Appendix C
Construction Stormwater Sampling and Analysis Guidance

Construction Storm Water Sampling and Analysis Guidance Document

To assist dischargers in complying with California State Water Resources Control Board Resolution No. 2001-046

October 2001

Purpose of Document, Compliance Notification, and Limitations

The purpose of this guidance document is to assist members of the Task Force and other dischargers subject to the Construction Activity Storm Water Discharge Permit, Order 99-08-DWQ, (General Permit) in implementing Resolution 2001-046. Users of this document are fully responsible for determining its suitability. Dischargers are fully responsible for compliance with the permit as amended. Compliance determinations are made by the Regional Water Quality Control Boards, the State Water Resources Control Board, and the U.S. Environmental Protection Agency. Dischargers who have questions about specific requirements of the General Permit, or this guidance document are advised to consult with the appropriate Regional Water Quality Control Board. Failure to comply with the General Permit as amended can result in significant administrative, civil, and criminal penalties.

Users of this document shall note the following limitations on its use:

- The scope of this document is limited to providing guidance on Resolution 2001-046 and does not address all of the monitoring requirements of General Permit. Subsequent Resolutions and Orders issued by the State Board and Orders or policies issued by Regional Boards are also not addressed by this document.

- The purpose of this document was to provide general information to assist dischargers through the process of developing a sampling and analysis strategy. Every possible situation that may expose pollutants to storm water on a construction site is not considered by this document. Dischargers must consider the full range of exposure of materials on their construction sites and develop an appropriate sampling and analysis strategies.

- Storm water requirements, including sampling and analysis strategies must be site specific for each individual project. Users need to adapt the recommendations in this document to each project individually.

- Regulatory interpretations may change over time as a result of new information, new court cases, or new laws. While this document was developed with the input of State and Regional Board input, users should consult with their regulators for current interpretations.

- The sampling and analysis requirements of Resolution 2001-046 are governed by the NPDES regulations. Users should be aware that these regulations and State regulations implementing the NPDES program contain significant requirements regarding quality assurance, quality control, qualifications of analytical laboratories, etc. that are not explicitly addressed by this document. Users should consult the NPDES regulations, or Regional Board staff to determine any additional requirements.

- Compliance with this guidance document does not automatically equate to compliance with the General Permit or Resolution 2001-046. Further, modifying a site specific sampling and analysis strategy to include or exclude items described in this guidance document does not necessarily mean that the site specific strategy is out of compliance the General Permit or Resolution 2001-046.

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Construction Storm Water Sampling and Analysis Guidance Document

1.0 Introduction

The purpose of this document is to provide guidance to owners and operators of construction sites who are permitees under the State Water Resources Control Board's National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges Associated With Construction Activity (General Permit), as modified by Resolution No. 2001-046, "*Modification of Water Quality Order 99-08-DWQ State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges Associated With Construction Activity (General Permit)*". The modifications to the General Permit require that a sampling and analysis strategy and sampling schedule for discharges from construction activity be developed and included in the project's Storm Water Pollution Prevention Plan (SWPPP). A sampling and analysis strategy and sampling schedule must be developed regardless of the time of the year that construction occurs.

This document was developed by the Construction General Permit Working Group of the California Storm Water Quality Task Force (Task Force) at the request of the State Water Resources Control Board (State Board). The Task Force was formed in 1989 to advise the State Board on storm water discharge issues. The Task Force membership is composed of storm water management and storm water quality professionals from cities, counties, special districts, industries, and consultants throughout California.

The sampling requirements and guidance provided in this document will apply to most construction projects, but may not apply to all construction projects. It is the responsibility of each construction site owner or operator (hereafter discharger) to evaluate their construction project and develop a site-specific sampling and analysis strategy in compliance with the General Permit's requirements. For further guidance and/or direction about what must be accomplished to comply with the General Permit and Resolution 2001-046, please contact your local Regional Water Quality Control Board (RWQCB).

The sampling requirements added to the General Permit by Resolution 2001-046 are intended to supplement the visual monitoring program previously required by the General Permit. All construction projects must continue the visual monitoring program that requires inspections before predicted rain events, during extended rain events, and following actual rain events that produce runoff.

1.1 Organization of this Document

This document is organized to assist the discharger through the evaluation process necessary to develop a sampling and analysis strategy in compliance with the General Permit. Appendix A provides an outline of the actual information that should be included in the project's SWPPP.

Section 1 provides the user with general information on why a sampling and analysis strategy is required.

Section 2 provides information on sediment, silt and turbidity sampling and analysis.

Section 3 provides information on non-visible pollutant sampling and analysis, including what to sample for in construction storm water runoff.

Section 4 provides general information on the sampling and analysis procedures that are applicable to the types of sampling and analysis required by the General Permit.

Section 5 provides useful definitions.

Section 6 provides other sources where one can obtain more information.

1.2 Background

The General Permit was reissued by the SWRCB on August 19, 1999. The San Francisco BayKeeper, Santa Monica BayKeeper, San Diego BayKeeper, and Orange Coast Keeper filed a petition for writ of mandate challenging the General Permit in the Superior Court, County of Sacramento.

On September 15, 2000, the Court issued a judgment and writ of mandate and directed the SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether Best Management Practices (BMPs) implemented on a construction site are:

(1) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired (Clean Water Act Section 303(d) List [303(d) List]) for sediment, silt, or turbidity; and

(2) preventing other pollutants that are known or should be known by permittees to occur on construction sites and that can not be visually observed or detected in storm water discharges, from causing or contributing to exceedances of water quality objectives.

The monitoring, sampling and analysis provisions in the General Permit were modified pursuant to the court order and were issued as Resolution No. 2001- 046, adopted by the SWRCB on April 26, 2001.

1.2.1 Impaired Water Bodies

Certain lakes, streams, rivers, creeks and other bodies of water in California have been determined by Regional Water Quality Control Boards to be impaired for sedimentation, siltation, or turbidity. These water bodies are listed in Attachment 3 to the General Permit. (Clean Water Act [CWA] Section 303(d) [303(d)] Water Bodies listed for Sedimentation). Discharges of storm water from construction sites into a 303(d) listed body of water is not prohibited as long as the type and level of pollutant(s) does not cause or contribute to a water quality exceedance.

To obtain the latest list of 303(d) water bodies, visit the State Water Resources Control Board's Web site at http://www.swrcb.ca.gov/.

