11

EROSION & SEDIMENT CONTROL

11 EROSION AND SEDIMENT CONTROL

The clearing and stripping of land for development can cause high localized erosion rates with subsequent deposition and damage to off-site properties. Whereas erosion and sedimentation is a natural process, the intensity is increased by development which can destroy the aesthetic and practical value of other properties, streams and lakes. The purpose of implementing an erosion and sedimentation control plan is to reduce the process to an acceptable level without placing undue burdens on the homeowner, builder or community.

After October 1, 1992, construction activities must be covered by a National Pollutant Discharge Elimination System (NPDES) permit. Failure to comply with these requirements may result in a fine of up to $25,000 per day of violation and possible imprisonment.

The primary objectives of the NPDES storm water permit for construction activities are to:

- Reduce excessive erosion potential;
- Minimize excessive sedimentation;
- Prevent other materials used at a construction site from causing off site contamination;
- Eliminate non-storm water discharges from the construction site;
- Install appropriate measures to reduce impacts on waterways resulting from the finished project, and provide a commitment that these measures will be maintained; and
- Establish maintenance commitments on post-construction sites.

11.1 Erosion and Sedimentation Process

Soil erosion is the process by which soil particles are removed from the land surface by wind, water or gravity. Most natural erosion occurs at slow rates; however, the rate of erosion increases when land is cleared or altered and left disturbed. The five most common types of erosion include erosion from rainfall impact, sheet erosion, rill or gully erosion, stream and channel erosion, and wind erosion.

Sedimentation is defined as the settling out of soil particles transported by water. Sedimentation occurs when the velocity of water in which soil particles are suspended is slowed sufficiently to allow particles to settle out. Larger particles, such as gravel and sand, settle more rapidly than fine particles such as silt and clay.

Effective construction site management first minimizes excessive soil erosion by keeping the soil stabilized as long as possible, and second directs runoff from remaining disturbed areas to locations where sediments are removed prior to discharge to water courses.

11.1.1 Factors Influencing Erosion

There are four primary factors that influence erosion: soil characteristics, vegetative cover, topography and climate.

Soil characteristics which determine the erodibility of the soil are particle size and gradation, organic content, soil structure and soil permeability. Soils with a high proportion of silt and very fine clays are generally the most erodible. Organic matter creates favorable soil structure, improving its stability and permeability. This increases infiltration capacity, delays the start of erosion and reduces the amount of runoff. Soil characteristics that affect soil stability include permeability and infiltration capacity; the less permeable the soil, the higher the likelihood of erosion.

Vegetative cover plays an extremely important role in controlling erosion by shielding the soil surface from the impacts of falling rain, slowing the velocity of runoff, maintaining the soil's capacity to absorb water and holding soil particles in place.

Topography, slope length and steepness are key elements in determining the volume and velocity of runoff. As slope length and/or steepness increase, the rate of runoff increases and the potential for erosion is magnified.

Rainfall frequency, intensity and duration are fundamental factors in determining the amount of erosion produced. When storms are frequent, intense or of long duration, erosion risks are high. In California, the erosion risk period is typically high in the winter rainy season (October through April) except in and near the Sierra Nevada Mountains and southern deserts, where summer thunderstorms may occur.

Table 11.1
Allowable Non-Storm Water Discharges for Construction Sites

- Discharges from fire fighting
- Fire hydrant flushing
- Potable water sources including dechlorinated water line flushing
- Uncontaminated groundwater resulting from dewatering activities
- Foundation or footing drains where the flows are not contaminated with process materials
- Natural occurring water such as springs, wetlands and riparian habitat
- Irrigation water discharged during seeding, planting, and maintenance, provided fertilizer and pesticides are applied correctly
- Pavement wash waters for dust control and general housekeeping practices provided spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used
- Individual car washing
- Air conditioning condensation

11.2 Storm Water Programs

The State construction general permit prohibits discharges which do not result from rainfall. However, certain *non-storm water* discharges are allowed if they do not cause a significant pollution problem. Table 11.1 provides examples of *non-storm water* discharges allowable under current law.

The need to protect the environment has resulted in a number of laws and subsequent regulations/programs. At times this has

resulted in overlap and ambiguity between programs. This situation is true for storm water programs. The Federal Clean Water Act (CWA), as amended in 1987, is the principal vehicle for the control of storm water pollutants. There are, however, other programs that directly or indirectly deal with the control of storm water pollutants.

11.2.1 Federal NPDES Program

In 1972, the Federal CWA was amended to provide that the discharge of pollutants to waters of the United States from any point source is effectively prohibited, unless the discharge is in compliance with the National Pollutant Discharge Elimination System (NPDES) permit. On November 16, 1990, U.S. Environmental Protection Agency (EPA) published final regulations that establish application requirements for storm water permits for specific categories of industries. Construction activities of five (5) acres or more (or less than 5 acres if part of a common plan of development or sale) are defined in the regulations as an industrial activity.

11.2.2 State NPDES Program

In California, the NPDES storm water permitting program is administrated by the State Water Resources Control Board (SWRCB) through nine Regional Water Quality Control Boards. The SWRCB has established a construction general permit that can be applied to most construction activities in the State.

11.2.3 Municipal NPDES Program

Municipalities with a population of over 100,000, drainage systems interconnected with these municipalities' systems or municipalities determined to be significant contributors of pollutants are required to obtain an NPDES storm water permit. In California, most of the major urbanized counties have already obtained an NPDES storm water permit.

