The Boeing Company
Santa Susana Field Laboratory
5800 Woolsey Canyon Road
Canoga Park, CA 91304-1148

Via FedEx

December 21, 2010
In reply refer to SHEA-110693

Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Attention: Cassandra Owens

Dear Ms. Owens:

Subject: 2010-2011 Best Management Practices (BMP) and Interim Source Removal Action (ISRA) Performance Monitoring Sampling and Analysis Plan for the 008/009 Watersheds (Order No. R4-2010-0090, NPDES No. CA0001309, CI No. 6027)

The Boeing Company (Boeing) is providing the attached BMP and ISRA Performance Monitoring Sampling and Analysis Plan for the Outfalls 008 & 009 Watersheds, as referenced in the October 14, 2010 BMP Plan. The attached plan has been developed with input and in accordance with recommendations from the Santa Susana Stormwater Expert Panel and prepared for Boeing and the National Aeronautics and Space Administration (NASA).

If you have any questions or require anything further, please contact Lori Blair at 818-466-8741.

Sincerely,

Tom Gallacher
Director, Santa Susana Field laboratory
Environment, Health and Safety

LNB:
Attachment: 2010-2011 BMP and ISRA Performance Monitoring Sampling and Analysis Plan for the 008/009 Watersheds

cc: Mr. Peter Raftery, RWQCB
Mr. Buck King, DTSC
Mr. Allen Elliott, NASA

MWH

BUILDING A BETTER WORLD

# TECHNICAL MEMORANDUM

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| TO: | Lori Blair, Boeing<br>Allen Elliott, NASA | DATE: | December 21, 2010 |
| FROM: | Bronwyn Kelly, MWH<br>Alex Fischl, MWH | CC: | Dixie Hambrick, MWH<br>Randy Dean, CH2M HILL<br>Stormwater Expert Panel<br>Brandon Steets, Geosyntec |

SUBJECT: 2010-2011 Best Management Practices (BMP) and Interim Source Removal Action (ISRA) Performance Monitoring Sampling and Analysis Plan for the 008/009 Watersheds

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## Introduction

This memorandum describes surface water sampling and analysis activities that will be conducted during the 2010-2011 rainy season within the Outfalls 008 and 009 watersheds at the Santa Susana Field Laboratory (SSFL) for treatment best management practices (BMP) (Treatment subarea monitoring) and to assess the performance of completed Interim Source Removal Actions (ISRAs) (ISRA performance monitoring)..

Treatment BMP subarea monitoring will involve the collection of surface water samples from areas receiving runoff from potential source areas and other infrastructure (e.g., roads, buildings, parking areas). This sampling is being conducted to collect data to assess the potential for contribution of National Pollutant Discharge Elimination System (NPDES) constituents of concern (COCs) from the potential source areas to surface water runoff to identify locations for treatment control feasibility assessment and design, as described in the BMP Plan (MWH, et al., 2010).

ISRA performance monitoring will involve the collection of surface water runoff samples both up- and downgradient of completed ISRA areas. This sampling is being conducted to collect engineering performance data to assess the contribution of ISRA COCs to surface water runoff following completion of remedial activities at ISRA areas, as described in the Final ISRA Work Plan (MWH, 2009).

Neither of these studies is an extension of the NPDES program, and therefore data collected as part of these studies are not a measurement of NPDES compliance within the watersheds.

## Treatment BMP Monitoring Locations

In 2008, the Stormwater Expert Panel (Expert Panel) reviewed the available surface water data within the Outfall 008 and 009 watersheds and recommended the installation of a number of engineered natural stormwater treatment systems, or ENTS (Expert Panel, 2008). Since this evaluation, multiple changes (i.e. ISRA activities, installation of culvert modifications, asphalt removal, and erosion control practices) to the Outfalls 008 and 009 watersheds have occurred that changed the basis for the recommendations. These changes are more fully described as part of a recently submitted BMP Work Plan (MWH, et al., 2010), including the ISRA activities. Erosion control and treatment BMPs are currently in place or being planned in selected locations in these watershed; however, other locations require data collection and evaluation to identify the need for and/or assist with the selection and design of new treatment BMPs.

To collect the necessary data to support further design and implementation of BMPs, additional water quality monitoring will occur during the 2010-2011 rainy season. Subarea monitoring for both "planned"[1] and "potential"[2] treatment BMPs will occur at 18 locations downgradient of contaminated areas and infrastructure (e.g., roads, buildings, parking areas). In addition, five locations were identified to monitor surface water runoff quality from natural undisturbed or "background" areas. The inspection and sample locations are listed in Table 1 and shown on Figures 1 through 8. Additional details regarding sampling location selection, protocols, and frequency are provided in a memorandum prepared by Geosyntec and the Expert Panel (Geosyntec and Expert Panel, 2010). This memorandum is included as Attachment 1.

## ISRA Performance Monitoring Locations

Phase I ISRA activities were completed during the early portion of the 2009-2010 rainy season and included excavation and restoration at ten ISRA areas in the Outfall 008 watershed, including CYN-1, DRG-1, HVS-1, HVS-2A, HVS-2B-1, HVS-2B-2, HVS-2C, HVS-2D, HVS-3, and HVS-4, and two ISRA areas within the Outfall 009 watershed, including A2LF-1 and A2LF-3. In addition, culvert upgrades were performed at 12 culvert modifications (CM) within the Outfall 009 watershed in 2009 as part of the SSFL surface water maintenance program (CM-1 through CM-12), some located within or downgradient of ISRA preliminary evaluation areas (PEAs). Phase II ISRA activities are planned to be completed during the early portion of

[1] "Planned" treatment BMPs include those that are expected to be designed and constructed in 2011, irrespective of subarea monitoring results.

[2] "Potential" treatment BMPs include those that will be considered based on comparison of subarea monitoring results with BMP trigger values (i.e., "background" stormwater quality thresholds that will be developed by the Expert Panel in early 2011); if deemed necessary BMPs will be designed in late 2011 and constructed thereafter.

the 2010-2011 rainy season and include excavation and restoration at 11 ISRA areas in the Outfall 009 watershed, including AP/STP-1A, AP/STP-1D, AP/STP-1F, B1-1A, B1-1B, B1-1C, B1-1D, B1-2, CTLI-1A, CTLI-1B, and IEL-1. Additional phases of ISRA activities are planned after the 2010-2011 rainy season at 22 ISRA areas within the Outfall 009 watershed, including A1LF-1, A1LF-2, A2LF-2A, A2LF-2B, AP/STP-1B, AP/STP-1C-1, AP/STP-1C-2, AP/STP-1D, AP/STP-1E-1, AP/STP-1E-2, AP/STP-1E-3, ELV-1C, ELV-1D, IEL-2, IEL-3, LOX-1A, LOX-1B-1, LOX-1B-2, LOX-1B-3, LOX-1B-4, LOX-1C, and LOX-1D. These ISRA areas and CMs are shown on Figure 1.

During the 2009-2010 rainy season, surface water runoff was inspected and sampled at the 12 Phase I ISRA areas and four of the CM systems, including CM-3, CM-8, CM-9, and CM-11. The activities were conducted according to the ISRA Performance Monitoring Sampling and Analysis Plan (SAP) (MWH, 2010a) and involved the collection of surface water runoff samples both up- and downgradient of the ISRA areas and CM systems. The up- and downgradient performance monitoring inspection and sample locations are shown on Figures 1, 2, 5, 6, and 7. As shown on Figure 2, primary downgradient performance sample locations were identified for Outfall 008 ISRA areas to assess overall effectiveness of multiple ISRA areas, and are placed in areas where runoff has historically been observed during most significant rain events. “Secondary” performance sample locations for Outfall 008 ISRA areas are located downgradient of the individual remedial areas; samples collected from these locations were placed on hold at the laboratory and analyzed if primary sample results indicate the need to further assess downgradient effects. A summary of the performance monitoring activities and results from the 2009-2010 rainy season are presented in the *ISRA Performance Monitoring for Outfall 008 and 009 Watersheds, 2009-2010 Rainy Season* (MWH, 2010b).

During the 2010-2011 rainy season, performance monitoring will continue at the 12 ISRA areas and four CMs monitored during the 2009-2010 rainy season to increase the number of samples for data evaluation and assessment. In addition, surface water runoff will be inspected and sampled both up- and downgradient of the 11 Phase II ISRA areas. The up- and downgradient performance monitoring inspection and sample locations are shown on Figures 1, 3, 4, 5, and 8. As shown on Figure 3, primary and secondary downgradient performance sample locations were identified for ISRA areas in the B-1 area. The rationale for using primary and secondary samples in the B-1 area, in addition to the analytical schedule, is the same as described above for Outfall 008 performance monitoring samples. The sample locations for the Phase II ISRA areas are proposed but may be revised, based on field observations during rain events, to locations where runoff is more common or sampling is safer.

## Inspection and Sampling Frequency

Inspections of Treatment BMP subarea monitoring and performance monitoring locations will be performed in conjunction with rain event Stormwater Pollution Prevention Plan (SWPPP) inspections, which are performed immediately prior to and at 24-hour intervals during rain events. The SSFL NPDES Permit definition of a discharge (rain) event is one that produces more than 0.1 inch of rainfall in a 24-hour period and must be preceded by at least 72 hours of dry weather. Inspections will be conducted as soon as conditions allow during rain events. Every attempt will be made to inspect sample locations during the first two hours of discharge, during daylight hours (sunrise to sunset). During inspections, the presence and characteristics of surface water runoff at sample locations will be noted on the inspection and sample collection form included as Attachment 2. Inspections will continue throughout the rain event on a 24-hour basis to document runoff conditions.

### *Treatment BMP Sampling Frequency*

Treatment BMP sampling will be performed at the same frequency as NPDES sampling, including when runoff is first observed during an inspection and on a weekly basis during extended rain events. In addition, a sample will be collected 48 hours after collection of the initial sample for each rain event if runoff is observed. This sample is being performed to maximize data collection over a short period of time, to rapidly identify the need for treatment BMPs (Geosyntec and Expert Panel, 2010).

### *Performance Monitoring Sampling Frequency*

Performance monitoring sampling will be performed at the same frequency as NPDES sampling, including when runoff is first observed during an inspection and on a weekly basis during extended rain events. This sampling frequency will adequately meet the data needs of the performance monitoring program (depending on sufficient rain events), which is designed to assess the contribution of ISRA COCs from completed remedial areas (MWH, 2009a).

## Sampling Methods and Analysis

Samples will be collected and analyzed per the NPDES Permit No. CA0001309 and the MRP No 6027. Details of sample collection methodology and sample analysis are provided below.