1.2.2 Non-visible pollutant sampling

Sampling and analysis for non-visible pollutants is required only when construction materials that could pollute runoff are exposed to rain and runoff. Just because a material is present on the construction site does not mean that dischargers must automatically sample for it in runoff. Dischargers can limit the amount of sampling and analysis they perform by limiting the exposure of construction materials to rain and storm water runoff. Materials that are not exposed do not have the potential to enter storm water runoff, and therefore do not need to be sampled in runoff. In cases where construction materials are exposed to rain water but the rain water that contacts them is contained, then sampling only needs to occur when inspections shows the containment failed. Many common Best Management Practices (BMPs) already limit exposure to most materials. Improving these practices to prevent exposure is a better approach to preventing pollution of runoff and will limit the amount of sampling and analysis. Improved BMPs are likely to be less costly than an on-going sampling and analysis program.

1.3 Purpose of Sampling

The purpose of sampling is to determine whether the BMPs employed on a construction site are effective in controlling potential construction site pollutants, which come in contact with storm water, from leaving the site and causing or contributing to an exceedance of water quality objectives in the receiving waters. According to the modifications to the General Permit (Resolution No. 2001-046), there are two categories of monitoring required, as shown below. These new monitoring requirements are illustrated in Figure 1-1.

- sediment in storm water discharged directly to water bodies listed as impaired for sediment/siltation or turbidity on the SWRCB's 303(d) list water bodies; and

- non-visible pollutants.

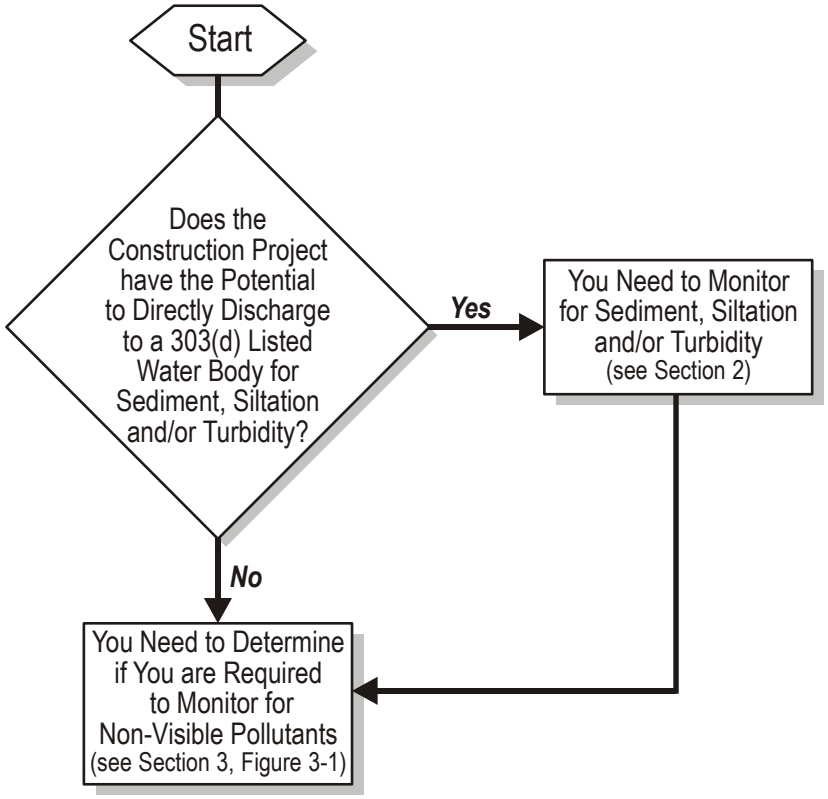

Figure 1-1
General Permit Monitoring and Analysis Requirements

2.0 Monitoring Program for Sedimentation/Siltation

2.1 What the Permit Says on Monitoring

The General Permit requires that storm water BMPs be developed, designed, installed and maintained during construction and post-construction phases. The purpose of the storm water BMPs is to reduce or eliminate pollutants which are caused by, or are the result of, the construction activities from coming in contact with rainfall and storm water surface drainage and/or being discharged off-site with the construction site's storm water runoff.

Soils, sediments, and fine (suspendable) particles that result from grading and earthwork activities and soil erosion from disturbed, un-stabilized land areas are potentially significant sources of storm water pollution at construction sites. The General Permit requires construction sites to develop, implement and maintain a combination of effective erosion control and sediment control BMPs to prevent soils, sediments, debris and suspendable solids from leaving the construction site and moving into receiving waters at levels above pre-construction levels.

The General Permit only requires sampling and analysis for sediment/silt or turbidity when the construction site runoff **discharges directly** into a water body that is impaired by sediment/silt or turbidity (that is, the water body is on the 303d list for one of these impairments.) A key point is that the discharge of runoff must directly enter the impaired water body or impaired segment of a water body. Construction site runoff that flows through a tributary or storm drainage system is not considered a direct discharge even if the flow eventually enters an impaired water body. (See the definition of direct discharge in Section 5 for further details.)

The General Permit requires that the SWPPP identify a strategy for conducting the sampling and analysis, including the frequency at which sampling will be conducted. The SWPPP must also show:

- the location(s) of direct discharges from construction activities to a water body listed on the SWRCB's 303(d) list for sediment, silt and/or turbidity;
- the designated sampling location in the listed water body representing the prevailing conditions up-stream of the discharge; and
- the designated sampling location in the listed water body representing the prevailing conditions down-stream of the discharge.

2.2 Deciding When to Sample

- Sampling must occur when storm water runoff directly discharges from the construction site to a 303(d) listed water body. Refer to Section 2.4, *Where to Sample*, for guidance on sampling locations.

- Samples need only be collected during daylight hours (sunrise to sunset), during the first two hours of discharge (runoff) from storm events which result in a direct discharge to any 303(d) listed water body.

- Storm water runoff samples must be collected regardless of the time of year, status of the construction site, or day of the week. Samples should be collected during the first two hours of runoff. Storm water inspections and sample collections are required even during non-working days (including weekends and holidays).

- Dischargers do not need to sample runoff for more than four (4) rain events per month.

2.3. Deciding What to Sample

- If the water body is listed as impaired for sedimentation or siltation, samples should be analyzed for Settleable Solids (mL/L) and Total Suspended Solids (mg/L) according to EPA 160.2. Samples may be analyzed for suspended sediment concentration (SSC) according to ASTM D3977-97 instead of or in addition to Total Suspended Solids.

- If the water body is listed as impaired for turbidity, samples should be analyzed for turbidity per EPA 180.1 or analyzed in the field using a turbidity meter.

- It is very important that consistent sampling and analysis methods are used for all sampling locations.

- Table 2-1 shows general sample handling and laboratory requirements for sediment sampling.

