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BOEING

FEDERAL EXPRESS DELIVERY

October 2, 2006

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

Attention: Mr. Jonathan Bishop, Executive Officer

Subject: 2006 Best Management Practices (BMP) Effectiveness Sampling Plan and Improvement Report for the Santa Susana Field Laboratory Ventura County, CA

Dear Mr. Bishop:

On November 22, 2005, Boeing was requested to submit a technical report pursuant to section 13267 "with justifications for the interim limits [requested by Boeing], as well as a plan to meet the final effluent limits" in Boeing's NPDES permit. On December 16, 2005, Boeing submitted a response to the November 22, 2005 letter including a 13267 Technical Report (Technical Report).

On December 19, 2005, Regional Board staff proposed a tentative Cease and Desist Order (CDO) with interim limits. However, the CDO was not adopted by the Regional Board and the limits in Boeing's NPDES permit were made immediately effective. The permit is now on appeal before the State Water Resources Control Board.

Boeing has asserted throughout the permitting process that it is unable to meet the final limits in its permit without an adequate compliance schedule and that an iterative BMP process should be employed. Despite the fact that the permit has been appealed, Boeing has continued to implement an iterative BMP process as described in the Technical Report. To date, this has included substantial work to evaluate and upgrade BMPs, investigation of site hydrological conditions, and a pilot program to test the effectiveness of certain media to remove regulated constituents from site discharges.

Although Boeing has received no feedback from the Regional Board on the Technical Report, and the compliance schedule proposed in the Technical Report was not incorporated into an approved CDO or the NPDES permit, Boeing is continuing to implement the program set forth in the Technical Report and is submitting its first annual BMP Implementation Program Report As noted on page

5-9 of the Technical Report, in 2006 Boeing developed a BMP effectiveness sampling plan with a corresponding quality assurance plan and a pilot test BMP program plan. Also, as noted on page 5-11 of the Technical Report, Boeing proposed to submit annual BMP implementation reports summarizing the BMP maintenance and upgrade activities along with long term analysis findings.

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This report includes two documents. The first is entitled the "BMP Effectiveness Sampling Plan" (Enclosure 1.) This plan documents the BMP sampling plan underway, including quality assurance procedures and a BMP pilot test plan. Since this is the first year of the new program, long term effectiveness data is not yet available. However, this plan details activities to commence during this year's storm season in order to collect the data necessary to determine long term effectiveness.

The second document is entitled the "BMP Implementation Report" (Enclosure 2.) This report details the activities already completed or currently underway to enhance the BMPs onsite.

It should also be noted that a pilot test study was undertaken this summer to determine removal efficiencies of various media. Results of this study are currently being incorporated into the design of the various BMP onsite. A full report of this pilot study will be submitted to your Agency on or before October 24, 2006 as noted in the BMP Schedule (Technical Report, page 5-10).

If you have questions, pertaining to this report or the status of the program, please contact Paul Costa of my staff at (818) 466-8778.

Sincerely,

J. L. Cole for

Tom Gallacher
Director, SHEA & Remediation Programs

PC:pj
Enclosures: Enclosure 1. - BMP Effectiveness Sampling Plan
Enclosure 2. - BMP Implementation Report

Cc: David Hung, RWQCB-LA
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SHEA-104334

BEST MANAGEMENT PRACTICES EFFECTIVENESS SAMPLING WORKPLAN

FOR

SANTA SUSANA FIELD LABORATORY

Prepared for:

THE BOEING COMPANY
SANTA SUSANA FIELD LABORATORY

Prepared by:

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May 2006

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1.0 INTRODUCTION

This Best Management Practice (BMP) Effectiveness Sampling Workplan (Workplan) has been prepared for The Boeing Company (Boeing) Santa Susana Field Laboratory (SSFL), located in Simi Hills, Ventura County, California (Site). The Site is located approximately 29 miles northwest of downtown Los Angeles, California, in the southeast corner of Ventura County. The Site is shown in Figure 1-1. This Workplan was prepared as a guide to evaluate both the effectiveness of structural BMPs in reducing constituent concentrations and the variability of constituent concentrations with both time and space. This Workplan will be used to evaluate various current structural BMPs and future structural BMPs at the outfalls that will be pilot tested at selected storm water outfalls at the Site. This Workplan does not address the site-wide erosion control measures or nonstructural BMP's implemented across the site.

The Site currently discharges storm water under waste discharge requirements, which serve as a National Pollutant Discharge Elimination System (NPDES) permit (permit number CA0001309).

1.1 BACKGROUND

Currently there are 18 surface water-monitoring locations (Outfalls) at the Site, identified on Figure 1-2. All 18 surface water Outfalls are currently monitored under the 2006 NPDES permit (Order No. R4-2006-0036). SSFL has developed guidance that addresses the implementation of storm water BMPs and for managing storm water. In addition, Boeing has implemented numerous BMPs to improve control of potential permitted constituents from leaving the Site via storm water. However, concentrations of NPDES-permitted constituents at some of the Outfalls have exceeded applicable permit limits, and therefore an evaluation will be conducted to assess BMPs currently in place at several Outfalls and to pilot test new technologies for possible implementation to reduce constituent concentrations in storm water.

1.2 PURPOSE AND OBJECTIVES

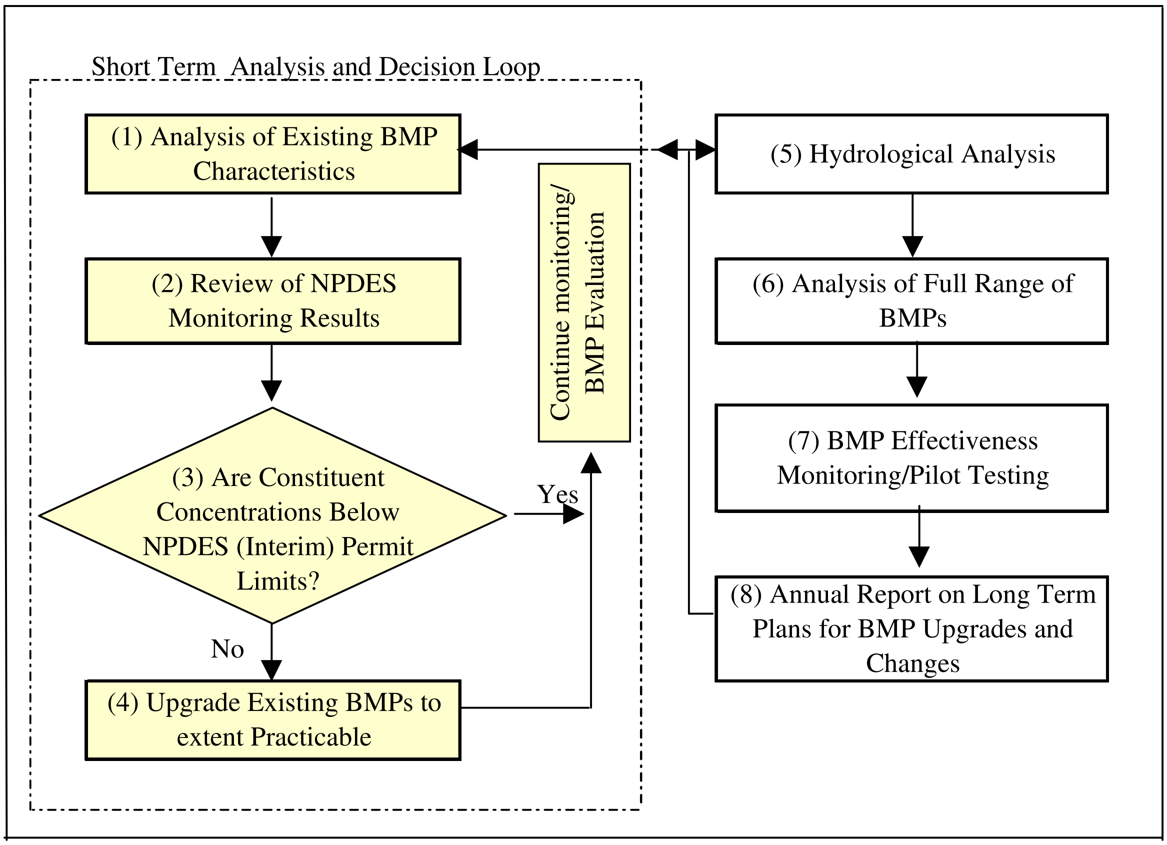
Boeing's goal is to identify the most appropriate BMP technology(ies) and utilize and to reduce constituent concentrations in stormwater flows from the Site, to implement pilot tests of those technologies, and then to select the appropriate technologies to implement at the Outfalls, as needed. The purpose of BMP evaluation at the Site is to monitor and evaluate current BMPs installed at several Outfall locations at the Site and to implement pilot tests of various new technologies. This evaluation will help in determining whether BMPs need to be added or upgraded at the Outfalls to reduce constituent concentrations further. This is intended to comply with the 13267 requirement dated November 22, 2005 and is consistent with the activities described in the Technical Report submitted by Boeing to fulfill that requirement, dated December 16, 2005.

2.0 BMP EVALUATION

This section provides a broad-based analysis, evaluation, and BMP upgrade and implementation decision making process. Figure 2-1 (below) outlines the process for monitoring and upgrading BMPs.

2.1 APPROACH

Figure 2-1. BMP Review and Evaluation Decision Flow Chart.



As shown in Figure 2-1, the short-term analysis and BMP improvement program (shaded boxes) will incorporate the results of compliance monitoring and would be triggered by individual storm events during the rainy season. The goal of the short-term evaluations is to maximize the effectiveness of existing BMPs to the extent practicable during the storm season. The long-term analysis and BMP evaluation program will provide data to allow a more comprehensive review and development of detailed recommendations regarding additional or modified Site BMP practices. Thus, BMP evaluations will be conducted over both short-term and long-term timescales. For example, a catastrophic failure of BMPs, such as part of the BMP washing away during a single storm event, would addressed immediately under the short-term decision loop. Long-term modifications or improvements to BMPs, or the selection of wholly new BMPs, will utilize information from the annual hydrologic analyses and from the BMP effectiveness monitoring and pilot testing programs. The long-term planning horizon will be especially important to identify BMP measures that may require significant time to implement (e.g., measures requiring stream bed alterations and associated permits).

The annual data evaluation process is shown as Steps 5 through 8. Information from Steps 5 through 7 would be used to develop an annual report (Step 8), which would detail a comprehensive BMP implementation strategy for the Site. Implementation of BMP improvements would be initiated either prior to the following year's rainy season or on the appropriate long-term planning schedule for more complex BMPs.

The main elements of the evaluation process listed in Figure 2-1 are detailed below.

<u>Short-Term BMP Improvement Program</u>

Step 1: Analysis of Existing BMP Characteristics: Current BMPs utilized at the Outfalls are summarized in Section 2.1 of this Workplan.

Step 2: Review of NPDES Monitoring Results: The current NPDES monitoring program requires grab samples to be collected for each storm event (where there is at least 0.1-inches of rainfall resulting in flow) from compliance monitoring points (Outfalls). Data obtained under this Workplan will be utilized to provide an initial characterization of the BMP influent and effluent at selected Outfalls and will be used to assist in short-term decisions about BMP improvements.

Step 3: Are Constituent Concentrations Below NPDES Permit Limits? Evaluate whether storm water runoff sampled pursuant to the NPDES monitoring program meets the current NPDES permit limits. If compliance monitoring samples meet permit limits, regularly scheduled monitoring and analysis of BMP implementation will continue. If they do not, proceed with Step 4.

Step 4: Upgrade Existing BMPs: If compliance monitoring samples do not meet limits or BMPs do not perform hydraulically (e.g., if flows "bypass" BMPs, or if BMPs wash out), current BMPs may be modified and upgraded, to the extent practicable, to further improve BMP effluent water quality. In this manner, compliance monitoring results will drive short-term BMP improvements. These improvements will typically take place on an annual basis with the exception of inter-storm hydraulic improvements should there be washout or other hydraulic failures that can be practicably repaired.

Long-Term BMP Effectiveness Monitoring

Step 5: Hydrologic Analysis: The hydrologic analysis will include an evaluation of Site precipitation characteristics and anticipated hydrologic response and will be conducted using available precipitation and flow data collected at Boeing SSFL and surrounding sites. The hydrologic analysis will be used to evaluate precipitation return period characteristics, runoff volumes, and/or runoff flow rates to provide a quantitative basis for the design of Site BMPs. Analysis will combine data from runoff flow meters currently installed in drainages at Outfall locations 001 and 002, 011 and 018, and analysis will be based upon available precipitation data sets. Scientifically appropriate methods, such as U.S. Environmental Protection Agency (USEPA)'s Storm Water Management Model (SWMM), will be utilized in initial and annual evaluations to characterize and predict precipitation-runoff relationships. The first year's hydrologic evaluation may be the most extensive, but will be updated annually with new rainfall and flow data, and may be used to guide the collection of additional hydrologic data, as appropriate. The hydrologic analysis may also be updated as hydrologic and surface characteristics change at SSFL, especially in regards to vegetation re-growth after the 2005 Topanga Fire. The hydrologic analysis will be used to guide BMP analysis and to improve overall implementation practices. Section 2.3 discusses the hydrologic processes as they are today.

Step 6: Analysis of Full Range of BMPs: This step will involve an analysis of the full range of available BMPs. At a minimum, BMPs to be evaluated will include those detailed in Section 3.0 (below). An initial screening process will be used to eliminate those alternatives that are infeasible at the Site (e.g., if Site characteristics, such as infiltration capacity, preclude their use). Detailed research analysis will be conducted for feasible potential BMPs, and will include an evaluation of their effectiveness for constituents found in storm water runoff from the Site, their implementation impacts and "footprint," and cost and feasibility considerations. After determining potentially feasible BMPs to be utilized at SSFL, small-scale structural test BMPs will be installed at SSFL to determine effectiveness in treating SSFL runoff. The small scale structural test BMPs will then undergo the same BMP Effectiveness Monitoring Program in order to appropriately design full scale implementation of new structural BMPs.

Step 7: BMP Effectiveness Monitoring/Pilot Testing: This step would involve monitoring that may include:

(a) Composites of time weighted samples collected from influent and effluent of BMPs to characterize time average constituent concentrations and mass loadings.
(b) Occasional analysis of time weighted samples collected from influent and effluent of BMPs to characterize hydrographic and constituent response curves during a storm.
(c) NPDES monitoring results, collected as a single grab sample per storm event, will be used to characterize the relationship between grab sample data and data collected either for multiple samples during a storm event or for time-weighted composite samples.

(d) Pilot testing of different filter media using pond water on-site to determine how well these different media will remove regulated constituents. Pond water will be used during the dry season in lieu of storm water to provide information in the short term (summer of 2006). Additional pilot testing, including pilot tests using storm water from the Site, may be planned depending upon results of the initial pilot tests.

(e) Field demonstrations of larger scale BMP using the best performing filter media to evaluate their effectiveness during storm events.

A BMP Effectiveness Monitoring Program and pilot testing program will be undertaken as presented in this Workplan and annual reports prepared to evaluate larger scale and longer term changes to the BMP program in place at SSFL.

Annual reports will be prepared and submitted outlining the prior year's activities of monitoring, BMP upgrades, and BMP testing. The details of this annual reporting are provided below in Section 3.4.

2.2 CURRENT BMPs

Numerous erosion control BMPs are currently in place throughout the Site to mitigate erosion and potential sediment transport via storm flows. In addition, Boeing has constructed BMPs at several Outfall locations at the Site to reduce concentrations of NPDES permitted constituents in storm water. The following sections summarize the current BMPs at the Site.

Outfalls

As detailed in Table 2-1 below, 12 of the 18 Outfalls at the Site are monitored during storm events for NPDES permitted constituents. Note that industrial operations have ceased at Outfalls 012, 013 and 014. Furthermore, wastewater is currently hauled off-site for disposal and the Sewage Treatment Plant (STP) no longer operate or discharge treated sewage at Outfalls 015, 016 and 017. This table also

Table 2-1

Current BMPs

Outfall Number	Area	Current BMPs[3] (as of May 2006)
001	Southern Undeveloped Land	• Fiber rolls
002	Southern Undeveloped Land	• Fiber rolls
003	IV	• Fiber rolls • Loose gravel bed • Activated carbon filter bags
004	IV	• Plastic tarp • Coarse and fine gravel • Straw bales • Activated carbon filter bags • Silt fencing
005	IV	• Fiber rolls • Coarse and fine gravel • Activated carbon filter bags
006	IV	• Fiber rolls • Coarse rip rap • Coarse and fine gravel • Activated carbon filter bags
007	IV	• Fiber rolls • Silt Fence • Activated carbon filter bags
008	Southern Undeveloped Land	• Fiber rolls • Silt Fence
009	II	• Fiber rolls
010	II	• Fiber rolls • Silt Fence • Coarse Rip rap • Gunite-lined sediment basin • Activated carbon filter bags
011	I	• Sedimentation pond (Perimeter Pond) • Activated carbon filter bags

Outfall Number	Area	Current BMPs[3] (as of May 2006)
012[1]	II	• None. No longer in use.
013[1]	II	• None. No longer in use.
014[1]	I	• None. No longer in use.
015[2]	I	• No activity. Wastewater currently hauled offsite – no discharges
016[2]	II	• No activity. Wastewater is pumped to STP-III where it is currently hauled offsite – no discharges
017[2]	III	• No activity. Wastewater currently hauled offsite – no discharges
018	II	• Sedimentation pond (R-2 Pond) • Activated carbon filter bags
Notes: 1) Storm water is not regulated at Outfalls 012-017. Rocket engine testing at the Site has ceased. 2) Sewage Treatment Plants, Outfalls 015, 016, & 017, no longer operate or discharge treated sewage. 3) BMPs reported in previous quarterly and/or annual discharge monitoring reports may have been removed and/or modified due to upgrade activities.		

summarizes permanent and temporary structural BMPs that have been installed at the Outfalls.

Additional to those BMPs implemented, Boeing continues to implement site-wide activities to mitigate transmission of regulated constituents into stormwater. This includes ash and debris removal to the extent practicable form the upstream drainages of the outfalls following the 2005 Topanga Wildfire; and site-wide prevention measures. Hydromulch was also placed over approximately 860 acres of at the Site. Hydromulch is a semi-liquid organic binder blended with hydromulch paper or wood fiber/pulp that is dispersed onto and adheres to the ground surface and soil surface to protect from further soil erosion, aid in minimizing sediment transport, and decrease the potential for landslides. In addition, hydroseeding (mulch material with a native seed mix) was completed at other selected upgradient areas at the Site.

2.3 FUTURE BMP TECHNOLOGIES

This section lists common BMPs that will be evaluated for use at the Site, whenever appropriate.

Wet Ponds

Wet ponds (basins) are constructed basins that maintain a permanent pool of water throughout the year. Wet ponds treat incoming storm water runoff by biological uptake and settling.

Extended Detention Basins

Extended detention basins are basins that are designed to detain storm water to allow particles and associated pollutants to settle. They differ from wet ponds in that they do not have a permanent pool of water.

Infiltration Basins

Infiltration basins are shallow impoundments that store and infiltrate storm water runoff. Infiltration basins avoid discharge of intercepted storm flows to surface waters, and they use the natural filtering ability of the soil to remove pollutants before it infiltrates into the water table.

Vegetative Buffer Strips

Vegetated buffer strips are vegetated surfaces designed to receive direct sheet flow runoff from adjacent surfaces. Sheet flow of runoff through vegetation reduces runoff velocity, removing some particles and associated pollutants, and allows some infiltration into the soil.

Fiber Rolls

Fiber rolls made of straw, flax, or other similar materials are bound into a tight tubular roll that is entrenched onto the toe or face of a slope to reduce runoff velocity, release runoff as sheet flow, and remove sediments from runoff.

Sand Bag Barriers

A sandbag barrier is a row of sand-filled bags that intercept flow and promote settling out sediments.

Straw Bale Barrier

A straw bale barrier is a row of straw bales placed on a level contour to intercept sheet flows and promote settling of sediments.

Silt fences

Silt fences are temporary sediment barriers that detain sediment-laden runoff, promoting sedimentation behind the fence.

Vortex Separators

Vortex separators direct storm flows into a round chamber where water moves in a centrifugal fashion, causing suspended materials to move to the center of the device where the heavier materials settle to the bottom.

Wet Vaults

A wet vault is a vault with a pool of water used for settling sediments. Vaults are generally 3 to 5 feet deep and the volume generally drains 21 to 48 hours after a storm event.

Vault and Cartridge Filters (Media Filters)

Storm water media filters are generally two-chambered devices that include a pretreatment settling basin, which removes large particles, and a filter bed filled with absorptive media, which removes finer particles and other pollutants. Filter media such as zeolite, compost, activated carbon or peat can effectively remove dissolved pollutants. Filter media may be in cartridges mounted within the vault, through which the water flows to exit the vault.

Storm Drain Inserts

Drain inserts are filters or fabric placed in a drop inlet to remove sediment and debris.

Constructed Wetlands and Gravel-Based Wetlands

Similar to wet ponds, constructed wetlands have shown substantial constituent removal capabilities. The action of the ecosystem within the pond works to provide settling of solids, conversion of organic compounds, solidification and absorption of metals, and removal of nitrogen.

Sand Filters

As opposed to proprietary vault based media filters, sand filters are non-proprietary systems that force storm water through layers of sand and possibly other media to filter it prior to its release to receiving waters.

2.4 HYDROLOGIC ANALYSIS

The hydrologic analysis will include an evaluation of Site precipitation characteristics and anticipated hydrologic response and will be conducted using available precipitation and flow data collected at the Site. Precipitation data from gauges near the Site may also be used in this analysis. The hydrologic analysis will be used to evaluate precipitation return period characteristics, runoff volumes, and/or runoff flow rates to provide a quantitative basis for the design of Site BMPs. Analysis will combine data from runoff flow meters currently installed in drainages at Outfall locations 001, 002, 011, and 018, and analysis will be based upon available precipitation data sets. Additionally, a limited number of additional flow meters may be installed to supplement the flow measurements at outfalls 001, 002, 011 and 018 – in particular a flow meter on a north facing outfall and a flow meter at an outfall that is not impacted by retention in large ponds such as perimeter pond or R-2 Pond. Scientifically appropriate methods, such as USEPA's SWMM, will be utilized in initial and annual evaluations to characterize and predict precipitation-runoff relationships. The first year's hydrologic evaluation may be the most extensive, but will be updated annually with new rainfall and flow data, and may be used to guide the collection of additional hydrologic data, as appropriate until there is consensus that the hydrologic model is sufficiently calibrated. The hydrologic analysis will be used to guide BMP analysis and to improve overall implementation practices.