### *Sample Collection Methods*

While flow or time-weighted composite sampling is preferred to maximize data robustness, given the short timeframe for planning and the need to safely and efficiently cover multiple sites with very different sampling location characteristics, manual grab sampling will be the method of

obtaining samples. Grab Samples will be collected from flowing surface water, not from puddles, by placing a pre-cleaned disposable sample container directly into a stream of flowing water at the sampling location. Sheet flow sampling approach, particularly for smooth flat ground, will use a dust pan to collect and concentrate sheet flow into a sample bottle, while carefully avoiding an increase in sample turbidity due to disturbance associated with dust pan placement. Dust pan materials should be carefully selected to avoid sample contamination (e.g., non-metal pans should be used for metal samples, non-plastic pans should be used for dioxin samples). Each sample location will be documented with GPS and photographs. Extended grab sampling methods will be conducted at the BMP subarea monitoring locations if time allows (e.g., during larger, longer duration forecasted storms where longer sample collection times are possible without compromising the number of locations that can be sampled during the storm). If possible, downgradient samples will be collected prior to the upgradient samples to minimize the potential for cross-contamination. Turbidity, conductivity, temperature, and pH will be measured using a calibrated water quality meter in the field immediately after the sample is collected. Field parameters will be documented on the inspection and sample collection form provided in Attachment 2. Qualitative flowrate observations, nearby erosion, turbidity, and any other notable information will also be documented on the sample form. Where possible and safe, discrete manual flow rate measurements will be collected at treatment BMP sample locations where flow is concentrated or channelized.

Each sample will be assigned a unique sample identification (ID). Each sample ID will include:

- A two-letter ID code to identify the general source area associated with the surface water being sampled (i.e., "HZ" for Happy Valley: "**HZ**SW0001S001");
- The sample type ("SW" for performance monitoring samples, and "BMP" for Treatment BMP monitoring samples) with a four-digit sample location number ("HZ**SW0001**S001" or "HZ**BMP0001**S001); and
- A sample designator "S" and a three digit sample number ("HZSW0001**S001**"). Note that a sample location (i.e., HZSW0001) may have more than one sample collected at it (i.e., one sample collected during each rain event represented by the following sample IDs, for example: HZSW0001**S001**, HZSW0001**S002**, HZSW0001**S003**, etc.).

Immediately after sample collection, sample bottles will be capped, sealed, labeled, documented on a Chain of Custody and prepared for pick up by a California state-certified laboratory.

RWQCB split samples will be prepared using a Dekaport cone splitter following the field protocol presented in a memorandum prepared by Dr. Eugene R. Weiner and the SSFL Stormwater Expert Panel (Weiner, 2010), which was approved by the RWQCB (RWQCB, 2010). The new

field protocol describes procedures for collection of primary samples, field blanks, equipment blanks, and preparation of RWQCB split samples using a Dekaport cone splitter. Laboratory reporting requirements for identifying laboratory Quality Assurance/Quality Control (QA/QC) problems are also presented in the memorandum.

Data will undergo review of the Level 2 QC parameters reported by the laboratory to evaluate impacts and potential bias in the usability of the data. Selected data may be validated for quality assurance purposes or to resolve data anomalies. Internal field duplicates, equipment blanks, and other QC samples and split QA samples will not be collected unless found to be necessary because of data inconsistencies.

***Sample Laboratory Analysis***

Treatment BMP subarea monitoring samples will be analyzed for NPDES COCs and other constituents to increase statistical power of background data set and to support BMP design (Geosyntec and Expert Panel, 2010) as identified on Table 1. ISRA Performance monitoring samples will be analyzed for the COCs associated with each ISRA area and upgradient of each CM system as identified on Table 2. Laboratory analytical methods and reporting limits are consistent with those specified in the 2009 NPDES permit for SSFL.

## Study Implementation, Duration, and Reporting

The planned implementation dates of monitoring activities for the 2010-2011 rainy season are as follows:

- Performance monitoring activities at Phase I ISRAs and the four CMs will begin at the start of the rainy season on October 1, 2010. Performance monitoring activities at Phase II ISRAs will begin in January, 2011 following completion of restoration activities.
- Treatment BMP subarea monitoring activities will begin in January, 2011.
- Use of the Dekaport cone splitter for collection of RWQCB split performance monitoring samples will begin in January, 2011.

At this time, Treatment BMP subarea monitoring is planned to continue through 2013 consistent with the BMP plan schedule, however annual evaluations will be conducted to reconsider the continued need for sampling, and suggested modifications based on prior year's findings. Performance monitoring at each ISRA area is currently proposed to continue through two rainy seasons (i.e., performance monitoring for ISRA areas completed in 2009 will occur during the 2009-2010 and 2010-2011 rainy season). However, an evaluation of the results from the initial rainy season for each ISRA area will be performed, and, as necessary, this duration will be

revised. Sampling results from the 2010-2011 rainy season will be published in a report scheduled to be submitted to the RWQCB in July 2011. This report will also identify locations for treatment BMP feasibility assessment and design (or areas where no BMPs are proposed but additional/continued monitoring may be needed), as well as any Panel-proposed modifications to the subarea monitoring program.

## References

Geosyntec and Stormwater Expert Panel, 2010. BMP Subarea Sampling Recommendations for 008/009 BMP Work. December 16.

MWH, 2009. Final Interim Source Removal Action (ISRA) Work Plan, Santa Susana Field Laboratory, Ventura County, California. May.

MWH, 2010a. ISRA Performance Monitoring Sampling and Analysis Plan, Santa Susana Field Laboratory, Ventura County, California, January 7.

MWH, 2010b. ISRA Performance Monitoring for Outfall 008 and 009 Watersheds, 2009-2010 Rainy Season, Santa Susana Field Laboratory, Ventura County, California, June 30.

MWH, et al., 2010. Best Management Practices (BMP) Plan, Outfalls 008 and 009 Watersheds, The Boeing Ocmpany, Santa Susana Field Laboratory, Canoga Park, California (Order No. R4-2010-0090; NPDES No. CA0001309, CI No. 6027). October 14.

RWQCB, 2010. Approval of the Plan for Environmental Sampling of Dioxins and Other Low Solubility Pollutants at Parts-per-Billion and Lower Concentrations, Report for the Final Interim Source Removal Action (ISRA) Submitted in Response to California Water Code Section 13304 Order (NPDES No. CA0001309, CI NO. 6027, SCP NO. 111, Site ID No. 2040109) Letter to Boeing. October 6.

Stormwater Expert Panel, 2008. Overview of the Alternatives Evaluation Process for ENTS Facilities in SSFL Drainage Subbasins 008 and 009 July 3.

Weiner, Eugene R., 2010 (prepared on behalf of, and reviewed by, the Stormwater Expert Panel). Environmental Sampling of Dioxins and Other Low Solubility Pollutants at Parts-per-Billion and Lower Concentrations: Field Protocols for Collecting SSFL ISRA Performance Samples and Obtaining Replicate Splits Using a Dekaport Cone Splitter, Wright Water Engineers, Inc., August.

## Tables



## Figures

## Attachments

**Table 1**
**Treatment BMP Monitoring Sampling Summary**
**2010-2011 Rainy Season**


| Object ID | Location | Purpose | Areas Monitored | Notes | Total Recoverable Metals by 200.7/200.8 | Total Dissolved Metals by 200.7/200.8 | Total Dioxins by 1613 | Total Settable Solids by SM2540F | Particle Size Distribution (field measurement) | Particle Size Distribution by ASTM D422 | Turbidity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outfall 008** | | | | | | | | | | | |
| HZBMP0001 | Happy Valley | Potential BMP Location | HVS | Co-located with HZSW0007 | X | X | X | X | X | X | X |
| HZBMP0002 | Happy Valley | Potential BMP Location | DRG & CYN | Co-located with HZSW0004 | X | X | X | X | X | X | X |
| HZBMP0003 | Happy Valley | Potential BMP Location | DRG & CYN | Co-located with HZSW0003 | X | X | X | X | X | X | X |
| **Outfall 009** | | | | | | | | | | | |
| A1BMP0001 | A1LF | Planned BMP Location | A1LF | Tributary drainage | X | X | X | X | X | X | X |
| A2BMP0001 | A2LF | Potential BMP Location | A2LF | Sheetflow upgradient of dirt road | X | X | X | X | X | X | X |
| A2BMP0002 | A2LF | Potential BMP Location | A2LF | Sheetflow upgradient of dirt road | X | X | X | X | X | X | X |
| APBMP0001 | Ash Pile | Planned BMP Location | Ash Pile, STP | Culvert Inlet | X | X | X | X | X | X | X |
| B1BMP0001 | B-1 | Planned BMP Location | B-1, Entrance Road | Culvert Inlet; co-located with B1SW0010 | X | X | X | X | X | X | X |
| B1BMP0002 | B-1 | Potential BMP Location | B-1, Parking Lot | Culvert Inlet | X | X | X | X | X | X | X |
| BGBMP0001 | UG CM-1 | Background | SE CM-1 subarea | Co-located with A2SW0006 | X | X | X | X | X | X | X |
| BGBMP0002 | UG CM-3 | Background | CM-3 subarea | Co-located with LXSW0001 | X | X | X | X | X | X | X |
| BGBMP0003 | Sage Ranch | Background | Sage Ranch | Tributary drainage east of LOX | X | X | X | X | X | X | X |
| BGBMP0004 | Sage Ranch | Background | Sage Ranch | Tributary drainage east of LOX | X | X | X | X | X | X | X |
| BGBMP0005 | Sage Ranch | Background | Sage Ranch | Culvert Inlet north of B-1 | X | X | X | X | X | X | X |
| EVBMP0001 | ELV | Planned BMP Location | ELV | Culvert Inlet | X | X | X | X | X | X | X |
| EVBMP0002 | ELV | Potential BMP Location | Helipad | Spillway | X | X | X | X | X | X | X |
| ILBMP0001 | Lower Parking Lot | Potential BMP Location | IEL | Stormdrain Outlet | X | X | X | X | X | X | X |
| ILBMP0002 | A1LF | Potential BMP Location | IEL, Area II Road | Culvert Inlet | X | X | X | X | X | X | X |
| ILBMP0003 | A1LF | Potential BMP Location | IEL, Parking Lot | Tributary drainage | X | X | X | X | X | X | X |
| LPBMP0001 | Lower Parking Lot | Planned BMP Location | Soil Stockpile Area | Sheetflow (cascade into spillway) | X | X | X | X | X | X | X |
| LXBMP0001 | LOX | Potential BMP Location | LOX | Sheetflow on dirt road | X | X | X | X | X | X | X |
| LXBMP0002 | LOX | Potential BMP Location | LOX | Sheetflow on dirt road | X | X | X | X | X | X | X |
| LXBMP0003 | LOX | Potential BMP Location | LOX | Sheetflow on dirt road | X | X | X | X | X | X | X |

