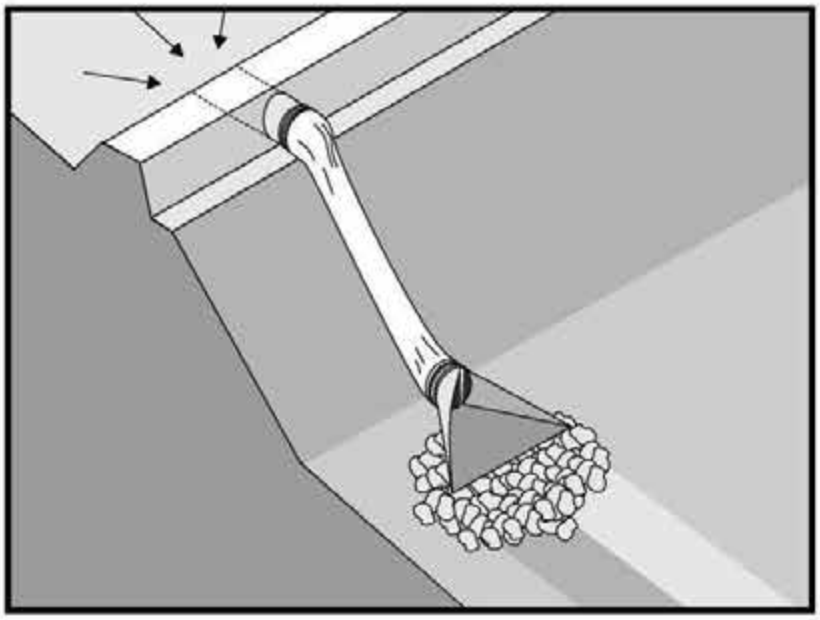
SECTION A–A

Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS

Slope Drains

EC-11



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

Description and Purpose

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area. Slope drains are used with earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

  - During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
  - If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.

- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.
- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.

- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.
  - Compact soil around and under entrance, outlet, and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - Check to ensure that pipe connections are watertight.
  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.
- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy-duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.
- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.
- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and, if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$19.60 per LF
15"	$22.00
18"	$26.00
24"	$32.00
30"	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$24.50
14"	$49.00
16"	$51.00
18"	$54.00
20"	$66.00
24"	$93.00
30"	$130.00

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.
- Inspect slope drainage for accumulations of debris and sediment.
- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.

- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

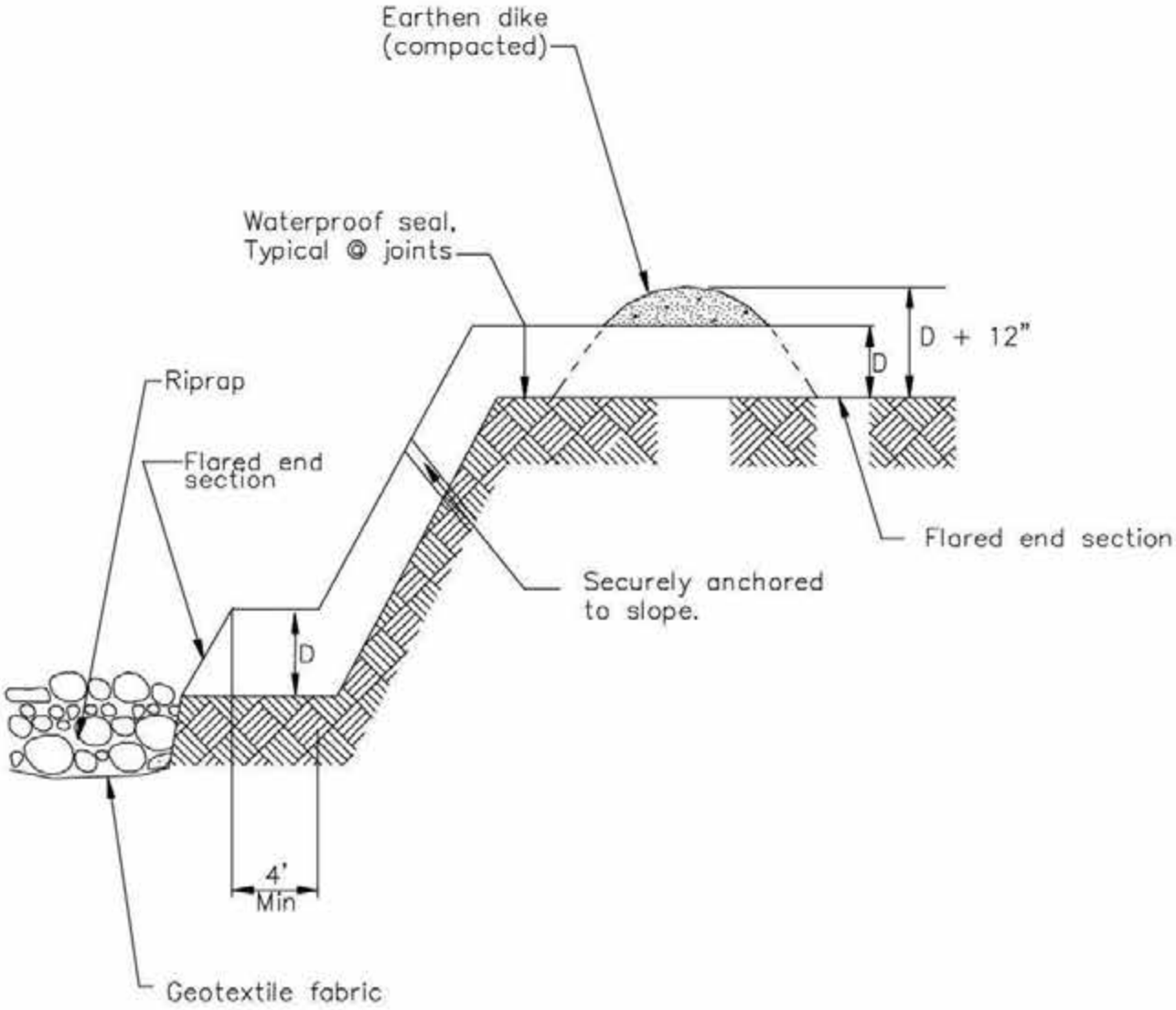
National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL SLOPE DRAIN
NOT TO SCALE

Streambank Stabilization EC-12

Objectives

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

Combination of erosion and sediment controls.

Description and Purpose

Stream channels, streambanks, and associated riparian areas are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream's sediment load, which can cause channel erosion or sedimentation and have adverse affects on the biotic system. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses. Streams on the 303(d) list and listed for sediment may require numerous measures to prevent any increases in sediment load to the stream.

Suitable Applications

These procedures typically apply to all construction projects that disturb or occur within stream channels and their associated riparian areas.

Limitations

Specific permit requirements or mitigation measures such as Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game supercede the guidance in this BMP.

- If numerical based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams listed as 303(d) impaired for sediment, silt, or turbidity, are required to conduct sampling

to verify that there is no net increase in sediment load due to construction activities.

Implementation

Planning

- Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, wildlife resources, land uses, or land users. Planning should take into account: scheduling; avoidance of in-stream construction; minimizing disturbance area and construction time period; using pre-disturbed areas; selecting crossing location; and selecting equipment.

Scheduling

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with EC-1, Scheduling. Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows.

- When in-stream construction is conducted in a perennial stream, work should optimally be performed during the rainy season. This is because in the summer, any sediment-containing water that is discharged into the watercourse will cause a large change in both water clarity and water chemistry. During the rainy season, there is typically more and faster flowing water in the stream so discharges are diluted faster. However, should in-stream work be scheduled for summer, establishing an isolation area, or diverting the stream, will significantly decrease the amount of sediment stirred up by construction work. Construction work near perennial streams should optimally be performed during the dry season (see below).

- When working in or near ephemeral streams, work should be performed during the dry season. By their very nature, ephemeral streams are usually dry in the summer, and therefore, in-stream construction activities will not cause significant water quality problems. However, when tying up the site at the end of the project, wash any fines (see Washing Fines) that accumulated in the channel back into the bed material, to decrease pollution from the first rainstorm of the season.

- When working near ephemeral or perennial streams, erosion and sediment controls (see silt fences, straw bale barriers, etc.) should be implemented to keep sediment out of stream channel.

Minimize Disturbance

- Minimize disturbance through: selection of the narrowest crossing location; limiting the number of equipment trips across a stream during construction; and, minimizing the number and size of work areas (equipment staging areas and spoil storage areas). Place work areas at least 50 ft from stream channel. Field reconnaissance should be conducted during the planning stage to identify work areas.

Use of Pre-Disturbed Areas

- Locate project sites and work areas in areas disturbed by prior construction or other activity when possible.

Selection of Project Site

- Avoid steep and unstable banks, highly erodible or saturated soils, or highly fractured rock.
- Select project site that minimizes disturbance to aquatic species or habitat.

Equipment Selection

- Select equipment that reduces the amount of pressure exerted on the ground surface, and therefore, reduces erosion potential and/or use overhead or aerial access for transporting equipment across drainage channels. Use equipment that exerts ground pressures of less than 5 or 6 lb/in^2, where possible. Low ground pressure equipment includes: wide or high flotation tires (34 to 72 in. wide); dual tires; bogie axle systems; tracked machines; lightweight equipment; and, central tire inflation systems.

Streambank Stabilization

Preservation of Existing Vegetation

- Preserve existing vegetation in accordance with EC-2, Preservation of Existing Vegetation. In a streambank environment, preservation of existing vegetation provides the following benefits.

Water Quality Protection

- Vegetated buffers on slopes trap sediment and promote groundwater recharge. The buffer width needed to maintain water quality ranges from 15 to 100 ft. On gradual slopes, most of the filtering occurs within the first 30 ft. Steeper slopes require a greater width of vegetative buffer to provide water quality benefits.

Streambank Stabilization

- The root system of riparian vegetation stabilizes streambanks by increasing tensile strength in the soil. The presence of vegetation modifies the moisture condition of slopes (infiltration, evapo transpiration, interception) and increases bank stability.

Riparian Habitat

- Buffers of diverse riparian vegetation provide food and shelter for riparian and aquatic organisms. Minimizing impacts to fisheries habitat is a major concern when working near streams and rivers. Riparian vegetation provides shade, shelter, organic matter (leaf detritus and large woody debris), and other nutrients that are necessary for fish and other aquatic organisms. Buffer widths for habitat concerns are typically wider than those recommended for water quality concerns (100 to 1500 ft).
- When working near watercourses, it is important to understand the work site's placement in the watershed. Riparian vegetation in headwater streams has a greater impact on overall water quality than vegetation in downstream reaches. Preserving existing vegetation upstream is necessary to maintain water quality, minimize bank failure, and maximize riparian habitat, downstream of the work site.

Limitations

- Local county and municipal ordinances regarding width, extent and type of vegetative buffer required may exceed the specifications provided here; these ordinances should be investigated prior to construction.

Streambank Stabilization Specific Installation

- As a general rule, the width of a buffer strip between a road and the stream is recommended to be 50 ft plus four times the percent slope of the land, measured between the road and the top of stream bank.

Hydraulic Mulch

- Apply hydraulic mulch on disturbed streambanks above mean high water level in accordance with EC-3, Hydraulic Mulch to provide temporary soil stabilization.

Limitations

- Do not place hydraulic mulch or tackifiers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication (eutrophication is an algal bloom caused by excessively high nutrient levels in the water).

Hydroseeding

- Hydroseed disturbed streambanks in accordance with EC-4, Hydroseeding.

Limitations

- Do not place tackifiers or fertilizers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication.

Soil Binders

- Apply soil binders to disturbed streambanks in accordance with EC-5, Soil Binders.

Limitations

- Do not place soil binders below the mean high water level. Soil binder must be environmentally benign and non-toxic to aquatic organisms.

Straw Mulch

- Apply straw mulch to disturbed streambanks in accordance with EC-6, Straw Mulch.

Limitations

- Do not place straw mulch below the mean high water level, as this material could wash into the channel and impact water quality or possibly cause eutrophication.

Geotextiles and Mats

- Install geotextiles and mats as described in EC-7, Geotextiles and Mats, to stabilize disturbed channels and streambanks. Not all applications should be in the channel, for example, certain geotextile netting may snag fish gills and are not appropriate in fish bearing streams. Geotextile fabrics that are not biodegradable are not appropriate for in stream use. Additionally, geotextile fabric or blankets placed in channels must be adequate to sustain anticipated hydraulic forces.

Earth Dikes, Drainage Swales, and Lined Ditches

- Convey, intercept, or divert runoff from disturbed streambanks using EC-9, Earth Dikes and Drainage Swales.

Limitations

- Do not place earth dikes in watercourses, as these structures are only suited for intercepting sheet flow, and should not be used to intercept concentrated flow.

- Appropriately sized velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Velocity Dissipation Devices

- Place velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with EC-10, Velocity Dissipation Devices.

Slope Drains

- Use slope drains to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area in accordance with EC-11, Slope Drains.

Limitations

- Appropriately sized outlet protection and velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Streambank Sediment Control

Silt Fences

- Install silt fences in accordance with SE-1, Silt Fence, to control sediment. Silt fences should only be installed where sediment laden water can pond, thus allowing the sediment to settle out.

Fiber Rolls

- Install fiber rolls in accordance with SE-5, Fiber Rolls, along contour of slopes above the high water level to intercept runoff, reduce flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. In a stream environment, fiber rolls should be used in conjunction with other sediment control methods such as SE-1, Silt Fence or SE-9 Straw Bale Barrier. Install silt fence, straw bale barrier, or other erosion control method along toe of slope above the high water level.

Gravel Bag Berm

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment laden sheet flow runoff in accordance with SE-6, Gravel Bag Berm. In a stream environment gravel bag barriers can allow sediment to settle from runoff before water leaves the construction site and can be used to isolate the work area from the live stream.

Limitations

- Gravel bag barriers are not recommended as a perimeter sediment control practice around streams.

Straw Bale Barrier

- Install straw bale barriers in accordance with SE-9, Straw Bale Barrier, to control sediment. Straw bale barriers should only be installed where sediment laden water can pond, thus allowing the sediment to settle out. Install a silt fence in accordance with SE-1, Silt Fence,

on down slope side of straw bale barrier closest to stream channel to provide added sediment control.

Rock Filter

Description and Purpose

Rock filters are temporary erosion control barriers composed of rock that is anchored in place. Rock filters detain the sediment laden runoff, retain the sediment, and release the water as sheet flow at a reduced velocity. Typical rock filter installations are illustrated at the end of this BMP.

Applications

- Near the toe of slopes that may be subject to flow and rill erosion.

Limitations

- Inappropriate for contributing drainage areas greater than 5 acres.
- Requires sufficient space for ponded water.
- Ineffective for diverting runoff because filters allow water to slowly seep through.
- Rock filter berms are difficult to remove when construction is complete.
- Unsuitable in developed areas or locations where aesthetics is a concern.

Specifications

- Rock: open graded rock, 0.75 to 5 in. for concentrated flow applications.
- Woven wire sheathing: 1 in. diameter, hexagonal mesh, galvanized 20gauge (used with rock filters in areas of concentrated flow).
- In construction traffic areas, maximum rock berm heights should be 12 in. Berms should be constructed every 300 ft on slopes less than 5%, every 200 ft on slopes between 5% and 10%, and every 100 ft on slopes greater than 10%.

Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Reshape berms as needed and replace lost or dislodged rock, and filter fabric.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

K-rail

Description and Purpose

This is temporary sediment control that uses K-rails to form the sediment deposition area, or to isolate the near bank construction area. Install K-rails at toe of slope in accordance with procedures described in NS-5, Clear Water Diversion.

Barriers are placed end to end in a pre-designed configuration and gravel filled bags are used at the toe of the barrier and at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

Appropriate Applications

- This technique is useful at the toe of embankments, cuts or fills slopes.

Limitations

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Implementation

- Refer to NS-5, Clear Water Diversion, for implementation requirements.

Instream Construction Sediment Control

There are three different options currently available for reducing turbidity while working in a stream or river. The stream can be isolated from the area in which work is occurring by means of a water barrier, the stream can be diverted around the work site through a pipe or temporary channel, or one can employ construction practices that minimize sediment suspension.

Whatever technique is implemented, an important thing to remember is that dilution can sometimes be the solution. A probable "worst time" to release high TSS into a stream system might be when the stream is very low; summer low flow, for example. During these times, the flow may be low while the biological activity in the stream is very high. Conversely, the addition of high TSS or sediment during a big storm discharge might have a relatively low impact, because the stream is already turbid, and the stream energy is capable of transporting both suspended solids, and large quantities of bedload through the system. The optimum time to "pull" in-stream structures may be during the rising limb of a storm hydrograph.

Techniques to minimize Total Suspended Solids (TSS)

- **Padding** - Padding laid in the stream below the work site may trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream, and placed on the bank to assist in re-vegetation.

- **Clean, washed gravel** - Using clean, washed gravel decreases solid suspension, as there are fewer small particles deposited in the stream.

- **Excavation using a large bucket** - Each time a bucket of soil is placed in the stream, a portion is suspended. Approximately the same amount is suspended whether a small amount of soil is placed in the stream, or a large amount. Therefore, using a large excavator bucket instead of a small one, will reduce the total amount of soil that washes downstream.

- **Use of dozer for backfilling** - Using a dozer for backfilling instead of a backhoe follows the same principles – the fewer times soil is deposited in the stream, the less soil will be suspended.

- **Partial dewatering with a pump** - Partially dewatering a stream with a pump reduces the amount of water, and thus the amount of water that can suspend sediment.

Washing Fines

Definition and Purpose

- Washing fines is an "in-channel" sediment control method, which uses water, either from a water truck or hydrant, to wash stream fines that were brought to the surface of the channel bed during restoration, back into the interstitial spaces of the gravel and cobbles.

- The purpose of this technique is to reduce or eliminate the discharge of sediment from the channel bottom during the first seasonal flow. Sediment should not be allowed into stream channels; however, occasionally in-channel restoration work will involve moving or otherwise disturbing fines (sand and silt sized particles) that are already in the stream, usually below bankfull discharge elevation. Subsequent re-watering of the channel can result in a plume of turbidity and sedimentation.

- This technique washes the fines back into the channel bed. Bedload materials, including gravel cobbles, boulders and those fines, are naturally mobilized during higher storm flows. This technique is intended to delay the discharge until the fines would naturally be mobilized.

Appropriate Applications

- This technique should be used when construction work is required in channels. It is especially useful in intermittent or ephemeral streams in which work is performed "in the dry", and which subsequently become re-watered.

Limitations

- The stream must have sufficient gravel and cobble substrate composition.

- The use of this technique requires consideration of time of year and timing of expected stream flows.

- The optimum time for the use of this technique is in the fall, prior to winter flows.

- Consultation with, and approval from the Department of Fish and Game and the Regional Water Quality Control Board may be required.

Implementation

- Apply sufficient water to wash fines, but not cause further erosion or runoff.

- Apply water slowly and evenly to prevent runoff and erosion.

- Consult with Department of Fish and Game and the Regional Water Quality Control Board for specific water quality requirements of applied water (e.g. chlorine).