3.0 BMP EFFECTIVENESS MONITORING WORKPLAN

This plan describes monitoring procedures that will be followed at Outfalls where the effectiveness of BMPs is being monitored. Automated sampling equipment will be installed and operated at seven Outfalls where BMPs are in place and sufficient flow occurs during or subsequent to rainfall events.

There are currently 18 Outfall locations across the Site that are monitored for compliance with the Site-specific NPDES permit. Eight of the 18 Outfalls have structural BMPs currently in place to reduce concentrations of NPDES permitted constituents of concern in storm water. As noted above, 6 of the interior former industrial outfalls are no longer in use. This BMP Workplan is designed to monitor the pollutant removal performance of some of these structural BMPs, where feasible, and as detailed below.

Seven Outfalls (003-007, 010, and 011) will be monitored because of likely flow during most rainfall events when flow occurs. The other Outfalls either have minimal to no flow during most rain events or are monitored only as industrial discharges. To adequately monitor these seven Outfalls, samples will be collected immediately upstream (influent) and downstream (effluent) of the structural BMP(s) for a total of 14 locations. Figures 3-1 through 3-7 show sample locations at the seven Outfalls. Appendix A shows photos of each influent and effluent autosampler at each Outfall.

Influent samples will be upstream of the BMPs. Effluent sample locations will be at the location where NPDES permit monitoring samples are collected. Influent and effluent samples will provide information on changes in the concentrations of constituents in water that flows through these BMPs. The data will then be evaluated to determine if BMP upgrades are needed.

3.1 HEALTH AND SAFETY

All field activities will follow the Site wide Health and Safety Plan (MWH 2003).

3.2 SAMPLE COLLECTION AND EQUIPMENT

Samplers

Influent and effluent samples will be collected using a dedicated portable Teledyne Isco 6712C automated sampler (sampler) or equal at each sample location. Each sampler is environmentally sealed in a durable polyethylene enclosure made up of three portions: the top portion of the sampler is equipped with a programmable electrical controller to guide sample collection frequencies and volume and a peristaltic pump; the middle portion is equipped with a sampling arm to direct water flow to bottles; and the bottom portion is equipped with a 24-bottle configuration where the center is open for placement of ice (or alternative). Each sampler will be mounted and fastened to a 36-inch by 36-inch level skid near or within close proximity to the sample location to ensure the samplers do not fall over during severe weather conditions. Figures 3-1 through 3-7 show locations of the samplers.

These samplers will be programmed when to start collecting after water flow has been detected, what volume to collect, what frequency to collect, how to distribute the samples via the sampling arm, and whether these are time- or time-weighted samples.

Pump, Tubing, and Strainer

A high performance peristaltic pump is located in the upper portion of the sampler. The pump works by rotating two bearings in a rotor against a 3/8-inch inner diameter (ID) silicon rubber tubing, which generates the pumping action. The pump delivers water at an USEPA-recommended minimum velocity of two feet per second. The pump counts the revolutions and will remind the sampler when the silicon tubing needs to be replaced. The silicon tubing delivers water directly to the sample bottles located in the lower portion of the sampler. Note that the peristaltic pump should not be used to collect volatile organic compounds due to the potential for cavitation in the water flow stream caused by the pump.

Attached to the silicon rubber tubing is a stainless steel coupling, which is then attached to a 3/8-inch vinyl tubing that extends to the influent/effluent point of sample collection. A 1.25-inch by 8-inch long standard weighted polypropylene strainer is attached to the vinyl tubing to minimize the potential for large debris to enter the tubing. The strainer will be strategically placed near the top of the water flow path to capture flowing water that is representative of the flow.

Power Source

The Outfalls are located in remote areas around the Site. Therefore, each sampler will be equipped with a 18-inch by 24-inch 40 watt solar panel attached to an 8- to 10-foot galvanized steel pole that powers a 12 volt sealed lead glass matt battery enclosed in a plastic safety box.

Influent Storm Water Sample Box

Influent into the BMP is typically sheet flow. To collect a representative sample of this sheet flow, a 12-inch by 12-inch by 9-inch deep stainless steel sample box will be installed in the likely storm water flow pathway where sheet flow is expected to occur during all rainfall events and where sheet flow is likely to be the deepest. This is the location where representative influent samples will be collected (see Figure 3-8 for sample box specifications). The box will be leveled in a hole so that the upper portion of the box will be flush to grade. This sample box has been designed for water to collect into a small reservoir, but in which velocity conditions do not vary significantly from the surrounding sheet flow, thus maintaining representative concentrations of suspended sediments and other constituents in the water for sampling purposes. A 'T'-bracket will be welded in the center of the 9-inch deep box to allow the strainer (discussed above) to rest on it. A removable lid will be made of 1/2-inch mesh openings to allow storm water flow into the box and minimize the potential for larger objects such as trash and vegetation to enter the box.

Effluent Sample Containment Structure

The existing Outfall sampling structures that are currently in place will be used to collect samples of water leaving the BMPs. These containment structures capture water in either stainless steel or concrete structures.

Actuator

Each influent and effluent sample structure will be equipped with an Isco 1640 Liquid Level stainless steel Actuator. The actuator will be installed at the point where water pours out of the sample containment structure, which then triggers the sampler to turn on and begin the sampling process once water encounters the actuator.

3.3 SAMPLE PROCEDURES

Prior to a forecasted rain event, twenty-four (24) sample bottles will be inserted into each sampler with the lids off and ice (or alternative) will be placed in the center of the bottom portion of the sampler. Once water encounters the actuator, it triggers the sampler to turn on. The peristaltic pump will then purge the tubing lines by pushing any residual and/or stagnant water out of the sample collection lines. The samplers will then capture time-paced, composite samples over the duration of influent and effluent storm water flows and pour water directly into ice-chilled sample bottles, located in the bottom portion of the sampler. Once sampling is complete, the pump purges the tubing lines one additional time.

Each of the 24-500 ml sample bottles in the Isco autosampler will be filled with a minimum of 200 ml of water during the duration of the rain event, capped, labeled, documented on a chain-of-custody form and field notes, placed in an ice-chilled cooler, near to 4 degrees Celsius, and shipped to a California state-certified laboratory.

Label samples using the following:

- [3 Digit Outfall Number] [INF or EFF]-[Bottle Number] *ex.* [006 INF-2]

SSFL sampling staff will follow the Sampling Plan in Appendix B for sample handling, packaging, documentation, and data evaluation procedures. Prior to the next forecasted rain event, any storm water that is still retained in the influent and effluent sample boxes or structures will be removed.

3.3.1 Sample Analysis and Sample Bottles

The following analytical test methods, types of bottles, preservative, and holding times for samples to be collected are summarized in the table below.

Constituent	Test Method	Bottle Type (# of Bottles)	Preservative	Holding Time	Turn Around Time
Suspended Sediment Concentration (SSC)	ASTM 3977-1977	Poly-500 Milliliter (m1)	None	7 days	48 hours

SSC will serve as an indicator for other constituents sorbed to soils and will facilitate inexpensive, efficient analysis of BMP effectiveness. Sample bottles will be decontaminated by the laboratory for re-use prior to the next sampling event.

During most storm events, autosampler sample bottles will be composited into one influent sample and one effluent composite sample from each Outfall by the laboratory, for each rainfall event in which flow occurred at that Outfall. On occasion, at the discretion of SSFL staff, each individual sample bottle will be analyzed independently to plot a graph of sediment concentrations over the time of the storm. These individual analyses will be infrequent with the bulk of the monitoring completed with time-weighted composites.

3.3.2 Sample Frequency

Samples will be collected over a minimum of three full rainy seasons (October 1 through April 15) to monitor BMP effectiveness. During sampling, the samplers will be programmed to collect small-specified volumes of water every 15 minutes to obtain a representative sample of each storm event. Three separate scenarios have been programmed into the samplers based on different duration scenarios. Table 3-1 shows the programs in detail. Duplicate samples will not be collected during this study.

3.4 REPORTING

Annual reports will be prepared to report on the results of BMP evaluations, pilot testing, effectiveness monitoring, upgrades, and new installation activities. These reports will contain:

- Compliance monitoring summaries
- Effectiveness monitoring summaries
- Timeline showing BMP upgrade activities that occurred over course of the year.
- Descriptions of BMP upgrade activities with discussions of their subsequent effectiveness should data be available
- Pilot testing description, activities, and results, if any.
- Hydrologic study results, if any.
- Conclusions regarding results of prior year's activities.
- Schedule of activities for following year.

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4.0 PILOT TESTING PLAN

Considering that the limits established in the permit for priority pollutants are extraordinarily low, there is little information available on the ability of BMP technologies to treat storm water to levels that consistently meet these effluent limits. Among available BMP technologies, direct filtration appears to be the most promising. Some case studies using various filter media have shown substantial reductions in metals concentrations. It is likely that storm water filter systems may result in significant removal of metals and other constituents. This combined with other managerial Site controls may result in constituent concentrations in storm flows that consistently achieve permit limits. However, at this time, because of the extraordinarily low permit limits and the "newness" of evaluating the ability of BMP technologies to achieve these low permit limits under all flow conditions, it is prudent to conduct testing of promising systems to:

- Determine which filtration media have the most promise of achieving permit limits.
- Determine design parameters for full-scale systems using such filter media.

A pilot test will be conducted at the Site to evaluate the constituent removal capabilities of a variety of filter media, as well as to evaluate the ability of BMPs to produce storm water that complies with the Site-specific NPDES permit requirements. Although the Site currently uses activated carbon as a filter media at some of the Outfalls, exceedances are still occasionally observed. It is advisable to test different filter media to determine their removal capabilities and to evaluate the hydraulic capacity of each for scale-up purposes. Rather than waiting for storms to occur, filter media will be tested using R-2 Pond water on Site during the summer of 2006.

Influent and effluent samples from the various filter media will be collected to provide information on changes in the concentrations of constituents in water that flows through these media. Data will then be evaluated to determine the ability of the filter media (or a combination of media) to reduce the NPDES permitted constituents for the Site and to evaluate the total mass of constituents that can be adsorbed by the filter media prior to breakthrough. Figure 4-1 shows the location of the pilot test.

4.1 HEALTH AND SAFETY

All field activities will follow the site wide Health and Safety Plan (MWH 2003).

4.2 PILOT TESTING EQUIPMENT

The following discusses the nine-selected filter media and the devices that will be constructed to contain these media.

<u>Filter Media</u>

Sand: A silica-based clean, washed sand. Particle sizes range from 0.45 to 0.55 inches. Sand is known to remove Total Suspended Sediments (TSS), turbidity, and some other constituents such as metals that may be adsorbed onto particles trapped by the sand.

Activated Carbon: An exceptionally high internal micro-porous particle structure for absorption of a wide range of low and high molecular weight impurities. It can be acid washed and coconut shell-based in an 8x30 mesh. Particle sizes range from 0.09 to 0.19 inches. Activated carbon is known to remove oil and grease and organics, such as VOCs.

Zeolite: A naturally occurring potassium-calcium-sodium aluminosilicate mineral used in a variety of water filtration applications that can simultaneously sorb inorganic cations, inorganic anions, and nonpolar organics. Particle sizes range from 0.13 to 0.19 inches. Zeolite is known to remove soluble metals, ammonium, and some organics.

Leaf Compost: Processed into a granular, organic media from deciduous leaves. Particle sizes range from 0.06 to 0.5 inches. Leaf compost is known to remove soluble metals, TSS, and oil and grease. Contech Stormwater, the sole provider of deciduous leaf compost, will provide this media in a passive, siphon-actuated proprietary filter device.

Perlite: A naturally occurring siliceous puffed volcanic ash made up of a porous, rough edged, and multi-cellular structure. Particle sizes range from 0.09 to 0.5 inches. Perlite is known to remove fine particle suspended solids and oil and grease.

Vermiculite: Similar to Perlite, a naturally occurring non-toxic mineral that expands upon application of heat. This expansion creates a great internal porosity, which enhances the material as a filter media in that fine particles diffuse into the internal pores and are removed from the water stream. Vermiculite is known to remove fine particle suspended solids and oil and grease.

Peat Moss: Naturally occurring mix of growing vegetative matter, decayed vegetative matter and peat. Peat moss is known to remove organics, nitrogen, and soluble metals.

Barley Straw: Naturally occurring dried barley stalks. Barley straw is known to remove setteleable solids, metals, dissolved organics, and oil and grease.

Experimental Carbon (SMCS Sorbent): A hydrophobic, super-absorbent, and highly effective Sorbent that is a carbon (C6-, C12-, and C18) -based compound. This gray/black pellet compound is expanded approximately 500 times, which makes it capable of absorbing a variety of constituents. SMCS Sorbent is known to remove metals, dissolved organics, and oil and grease.

<u>Filter Containment Devices</u>

Each filter medium will be placed in separate 55-gallon Department of Transportation (DOT)-approved drums, with the exception of the leaf compost media. Approximately ½ of the volume of each drum will be filled with the filter media to be pilot tested to provide room for piping, baffling, and media containment within the drum, which is necessary to equalize flow across the media and maintain consistent contact times within each drum. Each filter containment device will be placed on a skid, with a fiberglass grate and stainless steel cloth.

The leaf compost media will be contained in a two-cartridge StormFilter® CatchBasin, from Contech Stormwater. The StormFilter® CatchBasin is being used rather than a 55 gallon drum as a requirement of Contech Stormwater, who has a patent on using compost for storm water treatment. Rather than selling raw compost, they prefer to provide the treatment device as well.

4.3 PILOT TEST SYSTEM PROCESS

R-2 Pond water will be pumped into a 2-inch polyvinyl chlorinated (PVC) inlet pipe (influent), located approximately 2 feet above the bottom of the pond and approximately 50 feet from the pond edge, using a submersible pump. Water will flow into one of two 1/8-inch pore size strainers. The strainer will minimize the potential for debris and large sediments from entering the system and will reduce the likelihood of rapid filter clogging. Water will then be pumped into a 15-foot tall standpipe to provide the necessary head to sustain consistent flow through the filters.

Valves and totalizing rotameters will control and monitor flow rates at each filter media containment device so that contact times or retention times will be fairly consistent between media. Flows will be set so that there is approximately eight minutes of contact time in each filter in order to provide a common basis for comparison and correspond to various manufacturers' recommendations.

Influent will be uniformly distributed out of a flow spreading manifold into each of the parallel in-line drums. Pond water will percolate through the filter media while potential pollutants adsorb to the pilot tested media. Water will then flow by gravity to an outlet pipe (effluent) that will return the filtered water back to the pond's surface, located more than 20 feet away from the pilot test equipment and at the surface of the lake. Totalizing rotameters will measure effluent flow rates in each device's outlet pipe.

Each filter drum is equipped with an air vent pipe that releases air from the top of the filter drum and to allow water to pond on top of the media to provide additional head to overcome pressure losses that build up over time. The filter drums will also have upflow backwashing capabilities to reduce pressure losses and increase porosity by flushing out accumulated suspended solids, should it become necessary. Head from the standpipe will drive flow up through the filter drum and out another hose, which discharges backwash water from the top of the filter drum to R-2 Pond. Figure 4-2 shows the configuration of the filtration pilot test.

Once the filtration pilot test is complete, it will be dismantled and removed from the R-2 Pond area.

4.4 SAMPLING PROCEDURES

One inlet sample port is located immediately after the standpipe and before flowing into any of the filter media containment devices for influent water sample collection. One outlet sample port is located in the outlet pipe after each filter media (for a total of nine sample ports) for effluent water sample collection.

Grab water samples will be collected directly into laboratory provided sample bottles from each inlet and outlet sample port. SSFL sampling staff will follow the Sampling Plan in Appendix B for sample handling, packaging, documentation, and data evaluation procedures. Once all of the influent and effluent samples are collected, backwashing and adjustments to the flow rate will be conducted and documented. In addition, pressure drops and flow rates will be recorded from each device following every sampling event using the pressure gauges and flow meters on the equipment. The sample frequency to be followed is presented in Section 4.4.2.

Manual adjustments of flow rates will become necessary as the hydraulic conductivity of the filter media decreases over time.

Label samples using the following:

- [Media Designation (see below)]-[Effluent (EFF)] *ex.* [AC-EFF]
  - Sand (S)
  - Activated Carbon (AC)
  - Zeolite (Z)
  - Leaf Compost (LC)
  - Perlite (P)
  - Vermiculite (V)
  - Peat Moss (PM)
  - Barley Straw (BST)
  - SMCS Sorbent (SS)

or

- [Pilot Test (PT)]-[Influent (INF)] *ex.* [PT-INF]

SSFL sampling staff will follow the Sampling Plan in Appendix B for sample handling, packaging, documentation, and data evaluation procedures.

4.4.1 Sample Analysis and Sample Bottles

The following analytical test methods, types of bottles, preservative, and holding times for samples to be collected are summarized in the table below.

<table>
<tr><th>Constituent</th><th>Test Method</th><th>Bottle Type
(# of Bottles)</th><th>Preservative</th><th>Holding Time</th></tr>
<tr><td>Metals* (total and dissolved)</td><td>200.8 or 6020</td><td rowspan="4">500 Milliliter (ml) Poly</td><td rowspan="4">Nitric Acid (HNO_3)</td><td>6 months</td></tr>
<tr><td>Mercury</td><td>245.1 or 7470A</td><td>28 days</td></tr>
<tr><td>Iron</td><td>200.7 or 6010B</td><td>6 months</td></tr>
<tr><td>Hardness</td><td>SM2340B</td><td>6 months</td></tr>
<tr><td>Dioxin TCDD TEQ</td><td>1613</td><td>2x1 Liter (L) Ambers</td><td>None</td><td>1 year</td></tr>
</table>

Constituent	Test Method	Bottle Type (# of Bottles)	Preservative	Holding Time
Total Organic Carbon	415.1	3x40 ml VOAs	Hydrochloric Acid (HCl)	28 days
Oil and Grease	413.1	2x1 L Ambers	None	28 days
Total Kjeldahl Nitrogen	351.3	500 ml Poly	Hydrogen Sulfate (H_2SO_4)	28 days
Ammonia-N	350.2			28 days
Nitrate/Nitrite-N	300.0	500 m1 Poly	None	48 hours
Sulfate	300.0			28 days
Total Dissolved Solids (TDS)	SM 2540C			7 days
Suspended Sediment Concentration (SSC)	ASTM 3977-1977			7 days
Turbidity	180.1			48 hours
pH	150.1			Immediate
Alkalinity	310.1			14 days

*Only antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, manganese, nickel, selenium, silver, thallium, and zinc will be analyzed based on previous detections and NPDES permit requirements.

Sample bottles required for the specified analyses will generally be provided by the laboratory immediately prior to the sampling event. Bottles will not be rinsed prior to sample collection. Preservatives, if required, will be added to the bottles by the laboratory before shipping sample bottles to the Site.

4.4.2 Sample Frequency

Influent and effluent samples will be collected once per working day during the first week of operation and once a week thereafter. The pilot test is expected to run for approximately three months, although pilot test operation may end sooner if filter media exhibit breakthrough or at the onset of excessive clogging before the end of the three-month period. The following table summarizes the sampling frequency at each influent and effluent location.

Sampling Week	Number of Samples/Week	Frequency
1	5	1/day
2 through 12	1	1/Monday Morning

An effluent sample will be collected from each filter. Influent is expected to be the same for each filter, so one influent sample will be sufficient per sampling event.

4.5 REPORTING

Annual reports will be prepared to evaluate full scale and longer-term changes to the BMP program in place at the Site. The pilot testing results will be included in the annual report described in Section 3.4.

5.0 BMP POTENTIAL CONCEPTUAL DESIGNS

Following the pilot testing program, field demonstration BMPs would be selected, designed, and installed, as appropriate.

It will be necessary to test the scale-up factors from the pilot test to full scale. Because storm flow chemistry and sediment loads will vary from pond water, it will be important to assess the performance of the media under storm flow conditions. Hydraulic performance can also have a very significant impact on overall BMP performance. To determine scale-up factors, to optimize hydraulic performance, and to determine the effectiveness of the filter media with storm water, field demonstrations of different hydraulic configurations of the optimal media system(s) will be conducted. Thus, following pilot testing, field demonstration systems will be installed at select locations to evaluate the hydraulic design factors and develop design criteria for full-scale systems.

It is anticipated that the field demonstrations would be installed and operated over one or more storm season, after which planning, permitting, design, and installation of full-scale systems would take place. Of course, the schedule may be extended if the winter is dry and does not provide enough storm events, or storm events of sufficient size, to provide data for design and installation of full-scale systems.

It is anticipated at this time that full-scale BMPs would encompass significant portions of stream channels and require substantial environmental review, mitigation planning, and resource agency interaction prior to finalizing designs and installing.

Following planning of the full-scale BMPs, these full-scale BMPs will be procured and installed. The installation may take more than one summer season as well due to potential environmental constraints. In the meanwhile, the current BMPs will be maintained and, if monitoring data or hydraulic performance suggests, upgraded to the extent practicable as described in this document.

6.0 REFERENCES

MWH. 2003. Health and Safety Plan, RCRA Corrective Action Program Activities, Santa Susana Field Laboratory, Ventura County, California. April.