BMP - Best Management Practice
X = Collect and Analyze

**Table 2**
**ISRA Performance Monitoring Sampling Summary**
**2010-2011 Rainy Season**


| Object ID | Location | Purpose | Areas Monitored | Notes | Cadmium, total by 200.8 | Copper, total by 200.8 | Lead, total by 200.8 | Mercury, total by 245.1 | Dioxin by 1613 | Total Suspended Solids by 2540 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Outfall 008** | | | | | | | | | | |
| HZSW0003 | Happy Valley | DG Primary | CYN-1, DRG-1 | Primary Downgradient, CYN-1, DRG-1 | | X | X | | X | X |
| HZSW0004 | Happy Valley | DG Secondary | DRG-1 | Secondary Downgradient, DRG-1 | | | | | H | H |
| HZSW0005 | Happy Valley | UG | DRG-1 | Upgradient, DRG-1 | | | | | H | H |
| HZSW0006 | Happy Valley | UG | CYN-1, DRG-1 | Upgradient, CYN-1, DRG-1 | | X | X | | X | X |
| HZSW0007 | Happy Valley | DG Primary | all HVS | Primary Downgradient (all HVS) | | X | X | | X | X |
| HZSW0008 | Happy Valley | UG | HVS-1 | Upgradient, HVS-1 | | | X | | X | X |
| HZSW0009 | Happy Valley | DG Secondary | HVS-1 | Secondary Downgradient, HVS-1 | | | H | | H | H |
| HZSW0010 | Happy Valley | DG Secondary | HVS-3, -4 | Secondary Downgradient, HVS-3, -4 | | H | | | H | H |
| HZSW0011 | Happy Valley | UG | HVS-3 | Upgradient, HVS-3 | | X | | | X | X |
| HZSW0012 | Happy Valley | UG | HVS-2C | Upgradient, HVS-2C | | | X | | | X |
| HZSW0013 | Happy Valley | DG Secondary | HVS-2C | Secondary Downgradient, HVS-2C | | | H | | | H |
| HZSW0014 | Happy Valley | UG | HVS-2B-1, -2B-2 | Upgradient, HVS-2B-1, HVS-2B-2 | | X | X | | | X |
| HZSW0015 | Happy Valley | DG Secondary | HVS-2B-1, -2D | Secondary Downgradient, HVS-2B-1, -2D | | H | H | | H | H |
| HZSW0016 | Happy Valley | DG Secondary | HVS-2B-1, -2 | Secondary Downgradient, HVS-2B-1, -2 | | H | H | | | H |
| HZSW0017 | Happy Valley | UG | HVS-2A, -2D | Upgradient, HVS-2A, HVS-2D | | | X | | X | X |
| HZSW0018 | Happy Valley | DG Secondary | HVS-2A | Secondary Downgradient, HVS-2A | | | H | | | H |
| HZSW0019 | Happy Valley | DG Secondary | CYN-1 | Secondary Downgradient, CYN-1 | | H | H | | | H |
| **Outfall 009** | | | | | | | | | | |
| A1SW0002 | CM-8 | UG | CM-8 | Upgradient, CM-8 | | | X | | | X |
| A1SW0003 | CM-8 | DG Primary | CM-8 | Primary Downgradient, CM-8 | | | X | | | X |
| A1SW0004 | A1LF/CM-9 | UG | A1LF/CM-9 | Upgradient, CM-9 | X | X | X | X | X | X |
| A1SW0005 | A1LF/CM-9 | DG Primary | A1LF/CM-9 | Primary Downgradient, CM-9 | X | X | X | X | X | X |
| A1SW0006 | CM-11 | UG | CM-11 | Upgradient, CM-11 | | | | | X | X |
| A1SW0007 | CM-11 | DG Primary | CM-11 | Primary Downgradient, CM-11 | | | | | X | X |
| A2SW0001 | A2LF | UG | A2LF-3/CM-1 | Upgradient west, A2LF-3/CM-1 | | | X | | X | X |
| A2SW0006 | A2LF | UG | A2LF-3/CM-1 | Upgradient east, A2LF-3/CM-1 | | | X | | X | X |
| A2SW0002 | A2LF | DG Primary | A2LF-3/CM-1 | Primary Downgradient, A2LF-3/CM-1 | | | X | | X | X |
| A2SW0003 | A2LF | UG | A2LF-1 | Upgradient, A2LF-1 | | | | | X | X |
| A2SW0004 | A2LF | DG Primary | A2LF-1 | Primary Downgradient, A2LF-1 | | | | | X | X |
| APSW0001 | AP/STP | UG | AP/STP-1A | Upgradient, AP/STP-1A | | | X | | X | X |

**Table 2**
**ISRA Performance Monitoring Sampling Summary**
**2010-2011 Rainy Season**


| Object ID | Location | Purpose | Areas Monitored | Notes | Cadmium, total by 200.8 | Copper, total by 200.8 | Lead, total by 200.8 | Mercury, total by 245.1 | Dioxin by 1613 | Total Suspended Solids by 2540 |
|---|---|---|---|---|---|---|---|---|---|---|
| APSW0002 | AP/STP | DG Primary | AP/STP-1A | Primary Downgradient, AP/STP-1A | | | X | | X | X |
| APSW0003 | AP/STP | UG | AP/STP-1D | Upgradient, AP/STP-1D | | | | | X | X |
| APSW0004 | AP/STP | DG Primary | AP/STP-1D | Primary Downgradient, AP/STP-1D | | | | | X | X |
| APSW0005 | AP/STP | UG | AP/STP-1F | Upgradient, AP/STP-1F | | | | | X | X |
| APSW0006 | AP/STP | DG Primary | AP/STP-1F | Primary Downgradient, AP/STP-1F | | | | | X | X |
| B1SW0001 | B-1 | UG | B1-2 | Upgradient, B1-2 | X | X | X | X | X | X |
| B1SW0002 | B-1 | UG | B1-2 | Upgradient, B1-2 | X | X | X | X | X | X |
| B1SW0003 | B-1 | UG | B1-1B, -1C, -1D, -2 | Upgradient, B1-1B, -1C, -1D, -2 | X | X | X | X | X | X |
| B1SW0004 | B-1 | DG Secondary | B1-1D | Secondary Downgradient, B1-1D | | | | H | H | H |
| B1SW0005 | B-1 | DG Secondary | B1-1D | Secondary Downgradient, B1-1D | | | | H | H | H |
| B1SW0006 | B-1 | DG Secondary | B1-1B, -1C | Secondary Downgradient, B1-1B, -1C | | | | | H | H |
| B1SW0007 | B-1 | DG Secondary | B1-1B, -1C | Secondary Downgradient, B1-1B, -1C | | | | | H | H |
| B1SW0008 | B-1 | UG | B1-1A | Upgradient, B1-1A | X | | | | X | X |
| B1SW0009 | B-1 | DG Secondary | B1-1A | Secondary Downgradient, B1-1A | H | | | | H | H |
| B1SW0010 | B-1 | DG Primary | all B-1 | Primary Downgradient (all B-1) | X | X | X | X | X | X |
| ILSW0001 | IEL | UG | IEL-1 | Upgradient, IEL-1 | | X | | X | | X |
| ILSW0002 | IEL | DG Primary | IEL-1 | Primary Downgradient, IEL-1 | | X | | X | | X |
| LFSW0001 | CTLI | UG | CTLI-1A, -1B | Upgradient, CTLI-1A, -1B | | X | X | | X | X |
| LFSW0002 | CTLI | DG Primary | CTLI-1A, -1B | Primary Downgradient, CTLI-1A, -1B | | X | X | | X | X |
| LXSW0001 | CM-3 | Background | CM-3 | Upgradient, CM-3 | X | X | X | X | X | X |
| LXSW0002 | CM-3 | Background | CM-3 | Primary Downgradient, CM-3 | X | X | X | X | X | X |

DG - Downgradient
PM - ISRA Performance monitoring
UG - Upgradient
X = Collect and Analyze
H = Collect and place on Hold

# Outfalls 008 and 009
# BMP and ISRA Monitoring

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- NPDES Outfall
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Proposed Primary Downgradient Performance Monitoring Sample Location
- Proposed Upgradient Performance Monitoring Sample Location
- Proposed Secondary Downgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary

**Note:**

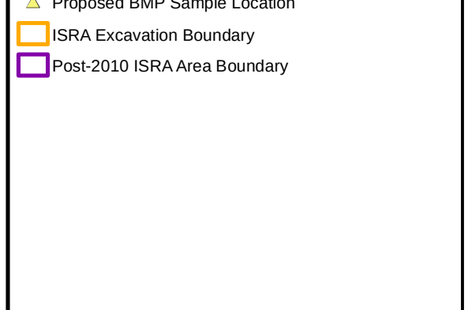
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.
3. Inspection/sampling at offsite monitoring locations subject to property owner approval.

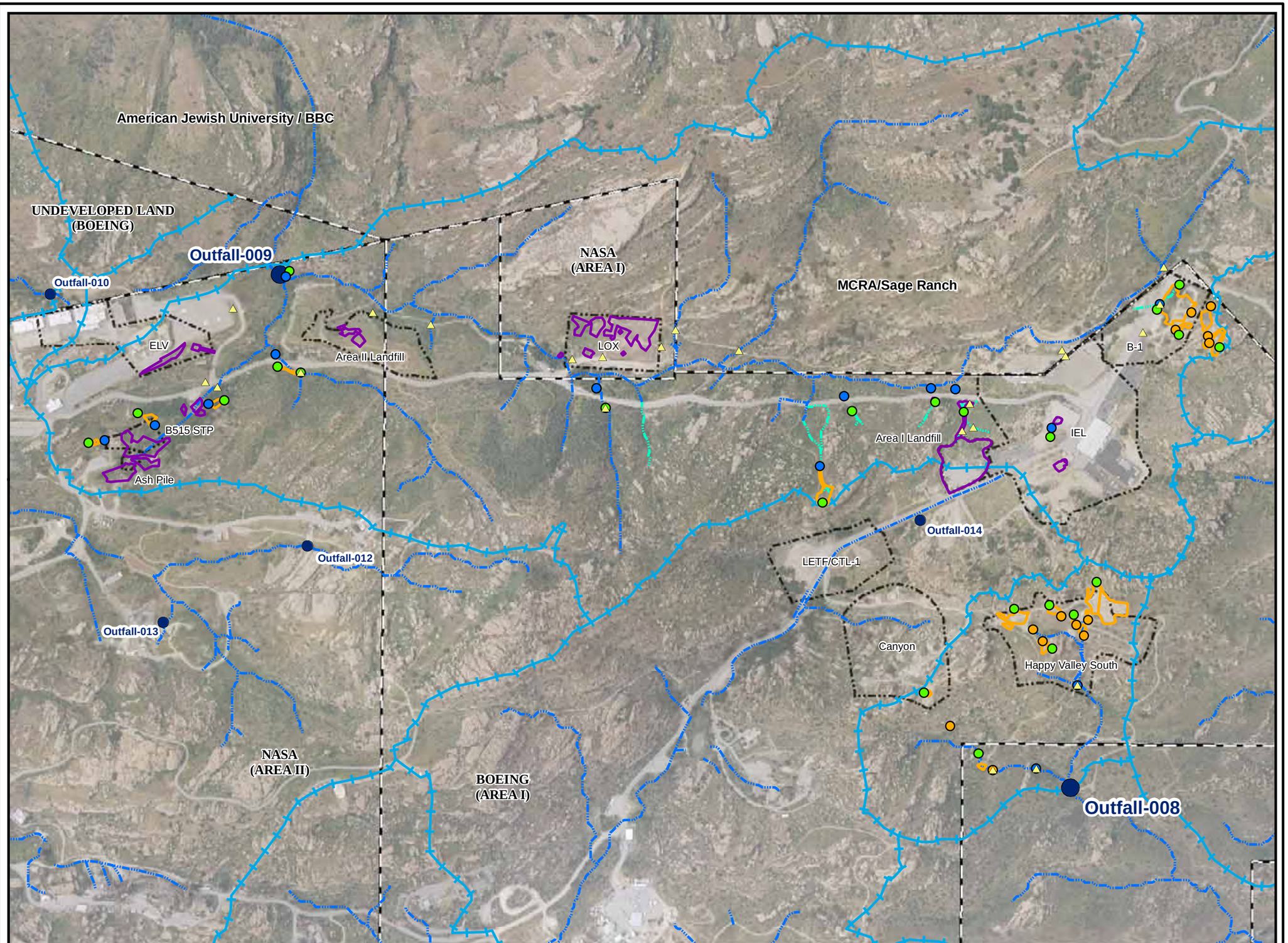
Document: ISRA_Plots_PerfMon_008and009.mxd