Inspection and Maintenance

- None necessary

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

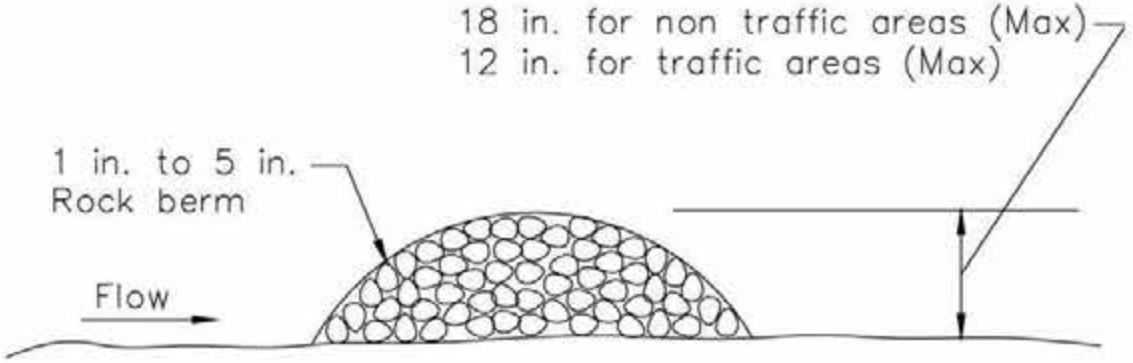
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, An Inventory of Current Practices (Draft), UESPA, 1990.

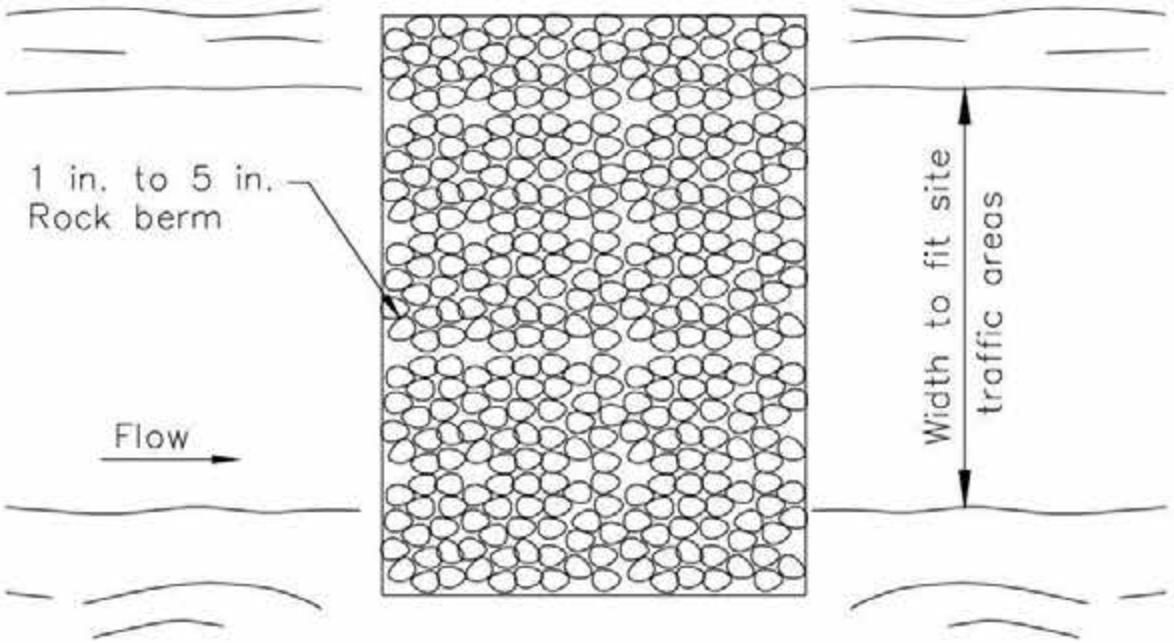
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



SECTION

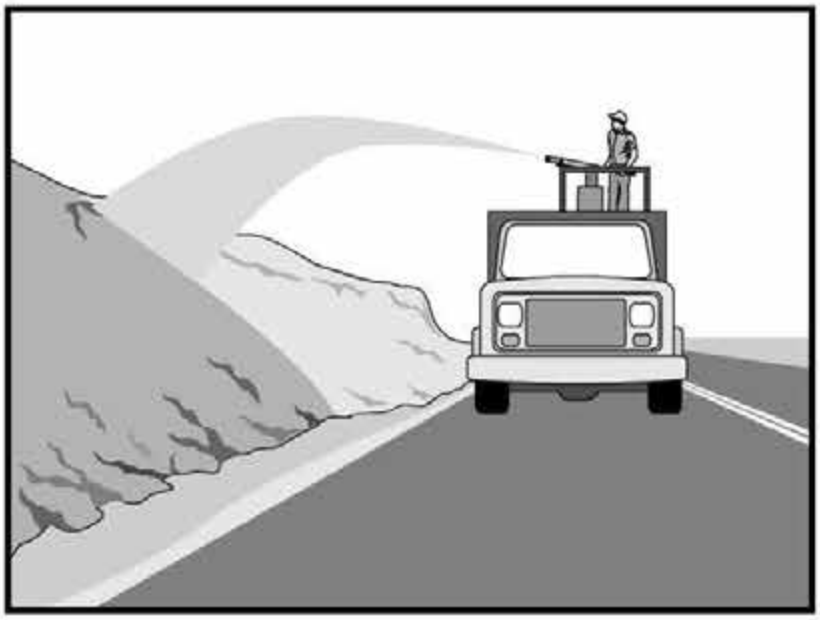


PLAN

TYPICAL ROCK FILTER
NOT TO SCALE

Polyacrylamide

EC-13



Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment
Nutrients
Trash
Metals
Bacteria
Oil and Grease
Organics

Potential Alternatives

None

Description and Purpose

Polyacrylamide (PAM) is a chemical that can be applied to disturbed oils at construction sites to reduce erosion and improve settling of suspended sediment.

PAM increases the soil's available pore volume, thus increasing infiltration and reducing the quantity of stormwater runoff that can cause erosion. Suspended sediments from PAM treated soils exhibit increased flocculation over untreated soils. The increased flocculation aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

Suitable Applications

PAM is suitable for use on disturbed soil areas that discharge to a sediment trap or sediment basin. PAM is typically used in conjunction with other BMPs to increase their performance.

PAM can be applied to the following areas:

- Rough graded soils that will be inactive for a period of time.
- Final graded soils before application of final stabilization (e.g., paving, planting, mulching).
- Temporary haul roads prior to placement of crushed rock surfacing.
- Compacted soil road base.
- Construction staging, materials storage, and layout areas.

- Soil stockpiles.
- Areas that will be mulched.

Limitations

- There is limited experience in California with use of PAM for erosion and sediment control.
- PAM shall not be directly applied to water or allowed to enter a water body.
- Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil.
- Some PAMs are more toxic and carcinogenic than others. Only the most environmentally safe PAM products should be used.
- The specific PAM copolymer formulation must be anionic. **Cationic PAM shall not be used in any application because of known aquatic toxicity problems**. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, will be used for soil applications.
- PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
- A sampling and analysis plan must be incorporated into the SWPPP as PAM may be considered to be a source of non-visible pollutants.

Implementation

General

PAM shall be used in accordance with the following general guidance:

- Pam shall be used in conjunction with other BMPs and not in place of other BMPs, including both erosion controls and sediment controls.
- Stormwater runoff from PAM treated soils should pass through a sediment control BMP prior to discharging to surface waters.
  - When the total drainage area is greater than or equal to 5 acres, PAM treated areas shall drain to a sediment basin.
  - Areas less than 5 acres shall drain to sediment control BMPs, such as a sediment trap, or a minimum of 3 check dams per acre. The total number of check dams used shall be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam shall be spaced evenly in the drainage channel. Through which stormwater flows are discharged off site.
- Do not add PAM to water discharging from site.

- On PAM treated sites, the use of silt fence and fiber rolls shall be maximized to limit the discharges of sediment to sediment traps and sediment basins.
- All areas not being actively worked one should be covered and protected from rainfall. PAM should not be the only cover BMP used.
- PAM can be applied to wet soil, but dry soil is preferred due to less sediment loss.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- Proper application and re-application plans are necessary to ensure total effectiveness of PAM usage.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over spray from reaching pavement, as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water this only makes cleanup messier and longer.
- Recent high interest in PAM has resulted in some entrepreneurial exploitation of the term "polymer". All PAMs are polymer, but not all polymers are PAM, and not all PAM products comply with ANSI/NSF Standard 60. PAM use shall be reviewed and approved by the local permitting authority.
- The PAM anionic charge density may vary from 2-30%; a value of 18% is typical. Studies conducted by the United States Department of Agriculture (USDA)/ Agricultural Research Service (ARS) demonstrated that soil stabilization was optimized by using very high molecular weight (12-15 mg/mole), highly anionic (>20% hydrolosis) PAM.
- PAM tackifiers are available and being used in place of guar and alpha plantago. Typically, PAM tackifiers should be used at a rate of no more than 0.5-1 lb per 1,000 gallons of water in hydro mulch machine. Some tackifier product instructions say to use at a rate of 3-5 lbs per acre, which can be too much. In addition, pump problems can occur at higher rates due to increased viscosity.

Preferred Application Method

PAM may be applied in dissolved form with water, or it may be applied in dry, granular, or powered form. The preferred application method is the dissolved form.

PAM is to be applied at a maximum rate of ½ pound PAM per 1000 gallons water per 1 acre of bare soil. Table 1 and Figure 1 can be used to determine the PAM and water application rate for a disturbed soil area. Higher concentrations of PAM **do not** provide any additional effectiveness.

Table 1 PAM and Water Application Rates		
Disturbed Area (acre)	PAM (lbs)	Water (gallons)
0.50	0.25	500
1.00	0.50	1,000
1.50	0.75	1,500
2.00	1.00	2,000
2.50	1.25	2,500
3.00	1.50	3,000
3.50	1.75	3,500
4.00	2.00	4,000
4.50	2.25	4,500
5.00	2.50	5,000

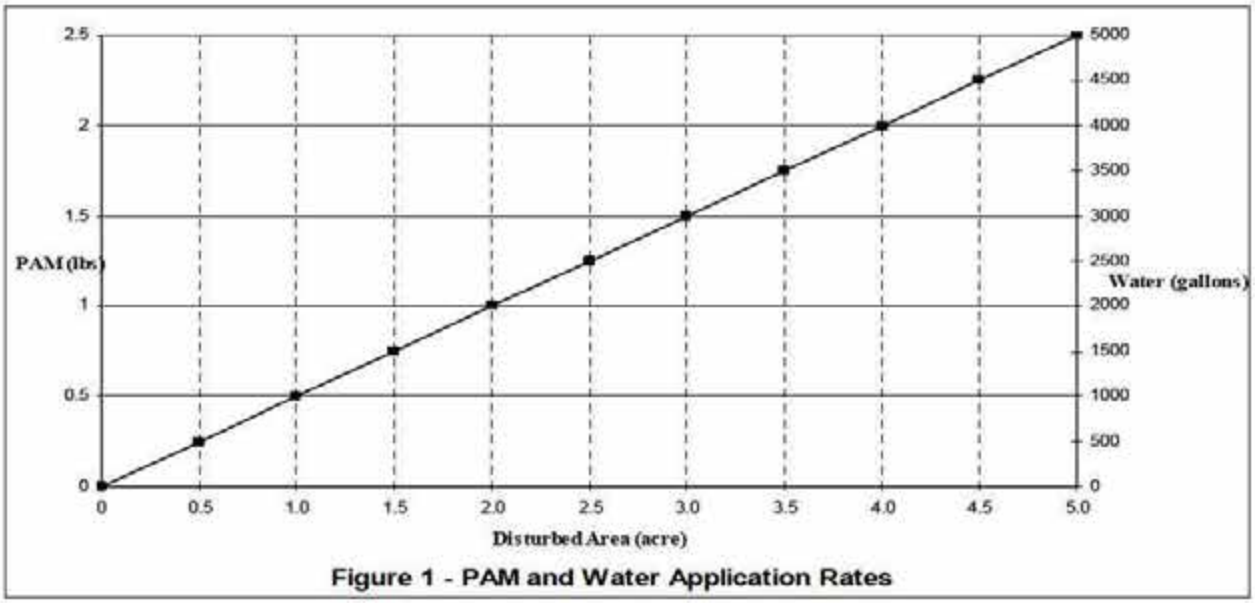


Figure 1 - PAM and Water Application Rates

- Pre-measure the area where PAM is to be applied and calculate the amount of product and water necessary to provide coverage at the specified application rate (1/2 pound PAM/1000 gallons/acre).
- PAM has infinite solubility in water, but dissolves very slowly. Dissolve pre-measured dry granular PAM with a known quantity of clean water in a bucket several hours or overnight. Mechanical mixing will help dissolve the PAM. Always add PAM to water – not water to PAM.

- Pre-fill the water truck about 1/8 full with water. The water does not have to be potable, but it must have relatively low turbidity – in the range of 20 NTU or less.
- Add the dissolved PAM and water mixture to the truck.
- Fill the water truck to specified volume for the amount of PAM to be applied.
- Spray the PAM/water mixture onto dry soil until the soil surface is uniformly and completely wetted.

Alternate Application Method

PAM may also be applied as a powder at the rate of 5 lbs per acre. This must be applied on a day that is dry. For areas less than 5-10 acres, a hand held "organ grinder" fertilizer spreader set to the smallest setting will work. Tractor mounted spreaders will work for larger areas.

Costs

- PAM: $1.30 - $5.50/lb (material cost only).

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- PAM must be reapplied on actively worked areas after a 48-hour period if PAM is to remain effective.
- Reapplication is not required unless PAM treated soil is disturbed or unless turbidity levels show the need for an additional application.
- If PAM treated soil is left undisturbed a reapplication may be necessary after two months.
- More PAM applications may be required for steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas.
- When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.
- Discharges from PAM treated areas must be monitored for non-visible pollutants.

References

Entry, J.A., and R.E. Sojka. Polyacrylamide Application to Soil Reduces the Movement of Microorganisms in Water. In 1999 Proceedings of the International Irrigation Show. Irrigation Associations, Orlando, FL, November, 1999.

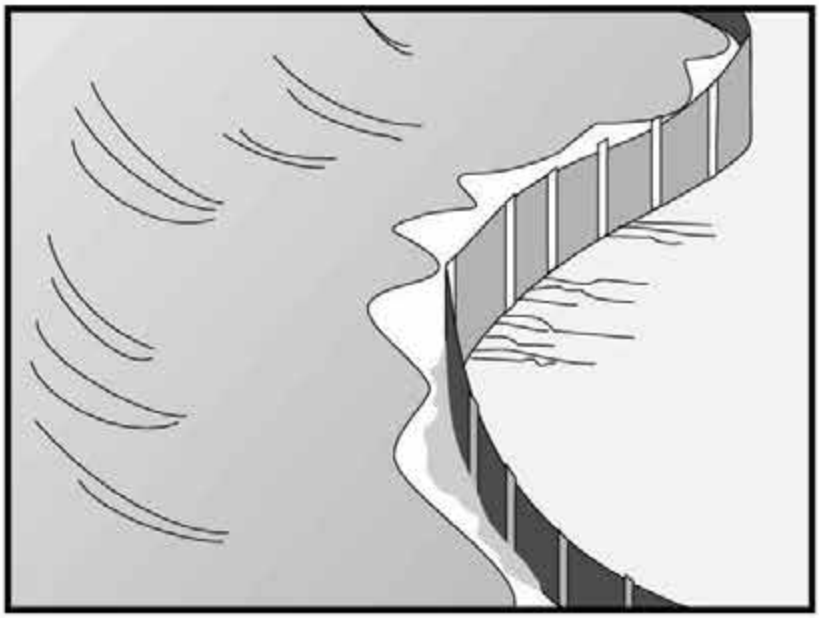
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Sojka, R.E., and R.D. Lentz, eds. Managing Irrigation Induced Erosion and Infiltration with Polyacrylamide. In Proceedings from Conference held at College of Southern Idaho, Twin Falls, Idaho, University of Idaho Miscellaneous Publication No. 101-96, May, 1996

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Silt Fence SE-1



Description and Purpose

A silt fence is made of a filter fabric that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They should also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Below other small cleared areas.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.

Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Do not use in locations where ponded water may cause flooding.
- Do not place fence on a slope, or across any contour line. If not installed at the same elevation throughout, silt fences will create erosion.
- Filter fences will create a temporary sedimentation pond on the upstream side of the fence and may cause temporary flooding. Fences not constructed on a level contour will be overtopped by concentrated flow resulting in failure of the filter fence.
- Improperly installed fences are subject to failure from undercutting, overlapping, or collapsing.
  - Not effective unless trenched and keyed in.
  - Not intended for use as mid-slope protection on slopes greater than 4:1 (H:V).
  - Do not allow water depth to exceed 1.5 ft at any point.

Implementation

General

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

Silt fences are preferable to straw bale barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw bale barriers, there are many instances where silt fences have been improperly installed. The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Don't use in streams, channels, or anywhere flow is concentrated. Don't use silt fences to divert flow.
- Don't use below slopes subject to creep, slumping, or landslides.
- Select filter fabric that retains 85% of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.
- The maximum slope perpendicular to the fence line should be 1:1.

- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft² of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area is permanently stabilized.

Design and Layout

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specification) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet that it has openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. Standard Sieve No. 200, select the EOS to retain 85 % of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100. If 85% or more of a soil, by weight, passes through the openings in a No. 200 sieve, filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large and they would clog the fabric quickly if the EOS were small enough to capture the soil.

The fence should be supported by a plastic or wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Filter fabric material should contain ultraviolet inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 °F to 120 °F.

- Layout in accordance with attached figures.
- For slopes steeper than 2:1 (H:V) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to sensitive receiving waters or Environmentally Sensitive Areas (ESAs), silt fence should be used in conjunction with erosion control BMPs.

Materials

- Silt fence fabric should be woven polypropylene with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491.

- Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

- There are new products that may use prefabricated plastic holders for the silt fence and use bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement.

Installation Guidelines

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line the proposed silt fence.

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength filter fabric is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench. When extra-strength filter fabric and closer post spacing are used, the mesh support fence may be eliminated. Filter fabric should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, filter cloth should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with compacted native material.

- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.

- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case should the reach exceed 500 ft.