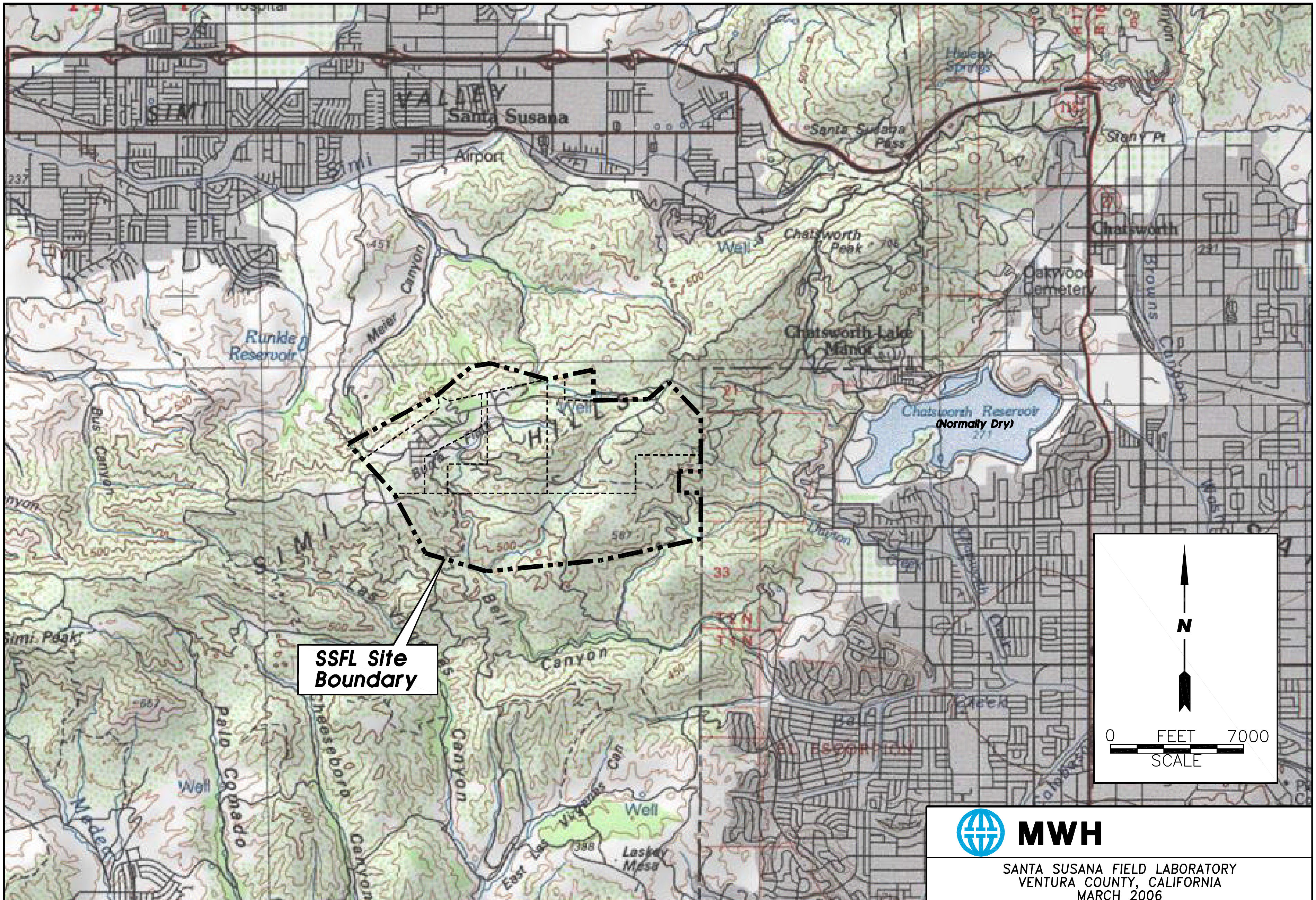
TABLES

TABLE 3-1
Sampler Programs
BMP Effectiveness Monitoring
Santa Susana Field Laboratory

Outfall	Typical Flow Durations (day)	Storm Water Flow Scenarios (day)	Sample Frequency (minutes)	Sample Volume (mL)	Switch Bottle After (mL)
003	~2	1	15	100	400
		2	15	50	400
		4	30	50	400
004	always < 1	1/2	15	200	400
		1	15	100	400
		2	15	50	400
005	1, sometimes > 1	1	15	100	400
		2	15	50	400
		4	30	50	400
006	1, sometimes > 1	1	15	100	400
		2	15	50	400
		4	30	50	400
007	always < 1	1/2	15	200	400
		1	15	100	400
		2	15	50	400
010	always <1	1/2	15	200	400
		1	15	100	400
		2	15	50	400
011	~2	1	15	100	400
		2	15	50	400
		4	30	50	400

mL - Milliliter

FIGURES



Please Note: The original version of this figure includes colorized features and shading. A black and white copy of this figure should not be used because it may not accurately represent the information presented.

MWH

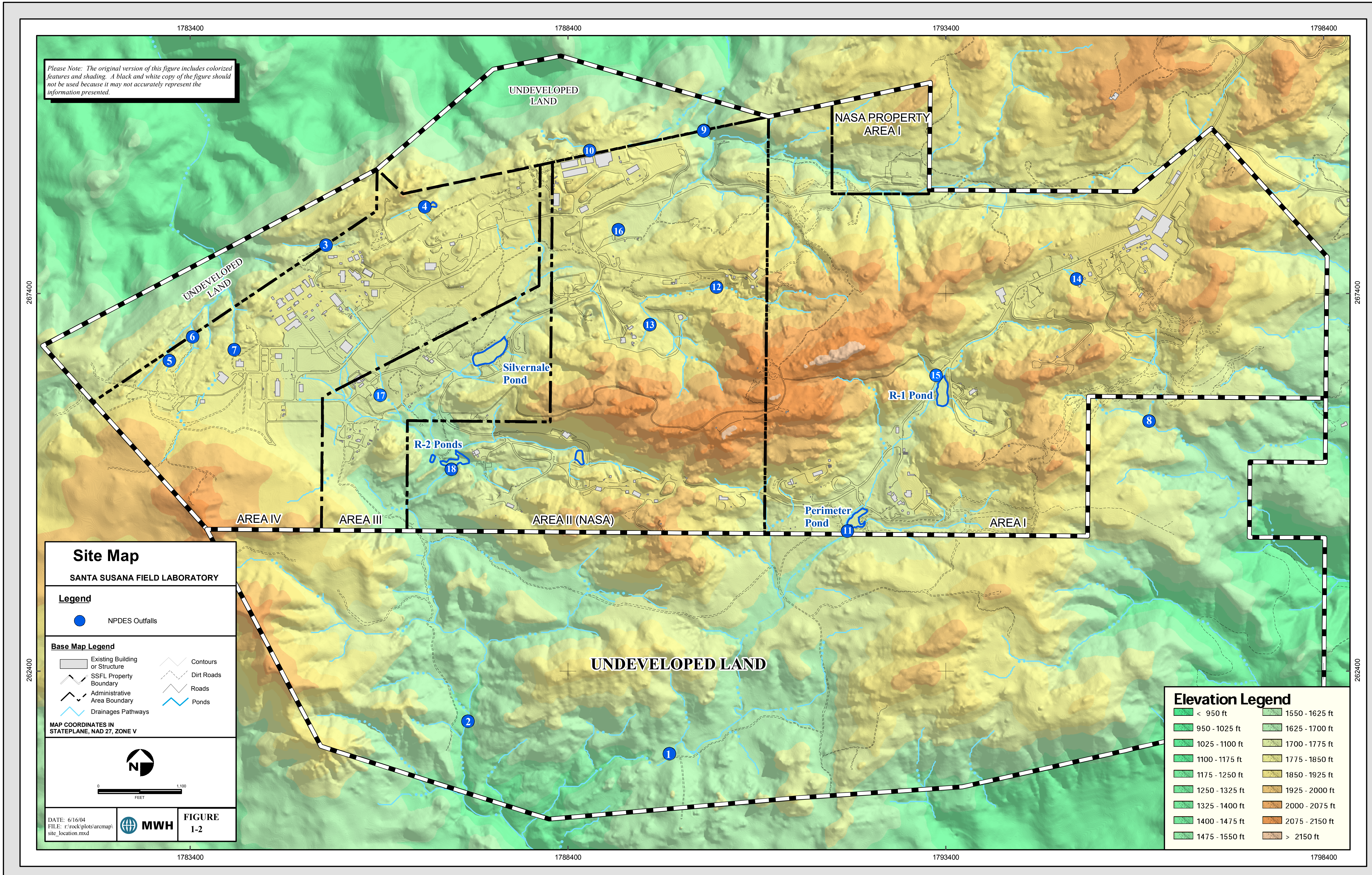
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
MARCH 2006

SITE LOCATION MAP

FIGURE 1–1

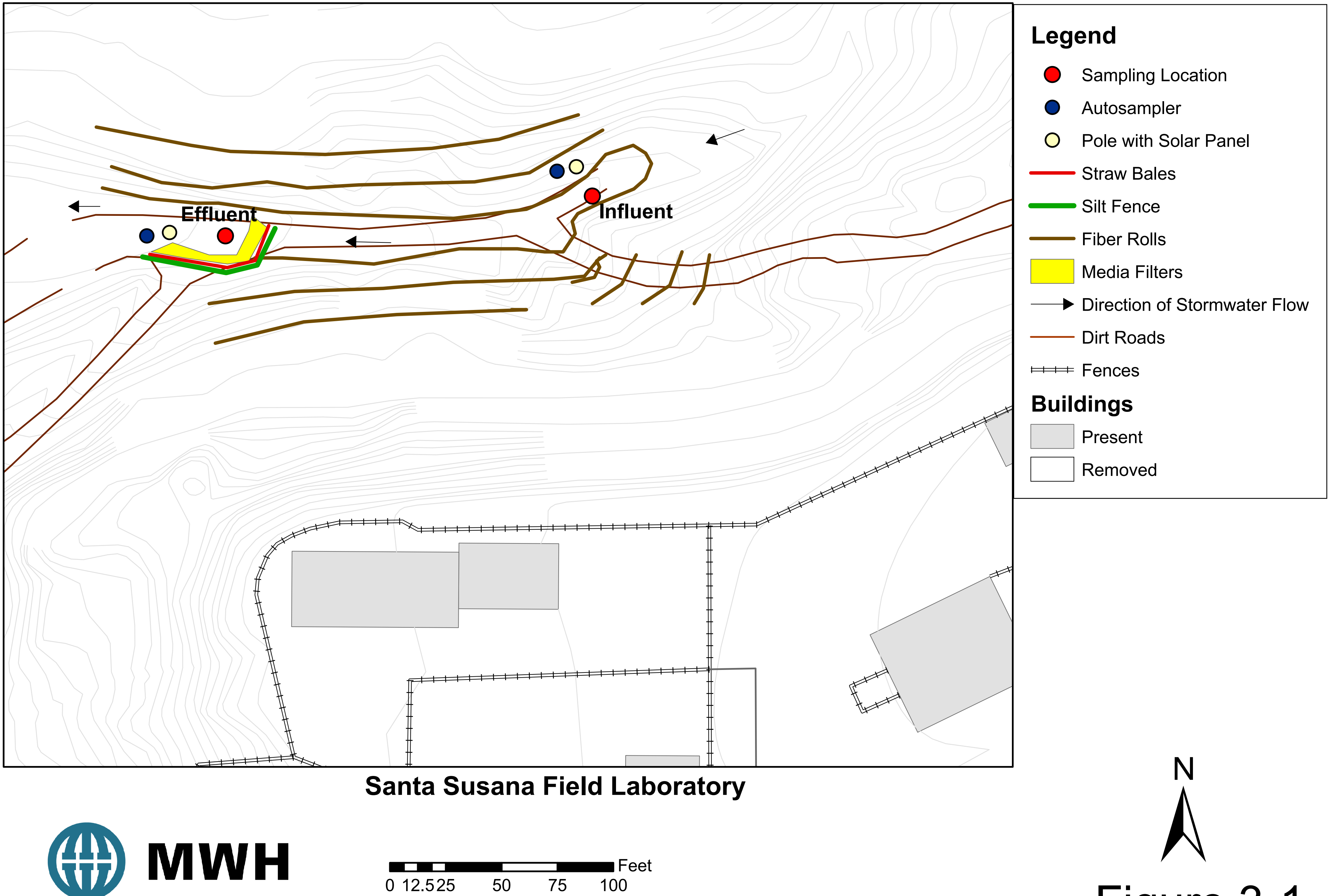
JOB No.

FILE: INDSVR\INDUSTRIAL\CAD MLUEBKE\BOEING\SANTA SUSANA\SWPP\SITE LOCATION 3 06



Please Note: The original version of this figure includes colorized features and shading. A black and white copy of the figure should not be used because it may not accurately represent the information presented.
1783400
1788400
1793400
1798400
267400
262400
UNDEVELOPED LAND
UNDEVELOPED LAND
NASA PROPERTY AREA I
UNDEVELOPED LAND
Silvernale Pond
R-1 Pond
R-2 Ponds
Perimeter Pond
AREA IV
AREA III
AREA II (NASA)
AREA I
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Site Map
SANTA SUSANA FIELD LABORATORY
Legend
NPDES Outfalls
Base Map Legend
Existing Building or Structure
SSFL Property Boundary
Administrative Area Boundary
Drainages Pathways
Contours
Dirt Roads
Roads
Ponds
MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V
N
0
1,100
FEET
DATE: 6/16/04
FILE: r:\rock\plots\arcmap\site_location.mxd
MWH
FIGURE 1-2
Elevation Legend
< 950 ft
950 - 1025 ft
1025 - 1100 ft
1100 - 1175 ft
1175 - 1250 ft
1250 - 1325 ft
1325 - 1400 ft
1400 - 1475 ft
1475 - 1550 ft
1550 - 1625 ft
1625 - 1700 ft
1700 - 1775 ft
1775 - 1850 ft
1850 - 1925 ft
1925 - 2000 ft
2000 - 2075 ft
2075 - 2150 ft
> 2150 ft

Outfall 003 Sample Locations



MWH

Figure 3-1

Outfall 004 Sample Locations

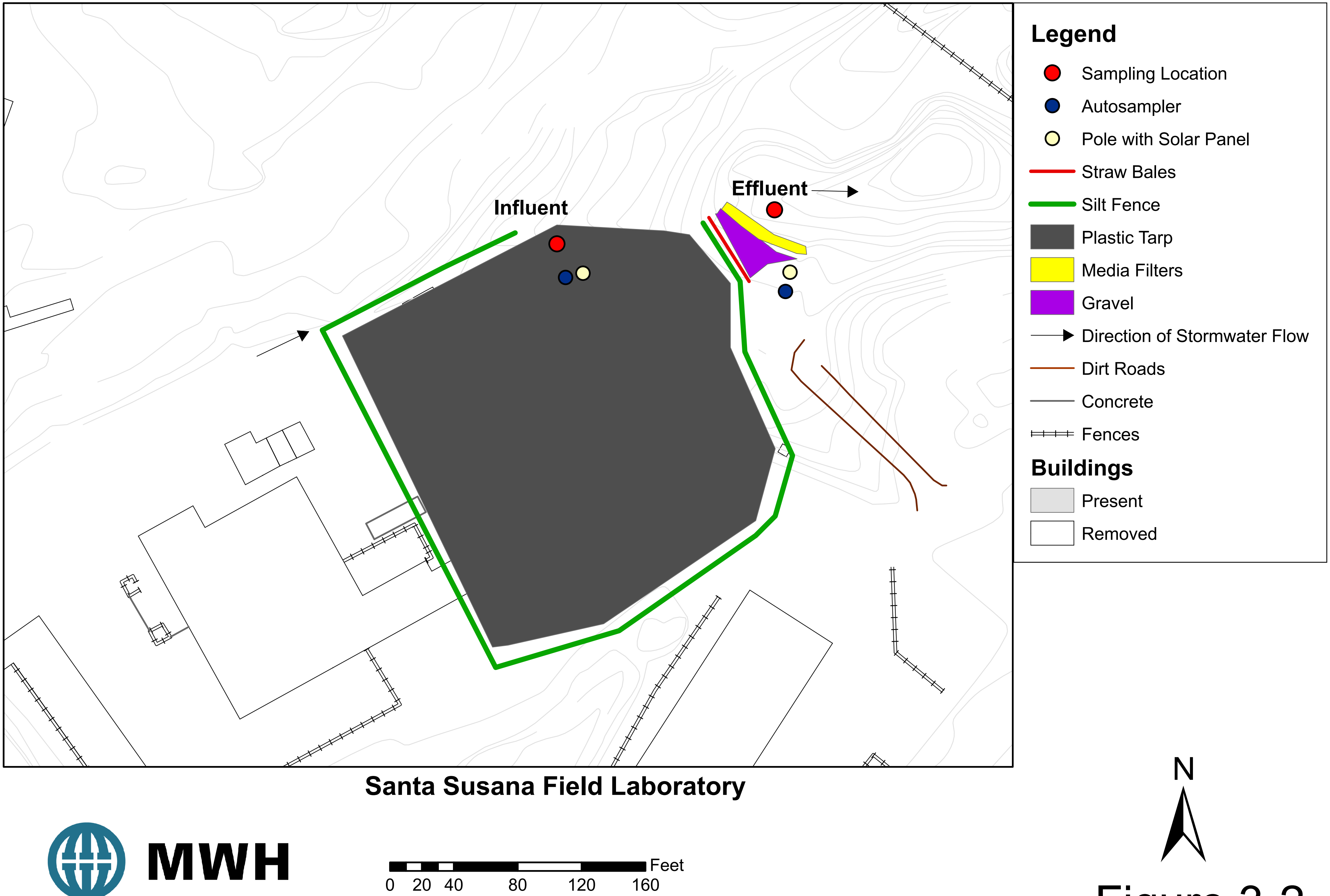
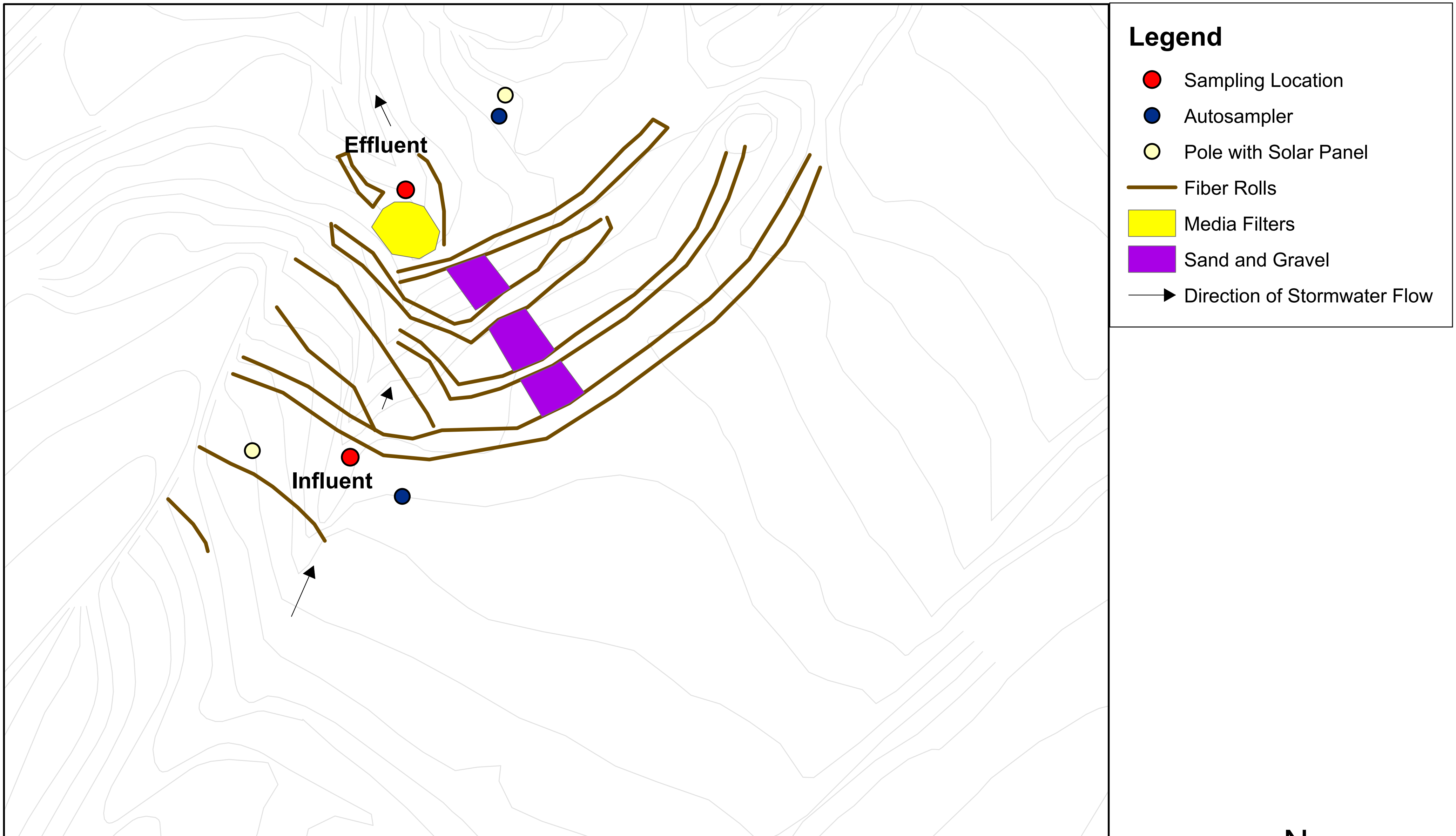