Date: Dec 20, 2010

1 inch = 700 feet

0 700 1,400 Feet






MWH

S A N T A S U S A N A F I E L D L A B O R A T O R Y

FIGURE 1

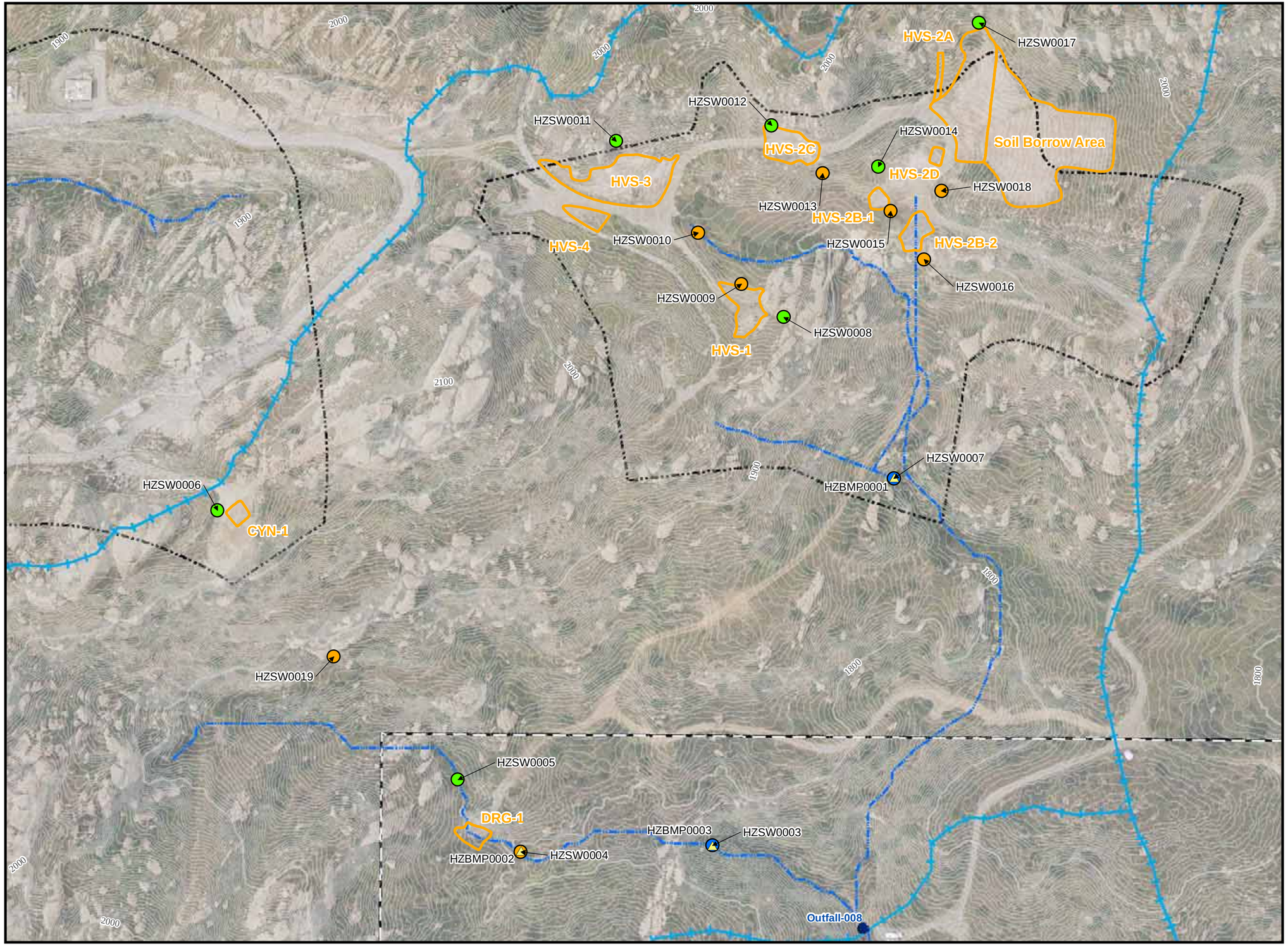
# Outfall 008
# BMP and ISRA Monitoring

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- NPDES Outfall
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Primary Downgradient Performance Monitoring Sample Location
- Upgradient Performance Monitoring Sample Location
- Secondary Downgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary




**Note:**

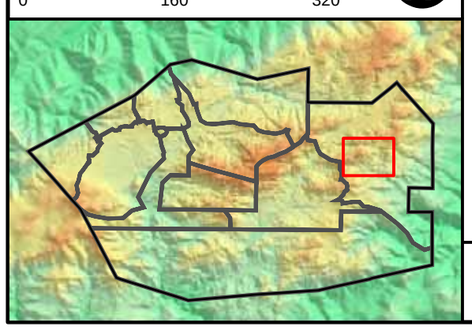
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.

Document: ISRA_Plots_PerfMon_HVS.mxd

Date: Dec 20, 2010

1 inch = 160 feet

0 160 320 Feet



MWH

S A N T A S U S A N A F I E L D L A B O R A T O R Y

FIGURE 2

# Outfall 009
# BMP and ISRA Monitoring
# B-1 Area

**Base Map Legend**

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

**Figure Legend**

- Proposed Primary Downgradient Performance Monitoring Sample Location
- Proposed Upgradient Performance Monitoring Sample Location
- Proposed Secondary Downgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary

**Note:**

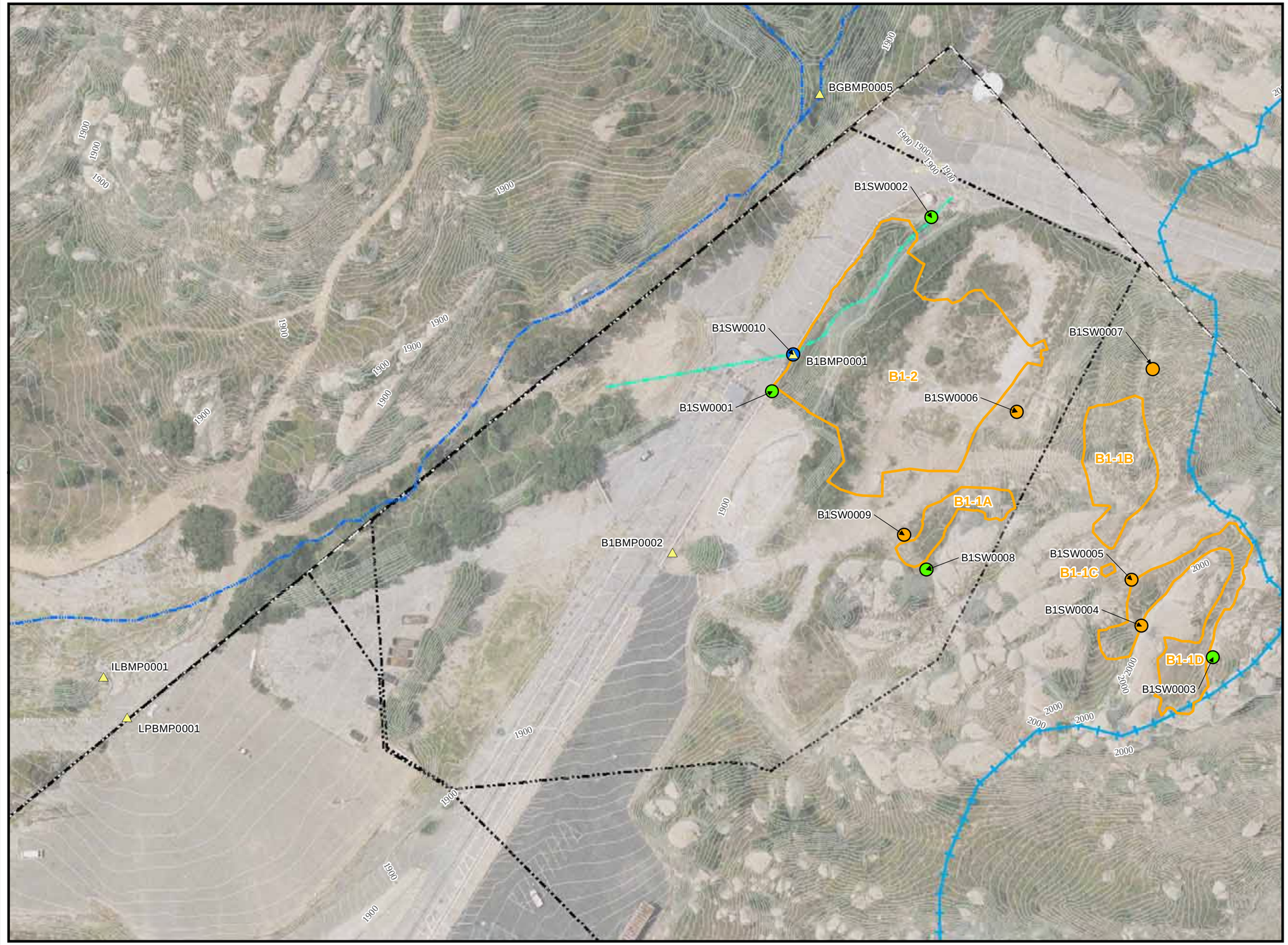
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.
3. Inspection/sampling at offsite monitoring locations subject to property owner approval.