Costs

- Average annual cost for installation and maintenance (assumes 6 month useful life): $7 per lineal foot ($850 per drainage acre). Range of cost is $3.50 - $9.10 per lineal foot.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed of, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence must be inspected and maintained.
- Holes, depressions, or other ground disturbance caused by the removal of the silt fences should be backfilled and repaired.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), UESPA, 1990.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Silt Fence

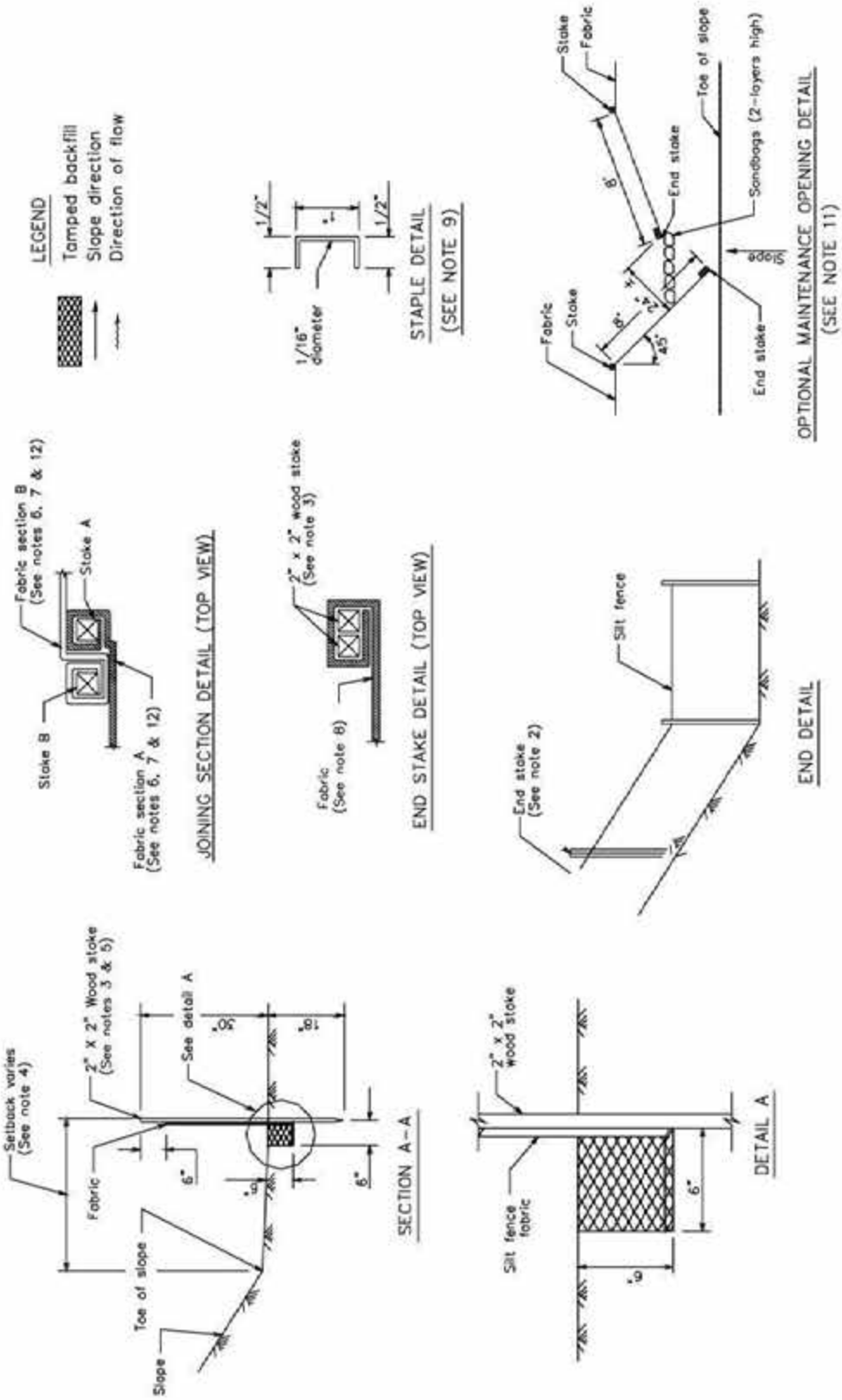
SE-1

NOTES

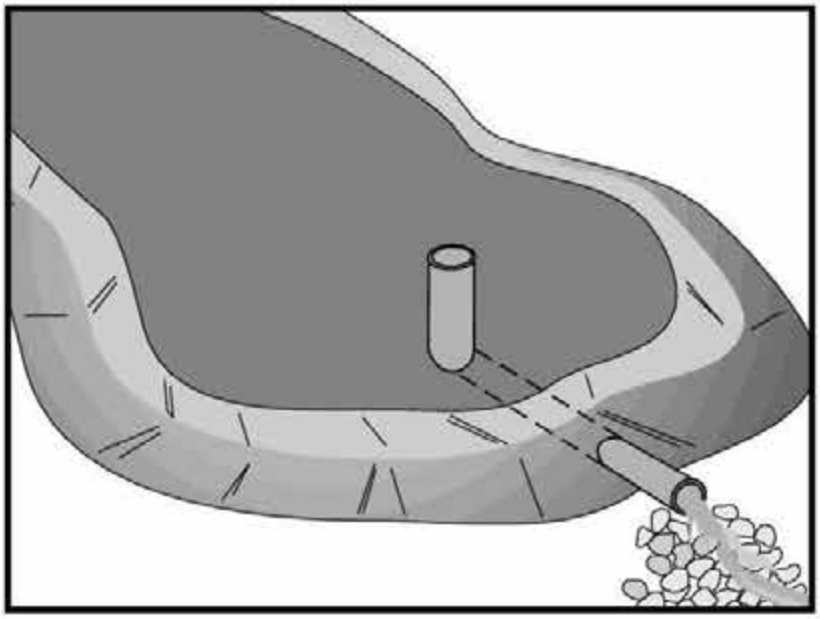
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. The last 8'–0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'–0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.

CROSS BARRIER DETAIL

SECTION C–C


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1/16" diameter
1/2"
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
Toe of slope
8'
End stake
Sandbags (2-layers high)
Slope
Fabric
Stake
8"
4"
45°
End stake
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
Fabric
6"
6"
6"
Toe of slope
Slope
SECTION A-A
2" x 2"
wood stake
Silt fence
fabric
6"
DETAIL A

Sediment Basin SE-2



Objectives

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres
- At the outlet of large disturbed watersheds, as necessary
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of

public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- Generally, sediment basins are limited to drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this handbook are only practically effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical treatment is used in addition to the sediment basin.
- Sites with very fine sediments (fine silt and clay) may require longer detention times for effective sediment removal.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from Division of Safety of Dams.
- Standing water may cause mosquitoes or other pests to breed.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure with a design life of 12 to 28 months in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to divert runoff to the basin inlet.

Many development projects in California will be required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins trap 70-80 % of the sediment that flows into them if designed according to this handbook. Therefore, they should be used in conjunction with erosion control practices such as

temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. The best locations are generally low areas. Drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). The basin must not be located in a stream but it should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

- Construct before clearing and grading work begins when feasible.
- Do not locate in a stream.
- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Large basins are subject to state and local dam safety requirements.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

Design

Sediment basins must be designed in accordance with Section A of the State of California NPDES General Permit for Stormwater Discharges Associated with Construction Activities (General Permit) where sediment basins are the only control measure proposed for the site. If there is insufficient area to construct a sediment basin in accordance with the General Permit requirements, then the alternate design standards specified herein may be used.

Sediment basins designed per the General Permit shall be designed as follows:

Option 1:

Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2:

Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet (133 yd^3) of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The

length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency.

OR

Option 3:
Sediment basin(s) shall be designed using the standard equation:

$$As=1.2Q/Vs \quad \text{(Eq. 1)}$$

Where:

As = Minimum surface area for trapping soil particles of a certain size

Vs = Settling velocity of the design particle size chosen

Q = C I A

Where

Q = Discharge rate measured in cubic feet per second

C = Runoff coefficient

I = Precipitation intensity for the 10-year, 6-hour rain event

A = Area draining into the sediment basin in acres

The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the *Vs* used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the 2 ft of capacity.

OR

Option 4:
The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

Other design considerations are:

- The volume of the settling zone should be sized to capture runoff from a 2-year storm or other appropriate design storms specified by the local agency. A detention time of 24 to 40 hours should allow 70 to 80 % of sediment to settle.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.
- The length to settling depth ratio (L/SD) should be less than 200.
- Sediment basins are best used in conjunction with erosion controls. Sediment basins that will be used as the only means of treatment, without upstream erosion and sediment controls, must be designed according to the four options required by the General Permit (see Options 1-4 above). Sediment basins that are used in conjunction with upstream erosion and sediment controls should be designed to have a capacity equivalent to 67 yd^3 of sediment storage per acre of contributory area.
- The length of the basin should be more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than 3 ft.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- Basins should be designed to drain within 72 hours following storm events. If a basin fails to drain within 72 hours, it must be pumped dry.
- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.
  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.
- Rock or vegetation should be used to protect the basin inlet and slopes against erosion.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.

- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- Basin inlets should be located to maximize travel distance to the basin outlet.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen; although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 72 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.
- The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. Design guidance for single orifice and perforated riser outlets follow:
  - *Flow Control Using a Single Orifice At The Bottom Of The Basin (Figure 1)*: The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H-Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H-Ho)^{0.5}}{CT} \qquad \text{(Eq. 2)}$$

where:

a = area of orifice (ft^2)

A = surface area of the basin at mid elevation (ft^2)

C = orifice coefficient

T = drawdown time of full basin (hrs)

g = gravity (32.2 ft/s²)

H = elevation when the basin is full (ft)

Ho = final elevation when basin is empty (ft)

With a drawdown time of 40 hours, the equation becomes:

$$a = \frac{(1.75x10^{-6})A(H - Ho)^{0.5}}{C} \qquad \text{(Eq. 3)}$$

- *Flow Control Using Multiple Orifices (see Figure2):*

$$a_t = \frac{2A(h_{max})}{3600CT(2g[h_{max} - h_{centroid\ of\ orifices}])^{0.5}} \qquad \text{(Eq. 4)}$$

With terms as described above except:

a_t = total area of orifices

h_{max} = maximum height from lowest orifice to the maximum water surface (ft)

$h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft)

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally (refer to Figure 2).

Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.
- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

Average annual costs for installation and maintenance (2 year useful life) are:

- Basin less than 50,000 ft³: Range, $0.24 - $1.58/ft³. Average, $0.73 per ft³. $400 - $2,400, $1,200 average per drainage acre.
- Basin size greater than 50,000 ft³: Range, $0.12 – $0.48/ft³. Average, $0.36 per ft³. $200 - $800, $600 average per drainage acre.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at appropriate locations.
- Remove standing water from basin within 72 hours after accumulation.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

References

A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zones, Metropolitan Washington Council of Governments, March 1992.

Draft-Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA. April 1990.

Guidelines for the Design and Construction of Small Embankment Dams, Division of Safety of Dams, California Department of Water Resources, March 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

McLean, J., 2000. Mosquitoes in Constructed Wetlands: A Management Bugaboo? In T.R. Schueler and H.K. Holland [eds.], The Practice of Watershed Protection. pp. 29-33. Center for Watershed Protection, Ellicott City, MD, 2000.

Metzger, M.E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. The dark site of stormwater runoff management: disease vectors associated with structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

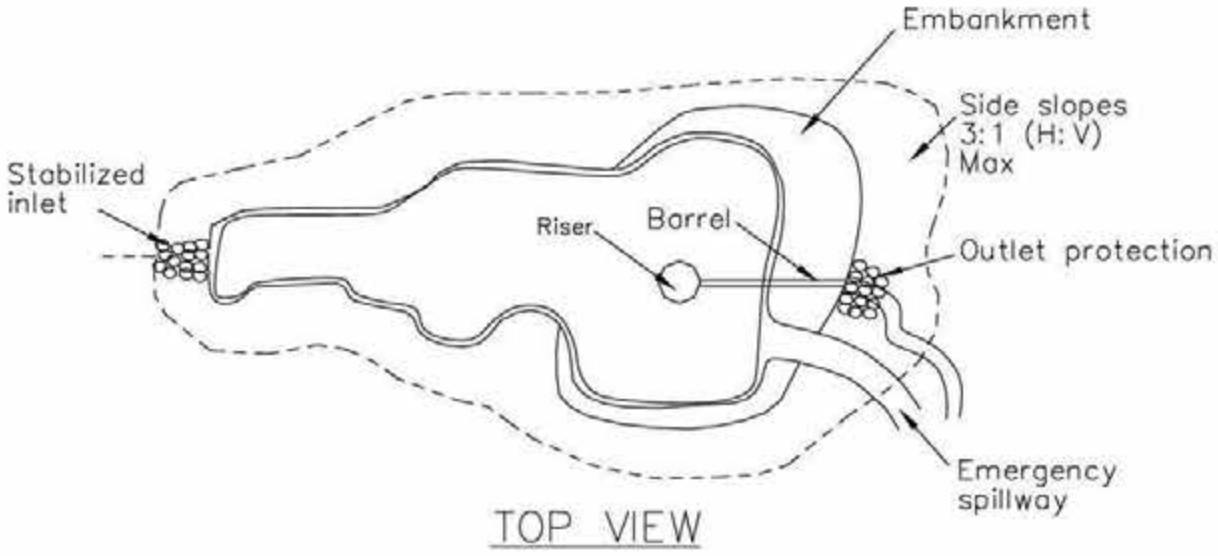
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Water, Work Group-Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

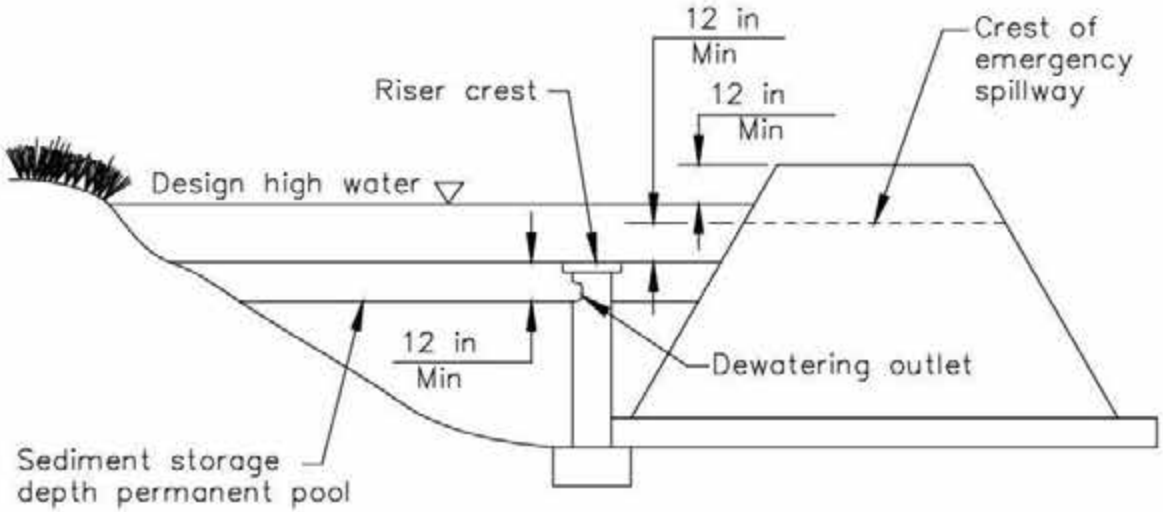
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993

Water Quality Management Plan for the Lake Tahoe Region, Volume II Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TOP VIEW



SIDE VIEW

NOTE:
This outlet provides no drainage for permanent pool.

FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
SINGLE ORIFICE DESIGN
NOT TO SCALE