Table 2-1
LABORATORY REQUIREMENTS[1] FOR STORM WATER MONITORING OF SEDIMENT, SILTATION AND/OR TURBIDITY

Parameters	Analytical Method	Target Reporting Limit	Minimum Sample Volume [2]	Container	Preservative	Holding Time
Total Suspended Solids (TSS) [2]	EPA 160.2	1 mg/L	100 mL	500 mL polypropylene	Store in ice or refrigerator at 4°C (39.2°F)	7 days
Settleable Solids (SS)	EPA 160.5	0.1 mL/L/hour	1 liter	1 liter mL polypropylene	Store in ice or refrigerator at 4°C (39.2°F)	48 hours
Suspended Sediment Concentration (SSC) [3]	ASTM D 3977-97	Contact Laboratory	200 mL	Contact Laboratory	Store in ice or refrigerator at 4°C (39.2°F)	7 days
Turbidity	EPA 180.1	1 NTU	100 mL	500 mL polypropylene or glass	Store in ice or refrigerator at 4°C (39.2°F), Dark	48 hours

1 The data in this table is a summary of recommended laboratory requirements. For specific EPA regulatory requirements, consult the sampling and analysis requirements found in 40 CFR 136.

2 Minimum sample volume recommended. Specific volume requirements will vary by laboratory; please check with your laboratory when setting up bottle orders.

3 Use either TSS or SSC, or both, for suspended solids analysis. Upstream and downstream samples should be analyzed by the same method.

2.4 Deciding Where to Sample

The General Permit requires that samples be collected at the following locations:

- Sample the 303(d) listed water body upstream of the construction site discharge
- Sample the 303(d) listed water body immediately downstream of the last point of discharge from the construction site

Additionally, for the purpose of interpreting the results of the samples collected from the 303(d) listed water body, it is advisable to collect and analyze samples of the actual discharge from the construction site. Remember that samples should only be collected from safely accessible locations.

In general, sample away from the bank in or near the main current. Collecting samples directly from ponded, sluggish, or stagnant water should be avoided. Be careful when collecting water upstream or downstream of confluences or point sources to minimize problems caused by backwater effects or poorly mixed flows. Note that samples collected directly downstream from a bridge can be contaminated from the bridge structure or runoff from the road surface.

Choose the upstream location in water that appears to represent the nature of the flow in the stream, for example, if there is a noticeable muddy plume in the center of the stream versus the outer edges, collect the sample from the center of the stream, if possible.

Downstream samples should represent the receiving water mixed with flow from the construction site. For instance if the flow from the site can be observed by either a color or a flow difference, collect the downstream sample from within the affected water.

2.5 Deciding How to Sample

- Only personnel trained in water quality sampling procedures should collect storm water samples.
- Sampling methods and locations should be determined in advance of the runoff event in order to provide sufficient time to gather the supplies and equipment necessary to sample and plan for safe access by the sampling crew(s).
- General guidance for sampling procedures is provided in Section 4 of this document.

2.6 How to Use Your Data

2.6.1 Coupling Your Visual Observations with Your Analytical Data

The General Permit requires that an effective combination of erosion and sediment control measures be implemented on the site at all times during the rainy season. Site inspections and observations before, during, and after storm events should provide visual indications of whether accelerated erosion is occurring on the site and whether the eroded material is being transported off-site. Visual observations of storm water runoff that appears to be transporting silt or sediment off-site (e.g., the water is soil-colored and non-transparent) probably indicate that you have a problem on the site that will be confirmed by the analytical data.

2.6.2 What on Your Site May Be Causing Sediment, Silt and/or Turbidity

Conditions or areas on your site that may be causing sediment, silt, and/or turbidity in your storm water runoff may include:

- Exposed soil areas with inadequate erosion control measures
- Active grading areas
- Poorly stabilized slopes
- Lack of perimeter sediment controls
- Areas of concentrated flow on unprotected soils
- Poorly maintained erosion and sediment control measures
- Unprotected soil stockpiles
- Failure of an erosion or sediment control measure

2.6.3 What To Do If You Get Data That Shows a Problem

The General Permit requires that BMPs be implemented on the construction site to prevent a net increase of sediment load in storm water discharges relative to pre-construction levels. Although the upstream un-contaminated (background) sample may not be representative of pre-construction levels at your site, it will provide a basis for comparison with the sample taken downstream of the construction site.

If a comparison of the upstream and downstream samples indicates an increase in silt, sediment and/or turbidity, follow the reporting requirements as shown in section B.3 (Receiving Water Limitations) of the General Permit. If you have collected samples of the discharge from your site, use these results to help identify if it is your project that is discharging sediment into the receiving water. It is recommended that the following steps be taken as soon as possible.

1. Identify the source of the silt, sediment or turbidity

2. Repair or replace any BMP that has failed

3. Maintain any BMP that is not functioning properly due to lack of maintenance

4. Evaluate whether additional or alternative BMPs should be implemented to provide an effective combination of erosion and sediment control measures on the site. Do not rely solely on perimeter sediment controls, particularly where there are fine-grained soils (such as silts or clays) on the site. Implement erosion controls (source controls) that keep the soil in place, even on temporary slopes and rough graded areas, wherever possible and as necessary to prevent sediment from leaving the site.

If sampling and analysis during subsequent storm events shows that there is still a problem, then repeat the steps above until the analytical results of upstream and downstream samples are relatively comparable.

2.7 Retention of Data

Results of field measurements and laboratory analyses must be kept in the SWPPP, which is required to be kept on the project site until the Notice of Termination is filed and approved by the appropriate RWQCB. It is also recommended that training logs, Chain-Of-Custody (COC) forms and other documentation relating to sampling and analysis be kept with the project's SWPPP). The General Permit requires that records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated or after project completion.

3.0 Monitoring Program for Pollutants Not Visually Detectable in Storm Water

Monitoring for pollutants not visually detectable is only required if those pollutants are determined to be potentially present in storm water leaving the construction site. Projects should attempt to eliminate the exposure of construction materials to prevent pollution of storm water and limit sampling and analysis requirements.

3.1 What the Permit Says on Monitoring

The General Permit requires that a sampling and analysis program be developed and conducted for pollutants which:

- Are not visually detectable in storm water discharges,
- Are or should be known to occur on the construction site, and
- Could cause or contribute to an exceedance of water quality objectives in the receiving water.

Pollutants that should be considered for inclusion in this sampling and analysis strategy are those identified in your SWPPP (as required by Sections A.5.b. and A.5.c. of the General Permit). The General Permit states that the SWPPP needs to identify a strategy for conducting the sampling and analysis, including the frequency and location(s) at which sampling will be conducted.