Municipalities with NPDES storm water permits for their own municipal separate storm sewer system are responsible for developing a management program for construction activities in their jurisdiction. The program addresses appropriate planning and construction procedures; ensures the implementation, inspection and monitoring of construction sites which discharge storm water into their systems; and provides for education and training for construction site operators.

REGULATION	ACTIVITY	POTENTIAL
General Plan Law	Municipal development objectives Adoption of ordinances	Storm water management controls, e.g., pollutants control, watershed protection
California Environmental Quality Act (CEQA)	Environmental review of projects	Mitigation measures for reduction of pollutants
Subdivision Map Act	Adoption of ordinances	Standard/Regulations for grading, erosion protection, detention/retention design, and dust control
Flood Plain Management & Drainage Ordinances	Control of velocity	Control of erosion
	Detention/retention	Control of sediment, pollutants, and quantity
	Bank stabilization and outlet controls	Erosion and Sediment controls
Clean Water Act 401 and 404 Permits	Permits Dredging and Filling in "Waters of the United States"	Erosion control, sediment control, long-term sediment balance & minimize pollutants
		Vegetative controls to preserve riparian areas
Zoning Ordinances	Cluster Development	Minimize Basin-wide runoff & impervious areas
	Hillside Development	Slope & erosion restriction. May include revegetation or stabilization.
	Landscape/Open space	Vegetative BMP's perimeter controls reduction of runoff
Sewer Use Ordinance	Control of illicit connections	Pollutant controls
Uniform Building Code	Chapter 70 - Excavating & Grading	Minimize erosion & sedimentation
		Standards for stable cut & fill slopes
Uniform Plumbing Code	Prevention of illicit connection	Pollutant controls
	Various Chapters on materials & application/use	Pollutant controls
Fire Code	Storage of Materials	Pollutant controls
Air Quality Management Plans	Emission	Sediment & dust controls
1601 and 1603 Stream Bed Alternation Agreements	Alternations to creek and stream beds	Pollutant controls
Coastal Zone Act	Regulation of non-point pollution near the ocean	Pollutant controls

Table 11.2
Existing Regulations for Storm Water Pollution Control

11.2.4 Other State and Local Programs

In many cases, storm water pollution control may already be achieved by existing regulations or programs. In California, the General Plan Law and the California Environmental Quality Act (CEQA), provide a basis for municipalities to review and comment on all projects within their jurisdiction. Under the General Plan Law, municipalities are required to develop policies and regulations which guide development within the municipality. Each development project is then reviewed for conformance with these policies. Under CEQA, projects are also subject to review and comment for any adverse impact the projects may have on the environment, including impacts from storm water discharges.

Other regulations which may be applicable are summarized on in Table 11.2. Actions taken under these regulations should be integrated with the Storm Water Pollution Prevention Plan SWPPP to promote consistency between activities required by local and State authorities.

11.3 Storm Water Pollution Prevention Plans

The following discussion provides guidelines for the development and implementation of a storm water pollution prevention plan for a construction project. Preparing and implementing the SWPPP need not be time-consuming, and can best be accomplished using and/or slightly revising current planning, design and construction activities employed by most projects.

Table 11.3
Base Map(s) of Site for SWPPP
and Other Site Planning

- Use scale large enough to distinguish existing and proposed features of the site
- Location map must extend 1/4 mile beyond the property boundary
- Site map(s) should show:
  - Topography
  - Limits of Construction
  - Conceptual project layout
  - Surface water bodies, water courses, known wetlands, springs and wells
  - Locations where drainage leaves/will leave the property
  - Existing land use
  - Existing vegetation
  - Steep or unstable slopes
  - Areas used to store soils and wastes
  - Areas of cut and fill
  - Existing and planned paved areas and buildings

The SWPPP must be prepared before construction begins, ideally during the project planning and design phases. Or, it may be completed at the end of the design phase or early in the construction phase. Implementation of the SWPPP begins when construction begins, typically before initial clearing, grubbing and grading operations since these activities usually increase erosion potential on the site. During construction the SWPPP should be referred to frequently and refined by the owner and contractors as changes occur in construction operations which significantly affects the potential for discharge of pollutants.

The following guidelines are organized according to the phases of a construction project: planning, design and construction. For each phase, guidelines are given on how to

incorporate SWPPP preparation into the work effort. A series of work sheets is included at the end of this chapter to aid in preparation of the SWPPP.

11.3.1 Planning Phase

The planning phase is the source of much of the information needed for the SWPPP. The basis for storm water pollution control decisions are also made at this phase via the normal review process. The following discussion addresses four activities which occur during the planning phase that are important to preparation of the SWPPP:

- Assess Site Conditions
- Develop Base Map
- Select Post-Construction Best Management Plan (BMP)
- Establish Long-Term Maintenance Agreements

Assess Site Conditions: The planning phase of any construction project defines the characteristics of the site and how these characteristics will impact the project. Information on what will be built, how it will be constructed, drainage patterns, soils, topography, rainfall and special site conditions is usually obtained and used for initial planning of public works or development projects.

Develop a Base Map(s): The designer will generally prepare a site analysis as either a formal document or as an informal plan. The site analysis reviews the site's physical conditions, adjacent areas, constraints, applicable zoning and development requirements. To avoid duplication of effort and reduce costs, the designer should prepare a site base map to be shared by the SWPPP and other site analyses (see Table 11.3). Worksheet 2 at the end of this section includes items considered necessary for preparing a topography base map.