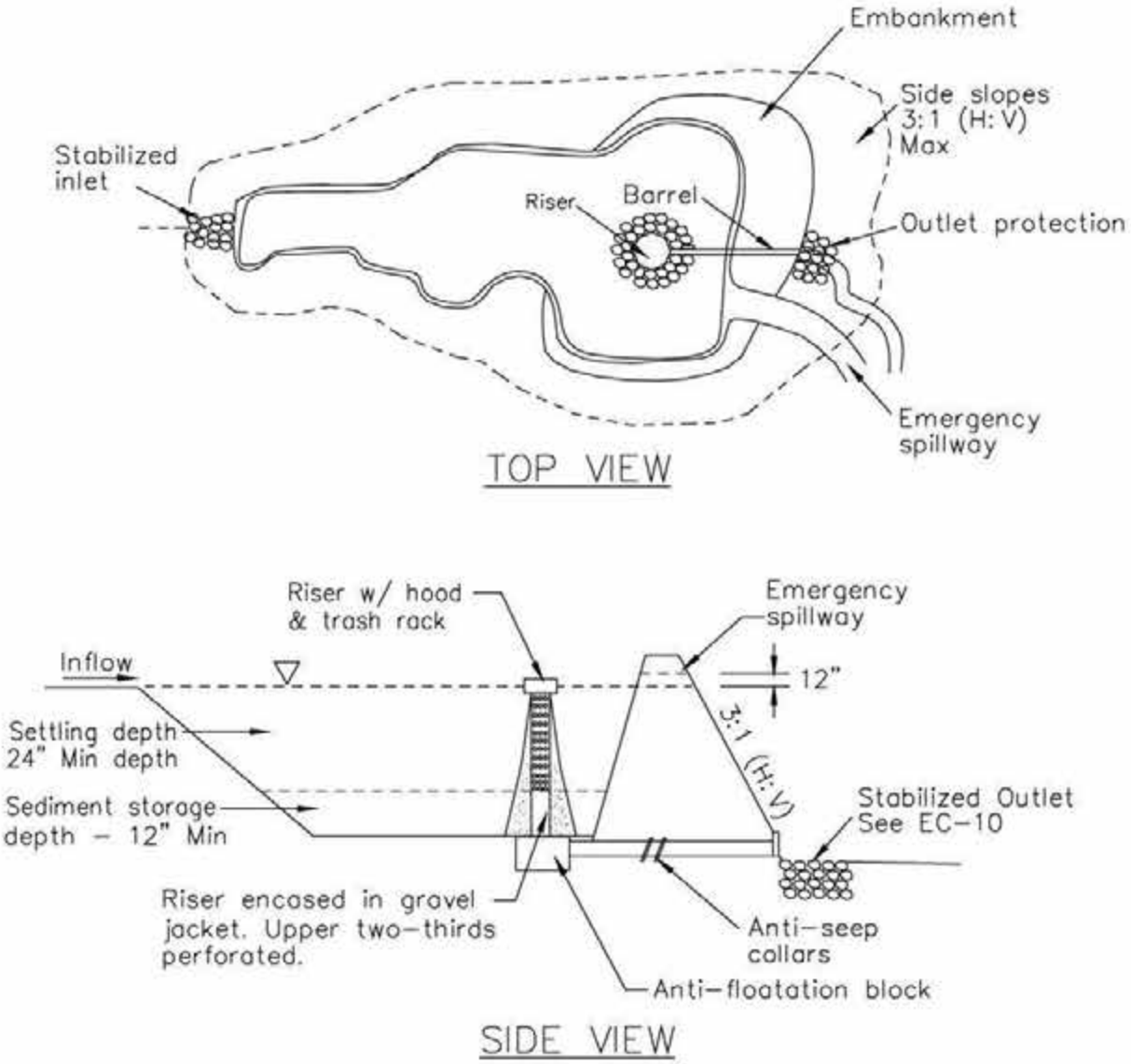


FIGURE 2: TYPICAL TEMPORARY SEDIMENT BASIN

MULTIPLE ORIFICE DESIGN

NOT TO SCALE

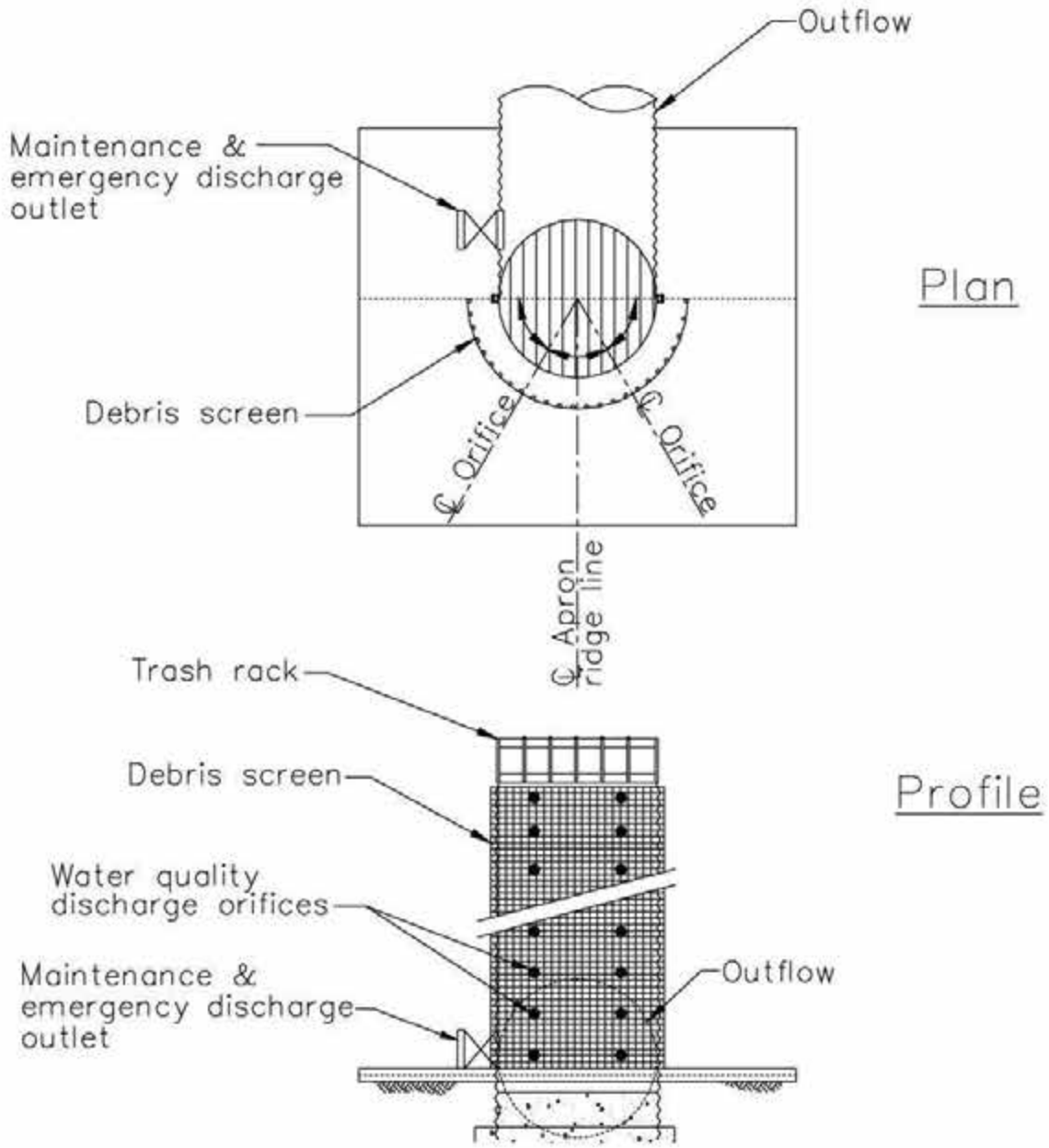
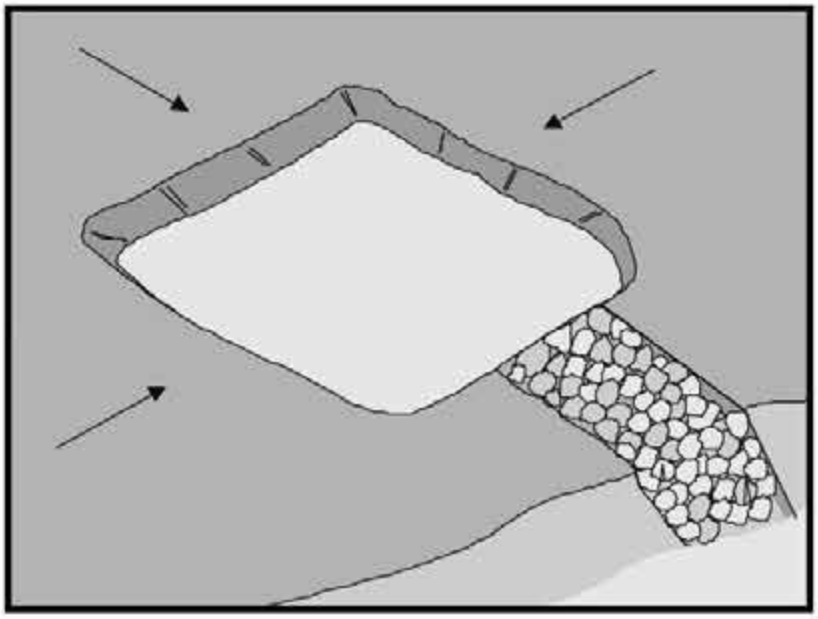


FIGURE 3: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

Sediment Trap SE-3



Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.
- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Objectives

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Limitations

- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed of, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.
- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.

- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft^3 ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 72 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.

References

Brown, W., and T. Schueler. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD, 1997.

Draft – Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA, April 1990.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E., D.F. Messer, C.L. Beitia, C.M. Myers, and V.L. Kramer, The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

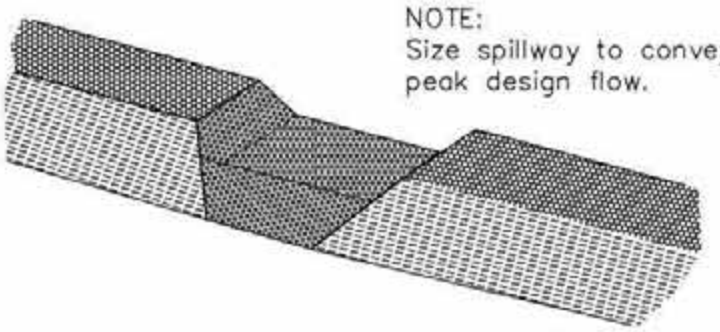
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

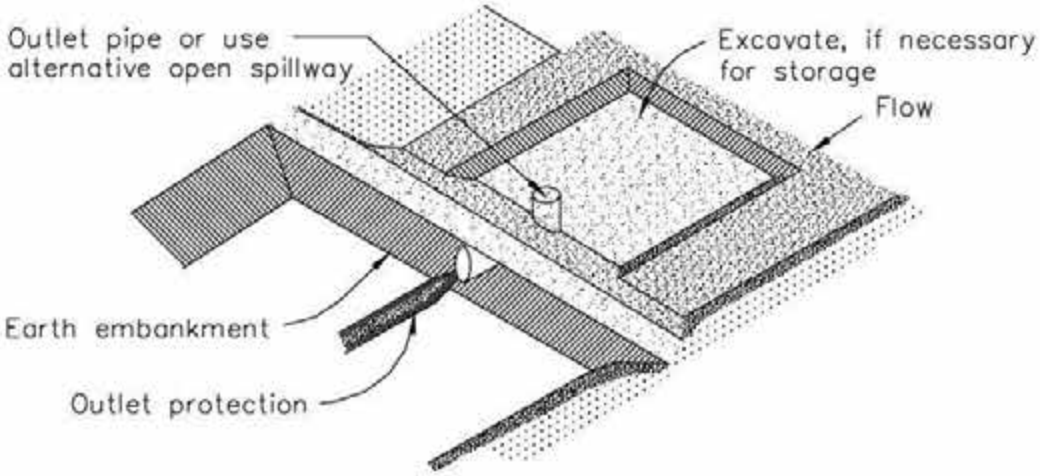
Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

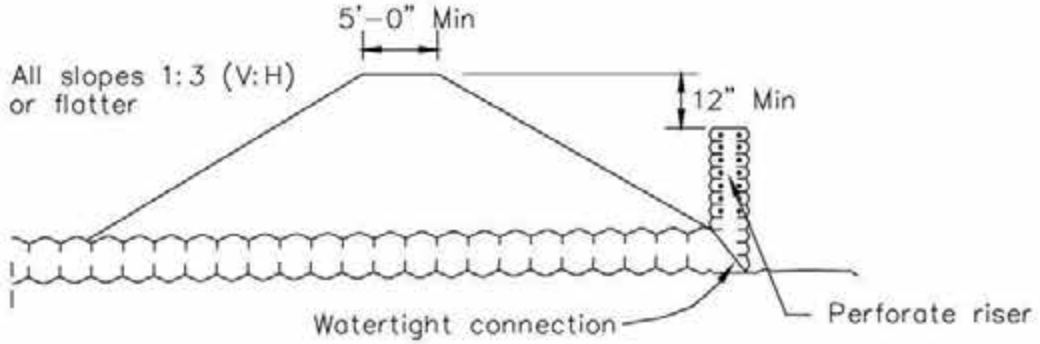
U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL OPEN SPILLWAY

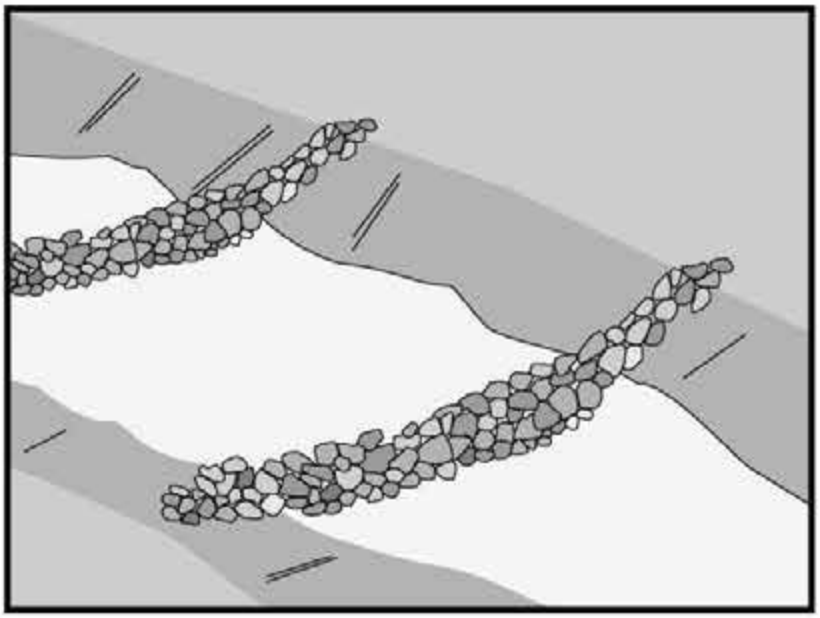




EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE

Check Dams SE-4



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing the velocity of flowing water, allowing sediment to settle and reducing erosion.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.

Limitations

- Not to be used in live streams or in channels with extended base flows.

- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion is expected, as installation may damage vegetation.
- Require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Reduced slopes reduce the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Use of check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity must be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, there are several options:

- Don't use check dams. Consider alternative BMPs.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam. The center section of the dam should be lower than the edge sections so that the check dam will direct flows to the center of the ditch or swale.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products manufactured specifically for use as check dams are also being used, and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Straw bales can also be used for check dams and can work if correctly installed; but in practice, straw bale check dams have a high failure rate. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam must completely span the ditch

or swale to prevent washout. The rock used must be large enough to stay in place given the expected design flow through the channel.

Log check dams are usually constructed of 4 to 6 in. diameter logs. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

Gravel bag and sandbag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet.

Manufactured products should be installed in accordance with the manufacturer's instructions.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- Backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap must be cleaned following each storm event.
- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.
- Gravel bags may be used as check dams with the following specifications:

Materials

Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms. Sandbags used for check dams should conform to SE-8, Sandbag Barrier. Fiber rolls used for check dams should conform to SE-5, Fiber Rolls. Straw bales used for check dams should conform to SE-9, Straw Bale Barrier.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section. Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Fiber rolls and straw bales must be trenched in and firmly staked in place.

Costs

Cost consists of only installation costs if materials are readily available. If material must be imported, costs may increase. For material costs, see SE-5, SE-6, SE-8 and SE-9.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Replace missing rock, bags, bales, etc. Replace bags or bales that have degraded or have become damaged.
- If the check dam is used as a sediment capture device, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

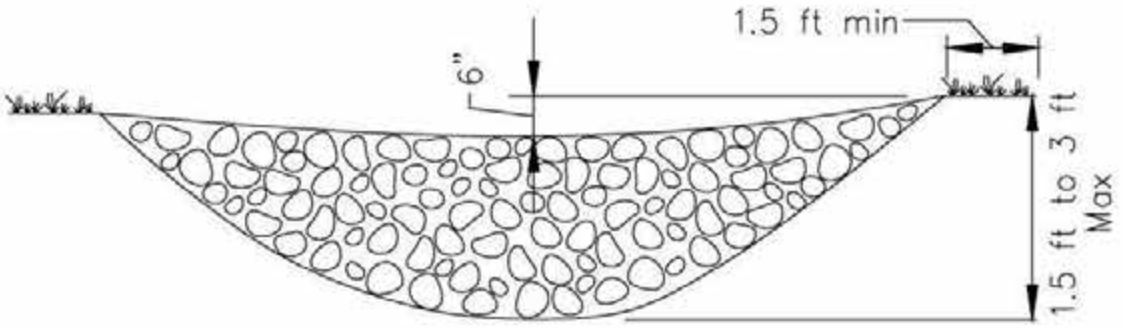
References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

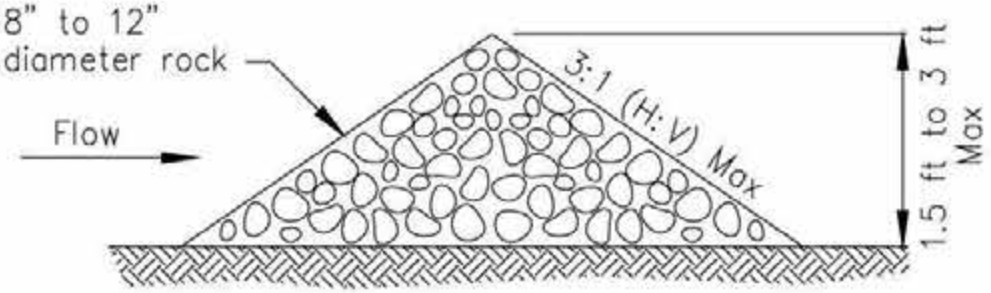
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

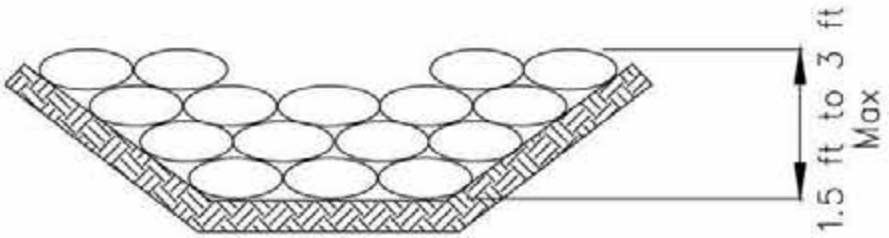


ELEVATION



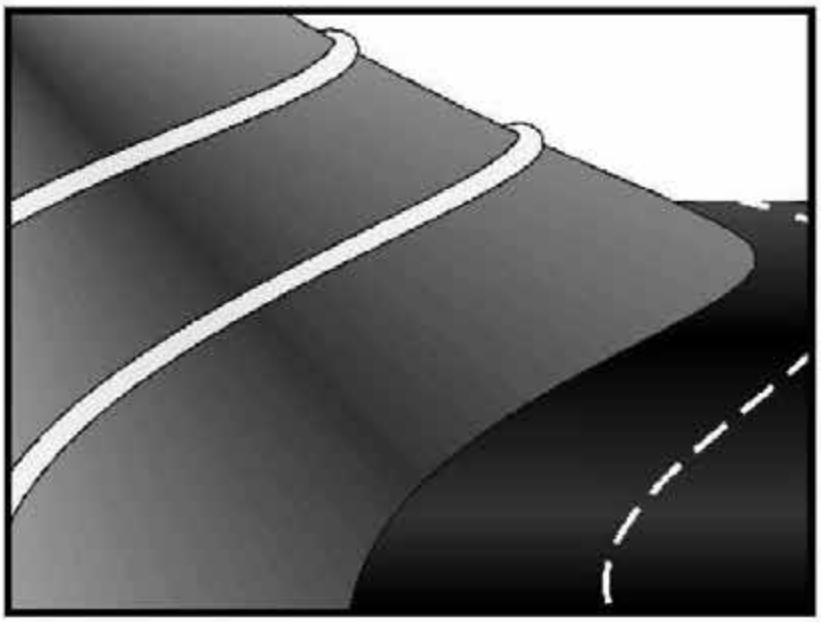
TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE



GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE

Fiber Rolls SE-5



Description and Purpose

A fiber roll consists of straw, flax, or other similar materials bound into a tight tubular roll. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- Along the perimeter of a project
- As check dams in unlined ditches
- Down-slope of exposed soil areas
- Around temporary stockpiles

Limitations

- Fiber rolls are not effective unless trenched

Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

CASQA

CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 in. diameter or installations achieving the same protection (i.e. stacked smaller diameter fiber rolls, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Implementation

Fiber Roll Materials

- Fiber rolls should be either prefabricated rolls or rolled tubes of erosion control blanket.

Assembly of Field Rolled Fiber Roll

- Roll length of erosion control blanket into a tube of minimum 8 in. diameter.
- Bind roll at each end and every 4 ft along length of roll with jute-type twine.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into a 2 to 4 in. deep trench with a width equal to the diameter of the fiber roll.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.

Removal

- Fiber rolls are typically left in place.