Document: ISRA_Plots_PerfMon_B1.mxd

Date: Dec 20, 2010

1 inch = 100 feet

0 100 200 Feet




MWH

SANTA SUSANA FIELD LABORATORY

FIGURE 3

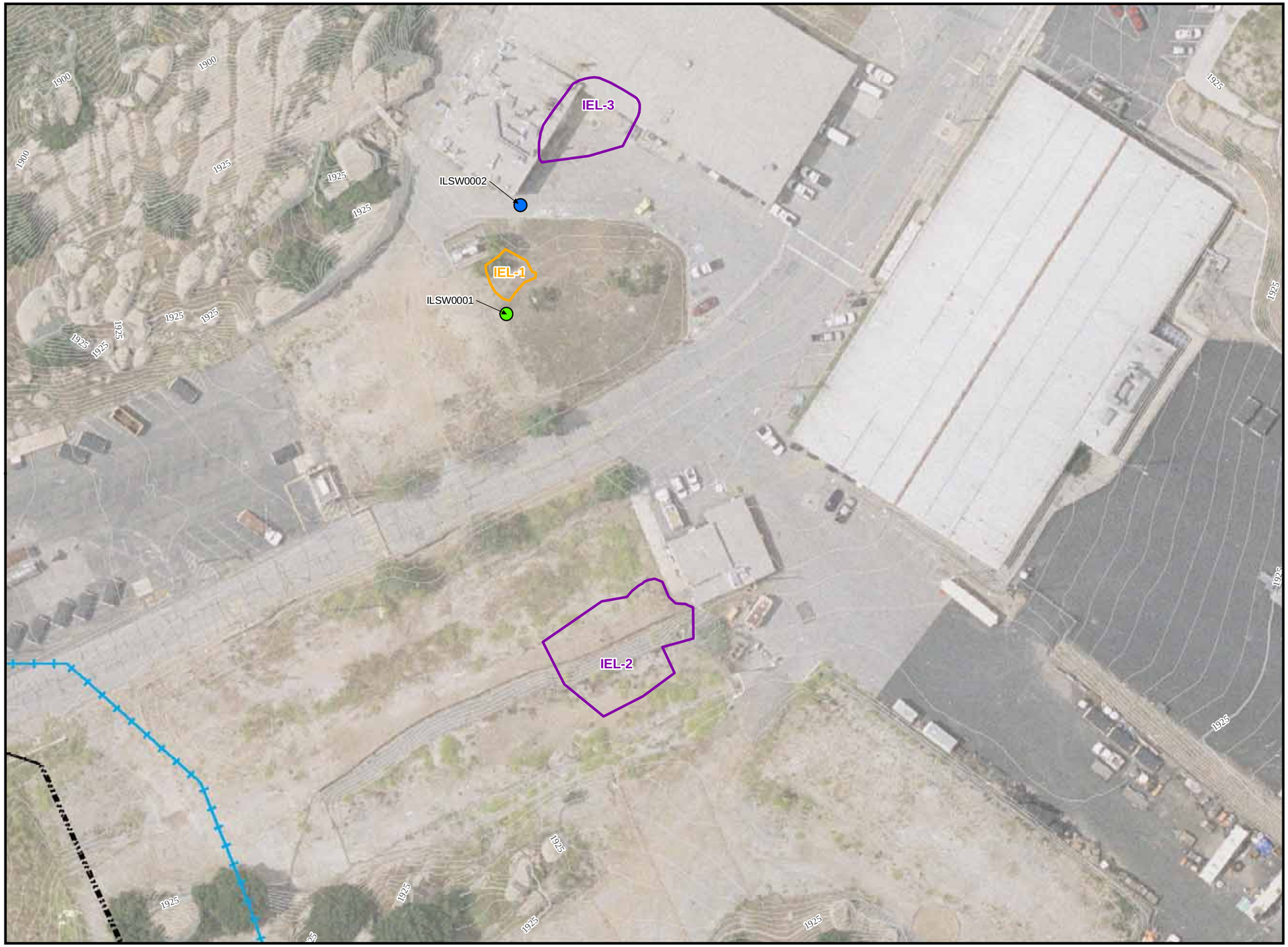
# Outfall 009
# BMP and ISRA Monitoring
# IEL Area

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Proposed Primary Downgradient Performance Monitoring Sample Location
- Proposed Upgradient Performance Monitoring Sample Location
- Proposed Secondary Downgradient Performance Monitoring Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary




**Note:**

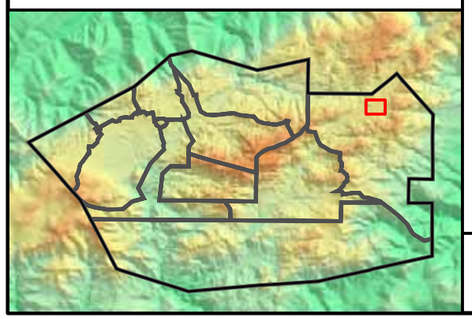
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.

Document: ISRA_Plots_PerfMon_IEL1.mxd

Date: Dec 17, 2010

1 inch = 60 feet

0 60 120 Feet



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SANTA SUSANA FIELD LABORATORY

FIGURE 4

# Outfall 009
# BMP and ISRA Monitoring
# A1LF Area

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Primary Downgradient Performance Monitoring Sample Location
- Upgradient Performance Monitoring Sample Location
- Secondary Downgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary

**Note:**

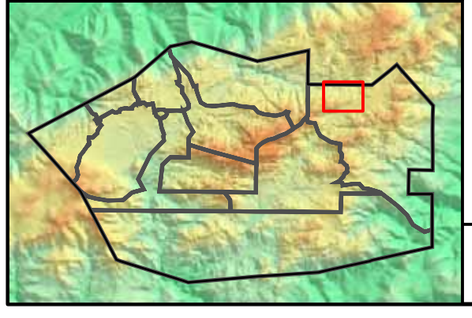
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.

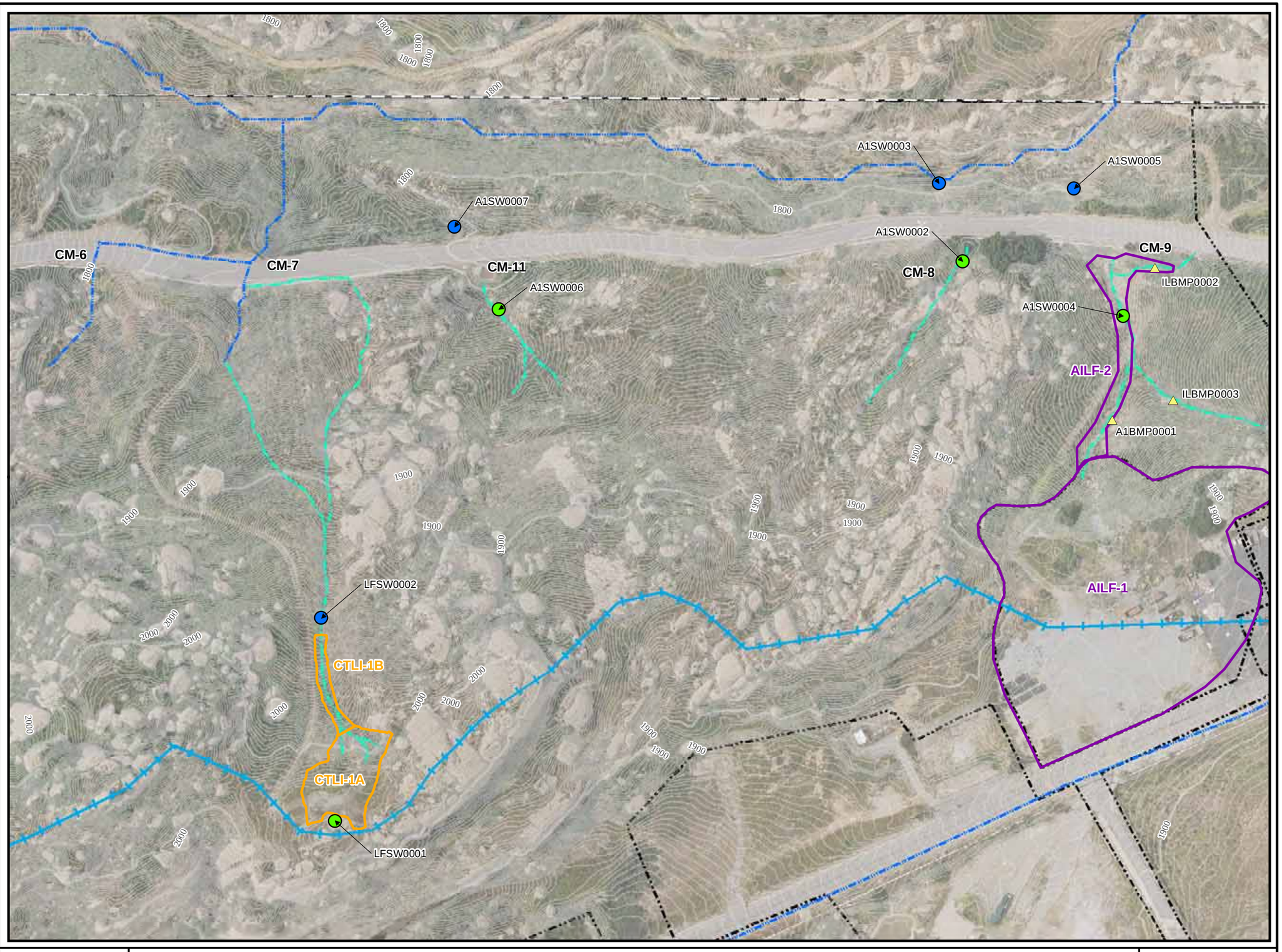
Document: ISRA_Plots_PerfMon_A1LF.mxd

Date: Dec 17, 2010

1 inch = 125 feet

0 125 250 Feet






MWH

SANTA SUSANA FIELD LABORATORY

FIGURE 5

# Outfall 009
# BMP and ISRA Monitoring
# LOX Area

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Primary Downgradient Performance Monitoring Sample Location
- Upgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary


**Note:**

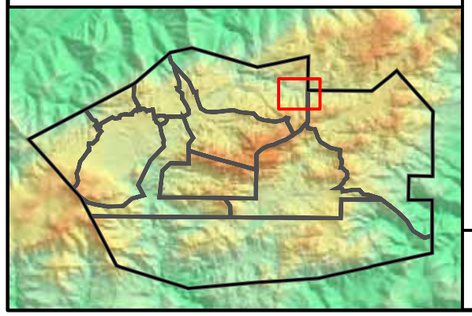
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.
3. Inspection/sampling at offsite monitoring locations subject to property owner approval.