Figure 3-2

Outfall 005 Sample Locations



Santa Susana Field Laboratory

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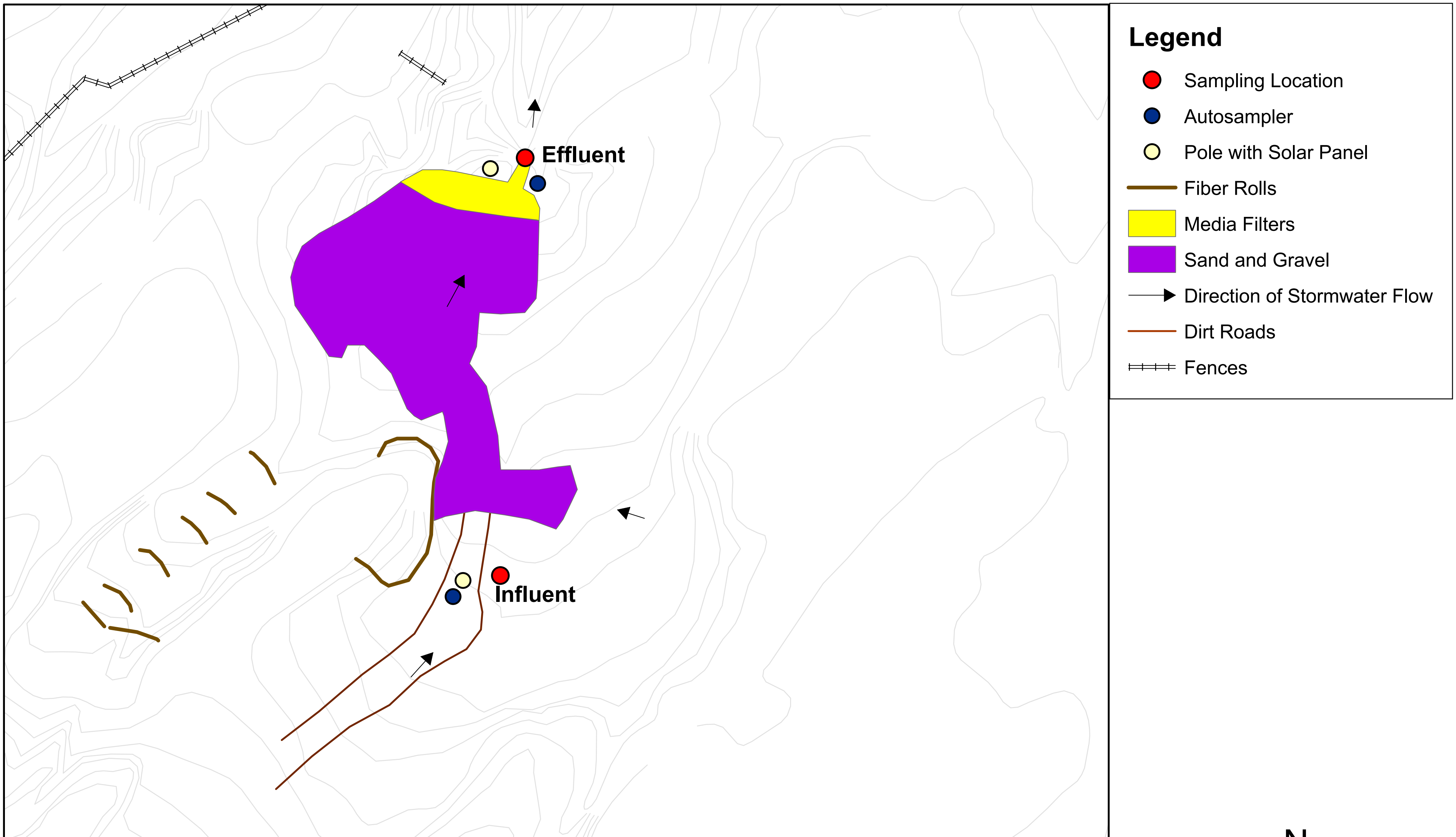
Feet
0 12.5 25 50 75 100

N

Figure 3-3

Outfall 006 Sample Locations



Santa Susana Field Laboratory

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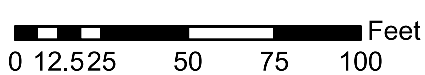


N

Figure 3-4

Outfall 007 Sample Locations

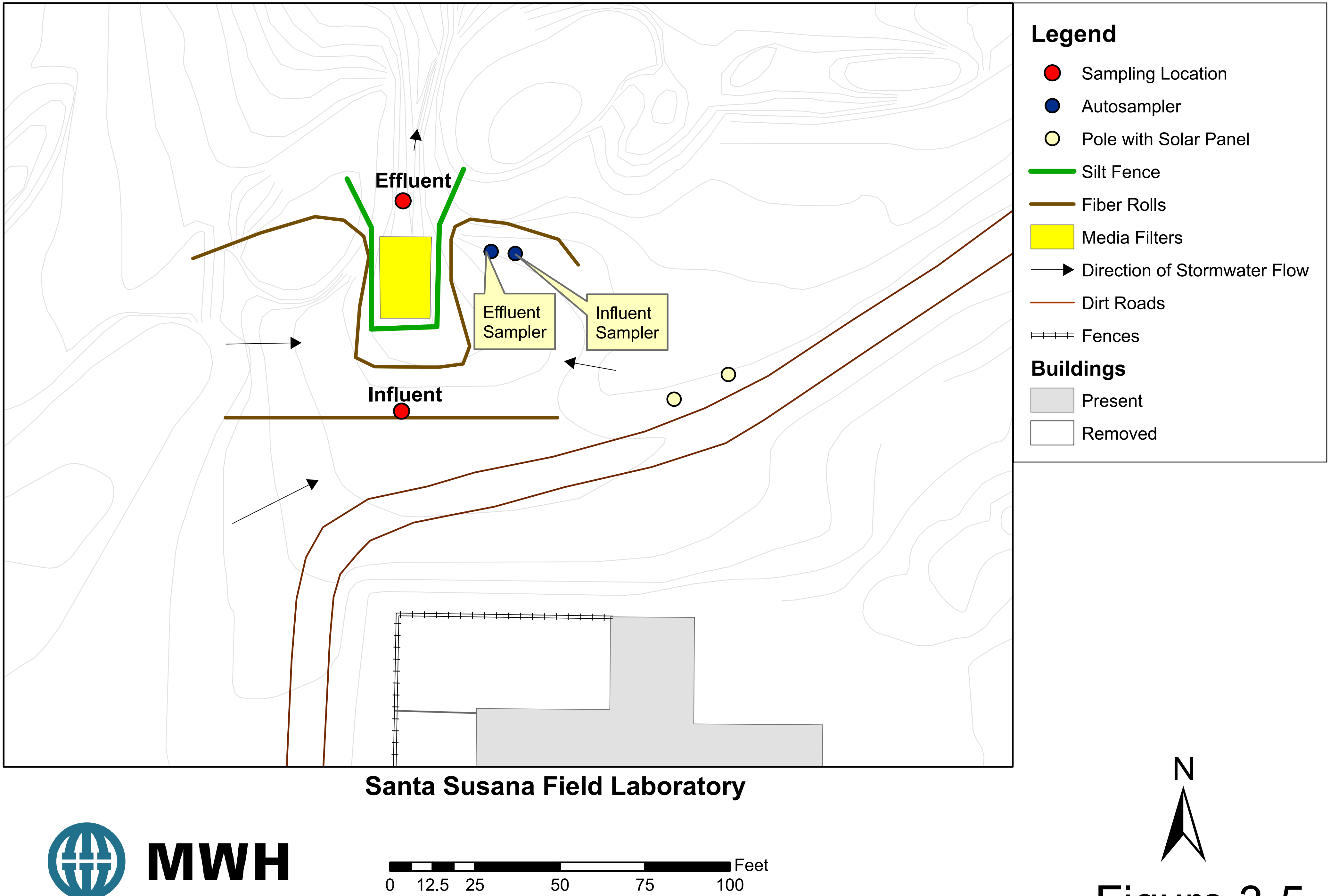


Figure 3-5

Outfall 010 Sample Locations

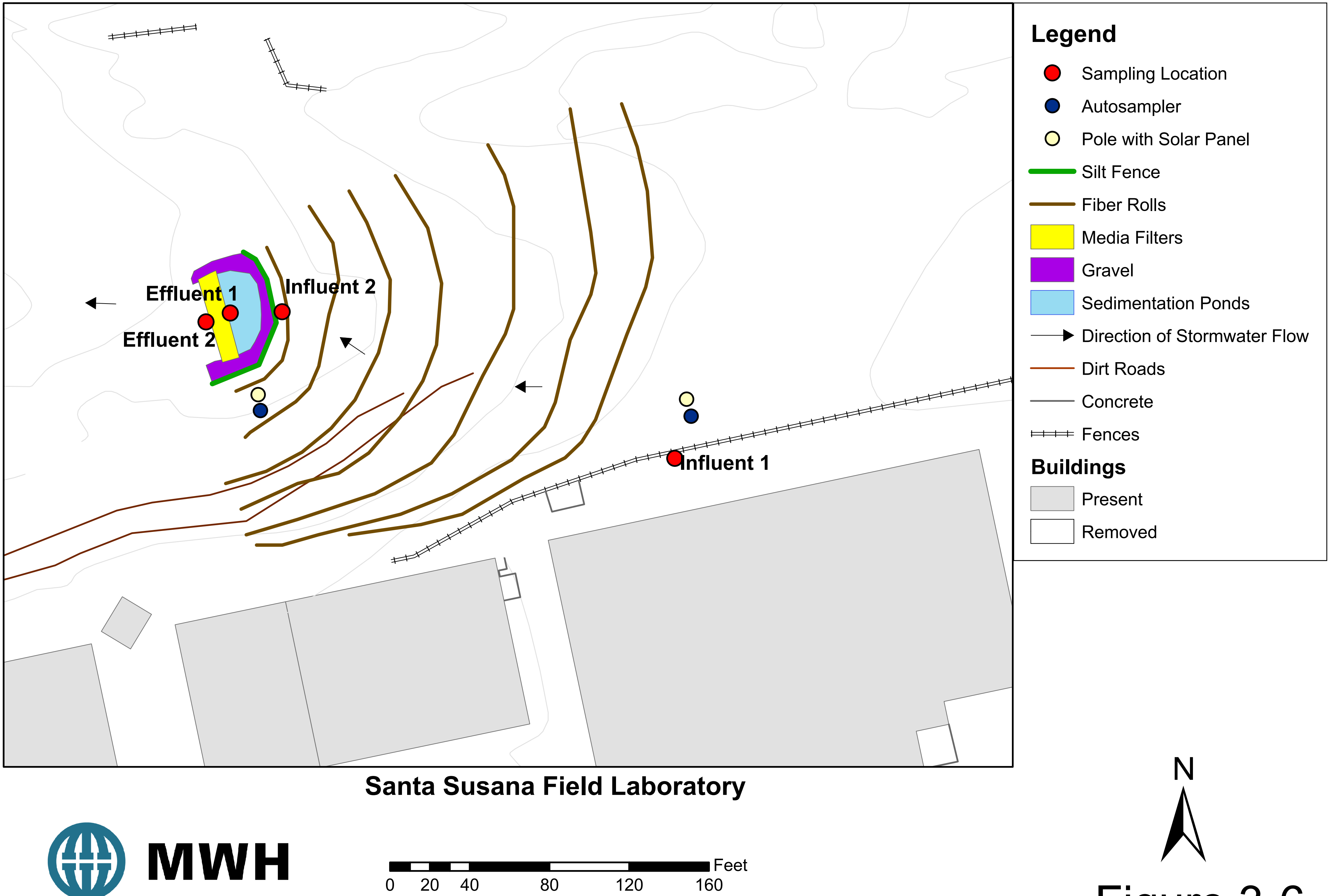
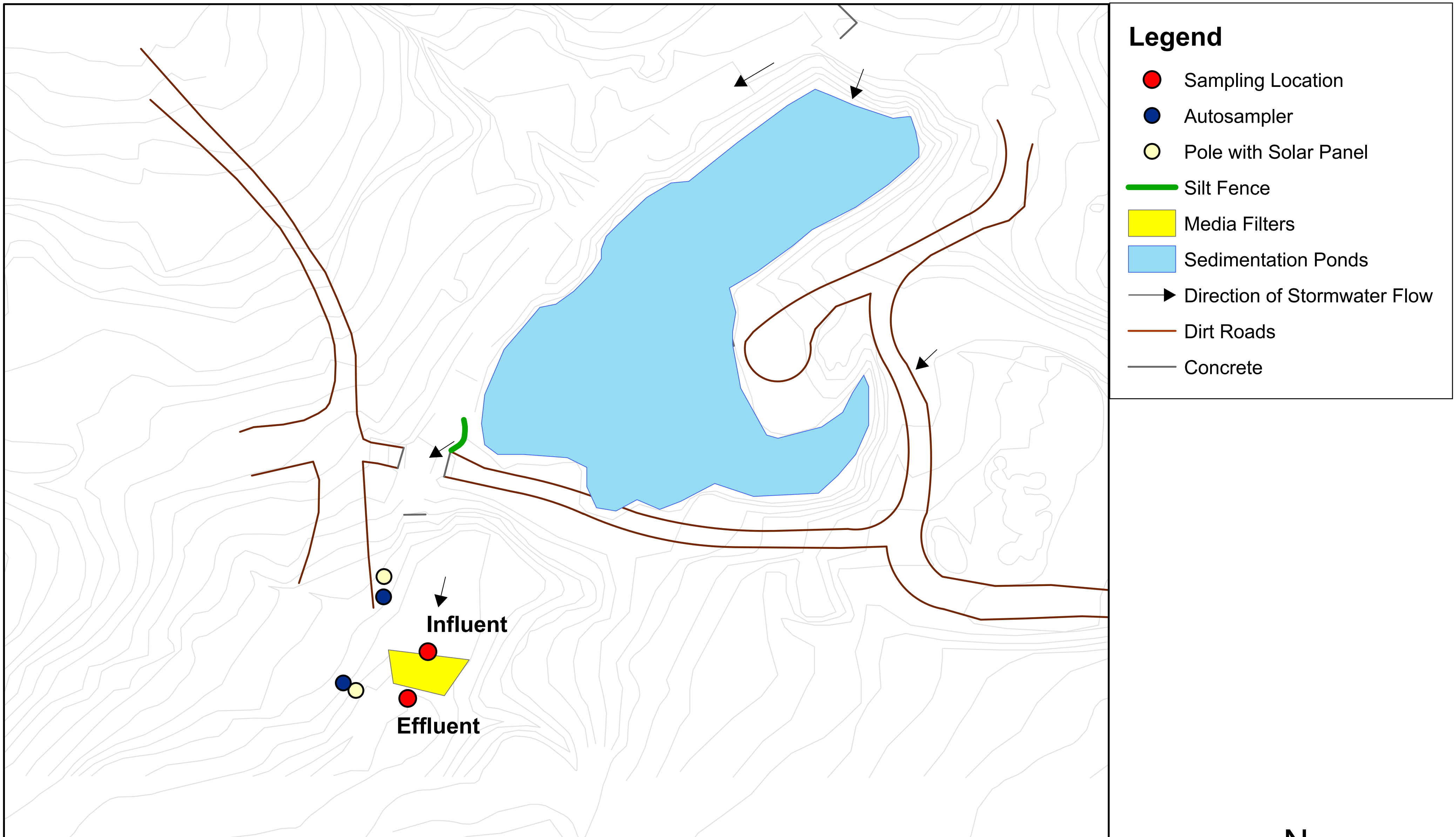


Figure 3-6

Outfall 011 Sample Locations



Santa Susana Field Laboratory

MWH

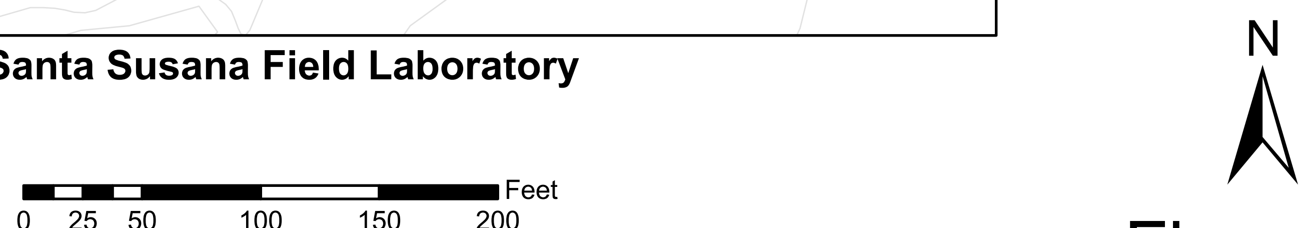
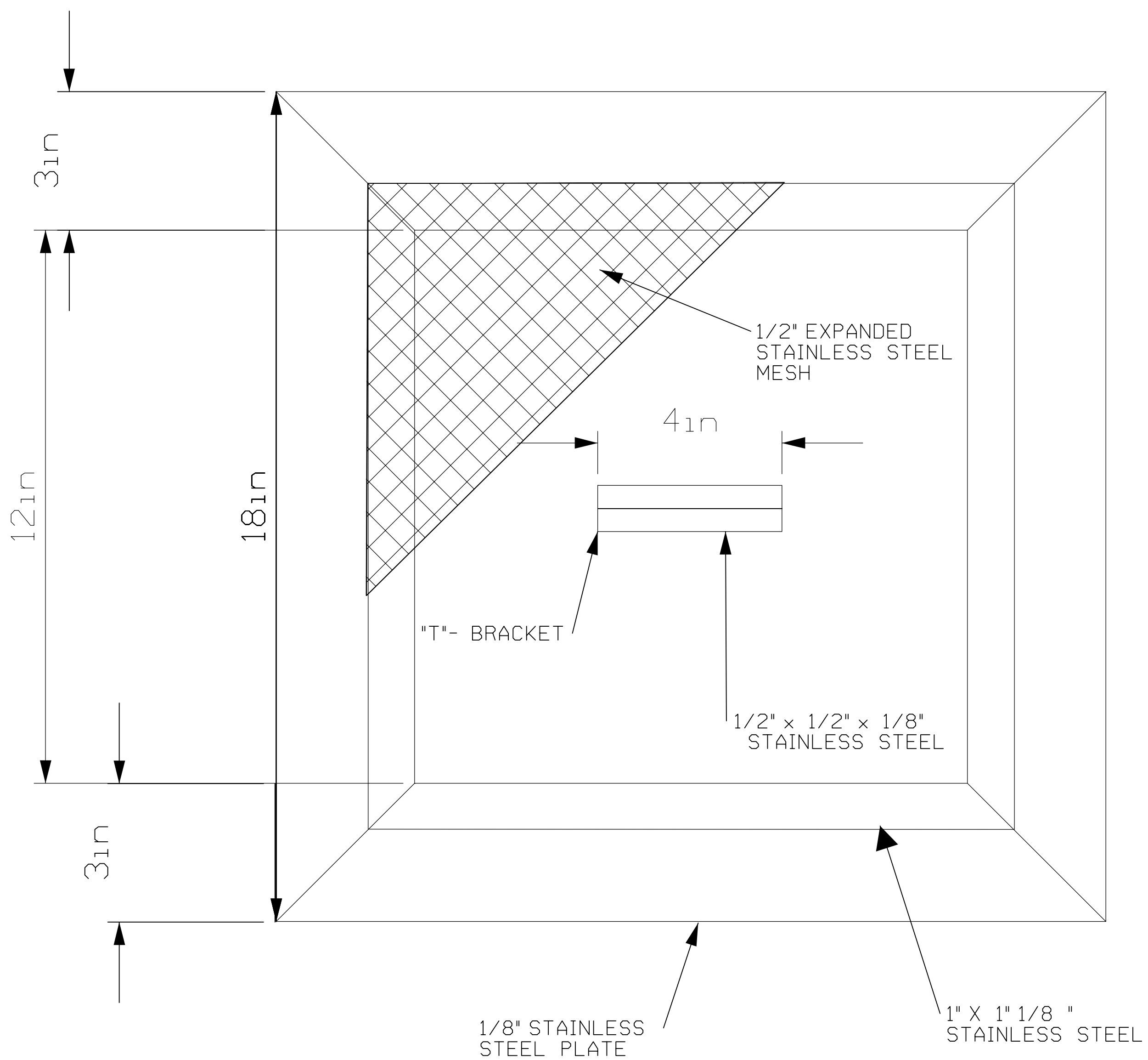
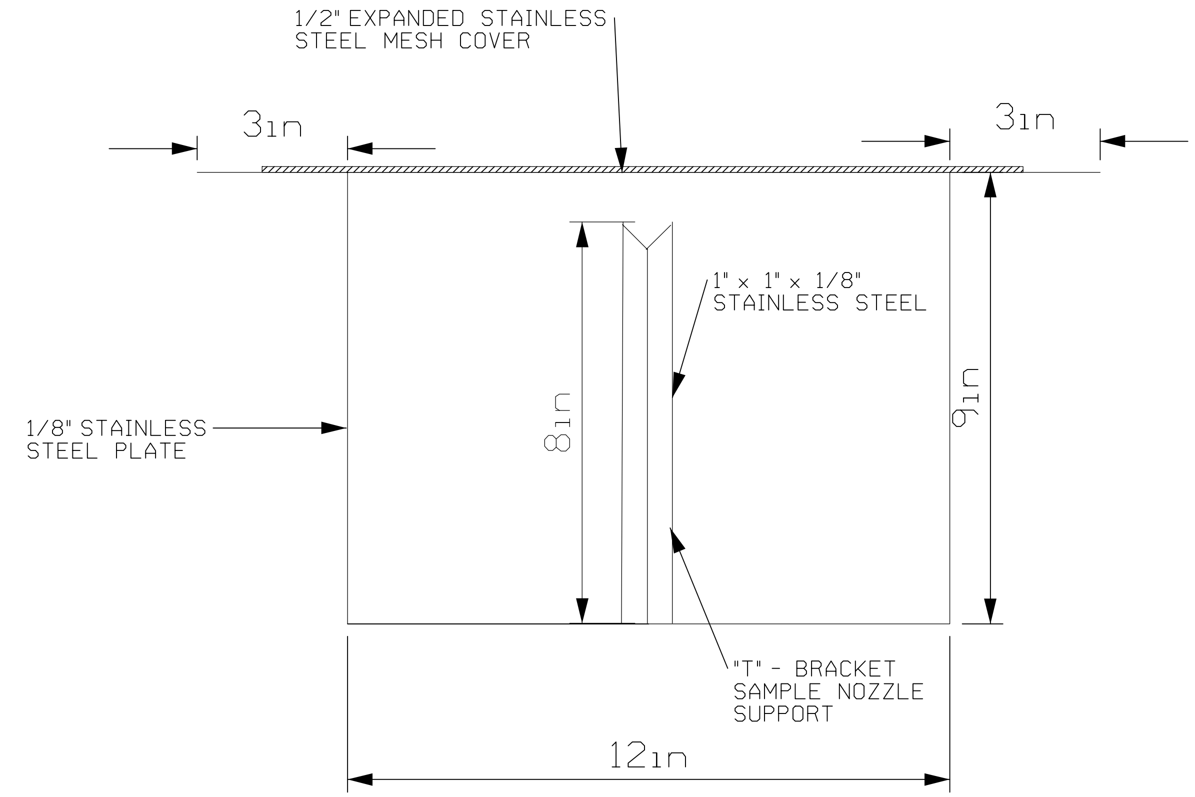