- If fiber rolls are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

Costs

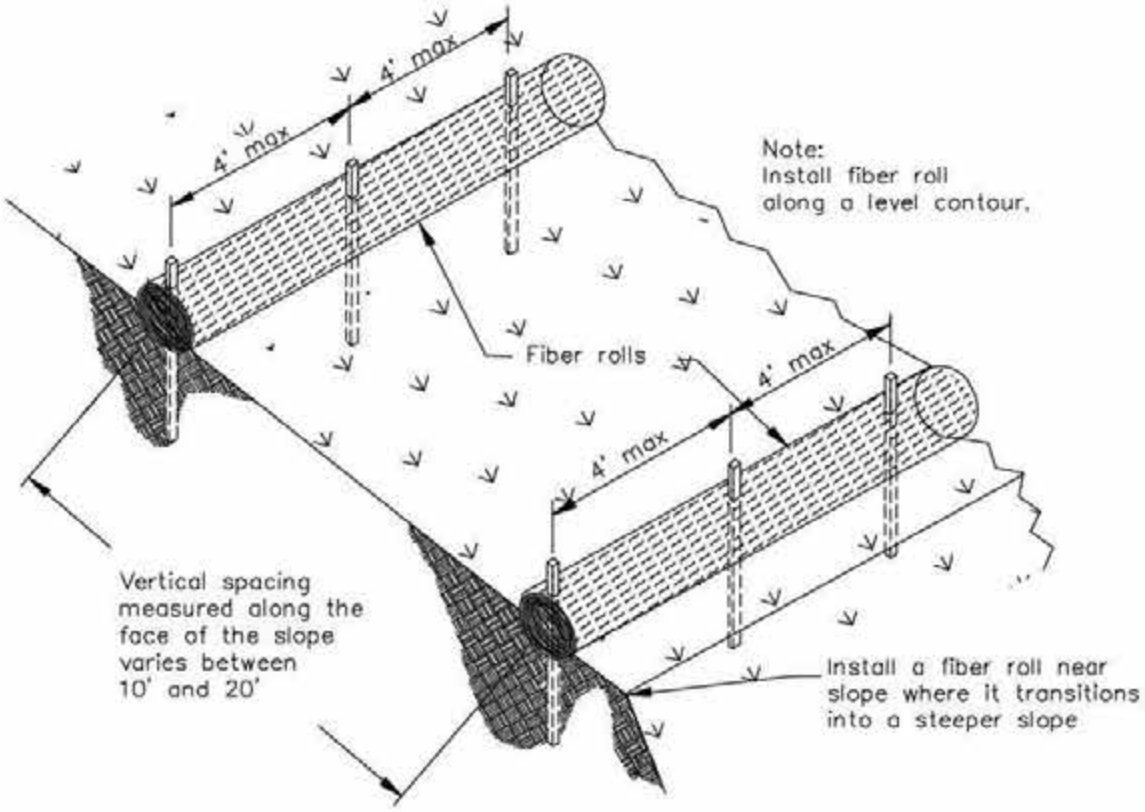
Material costs for fiber rolls range from $20 - $30 per 25 ft roll.

Inspection and Maintenance

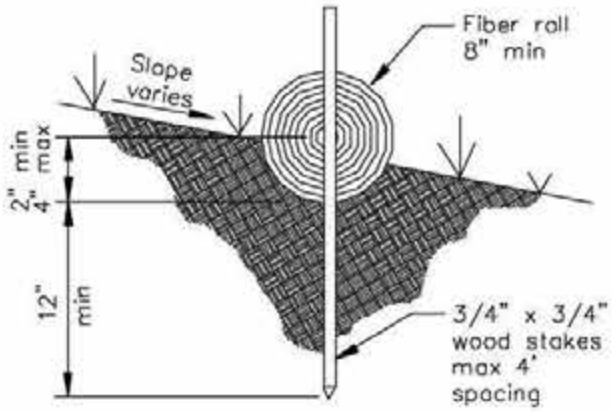
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the fiber roll and the adjacent ground surface. Sediment removed during maintenance may be incorporated into earthwork on the site of disposed at an appropriate location.
- If fiber rolls are used for erosion control, such as in a mini check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

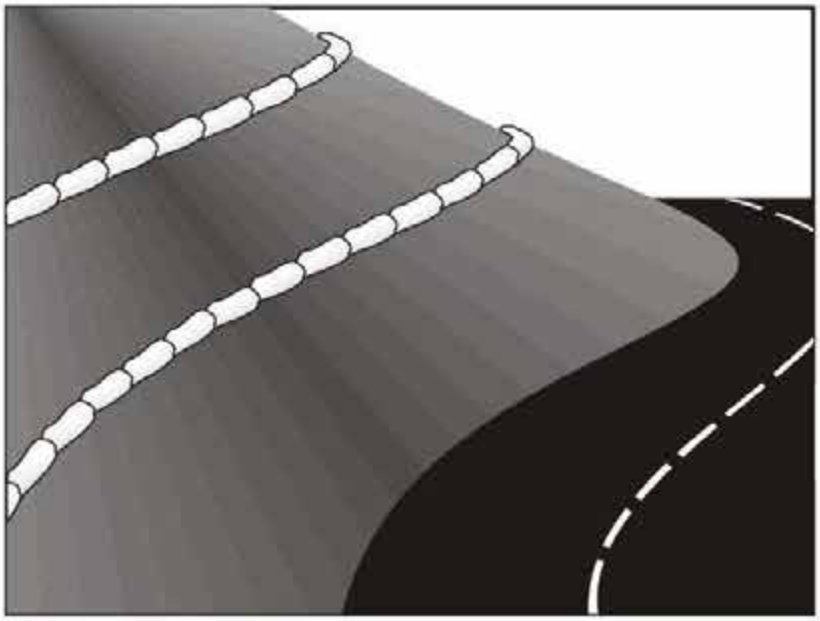


TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm SE-6



Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flows, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:

Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Berms may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel–filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous.

Design and Layout

- Locate gravel bag berms on level contours.
  - Slopes between 20:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Gravel bags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed the slope toe.
- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.

- For installation near the toe of the slope, consider moving the gravel bag barriers away from the slope toe to facilitate cleaning. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 or flatter.
- Butt ends of bags tightly
- On multiple row, or multiple layer construction, overlapp butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
- ***Bag Size:*** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** Fill material should be 0.5 to 1 in. Class 2 aggregate base, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Gravel filter: Expensive, since off-site materials, hand construction, and demolition/removal are usually required. Material costs for gravel bags are average of $2.50 per empty gravel bag. Gravel costs range from $20-$35 per yd^3.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace gravel bags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove gravel bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Street Sweeping and Vacuuming SE-7

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TR	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

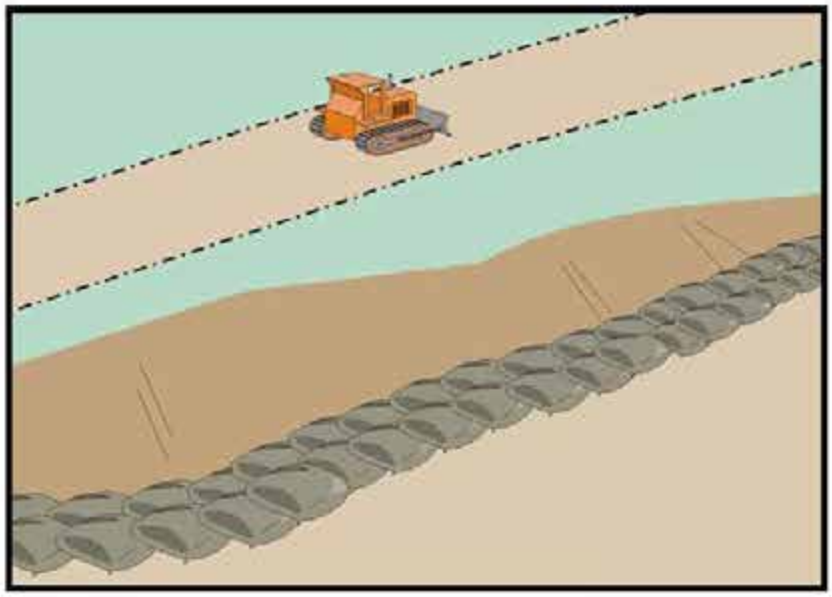
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbag barriers pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-9 Straw Bale Barrier

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Barriers may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. While the sand-filled bags are porous, the fine sand tends to quickly plug with sediment, limiting the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms, or SE-9, Straw Bale Barriers. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to ground bag berms, but less porous.

Design and Layout

- Locate sandbag barriers on a level contour.
  - Slopes between 20:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Sandbags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed near the slope toe.
- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sandbags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 5 acres.

- Stack sandbags at least three bags high.
- Butt ends of bags tightly.
- Overlapp butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 or flatter.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap may not acceptable in some jurisdictions.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material.

Costs

Sandbag barriers are more costly, but typically have a longer useful life than other barriers. Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag.

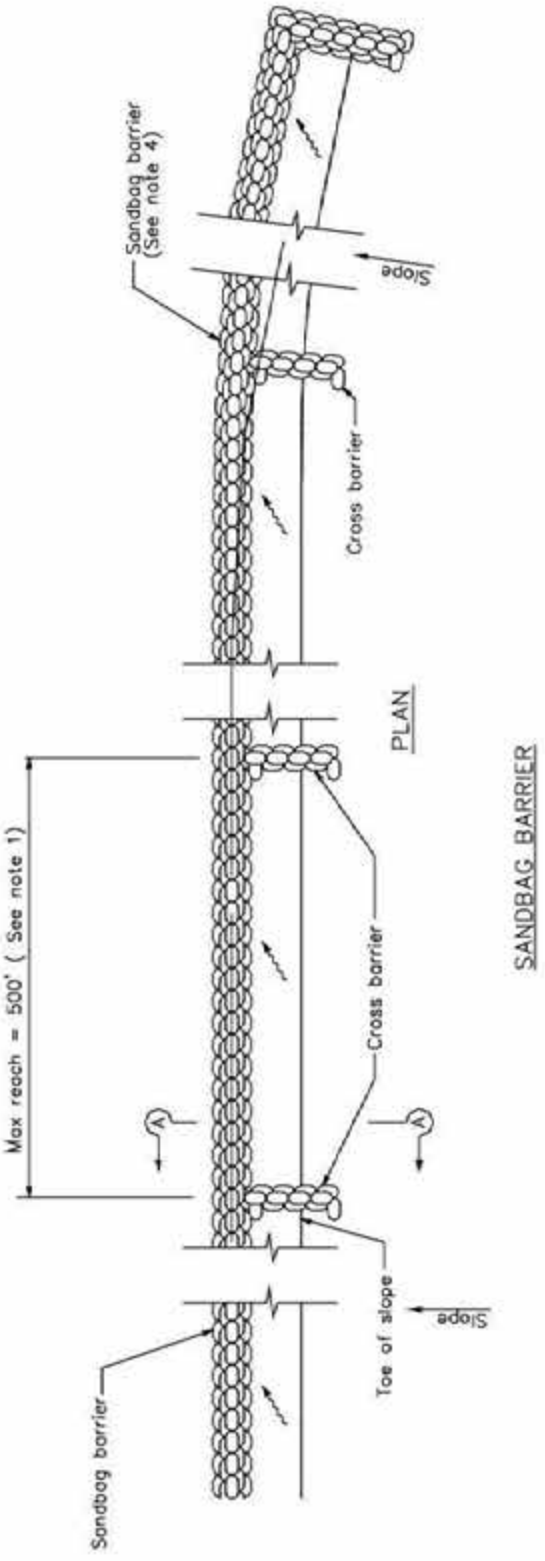
Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.

- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

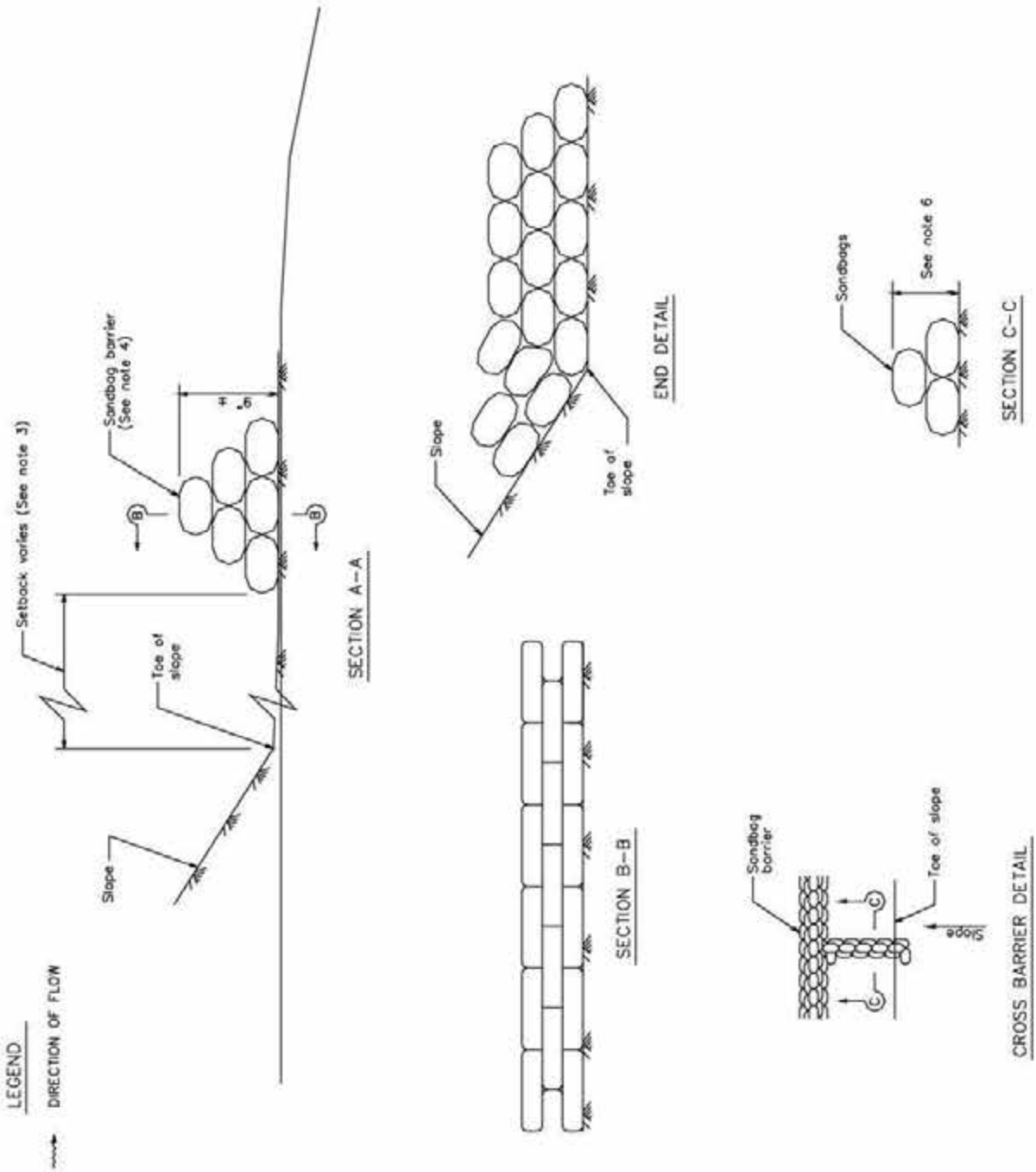
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



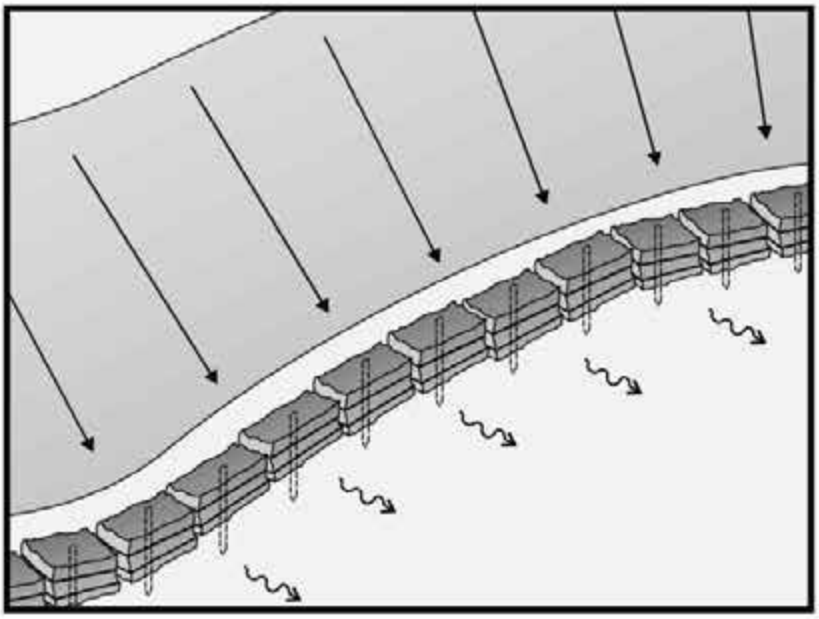
SANDBAG BARRIER

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.


LEGEND
DIRECTION OF FLOW
Setback varies (See note 3)
Sandbag barrier (See note 4)
H
B
Toe of slope
Slope
SECTION A-A
SECTION B-B
Slope
Toe of slope
END DETAIL
Sandbags
See note 6
SECTION C-C
Sandbag barrier
Toe of slope
C
CROSS BARRIER DETAIL

Straw Bale Barrier SE-9



Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet- flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

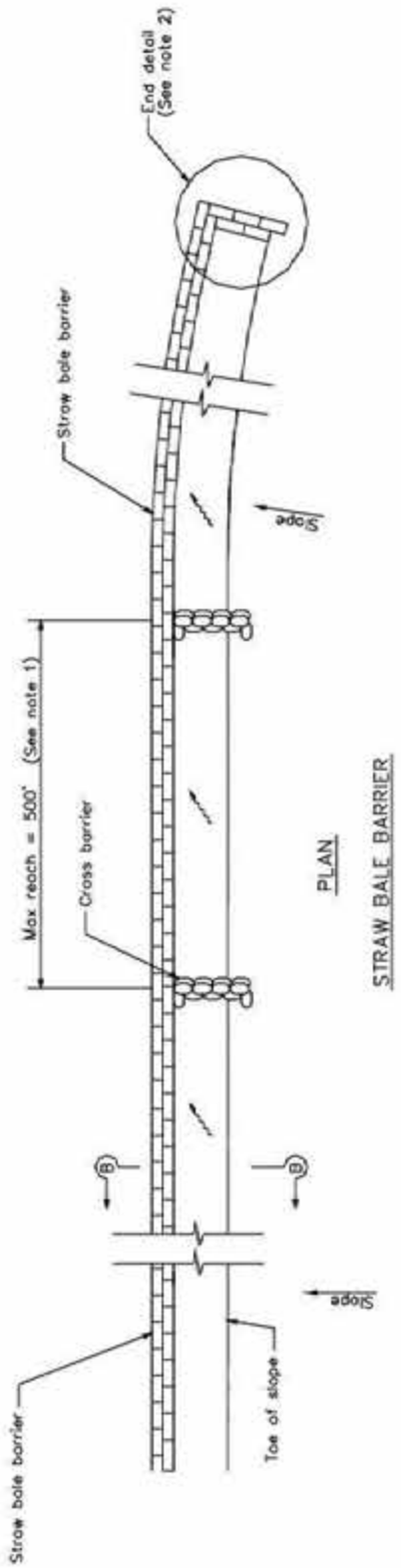
Inspection and Maintenance

Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.
- Replace or repair damaged bales as needed.
- Repair washouts or other damages as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

