



Environmental Functional Area

Environmental Support and Programmatic Outreach Group

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**Lawrence Livermore National Laboratory
Livermore Site
Annual Storm Water Monitoring Report for
Waste Discharge Requirements 95-174**

**Annual Report
2014–2015**

August 2015

Craig B. Fish

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**Lawrence Livermore National Laboratory
Livermore Site Annual Storm Water
Monitoring Report
for Waste Discharge Requirements 95-174**

Reporting Period May 1, 2014 through April 30, 2015

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Acronyms and Definitions

ALP	Arroyo Las Positas
ALPE	Arroyo Las Positas East (storm water influent sampling location)
ALPO	Arroyo Las Positas Outfall (storm water influent sampling location)
ASS2	Arroyo Seco South (storm water influent sampling location)
ASW	Arroyo Seco West (storm water effluent sampling location)
AWQC	ambient water quality criteria
B	building
BMP	best management practice
Bq/L	becquerel/liter
CA	California
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
COD	chemical oxygen demand
DI	deionized
DO	dissolved oxygen
DOE	Department of Energy
DRB	Drainage Retention Basin, renamed Lake Hausmann
EFA	Environmental Functional Area
ERD	Environmental Restoration Department
gpm	gallons per minute
GRNE	Greenville Road East (storm water influent sampling location)
HMMA	Hazardous Materials Management Area
hr	hour
IMF WAA	Institutionally Managed Facilities Waste Accumulation Area
LCW	low conductivity water
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
MCL	maximum contaminant level
µg/L	micrograms per liter
mg/L	milligrams per liter
MUSD	Maintenance and Utilities Services Department
N/A	not analyzed
NOEC	no observed effects concentration
NPDES	National Pollutant Discharge Elimination System
O&G	oil and grease
pCi	picocurie
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
ppb	parts per billion
PVC	polyvinyl chloride
PTU	portable treatment unit

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Acronyms and Definitions (Continued)

QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act of 1976
RHWM	Radioactive and Hazardous Waste Management
SC	specific conductance
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SI	système internationale
SM	standard method
SWPPP	Storm Water Pollution Prevention Plan
T	trailer
TCE	trichloroethene (or trichloroethylene)
TDS	total dissolved solids
TF	treatment facility
TOC	total organic carbon
TSS	total suspended solids
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
WAA	waste accumulation area
WDR	Waste Discharge Requirements
WPDC	West Perimeter Drainage Channel (storm water effluent sampling location)

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EXECUTIVE SUMMARY

Results of the storm water quality monitoring program at Lawrence Livermore National Laboratory (LLNL) in Livermore, California are reported as required in the Waste Discharge Requirements (WDR) 95-174, National Pollutant Discharge Elimination System (NPDES) Permit No. CA0030023. This report presents results for the 2014–2015 water year including: the Storm Water Pollution Prevention Plan (SWPPP) facility inspection results, wet and dry season observations, storm water discharge analytical data, and a summary interpretation of the data.

The facility inspection results indicated a few minor instances at the Livermore Site in which best management practices (BMPs) listed in the SWPPP were not properly implemented, but that corrective actions have either been made or are in progress. Other than minor debris accumulation (primarily leaves and sticks) at some sampling locations, storm water observations did not identify any pollutants. Although there are no numeric effluent limits placed on storm water discharges, data are compared with various criteria to determine if water quality remains similar to natural or upstream conditions, or that concentrations are below levels of concern. Acute and chronic fish toxicity testing indicated no toxicity in effluent storm water samples. Storm water samples for the event on December 11, 2014 showed one constituent (gross beta activity) above LLNL site-specific threshold comparison criteria in one effluent sample (WPDC). The second WPDC sample of the water year and the 2 samples for WPDC for gross beta activity for the prior year did not exceed the comparison criteria. For the April 7, 2015 event, analytical results showed nitrate as NO_3 exceeded the LLNL site-specific threshold comparison criteria in one effluent sample. The Nitrate as NO_3 exceedance is likely from CERCLA groundwater cleanup activities. All other effluent monitoring results were less than comparison criteria. These results indicate that LLNL's current BMPs are effective and that operations at the LLNL Livermore Site during 2014–2015 did not significantly impact storm water quality.

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1.0 Introduction

This report discusses the results of the 2014–2015 Livermore Site storm water monitoring program. Storm water quality monitoring results for the LLNL Livermore Site are summarized, fulfilling the annual reporting requirements of WDR 95-174, issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) on August 23, 1995, (hereafter referred to as “the Permit”). The Permit expired on August 23, 2000. LLNL submitted a Report of Waste Discharge (and an NPDES permit application) to renew the Permit on February 18, 2000, meeting the requirement to submit a renewal application 180 days in advance of permit expiration. SFBRWQCB staff confirmed the administrative continuance in November 2000 (Morse 2000).

The Livermore Site is a 3.28-km² facility that is crossed by two intermittent streams, Arroyo Las Positas and Arroyo Seco. The average annual rainfall at the Livermore Site is 13.7 inches (34.8 cm), and the rainfall for the 2014–2015 reporting period was 10.75 inches (27.31 cm). Monthly rainfall totals are presented in **Table 1**. LLNL monitors influent and effluent water quality as required by the Permit. The six perimeter storm water sampling locations are shown in **Figure 1**, along with three internal (on-site) monitoring locations around the drainage retention basin, renamed Lake Haussmann.

Table 1. Monthly rainfall totals (in inches) collected at the LLNL Site meteorological station.

Date	Monthly Total (inches)
May 2014	0.02
June 2014	0.00
July 2014	0.00
August 2014	0.00
September 2014	0.17
October 2014	0.33
November 2014	1.04
December 2014	6.81
January 2015	0.03
February 2015	1.30
March 2015	0.28
April 2015	0.77
Water Year TOTAL	10.75 inches

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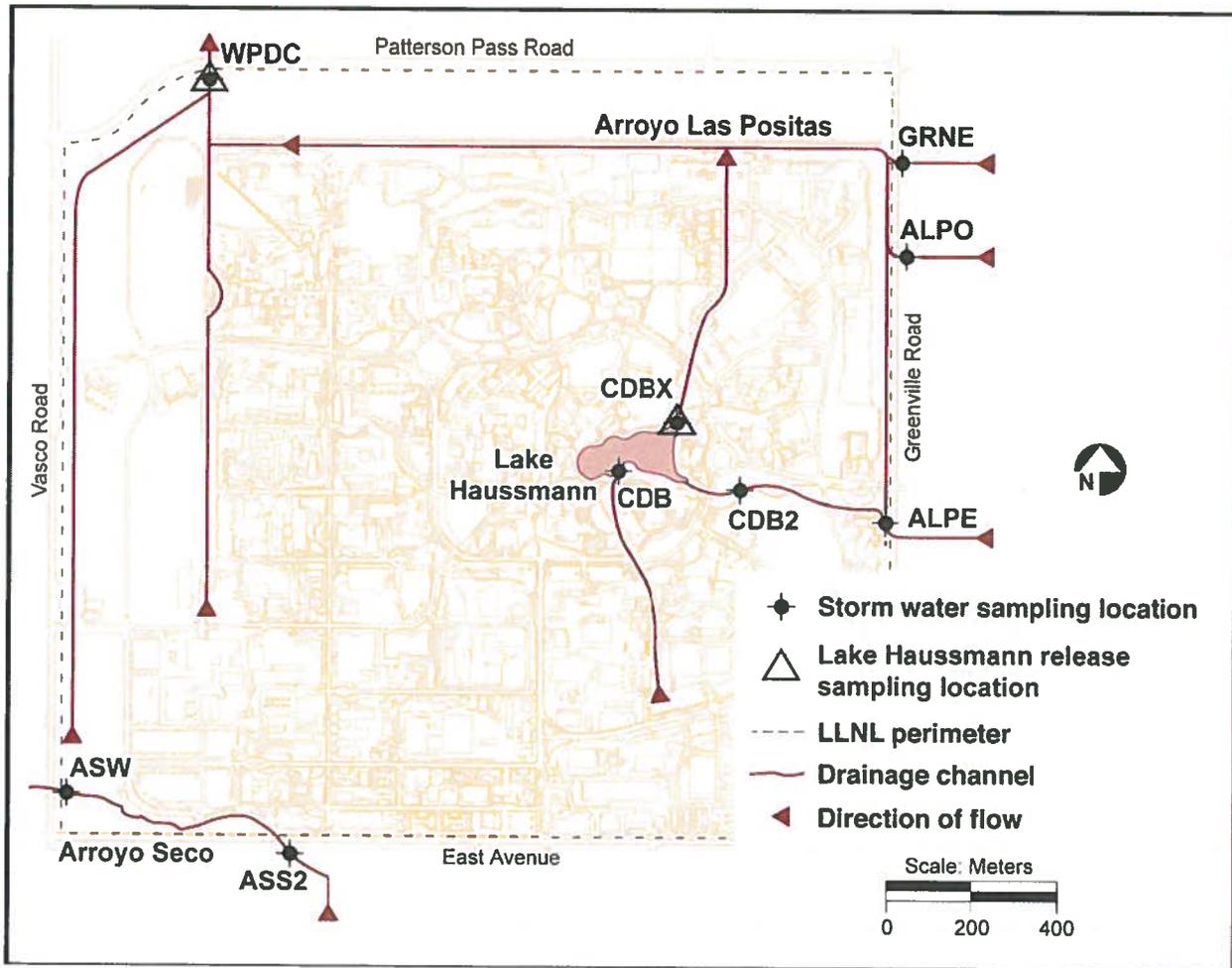


Figure 1. Routine storm water sampling and observation locations.