Figure 3-7



PLAN VIEW

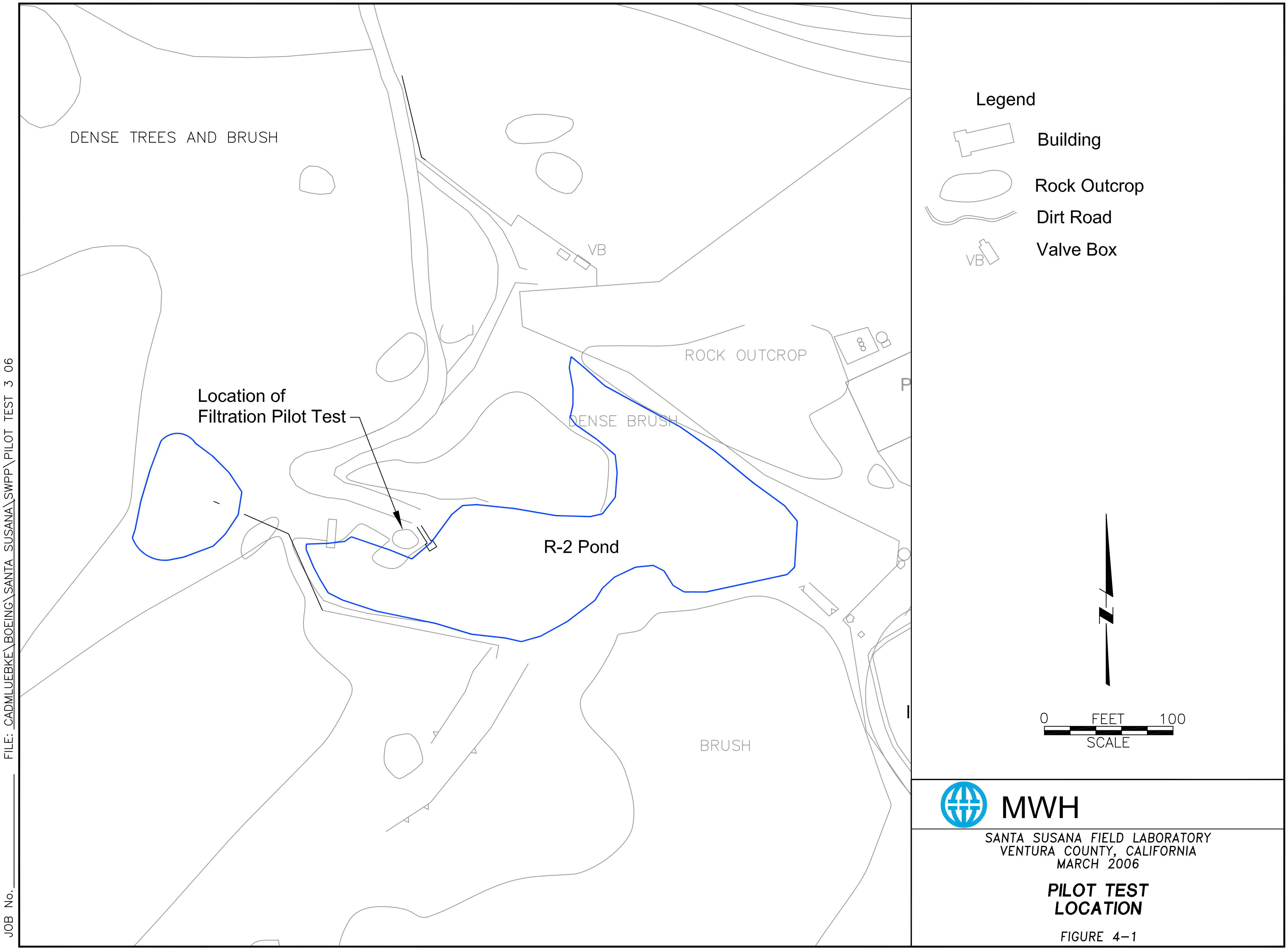


SECTION VIEW

NOTE: 1/8-INCH THICKNESS STAINLESS STEEL PLATE CONSTRUCTION- WITH THE ADDED 3-INCH LAB AROUND PERIMETER, STRUCTURAL STRENGTH SHOULD BE MORE THAN ADEQUATE.

MWH

FIGURE 3-8
STORMWATER BMP SAMPLE COLLECTION STATION



MWH

SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
MARCH 2006

PILOT TEST LOCATION

FIGURE 4-1

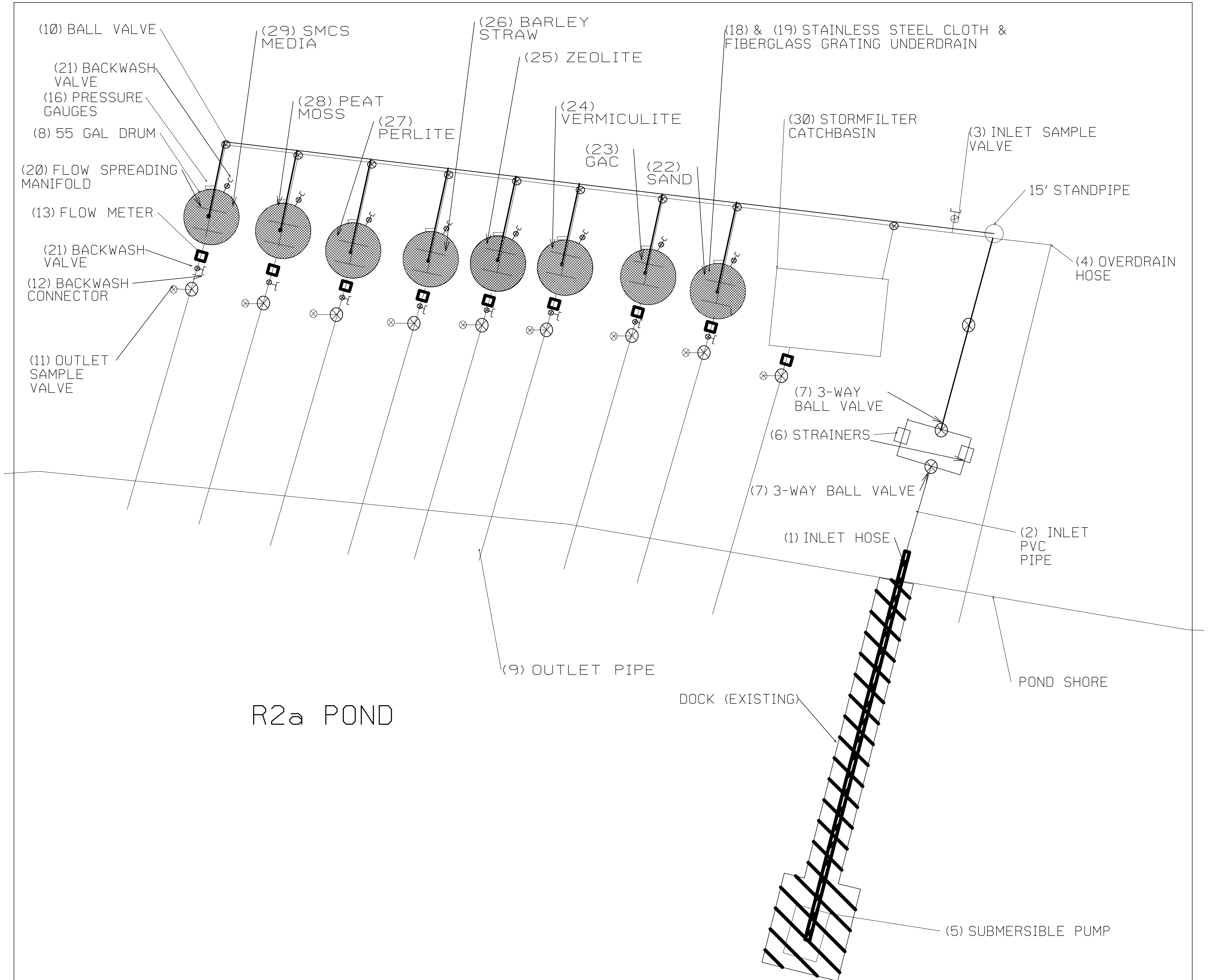


FIGURE 4-2
FILTRATION PLAN VIEW

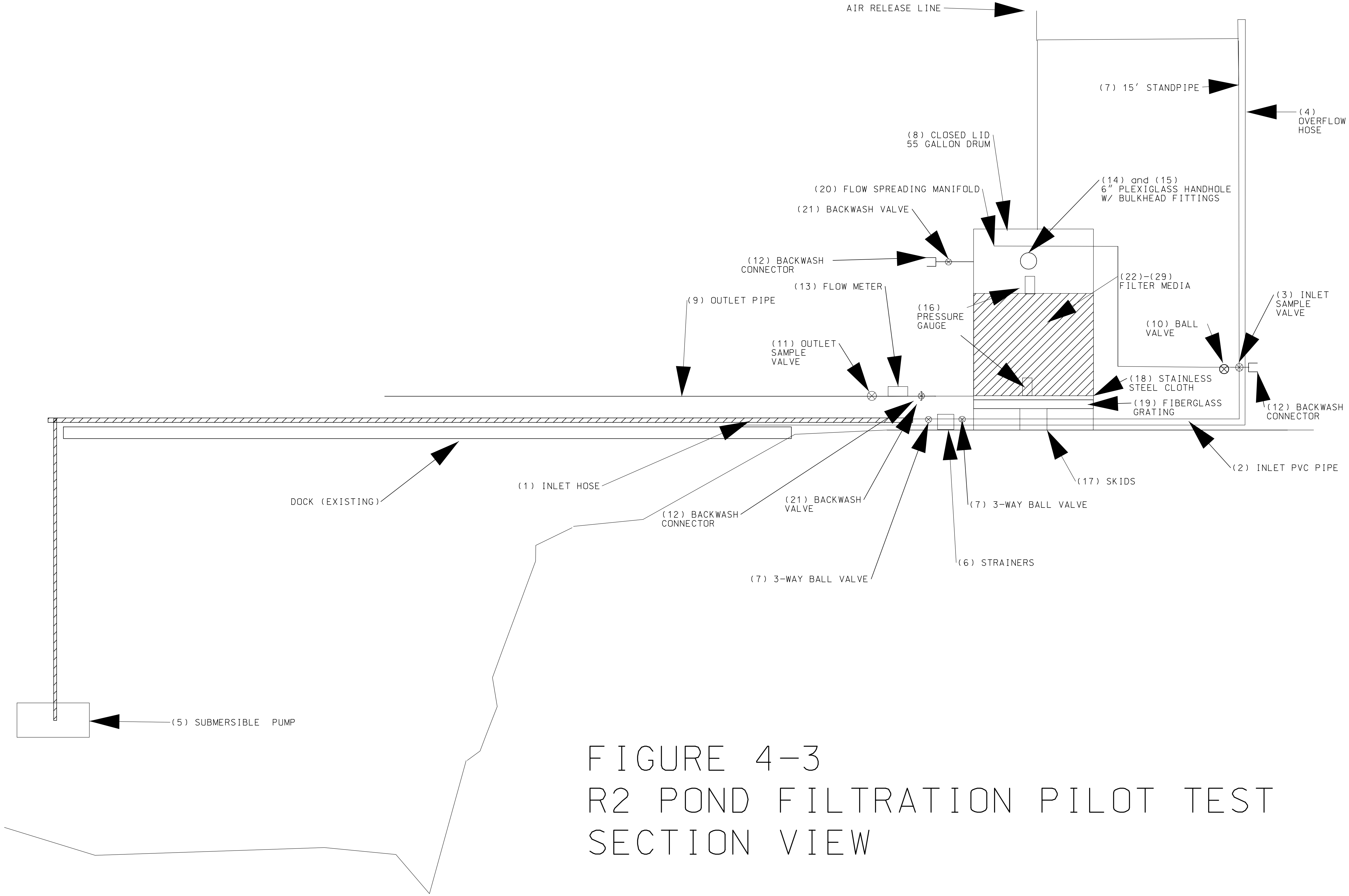


FIGURE 4-3
R2 POND FILTRATION PILOT TEST
SECTION VIEW

APPENDIX A

PHOTOS OF AUTOSAMPLERS

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 1 **Date:** May 10, 2006 **Location:** Outfall 003: **Direction:** Looking North **Comments:** View of influent sample location.	
Photograph ID: 2 **Date:** May 10, 2006 **Location:** Outfall 003: **Direction:** Looking East **Comments:** View of effluent sample location.	

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 3

Date: Apr 24, 2006

Location:
Outfall 004:

Direction:
Looking Northeast

Comments:
View of influent sample location.

Photograph ID: 4

Date: May 10, 2006

Location:
Outfall 004:

Direction:
Looking Northwest

Comments:
View of effluent sample location.

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 5

Date: Apr 24, 2006

Location:
Outfall 005:

Direction:
Looking South

Comments:
View of influent sample location.

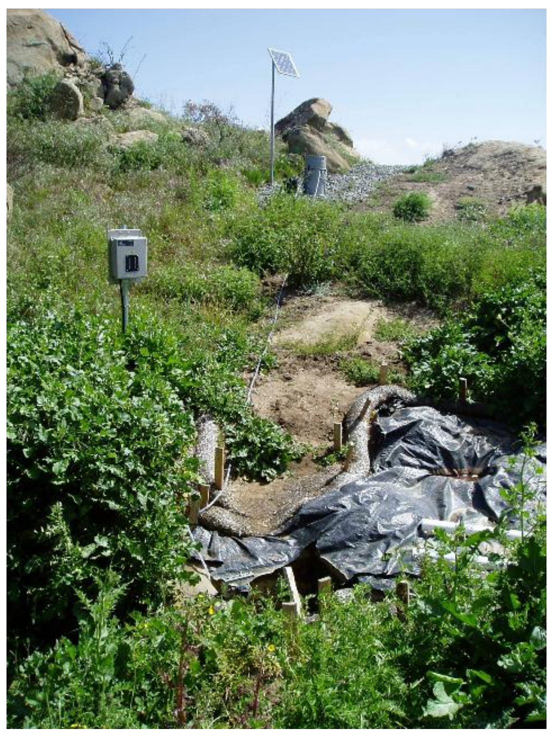
Photograph ID: 6

Date: May 10, 2006

Location:
Outfall 005:

Direction:
Looking Northeast

Comments:
View of effluent sample location.



Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 7

Date: May 10, 2006

Location:
Outfall 006:

Direction:
Looking South

Comments:
View of influent sample location.

Photograph ID: 8

Date: May 10, 2006

Location:
Outfall 006:

Direction:
Looking Southeast

Comments:
View of effluent sample location.

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 9

Date: May 10, 2006

Location:
Outfall 007:

Direction:
Looking Northeast

Comments:
View of influent sample location.

Photograph ID: 10

Date: May 10, 2006

Location:
Outfall 007:

Direction:
Looking Southeast

Comments:
View of effluent sample location.

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

Photograph ID: 11 **Date:** Apr 24, 2006 **Location:** Outfall 010: **Direction:** Looking Southwest **Comments:** View of influent sample location.	
Photograph ID: 12 **Date:** Apr 24, 2006 **Location:** Outfall 010: **Direction:** Looking North **Comments:** View of effluent sample location.	

Customer:	**Boeing**	**Project Number:**	
Site Name:	**Santa Susana Field Laboratory**	**Site Location:**	**Ventura Co, California**

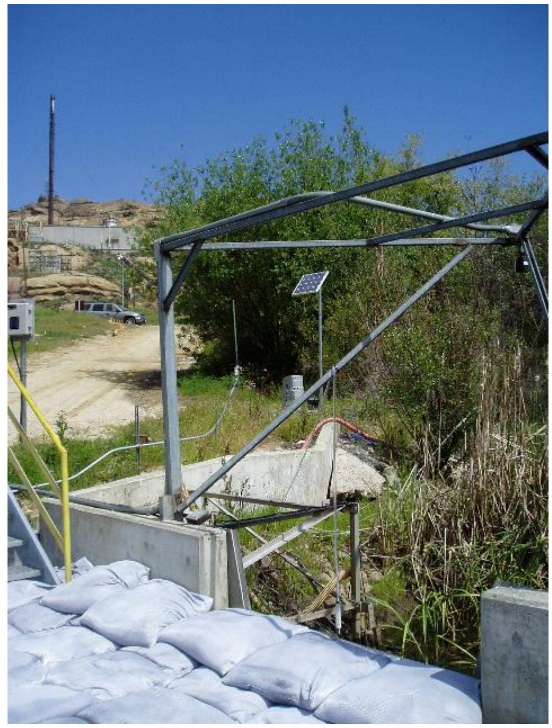
Photograph ID: 13

Date: Apr 24, 2006

Location:
Outfall 011:

Direction:
Looking Northwest

Comments:
View of influent sample location.



Photograph ID: 14

Date: Apr 24, 2006

Location:
Outfall 011:

Direction:
Looking Northwest

Comments:
View of effluent sample location.

APPENDIX B

SAMPLING AND ANALYSIS PLAN

APPENDIX B

SAMPLING AND ANALYSIS PLAN

This document presents the Sampling and Analysis Plan (SAP) for monitoring and evaluating Best Management Practices (BMPs) at the Santa Susana Field Laboratory (SSFL), located in Simi Hills, Ventura County, California (Site). Samples will be collected at the Site for water quality analysis for the purposes of evaluating the effectiveness of BMPs only. Monitoring of surface water discharges from the Site is currently conducted under Waste Discharge Requirements (Order No. R4-2006-0008) which serve as a National Pollutant Discharge Elimination System (NPDES) permit (Number CA0001309) and Monitoring and Reporting Program (MRP No. 6027).

Proper sample preparation and handling procedures maintain sample integrity. Improper handling can render samples unsuitable for analysis. The purpose of this SAP is to aid the sampler(s) in collecting high quality representative water samples to evaluate BMP effectiveness.

B.1 SAMPLE COLLECTION PROCEDURES

To achieve the purpose and objectives of BMP effectiveness, only personnel trained in proper water quality sampling will collect samples. The sampler(s) will have an adequate stock of sampling supplies, including, but is not limited to, surgical gloves, sample collection equipment (i.e. buckets, scoops, separate bottles), sample coolers, sample bottles, sample labels, plastic bags, paper towels, personal rain gear, blue ice, sample documentation forms, and Chain-of-Custody (COC) forms. Sampler(s) will have a thorough understanding of each scope of work and will have reviewed the Health and Safety Plan.

B.1.1 Field Instrument Calibration

If field instrument(s) are needed, they will be maintained in accordance with the manufacturer's instructions and will be calibrated before each sampling event and at least once per day. Maintenance and calibration records will be maintained daily in the field notes (See Section B.2.1.1 below).

B.1.2 Sample Bottles and Preservatives

Only certified clean sample bottles from a laboratory or from a vendor shall be used for sampling. Using certified sample bottles ensures a properly decontaminated and clean sample bottle that will not inhibit sample integrity. In some cases, sample bottles may be re-used, such as Isco autosampler bottles, however, they must be decontaminated by the laboratory prior to sample collection. Chemical preservatives, if required, will be added to the sample bottles prior to sample collection by the laboratory. After collection, samples will be placed in an ice-chilled cooler immediately after collection and during shipment to minimize the transformation of contaminants through biodegradation or reaction while awaiting laboratory analysis.

B.1.3 Sample Collection and Handling

Water quality samples will be collected using one of the following methods:

- Place a sample bottle directly into the water flow path and allow the sample bottle to fill completely without spilling preservatives (if any); or
- Place a decontaminated bucket, bailer, scoop, unpreserved separate sample bottle, or other collection device in the water flow path and transferring the collected water to appropriate sample bottles, allowing the sample bottles to fill completely without spilling preservatives (if any).

Water samples will not be collected directly from ponded, sluggish, or stagnant water, to the extent as possible, as it may not be representative of the sampling purpose. Sample frequencies will be noted during each scope of work, however, frequencies may change based upon results and/or changes in technical objectives.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel shall:

- Wear a clean pair of surgical gloves prior to the collection and handling of each sample at each location.
- Not contaminate the inside of the sample bottle by allowing it to come into contact with any material other than the water sample.
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection.
- Not leave the cooler lid open for an extended period of time once samples are placed inside.
- Not sample near a running vehicle where exhaust fumes may impact the sample.
- Not touch the exposed end of a sampling tube, if applicable.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Not eat, smoke, or drink during sample collection.
- Not sneeze or cough in the direction of an open sample bottle.
- Minimize the exposure of the filled sample bottles to direct sunlight, as sunlight may cause biochemical transformation of the sample to take place.

B.1.4 Sample Packaging

Immediately following collection, sample bottles for laboratory analytical testing will be capped, labeled, documented on the COC form and field notes, sealed in a plastic bag, placed in an ice-chilled cooler, at as near to 4 degrees Celsius, and delivered to a California state-certified laboratory.

B.1.5 Decontamination Procedures

All equipment that comes into contact with potentially contaminated soil or water will be decontaminated to ensure that each sample is collected in a consistently clean and quality-oriented manner. Disposable equipment intended for one time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. Decontamination liquids shall be collected and disposed of properly. All sampling devices will be decontaminated using the following procedures:

- Wash with a non-phosphate detergent, using a brush if necessary;
- Rinse with tap water;
- Initial rinse with deionized water;
- Final rinse with deionized water.
- Note: wipe after each step above with disposable low-lint KimWipes, if necessary.

If samples are to be analyzed for metals, sampling equipment will be decontaminated using the following procedures:

- Wash with a non-phosphate detergent, using a brush if necessary;
- Rinse with tap water;
- Rinse with deionized water;
- Rinse with 10% Nitric Acid;
- Triple rinse with deionized water;
- Rinse with Isopropanol;
- Triple rinse with deionized water.
- None: wipe after each step above with disposable low-lint KimWipes, if necessary.

B.1.6 Investigative Waste Management

In the process of collecting environmental samples during the proposed field sampling program, different types of potentially contaminated investigation-derived wastes (IDW) may be generated that including, used personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids.

Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.

Decontamination water will be placed in 5-gallon buckets. The buckets will be labeled and sealed so that they are watertight, pending receipt of analytical results. Following receipt of analytical results, all decontamination water will be disposed of as appropriate (sanitary sewer if nondetect analytical results or disposal/treatment/recycling facilities if analytical results indicate detectable levels of compounds).

B.2 QUALITY ASSURANCE AND QUALITY CONTROL

The following quality assurance and quality control (QA/QC) procedures will verify that proper documentation, field checks, and laboratory analyses are utilized during implementation of the BMP effectiveness study.