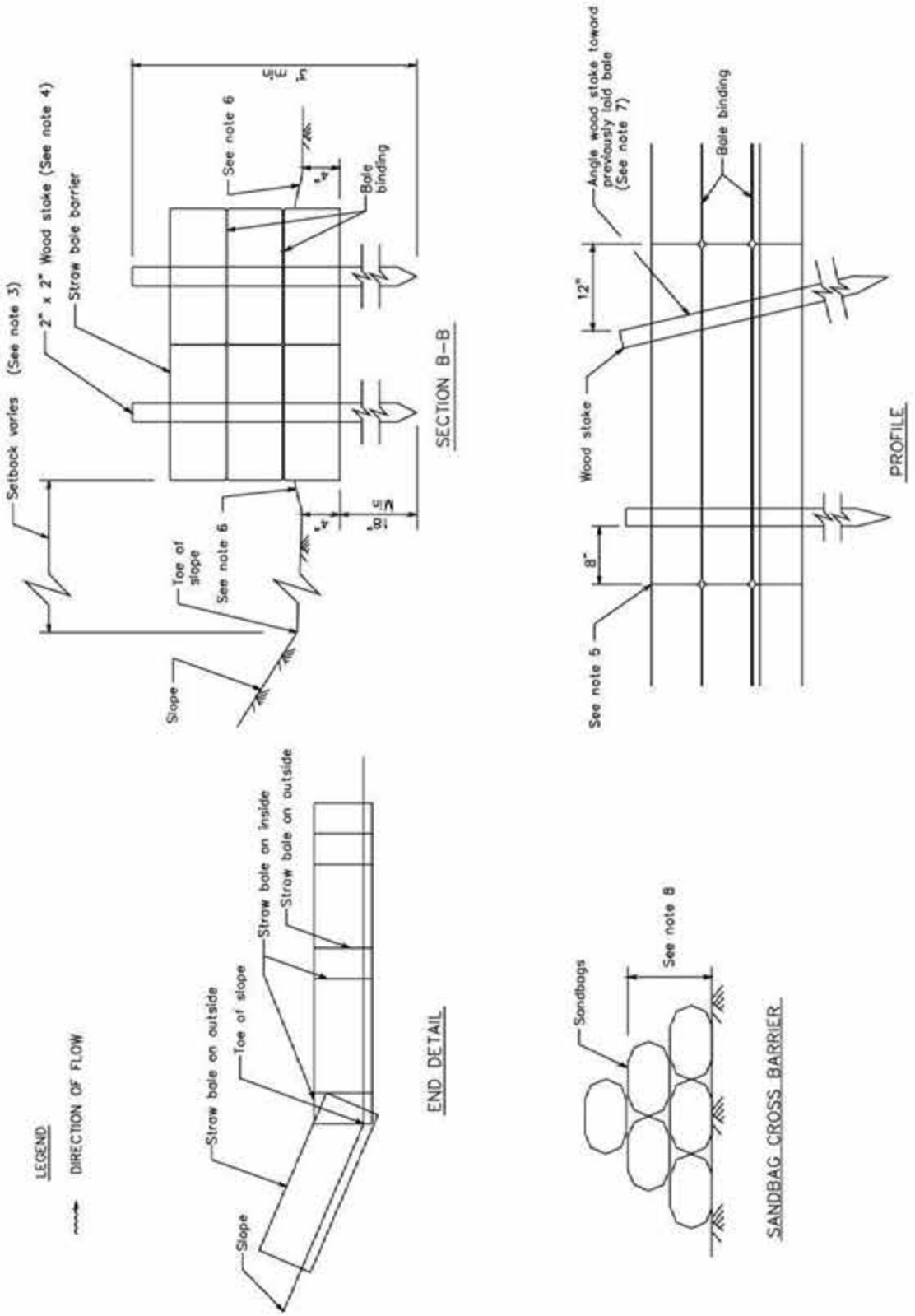
STRAW BALE BARRIER

LEGEND

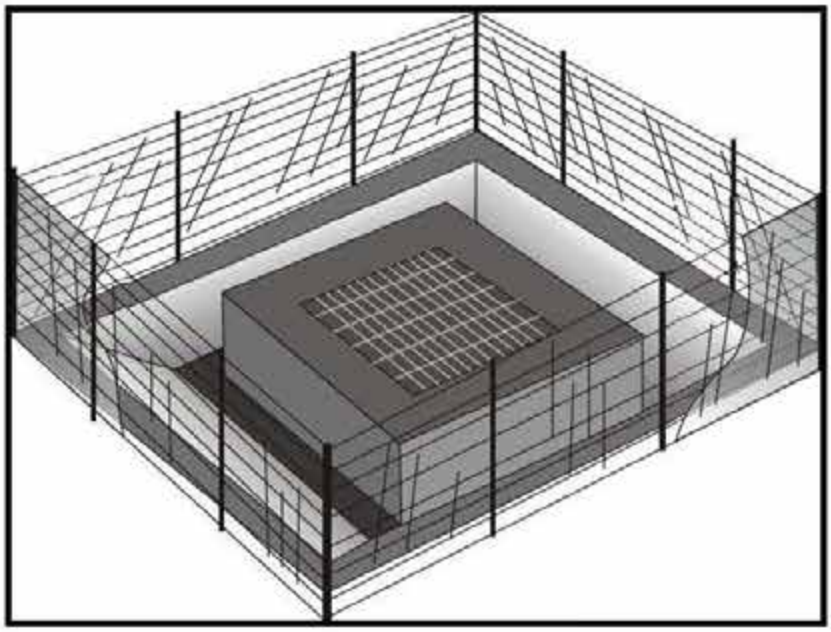
DIRECTION OF FLOW

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales.
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.


Setback varies (See note 3)
2" x 2" Wood stake (See note 4)
Straw bale barrier
See note 6
Bale binding
3 in
Toe of slope
See note 6
Slope
SECTION B-B
Angle wood stake toward previously laid bale (See note 7)
Bale binding
12"
Wood stake
8"
See note 5
PROFILE
LEGEND
DIRECTION OF FLOW
Straw bale on outside
Toe of slope
Straw bale on inside
Straw bale on outside
Slope
END DETAIL
Sandbags
See note 8
SANDBAG CROSS BARRIER

Storm Drain Inlet Protection SE-10



Objectives		
EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction.

Suitable Applications

Every storm drain inlet receiving sediment-laden runoff should be protected.

Limitations

- Drainage area should not exceed 1 acre.
- Straw bales, while potentially effective, have not produced in practice satisfactory results, primarily due to improper installation.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Inlet protection usually requires other methods of temporary protection to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are

expected, use other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Large amounts of sediment may enter the storm drain system when storm drains are installed before the upslope drainage area is stabilized, or where construction is adjacent to an existing storm drain. In cases of extreme sediment loading, the storm drain itself may clog and lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Inlet protection methods not presented in this handbook should be approved by the local stormwater management agency.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- Limit upstream drainage area to 1 acre maximum. For larger drainage areas, use SE-2, Sediment Basin, or SE-3, Sediment Trap, upstream of the inlet protection device.
- The key to successful and safe use of storm drain inlet protection devices is to know where runoff will pond or be diverted.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the

inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Four types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Filter Fabric Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Filter Fabric Fence*** - The filter fabric fence (Type 1) protection is shown in the attached figure. Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes must be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.
  5. Backfill the trench with gravel or compacted earth all the way around.
- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - The excavated drop inlet sediment trap (Type 2) is shown in the attached figures. Install filter fabric fence in

accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area.

- ***DI Protection Type 3 - Gravel bag*** - The gravel bag barrier (Type 3) is shown in the figures. Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability.

  1. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
  2. Construct on gently sloping street.
  3. Leave room upstream of barrier for water to pond and sediment to settle.
  4. Place several layers of sand bags – overlapping the bags and packing them tightly together.
  5. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - The block and gravel filter (Type 4) is shown in the figures. Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place filter fabric over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

Costs

- Average annual cost for installation and maintenance (one year useful life) is $200 per inlet.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Filter Fabric Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.

- Gravel Filters. If the gravel becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site ore disposed at an appropriate location.

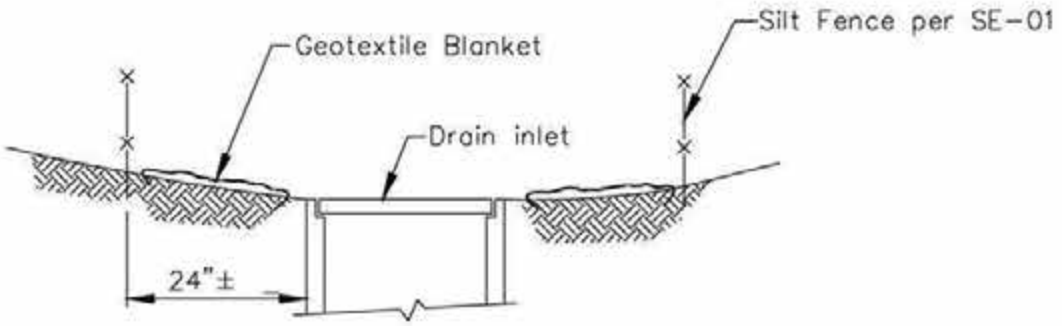
- Remove storm drain inlet protection once the drainage area is stabilized.

  - Clean and regrade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

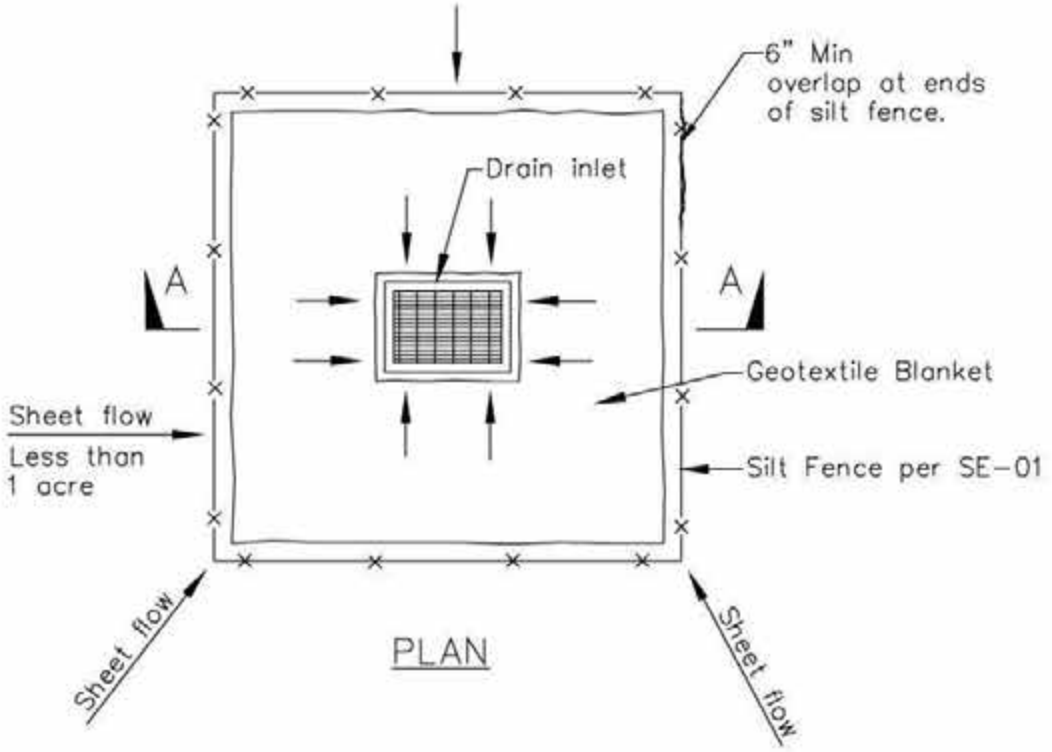
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.



SECTION A–A

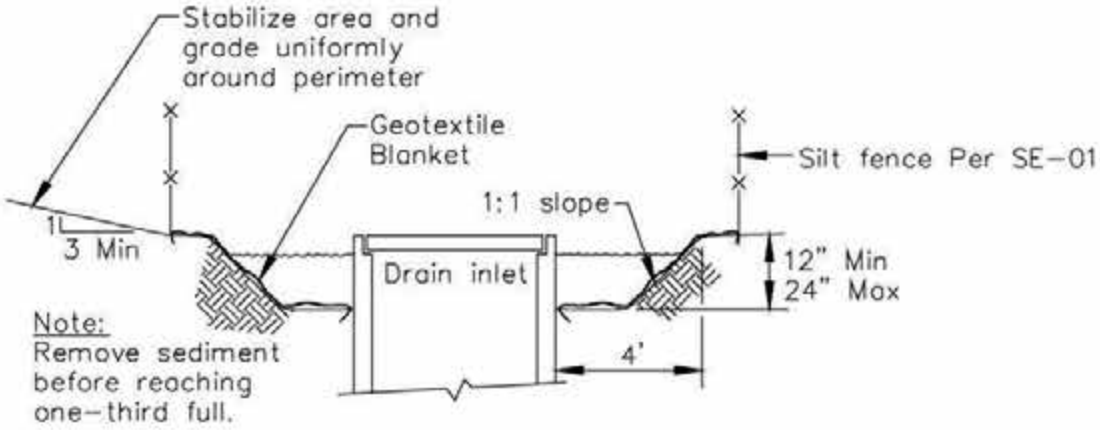


PLAN

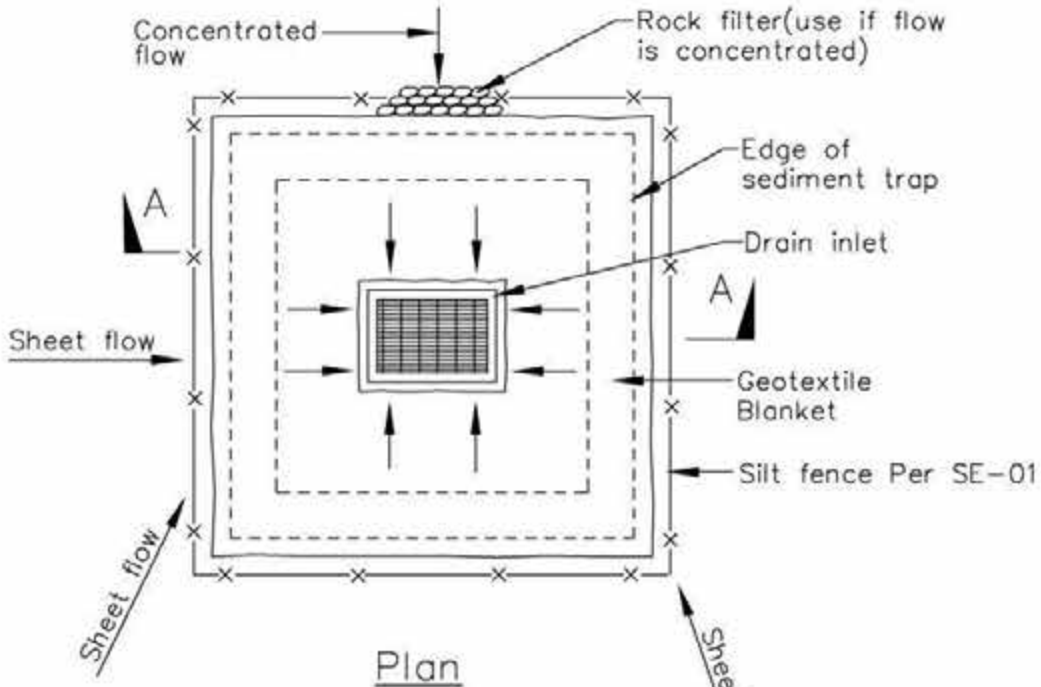
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



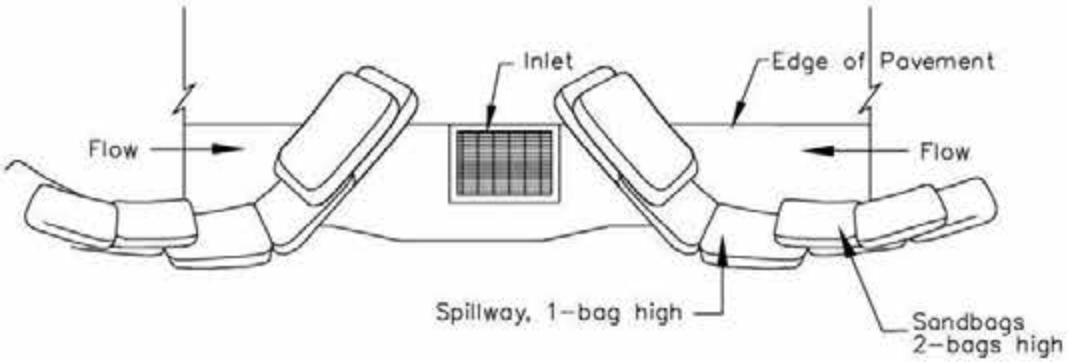
Section A-A



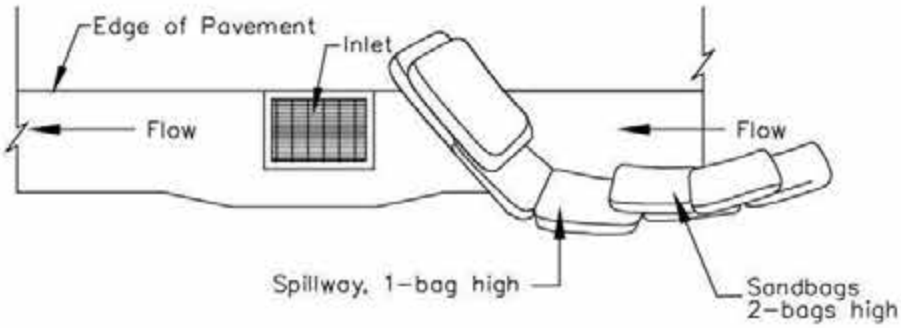
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