Document: ISRA_Plots_PerfMon_LOX.mxd

Date: Dec 20, 2010

1 inch = 130 feet

0 130 260 Feet



MWH

SANTA SUSANA FIELD LABORATORY

FIGURE 6

# Outfall 009
# BMP and ISRA Monitoring
# A2LF and ELV Areas

**Base Map Legend**

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

**Figure Legend**

- Primary Downgradient Performance Monitoring Sample Location
- Upgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary

**Note:**

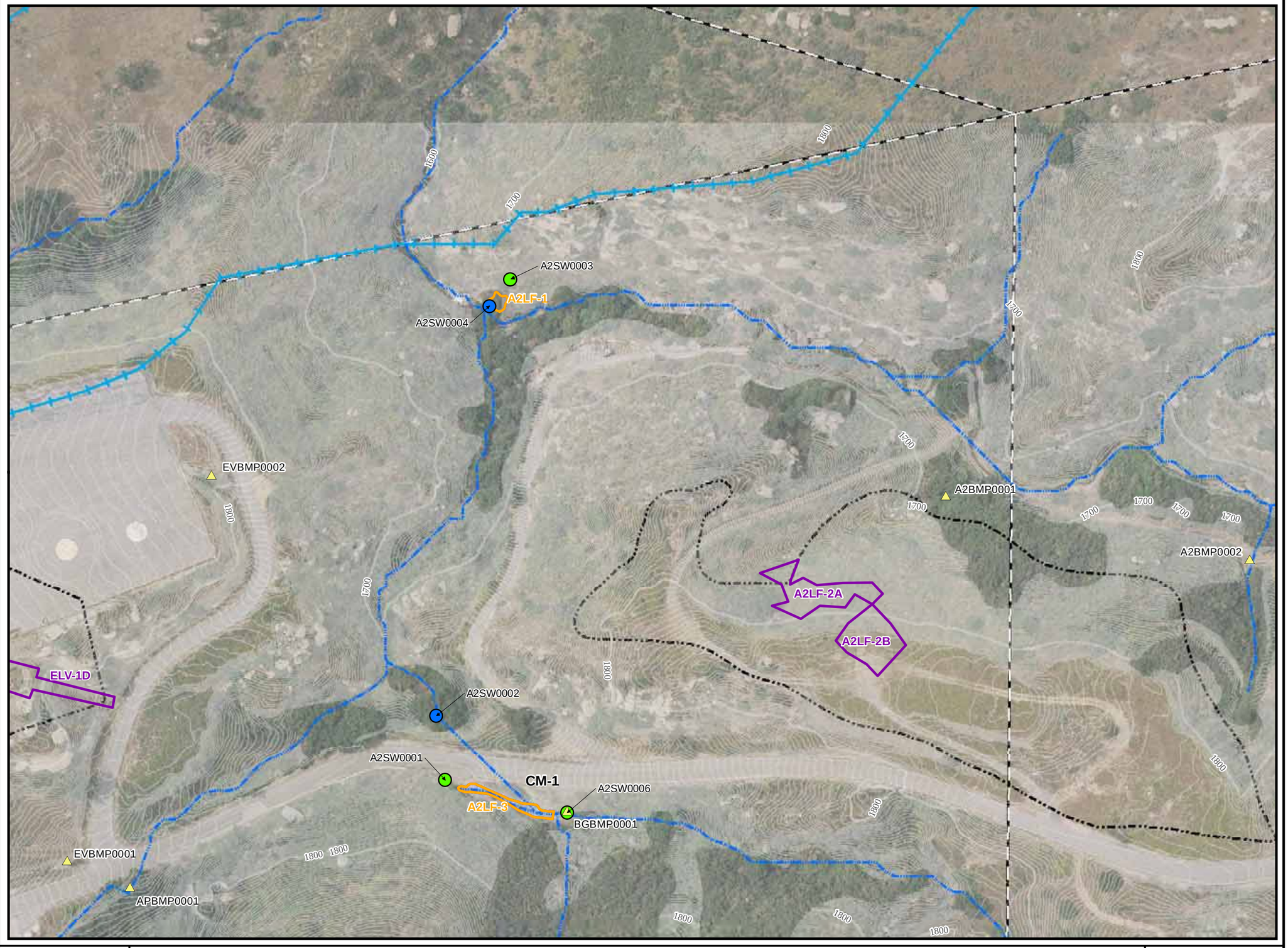
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.

Document: ISRA_Plots_PerfMon_A2LF.mxd

Date: Dec 20, 2010

1 inch = 133 feet

0 130 260 Feet




MWH

S A N T A S U S A N A F I E L D L A B O R A T O R Y

FIGURE 7

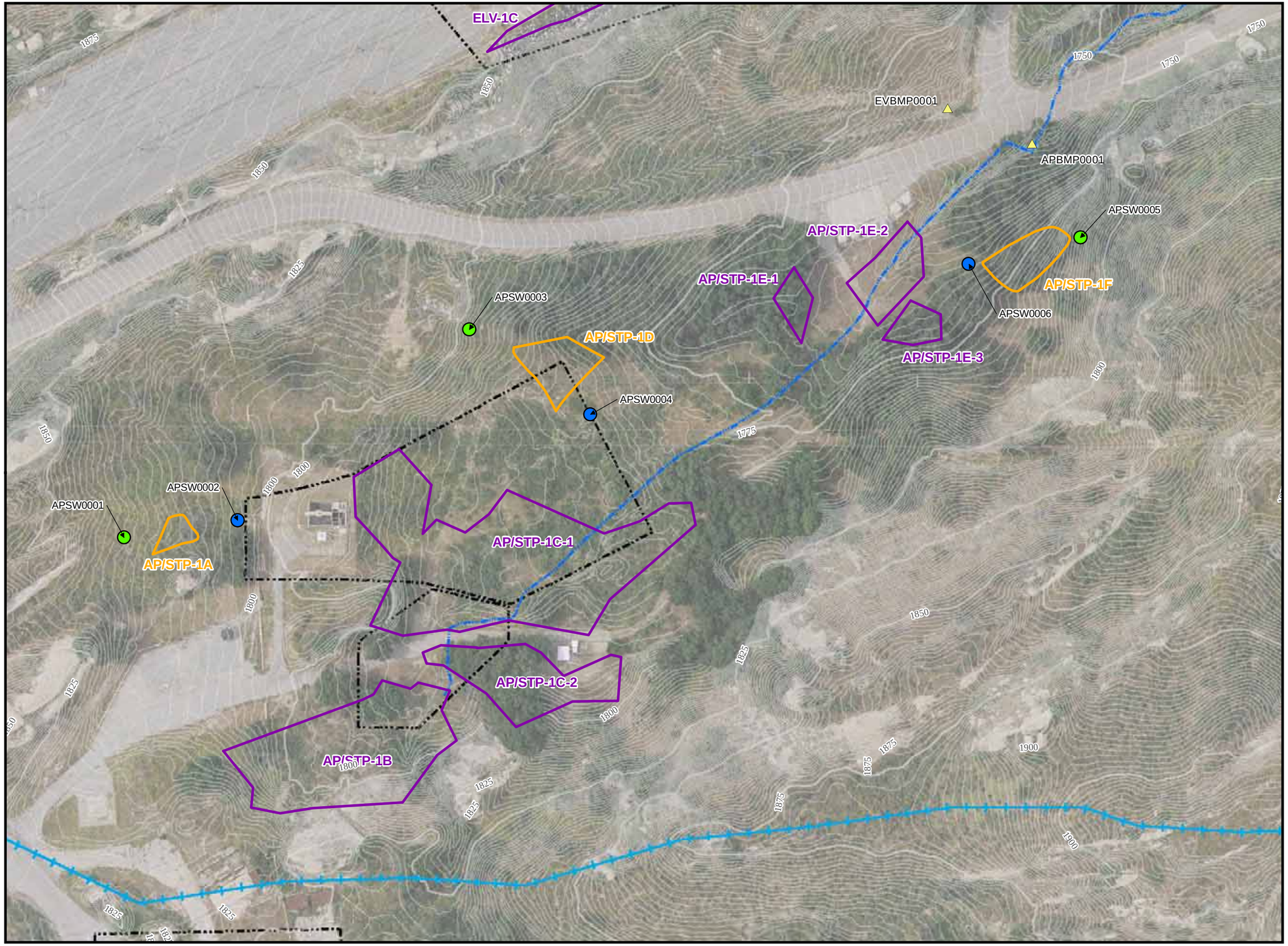
# Outfall 009
# BMP and ISRA Monitoring
# AP/STP Area

## Base Map Legend

- Administrative Area Boundary
- RFI Site Boundary
- Drainage
- Non Jurisdictional Surface Water Pathway
- Surface Water Divide

## Figure Legend

- Proposed Primary Downgradient Performance Monitoring Sample Location
- Proposed Upgradient Performance Monitoring Sample Location
- Proposed Secondary Downgradient Performance Monitoring Sample Location
- Proposed BMP Sample Location
- ISRA Excavation Boundary
- Post-2010 ISRA Area Boundary




**Note:**

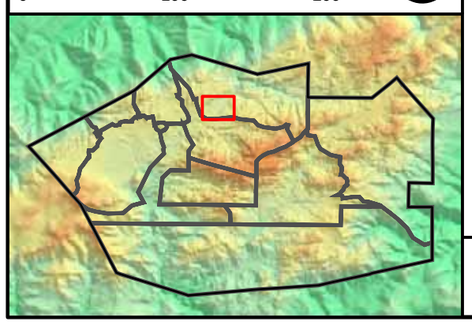
1. Aerial imagery from 2010 Sage Consulting.
2. Topographic contours from 2010 Sage Consulting.

Document: ISRA_Plots_PerfMon_APSTP.mxd

Date: Dec 17, 2010

1 inch = 100 feet

0 100 200 Feet



MWH

SANTA SUSANA FIELD LABORATORY

FIGURE 8

**Attachment 1**

BMP Subarea Sampling Recommendations for 008/009 BMP Work Plan (Geosyntec and Stormwater Expert Panel, 2010)

Geosyntec consultants

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Portland, Oregon 97204
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www.geosyntec.com

# Memorandum

| | |
|---|---|
| Date: | 16 December 2010 |
| To: | Lori Blair, The Boeing Company |
| Copies to: | Bronwyn Kelly, MWH |
| From: | Brandon Steets, Eric Strecker and Paul Hobson, Geosyntec Consultants, and the Stormwater Expert Panel (reviewers) |
| Subject: | BMP Subarea Sampling Recommendations for 008/009 BMP Work Plan<br>Geosyntec Project: SB0363Q, Phase 06*6 |

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The purpose of this memorandum is to provide stormwater runoff monitoring recommendations for evaluating where distributed treatment BMPs (both short- and long-term) may be needed in upstream subareas of the Outfall 008 and 009 watersheds, as proposed in the October 2010 SSFL 008/009 BMP Work Plan. This memo describes general guidance for the sampling locations (Figures 1a, 1b, and 1c[1]), analytes, frequency, and protocol. While the memo provides some suggested specifics, we recommend that the monitoring plan be flexibly and adaptively implemented, such that modifications may be made in the future based on sampling team and Expert Panel observations and analyses, as well as input received from the public and/or Regional Water Quality Control Board (RWQCB) staff. Furthermore, we recommend an annual assessment of the monitoring program (including field sampling protocol, locations, analytes, etc.), based on evaluations of lab data and feedback from field staff.

The investigation questions being addressed in this monitoring study are as follows:

1. For the **potential treatment BMP locations[2], where data collection is necessary to evaluate the need for new treatment BMPs,** what are the ranges in concentrations for the NPDES Pollutants of Concern (POCs) (e.g., dioxins, total metals) and other parameters that are relevant to BMP design and treatability (e.g., Total Suspended Solids [TSS], dissolved metals, and Particle Size Distribution [PSD])? How do these POC

[1] The subarea boundaries shown in these figures are based on drainage area delineations that are used in the existing US EPA Storm Water Management Model (SWMM) continuous hydrologic model for the 008 and 009 watersheds.
[2] These are treatment BMPs that may be designed and constructed, subject to evaluation of runoff quality data, after 2011.

concentrations compare with treatment BMP triggers (or concentration thresholds that will trigger treatment BMP placement) that will be developed this winter/spring based on existing available stormwater background data?