Sampling for non-visibly detectable pollutants is required under the following two conditions:

- Visual inspections, currently required before, during and after storm events, indicate that there has been a breach, malfunction, leakage or spill from a BMP that could result in the discharge of pollutants in storm water and the pollutants would not be visually detectable; or
- Storm water comes into contact with soil amendments, other exposed materials, or site contamination that is discharged off the construction site.

A sample of uncontaminated (background) storm water from the site must be collected for comparison with the sample(s) collected from storm water suspected of containing construction-related pollutants. The General Permit also states that the SWPPP needs to describe the sampling procedure, location and rationale for obtaining the uncontaminated sample of storm water.

3.2 What are "known or should be known pollutants"

Pollutants can be considered to be known or should be known to occur on the construction site if they are currently in use or are present as a result of previous land uses. This includes materials that:

- are being used in the construction activities
- are stored on the construction site
- were spilled during construction operations and not cleaned up
- were stored (or used) in a manner that presented the potential for a release of the materials during past land use activities
- were spilled during previous land use activities and not cleaned up
- were applied to the soil as part of past land use activities.

Construction material inventories and the project SWPPP should provide adequate information on materials currently in use or proposed for use on the construction site.

To determine the potential for pollutants to exist on the construction site as a result of past land use activities dischargers should review existing environmental and real estate documentation. Good sources of information on previously existing contamination and past land uses include Environmental Assessments, Initial Studies, Environmental Impact Reports or Environmental Impact Statements prepared under the requirements of the National Environmental Policy Act or the California Environmental Quality Act, and Phase 1 Assessments prepared for property transfers. In some instances, the results of soil chemical analyses may be available and can provide additional information on potential contamination.

3.3 Deciding If Sampling is Required (When to Sample)

All construction projects must ensure that proper inspections are conducted throughout the duration of the project to make sure that appropriately selected BMPs have been implemented, are being maintained, and are effective in preventing potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters.

The frequency of sampling for non-visible pollutants must be determined based on the exposure of pollutant sources. Runoff only needs to be sampled when there is exposure of a pollutant source to storm water that enters a storm drain or surface water. Inspections of material storage areas that identify a BMP failure, which exposes potential non-visible pollutants to storm water that runs off the construction site, trigger sampling and analysis. If spills are cleaned up and the contaminated material is isolated, eliminating exposure to storm water runoff, sampling does not need to occur. For instances when the potential for previously existing contamination is identified, it may be appropriate to conduct screening analysis during the first one or two storm events of the season to determine if the potential contaminant is running off the construction site.

Figure 3.1 provides a flow chart to help determine when sampling and analysis is required.

3.3.1 Sampling and Analysis is Not Required

Sampling and analysis is not required to be implemented under the following conditions. However, a contingency sampling strategy should be prepared in the event of an incidental discharge. Your SWPPP should also describe why you expect sampling and analysis not to be needed.

- Where a construction project is "self-contained", meaning that the project generates no runoff or any potential runoff discharges containing pollutants can be totally contained within the construction project site without discharging to a water body or storm drain system.

- Where construction materials and compounds are kept or used so that they are not in contact with storm water (e.g., in water-tight containers, under a water-tight roof, inside a building, etc.).

- Where for specific pollutants, the BMPs implemented at the construction site fully contain the exposed pollutants (e.g., bermed concrete washout area).

- For building materials that are in their final constructed form or are designed for exposure (e.g., fence materials, support structures and equipment that will remain exposed at the completion of the project, etc.).

- Where pollutants may have been spilled or released on-site, but have been properly cleaned-up and storm water exposure has been eliminated prior to a storm event.

- For stockpiles of construction materials for which both cover and containment BMPs have been properly implemented to protect them from run-on and from contributing pollutants to storm water runoff.

3.3.2 Sampling and Analysis Is Required

Sampling and analysis is required when non-visible pollutants have the potential to contact storm water and run off the construction site into a storm drainage system or water body. Some examples of this situation are:

- Where construction materials and compounds are stored or used such that they may come in contact with storm water.

- For construction projects that utilize soil amendments (see definition in Section 5) that can come in contact with storm water runoff. (If you have independent test data are available that demonstrates acceptable concentration levels, sampling and analysis may not be required. Contact the appropriate Regional Board to determine acceptable concentration(s) of the material(s) in question.)

- When a leak or spill occurs prior to a storm event and is not fully contained and cleaned.

- When a leak or spill occurs during a storm event, and it cannot immediately be isolated and/or cleaned-up, and the possibility of an off-site discharge exists.

- When during regular inspections of stockpiles, it is discovered that cover and containment BMPs have been compromised and storm water comes in contact with the stockpiled materials resulting in runoff discharging into a storm drain system or water body.

- When material storage BMPs have been compromised, breached, or have failed.

If a determination has been made that sampling is needed, storm water runoff samples must be collected regardless of the time of year, status of the construction site, or day of the week. Samples should be collected during the first two hours of runoff. Storm water inspections and sample collections are required even during non-working days (including weekends and holidays).

3.3.3 Coordinating between Inspection Findings and Sampling

- A breach or malfunction in a BMP, leakage, or a spill observed during regular inspections, which could result in the discharge of pollutants to a storm drain system or water body (e.g., because it was not cleaned up) and that would not be visually detectable in storm water, triggers sampling and analysis.

- If a leakage or spill is observed during inspections, and appropriate measures are taken to fully contain and clean up the leakage or spill, then the potential to discharge pollutants to storm water no longer exists and no sampling is required.