2.0 Non-Storm Water Discharges

The SFBRWQCB issued the Permit to LLNL, allowing storm water discharges associated with industrial activities and four categories of non-storm water discharges, including mechanical equipment sources (e.g., air conditioners), building and grounds maintenance (e.g., landscape irrigation), fire suppression and safety systems (e.g., hydrant testing), and water systems (e.g., backflow preventors). In addition, the Permit allows LLNL to administratively control several building conduits that remain open because they are impractical to seal.

LLNL tracks authorized non-storm water discharge sources through the Building Drain Management database and key plans, and an internal drain connection permitting process. As required by the Permit, Provision C.8, LLNL evaluates all new construction, remodeling, and equipment upgrades to determine if it is practical to eliminate permitted discharge sources. If it is practical to do so, the discharge is eliminated. Modifications that result in new connections to building conduits are added to the Building Drain Management database.

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Authorized non-storm water discharge sources and open building conduits are included in LLNL's Dry Season Observation Program. These observations help LLNL verify that the BMPs applied to these discharge sources continue to be properly implemented. Areas in the Dry Season Observation Program include secondary containment areas, loading and receiving areas, floor drains open to the storm drainage system, and automatic sump pumps. These locations and observation results are discussed in detail in this report in Section 4.0, Visual Observations. Non-routine releases are summarized in **Appendix A, Table A-1**. This table includes unplanned releases reportable under the Permit, Provision C.1, and non-routine releases allowed under the Permit but requiring prior notification under Provision C.7.

3.0 Annual Site Inspections

Each of the Principal Directorates and Associate Directorates (ADs) (LLNL's high level organizational units) at LLNL conducts an annual inspection of its facilities to verify implementation of the SWPPP and ensures that measures to reduce pollutant loading to storm water runoff are adequately and properly implemented. The Principal Associate Directors and ADs certify that their facilities comply with the provisions of the Permit and the SWPPP. Each Principal Directorate and ADs document and keep on file the annual inspection results (as required by the Permit). These records include the dates, places, and times of the site inspections and the names of individuals performing the inspections. Because of the large number of facilities inspected (more than 500 buildings and trailers), the detailed inspection results are not included in this report, but the individual inspection records are available for submittal or review upon request. All inspections were completed; findings and deficiencies are summarized in **Appendix A, Table A-2**.

A few inspections noted inconsistent or incomplete implementation of BMPs in the annual SWPPP inspections. All of these issues have either been corrected or are in the process of being corrected as described in **Appendix A, Table A-2**. All other inspections indicated that the applicable BMPs were implemented correctly and adequately.

4.0 Visual Observations

Dry season observations were performed and are provided in **Appendix A, Table A-3**. The Permit requires that observations be conducted at least twice during the dry season (May through September). These observations occurred on June 16 and September 17, 2014, at storm water effluent sampling locations (**Figure 1**, Arroyo Seco West [ASW] and West Perimeter Drainage Channel [WPDC]), at storm water influent sampling locations (**Figure 1**, Arroyo Seco South [ASS2], Arroyo Las Positas East [ALPE], Arroyo Las Positas Outfall [ALPO], and Greenville Road East [GRNE]), at areas with a "high potential" of storm water pollution, and at non-storm water discharge locations to determine the presence of stains, sludges, odors, and other anomalous conditions. "High potential" areas include areas with automatic (e.g., sump pumps) or direct connections to the surface and areas where activities may result in accidental releases to the surface (e.g., loading/receiving areas and open rinse areas).

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To determine the “high potential” areas, LLNL compiled and categorized potential storm water pollution areas, using information from the following sources:

- *LLNL Livermore Site Annual Storm Water Monitoring Report* (Brandstetter 1994);
- LLNL’s Building Drain Management Database;
- LLNL’s *Report of Waste Discharges*, March 1995 (Mathews and Welsh 1995); and
- LLNL’s Observation Records.

LLNL then conducted inspections, visual observations, and assessments of these potential areas for storm water pollution. Areas determined as “high potential” are included in the dry season observation program as follows:

- Arroyo Seco and Arroyo Las Positas (observations conducted at influent and effluent locations);
- Avenue K storm drain;
- Automatic sump pump area at Building 191;
- Loading/receiving areas in Buildings 194 and 341;
- Concrete wash area near Parking Lot F-2; and
- Floor drain areas open to the environment in Buildings 111, 194, 391, and 551.

During this reporting period, the dry season observations did not identify any unusual discharges. Observed evidence of flow at some locations was from discharges of treated groundwater allowed under the *Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Record of Decision* (US Department of Energy 1992). All indications of non-storm water flows were attributable to permitted discharges or natural sources.

Wet season observations are summarized in **Appendix A, Table A-4**. The Permit requires that wet season observations be conducted monthly during the wet season (October 2014 through April 2015) when significant storm events occur (a significant storm is defined as runoff lasting more than one hour). These observations are conducted at storm water influent and effluent sampling locations. Observations often indicated turbidity at both influent and effluent locations, but no unusual conditions or anomalies were observed. Storm event observations were recorded during the qualifying December 2014 and April 2015 storms. Wet season observations were also conducted during the months of October and November 2014, and January, February and March 2015.

5.0 Storm Water Sampling and Analysis

The Permit requires collection of two samples each wet season at effluent locations ASW and WPDC and at influent locations ALPE, ALPO, ASS2, and GRNE. Permit-driven storm water samples were collected on December 11, 2014 and April 7, 2015; however, as in recent past years, there was insufficient runoff at ALPO during the April 2015 storm to sample this influent location. Samples were collected as soon as possible after runoff began (most within the first hour). Water quality data from these storm water samples for the 2014–2015 reporting period are presented in **Appendix A, Table A-6 and Table A-7**. Quality assurance and quality control (QA/QC) checks are performed on all sampling and analysis from LLNL. All data analysis included standard

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QA/QC practices. LLNL reports on QA annually in the Site Annual Environmental Report (Jones et al. 2014); this information is available upon request.

The Permit currently does not contain numeric limits for storm water effluent. Therefore, site-specific comparison criteria were developed from historical data to identify out-of-the-ordinary data values (**Table 2**). These criteria are used to identify data values that require further investigation and explanation. In addition to the Livermore Site-specific comparison criteria, storm water results are compared to other published values, including: United States Environmental Protection Agency (U.S. EPA) benchmarks; *The Water Quality Control Plan, San Francisco Bay Basin (Region 2)* (Basin Plan) (SFBRWQCB 1995); U.S. EPA and State maximum contaminant levels (MCLs) and Ambient Water Quality Criteria (AWQC). Although these latter criteria were established for other regulatory programs, use of a broad range of criteria can help LLNL evaluate the quality of Livermore Site storm water effluent and determine the adequacy of BMPs. If a measured concentration is found to be higher than the comparison criteria, but the value is the same or higher at the influent location, the source is assumed to be unrelated to Livermore Site operations; therefore, further analysis is not warranted.

Table 2. Livermore Site-specific threshold comparison criteria for selected water quality parameters for storm water runoff.

Parameter	Comparison criteria
Total suspended solids (TSS)	750 mg/L ^a
Chemical oxygen demand (COD)	200 mg/L ^a
pH	<6.0, >8.5 ^a
Nitrate (as NO ₃)	10 mg/L ^a
Ortho-phosphate	2.5 mg/L ^a
Beryllium	1.6 µg/L ^a
Chromium(VI)	15 µg/L ^a
Copper	36 µg/L ^a
Lead	15 µg/L ^b
Mercury	Above RL ^c
Zinc	350 µg/L ^a
Diuron	14 µg/L ^a
Oil and grease	9 mg/L ^a
Tritium	36 Bq/L ^a
Gross alpha	0.34 Bq/L ^a
Gross beta	0.48 Bq/L ^a

Note: The sources of values above these are examined to determine if any action is necessary.

^a Site-specific value calculated from historical data and studies. These values are lower than the MCLs and EPA benchmarks except for zinc, total suspended solids (TSS), and chemical oxygen demand (COD).

^b California and EPA drinking water action level.

^c RL = reporting limit = 0.0002 mg/L for mercury.

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5.1 Toxicity Monitoring

As required by the Permit, grab samples were collected from the site storm water effluent location, WPDC, and analyzed for acute and chronic toxicity using fathead minnows (*Pimephales promelas*) as the test species. These tests are required only at effluent location WPDC and are not conducted with water from corresponding influent locations. The testing laboratory provides water for the control sample, which consists of EPA synthetic moderately-hard water.

In the acute test, 96-hour survival is observed in undiluted storm water collected from location WPDC. The Permit states that an acceptable survival rate is 20 percent lower than a control sample. If the acute toxicity test is failed, the Permit requires LLNL to conduct toxicity testing during the next significant storm event. After failing two consecutive tests, LLNL must perform a toxicity reduction evaluation to identify the source of the toxicity. The 96-hour acute toxicity test results from the April 7, 2015 sample collected at WPDC (100 percent survival, compared to 100 percent survival in the laboratory control sample) show that this water was not acutely toxic to fathead minnow survival (**Table 3a**).