Select Post-Construction BMPs: Post-construction BMPs are the final improvements to and configuration of the project which are designed to control long-term storm water pollution. Post-construction BMPs are normally selected in the planning phase in conjunction with the approval of the tentative map, designed during the design phase of a project and completed to the satisfaction of the municipality and/or the ultimate owner.

Establish Maintenance Agreements: The general permit requires that the project owner arrange for the maintenance of any drainage/storm water pollution control measures after construction is complete.

11.3.2 Design Phase

There are three principal activities which are typically incorporated into the SWPPP during the design phase:

- Prepare Project Site Plan
- Define BMP Objectives

- Design Post-Construction BMPs

Prepare Project Site Plan: Numerous studies, reports and documents are typically prepared during preliminary and final design as the basis for many decisions about the project. A Hydrology Report, Drainage Study or similar document is typically required as part of project infrastructure. The Hydrology Report should address the design storm which will be used for erosion and sedimentation control.

The Soils Report is normally prepared based upon site soil sampling which will identify soil constraints, design criteria, slope stability, etc. Both of these reports are used by the engineer in preparation of the preliminary grading and drainage plan. They also form the technical basis for selection of erosion and sedimentation control BMPs and post-construction BMPs. This preliminary site plan includes several items which are required for the SWPPP:

- Locations of buildings and paved areas
- Proposed flow paths:
  - On-site flow paths where erosion during construction may occur and erosion and sedimentation BMPs should be applied.
  - Locations where runoff will leave the property.
  - Diversion of, or conveyance for upstream runoff.
  - Locations of flood control facilities and post-construction BMPs.
  - Approximate locations where cut and fill will occur.
  - Access points for construction traffic.
  - Areas where existing vegetation may be preserved.
  - Areas most suitable for the Contractor's yard, material storage area and vehicle maintenance area (consider location in areas to be paved).

Define BMP Objectives: During the final project design process the engineer will prepare detailed grading plans, paving and drainage plans and other plans necessary for the successful construction of the project.

For the SWPPP to be compatible with the other engineering plans, the most practical process may be for the engineer to develop BMP objectives for the construction period based on contractor activities, and the grading and drainage plan for the site.

The BMP objectives should include, at a minimum, the following items:

- Practice Good Housekeeping
- Contain Waste
- Minimize Disturbed Area
- Stabilize Disturbed area
- Protect Slopes and Channels
- Control Perimeter of Site
- Control Internal Erosion

A narrative discussion of these objectives should be prepared suitable for inclusion in the SWPPP, as well as to guide the BMP selection process. Worksheets 3, 4 and 5 at the end of this section may be used in conjunction with the site map to define BMP objectives.

11.3.3 Construction Phase

Four activities which must be addressed during the bidding and mobilization period of the construction phase include selection of BMPs, Completion of the SWPPP, submittal of the Notice of Intent (NOI) and training of field personnel.

Select BMPs: Either the owner, the owner's design consultant, or the contractor may perform these activities, at the discretion of the owner. The construction documentation should specify what the responsibilities of the owner and the contractor are with regard to storm water pollution control before, during and after construction.

Complete the SWPPP: The SWPPP should be directed at personnel on the construction project such as supervisors, foremen or inspectors. It should provide specific guidance on actions to be taken by these personnel and should be presented in a format which accommodates daily use.

Contents of the SWPPP: The SWPPP should provide a simple narrative and diagram that locates the construction site, identifies potential pollutant sources on-site, shows the location of the management practices to be used to minimize erosion and sedimentation during construction, describes measures which eliminate pollution of storm runoff by any chemicals and materials used during the construction process and shows areas for long-term post-construction control measures.

Guidelines for SWPPP Preparation: The SWPPP should be an independent document which concisely provides the erosion, sedimentation and pollution control measures to be used. All necessary planning work has been done during the site planning and design process.

The final step consists of consolidating the pertinent information and developing it into a specific erosion and sediment control plan for the project. The plan consists of three parts: a site plan, narrative and an inspection and maintenance plan. The site plan is one of a series of maps or drawings pictorially explaining information contained in the narrative. The narrative verbally explains the problems and their solutions with all necessary documentation. The inspection and maintenance plan describes the procedures whereby the BMPs are maintained in good and effective condition.

- *Site Plan:* The SWPPP site plan should be a simple illustration of the project site showing key physical features and the location of erosion and sediment control measures and all construction operation measures such as entrance

drives and construction yards. To the extent possible locally required grading plans should be used in preparing the SWPPP.

- *Project Location Map:* A figure showing the project site and the surrounding area (one-quarter mile beyond the project limits and with additional areas if necessary to show local drainage patterns). A USGS 1:24,000 scale topographic map is often used as a project location map.

- *Detailed Site Plan:* A series of one or more drawings of the construction site at a scale, typically, no smaller than 1 inch = 400 feet, sufficient to clearly show on-site drainage patterns and the location of erosion sedimentation controls. Worksheet 2 may be used as a check list for preparing a site plan.

When the layout of the site has been decided upon, a plan to control erosion, sedimentation and other pollutants from the disturbed areas must be formulated.