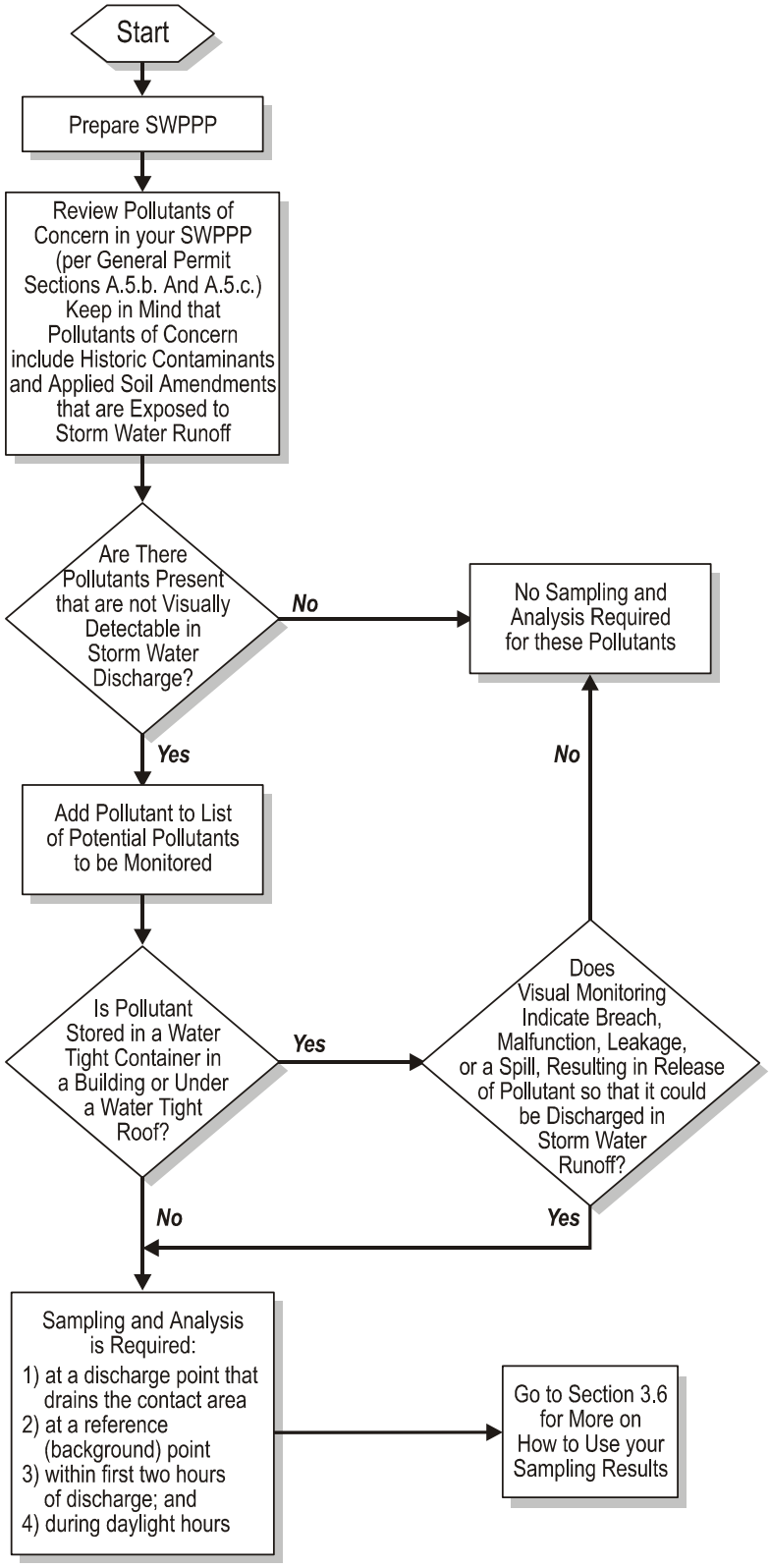

Figure 3-1
Monitoring for Non-Visually Detectable Pollutants

3.4 Deciding What to Sample

Based on your review of potential sources from your SWPPP (required by General Permit sections A5b and A5c), which will include construction related materials, soil amendments, and historic contaminants, develop a list of potential pollutants. Identify from this list those pollutants that are not visibly detectable. These are the constituents that you will likely have to sample for in runoff if the materials are exposed to storm water. Consult with your analytical laboratory or water quality chemist to determine if there are field tests or indicator parameters that can be used. Appendix B lists typical construction materials that might cause non-visible contamination of runoff if exposed to storm water.

3.5 Deciding How to Sample

- Only personnel trained in water quality sampling procedures should collect storm water samples.

- Sampling methods and locations should be determined in advance of the runoff event in order to provide sufficient time to gather the supplies and equipment necessary to sample and plan for safe access by the sampling personnel.

- General guidance for sampling procedures is provided in Section 4 of this document.

3.6 Deciding Where to Sample

Sampling locations must be identified that provide information on both the runoff quality that is affected by material storage, historic contamination or other exposed potential pollutants, and the background runoff quality (i.e., uncontaminated sample). Material storage may be confined to a small area of the project while historic contamination or exposed materials, such as soil amendments, may be widely spread throughout the construction site. For this reason, the sampling locations identified for these two types of potential pollutants may be different.

- Samples must be collected at locations identified in your SWPPP or areas identified by visual observations/inspections where there has been a BMP failure or breach and which can be safely accessed.

- A location that is not affected by material storage activities or by runoff from material storage areas should be selected as a background or reference sampling location for collecting the uncontaminated runoff sample. For a widely spread potential contaminant, you may need to select sampling locations at the perimeter of your site, where storm water enters (unaffected by your activities) and leaves (affected by your activities) the site. The SWPPP must describe the sampling procedure, the location, and the rationale for selecting this location.

3.7 How to Use Your Sampling Data

Corrective action must be initiated where non-visible pollutant sample test results indicate that the construction site's storm water discharges may cause or contribute to a water quality exceedance in the receiving water. This can be determined by comparing your construction site's storm water test results with the background sample.

Where your site's storm water test results significantly exceed the background concentrations, you must evaluate the BMPs to determine what is causing the difference. Possible solutions may include repairing the existing BMPs, evaluating alternative BMPs that could be implemented, and/or implementing additional BMPs (cover and/or containment) which further limit or eliminate contact between storm water and non-visible pollutant sources at your site. Where contact cannot be reduced or eliminated, storm water that has come in contact with the non-visible pollutant source should be retained on-site and not allowed to be discharged to the storm drainage system or a water body. Contact your RWQCB to determine whether it is permissible to discharge the retained storm water. It is advisable to conduct additional sampling during the next runoff event after corrective actions are implemented to demonstrate and document that the problems have been corrected.

3.7.1 Coupling Your Visual Observations with Your Sampling Results

If visual inspection of storm water BMPs used to contain non-visible pollutants at a construction site indicates that a BMP has failed or been compromised then field monitoring of the storm water from the site for non-visible pollutants is required. Of course, any BMP that has been visually inspected and found breached or compromised should be immediately repaired or replaced.

The intent of conducting field monitoring for non-visible pollutants is to obtain an immediate indication if storm water that is discharging from a site has been contaminated. An immediate indication of a polluted discharge requires an immediate response in the form of back tracking from the point of discharge to find the source and take appropriate measures to prevent a recurrence of a polluted discharge.

If at all feasible, the contaminated discharge should be contained and prevented from being discharged off site. After taking steps to correct the failed BMP, it is advisable that field monitoring in the vicinity of the BMP be conducted to verify that pollutants are no longer in the storm water.

3.7.2 What To Do If You Get Data That Shows a Problem

If your data shows a problem, follow the reporting requirements as shown in section B.3 (Receiving Water Limitations) of the General Permit. It is recommended that the following steps be taken as soon as possible:

1. Identify the source

2. Repair or replace any BMP that has failed

3. Maintain any BMP that is not functioning properly due to lack of maintenance

4. Evaluate whether additional or alternative BMPs should be implemented.

If sampling and analysis during subsequent storm events shows that there is still a problem, then repeat the steps above until the analytical results of upstream and downstream samples are relatively comparable.