B.2.1 FIELD DOCUMENTATION

B.2.1.1 Field Notes

Field notes will document where, when, how, and from whom any vital project information was obtained. Entries will be complete and accurate enough to permit reconstruction of field activities. Each page of the field notes will be dated and the time of entry noted in military time. All entries will be legible, written in indelible ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology, which might prove inappropriate. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable. All field notebooks will be hard-bound with pages permanently affixed within the binding. No loose leaf, spiral bound, 3-ring binder, comb bound, or any other type of unbound or removal page-binding will be used for field notes.

Entries in the field notes will include at a minimum the following for each sample date:

- Site name and address;
- Team members;
- Time of site arrival/entry on site and time of site departure;
- Other personnel onsite;
- A summary of any onsite meetings;
- Deviations from sampling plans and Site safety plans;
- Changes in personnel and responsibilities as well as reasons for the changes; and

- Calibration readings for any equipment used.
- At a minimum, the following information will be recorded during the collection of each sample:

  - Sample identification number;
  - Date and time of sample collection;
  - Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.); and
  - Instrument data readings (e.g., PID, etc.).

B.2.1.2 Sample Labels

Sample labels will include:

- Project name and/or number;
- Site name;
- Sample identification number (see each scope of work for labeling ID procedures;
- Sampler's initials;
- Date and time of collection; and,
- Preservative, if any.

B.2.1.3 Chain-of-Custody Records

Chain-of-custody (COC) records are used to document sample collection and shipment to laboratory for analysis. All sample shipments for analyses will be accompanied by a COC record. COC form(s) will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, COC form(s) will be completed and sent with the samples for each cooler. The COC record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until receipt by the laboratory or laboratory courier, the custody of the samples will be the responsibility of the sample collector.

B.2.2 Field Quality Control Samples

Field quality control samples will be collected and analyzed to check the quality of field sampling, equipment decontamination procedures, and potential contamination to samples during transportation. QA/QC samples will be collected, assigned individual sample numbers, and submitted blind to the analytical laboratory. QA/QC samples will be analyzed using the same methodology as the original samples. The following QA/QC samples will be collected:

- Duplicate Water Samples: Collect one sample for every 10 original samples.
- Trip Blanks: Submit one trip blank for every sample cooler containing samples for volatile organic compounds (VOC) analysis. Trip blanks will be supplied by the laboratory.
- Temperature Blanks: Submit one with every cooler. Temperature blanks will be supplied by the laboratory.

See each scope of work for QC sample ID labeling procedures and if QA/QC shall be conducted.

B.2.3 Laboratory Quality Control Samples

The laboratory will perform analyses in accordance with QA/QC protocols designed by the laboratory to verify and maintain the desired level of quality in the analytical process. Laboratory quality control samples will consist of laboratory blanks, laboratory control samples (spiked samples), duplicate laboratory control samples (duplicate spiked samples), and matrix spike/matrix spike duplicates (MS/MSDs).

B.2.4 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this Workplan. When appropriate, modifications to the approved plan will be documented.

B.3 DATA EVALUATION

During the BMP studies, a variety of data will be collected to meet the objectives of the Workplan. Each sample collected may be analyzed for a number of different chemicals, depending on the rationale for sample collection. Data collected will be evaluated to determine if the existing BMP in place at each Outfall location is effective in removing unwanted constituents from the influent stream or to determine if new technology BMPs will remove constituents.

B.3.1 Evaluation of Analytical Results

Analytical results reported by the laboratory may be sent to a third party to be validated. If validated, the data validator will perform Level IV data validation on the data and will inform the laboratory if there are any major "issues" existing with the data. If there are “issues,” the laboratory may correct the data or the data validator will note “issues” in their data validation report, if it cannot be corrected. Upon completion of validation, the data validator will supply validation codes and validation information.

B.3.2 Evaluation of Qualified Data

For analytical results, various qualifiers pertaining to the quality of the data are attached to certain data by either the laboratories conducting the analysis or by persons conducting the data evaluation. All qualifiers will be included when reporting the data when validation is to be conducted.

B.3.3 Evaluation of Blanks

Blank samples will be analyzed to determine whether contamination has been introduced into a sample set either: (1) in the field while the samples were collected or transported to the laboratory, or (2) in the laboratory during sample preparation and analysis. To prevent inclusion of non-site-related contaminants in the screening evaluation, the concentrations of the chemicals detected in the blanks will be compared to the concentrations of the same chemicals detected in the Site samples.

If the blank contains detectable concentrations of common laboratory contaminants (acetone, 2-butanone, methylene chloride, toluene, and phthalate esters), the sample results will be considered as positive results only if the concentrations in the sample exceed 10 times the maximum amount detected in any blank. If the concentration of a common laboratory contaminant is less than 10 times the concentration detected in the blank, then it will be concluded that the chemical was not detected in the particular sample above a quantitation limit equal to blank concentration. If all samples contain levels of a common laboratory contaminant that are less than 10 times the level of contamination noted in the blank, then the chemical will be eliminated from use in the screening evaluation. If the blank contains detectable concentrations of chemicals that are not common laboratory contaminants, then the above considerations apply; however, the sample concentrations are compared to five times the concentration detected in the blank.

BEST MANAGEMENT PRACTICES IMPLEMENTATION REPORT

FOR

SANTA SUSANA FIELD LABORATORY

Prepared for:

THE BOEING COMPANY
SANTA SUSANA FIELD LABORATORY

Prepared by:

MWH
300 N. LAKE AVENUE
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September 2006

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LIST OF FIGURES

1.0 INTRODUCTION

The Boeing Company (Boeing) is committed to implementing an iterative Best Management Practice (BMP) approach to pursue surface water discharge compliance objectives defined by their NPDES permit obligations. This approach was described in the 13267 Technical Report, submitted by Boeing to the Regional Water Quality Control Board (RWQCB) on December 16, 2005 (Boeing 2005). Also pursuant to the 13267 Technical Report, Boeing prepared a BMP Effectiveness Sampling Workplan (Workplan) in May 2006 (MWH 2006). The activities described in the Workplan were substantially implemented during the summer of 2006 and are being incorporated into BMP upgrades. The majority of these upgrades will be substantially complete by October 15, 2006 and will be finished no later than end of the year, pursuant to the 13267 Technical Report.

The recent efforts to upgrade and improve BMP performance included a preliminary hydrological study, a filtration pilot test and a BMP Effectiveness Monitoring Program. These efforts served to monitor and evaluate current BMPs installed at several Outfall locations onsite in order to implement pilot tests of new BMP technologies. Based on preliminary results from the hydrologic study, filtration pilot test and BMP Effectiveness Monitoring Program, new BMP upgrades at several Outfalls onsite have been designed and are currently undergoing construction. Boeing is providing this document as an annual BMP implementation report that summarizes the current BMP maintenance and upgrades. This BMP Upgrade Report provides preliminary draft plans and specifications and describes current developments in the construction of the new BMP upgrades.

Since new BMP upgrades are currently in the construction phase, all plans, specifications and drawings are preliminary drafts. Ongoing changes to these preliminary drafts have occurred as field conditions dictate throughout the course of BMP upgrade construction.

In addition to the structural BMP upgrades described in this report, as a precautionary measure, Boeing has emplaced runoff control devices and erosion control measures site wide, where appropriate, to mitigate the movement of constituents into the watershed from historical Site industrial areas. Furthermore, following the Topanga Fire, Boeing emplaced extensive erosion control BMPs, in conjunction with hydromulching over 860 acres of the site in an effort to reduce erosion of ash and soil. Boeing has also collected and removed over 920 tons of ash derived from the Topanga Fire for off site disposal. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

2.0 BMP UPGRADES BY OUTFALL

2.1 OUTFALLS 001, 002, 008, 009

Since Outfalls 001, 002, 008 and 009 are each located within stream channels and have large drainage areas, implementing significant structural BMP upgrades would take several years to permit, design and construct. Instead, sediments will be removed upstream of straw bales and straw bales will be refurbished in each of these channels, if allowable under existing permits. Digital data loggers with flow meter devices will also be installed at Outfalls 001, 002, 008 and 009, where not already in place. Currently, sediments have been removed upstream of straw bales in the channel at Outfalls 001 and 002. Completion of BMP maintenance and the digital data logger installations are anticipated to be completed by the end of 2006.

2.2 OUTFALL 003

At Outfall 003, an engineered, at-grade, two stage sand and granular activated carbon (GAC)/zeolite storm water filter system will be installed north of the existing sample location. **Figure 2-1 Outfall 003 BMP Upgrades - Layout and Profile** shows preliminary draft layout and profile drawings. The primary stage sand filter system is separated by an underdrain flow barrier from the secondary stage GAC/zeolite filter system.

These passive filter beds rely on gravity head for filtration. In addition, distribution piping will be installed to distribute flow evenly across the media and to allow for adequate retention time. The current outfall location will be relocated a little further downstream of the existing sample location so that it is downstream of the upgraded BMP. A digital data logger with a flow meter device will also be installed to monitor flow rates during rain events.

Currently, the existing slope for the new sand and GAC/zeolite filter beds has been flattened, the flow barriers are being constructed and the sand media is being put in place. Completion of the BMP upgrades and the digital data logger installation are anticipated to be completed by the end of 2006.

2.3 OUTFALL 004

At Outfall 004, the upgraded structural BMP's consist of a sand filter bed upstream of a mesh bag media filter bed of GAC and zeolite. **Figure 2-2 Outfall 004 BMP Upgrades - Filter Beds** and **Figure 2-3 Outfall 004 BMP Upgrades - Filter Bed, Underdrain, and Overdrain Piping,** show preliminary draft layout drawings. Both the sand filter and the GAC/zeolite bed comprise an area of 500 ft^2 each. An underdrain hydraulic flow distribution device will be installed to uniformly distribute storm water over the surface of the filter bed. A digital data logger with a flow meter device will also be installed to monitor flow rates during rain events.

Currently, the existing straw bales have been removed for upgrade to a HDPE underdrain flow barrier. GAC-filled mesh bags were also removed from the existing filter bed in order to be replaced with the new filter media. The HDPE underdrain and perimeter flow barriers have both been constructed. Completion of the BMP upgrades and the digital data logger installation are anticipated to be completed by the end of 2006.

2.4 OUTFALLS 005 and 007

At Outfalls 005 and 007, 6 foot tall dams will be used to retain storm water at each of the Outfalls before being treated by a filtration system or off-site disposal of storm water. **Figure 2-4 Outfall 005 BMP Upgrades - Layout** and **Figure 2-6 Outfall 007 BMP Upgrades - Layout** show preliminary draft site layout drawings. The dams will be formed with gabions, which are wire mesh baskets containing 4-8 inch size crushed rock. A geomembrane/geotextile material will be placed along the surface of the water basin. A pump and tanks will be installed to capture a 10 year 24-hour storm volume for Outfall 005. A separate pump and tank system will capture a 2 year 24-hour storm volume for Outfall 007. If a filtration system is used, a filtration treatment system and pump station will be installed at each Outfall to filter the pumped water and discharge the treated water at each existing outfall.

Currently, the areas were graded for dam construction, all rock anchors were set in place and the gabion boxes were assembled and installed at both Outfalls. The gabion boxes were completely filled with rocks at Outfall 005 and are currently being filled at Outfall 007. Completion of the BMP upgrades at both Outfalls are anticipated to be completed by the end of 2006.

2.5 OUTFALL 006

The structural BMPs at Outfall 006 consist of a sand filter bed upstream of a mesh bag media filter bed of GAC and zeolite. **Figure 2-5 Outfall 006 BMP Upgrades - Layout** shows the preliminary draft site layout drawing. The size of the sand filter bed is approximately 1960 ft^2 and the GAC/zeolite bed is 1215 ft^2. An underdrain flow barrier will be constructed and installed between the sand bed and GAC/zeolite layer to provide even hydraulic flow distribution. Both passive filter units rely on gravity head for storm water filtration. A digital data logger with a flow meter device will also be installed to monitor flow rates during rain events.

Currently, the existing GAC-filled mesh bags and sand have been removed in order to be replaced with the new media and to make room for installation of the downstream underdrain flow barrier, which is currently being constructed. Completion of the BMP and the digital data logger installation are anticipated to be completed by the end of 2006.

2.6 OUTFALL 010

The existing structural BMPs at Outfall 010 consist of a sedimentation basin upstream of a GAC mesh bag media filter bed. **Figure 2-7 Outfall 010 BMP Upgrades – Layout and Profile** shows the preliminary draft site layout and profile drawings. The BMP upgrades will consist of modifying the sedimentation basin into a two-layered GAC/zeolite and sand filter bed with an underdrain system. The passive filter beds rely on gravity head for storm water filtration. An underdrain piping collection system will be connected to an effluent manifold beneath the stainless steel containment wall. A digital data logger with a flow meter device will also be installed to monitor flow rates during rain events.

Currently, construction of the BMP upgrades at Outfall 010 are near completion. The underdrain system, all media layers and crushed rocked layers, stainless steel wire mesh and underdrain piping system have all been installed. Installation of a flow meter and a digital data logger are anticipated to be completed by the end of 2006.

2.7 OUTFALL 011

At Outfall 011, mesh bags of GAC filter media were installed in May 2005 and BMP maintenance improvements will be implemented. The filter media mesh bags will be realigned to provide a uniformly sloping surface on the filter bed. The flow monitoring chamber will be reinstalled to promote uniform overflow along the entire perimeter of the chamber. A digital data logger with a flow meter device will also be installed to monitor flow rates during rain events. Completion of the BMP upgrades and the digital data logger installation are anticipated to be completed by the end of 2006.

2.8 OUTFALLS 012-017

Outfalls 012-017 are internal outfalls consisting of Alfa (012), Bravo (013) and APTF (014) test stands and three sewage treatment plants (015-017). Note that industrial operations have ceased at Outfalls 012, 013 and 014. Furthermore, wastewater is currently hauled off-site for disposal and the Sewage Treatment Plant (STP) no longer operate or discharge treated sewage at Outfalls 015, 016 and 017. Additional BMP upgrades are not currently planned for any of these Outfalls.

2.9 OUTFALL 018

The structural BMP at Outfall 018 is a filter bed constructed as a series of eight filter cells in the R-2 Pond concrete overflow channel. **Figure 2-8 Outfall 018 BMP Upgrades - Layout** and **Figure 2-9 Outfall 018 BMP Upgrades - Profile** show preliminary draft site layout and profile drawings, respectively. Each filter cell is approximately 18 feet at its bottom wide by 10 feet long with eight cells connected in a parallel flow arrangement as shown in the drawings.

The concrete channel has an approximate 10% slope allowing a 1-foot elevation drop between succeeding cells. Each filter cell will be filled with aqueous phase GAC and zeolite in bulk form. The top of each filter cell will be covered with approximately 4-inches of 2-inch minus crushed rock to prevent erosion of the GAC. Underdrain pipes on the bottom of each filter cell will be covered with a filter sleeve and bedded in 6-inches of coarse sand to prevent loss of GAC filter media through the underdrain system. The 3-inch diameter underdrain laterals will be connected to two 10-inch diameter filtered water collection lines running under the eight filter cells. A concrete mixing zone will be located at the downstream end of the filter cells directly upstream of a flow monitoring flume.

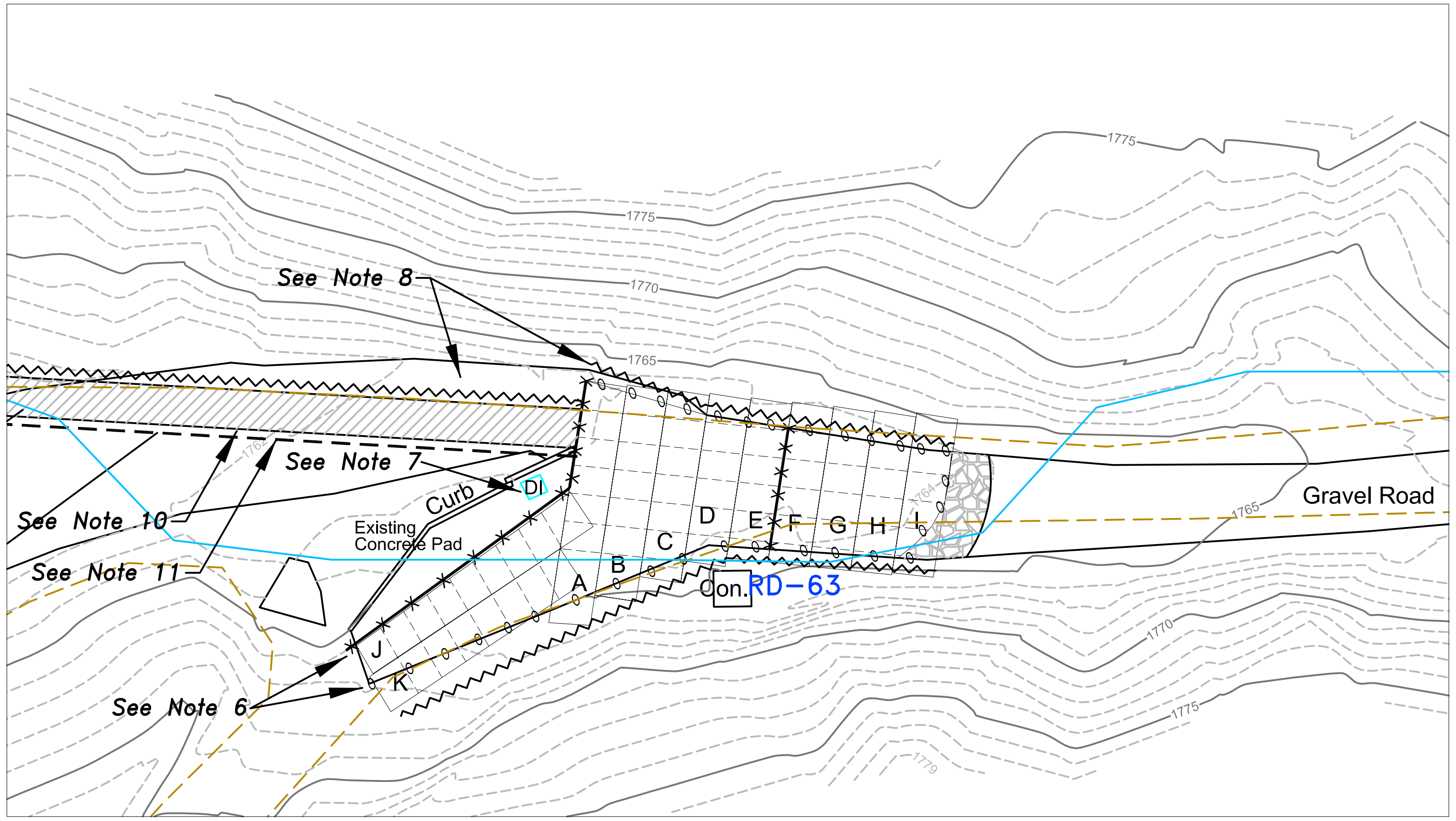
Currently, the concrete box culvert channel and new sample monitoring location have been completed. Construction of the Outfall 018 is currently on pause and is awaiting final environmental approval.

3.0 REFERENCES

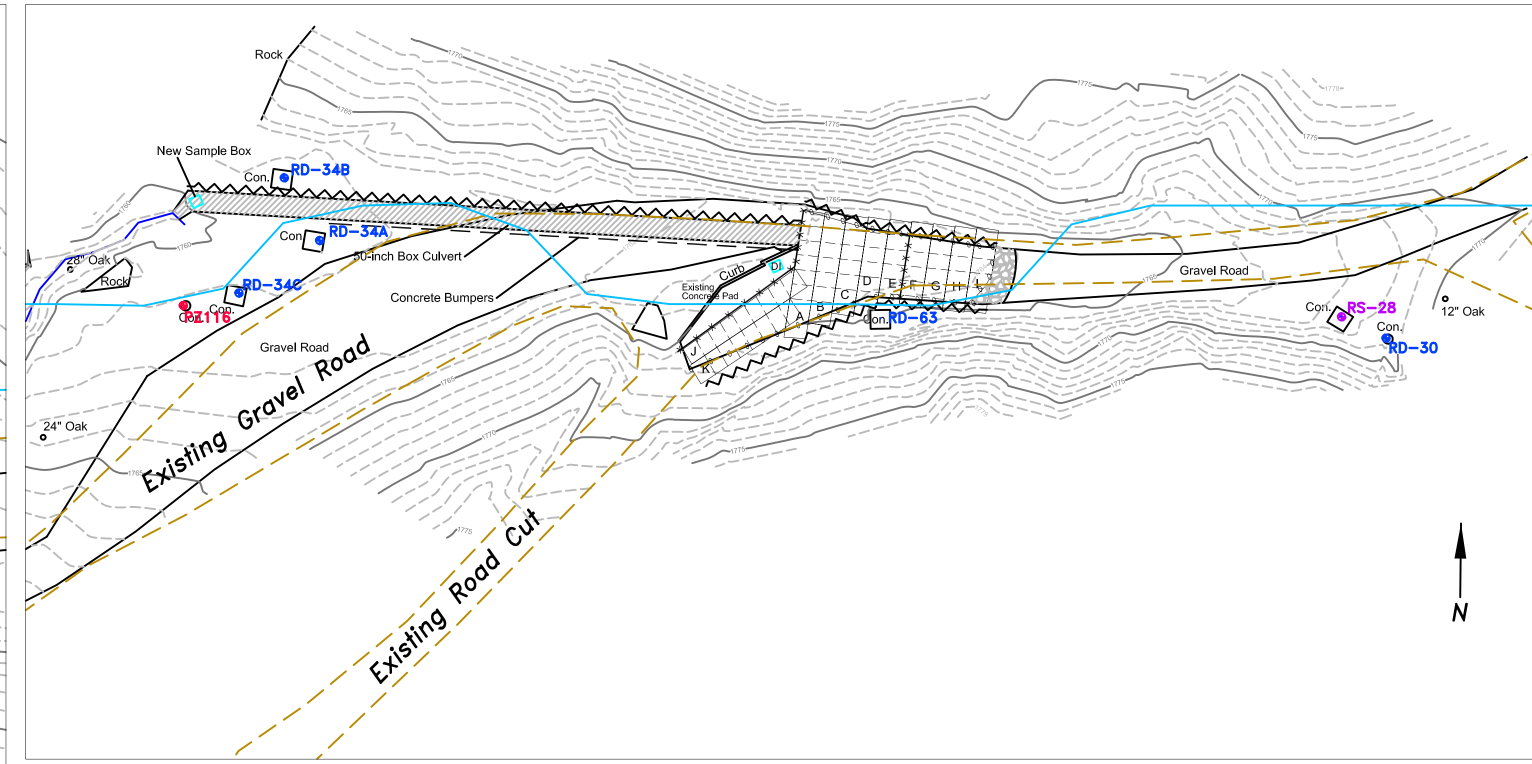
1. Boeing Company SSFL. 2005. 13267 Workplan, Pursuant to Section 13267 of the California Water Code, Santa Susana Field Laboratory, Ventura County, California. December.