2. For the **planned treatment BMP locations[3], where BMPs are already under development**, what are the ranges in concentrations for the NPDES POCs and other parameters that are relevant to BMP design and treatability? How do these "baseline" or pre-BMP concentrations compare with future post-BMP implementation concentrations (i.e., for assessment of BMP performance)?
3. For the **"background" (or natural undisturbed) locations**, what are the ranges in concentrations for the NPDES POCs and other parameters that are relevant to BMP design and treatability? How do these concentrations compare with the treatment BMP trigger thresholds, and should the BMP triggers be revised to reflect these new results?

**Locations**. Figures 1a, 1b, and 1c indicate 23 locations that are recommended for consideration for BMP subarea monitoring based upon the location of contaminated areas and infrastructure (e.g., roads, buildings, parking areas). These are considered temporary sampling locations that were selected to achieve the objectives of this specific monitoring program only. Observed runoff concentrations from the outlets of these areas will be compared with treatment BMP trigger levels to then identify which subareas will be considered for future treatment BMP design and construction. Although data will be collected for a wide range of parameters, the Panel currently anticipates that treatment BMP triggers will be developed for only the dioxin and metal POCs that have been observed to exceed NPDES permit limits at the corresponding outfall. The proposed sampling locations were selected based on the following subarea characteristics:

1. Presence of RFI and ISRA areas where historic industrial activities were known to occur, or where soil concentrations for NPDES POCs were found to be above background (or approximately 3X background in the case of dioxin), consistent with ISRA evaluation methodology. For such areas, which are considered potential stormwater sources for the NPDES POCs, smaller drainage areas were selected to enable these critical areas to be assessed and mitigated (if treatment is deemed necessary) early in the monitoring program.
2. Presence of significant developed area (e.g., paved road or parking lot surfaces, buildings).
3. Lack of historic industrial activities, known surface soil contamination, or significant developed area. These might be considered suitable "background" or undeveloped/unimpacted control sites, for comparison purposes.

[3] These are treatment BMPs that are currently planned for design and construction in 2011.

23 total sampling locations are proposed, with five representing background runoff, four to five representing planned treatment BMP locations, and the rest representing potential treatment BMP locations. Additional locations may be added later based on feedback from field sampling personnel – i.e., if frequent runoff is observed at a particular stormdrain or culvert inlet, and drainage area attributes match any of the three selection criteria described above, this location will be considered by the Panel for addition to this subarea monitoring program.

**Analytes** should include the NPDES POCs that were studied in the ISRA program. For this subarea sampling plan, this will include dioxins, metals (full metal suite for both total and dissolved), total suspended solids (TSS), turbidity, and particle size distribution (PSD). PSD should be measured by both field (LISST meter) and lab analysis, unless LISST results are considered validated by the Panel, after which point 10% of PSD analyses can be sent to the lab for continued confirmation analysis. The full metals suite is recommended for analysis in this BMP subarea monitoring program to increase the statistical power of background data evaluations, and to support BMP design (since the level and form of other metals may influence BMP design).

Each of these analytes should be analyzed for every location for every sampling event. Where possible and safe, discrete flowrate measurements should also be collected at concentrated flow locations (i.e., not necessary at sheet flow locations), based on manual measurements of cross-sectional area (e.g., depth and geometry of channel or pipe) and velocity (leaf and stopwatch method). Photographs of flow, as well as visual observations of nearby erosion (e.g., where relative to sample location, and how severe) and flow characteristics (e.g., clear vs turbid, trickle vs high flow, etc.), should also be included with the field notes.

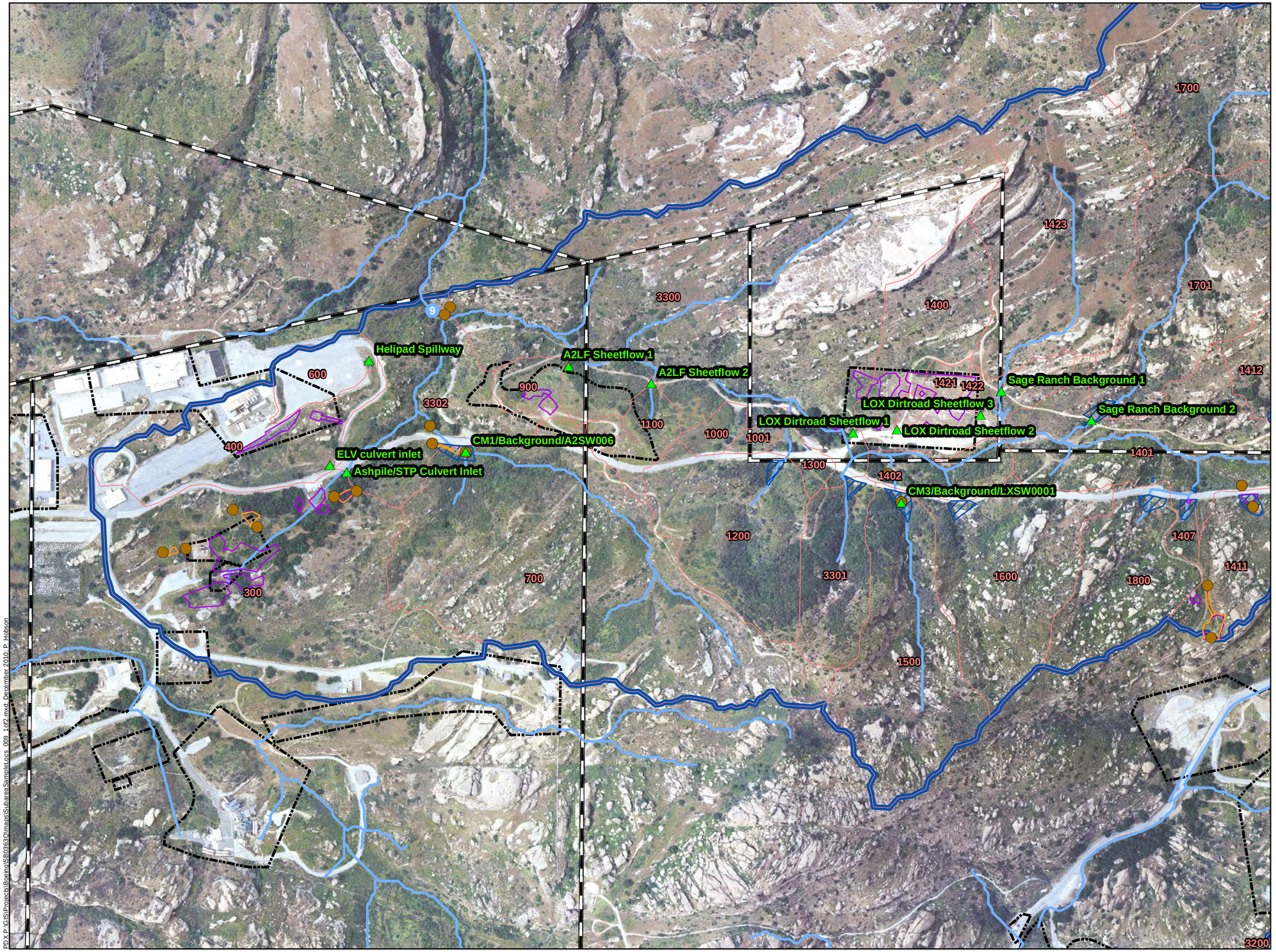
**Sampling frequency** should be during every runoff-producing storm event as defined in the NPDES permit and ISRA monitoring plan. However, if runoff is still occurring 48-hours after the initial sample collection, additional samples are recommended. This is different than for other SSFL stormwater monitoring programs such as NPDES and ISRA because this BMP subarea monitoring program is intended to maximize data collection over a short period of time, to rapidly identify the need for treatment BMPs.

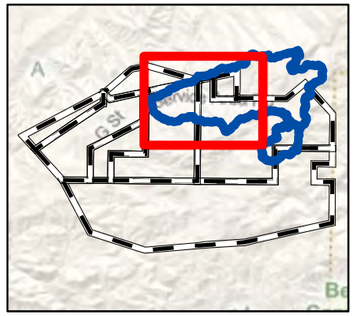
**Sampling protocol** should be consistent with ISRA procedures for manual collection of stormwater runoff grab samples. At locations where runoff from a specific location cannot be sampled using these procedures because concentrated runoff flows are not present and the concentrated flows downgradient of these locations include runoff from other sources (e.g., sheet flow along dirt roads), new sample collection protocol may need to be developed, such as the use of a gravel-lined trench and perforated underdrain collection pipe that leads to a sample box. Another recommended sheet flow sampling approach, particularly for smooth flat ground, is to use a dust pan to collect and concentrate sheet flow into a sample bottle, while carefully avoiding an increase in sample turbidity due to disturbance associated with dust pan placement. Dust pan materials should be carefully selected to avoid sample contamination (e.g., non-metal pans should be used for metal samples, non-plastic pans should be used for dioxin samples).

Furthermore, while flow or time-weighted composite sampling would be preferred to maximize data robustness, given the short timeframe for planning and the need to safely and efficiently cover multiple sites with very different sampling location characteristics, manual grab sampling will be acceptable. If possible, it would be preferred to collect and composite multiple grabs as opposed to just a single instantaneous grab sample, where possible and as conditions allow (e.g., small brief storms may preclude extended grab sampling to allow for rapid sampling of multiple locations). For this extended grab approach, five subgrab samples (i.e., partial bottle fills) should be collected over a duration of five to 15 minutes. Samples should not be decanted from one bottle to another.

**QA practices.** Periodic group training of field sampling staff should be conducted to ensure uniformity of sampling practices. If ISRA surface water sampling protocol (which were reviewed and approved by the Expert Panel) are used for the BMP subarea monitoring program, all sampling staff should demonstrate adequate familiarity with this protocol.