3.8 Retention of Data

Results of field measurements and laboratory analyses must be kept in the SWPPP, which is required to be kept on the project site until the Notice of Termination is filed and approved by the appropriate RWQCB. It is also recommended that field training logs, Chain-Of-Custody (COC) forms and other documentation relating to sampling and analysis be kept with the project's SWPPP. The General Permit requires that records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated or after project completion.

4.0 Sampling Procedures

The collection and handling of storm water runoff samples requires care to ensure the integrity and validity of the samples. Special documentation, a Chain of Custody (COC) form, must follow the sample from the collection through the analysis process. Additional documentation to track other information of interest, e.g. field conditions, or required field measurements may also be used. This type of information is recorded on a field tracking form.

Every sample must be collected with care to ensure that the sample is representative of the runoff being tested, must be collected in the right kind of container, be preserved in accordance with the test method's specifications, and stored cold until delivered to an analytical laboratory. Some types of samples have very short holding times and must be analyzed before this holding time is exceeded. Sample handling requirements and documentation form the basis of your sampling quality assurance program.

Before starting any sampling program, contact the analytical laboratory that you plan to use to analyze your samples. Make sure to select a laboratory that will provide you with the support that you need, such as, properly cleaned and preserved sampling containers and COC forms. Some laboratories can assist in identifying courier services available to transport samples to the laboratory, or may be able to provide sampling service for you. All these details need to be worked out in advance of sample collection. The analytical laboratory should also be consulted on what additional samples will need to be collected for quality assurance and quality control purposes.

Both field and/or analytical analysis methods can be used to meet the Permit requirements. Field techniques have the advantage of providing immediate results. However, there are only a limited number of analyses that can be done in the field. Analytical laboratories can analyze for a wide range of parameters, but the data may take several weeks or longer to get back.

Some constituents (e.g. pH) can be evaluated in the field with special equipment. Field samples must be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Field equipment must be used by trained staff and the equipment must be calibrated and maintained according to the manufacturer's specifications.

Laboratory analyses should be conducted by a laboratory that is currently accredited by the California Department of Health Services Environmental Laboratory Accreditation Program (ELAP). Analyses must be conducted in accordance with 40 CFR Part 136.

Refer to the California Department of Transportation (Caltrans) *Guidance Manual: Stormwater Monitoring Protocols (Second Edition), July 2000* to assist you in developing a

sampling and analysis program. This document may be downloaded from the Caltrans Website, at http://www.dot.ca.gov/hq/env/stormwater/special/index.htm.

Figure 4-1 is an outline for a typical comprehensive storm water sampling and analysis plan. As some laboratories may have specific requirements for sample collection and handling, specific information or requirements on your samples should be checked with your laboratory.

1 PROJECT OVERVIEW/DESCRIPTION
- 1.1 Description of why the project is being conducted
- 1.2 Description of who is conducting the project
- 1.3 General scope of monitoring activities
- 1.4 Project organization/roles and responsibilities

2 MONITORING SITES
- 2.1 Site location (map)
- 2.2 Written driving directions
- 2.3 Site access instructions (gates, locks, keys, combinations)
- 2.4 Notification procedures

3 ANALYTICAL CONSTITUENTS
- 3.1 List of constituents for sampling and analysis (including sample collection methods, container type, volume required, preservation and laboratory performing analysis)

4 DATA QUALITY OBJECTIVES (DQOs)
- 4.1 Analytical reporting limits
- 4.2 Analytical precision, accuracy and completeness

5 FIELD EQUIPMENT MAINTENANCE
- 5.1 Equipment calibration
- 5.2 Equipment maintenance
- 5.3 Equipment cleaning (bottles/lids/tubing)

6 MONITORING PREPARATION AND LOGISTICS
- 6.1 Weather tracking
- 6.2 Storm selection criteria
- 6.3 Storm action levels
- 6.4 Communications/notification procedures
- 6.5 Sample bottle order
- 6.6 Sample bottle labeling
- 6.7 Field equipment preparation

7 SAMPLE COLLECTION, PRESERVATION AND DELIVERY
- 7.1 Sample collection methods
- 7.2 Field measurement methods
- 7.3 Field equipment list
- 7.4 Sample containers, preservation and handling
- 7.5 QA/QC sample collection methods
- 7.6 Sample labeling (site names, codes, etc.)
- 7.7 Composite sample splitting
- 7.8 Forms and procedures for documenting sample collection and field measurements
- 7.9 Laboratory communication procedures
- 7.10 Sample shipping/delivery, chain-of-custody

8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)
- 8.1 Field procedures for QA/QC sample collection

9 LABORATORY SAMPLE PREPARATION AND ANALYTICAL METHODS
- 9.1 Laboratory sample preparation procedures
- 9.2 Analytical constituent table (including analytical methods, holding times and reporting limits)

10 DATA MANAGEMENT AND REPORTING PROCEDURES
- 10.1 Analytical data validation
- 10.2 Electronic data transfer
- 10.3 Filing of electronic and hard copy data
- 10.4 Reports

APPENDICES
- A Clean Sampling Techniques
- B Health and Safety Plan

Figure 4-1
Outline for a Typical Storm Water Sampling and Analysis Plan

5.0 Definitions

Chain of Custody (COC) Form

A form used to track sample handling as samples progress from sample collection to the analytical laboratory. The COC is then used to track the resulting analytical data from the laboratory to the client. COC forms can be provided by an analytical laboratory upon request.

Direct Discharge

Storm water runoff that flows from a construction site directly into a 303(d) water body listed for sedimentation, siltation, or turbidity. Storm water runoff from the construction site is considered a direct discharge to a 303(d) listed water body unless it first flows through:

1) A municipal separate storm sewer system (MS4) that has been formally accepted by and is under control and operation of a municipal entity;

2) A separate storm water conveyance system where there is co-mingling of site storm water with off-site sources; or

3) A tributary or segment of a water body that is not listed on the 303d list before reaching the 303d listed water body or segment.

Electrical Conductivity (EC)

Measure of the ability of water to carry an electric current. This ability depends on the presence of ions, their concentration, valence, mobility and temperature. EC measurements can give an estimate of the variations in the dissolved mineral content of storm water in relation to receiving waters.

Field Measurements

Water quality testing performed in the field with portable field-testing kits or meters.

Field Tracking Form (FTF)

A form that serves as a guide to sampling crews to obtain sampling information and to prescribe and document sample collection information in the field. The FTF usually contains sample identifiers, sampling locations, requested analyses, QC sample identifiers, special instructions, and field notes.