2. MWH. 2006. BMP Effectiveness Sampling Workplan. May.

FIGURES



OUTFALL 3 DETAIL
1" = 20'



OUTFALL 3
1" = 40'

Legend

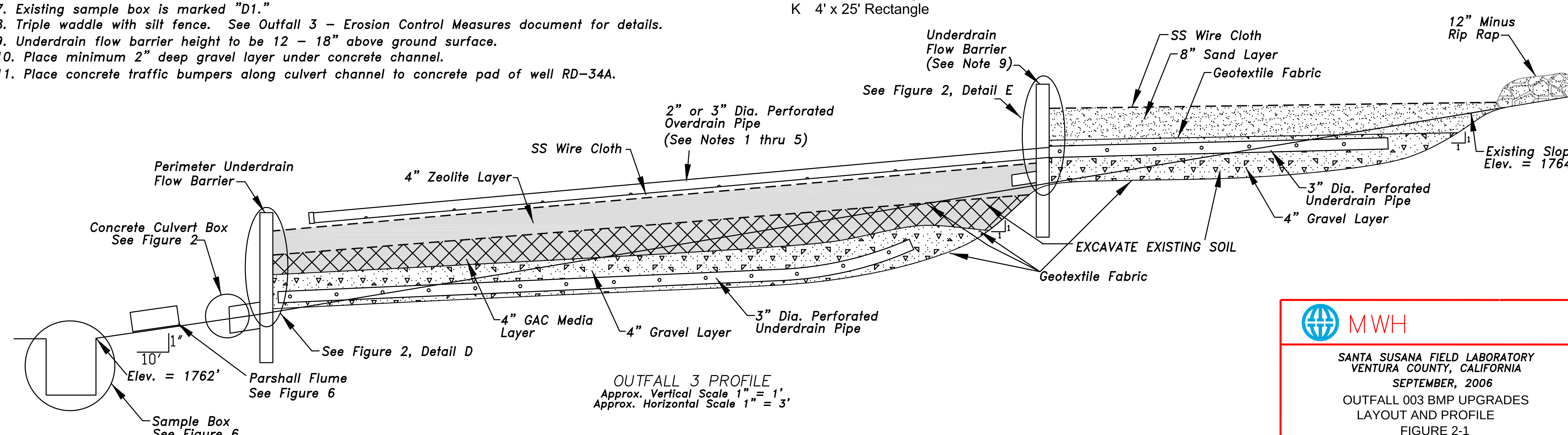
Existing Groundwater Monitoring Well

S.S. WIRE CLOTH PANEL SCEDULE

A	4' x 25' Rectangle
B	4' x 25' Rectangle
C	4' x 25' Rectangle
D	4' x 25' Rectangle
E	4' x 25' Rectangle
F	4' x 20' Rectangle
G	4' x 20' Rectangle
H	4' x 20' Rectangle
I	4' x 15' Rectangle
J	4' x 28' Rectangle
K	4' x 25' Rectangle

Notes

1. Use Sch 40 perforated PVC pipe.
2. Use PVC pipe with 0.5" perforations spaced 1' or less.
3. Use 0.25" SS machine screws to hold couplings pressure-fit.
4. Use perforated end caps to cap the pipes.
5. Overdrain pipes spaced in 1 ft parallels; underdrain pipes spaced in 2 ft parallels.
6. Location of anchors approximate. Space flow barrier anchors ("X") 3.5' apart; space wire cloth unistrut anchors ("O") 3' apart.
7. Existing sample box is marked "D1."
8. Triple waddle with silt fence. See Outfall 3 – Erosion Control Measures document for details.
9. Underdrain flow barrier height to be 12 – 18" above ground surface.
10. Place minimum 2" deep gravel layer under concrete channel.
11. Place concrete traffic bumpers along culvert channel to concrete pad of well RD-34A.



OUTFALL 3 PROFILE
Approx. Vertical Scale 1" = 1'
Approx. Horizontal Scale 1" = 3'

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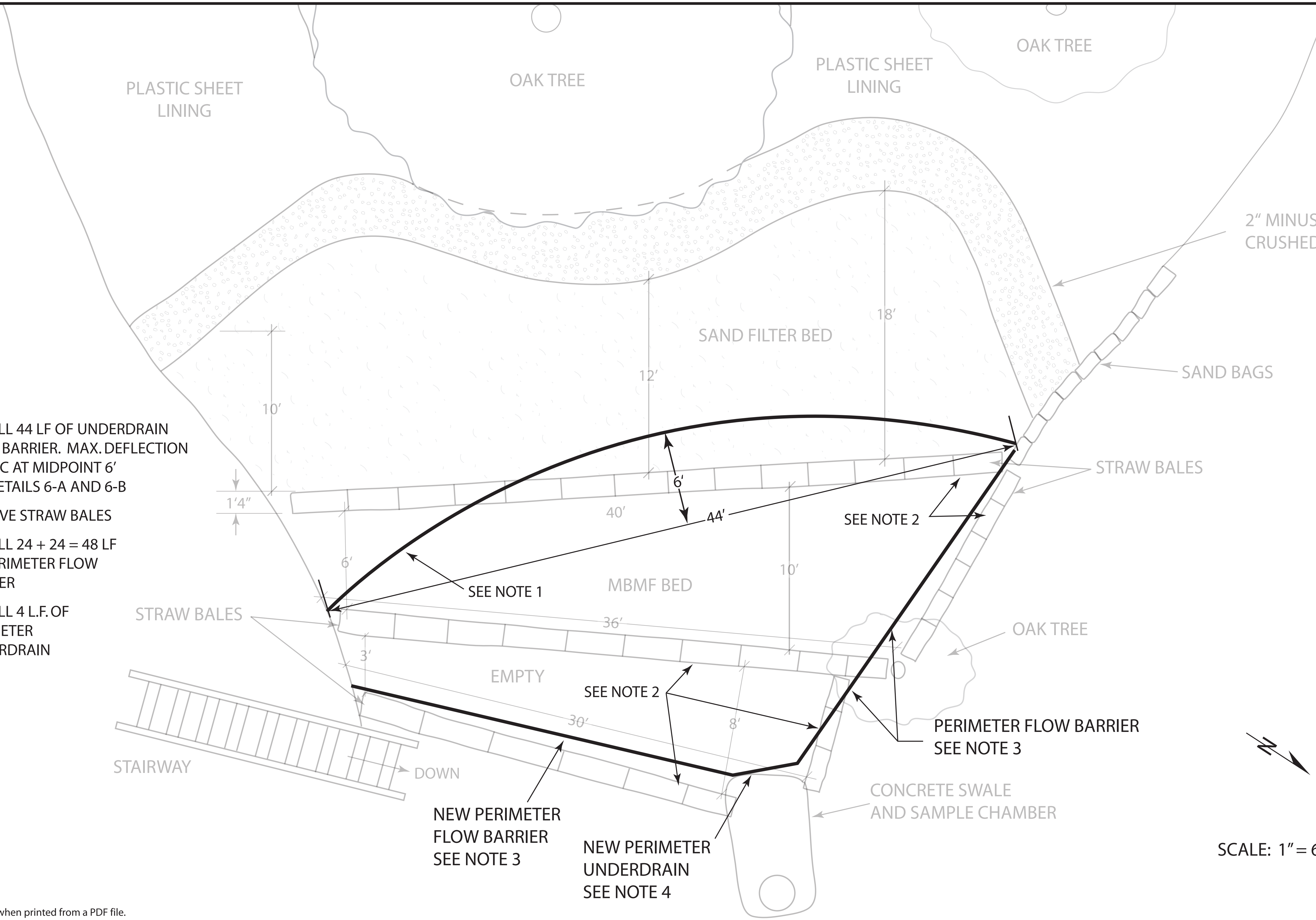
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
SEPTEMBER, 2006
OUTFALL 003 BMP UPGRADES
LAYOUT AND PROFILE
FIGURE 2-1

NOTES:

1. INSTALL 44 LF OF UNDERDRAIN FLOW BARRIER. MAX. DEFLECTION OF ARC AT MIDPOINT 6′ SEE DETAILS 6-A AND 6-B
2. REMOVE STRAW BALES
3. INSTALL 24 + 24 = 48 LF OF PERIMETER FLOW BARRIER
4. INSTALL 4 L.F. OF PERIMETER UNDERDRAIN



SCALE: 1″ = 6′

Not to scale when printed from a PDF file.

8/22/06

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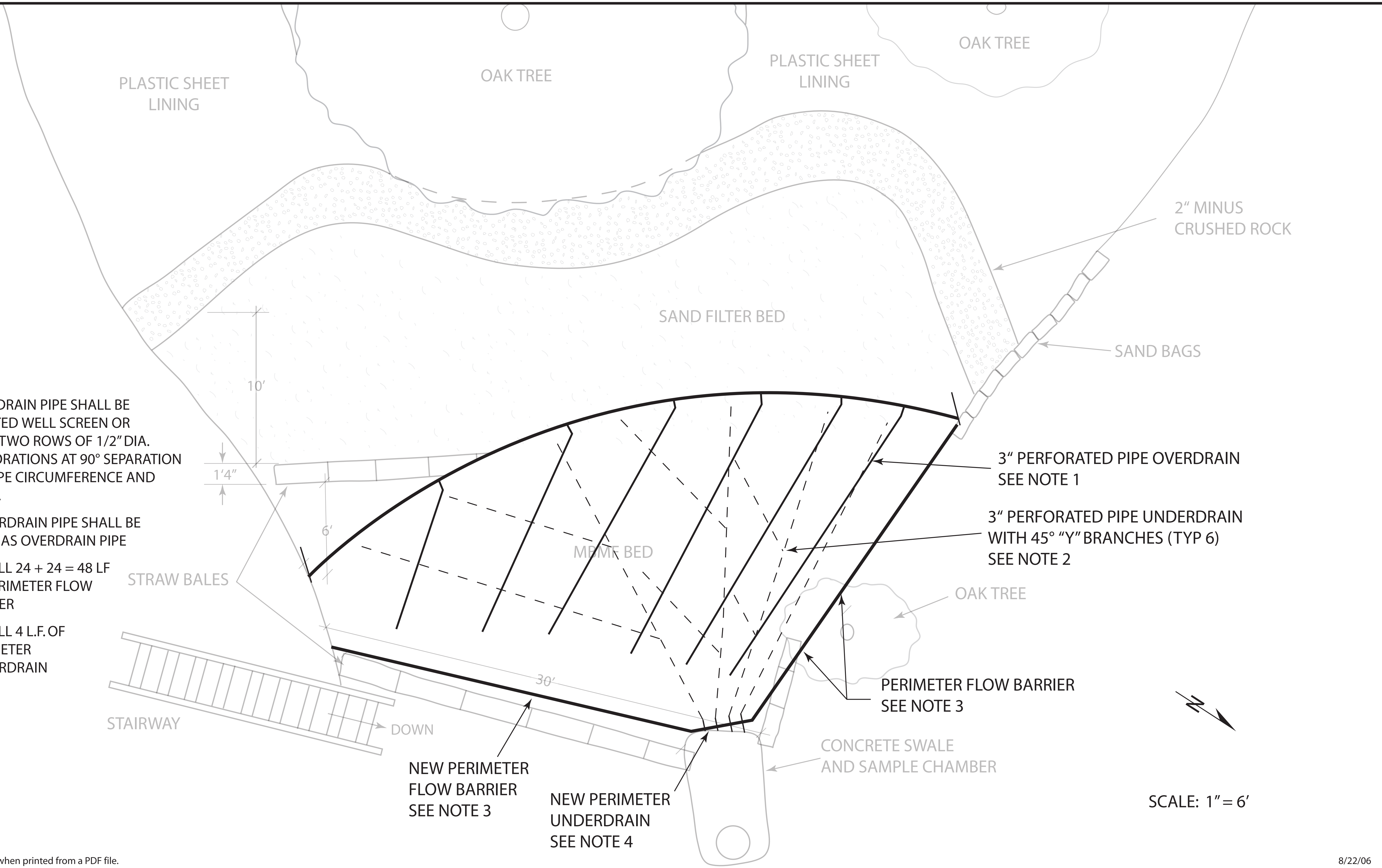
OUTFALL 004 BMP UPGRADES
FILTER BEDS

2-2
FIGURE

PROJECT NO.
AG.02.01



NOTES:

1. OVERDRAIN PIPE SHALL BE SLOTTED WELL SCREEN OR HAVE TWO ROWS OF 1/2" DIA. PERFORATIONS AT 90° SEPARATION ON PIPE CIRCUMFERENCE AND 6" O.C.
2. UNDERDRAIN PIPE SHALL BE SAME AS OVERDRAIN PIPE
3. INSTALL 24 + 24 = 48 LF OF PERIMETER FLOW BARRIER
4. INSTALL 4 L.F. OF PERIMETER UNDERDRAIN

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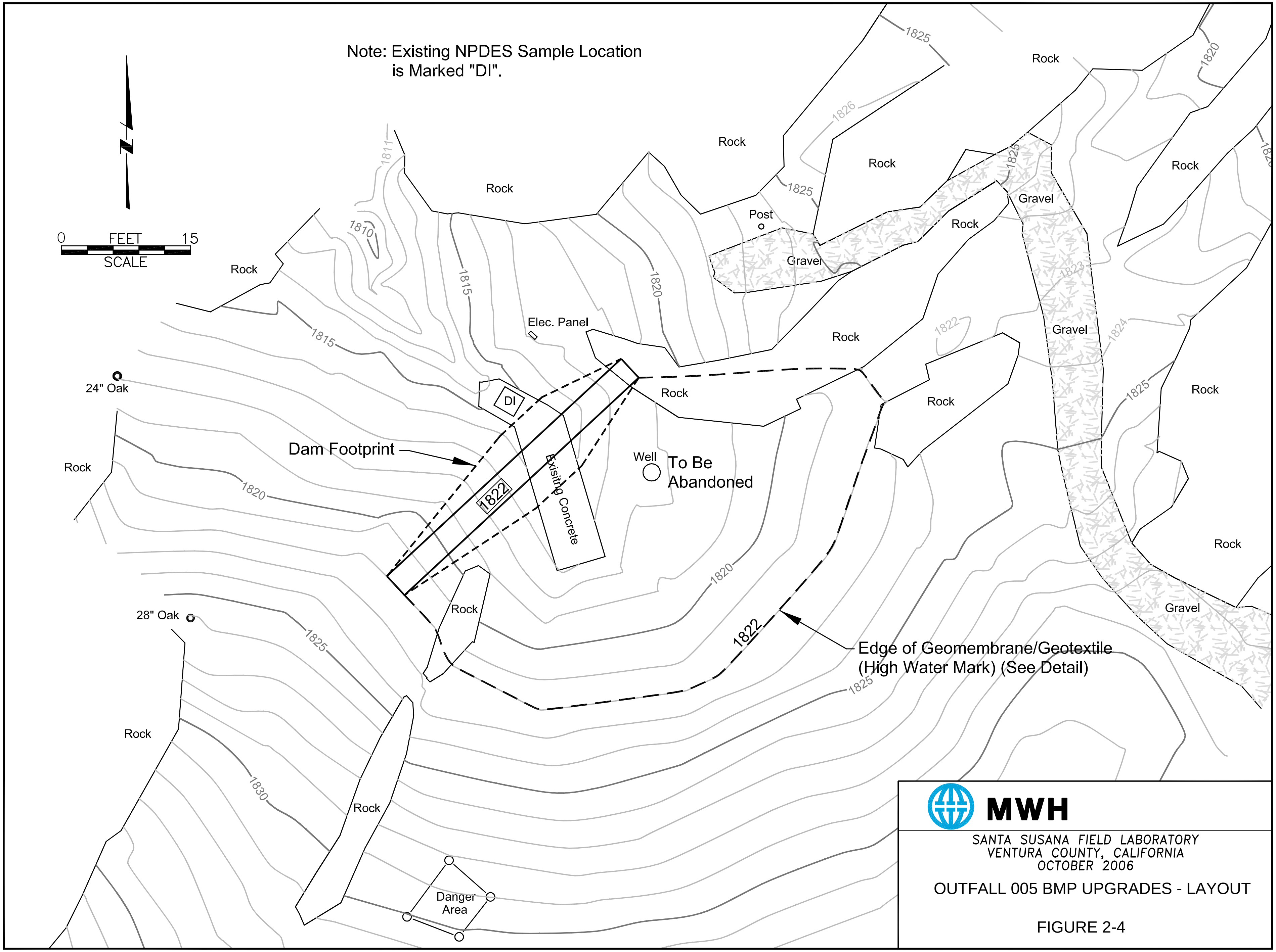
OUTFALL 004 BMP UPGRADES
FILTER BED, UNDERDRAIN, AND OVERDRAIN PIPING

2-3
FIGURE

PROJECT NO.
AG.02.01



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SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
OCTOBER 2006

OUTFALL 005 BMP UPGRADES - LAYOUT

FIGURE 2-4

FILE: CADMLUEBKE\BOEING SANTA SUSANA\NPDES OUTFALLS\OUTFALL 05 10 2 06

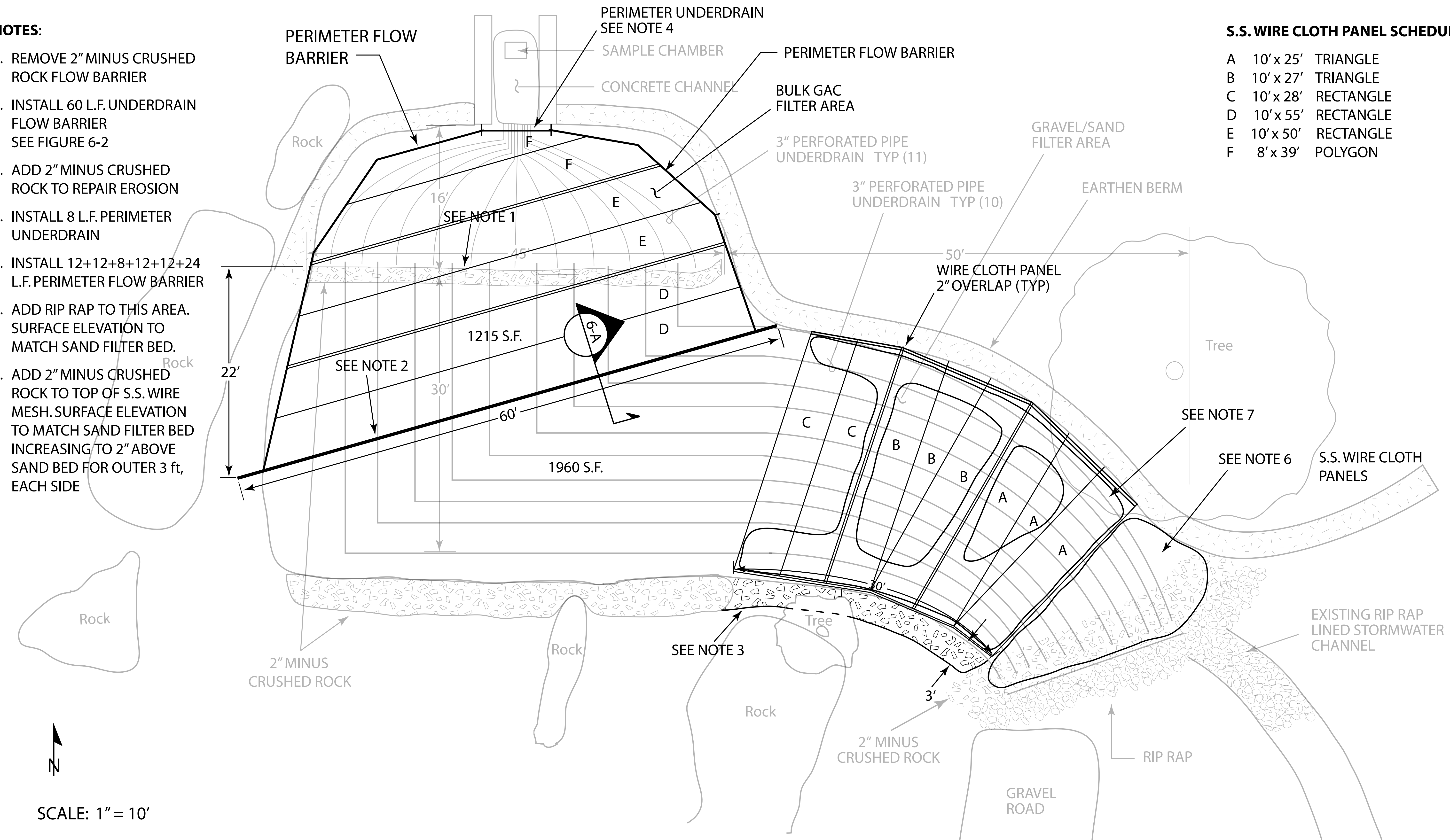
JOB No.

NOTES:

1. REMOVE 2" MINUS CRUSHED ROCK FLOW BARRIER
2. INSTALL 60 L.F. UNDERDRAIN FLOW BARRIER SEE FIGURE 6-2
3. ADD 2" MINUS CRUSHED ROCK TO REPAIR EROSION
4. INSTALL 8 L.F. PERIMETER UNDERDRAIN
5. INSTALL 12+12+8+12+12+24 L.F. PERIMETER FLOW BARRIER
6. ADD RIP RAP TO THIS AREA. SURFACE ELEVATION TO MATCH SAND FILTER BED.
7. ADD 2" MINUS CRUSHED ROCK TO TOP OF S.S. WIRE MESH. SURFACE ELEVATION TO MATCH SAND FILTER BED INCREASING TO 2" ABOVE SAND BED FOR OUTER 3 ft, EACH SIDE

S.S. WIRE CLOTH PANEL SCHEDULE

A	10' x 25'	TRIANGLE
B	10' x 27'	TRIANGLE
C	10' x 28'	RECTANGLE
D	10' x 55'	RECTANGLE
E	10' x 50'	RECTANGLE
F	8' x 39'	POLYGON



SCALE: 1" = 10'

Not to scale when printed from a PDF file.