The 7-day chronic fish toxicity test compared the survival and growth of fathead minnow larvae in the storm water sample (again collected at WPDC on April 7, 2015) to the survival and growth of the minnow larvae in a laboratory control sample water. The test results are summarized in **Table 3b**. The analytical laboratory reported no statistically significant differences for either end point, and the no observed effect concentrations (NOECs) for both survival and growth were determined to be 100 percent. These results demonstrate that there was no observed toxicity in LLNL storm water effluent.

Table 3a. Single point acute fish toxicity test results for April 7, 2015, at WPDC.

Location	Sample	% Survival		
		Replicate A	Replicate B	Mean
Laboratory Control	EPA synthetic "moderately hard" water	100	100	100
WPDC	Site Effluent	100	100	100

Table 3b. Chronic fish toxicity test results for April 7, 2015, at WPDC.

Sample Concentration (%)	7-day survival Avg. (%)	7-day weight ^a Avg. (mg)
100% Laboratory Control	100	0.664
100% WPDC Site Effluent	100	0.652

^a Average weight of the fathead minnow larvae at the end of the 7-day toxicity test.

5.2 Non-Radioactive Parameters

Table 4 lists the constituents in the December 11, 2014 and the April 7, 2015 storm water samples that exceeded the threshold comparison criteria in **Table 2** (full results are in **Appendix A, Table A-6 and A-7**).

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Table 4. Constituents in storm water greater than the LLNL-specific threshold comparison criteria.

Constituent	Date	Location	Influent or Effluent	Result	LLNL Threshold Criteria
TSS	12/11/2014	ALPO	Influent	760 mg/L	750 mg/L
Gross Beta	12/11/2014	WPDC	Effluent	15.9 pCi/L	12.97 pCi/L
Nitrate (as NO ₃)	12/11/2014	GRNE	Influent	13 mg/L	10 mg/L
	12/11/2014	ALPO	Influent	12 mg/L	10 mg/L
	04/07/2015	ASW	Effluent	22 mg/L	10 mg/L
	04/07/2015	GRNE	Influent	30 mg/L	10 mg/L
Copper	12/11/2014	ALPO	Influent	42 mg/L	36 mg/L
Lead	12/11/2015	ALPO	Influent	20 mg/L	15 mg/L

Nitrate concentration was found above the LLNL comparison criteria of 10 mg/L at ASW during the second storm. ASW is an effluent sample.

Because runoff from landscaped areas between the ASS2 and ASW locations could contribute to the nitrate concentration reported in the ASW sample, that source was immediately investigated. However, landscape services personnel had not applied fertilizer to this area in the months of March or April 2015. The turf in that area is being browned out due to the drought. Fertilizer at LLNL is always applied in accordance with applicable LLNL BMPs.

Another possible source of nitrates in samples collected at ASW is the treated groundwater that discharged from Treatment Facility A (TFA), immediately upstream of the ASW sampling location. TFA is permitted under CERCLA for removing volatile organic compounds (VOCs) from groundwater. TFA was in operation on April 7, 2015, discharging at 240 gpm. Nitrate concentrations in groundwater from extraction wells that supply TFA typically range from 20 mg/L to 40 mg/L. Hence, any TFA effluent that comingles with storm water runoff between the ASS2 and ASW sampling locations would have the effect of increasing nitrate concentration in runoff samples. LLNL continues to monitor for nitrates and investigate potential sources.

5.3 Radioactive Parameters

Environmental measurements are reported in *Système Internationale* (SI) units. The SI unit for radioactivity is the becquerel (Bq), equal to 1 nuclear disintegration per second. The more commonly used unit, picocurie (pCi), is equal to 1 nuclear disintegration per 27 seconds. Results for tritium, gross alpha, and gross beta activities from storm water samples collected during 2014–2015 are included in **Appendix A, Tables A-6 and A-7**. The gross beta measurement of radioactivity was above the LLNL specific comparison criteria (0.48 Bq/L) at the WPDC location on December 11, 2014 (**Table 4**). Occasionally we detect gross alpha or gross beta radioactivity in runoff samples. The gross beta activity is likely due to naturally occurring potassium-40, radon-228 and uranium-238 daughters in soil particles entrained in the runoff. The two WPDC samples from the previous water year and the WPDC sample from the April 2015 sample were all below the Livermore Site comparison value.

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6.0 Summary and Conclusions

The storm water monitoring program at LLNL goes beyond the requirements of the Permit by sampling at more locations and for more parameters than the Permit requires. This additional monitoring is called for under the environmental monitoring requirements of various Department of Energy (DOE) Orders. Furthermore, LLNL investigates water quality parameters that are found to be above historic levels as demonstrated by the site-specific comparison criteria in **Table 2**.

Storm water observations were performed monthly during the wet season and quarterly during the dry season, with no major deficiencies noted. Inspections of BMPs listed in the SWPPP revealed some areas for improvement, for which corrective actions have either been made or are in progress.

Storm water samples showed two effluent constituents from sampling location WPDC (gross beta) and ASW (nitrate) above LLNL site-specific threshold comparison criteria. The high gross beta value does not represent a trend and is likely due to naturally occurring radioactivity in soil. The high nitrate value is consistent with nitrogen concentrations in groundwater from extraction wells that are discharged under a CERCLA permit to Arroyo Seco.

Acute and chronic fish toxicity testing indicated no toxicity in storm water runoff samples, and all other effluent monitoring results were less than comparison criteria. These monitoring results indicate that LLNL's current BMPs are effective and that operations at the LLNL Livermore Site during 2014–2015 did not impact storm water quality.

7.0 References

- Brandstetter, E. (1994), *Lawrence Livermore National Laboratory Annual Industrial Activity Storm Water Monitoring Report* (Site No. 2 01S004546), Lawrence Livermore National Laboratory, Livermore, CA (UCRL-AR-126783-94).
- Jones, Henry, et al. (2014), *Environmental Report 2013*, Lawrence Livermore National Laboratory, Livermore CA (UCRL-TR-50027-13).
- Mathews, S. and R.L. Welsh (1995), *Report of Waste Discharges (National Pollutant Discharge Elimination System Application) for Lawrence Livermore National Laboratory Livermore Site Nonstorm Water Discharges*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-AR-120460).
- Morse, S.F., to D. Fisher (2000), Letter re: *Renewal of National Pollutant Discharge Elimination System Permit No. CA 0030023 Lawrence Livermore National Laboratory* (File No. 2199.9026 CIC November 8, 2001).
- SFBRWQCB (1995), *Waste Discharge Requirements and National Pollutant Discharge Elimination System Storm Water Permit for: U.S. Department of Energy and Lawrence Livermore National Laboratory*, State of California, Oakland, CA (Order No. 95-174, NPDES No. CA0030023).

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SFBRWQCB (1995), *Water Quality Control Plan, San Francisco Bay Basin (Region 2) Basin Plan*, San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

U.S. Department of Energy (1992), Record of Decision for *the Lawrence Livermore National Laboratory Livermore Site*, US Department of Energy, Washington, DC (UCRL-AR-109105).

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APPENDIX A TABLES

Tables A-1 through A-7

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Table A-1. May 1, 2014–April 30, 2015 - Summary of non-routine releases, Livermore Site.