Holding Time

Holding time is specified by the analytical method and is the elapsed time between the time the sample is collected and the time the analysis must be initiated.

pH

The pH is universally used to express the intensity of the acid or alkaline condition of a water sample. The pH of natural waters tends to range between 6 and 9, with neutral being 7. Extremes of pH can have deleterious effects on aquatic systems.

Sampling and Analysis Plan

A document that describes how the samples will be collected and under what conditions, where and when the samples will be collected, what the sample will be tested for, what test methods and detection limits will be used, and what methods/procedures will be maintained to insure the integrity of the sample during collection, storage, shipping and testing (i.e., quality assurance/quality control protocols).

Sediment

Solid particulate matter, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Sedimentation/Siltation

The process of sediment/silt deposition.

Settleable Solids

The settleable solids (SS) test measures the solid material that can be settled within a water column during a specified time frame. This typically is tested by placing a water sample into an Imhoff settling cone and allowing the solids to settle by gravity. Results are reported either as a volume (mL/L) or a weight (mg/L).

Silt

Soil particles between 0.05mm and 0.002mm in size. (For the purposes of its use here, it also includes clay, which is categorized by a particle size less than 0.002mm.)

Soil Amendment

Any material that is added to the soil to change its chemical properties, engineering properties, or erosion resistance that could become mobilized by storm water and would be not visible in the runoff. Soil amendments include lime, cementitious binders, chlorides, emulsions, polymers, soil stabilizers, and tackifiers applied as a stand-alone treatment (i.e., without mulch). Plant fibers (such as straw or hay), wood and recycled paper fibers (such as mulches and matrices), bark or wood chips, green waste or composted organic materials, and biodegradable or synthetic blanket fibers would not be included as soil amendments in this context because they would be visible in storm water runoff.

Suspended Sediment Concentration (SSC)

The suspended sediment concentration (SSC) test measures the concentration of suspended solid material in a water sample by measuring the dry weight of all of the solid material from a known volume of a collected water sample. Results are reported in mg/L.

Total Suspended Solids (TSS)

Suspended solids in a water sample include inorganic substances, such as soil particles and organic substances, such as algae, aquatic plant/animal waste, particles related to industrial/sewage waste, etc. The total suspended solids test (TSS) test measures the concentration of suspended solids in water by measuring the dry weight of a solid material contained in a known volume of a sub-sample of a collected water sample. Results are reported in mg/L.

Turbidity

Cloudiness of water quantified by the degree to which light traveling through a water column is scattered by the suspended organic and inorganic particles it contains. The scattering of light increases with a greater suspended load. Turbidity is commonly measured in Nephelometric Turbidity Units (NTU).

6.0 Sources of Further Assistance

Regional Water Quality Control Boards

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
NORTH COAST REGION	5550 Skylane Blvd., Suite A Santa Rosa, CA 95403	John Short shorj@rb1.swrcb.ca.gov	(707) 576-2065 FAX: (707) 523-0135
SAN FRANCISCO BAY REGION	1515 Clay St., Suite 1400 Oakland, CA 94612	Hossain Kazemi mhk@rb2.swrcb.ca.gov	(510) 622-2369 FAX: (510) 622-2460
CENTRAL COAST REGION	81 Higuera St., Suite 200 San Luis Obispo, CA 93401-5427	Jennifer Bitting jbitting@rb3.swrcb.ca.gov	(805) 549-3334 FAX: (805) 543-0397
LOS ANGELES REGION	320 W. 4th St., Suite 200 Los Angeles, CA 90013	Yi Lu (Inland Los Angeles) ylu@rb4.swrcb.ca.gov	(213) 576-6728 FAX: (213) 576-6686
		Ejigu Soloman (Ventura County) esoloman@rb4.swrcb.ca.gov	213) 576-6727 FAX: (213) 576-6686
		Xavier Swamikannu (Coastal) xswami@rb4.swrcb.ca.gov	(213) 576-6654 FAX (213) 576-6686
CENTRAL VALLEY REGION **Sacramento Office**	3443 Routier Rd., Suite A Sacramento, CA 95827-3098	Sue McConnell mcconns@rb5s.swrcb.ca.gov	(916) 255-3098 FAX: (916) 255-3015
CENTRAL VALLEY REGION **Fresno Branch Office**	3614 East Ashlan Ave. Fresno, CA 93726	Jarma Bennett bennettj@rb5f.swrcb.ca.gov	(559) 445-6046 FAX: (559) 445-5910
CENTRAL VALLEY REGION **Redding Branch Office**	415 Knollcrest Dr. Redding, CA 96002	Carole Crowe crowec@rb5r.swrcb.ca.gov	(530) 224-4849 FAX: (530) 224-4857
LAHONTAN REGION **South Lake Tahoe Office**	2501 Lake Tahoe Blvd. South Lake Tahoe, CA 96150	Mary Fiore-Wagner fiorm@rb6s.swrcb.ca.gov	(530) 542-5245 FAX: (530) 544-2271
LAHONTAN REGION **Victorville Office**	15428 Civic Dr., Suite 100 Victorville, CA 92392	Eugene Rondash erondash@rb6v.swrcb.ca.gov	(760) 241-2434 FAX: (760) 241-7308
COLORADO RIVER BASIN REGION	73-720 Fred Waring Dr., Suite 100 Palm Desert, CA 92260	Abdi Haile haila@rb7.swrcb.ca.gov	(760) 776-8939 FAX: (760) 341-6820
		Rosalyn Fleming flemr@rb7.swrcb.ca.gov	(760) 776-8939 FAX: (760) 341-6820

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
SANTA ANA REGION	3737 Main St., Suite 500 Riverside, CA 92501-3339	Michael Roth (Riverside County) mroth@rb8.swrcb.ca.gov	(909) 320-2027 FAX: (909) 781-6288
		Aaron Buck (Orange County) abuck@rb8.swrcb.ca.gov	(909) 782-4469 FAX: (909) 781-6288
		Muhammad Bashir (San Bernardino County) mbashir@rb8.swrcb.ca.gov	(909) 320-6396 FAX: (909) 781-6288
SAN DIEGO REGION	9771 Clairemont Mesa Blvd., Suite A San Diego, CA 92124	Jane Ledford ledfj@rb9.swrcb.ca.gov	(858) 467-3272 FAX: (858) 571-6972

State Water Resources Control Board

Division of Water Quality
Storm Water Permit Section
P.O. Box 1977
Sacramento, CA 95812-1977
Construction Inquiry Line: (916) 341-5537
Web Site: http://www.swrcb.ca.gov/
e-mail: stormwater@swrcb.ca.gov