- *Narrative:* The narrative is a written statement which explains the erosion, sediment and other pollutant control decisions made for a particular project and the justification for those decisions. The narrative should contain concise conditions, construction schedules and other pertinent items which are not contained on a typical site plan. Worksheets 3, 4, 5 and 6 are intended for guidance on preparing the narrative portions of the SWPPP.

  The narrative is important to the construction superintendent and inspector who are responsible for implementing the plan. It provides them with a single report that describes where and when the various BMPs for contractor activities and post-construction controls should be installed.

- *Monitoring, Inspection and Maintenance Plan:* Every BMP installed on a construction site must be

Table 11.4
Contents of the
Notice of Intent

- **Owner/Developer's Name, Address, and Telephone Number**
- **Construction Site Information**
  - Project Name and Address
  - Construction Start and Completion Date
- **Site Map**
  - Existing and proposed buildings and paved areas
  - Storm drainage system
  - Adjacent streets
- **Receiving Water Information**
  - Municipality where project is located
  - Nearest downstream water course or water body (from USGS Map or equivalent)
- **Type of Construction**
  - Size of sites
  - Change in impervious surface area
- **Material Handling/Management Practices**
  - Materials to be used during construction
  - Management practices to control possible pollutants
- **Regulatory Status**

checked periodically and maintained sufficiently to ensure proper performance. The construction general permit requires that an Inspection and Maintenance Plan be implemented which assigns personnel responsible for BMP inspection and maintenance, requires maintenance of any BMP whose effectiveness is compromised, and keeps inspection and maintenance records on file for at least three years.

- *Notice of Intent (NOI):* The construction general permit requires that an NOI be submitted to the State Water Resources Control Board (SWRCB) prior to the start of construction. The NOI is not an application for a permit and is not subject to approval - it simply notifies the SWRCB that a construction project is about to begin, the location of the project, the responsible parties and a certification that a SWPPP has been prepared and will be followed. The owner of the construction project is responsible for submitting the NOI. Owners who submit NOIs are authorized to discharge storm water under the conditions of the construction general permit. The completed NOI must be attached to the SWPPP.

  Prior to issuance of a grading permit, an executed copy of the NOI shall be on file with the City.

  If a construction projects begins before the NOI is submitted, the NOI should be submitted as soon as possible thereafter. All construction projects are subject to the general permit including projects which began before the general permit was issued. Owners of active construction projects without a SWPPP in place are discharging storm water without an NPDES permit and are in violation of the Clean Water Act. Violations may result in fines or imprisonment.

  Failure to comply with the Clean Water Act may result in fines up to $25,000 per day of violation or any other appropriate sanction.

- *Contents of the NOI:* The construction general permit and NOI are included at the end of this section. Much of the information provided on the NOI should have been developed for the SWPPP. Table 11.4 summarizes this information.

- *Train Personnel:* Training is imperative to the success of the BMPs. Adequate training is required if these BMPs are to be installed and maintained properly. These BMPs will fail if not properly installed and maintained.

  An effective training program is based on four objectives:

  - How to identify a storm water pollution problem;
  - How to define solutions;

- Making every employee responsible for storm water pollution and its solution; and
- Soliciting feedback to improve the BMPs.

- *Construction Operations:* The construction bid package will usually contain specifications that the contractor comply with the construction general permit by implementing the SWPPP. This may be contractually, or the owner may require the contractor to prepare some or all of the SWPPP, and submit the NOI to cover the particular construction activity. During construction, the contractor then implements the BMPs according to the SWPPP. The owner/contractor is also responsible for maintenance and inspection of the BMPs for erosion and sediment control and other contractor activities, and the installation of the post-construction BMPs.

  Because site conditions will vary during construction, the SWPPP should be revised as necessary, with any changes highlighted on the copy maintained at the construction site. There is no formal revision process; upon inspection the SWPPP must reflect the existing status and condition of the site.

- *Construction Completion:* During construction, the post-construction BMPs should have been installed according to construction plans and specifications. The general construction permit remains in force until construction is complete. Post-construction BMPs should be properly installed, and responsible parties must be designated and funds committed to the long-term maintenance needs of these BMPs.

  The SWRCB must be notified of two conditions:

  - When construction is complete; and
  - When change of ownership occurs.

  The SWRCB requires that a Notice of Termination be provided for such notification. If a new owner is assuming responsibility for some or all of the construction site, a revised NOI and annual fee must also be submitted, and the SWPPP must be revised by the new owner for any changes in construction conditions.

11.4 Best Management Practices Selection

Best management practices are generally selected in a three step process:

- *Define BMP Objectives:* Define locations where erosion is likely to occur and where other construction related pollution may be generated.

- *Identify BMP Category:* Select the appropriate category or categories of BMPs which address each objective.

- *Select Appropriate BMPs:* BMPs for contractor activities and erosion and sedimentation control are chosen from each category based on site constraints, construction requirements and cost-effectiveness.

11.4.1 Define BMP Objectives

Each construction project is unique. Therefore, an understanding of the pollution risks of the construction activity is essential for selecting and implementing BMPs. Defining these risks requires review of the characteristics of the site and the nature of the construction.

Once these pollution risks are defined, BMP objectives are developed and BMPs selected. The BMP objectives for construction projects are as follows:

Practice Good Housekeeping: Perform activities in a manner which keeps potential pollutants from draining or being transported off-site by managing pollutant sources and modifying construction activities.