Date	Location	Description
5/12/14	B-191	A 1-½ inch irrigation control valve with an estimated flow of 40 gpm stuck on over the weekend at B-191, west of parking lot A10. It started its cycle on Saturday at 9 p.m. and was secured Monday at 6:30 a.m. = 33.5 h = 2,010 min × 40 gpm = estimated 80,400 gal total discharge. We estimate that 75% reached Arroyo Las Positas via an overland route= 40 gpm × 75% = 30 gpm. This flow is a tenth of the ERD treated water discharge to Arroyo Las Positas that passes north of B-191, which totals 322 gpm. A wildlife biologist visited the area and didn't see evidence of any direct sedimentation to the Arroyo. Notification was made to the SFBRWCB in accordance with our Industrial Storm Water Permit (95-174) and Storm Water Pollution Prevention Plan (SWPPP) as a "Low Impact/Nuisance" category. Courtesy notification was made to the City of Livermore.
5/14/14	B-132N	Water flowed into a storm drain on the west side of B-132N from programmatic activities. Program personnel confirmed that it was clean city water from testing an abrasive cutter. The last catch basin along the drainage route was completely dry, therefore it was determined that the water did not flow offsite
5/29/14	B-271	Approximately 45 gal of City water from a water main line that feeds the generators for B-271 became blocked by tree roots northwest of the facility. The water overflowed onto the nearby parking lot, no water entered any catch basins. MUSD personnel unblocked the water line in the afternoon.
5/31/14	B-321C	<p>Approximately 1,500 gal of Chiller Water (with sodium nitrite at 500 ppm) was released from a leaking pipe on the roof of B-321C. The released water ran down roof drains to the asphalt north of B-321 and into a storm drain catch basin on the north side of T-3226. Storm Drains north of B-321 flow north past the West Traffic Circle to Arroyo Las Positas. This catch basin is approximately ¾ of a mile south of Arroyo Las Positas. Approximately 1/3 of the distance is culverted. Approximately 2/3 of the distance is an unlined, vegetated channel.</p> <p>An HVAC technician was working on the system at 10:30 a.m. and did not see any leaking water. Later, a leak was discovered at 4:30 p.m. Given a maximum leak time of 6 h (360 min) and a ¾-in. makeup line that could flow at approximately 10 gpm, it is calculated that 3,600 gal from CW makeup was leaked. Estimate of 2,000 ft of 6-in. pipe for system volume of (2,000 × 1.5 gal/ft) 3,000 gal and given the assumption chilled water pumps evacuated 50% of system volume before cavitating (3,000 × 0.5), it is calculated that 1,500 gal of treated water at 500 ppm sodium nitrite was released. During the wildlife assessment on 6/2, evidence showed that water did not flow through the channel to the Arroyo. The discharged water must have percolated into the soil very soon after it reached the unlined channel. The above ground storm drain was surveyed from the discharge location of the culvert downstream approximately 0.25 mi. There was no ponded water or saturated soil within relatively deep (2–3 feet) erosional depressions in the above ground drainage channel indicating that it is unlikely that chiller water reached Arroyo Las Positas.</p>
6/3/14	Lift Station LS-303A, south of West Gate	At approximately 9:30 a.m., the MUSD Water Shop received a call from Security reporting a smell of sewage at the security kiosk (Building OS071N) located on West Gate Drive. Raw sewage spilled out of the 3-in. cleanout inside of Lift Station LS-303A, which is located south of West Gate Drive directly across from the kiosk. Approximately 10 gal of sewage spilled out of the west side of the lift station onto the surrounding soil and landscape bark, approximately 5 gal of raw sewage remained inside of the lift station. The overflow was stopped by 9:45 a.m. The discharge caused some erosion on the west side of the lift station's concrete pad and also pooled on the west and northwest side of it. All of the spilled sewage was east of the inner perimeter fencing. The raw sewage was cleaned out the lift station, the cleanout cap that had been pushed off was placed back on the cleanout, and a bleach solution was sprayed onto the affected areas. Cleanup was completed by 11:00 a.m. None reached the storm drainage system or an arroyo, no Reportable Quantity (RQ) threshold was exceeded.

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Table A-1. May 1, 2014–April 30, 2015 - Summary of non-routine releases, Livermore Site.

Date	Location	Description
6/9/14	B-451	A Water Shop employee in the vicinity of the B-451 observed water spraying from the irrigation valve located in landscaping near the southwest corner of the building. Mechanical Utilities employees were contacted and the source of water was immediately shut off. Approximately 20 gal of water was released, the majority of the water remained in the landscape area. Less than 1 gal of water traveled southwest to catch basin 450-006, not enough water to leave the catch basin.
8/4/14	B-391	Approximately 15 gal of clean DI water spilled over a 2–3 h period from the top of a DI tank onto a cement pad outside of B-391. A small amount of water may have run off the pad and into the adjacent soil. There are no storm drains in the immediate vicinity. The tank set point was lowered to prevent future occurrences. The tank system is scheduled to be replaced.
8/6/14	B-511	A hydraulic hose broke on a crane that was parked north of B-511. Much of the oil sprayed the crane and an estimated half a cup of oil spilled onto asphalt. Absorbent material was immediately applied to the spill, and all of the released hydraulic oil was absorbed. The equipment was wiped down and then power washed at the outdoor steam clean area (that has an oil water separator) southeast of B-511. The spill was confined to the asphalt, none of the released hydraulic oil made contact with soil, water, or a storm drain.
8/13/14	B-321C	A slow city water leak in B-321C, R-1351 above machining equipment was reported on 8/13/14. A temporary solution to redirect the water to storm drain was implemented at approximately 6:45 p.m. on 8/13/14 to prevent pressure from building up and the pipe from leaking overnight. Following environmental personnel response, flow being released to the storm drain was measured at roughly .25 gal/min. The redirect to the storm drain was halted at 10:10 a.m. on 8/14/14. City water flow for approximately 925 min at .25 gal/min. = approximately 232 gal released to storm drain. After discontinuing the redirect to storm drain, water was collected in a 55-gal drum until repairs could be completed. A survey of the storm drain channels found them to be dry, indicating that the released water did not reach the arroyo or get offsite.
8/21/14	B-154	The joint to a sink faucet failed, leaking DI water in B-154, R-1021. Approximately 60 gal of water was released, which covered the floor of R-1021 and migrated to other rooms. RHWM personnel responded by vacuuming and capturing the water. Scintillation counts on three aliquots of the water were performed; the results were at radiological background levels. Approximately 5 gal of DI water exited the facility onto a concrete walkway on the southwest side; no water entered the nearby soil.
8/22/14	B-581	An oil-filled electrical item appeared to have leaked about 32 oz. of oil out of a scrap metal hopper near B-581, and onto the concrete below. Approximately 8 oz. of the oil appeared to be on the concrete. No oil reached soil or a storm drain. The scrap metal hopper was wiped clean of oil and absorbent was used to clean the concrete. All cleanup material will be managed through RHWM.
9/8/14	B-482	Vehicle in the D-7 parking lot near B-482 appears to have lost of its oil (approximately 4 quarts) on the pavement. The quantity was sufficient to flow down the slope across two other parking spaces and to puddle in a few places. The affected area measured approximately 2.5 ft × 17 ft. It soaked into the pavement and was cleaned up by RHWM.
9/18/14	B-242	Oil leaked out of a 3-yard municipal waste dumpster near the B-242. Approximately 8 oz. of cooking oil appeared to have leaked out of the dumpster onto the asphalt and concrete. No oil reached soil or a storm drain. Absorbent was used to clean the impacted concrete and asphalt by RHWM on the same day.
9/22/14	B-482	A Landscape and Pest Control employee noticed a water puddle on the lawn near B-482 facing the South-West corner due to a cracked PVC pipe on the main line. The employee immediately shut off the chlorinated irrigation water at the backflow preventer. It is estimated that 1–5 gpm of water was released for approximately 12 h. The estimated 720–3,600 gal of water that was released discharged into the landscape area and did not reach nearby storm drain; thus did not reach the Arroyo.

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Table A-1. May 1, 2014–April 30, 2015 - Summary of non-routine releases, Livermore Site.

Date	Location	Description
10/26/14	B-610	Approximately 2 gal of a dilute surfactant (0.5 oz./gal) were drained from a floor scrubber to an asphalt area north of LLNL's vehicle inspection station (B-610). The custodian supervisor witnessed the discharge and immediately stopped the action. Since this incident, the custodians have been re-trained on disposal of floor cleaning effluent. The 2 gal of dilute surfactant quickly permeated the asphalt and there was no remaining liquid to clean up. The water never left the parking lot area and did not reach a storm drain or channel.
11/25/14	B-133	Water was released from the B-133 cooling towers that flowed into a storm drain when a cell was overfilled, causing it to run onto the asphalt and into a nearby storm drain. The water contained chlorine and a small amount of CL5755 inhibitor [2-butenedioic acid (Z)-, homopolymer and 2-butenedioic acid (5–10%); 2-phosphono-1,2,4-butane tricarboxylic acid (1–5%); and aromatic azole (1–5%)]. The amount of discharged water was estimated to be 300–400 gal.
11/25/14	B-324	An estimated 2,000 gal of Low Conductivity Water (~ 4 megohm-cm) leaked from a beached underground pipe located west of B-324. Immediately upon notification of the spill, Mechanical Utilities employees shut off a valve and stopped the leak. An estimated 95% of the water discharged into an adjacent concrete secondary containment trench around a transformer located approximately 15 feet north of the pipe breach area. The water accumulated in the secondary containment and the remaining 5% of the water puddled around the asphalt area where the underground pipe breach occurred. Neither had visible oil sheen and both had a pH level of 6. None of the estimated 2,000 gal of water reached the nearby storm drain; thus this release is not expected to have reached the Arroyo. All the collected water will be discharged into a sanitary sewer early next week.
12/17/14	B-693	A city water hose bib located on the west side of B-693 was broken when it was accidentally contacted by a fork truck. The isolation valve for the water line was located and the flow of water was immediately shut off. A total of approximately 50 gal of city water flowed across the asphalt surface to the catch basin located west of B-693 and East of B-695. The majority of the water remained in the catch basin. Due to the small volume of water released, no flow was anticipated to reach the arroyo or flow offsite. Prior to entering the storm drain, the released water did not come into contact with hazardous or radioactive containers or materials.
1/9/15	B-131	An FPOC reported staining on the ground near a municipal waste dumpster located at the southwest corner of the B-131 Highway. It was determined that the likely source of the stain was cooking oil from an event that had occurred previously during the week that had been thrown into the trash, where it eventually leaked out from the corner of the dumpster. Approximately 2 cups of used cooking oil leaked from the dumpster onto the asphalt surface, affecting an area approximately 3 ft × 4 ft. The spilled material contacted only asphalt and did not come into contact with a storm drain or soil. Absorbent material was worked into the stained area. The used absorbent was swept up and placed into a sealed bag for disposal as municipal waste.
1/26/15	B-543	An employee noticed water seeping up out of the ground in the landscaped area west of B-543, which was reported to Landscape and Pest Management. The source of the water was investigated and determined to be from an irrigation valve that failed to close all the way. The irrigation valve was secured at approximately 12:00 p.m. (noon), the rate of flow from the valve was estimated to be about 0.5 gal/min, it is estimated that approximately 200 gal of irrigation water was released. The majority of the irrigation water remained in the landscape area; approximately five to 10 gal flowed onto the adjacent asphalt walkway. None of the irrigation water reached the storm drainage system.
1/27/15	B-162	Approximately 150 gal of water escaped a sewer cleanout and ran north along B-162, across the parking lot, and ended in landscaping near the entrance to B-161. Water Shop personnel cleared the line and sprayed the effected asphalt areas with a ten percent bleach solution. The amount of sewage was less than the reportable quantity and no sewage reached the storm sewer system.
2/2/15	TFC-East	Less than 10 gal of treated ground water was released from ERD ground water treatment facility C-East (TFC-East), located north of T-2727. None of the water flowed over ground to the storm water system and none reached soil.