How to Obtain a List of State Certified Laboratories

http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm

Other Useful Web Sites

California Stormwater Quality Task Force
http://www.stormwatertaskforce.org/

California Department of Transportation
Environmental Program http://www.dot.ca.gov/hq/env/index.htm

Storm Water Management Program http://www.dot.ca.gov/hq/env/stormwater/

APPENDIX A

General Outline of Information that should be included in your SWPPP for the Sampling and Analysis Requirements

1. Sedimentation monitoring

(In this section identify whether you need to sample for sedimentation, siltation, or turbidity. At a minimum, identify elements a & b. Note that some water bodies are identified as impaired on a segment basis rather than for the whole water body. Only construction sites with direct discharges into water bodies impaired for sediment, silt, or turbidity are required to perform this sampling. This type of monitoring may not be necessary for all projects. If you do need to conduct this monitoring your SWPPP needs to include section 2, if not move on to section 3.)

a. Site storm water discharge points

b. Receiving water

c. Review 303d list

2. Monitoring strategy for sediment

(In this section, identify the sampling process. Include where you will sample (at least one up and one down stream location is needed), what you will sample for, and your field quality control samples. Identify how your samples will be analyzed. Field measurements may be appropriate. If you conduct field sampling, you need to follow the field meter instructions, including calibration requirements.)

a. Sample locations

   i. Location upstream of the construction site in the receiving water (permit required location)

   ii. Location immediately downstream of the construction site in the receiving water (permit required location)

   iii. Location where storm water is discharged from the construction site (recommended location)

b. Parameters to be analyzed

   i. Field measurements

   ii. Laboratory analyses

c. Quality control samples, such as split samples, field blanks, equipment blanks.

3. Non-visible pollutant monitoring

(In this section, identify the potential sources of non-visual pollutants. Your SWPPP should discuss the materials in use and the activities conducted on your site, and any past contamination of your project site. These three elements are the potential pollutant sources. Determine if the potential pollutants from these sources are non-visible and can be discharged in storm water runoff. Most projects will have to develop this sampling and analysis plan. If you don't think your site can discharge pollutants, because every thing is either stored so that it doesn't contact storm water or because your site doesn't discharge runoff, it is advisable to develop a contingency sampling plan and analysis strategy, in the event of spill or containment failure. Identify how you will use your current inspection program to trigger sampling and analysis.)

a. Source identification

   i. Pre-construction contamination

   ii. Construction activities

   iii. Construction materials

b. Connect your sampling program to your inspection program

4. Monitoring strategy for non-visual pollutants

(In this section, identify the sampling process. Include where you will sample, what you will sample for, when you will sample, and your field quality control samples. For sampling locations, you need to collect samples of runoff that contacts the stored materials and runoff unaffected by it. The unaffected runoff can be immediately upstream of the potential source or from a reference location on the site. Identify how your samples will be analyzed. Field measurements and indicator parameters may be appropriate. If you conduct field sampling, you need to follow the field meter instructions including calibration requirements.)

a. Sample locations

   i. Location downstream from the storage or spill area

   ii. Location unaffected by the storage or spill area

b. Parameters to be analyzed

c. Quality control samples, such as split samples, field blanks, equipment blanks

5. Data Evaluation

(In this section, you need to identify how you will use your data. In general, if you find high levels of sediment, analytes or indicator parameters, relative to background levels, you need to contact the Regional Board, identify the source, and review your BMPs for malfunctions or potential upgrades.)

6. Training for sampling personnel

(In this section, identify how you have trained your staff or whether you hired trained sampling staff. All personnel collecting samples should be trained to collect samples in accordance with the regulatory requirements (40 CFR Part 136) or follow manufacturers instructions for use and calibration of field meters and instruments. You may want to subcontract sample collection to firms that specialize in water quality sampling)

7. Sampling procedures

(In this section identify your sampling procedures, e.g., how you will decide when to sample; how samples will be collected; if there is a special order to sample collection; what field paper work will be completed (field tracking forms, chains of custody); how samples will be handled and transmitted to the laboratory. Other sampling procedures may be needed depending on the specifics of you site and sampling program.)

8. Sampling and analysis records

(In this section, identify where you are storing records associated with sampling and analysis. Field and analytical data must be kept in the SWPPP until the Notice of Termination is filed and approved. But you also need to keep other documents associated with the sampling program, such as calibration charts, field tracking forms chains of custody, training records of samplers, laboratory certification information. Identify where this information is kept if other than in the SWPPP.)

APPENDIX B

List of Common Potential Non-visible Pollutants at Construction Projects

The following table represents potential sources of non-visible pollutants that are common to most construction sites. This list is not meant to be inclusive but to provide direction to construction site operators. Over the next year, the State Water Resources Control Board plans to conduct research into non-visible pollutants to provide further guidance and information on appropriate analytical and field tests for common construction pollutants.

List of Common Potential Non-visible Pollutants at Construction Projects

Category	Potential Pollutant Source	Field Indicator of Pollutant Release	Laboratory Analysis
Line flushing	Chlorinated water	Colormetric kit	Residual chlorine
Portable toilets	Bacteria, disinfectants	NA	Total/fecal coliform
Concrete & Masonry	Acid wash	pH meter	pH
	Curing compounds	pH meter	pH, alkalinity, volatile organic compounds (VOCs)
	Concrete rinse water	ph meter	pH
Painting	Resins	NA	Semi-volatile organic compounds (SVOCs)
	Thinners	Phenols kit	Phenols, VOCs
	Paint Strippers	NA	VOCs
	Solvents	Phenols kit	Phenols, VOCs
	Adhesives	Phenols kit	Phenols, SVOCs
	Sealants	N/A	SVOCs
Cleaning	Detergents	Colorimetric kit	MBAS, phosphates
	Bleaches	Colorimetric kit	Residual chlorine
	Solvents	Phenols kit	VOCs
Landscaping	Pesticides/Herbicides	NA	Check with analytical laboratory
	Fertilizers	NA	$NO_3/NH_3/P$
	Lime and gypsum	pH meter	Acidity/alkalinity
	Aluminum sulfate, sulfur	Total dissolved solids (TDS), pH	TDS, alkalinity
Treated wood	Copper, arsenic, selenium	Metals test kits may be available	Metals
Soil amendments & dust control	Lime, gypsum	pH meter	pH
	Plant gums	NA	Biochemical oxygen demand (BOD)
	Magnesium chloride	TDS	Alkalinity, TDS
	Calcium chloride	TDS	Alkalinity, TDS
	Natural brines	TDS	Alkalinity, TDS
	Lignosulfonates	TDS	Alkalinity, TDS