Contain Waste: Dispose of all construction waste in designated areas, and keep storm water from flowing onto or off these areas.

Minimize Disturbed Areas: Only clear land which will be actively under construction in the near term, minimize new land disturbance during the rainy season and avoid clearing/disturbing sensitive areas and other areas where site improvements will not be constructed.

Stabilize Disturbed Areas: Provide temporary stabilization of disturbed soils whenever active construction is not occurring on a portion of the site. Provide permanent stabilization during finish grading and landscape the site.

Protect Slopes and Channels: Outside of the approved grading plan area, avoid disturbing steep or unstable slopes. Safely convey runoff from the top of the slope and stabilize disturbed slopes as quickly as possible. Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible and ensure that increases in runoff velocity caused by the project do not erode the channel.

Control Site Perimeter: Upstream runoff should be diverted around or safely through the construction project. Local codes usually state that such diversions must not cause downstream property damage or be diverted into another watershed. Runoff from the project site should be free from excessive sediment and other contaminants.

Control Internal Erosion: Detain sediment-laden waters from disturbed, active areas within the site.

Site characteristics and contractor activities affect both the potential for erosion and contamination by other constituents used on the construction site. Before defining BMP objectives, the engineer should carefully consider:

1. Site conditions that affect sedimentation and erosion including:
   a. Soil type, including underlying soil strata which are likely to be exposed to storm water.
   b. Natural terrain and slope.
   c. Final slopes and grades.
   d. Location of concentrated flows, storm drains and streams.
   e. Existing vegetation and ground cover.
2. Climatic factors, which in arid and semi-arid regions include:
   a. Seasonal rainfall patterns.
   b. Appropriate design storm including intensity and quantity of rainfall.
3. Type of construction.
4. Construction schedules.
5. Construction sequencing and phasing of construction.
6. Size of construction project and area to be graded.
7. Location of the construction activity relative to adjacent uses and public improvements.
8. Cost-effectiveness
9. Types of construction materials and potential pollutants present on-site.

11.4.2 Identify BMP Categories

Once the BMP objectives are defined, it is necessary to identify the category of BMPs that is best suited to meet each objective. A category is a grouping of BMPs which are related in how they control storm water pollution, see Table 11.5. The particular BMP selection from each category depends on the specific site conditions, construction activities and cost-effectiveness considerations.

To determine where to place categories of BMPs, a map of the project site is prepared with sufficient topographic detail to show existing and proposed drainage patterns and existing and proposed permanent storm water control structures. The project site map should identify the following:

- Locations where storm water enters and exits the site. Include both sheet flow and channel flow for the existing and final graded contours.
- Locate permanent storm water collection and control structures.
- Identify locations subject to high rates of erosion such as steep slopes and unlined channels. Long, steep slopes over 100' in length are considered as areas of moderate to high erosion potential.
- Categorize slopes as:
    - Low erosion potential: 0 to 5 percent slope.
    - Moderate erosion potential: 5 to 10 percent slope.
    - High erosion potential: slope greater than 10 percent.
- Identify sensitive areas which must not be disturbed, as well as other areas where site improvements will not be constructed. Establish clearing limits around these areas to prevent disturbance by the construction activity.
- Identify the boundaries of drainage areas if the site has more than one drainage outlet. Then calculate the appropriate area of each drainage area.
- Define areas where various contractor activities have a likely risk of causing a pollutant discharge.

With this site map in hand, categories of BMPs can be selected and located. In general, the categories of BMPs should be considered in the order listed in Table 11.5. This is because it is more effective to prevent erosion/pollution than to remove sediment/pollutants, and because erosion prevention is achieved most cost-effectively by planning before construction begins and phasing construction activities.

As shown in Table 11.5, most BMPs achieve more than one objective. This should be taken into account when selecting BMPs to achieve maximum cost-effectiveness.

BMP CATEGORY	BMP OBJECTIVES						
	Practice Good Housekeeping	Contain Waste	Minimize Disturbed Areas	Stabilize Disturbed Areas	Protect Slope & Channels	Control Site Perimeter	Control Internal Erosion
BMPs FOR CONTRACTOR ACTIVITIES (Chapter 4)							
Construction Practices (CA 1 to 10)	✓			✓	✓	✓	✓
Material Management (CA 10 to 19)	✓						
Waste Management (CA 20 to 29)		✓	✓	✓			
Vehicle & Equipment Management (CA 30 to 39)	✓					✓	✓
Contractor Training (CA 40)	✓	✓					
BMPs FOR EROSION & SEDIMENT CONTROL (Chapter 5)							
Site Planning Considerations (ESC 01 to ESC 10)	✓	✓	✓	✓	✓	✓	✓
Vegetative Stabilization (ESC 10 to ESC 19)				✓	✓		
Physical Stabilization (ESC 20 to ESC 29)	✓		✓	✓	✓	✓	
Diversion of Runoff (ESC 30 to ESC 39)	✓		✓	✓	✓	✓	
Velocity Reduction (ESC 40 to ESC 49)				✓	✓		
Sediment Trapping/Filtering (ESC 50 to ESC 59)				✓	✓	✓	✓
POST CONSTRUCTION BMPs (See Municipal BMP Handbook)				✓	✓	✓	✓

Table 11.5
Categories of BMPs and the BMP Objectives Met by Each

11.4.3 Selecting BMPs for Contractor Activities

Certain contractor activities may cause pollution if not properly managed. Contractor activities that impact storm water quality include:

Construction Practices

- Dewater Operations
- Paving Operations
- Structure Construction

Material Management

- Material Delivery and Storage
- Material Use
- Spill Prevention and Control

Waste Management

- Solid Waste
- Hazardous Waste
- Contaminated Soils
- Sanitary/Septic Wastes

Vehicle and Equipment Management

- Cleaning
- Fueling
- Maintenance

During the selection of the proposed BMPs, each contractor activity should be given consideration. These considerations should include the following:

Is it expected to rain? BMPs may be different on rainy days vs. dry days, winter days vs. summer days. For instance, material storage areas may be covered with tarp during the rainy season, but not in the summer.