8/14/06

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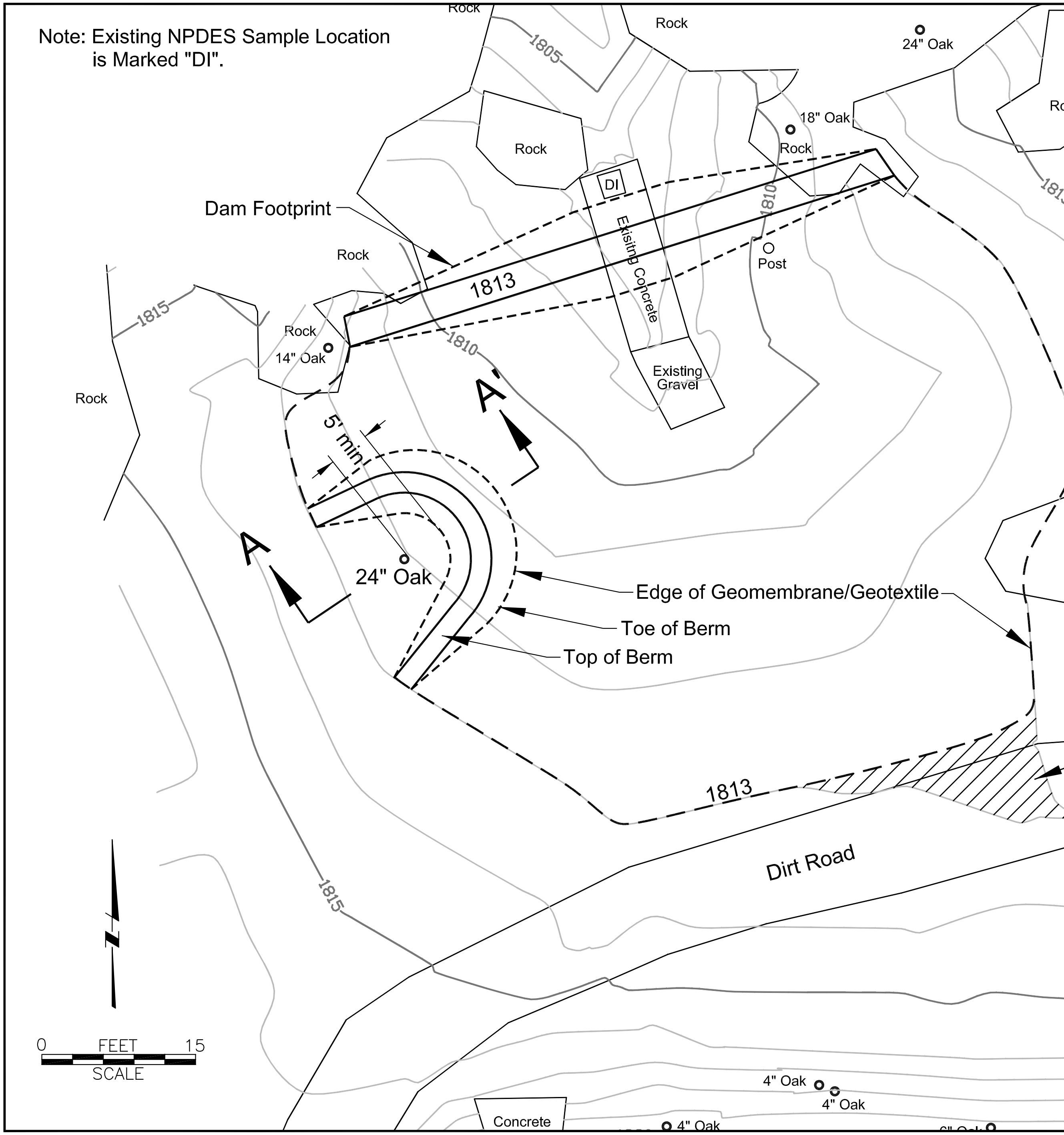
OUTFALL 006 BMP UPGRADES - LAYOUT

2-5
FIGURE

PROJECT NO.
AG.02.01



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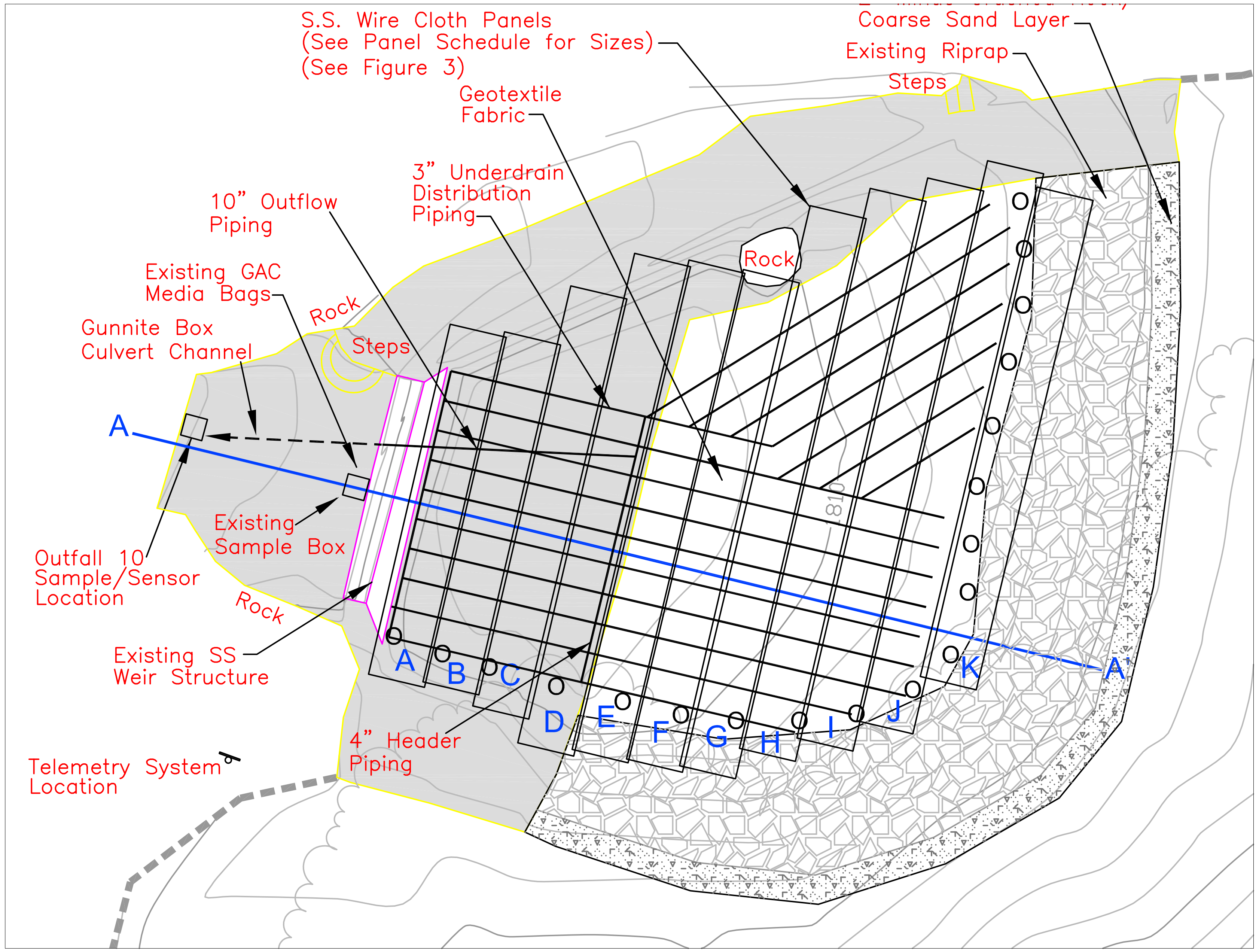
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
OCTOBER 2006

OUTFALL 007 BMP UPGRADES - LAYOUT

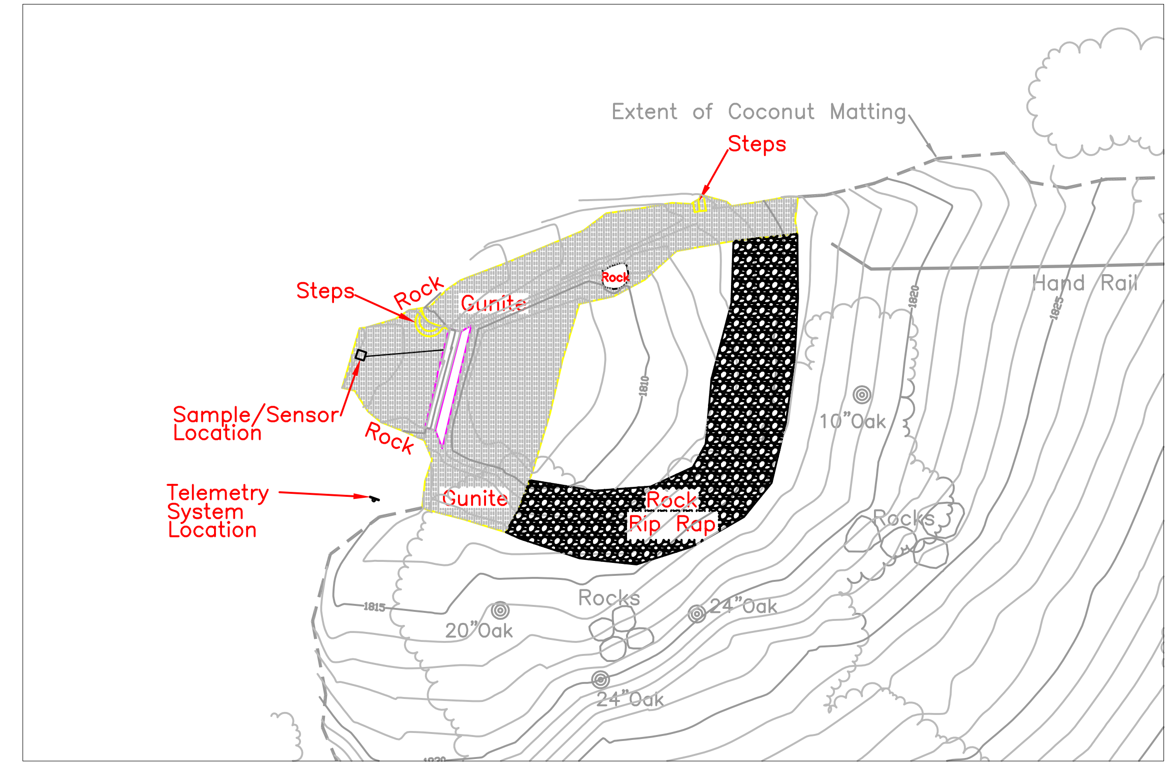
FIGURE 2-6

FILE: CADMLUEBKE\BOEING SANTA SUSANA\NPDES OUTFALLS\OUTFALL 07 10 2 06

JOB No.



OUTFALL 10 DETAIL
1" = 10'

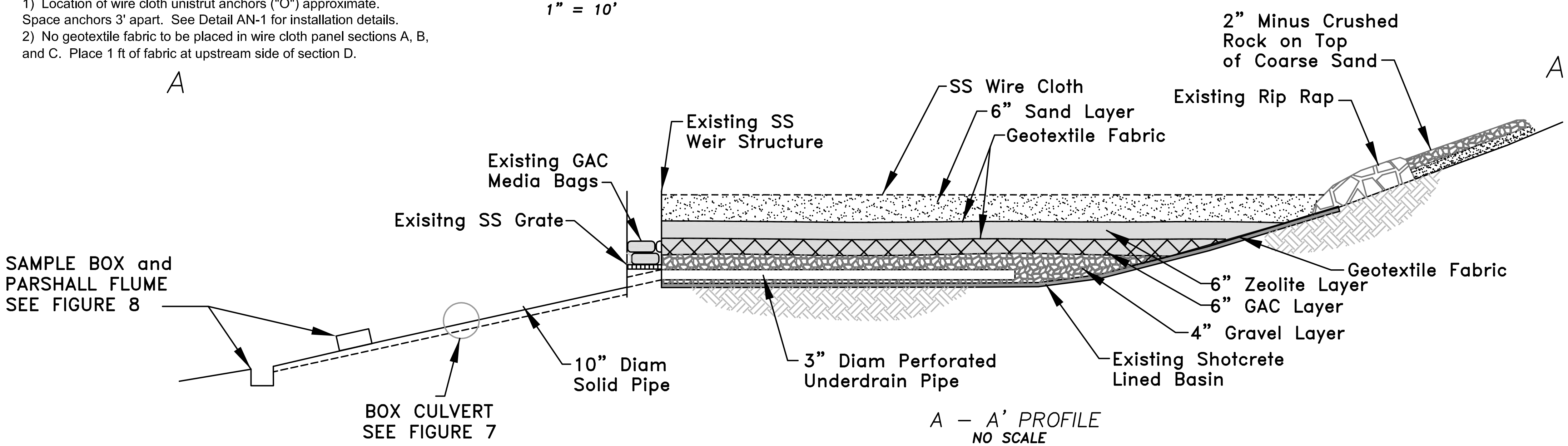


OUTFALL 10
1" = 30'

S.S. WIRE CLOTH PANEL SCEDULE

A	4' x 25' Rectangle
B	4' x 25' Rectangle
C	4' x 30' Rectangle
D	4' x 35' Rectangle
E	4' x 35' Rectangle
F	4' x 35' Rectangle
G	4' x 40' Rectangle
H	4' x 40' Rectangle
I	4' x 40' Rectangle
J	4' x 40' Rectangle
K	4' x 35' Rectangle

NOTES:
1) Location of wire cloth unistrut anchors ("O") approximate.
Space anchors 3' apart. See Detail AN-1 for installation details.
2) No geotextile fabric to be placed in wire cloth panel sections A, B, and C. Place 1 ft of fabric at upstream side of section D.



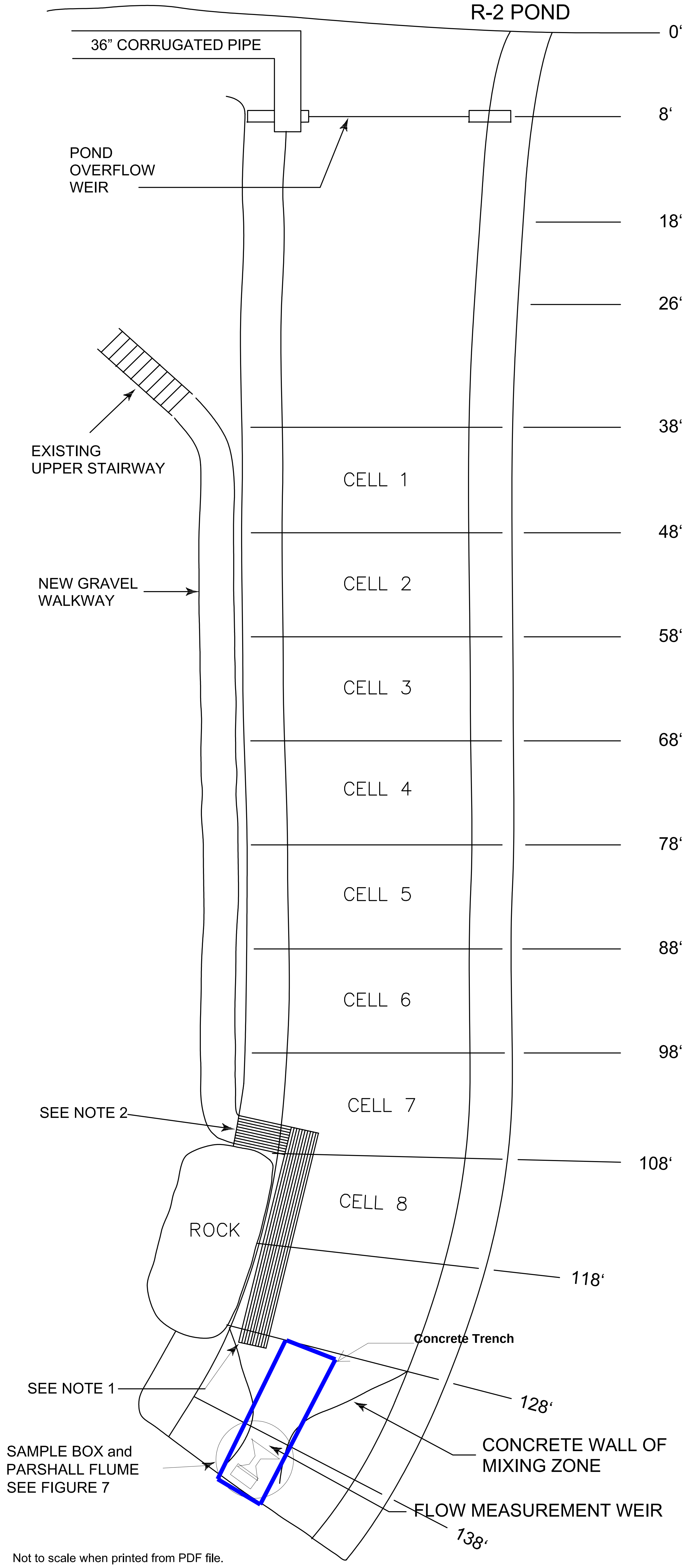
A — A' PROFILE
NO SCALE

INDSVR\INDUSTRIAL\CAD MLUEBKE\BOEING SANTA SUSANA\NPDES OUTFALLS\BMP\OUTFALL 10

MWH

SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
AUGUST 31, 2006

OUTFALL 010 BMP UPGRADES
LAYOUT AND PROFILE
FIGURE 2-7



NOTES:

1. 32 L.F. INDUSTRIAL GRATING CATWALK SUPPORTED BY THREADED ANCHOR RODS USED TO ANCHOR FILTER CELL OVERFLOW WEIRS

2. 6 L.F. GRATING BRIDGE BETWEEN TOP OF SPILLWAY CHANNEL AND INDUSTRIAL CATWALK

3. ELEVATION ACROSS BOTTOM AT 78' LINE AND 98' LINE LEVEL WITHIN 1". AT 138' LINE BOTTOM IS 11" LOWER ON WEST SIDE COMPARED TO EAST SIDE.

N

SCALE: 1" = 10'

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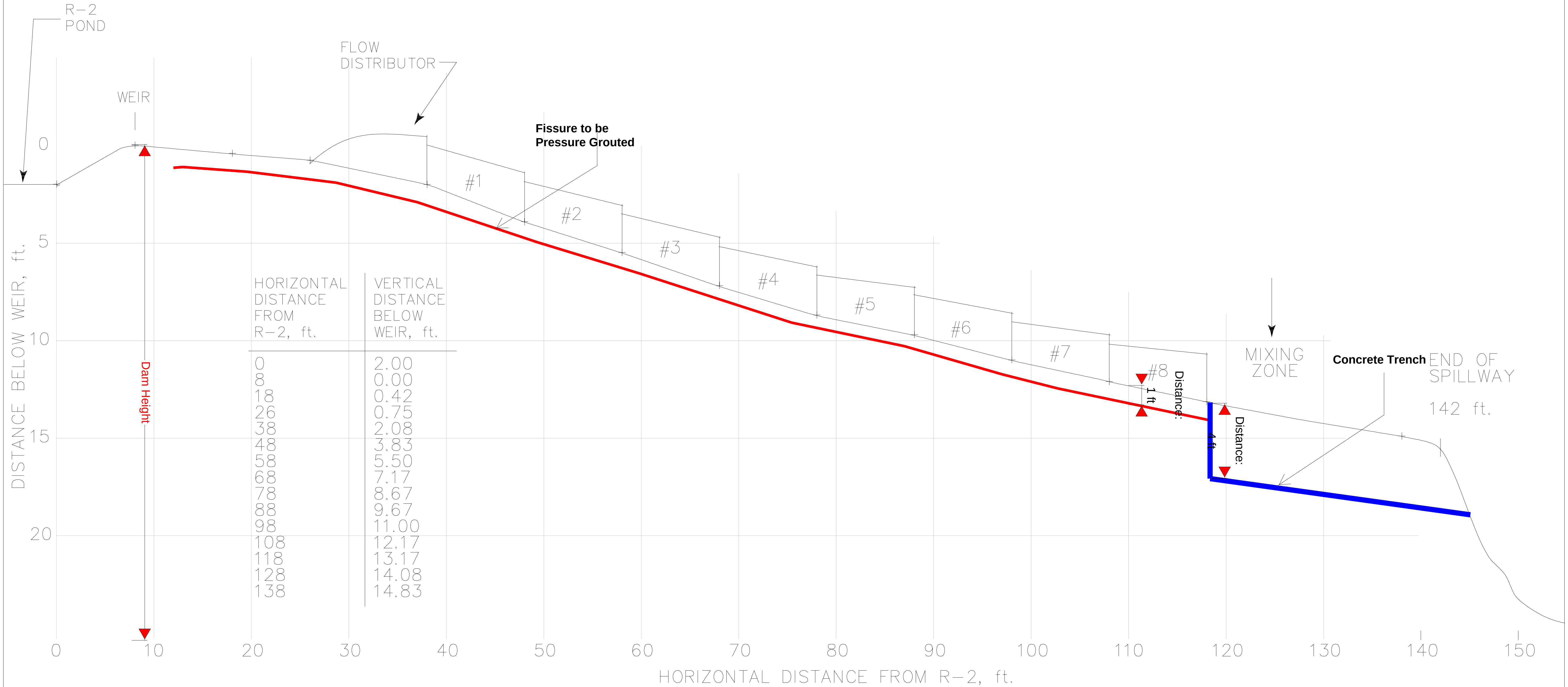
OUTFALL 018 BMP UPGRADES - LAYOUT

2-8

FIGURE

PROJECT NO.
AG.10.01



HORIZONTAL DISTANCE FROM R-2, ft.	VERTICAL DISTANCE BELOW WEIR, ft.
0	2.00
8	0.00
18	0.42
26	0.75
38	2.08
48	3.83
58	5.50
68	7.17
78	8.67
88	9.67
98	11.00
108	12.17
118	13.17
128	14.08
138	14.83

HORIZONTAL SCALE: 1 in. = 10 ft.
VERTICAL SCALE: 1 in. =5 ft.

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OUTFALL 018 BMP UPGRADES - PROFILE

2-9

FIGURE

PROJECT NO.
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