* * * * *



## Legend

- Subarea Sampling Locations
- CM & ISRA Performance Mon. Locs
- NPDES Outfalls
- ISRA Excavation Boundary
- Post-2010 ISRA Excavation Boundary
- SWMM Subareas
- Culvert Maintenance Footprints
- Streams
- Outfall Watersheds
- Property Boundary
- RFI Boundaries

**Note:**
**Red numbers are SWMM area identifiers**

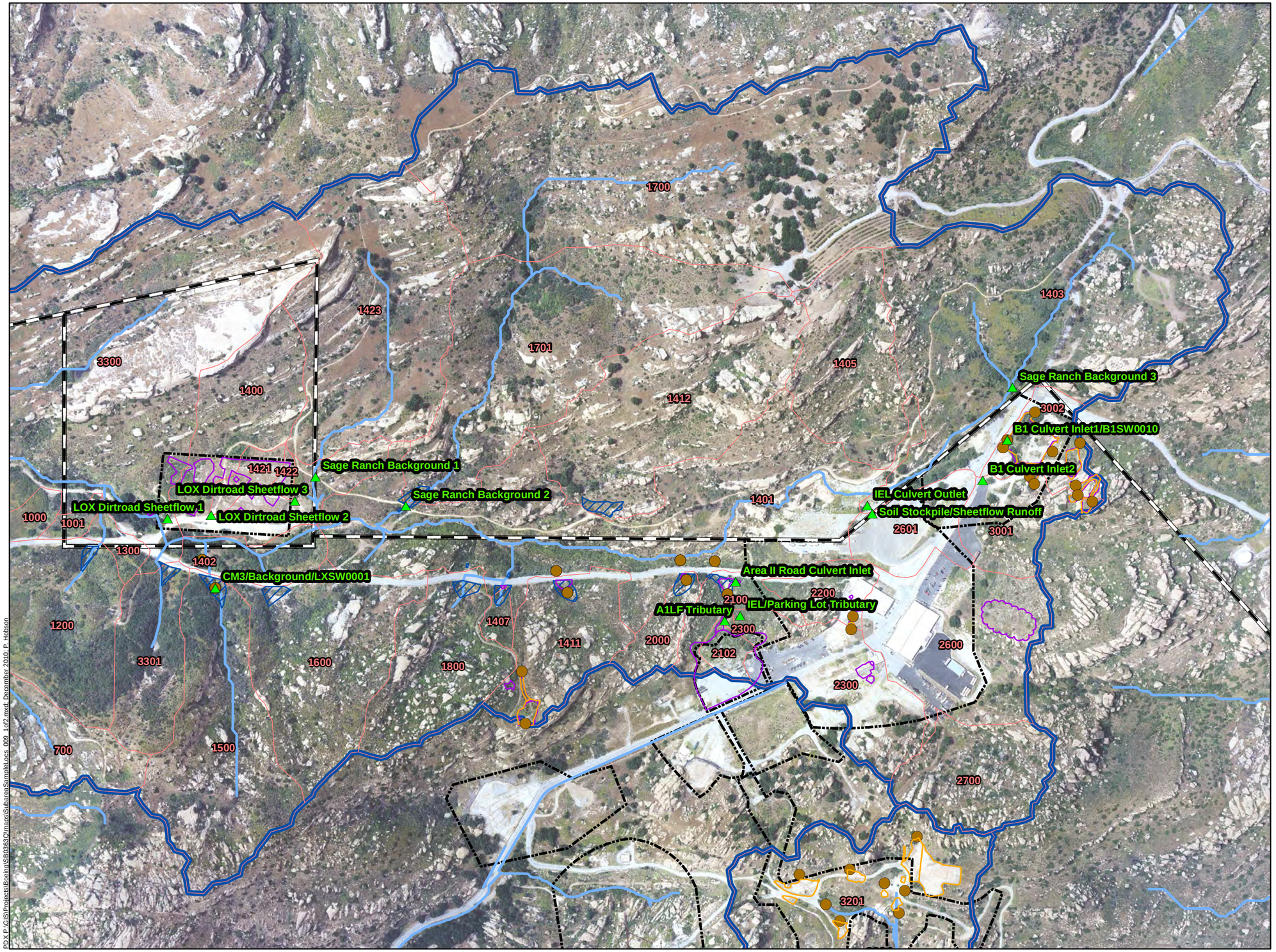
500 250 0 500
Feet

Figure 1a:
**Recommended Subarea Sampling Locations, Outfall 009 West**
Santa Susana Field Laboratory
Ventura County, CA

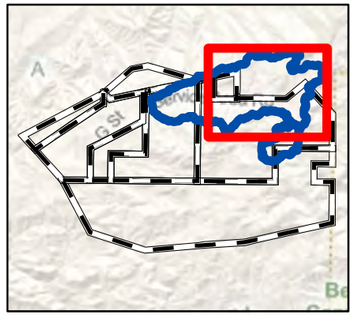
Geosyntec consultants

| Santa Barbara, CA | Dec. 2010 |
|---|---|

PD X P:\GIS\Projects\Boeing\SB03633\maps\SubareaSampleLocs_009_1of2.mxd. December 2010; P. Hobson




PD:X:\GIS\Projects\Boeing\SB03630\maps\SubareaSampleLocs_009_1of2.mxd: December 2010: P. Hobson



## Legend

- Subarea Sampling Locations
- CM & ISRA Performance Mon. Locs
- NPDES Outfalls
- ISRA Excavation Boundary
- Post-2010 ISRA Excavation Boundary
- SWMM Subareas
- Culvert Maintenance Footprints
- Streams
- Outfall Watersheds
- Property Boundary
- RFI Boundaries

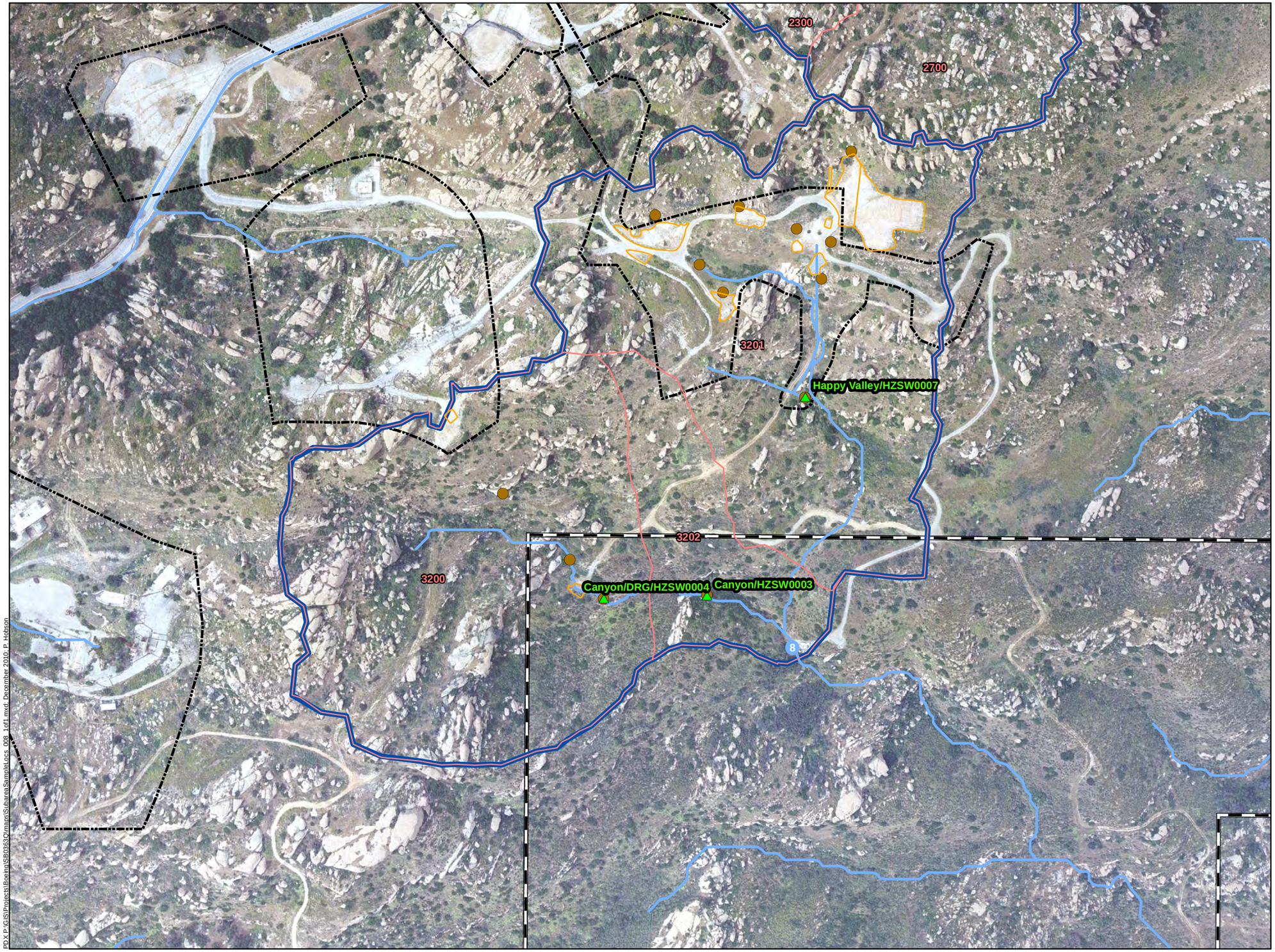
**Note:**
**Red numbers are SWMM area identifiers**

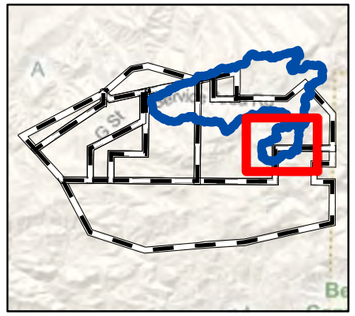
500 250 0 500
Feet

Figure 1b:
**Recommended Subarea Sampling Locations, Outfall 009 East**
Santa Susana Field Laboratory
Ventura County, CA

Geosyntec consultants

Santa Barbara, CA | Dec. 2010



## Legend

- Subarea Sampling Locations
- CM & ISRA Perf. Mon. Locs
- NPDES Outfalls
- ISRA Excavation Boundary
- Post-2010 ISRA Excavation Boundary
- SWMM Subareas
- Culvert Maintenance Footprints
- Streams
- Outfall Watersheds
- Property Boundary
- RFI Boundaries

**Note:**
**Red numbers are SWMM area identifiers**

300 150 0 300
Feet

**Figure 1c:**
**Recommended Subarea Sampling Locations, Outfall 008**
Santa Susana Field Laboratory
Ventura County, CA

Geosyntec consultants

| Santa Barbara, CA | Dec. 2010 |
|---|---|

P:\GIS\Projects\Boeing\SB0360\Maps\SubareaSampleLocs_008_1of1.mxd December 2010, P. Hotson

**Attachment 2**

Surface Water Monitoring Inspection and Sample Collection Form

# Surface Water Monitoring Inspection and Sample Collection Form

MWH

Inspector/Sampler: _____
Date: _____
Weather: _____
Outfall (008 or 009) _____

Rain Event Start Date/Time: _____
Rain Event Inspection #: _____
Prior Rain Event Insepction Date: _____

| | | | | | Sample Tracking Information | | | | | Sample Field Measurements | | | | Sample Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Location* | ISRA Area(s) | Qualitative Flow Observations** | Photo Number(s) | Object ID | Sample ID | Sample Type*** | Sample Time | Analyses | Conductivity (mS or uS) | pH | Temperature (C) | Turbidity (NTU) | Notes (such as: color, order, sheen, foam, biological material, etc) |
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |

*Sample Location: Primary Upgradient; Primary Downgradient; Secondary Downgradient

**Qualitative Flow Measurement: **No Flow**; **Low Flow:** trickle or minor amount of flow; **Moderate Flow:** Water is flowing normally, no significant erosion or turbid water; **High Flow:** Significant water flow/velocity, slope erosion.

***Sample Type: Primary, Duplicate, Internal Split, RWQCB Split, DTSC Split