How much material is used? Less stringent BMPs may be used if a "small" amount of material is used.

How much water is used? The more water used and wastewater generated, the more likely that pollutants transported by this water will reach the drainage system or be transported off-site. Washing out one concrete truck on a flat area of the site may be sufficient, but a containment pit should be constructed if a number of trucks will be washed out at the same site. Consideration should be given to recycling water whenever possible.

What are the site conditions? BMPs selected will differ depending on whether the activity is conducted on a slope or flat ground, near a drainage structure or

watercourse. Anticipating problems and conducting activities away from certain sensitive area will reduce the cost and inconvenience of performing BMPs.

What about accidents? Pre-establishing a BMP for every conceivable pollutant discharge may be very costly and significantly disrupt construction.

As a rule, establish controls for common activities and be prepared to respond quickly to accidents.

Keep in mind that the BMPs are suggested practices which may or may not apply in every case.

11.4.4 Selecting BMPs for Erosion and Sediment Control

BMPs for erosion and sediment control are selected to meet the BMP objectives based on specific site conditions, construction activities and cost-effectiveness. Different BMPs may be needed at different times during construction constantly changing site conditions. The remainder of this section discusses how each BMP objective should be met to address the dynamics of a typical construction project.

Minimize Disturbed Areas

The first step for selecting BMPs is to compare the project layout and schedule with on-site management measures that where appropriate, can limit the exposure of the project site to erosion and sedimentation.

These BMPs all have a similar goal, which is to minimize the amount of the site subject to erosion. Consider the following BMPs:

1. Do not disturb any portion of the site unless an improvement is to be constructed there.

2. The staging and timing of construction can minimize the size of exposed areas and the length of time the areas are exposed and subject to erosion.

3. The staging of grading operations should limit the amount of areas exposed to erosion at any one time. Only the areas that are actively involved in cut and fill operations or are otherwise being graded should be exposed. Exposed areas should be stabilized as soon as grading is complete in the area.

4. Retain existing vegetation and ground cover where feasible, especially along watercourses and the downstream perimeter of the site.

5. Do not clear any portion of the site until active construction begins.

6. Quickly complete construction on each portion of the site.

7. Install landscaping and other improvements that permanently stabilize each part of the site immediately after the land has been graded to its final contour.

8. Minimize the amount of denuded areas and any new grading activities during the wet months of October through April.

9. Construct post-construction storm water control facilities early in the project and use for sediment trapping, slope stabilization and velocity reduction during the construction period.

Stabilize Disturbed Areas

The purpose of site stabilization BMPs is to prevent erosion by covering disturbed soil. This covering may be vegetative, chemical or physical. Locations on a construction site which are particularly subject to erosion and should be stabilized as soon as possible include:

- Slopes
- Highly erosive soils
- Construction entrances
- Stream channels
- Soil stockpiles

Stabilize disturbed areas keeping in mind the following:

1. As a rule, native vegetation in undisturbed areas represents the "baseline" for erosion control. The Subdivision Map Act provides language to limit erosion to pre-development levels. Thus, retaining native vegetation in undisturbed areas provides the first and best line of defense against erosion and sedimentation and does so at least cost to the contractor, while minimizing the requirement to revegetate or provide structural controls.

2. Temporary ground covers protect soil from erosion until permanent vegetation can be established or permanent construction is installed.

3. Timing of revegetation efforts is critical in arid regions. Revegetation should be performed just before or during the rainy season unless an irrigation system exists on-site.

4. Certain relative non-toxic chemicals, such as magnesium chloride or lignum sulfate, may be used for soil stabilization where revegetation is not practicable. These two chemicals do not have an adverse impact on plant life and are a low-cost stabilization treatment.

5. Ground cover of gravel, decomposed granite, wood chips or mulch may be used.

Protect Slopes and Channels

The next step is to provide slope protection in disturbed areas. Consider the following BMPs:

1. Avoid constructing steep slopes. Increasing slope length and steepness increases the velocity of runoff, which greatly increases its erosive energy. If slope steepness is doubled while other factors are held constant, soil loss potential is increased 2.5 times. If both slope steepness and length are doubled, soil loss potential is nearly 4 times greater.

2. Divert or intercept storm water before it reaches long and/or steep slopes using temporary dikes, swales or pipe slope drains.

3. Long steep slopes should be terraced at regular intervals. Terraces will slow down the runoff and provide a place for small amounts of sediment to settle out.

4. Slope benches may be constructed with either ditches along them or back sloped at a gentle angle toward the hill. These benches and ditches intercept runoff before it can reach an erosive velocity and divert it to a stable outlet.

5. Slope stability for cuts and fills should conform to grading ordinances, the Uniform Building Code and/or soils report recommendations.