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Table A-1. May 1, 2014–April 30, 2015 - Summary of non-routine releases, Livermore Site.

Date	Location	Description
2/3/15	B-625	A small spill of hydraulic oil was observed in the vicinity of the tanker storage area near the northeast side of the B-625 yard area when a valve associated with a hydraulic emergency shut-off feature on the 1,000 gal tanker was not sealing properly. Approximately 200 mL of hydraulic fluid had leaked from the valve to the asphalt and affected an area of approximately 6 in. × 18 in. The released oil was part of a closed-loop system, and not associated with other hazardous waste activities. RHW staff immediately responded and placed absorbent material on the stained asphalt. A bag was placed over the leaking valve to prevent additional drips from occurring. The absorbent material was worked into the stained asphalt and collected. The used absorbent was managed as hazardous waste. The tanker was then immediately moved from the yard into a maintenance facility where the valve will be repaired. None of the released material reached soil, storm drain, or water contact.
2/4/15	B-175	Accumulated water from the B-175 south berm was observed to be releasing onto asphalt due to a dislocated plug on an overflow drain, approximately 5–7 gal of water from the south berm released onto asphalt. No catch basins were within the vicinity of the area, and the water did not enter any soil areas. Aliquots and swipe samples of the water were collected, and the final results indicated background levels. Additionally, no radiological activity on the asphalt was detected with a direct meter. RHW staff placed absorbent and pigs in the area to prevent the released water from traveling further and replaced the older tapered plugs on the drains to form a better seal.
2/25/15	B-571/ B-671	A 3-inch PVC city water line was broken while excavating north of a vault box between B-571 and B-671 to find the source of an ongoing water leak. The vault box contained four water lines, two of which went vertical out of the vault box and were at a more shallow depth than expected. The line was broken at approximately 1:44 p.m. and the water main was shut off at 2:00 p.m. An estimated 6,000 gal of city water was released to the excavation pit, vault box, and two nearby storm drains before the water main was shut off. An inspection of surrounding storm drains and channels showed no indication of water reaching Arroyo Las Positas or traveling offsite. Water was pumped from the pit and vault to the landscaped area south of the vault and the damaged line was repaired later that afternoon. An EFA Biologist walked the worksite late Wednesday afternoon and paused work for Thursday morning until measures could be taken to minimize potential impacts to federally threatened California red-legged frogs. Water was restored to B-571 on Thursday and work resumed to find the cause of the initial water leak.
3/11/15	B-332	A 1 gal can of latex paint was accidentally dropped, spilling about 1/2 gal onto the asphalt area in front of the back door. The storm drain was immediately blocked as a precaution and the paint was cleaned up by hand using water, brushes, and rags. No paint or cleanup residue entered the nearby storm drain.
3/20/15	Well 20	6-in. pipe broken near well 20; approximately 261,000 gal of water released. The water crossed Corral Hollow Road but did not reach a blue line. Well 20 was shut down, break was repaired, and well 20 was restored to normal operating conditions
3/24/15	B-365	Approximately 20 gal of water from a Fire Department truck was released onto asphalt and into a storm drain north of B-365 during an exercise. Fire Department personnel placed absorbent pigs around the storm drain and the area RHW Field Technician added absorbent to the area to prevent any further city water from entering the storm drain. A release offsite did not occur since the channel did not have running water flowing through it.
3/27/15	B-511	Approximately 2 gal of floor stripping mop water leaked on the asphalt from a breached custodial vacuum truck on the South Outer Loop Road North of B-511. Immediately upon notification of the spill, MUSD employees stopped the leak and wiped off the residual water from the truck. Most of the water seeped onto the asphalt and the spill left a thin dark residue layer. RHW staff members cleaned up the residue and disposed the cleanup waste in the RHW California hazardous waste stream. None of the water reached the nearby storm drain.

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Table A-1. May 1, 2014–April 30, 2015 - Summary of non-routine releases, Livermore Site.

Date	Location	Description
3/29/15	B-321C	The fitting on a 4-in. water line return with chilled water failed, discharging water onto the floor in B-321C. Some water made it out of the door, estimated between 50 and 100 gal. The water flowed into the courtyard to the northwest but did not reach storm drain catch basin. The area was surveyed for radioactivity by the area Health and Safety (H&S) technician with no activity detected above background. Pigs were deployed by the fire department.
3/29/15	B-239	A city water line broke under the facility, releasing approximately 5,400 gal of water. The water was surfacing where the horizontal asphalt meets the vertical concrete walls of the facility at the northeast corner and pushed up a fair amount of sediment with it. The water flowed east across the asphalt to a down-spout that directed the water toward the sunken driveway. The water then entered the catch basin / trough at the roll-up door, where it drained into the sump before being pumped into the storm drainage system. Water did not reach offsite.

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Table A-2. Summary of best management practice inspections in potential pollutant source/industrial activity areas.

Principal Directorate and AD Responsible for Potential Pollutant Source/Industrial Activity	Deficiencies in BMPs or BMP Implementation and Additional/Revised BMPs or Corrective Actions.
1-Director's Office/Security Organization	No direct responsibility for facilities at the Livermore Site. (Facilities managed by Operations & Business)
2-Engineering	No direct responsibility for facilities at the Livermore Site. (Facilities managed by Operations & Business)
3-Computation	No deficiencies were found.
4-Physical & Life Sciences	No direct responsibility for facilities at the Livermore Site. (Facilities managed by Operations & Business)
5-Global Security	No direct responsibility for facilities at the Livermore Site. (Facilities managed by Operations & Business)
6-Weapons and Complex Integration	No deficiencies were found.
7-National Ignition Facility and Photon Science	No deficiencies were found.
8-Operations and Business	South side B141 and South side T5475: Unclog storm drain U193: Reapply epoxy PTU-3, TF406, TF5475-1, TF5475-3, T4399: Address exposed materials

Table A-3. Record of Dry Season Observations.				Discharge Observations		
Location	Inspector	Date	Time	Floating Material, Debris, Odor, Discolorations, or Oil and Grease?	Observations	Description
ALPE	Karl Brunckhorst	24-Jun-14	8:58 AM	Leaves, sticks, paper, plastic		
ALPO	Karl Brunckhorst	24-Jun-14	8:56 AM	Leaves, sticks, plastic		
ASS2	Karl Brunckhorst	24-Jun-14	8:30 AM	Leaves, sticks		
ASW	Karl Brunckhorst	24-Jun-14	8:40 AM	Leaves, sticks		ERD'S Treatment Facility "A" is discharging, no corrective action needed
AVE. K	Karl Brunckhorst	24-Jun-14	9:14 AM	Leaves, sticks, paper, plastic		
B111	Karl Brunckhorst	24-Jun-14	8:33 AM	Leaves, sticks		
B-191 / HEAF	Karl Brunckhorst	24-Jun-14	9:32 AM		Clean	
B194	Karl Brunckhorst	24-Jun-14	9:24 AM	Leaves		
B341	Karl Brunckhorst	24-Jun-14	9:16 AM	Leaves, sticks	No work activity going on	
B391	Karl Brunckhorst	24-Jun-14	9:21 AM	Leaves		
B551W	Karl Brunckhorst	24-Jun-14	9:05 AM	Leaves, sticks		
GRNE	Karl Brunckhorst	24-Jun-14	8:52 AM	Leaves, sticks, paper, plastic		
LABOR ONLY	Karl Brunckhorst	24-Jun-14	9:08 AM		Clean	Evidence of rinsing activities where non-hazardous materials are being removed within containment area, no corrective action taken
WPDC	Karl Brunckhorst	24-Jun-14	8:44 AM	Leaves, sticks, paper		Lake Haussmann & ERD Treatment Facility "B" discharging, no corrective action needed
ALPE	Karl Brunckhorst	17-Sep-14	9:27 AM	Leaves, sticks, paper, plastic		
ALPO	Karl Brunckhorst	17-Sep-14	9:23 AM	Leaves, sticks, plastic		
ASS2	Karl Brunckhorst	17-Sep-14	9:00 AM	Leaves, sticks		Permitted construction taking place in the arroyo
ASW	Karl Brunckhorst	17-Sep-14	9:08 AM	Leaves, sticks		ERD's Treatment Facility "A" is discharging, no corrective action needed
AVE. K	Karl Brunckhorst	17-Sep-14	9:58 AM	Leaves, sticks, paper, plastic		
B111	Karl Brunckhorst	17-Sep-14	9:03 AM	Leaves, sticks		
B191 / HEAF	Karl Brunckhorst	17-Sep-14	9:46 AM		Clean	
B194	Karl Brunckhorst	17-Sep-14	9:43 AM		Clean	
B341	Karl Brunckhorst	17-Sep-14	9:36 AM		Clean	Construction taking place in and around B341

Table A-3. Record of Dry Season Observations.				Discharge Observations		
Location	Inspector	Date	Time	Floating Material, Debris, Odor, Discolorations, or Oil and Gease?	Observations	Description
B391	Karl Brunckhorst	17-Sep-14	9:40 AM	Leaves, sticks		
B551 W	Karl Brunckhorst	17-Sep-14	9:32 AM	Leaves, sticks		
GRNE	Karl Brunckhorst	17-Sep-14	9:19 AM	Leaves, sticks, paper, plastic	Stockpile of fine gravel material along roadside near sample location	
LABOR ONLY	Karl Brunckhorst	17-Sep-14	9:52 AM		Clean	Evidence of rinsing activities where non-hazardous materials are being removed within containment area, no corrective action taken
WPDC	Karl Brunckhorst	17-Sep-14	9:14 AM	Leaves, sticks		Lake Haussmann and ERD's Treatment Facility "B" is discharging, no corrective action needed

Table A-4. Record of Wet Season Observations.