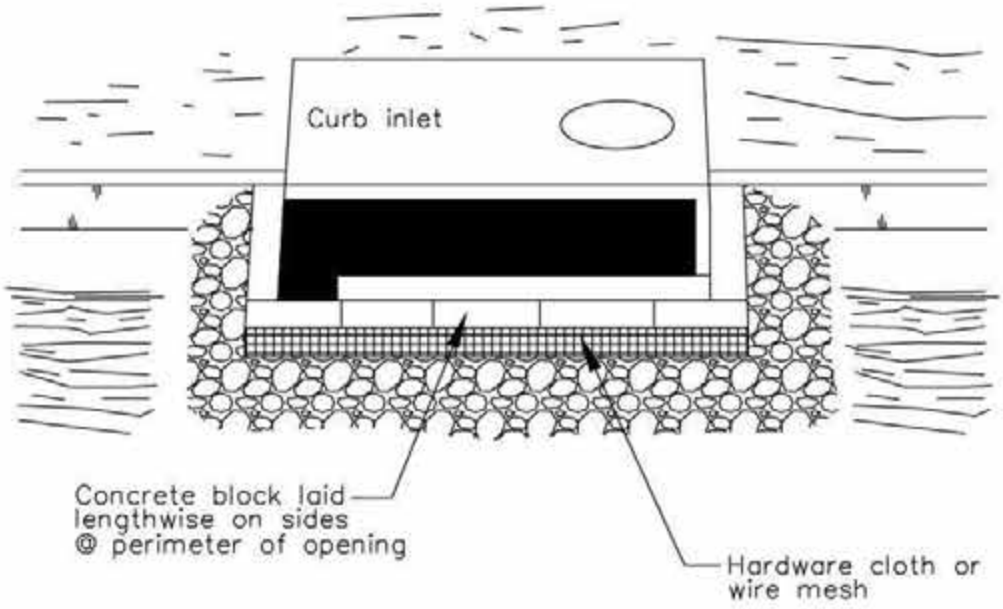


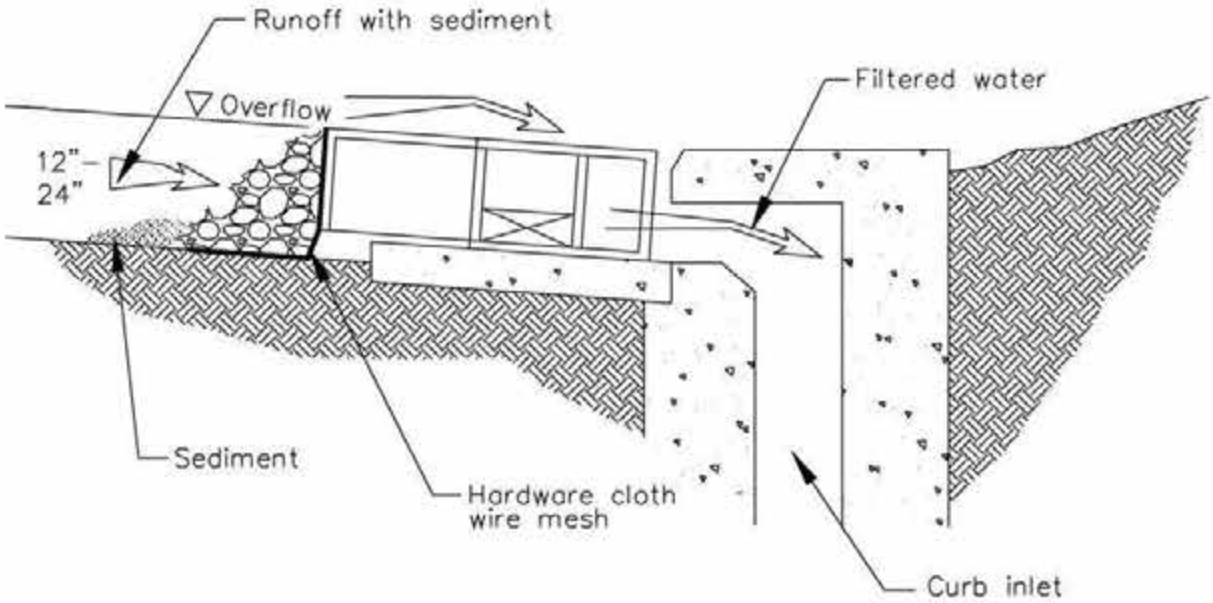
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

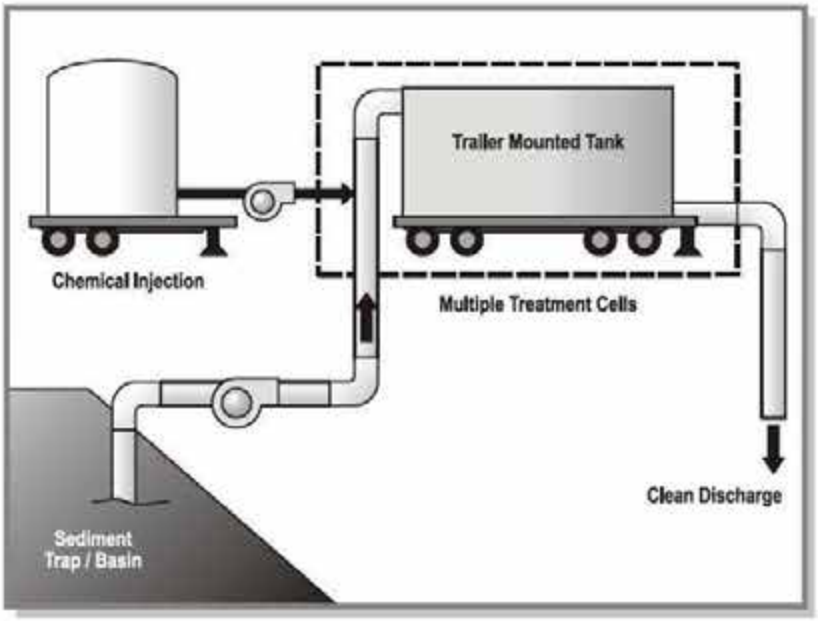
DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4
NOT TO SCALE

Chemical Treatment SE-11



Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Chemical treatment includes the application of chemicals to stormwater to aid in the reduction of turbidity caused by fine suspended sediment.

Suitable Applications

Chemical treatment can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sensitive wastes cannot be avoided using other BMPs. Typically, chemical use is limited to waters with numeric turbidity standards.

Limitations

The use of chemical treatment must have the advanced approval of the Regional Water Quality Control Board.

- Chemical Treatment of stormwater is relatively new and unproven technology in California.
- BMP has not been used often in California
- Petroleum based polymers should not be used
- Requires sediment basin or trailer mounted unit for chemical application
- Batch treatment required, flow through continuous treatment not allowed
- Requires large area

- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- Requires monitoring for non-visible pollutants

Implementation

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Chemical treatment may be used to reduce the turbidity of stormwater runoff. Very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

Criteria for Chemical Treatment Product Use

Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol should be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- Treatment chemicals must be approved by EPA for potable water use.
- Petroleum-based polymers are prohibited.
- Prior to authorization for field use, jar tests should be conducted to demonstrate that turbidity reduction necessary to meet the receiving water criteria could be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability.
- Prior to authorization for field use, the chemically treated stormwater should be tested for aquatic toxicity. Applicable state or local Whole Effluent Toxicity Testing and Limits, should be used. Testing should use stormwater from the construction site at which the treatment chemical is proposed for use or a water solution using soil from the proposed site.
- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).
- The approval of a proposed treatment chemical should be conditional, subject to full-scale bioassay monitoring of treated stormwater at the construction site where the proposed treatment chemical is to be used.
- Treatment chemicals that have already passed the above testing protocol do not need to be reevaluated. Contact the RWQCB for a list of treatment chemicals that may be approved for use.

Treatment System Design Considerations

The design and operation of a chemical treatment system should take into consideration the factors that determine optimum, cost-effective performance. It may not be possible to fully

incorporate all of the classic concepts into the design because of practical limitations at construction sites. Nonetheless, it is important to recognize the following:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage "adding more is always better" is not the case.
- The coagulant must be mixed rapidly into the water to insure proper dispersion.
- Experience has found that sufficient flocculation occurs in the pipe leading from the point of chemical addition to the settling or sediment basin.
- Since the volume of the basin is a determinant in the amount of energy per unit volume, the size of the energy input system can be too small relative to the volume of the basin.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a physical filter such as vegetated swale that would catch any unintended floc discharge.
- A pH-adjusting chemical should be added into the sediment basin to control pH. Experience shows that the most common problem is low pH.

Treatment System Design

Chemical treatment systems should be designed as batch treatment systems using either ponds or portable trailer-mounted tanks. Flow-through continuous treatment systems are not allowed at this time.

A chemical treatment system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), a sediment basin or sediment trap, pumps, a chemical feed system, treatment cells, and interconnecting piping.

The treatment system should use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps or tanks. Portable tanks may also be suitable for some sites.

The following equipment should be located in an operation shed:

- The chemical injector
- Secondary contaminant for acid, caustic, buffering compound, and treatment chemical
- Emergency shower and eyewash
- Monitoring equipment which consists of a pH meter and a turbidimeter

Sizing Criteria

The combination of the sediment basin or other holding area and treatment capacity should be large enough to treat stormwater during multiple day storm events. See SE-2, Sediment Basin, for design criteria. Bypass should be provided around the chemical treatment system to

accommodate extreme storm events. Runoff volume should be calculated using the Rational Method. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

There are two opposing considerations in sizing the treatment cells. A larger cell is able to treat a larger volume of water each time a batch is processed. However, the larger the cell the longer the time required to empty the cell. A larger cell may also be less effective at flocculation and therefore require a longer settling time. The simplest approach to sizing the treatment cell is to multiply the allowable discharge flow rate times the desired drawdown time. A 4-hour drawdown time allows one batch per cell per 8-hour work period, given 1 hour of flocculation followed by 2 hours of settling.

The permissible discharge rate governed by potential downstream effect can be used to calculate the recommended size of the treatment cells. The following discharge flow rate limits apply absent any local requirements:

- If the discharge is direct or indirect to a stream, the discharge flow rate should not exceed 50 percent of the peak flow rate for all events between the 2-year and the 10-year, 24-hour event.
- If discharge is occuring during a storm event equal to or greater than the 10-year storm the allowable discharge rate is the peak flow rate of the 10-year, 24-hour event.
- Discharge to a stream should not increase the stream flow rate by more than 10 percent.
- If the discharge is directly to a lake or major receiving water there is no discharge flow limit.
- If the discharge is to a municipal storm drainage system, the allowable discharge rate may be limited by the capacity of the public system. It may be necessary to clean the municipal storm drainage system prior to the start of the discharge to prevent scouring solids from the drainage system.
- Runoff rates may be calculated using the Rational Method, unless another method is required by the local flood control agency or agency that issued the grading permit.

Costs

Costs for chemical treatment may be significant due to equipment required and cost of chemicals. The cost is offset by the ability to reduce some use of other onsite erosion control BMPs and the reuse of equipment (e.g., pumps and dosing equipment). The incremental cost is generally less than 1% of the total construction costs.

Inspection and Maintenance

Chemical treatment systems must be operated and maintained by individuals with expertise in their use. Chemical treatment systems should be monitored continuously while in use.

The following monitoring should be conducted. Test results should be recorded on a daily log kept on site.

Operational Monitoring

- pH conductivity (as a surrogate for alkalinity), turbidity, and temperature of the untreated stormwater
- Total volume treated and discharged
- Discharge time and flow rate
- Type and amount of chemical used for pH adjustment
- Amount of polymer used for treatment
- Settling time

Compliance Monitoring

- pH and turbidity of the treated stormwater
- pH and turbidity of the receiving water

Bio-monitoring

Treated stormwater should be tested for acute (lethal) toxicity. Bioassays should be conducted by a laboratory accredited by the State of California. **The performance standard for acute toxicity is no statistically significant difference in survival between the control and 100 percent chemically treated stormwater.**

Acute toxicity tests should be conducted with the following species and protocols:

- Fathead minnow, Pimephales promelas (96 hour static-renewal test, method: EPA/600/4-90/027F). Rainbow trout, Oncorhynchus mykiss (96 hour static-renewal test, method: EPA/600/4-90/027F) may be used as a substitute for fathead minnow.
- Daphnid, Ceriodaphnia dubia, Daphnia pulex, or Daphnia magna (48 hour static test, method: EPA/600/4-90/027F).

All toxicity tests should meet quality assurance criteria and test conditions in the most recent versions of the EPA test method.

Bioassays should be performed on the first five batches and on every tenth batch thereafter or as otherwise approved by the RWQCB. Failure to meet the performance standard should be immediately reported to the RWQCB.

Discharge Compliance:

Prior to discharge, each batch of treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits may be established by the water quality standards or a site-specific discharge permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity must be within 5 NTUs of the background turbidity. Background is measured in the receiving water, upstream from the treatment process discharge point. pH must be within the range of 6.5 to 8.5 standard units and not cause a change in the pH of the receiving water of more than 0.2 standard units. It is often

possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements should be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water should not be taken from the treatment pond to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training:

Each contractor who intends to use chemical treatment should be trained by an experienced contractor on an active site for at least 40 hours.

Standard BMPs:

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment.

Sediment Removal and Disposal

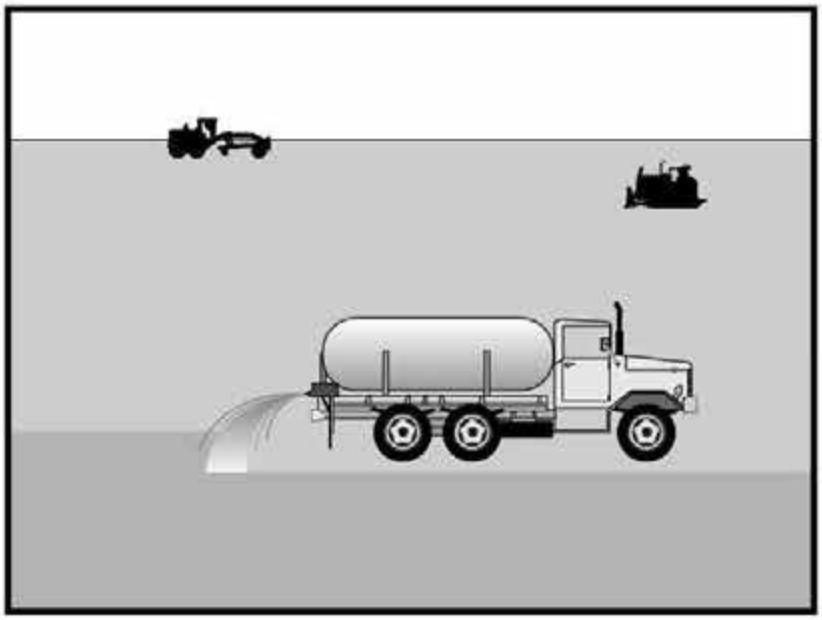
- Sediment should be removed from the storage or treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the decommissioning of the cells. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.
- Sediment may be incorporated into the site away from drainages.

References

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Wind Erosion Control WE-1



Objectives		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

Suitable Applications

Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Over watering may cause erosion.

- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Effectiveness depends on soil, temperature, humidity, and wind velocity.
- Chemically treated sub grades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- Asphalt, as a mulch tack or chemical mulch, requires a 24-hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

Implementation

General

California's Mediterranean climate, with short wet seasons and long hot dry seasons, allows the soils to thoroughly dry out. During these dry seasons, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast, and Sacramento, among others, have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line.

Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). Approximately 90 percent of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and public health departments are in place in some regions within California.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction and Grading Permits: Require provisions for dust control plans.
- Opacity Emission Limits: Enforce compliance with California air pollution control laws.
- Increase Overall Enforcement Activities: Priority given to cases involving citizen complaints.
- Maintain Field Application Records: Require records of dust control measures from contractor;
- Stormwater Pollution Prevention Plan: (SWPPP): Integrate dust control measures into SWPPP.

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table shows dust control practices that can be applied to site conditions that cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph, and controlling the number and activity of vehicles on a site at any given time.

SITE CONDITION	DUST CONTROL PRACTICES								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Silt Fences	Temporary Gravel Construction Entrances/Equipment Wash Down	Haul Truck Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X		X		X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/ Excavation			X	X		X			X
Truck Traffic on Unpaved Roads			X	X	X		X	X	
Mud/Dirt Carry Out					X		X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (EC-1, Scheduling).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.

- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality Control Board requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."
- Materials applied as temporary soil stabilizers and soil binders also generally provide wind erosion control benefits.
- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize inactive construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater.

Costs

Installation costs for water and chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Check areas protected to ensure coverage.
- Most dust control measures require frequent, often daily, or multiple times per day attention.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

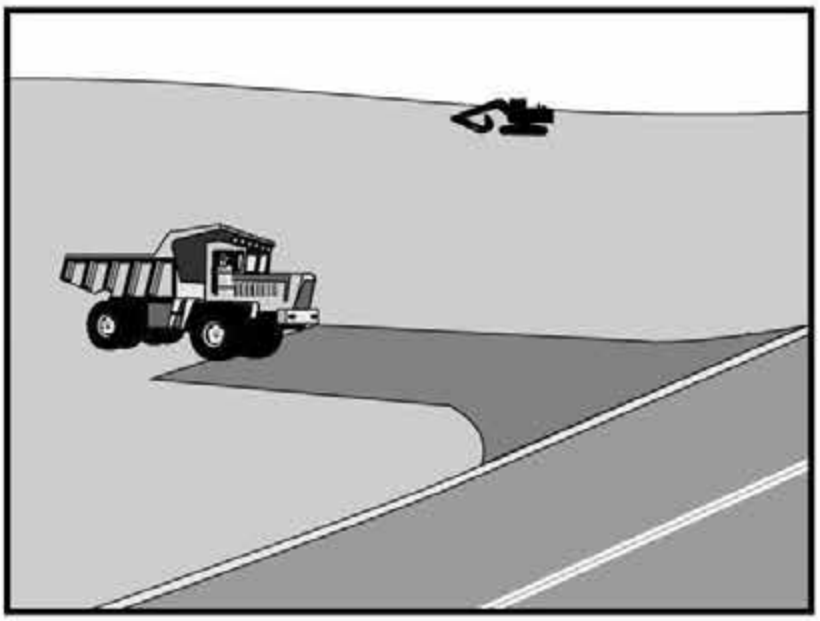
California Air Pollution Control Laws, California Air Resources Board, 1992.

Caltrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stabilized Construction Entrance/Exit TC-1



Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Stabilized Construction Entrance/Exit TC-1

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft minimum, and 30 ft minimum width.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

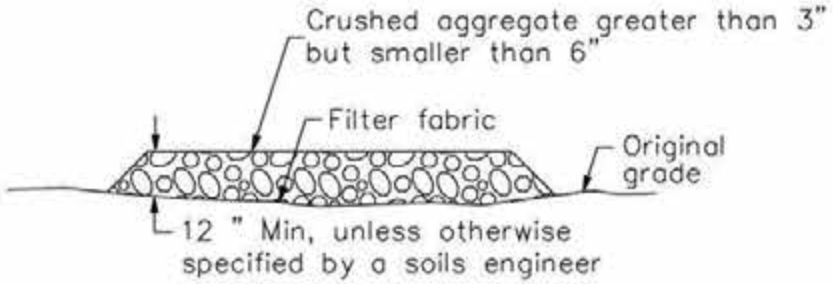
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

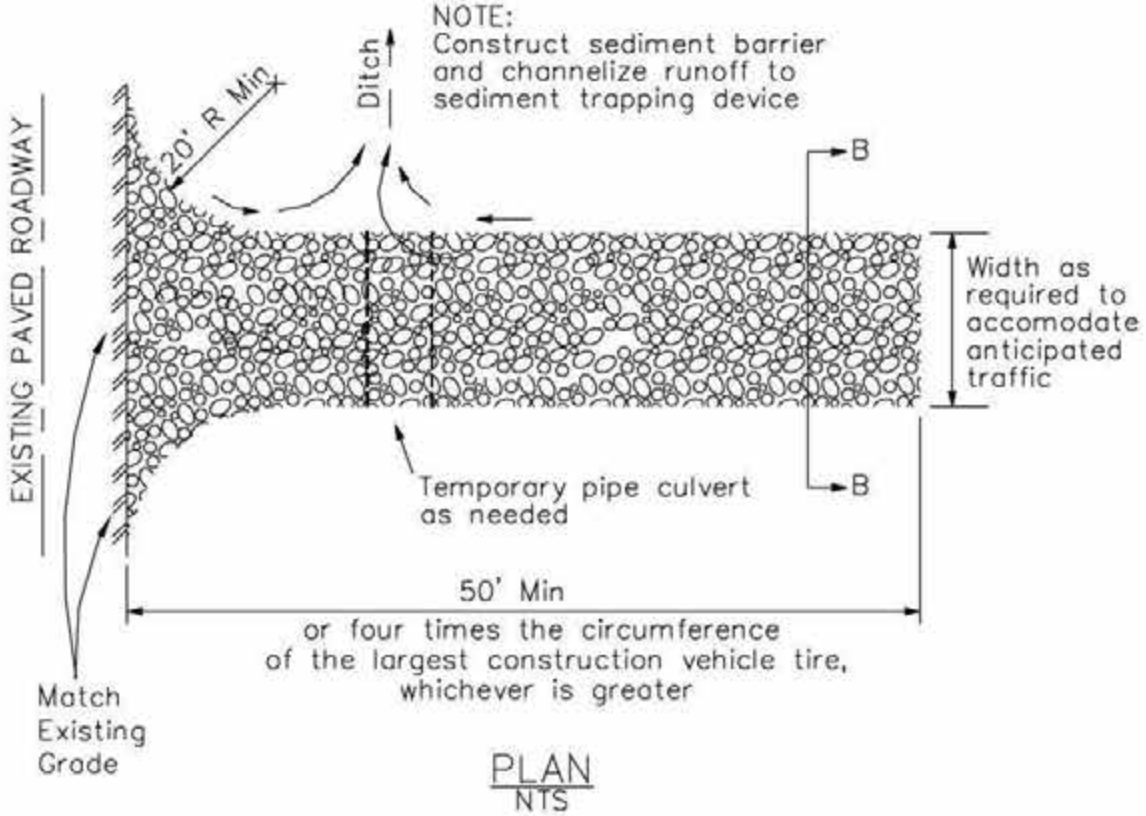
Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Stabilized Construction Entrance/Exit TC-1

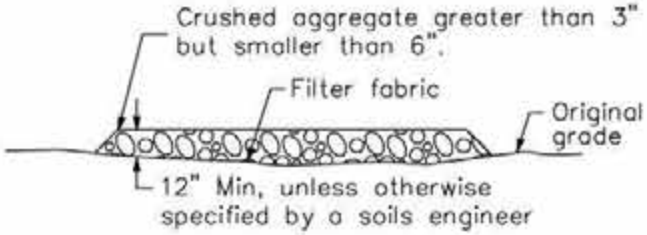


SECTION B–B
NTS

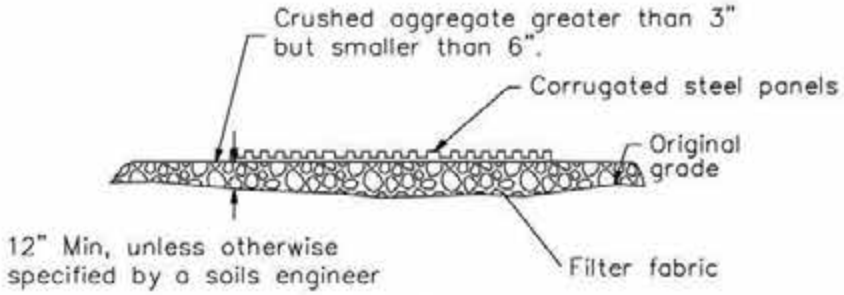


PLAN
NTS

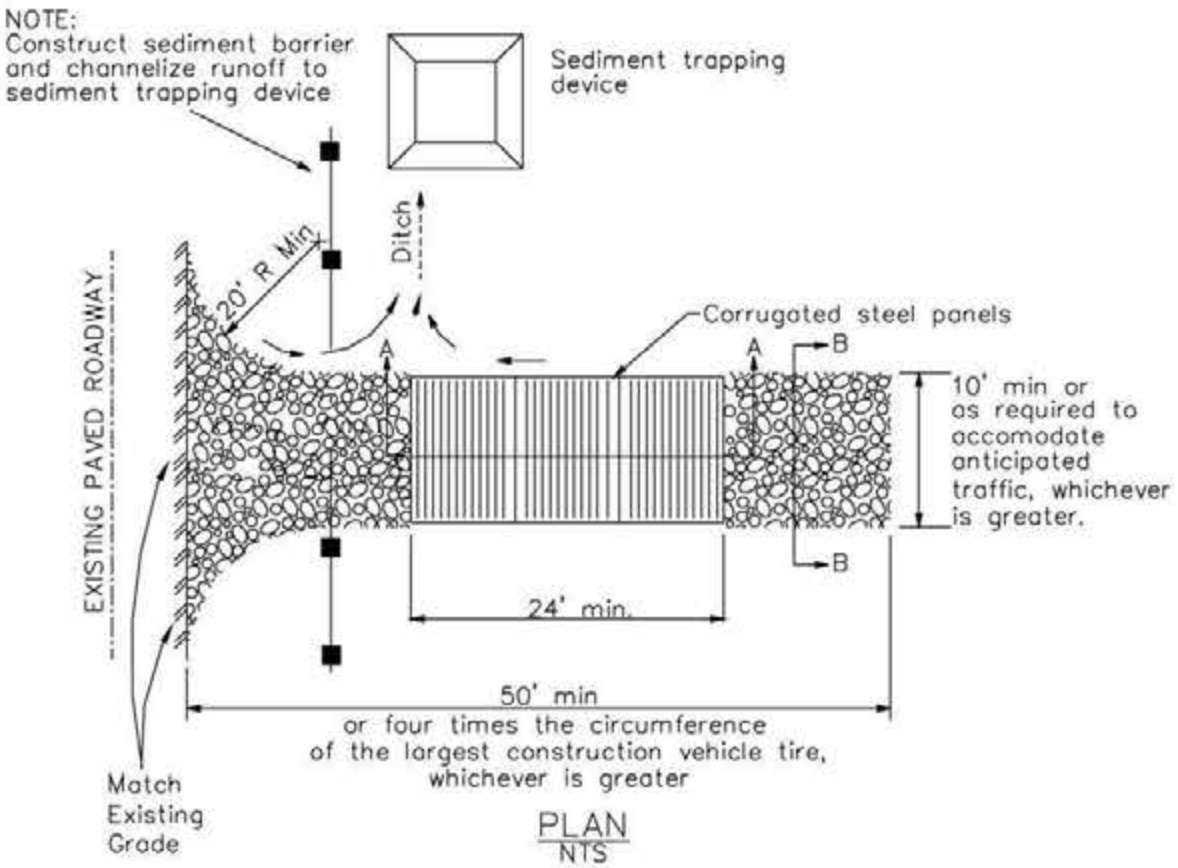
Stabilized Construction Entrance/Exit TC-1



SECTION B–B
NTS

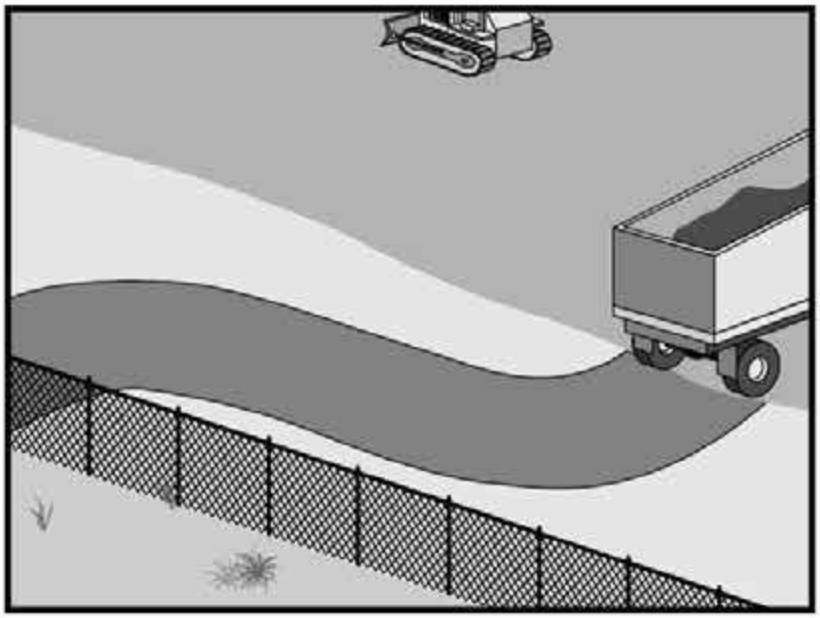


SECTION A–A
NOT TO SCALE



PLAN
NTS

Stabilized Construction Roadway TC-2



Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered

Limitations

- The roadway must be removed or paved when construction is complete.

Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.

- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, impact weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

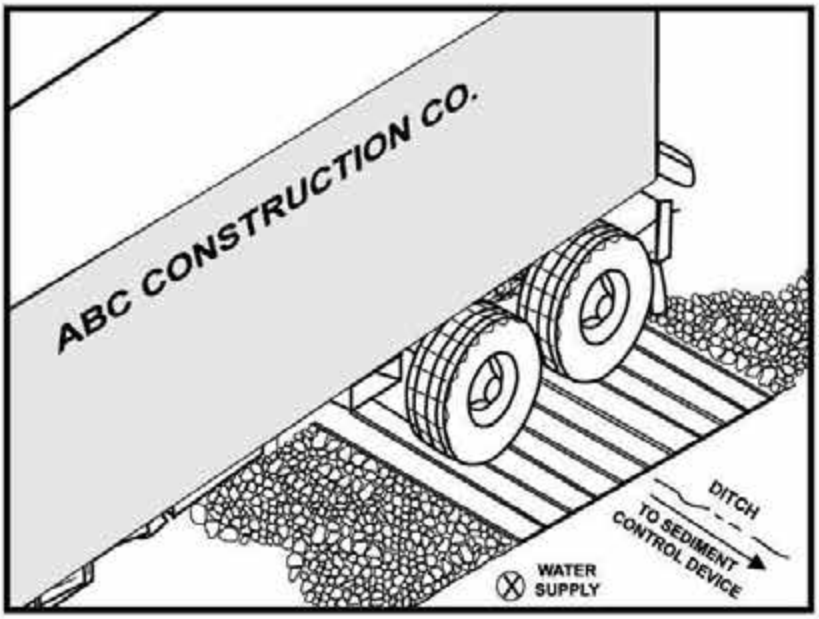
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Entrance/Outlet Tire Wash TC-3



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

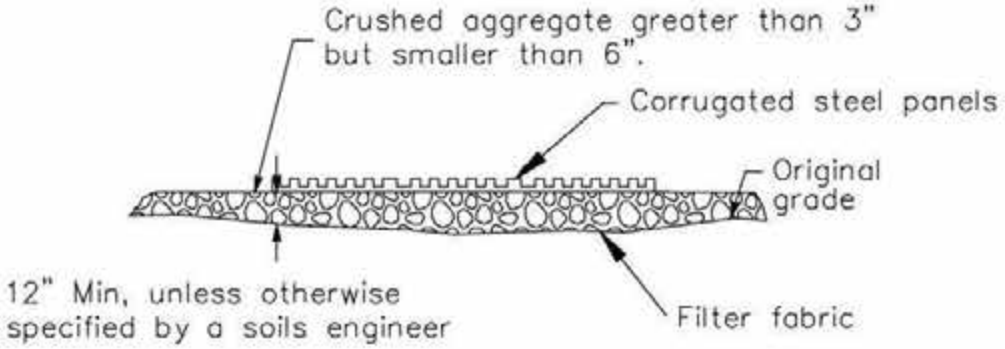
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

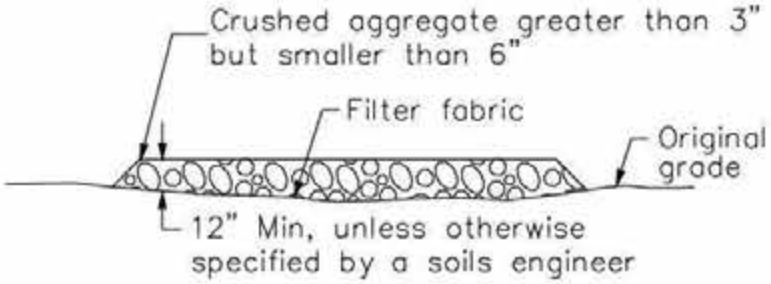
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

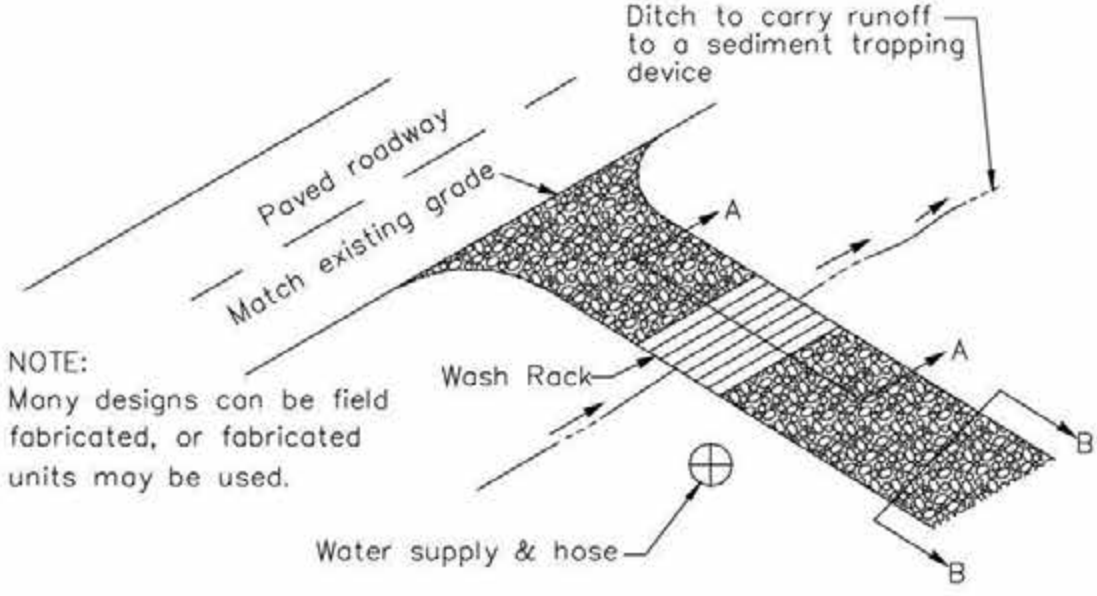
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A–A
NOT TO SCALE



SECTION B–B
NTS



TYPICAL TIRE WASH
NOT TO SCALE

APPENDIX E

SPECIAL-STATUS SPECIES LISTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:
Consultation Code: 08ESMF00-2019-SLI-1802
Event Code: 08ESMF00-2019-E-05772
Project Name: GratonBOH

April 30, 2019

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2019-SLI-1802

Event Code: 08ESMF00-2019-E-05772

Project Name: GratonBOH

Project Type: DEVELOPMENT

Project Description: development

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/38.35880366628414N122.72443002310337W

Counties: Sonoma, CA

Endangered Species Act Species

There is a total of 12 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle *Chelonia mydas* Population: East Pacific DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander *Ambystoma californiense* Population: U.S.A. (CA - Sonoma County) There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2076	Endangered

Insects

NAME	STATUS
San Bruno Elfin Butterfly *Callophrys mossii bayensis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered

Crustaceans

NAME	STATUS
California Freshwater Shrimp *Syncaris pacifica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered

Flowering Plants

NAME	STATUS
Burke's Goldfields *Lasthenia burkei* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4338	Endangered
Sebastopol Meadowfoam *Limnanthes vinculans* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/404	Endangered
Showy Indian Clover *Trifolium amoenum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6459	Endangered
Sonoma Alopecurus *Alopecurus aequalis var. sonomensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/557	Endangered
Sonoma Sunshine *Blennosperma bakeri* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1260	Endangered

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
California Tiger Salamander *Ambystoma californiense* https://ecos.fws.gov/ecp/species/2076#crithab	Final

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Cotati (3812236))

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
Amorpha californica var. napensis Napa false indigo	PDFAB08012	None	None	G4T2	S2	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Blennosperma bakeri Sonoma sunshine	PDAST1A010	Endangered	Endangered	G1	S1	1B.1
Bombus occidentalis western bumble bee	IIHYM24250	None	None	G2G3	S1	
Centromadia parryi ssp. parryi pappose tarplant	PDAST4R0P2	None	None	G3T2	S2	1B.2
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Hemizonia congesta ssp. congesta congested-headed hayfield tarplant	PDAST4R065	None	None	G5T2	S2	1B.2
Lasthenia burkei Burke's goldfields	PDAST5L010	Endangered	Endangered	G1	S1	1B.1
Limnanthes vinculans Sebastopol meadowfoam	PDLIM02090	Endangered	Endangered	G1	S1	1B.1
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Microseris paludosa marsh microseris	PDAST6E0D0	None	None	G2	S2	1B.2
Oncorhynchus mykiss irideus pop. 8 steelhead - central California coast DPS	AFCHA0209G	Threatened	None	G5T2T3Q	S2S3	
Pleuropogon hooverianus North Coast semaphore grass	PMPOA4Y070	None	Threatened	G2	S2	1B.1
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Trifolium amoenum two-fork clover	PDFAB40040	Endangered	None	G1	S1	1B.1
Trifolium hydrophilum saline clover	PDFAB400R5	None	None	G2	S2	1B.2

Record Count: 21

CNPS California Native Plant Society

Plant List

Inventory of Rare and Endangered Plants

14 matches found. *Click on scientific name for details*

Search Criteria

Found in Quad 3812236

Modify Search Criteria | Export to Excel | Modify Columns | Modify Sort | Display Photos

Scientific Name	Common Name	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Amorpha californica var. napensis	Napa false indigo	Apr-Jul	1B.2		
Blennosperma bakeri	Sonoma sunshine	Mar-May	1B.1	CE	FE
Centromadia parryi ssp. parryi	pappose tarplant	May-Nov	1B.2		
Fritillaria liliacea	fragrant fritillary	Feb-Apr	1B.2		
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	Apr-Nov	1B.2		
Lasthenia burkei	Burke's goldfields	Apr-Jun	1B.1	CE	FE
Limnanthes vinculans	Sebastopol meadowfoam	Apr-May	1B.1	CE	FE
Microseris paludosa	marsh microseris	Apr-Jun(Jul)	1B.2		
Pleuropogon hooverianus	North Coast semaphore grass	Apr-Jun	1B.1	CT	
Pleuropogon refractus	nodding semaphore grass	(Mar)Apr-Aug	4.2		
Ranunculus lobbii	Lobb's aquatic buttercup	Feb-May	4.2		
Rhynchospora globularis	round-headed beaked-rush	Jul-Aug	2B.1		
Trifolium amoenum	two-fork clover	Apr-Jun	1B.1		FE
Trifolium hydrophilum	saline clover	Apr-Jun	1B.2		

Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 30 April 2019].

Search the Inventory
Simple Search
Advanced Search
Glossary

Information
About the Inventory
About the Rare Plant Program
CNPS Home Page
About CNPS
Join CNPS

Contributors
The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments

rareplants@cnps.org