6. Overland flow velocities can be reduced by creating a rough surface for runoff to cross. Driving a bulldozer up and down a slope creates tread marks parallel to slope contours. These miniature terraces both slow runoff velocity and provide flat places for vegetation to hold.

7. Raking or disking the soil surface before seeding also keeps runoff velocities down and increases plant establishment rates. Vegetation, once established, will further reduce runoff rates.

8. Build check dams or other energy dissipation structures in unlined drainage channels to slow runoff velocity and encourage settlement of sediments.

9. Construct velocity reducing structures or riprap linings as soon as storm water outfalls are constructed.

Control Site Perimeter

Perimeter control establishes barriers along the perimeter of the project site. Several strategies for using BMPs for perimeter control may be considered.

1. Divert upstream runoff around or through the construction site with no contact with exposed soils or construction activities.

2. Runoff from areas upslope of those that have been denuded should not be allowed to cross the exposed soils, particularly when the denuded areas are on slopes.

3. Leave a vegetative barrier along the property boundary and interior water courses.

4. Trap and remove sediment in runoff from the construction site before it leaves the property.

Perimeter control should be placed everywhere runoff enters or leaves the site. Perimeter controls for all but the smallest projects will become overloaded by both runoff and sediment, and should be supplemented by additional controls within the interior of the construction site.

Runoff which is free of excessive sediment should be diverted around disturbed areas of the construction site and other locations highly susceptible to erosion. If possible, the runoff should be diverted to stabilized areas where the runoff can be retained and allowed to soak into the ground, or into stabilized drainage ways with sufficient hydraulic capacity to convey any increases in flow. When possible, permanent drainage structures should be built early in the construction project to collect and convey flow diversions.

Runoff diversions should be considered in the following situations:

1. Divert upslope water around unvegetated areas of the construction site with dikes, swales or temporary storm drains.

2. Divert runoff to soils able to absorb water.

3. Dikes and ditches are the two most common BMPs to divert upland runoff away from a disturbed area; to intercept runoff from a disturbed area; to intercept runoff on cut or fill slopes; and to prevent runoff from entering a disturbed area, such as a group of building pads.

4. Upstream, off-site flow can be taken to the downstream area of the project site and released back into the natural drainage pattern. A spreading basin or

other temporary form of energy dissipator may be needed for large diverted flows or at the base of steep slopes.

5. Perimeter channel or berm to divert flow should not flood, cause erosion or otherwise adversely impact surrounding properties. While structures designed for sediment control are temporary and are designed to remove sediment from frequent storms, they must be designed to safely detain and/or carry major floods without increased risk of property damage.

Control Internal Erosion

Once all other erosion and sediment control BMPs have been exhausted, excessive sediment should be removed from the storm water both within and along the perimeter of the project site. The appropriate controls work on the same principle: the velocity of sediment-laden runoff is slowed by temporary barrier basin which pond the storm water to allow sediments to settle out. Sediment trapping BMPs include silt fence, straw bales, sand bags, brush or rock filters, storm drain inlet protection, sediment traps and basins.

Appropriate strategies for implementing sediment trapping controls include:

1. Direct sediment-laden storm water to temporary sediment traps.

2. Locate sediment basins and traps at low points below disturbed areas.

3. Protect all existing or newly installed storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets.

4. Direct off-site and/or sediment-free storm water away from denuded areas and away from temporary sediment traps.

5. Construct temporary sediment traps or basins at the drainage outlet for the site. The discharge from one basin should not enter the inlet of another basin.

6. Excavate post-construction storm water detention basins early in the project, use them as sedimentation basins during construction, remove accumulated sediment, and landscape the basin when the upstream drainage area is stabilized.

7. Temporary sediment barriers such as silt fences, straw bale and sand bag barriers and brush or rock filters should only be used in areas where sheet flow runoff occurs. Temporary sediment barriers should only be installed along a contour line on relatively flat slopes where sufficient area for ponding sediment-laden water exists. These barriers are not appropriate for large drainage areas unless the drainage area is split and additional barriers are

placed upstream so that the incremental drainage area to each barrier is less than one acre.

8. Protect all existing or newly-installed storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets.

11.4.5 Selection of Post-Construction BMPs

Post-construction BMPs are generally oriented toward municipal requirements established in a master plan or ordinance. For most projects, there will be no single BMP which addresses all the post-construction storm water quality problems. Instead, a multi-level strategy will be worked out which incorporates source controls, on-site treatment controls and community-wide treatment.

Source Control BMPs

- Planning Management: Municipalities may regulate through zoning ordinances, subdivision ordinances or buffer/setback requirements the amount of runoff from a site. The municipality may discourage development in environmentally sensitive areas. For a specific project, the developer may achieve these goals by minimizing the impervious area that is directly connected to the drainage system, and by incorporating setbacks from surface waters.

- Materials Management: The objective of these BMPs is to minimize the opportunity for rainfall or runoff to come into contact with pollutants. Commercial and industrial project designs should be adopted to keep pollutant storage/use/disposal areas out of floodplains, away from drainage paths, under cover and/or in containment areas.

- Spill Prevention: Spill prevention BMPs should be incorporated into project designs by using containments, leak resistant materials and accessways for proper cleanup.

- Illegal Dumping: Signs may be installed at inlets or along drainageways, and brochures may be distributed to residents/tenants of new facilities to increase awareness about illegal dumping.