Location	Inspector	Date	Time	Floating Material, Debris, Odor, Discolorations, or Oil and Grease?	Discharge Observations		Comments
					Turbidity	Runoff	
ALPE	Crystal Rosene	31-Oct-14	1:05 PM	Leaves, sticks	No	No Runoff	
ALPO	Crystal Rosene	31-Oct-14	1:07 PM	Leaves, sticks, paper	No	No Runoff	
ASS2	Crystal Rosene	31-Oct-14	1:25 PM	Leaves, sticks	No	No Runoff	
ASW	Crystal Rosene	31-Oct-14	1:30 PM	Leaves, sticks	Low	No Runoff	ERD's Treatment Facility "A" discharging.
GRNE	Crystal Rosene	31-Oct-14	1:09 PM	Leaves, sticks	No	No Runoff	
WPDC	Crystal Rosene	31-Oct-14	1:35 PM	Leaves, sticks	Low	No Runoff	ERD Treatment Facility "B" and Lake Haussmann are discharging.
ALPE	Karl Brunnckhorst	20-Nov-14	2:24 PM	Leaves, sticks, paper, plastic	No	No Runoff	
ALPO	Karl Brunnckhorst	20-Nov-14	2:45 PM	Leaves, sticks, paper, plastic	No	No Runoff	
ASS2	Karl Brunnckhorst	20-Nov-14	2:28 PM	Leaves, sticks	No	No Runoff	
ASW	Karl Brunnckhorst	20-Nov-14	2:32 PM	Leaves, sticks	Low	No Runoff	ERD's Treatment Facility "A" discharging.
GRNE	Karl Brunnckhorst	20-Nov-14	2:43 PM	Leaves, sticks, paper, plastic, cans	No	No Runoff	
WPDC	Karl Brunnckhorst	20-Nov-14	2::38 PM	Leaves, sticks	Low	No Runoff	Lake Haussmann & ERD Treatment Facility B discharging.
ALPE	Terrance Poole	11-Dec-14	9:38 AM	Leaves, sticks	Moderate	Significant	Qualifying monitored storm event.
ALPO	Terrance Poole	11-Dec-14	10:50 AM	Sticks, paper	Moderate	Significant	Qualifying monitored storm event.
ASS2	Henry Jones	11-Dec-14	9:45 AM	Leaves, sticks	Moderate	Significant	Qualifying monitored storm event.
ASW	Crystal Rosene	11-Dec-14	10:25 AM	Leaves, sticks	Moderate	Significant	ERD's Treatment Facility "A" discharging. Qualifying monitored storm event.

Table A-4. Record of Wet Season Observations.

Location	Inspector	Date	Time	Floating Material, Debris, Odor, Discolorations, or Oil and Gease?	Discharge Observations		Comments
					Turbidity	Runoff	
GRNE	Terrance Poole	11-Dec-14	10:30 AM	Leaves, sticks, plastic	Moderate	Significant	Qualifying monitored storm event.
WPDC	Crystal Rosene	11-Dec-14	11:10 AM	Leaves, sticks	Moderate	Significant	Lake Haussmann & ERD Treatment Facility B discharging. Qualifying monitored storm event.
ALPE	Karl Brunckhorst	30-Jan-15	9:48 AM	Leaves, sticks, plastic	No	No Runoff	
ALPO	Karl Brunckhorst	30-Jan-15	9:44 AM	Leaves, sticks	No	No Runoff	
ASS2	Karl Brunckhorst	30-Jan-15	9:25 AM	Leaves, sticks	No	No Runoff	
ASW	Karl Brunckhorst	30-Jan-15	9:31 AM	Leaves, sticks	Low	No Runoff	ERD's Treatment Facility "A" discharging.
GRNE	Karl Brunckhorst	30-Jan-15	9:40 AM	Leaves, sticks, paper, plastic	No	No Runoff	
WPDC	Karl Brunckhorst	30-Jan-15	9:36 AM	Leaves, sticks	Low	No Runoff	Lake Haussmann & ERD Treatment Facility B discharging.
ALPE	Karl Brunckhorst	27-Feb-15	9:42 AM	Leaves, sticks, plastic	No	No Runoff	
ALPO	Karl Brunckhorst	27-Feb-15	9:38 AM	Leaves, sticks, paper	No	No Runoff	Soil disturbing activities occurring at sample location.
ASS2	Karl Brunckhorst	27-Feb-15	9:22 AM	Leaves, sticks	No	No Runoff	
ASW	Karl Brunckhorst	27-Feb-15	9:26 AM	Leaves, sticks, plastic	Low	No Runoff	ERD's Treatment Facility "A" discharging.
GRNE	Karl Brunckhorst	27-Feb-15	9:34 AM	Leaves, sticks, paper, plastic	No	No Runoff	
WPDC	Karl Brunckhorst	27-Feb-15	9:30 AM	Leaves, sticks, paper, plastic	Low	No Runoff	Lake Haussmann & ERD Treatment Facility B discharging.

Table A-4. Record of Wet Season Observations.

Location	Inspector	Date	Time	Floating Material, Debris, Odor, Discolorations, or Oil and Gease?	Discharge Observations		Comments
					Turbidity	Runoff	
ALPE	Karl Brunckhorst	30-Mar-15	10:08 AM	Leaves, sticks, plastic	No	No Runoff	
ALPO	Karl Brunckhorst	30-Mar-15	10:04 AM	Leaves, sticks	No	No Runoff	
ASS2	Karl Brunckhorst	30-Mar-15	9:43 AM	Leaves, sticks	No	No Runoff	
ASW	Karl Brunckhorst	30-Mar-15	9:50 AM	Leaves, sticks	Low	No Runoff	ERD's Treatment Facility "A" discharging.
GRNE	Karl Brunckhorst	30-Mar-15	10:02 AM	Leaves, sticks, paper, plastic	No	No Runoff	
WPDC	Karl Brunckhorst	30-Mar-15	9:56 AM	Leaves, sticks, plastic	Low	No Runoff	Lake Haussmann & ERD Treatment Facility B discharging.
ALPE	Bob Williams	7-Apr-15	9:40 AM	Leaves, sticks	Moderate	Significant	Qualifying monitored storm event.
ALPO	Steve Hall	7-Apr-15	10:00 AM	Leaves, sticks	No	No Runoff	
ASS2	Crystal Rosene	7-Apr-15	8:30 AM	Leaves, sticks	Moderate	Significant	Qualifying monitored storm event.
ASW	Crystal Rosene	7-Apr-15	9:00 AM	Leaves, sticks	High	Significant	ERD's Treatment Facility "A" discharging. Qualifying monitored storm event.
GRNE	Bob Williams	7-Apr-15	9:15 AM	Leaves, sticks, paper, plastic	Moderate	Significant	Qualifying monitored storm event.
WPDC	Crystal Rosene	7-Apr-15	9:30 AM	Leaves, sticks	Moderate	Significant	Lake Haussmann & ERD Treatment Facility B discharging. Qualifying monitored storm event.

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Table A-5. October 2014–April 2015 daily rainfall totals (for days with >0.2 inches precipitation), Livermore Site.

Date	Precipitation Daily Total (Inches)	Day of Week	Description of Event
10/31/2014	0.24	Friday	0.2" by 3 pm but ground too dry*
11/13/2014	0.27	Thursday	0.24" by 2 am
11/20/2014	0.20	Thursday	0.1 by 5 pm*
11/30/2014	0.42	Sunday	Not a work day
12/02/2014	1.37	Tuesday	Discharge by 4:30 am
12/03/2014	0.57	Wednesday	Less than 3 work days
12/11/2014	2.41	Thursday	SAMPLED
12/12/2014	0.37	Friday	Less than 3 work days
12/15/2014	0.77	Monday	Discharge by 2 am
12/16/2014	0.35	Tuesday	Less than 3 work days
12/17/2014	0.24	Wednesday	Less than 3 work days
12/19/2014	0.22	Friday	Less than 3 work days
12/20/2014	0.24	Saturday	Not a work day
02/06/2015	0.45	Friday	Runoff after 5 pm*
02/07/2015	0.38	Saturday	Not a work day
02/08/2015	0.38	Sunday	Not a work day
04/07/2015	0.37	Tuesday	SAMPLED
04/25/2015	0.32	Saturday	Not a work day

*Insufficient storm water run-off during hours of operation.

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	DATE/TIME OF SAMPLE LOCATION	TIME DISCHARGE STARTED	ANALYTICAL RESULTS					
			For First Storm Event					
			BASIC PARAMETERS					
			pH	TSS	O&G	TOC	DO	
WPDC (ALP Effluent)	12/11/2014	Ongoing						
	11:10 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	7.13	100	<6.2	9.6	10	
GRNE (ALP Influent)	12/11/2014	Ongoing						
	10:30 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	7.1	49	<5	7.2	9.9	
ALPO (ALP Influent)	12/11/2014	Ongoing						
	10:50 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Not Sampled	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	7.73	760	<5	4.5	8.6	
ALPE (ALP Influent)	12/11/2014	Ongoing						
	9:38 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input type="checkbox"/> PM <input type="checkbox"/>	7.09	170	<5	5.3	10	
TEST REPORTING UNITS:			pH Units	mg/L	mg/L	mg/L	mg O/L	
TEST METHOD USED:			SM-4500HB	SM-2540D	E1664HEM	SM-5310C	SM-4500OG	
ANALYZED BY (SELF/LAB):			BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	

ALP - Arroyo Las Positas
TSS - Total Suspended Solids
SC - Specific Conductance
O&G - Oil & Grease
TOC - Total Organic Carbon
DO - Dissolved Oxygen
N/A - Not Analyzed
Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For First Storm Event			
	OTHER PARAMETERS			
	Beryllium	Bromacil	Cadmium	Chemical Oxygen Demand
WPDC (ALP Effluent)	<0.001	<0.5	<0.0005	39
GRNE (ALP Influent)	<0.001	12	<0.0005	25
ALPO (ALP Influent)	<0.001	<0.5	<0.0005	120
Not Sampled No Runoff				
ALPE (ALP Influent)	<0.001	<0.5	<0.0005	48
TEST REPORTING UNITS:	mg/L	µg/L	mg/L	mg O/L
TEST METHOD USED:	E200.8	E525.2	E200.8	E410.4
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs

ALP - Arroyo Las Positas
 TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS									
	For First Storm Event									
	OTHER PARAMETERS									
	Copper	Diazinon	Diuron	Glyphosate	Hexavalent Chromium	Lead	Mercury			
WPDC (ALP Effluent)	0.01	<0.2	<1	<6	<0.002	<0.005	<0.0002			
GRNE (ALP Influent)	0.0092	<0.2	<1	<6	<0.002	<0.005	<0.0002			
ALPO (ALP Influent)	0.042	<0.2	<1	<6	<0.002	0.02	<0.0002			
Not Sampled No Runoff										
ALPE (ALP Influent)	0.016	<0.2	<1	<6	<0.002	0.0064	<0.0002			
TEST REPORTING UNITS:	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L			
TEST METHOD USED:	E200.8	E525.2	E632	E547	E218.6	E200.8	E245.1			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

ALP - Arroyo Las Positas
TSS - Total Suspended Solids
SC - Specific Conductance
O&G - Oil & Grease
TOC - Total Organic Carbon
DO - Dissolved Oxygen
N/A - Not Analyzed
Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS									
	For First Storm Event									
	OTHER PARAMETERS									
	Nitrate (as NO ₃)	Ortho-Phosphate	Pentachloro-phenol	Pyrene	Simazine	Total Dissolved Solids	Zinc			
WPDC (ALP Effluent)	2.7	0.36	<1	<0.1	<0.3	89	0.1			
GRNE (ALP Influent)	13	0.68	<1	<0.1	<0.3	73	0.063			
ALPO (ALP Influent)	12	0.97	<1	<0.1	<0.3	830	0.12			
Not Sampled No Runoff										
ALPE (Influent)	2	0.23	<1	<0.1	<0.3	39	0.12			
TEST REPORTING UNITS:	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L			
TEST METHOD USED:	E300.0	E365.1	E525.2	E525.2	E525.2	SM-2540C	E200.8			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

ALP - Arroyo Las Positas
 TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Dilution was raised to 10.101 for the E525.2 for ALPE location only.

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS		
	For First Storm Event		
	OTHER PARAMETERS		
	Gross alpha	Gross beta	Tritium
WPDC (ALP Effluent)	0.10582 ± 0.04218	0.5883 ± 0.10434	5.254 ± 3.256
GRNE (ALP Influent)	0.06142 ± 0.024494	0.16872 ± 0.03885	0.11248 ± 2.5974
ALPO (ALP Influent)	0.09287 ± 0.04736	0.33596 ± 0.06697	3.6297 ± 3.0081
Not Sampled No Runoff			
ALPE (Influent)	0.11581 ± 0.03774	0.222 ± 0.04699	1.2506 ± 2.7639
TEST REPORTING UNITS:	Bq/L	Bq/L	Bq/L
TEST METHOD USED:	E900	E900	E906
ANALYZED BY (SELF/LAB):	GEL Labs	GEL Labs	GEL Labs
			AS:PUISO
			GEL Labs
			Plutonium 239+240
			-0.000035187 ± 0.000969
			N/A
			N/A
			N/A

Radioactivities are reported as the measured concentration and an uncertainty (s +/-2 counting error). If the concentration is less than or equal to the uncertainty, the result is considered to be a nondetection.

ALP - Arroyo Las Positas

TSS - Total Suspended Solids

SC - Specific Conductance

O&G - Oil & Grease

TOC - Total Organic Carbon

DO - Dissolved Oxygen

N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	DATE/TIME OF SAMPLE COLLECTION	TIME DISCHARGE STARTED	ANALYTICAL RESULTS For First Storm Event							
			BASIC PARAMETERS							
			pH	TSS	O&G	TOC	DO			
ASW (Arroyo Seco Effluent)	12/11/2014	Ongoing								
	10:25 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	6.81	92	<6.2	7.4		11		
ASS2 (Arroyo Seco Influent)	12/11/2014	Ongoing								
	9:45 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	6.73	150	<6.2	6.8		11		
TEST REPORTING UNITS:			pH Units	mg/L	mg/L	mg/L	mg O/L			
TEST METHOD USED:			SM-4500HB	SM-2540D	E1664HEM	SM-5310C	SM-4500OG			
ANALYZED BY (SELF/LAB):			BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs		

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed
 Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS			
	For First Storm Event			
	OTHER PARAMETERS			
	Beryllium	Bromacil	Cadmium	Chemical Oxygen Demand
ASW (Arroyo Seco Effluent)	<0.001	<0.5	<0.0005	<25
ASS2 (Arroyo Seco Influent)	<0.001	<0.5	<0.0005	43
TEST REPORTING UNITS:	mg/L	µg/L	mg/L	mg O2/ L
TEST METHOD USED:	E200.8	E525.2	E200.8	E410.4
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For First Storm Event									
	OTHER PARAMETERS									
	Copper	Diazinon	Diuron	Glyphosate	Hexavalent Chromium	Lead	Mercury			
ASW (Arroyo Seco Effluent)	0.011	<0.2	<1	<6	<0.002	<0.005	<0.0002			
ASS2 (Arroyo Seco Influent)	0.015	<0.2	<1	<6	<0.002	0.0083	<0.0002			
TEST REPORTING UNITS:	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L			
TEST METHOD USED:	E200.8	E525.2	E632	E547	E218.6	E200.8	E245.1			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS									
	For First Storm Event									
	OTHER PARAMETERS									
	Nitrate (as NO ₃)	Ortho Phosphate	Pentachlorophenol	Pyrene	Simazine	Total Dissolved Solids	Zinc			
ASW (Arroyo Seco Effluent)	1.2	0.46	<1	<0.1	<0.3	24	0.095			
ASS2 (Arroyo Seco Influent)	1.3	0.4	<1	<0.1	<0.3	40	0.15			
TEST REPORTING UNITS:	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L			
TEST METHOD USED:	E300.0	E365.1	E525.2	E525.2	E525.2	SM-2540C	E200.8			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-6. Storm water quality data for December 11, 2014.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event			
	OTHER PARAMETERS			
	Gross alpha	Gross beta	Tritium	Plutonium 239+240
ASW (Arroyo Seco Effluent)	0.027935 ± 0.018796	0.11396 ± 0.031561	0.7252 ± 2.6085	0.00 ± 0.000518
ASS2 (Arroyo Seco Influent)	0.10212 ± 0.028342	0.16835 ± 0.03774	-1.2913 ± 2.4531	N/A
TEST REPORTING UNITS:	Bq/L	Bq/L	Bq/L	Bq/L
TEST METHOD USED:	E900	E900	E906	E906
ANALYZED BY (SELF/LAB):	GEL Labs	GEL Labs	GEL Labs	GEL Labs

Radioactivities are reported as the measured concentration and an uncertainty (s +/-2 counting error). If the concentration is less than or equal to the uncertainty, the result is considered to be a nondetection.

TSS - Total Suspended Solids

SC - Specific Conductance

O&G - Oil & Grease

TOC - Total Organic Carbon

DO - Dissolved Oxygen

N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	DATE/TIME OF SAMPLE LOCATION	TIME DISCHARGE STARTED	ANALYTICAL RESULTS For Second Storm Event						
			BASIC PARAMETERS						
			pH	TSS	O&G	TOC	DO		
WPDC (ALP Effluent)	4/7/2015	Ongoing							
	9:30 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	7.5	74	<5	19		9.8	
GRNE (ALP Influent)	4/7/2015	Ongoing							
	9:15 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	6.69	170	<6.1	4.5		11	
ALPO (ALP Influent)	NA								
	AM <input type="checkbox"/> PM <input type="checkbox"/> Not Sampled	AM <input type="checkbox"/> PM <input type="checkbox"/>	N/A	N/A	N/A	N/A		N/A	
ALPE (ALP Influent)	4/7/2015	Ongoing							
	8:40 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	6.81	70	<5	12		11	
TEST REPORTING UNITS:			pH Units	mg/L	mg/L	mg/L	mg/L	mg O/L	
TEST METHOD USED:			SM-4500HB	SM-2540D	E1664HEM	SM-5310C	SM-4500OG		
ANALYZED BY (SELF/LAB):			BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	

ALP - Arroyo Las Positas
TSS - Total Suspended Solids
SC - Specific Conductance
O&G - Oil & Grease
TOC - Total Organic Carbon
DO - Dissolved Oxygen
N/A - Not Analyzed
Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event			
	OTHER PARAMETERS			
	Beryllium	Bromacil	Cadmium	Chemical Oxygen Demand
WPDC (ALP Effluent)	<0.0002	<0.5	<0.0005	57
GRNE (ALP Influent)	0.00024	16	<0.0005	<25
ALPO (ALP Influent) Not Sampled No Runoff	N/A	N/A	N/A	N/A
ALPE (ALP Influent)	<0.0002	<0.5	<0.0005	43
TEST REPORTING UNITS:	mg/L	µg/L	mg/L	mg O/L
TEST METHOD USED:	E200.8	E525.2	E200.8	E410.4
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs

ALP - Arroyo Las Positas
 TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event									
	OTHER PARAMETERS									
	Copper	Diazinon	Diuron	Glyphosate	Hexavalent Chromium	Lead	Mercury			
WPDC (ALP Effluent)	0.0091	<0.2	<1	<25	<0.002	<0.005	<0.0002			
GRNE (ALP Influent)	0.012	<0.2	<1	<25	<0.002	<0.005	<0.0002			
ALPO (ALP Influent) Not Sampled No Runoff	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
ALPE (ALP Influent)	0.012	<0.2	<1	67	<0.002	<0.005	<0.0002			
TEST REPORTING UNITS:	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L			
TEST METHOD USED:	E200.8	E525.2	E632	E547	E218.6	E200.8	E245.1			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

ALP - Arroyo Las Positas
TSS - Total Suspended Solids
SC - Specific Conductance
O&G - Oil & Grease
TOC - Total Organic Carbon
DO - Dissolved Oxygen
N/A - Not Analyzed
Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS									
	For Second Storm Event									
	OTHER PARAMETERS									
	Nitrate (as NO ₃)	Ortho-Phosphate	Pentachloro-phenol	Pyrene	Simazine	Total Dissolved Solids	Zinc			
WPDC (ALP Effluent)	6.1	1.2	<1	<0.1	<0.3	270	0.083			
GRNE (ALP Influent)	30	0.5	<1	<0.1	<0.3	110	0.11			
ALPO (ALP Influent)	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Not Sampled No Runoff										
ALPE (Influent)	4.4	0.63	<1	<0.1	<0.3	43	0.051			
TEST REPORTING UNITS:	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L			
TEST METHOD USED:	E300.0	E365.1	E525.2	E525.2	E525.2	SM-2540C	E200.8			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

ALP - Arroyo Las Positas
 TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Dilution was raised to 10.101 for the E525.2 for ALPE location only.

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS			
	For Second Storm Event			
	OTHER PARAMETERS			
	Gross alpha	Gross beta	Tritium	Plutonium 239+240
WPDC (ALP Effluent)	0.06734 ± 0.027491	0.20757 ± 0.04477	4.107 ± 2.738	0.00011026 ± 0.0011544
GRNE (ALP Influent)	0.1887 ± 0.0555	0.35927 ± 0.0666	1.5281 ± 2.331	N/A
ALPO (ALP Influent) Not Sampled No Runoff	N/A	N/A	N/A	N/A
ALPE (Influent)	0.030229 ± 0.023902	0.13431 ± 0.033966	0.10545 ± 2.1867	N/A
TEST REPORTING UNITS:	Bq/L	Bq/L	Bq/L	Bq/L
TEST METHOD USED:	E900	E900	E906	AS:PUISO
ANALYZED BY (SELF/LAB):	GEL Labs	GEL Labs	GEL Labs	GEL Labs

Radioactivities are reported as the measured concentration and an uncertainty (s +/-2 counting error). If the concentration is less than or equal to the uncertainty, the result is considered to be a nondetection.

ALP - Arroyo Las Positas

TSS - Total Suspended Solids

SC - Specific Conductance

O&G - Oil & Grease

TOC - Total Organic Carbon

DO - Dissolved Oxygen

N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	DATE/TIME OF SAMPLE COLLECTION	TIME DISCHARGE STARTED	ANALYTICAL RESULTS					
			For Second Storm Event					
			BASIC PARAMETERS					
			pH	TSS	O&G	TOC	DO	
ASW (Arroyo Seco Effluent)	4/7/2015	Ongoing	8.07	6.7	<5	9.7	11	
	9:00 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>						
ASS2 (Arroyo Seco Influent)	4/7/2015	Ongoing	6.23	6.9	<5	6.7	11	
	8:30 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>	AM <input checked="" type="checkbox"/> PM <input type="checkbox"/>						
TEST REPORTING UNITS:			pH Units	mg/L	mg/L	mg/L	mg O/L	
TEST METHOD USED:			SM-4500HB	SM-2540D	E1664HEM	SM-5310C	SM-4500OG	
ANALYZED BY (SELF/LAB):			BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed
 Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event			
	OTHER PARAMETERS			
	Beryllium	Bromacil	Cadmium	Chemical Oxygen Demand
ASW (Arroyo Seco Effluent)	<0.0002	<0.5	<0.0005	<25
ASS2 (Arroyo Seco Influent)	<0.0002	<0.5	<0.0005	<25
TEST REPORTING UNITS:	mg/L	µg/L	mg/L	mg O ₂ /L
TEST METHOD USED:	E200.8	E525.2	E200.8	E410.4
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs

TSS - Total Suspended Solids

SC - Specific Conductance

O&G - Oil & Grease

TOC - Total Organic Carbon

DO - Dissolved Oxygen

N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event									
	OTHER PARAMETERS									
	Copper	Diazinon	Diuron	Glyphosate	Hexavalent Chromium	Lead	Mercury			
ASW (Arroyo Seco Effluent)	0.0041	<0.2	<1	<25	0.0066	<0.005	<0.0002			
ASS2 (Arroyo Seco Influent)	0.0052	<0.2	<1	<25	<0.002	<0.005	<0.0002			
TEST REPORTING UNITS:	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L			
TEST METHOD USED:	E200.8	E525.2	E632	E547	E218.6	E200.8	E245.1			
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs			

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event							
	OTHER PARAMETERS							
	Nitrate (as NO ₃)	Ortho Phosphate	Pentachlorophenol	Pyrene	Simazine	Total Dissolved Solids	Zinc	
ASW (Arroyo Seco Effluent)	22.	0.51	<1	<0.1	<0.3	400	0.031	
ASS2 (Arroyo Seco Influent)	0.9	0.47	<1	<0.1	<0.3	18	0.03	
TEST REPORTING UNITS:	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	
TEST METHOD USED:	E300.0	E365.1	E525.2	E525.2	E525.2	SM-2540C	E200.8	
ANALYZED BY (SELF/LAB):	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs	BC Labs

TSS - Total Suspended Solids
 SC - Specific Conductance
 O&G - Oil & Grease
 TOC - Total Organic Carbon
 DO - Dissolved Oxygen
 N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater

Table A-7. Storm water quality data for April 7, 2015.

DESCRIBE DISCHARGE LOCATION	ANALYTICAL RESULTS For Second Storm Event			
	OTHER PARAMETERS			
	Gross alpha	Gross beta	Tritium	Plutonium 239+240
ASW (Arroyo Seco Effluent)	0.04292 ± 0.04181	0.15614 ± 0.036852	1.0212 ± 2.2422	0.0004218 ± 0.0011877
ASS2 (Arroyo Seco Inflow)	0.01443 ± 0.015651	0.11544 ± 0.029119	1.5059 ± 2.3643	N/A
TEST REPORTING UNITS:	Bq/L	Bq/L	Bq/L	Bq/L
TEST METHOD USED:	E900	E900	E906	E906
ANALYZED BY (SELF/LAB):	GEL Labs	GEL Labs	GEL Labs	GEL Labs

Radioactivities are reported as the measured concentration and an uncertainty (s +/-2 counting error). If the concentration is less than or equal to the uncertainty, the result is considered to be a nondetection.

- TSS - Total Suspended Solids
- SC - Specific Conductance
- O&G - Oil & Grease
- TOC - Total Organic Carbon
- DO - Dissolved Oxygen
- N/A - Not Analyzed

Test Method Used: E is EPA Method and SM is Standard methods for the examination of water and wastewater



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