- Illegal Connections: Most municipalities will have ordinances, and may require inspection of construction sites to prevent connections to the storm water system from non-storm water sources. This includes connections of floor drains, washdown areas, septic tank overflows and the like.

- Street/Storm Drain Maintenance: Infrastructure maintenance after construction will be required and may be performed by the municipality or property owner. Such BMPs would include street sweeping, catch basin cleaning and

drainage structure cleanouts. Maintenance considerations should be integrated into the infrastructure when designed.

11.5 Measuring BMP Performance

One of the final steps in the preparation of the Storm Water Pollution Prevention Plan (SWPPP) is to develop a program to monitor how well the BMPs work, and to evaluate whether additional BMPs are required. The construction general permit requires that a monitoring, inspection and maintenance plan with the following objective be a component of the SWPPP:

- To inspect BMPs annually, as well as prior to and after a storm event.
- To aid in implementation of the SWPPP.
- To measure the effectiveness of the BMPs.

To meet these objectives the monitoring effort has these elements:

- Site Inspection
- Certification of Compliance
- BMPs Monitoring
- Record Keeping
- SWPPP Review and Modifications

11.5.1 Site Inspections

Inspections before and after a storm event are required by the construction general permit. At the onset of a construction project (e.g., clearing, grubbing, earth movement) it may be more appropriate to perform inspection of the BMPs on a regular basis instead of just before and after a storm. This will allow sufficient time for any corrections or improvements to be made in time before a storm. Inspection can usually be performed as part of a regular construction inspection program. According to the general permit, a tracking or follow-up procedure must follow an inspection which discovers deficiencies in the BMPs.

The results of the inspection and assessment must be written. Include the date of the inspection, the person(s) who performed the inspection and the observations. Inspection records must be retained for three (3) years.

A sample inspection form has been provided as Worksheet No. 7.

11.5.2 Certification of Compliance

Each site must be certified based on the annual inspection, conducted by the Owner, or his representative, that the facility is in compliance with the requirements of the general permit and the SWPPP. If the inspection indicates noncompliance, the governing Regional Water Quality Control Board is to be notified immediately. The

notification shall identify the type(s) of noncompliance, the actions required to come into compliance and a time schedule to achieve compliance.

11.5.3 BMPs Monitoring

The type of BMP monitoring depends on which BMP is implemented. In the case of BMPs installed during construction the monitoring consists of visual inspection to ensure that the BMP was implemented and maintained according to the SWPPP. Such inspection would include:

- Looking for evidence of spills and resulting clean-up procedures;
- Examining the integrity of containment structures;
- Verifying use of employees education programs for the various activities;
- Noting the location of activity;
- Verifying adequacy of trash receptacle; and
- Verifying waste disposal practices.

In the case of sediment and erosion control BMPs, the monitoring program should consist of regular inspection to determine the following:

Are the installed BMPs effective?

The effectiveness of a BMP would be based on the presence of silt behind or within control devices, the presence of silt downstream of the site and signs of erosion in stabilized areas after a storm event. The system may be deemed ineffective if:

1. Silt is present outside of the control area;

2. Structural controls are breached or fail under storm events of minor, less than 2-year, 24-hour) intensity;

3. Rills or gullies are present in stabilized slopes;

4. Evidence of silt buildup in downstream storm drains and drainage ways is apparent; and

5. Controls are not maintained in accordance with design guidelines.

Have drainage patterns changed?

If the site has undergone significant grading operations, changing the drainage patterns, adjustments to the BMP controls will likely be required to address this change. The inspector shall determine the extent of the drainage pattern changes, if the changes are addressed in the SWPPP and if modifications to the erosion and sediment controls are required to address this change.

Are sediment and erosion BMP installed properly?

The SWPPP BMPs should include details or references to allow for the proper construction of structural or vegetative erosion control devices. The inspector should ensure that these systems are installed in the proper locations according to the SWPPP.

Are areas stabilized as quickly as possible in an area after completion of construction activities?

Active construction areas (inactive construction areas may be defined as areas in which no construction activity will occur for a period of 30 days or longer) which have been disturbed should be stabilized through the use of vegetation, mulch, erosion control matting or structural methods within seven calendar days from the last construction activity in the area. If construction, climatological, or other site conditions do not allow stabilization within this time frame, the SWPPP should define alternative approaches (e.g. watering or chemicals for dust control).

Are the BMPs properly maintained?

Maintenance of the erosion and sediment devices is the most critical as well as the potentially most expensive part of the erosion control plan. The inspector should inspect the site on a regular basis and after any storm of 0.5 inches or greater to determine maintenance requirements and general condition of the system.

The following maintenance tasks should be performed on a regular basis:

1. Removal of silt from barriers and sedimentation devices.

2. Replacement or repair of worn or damaged geotextile fabric.

3. Repair or replacement of damaged structural controls.

4. Seeding or mulching of damaged stabilized areas.

5. BMPs for any chemicals or fuels not addressed in the SWPPP must be developed.

6. Other control maintenance as defined in the BMP fact sheet of the approved SWPPP.

All maintenance related to a storm event should be completed within 48 hours of the storm event.

11.5.4 Record Keeping

Records of all inspections, compliance certifications and noncompliance reporting are to be retained for at least three (3) years by the Owner/Developer.

It is suggested that records of incidents such as spills, or other episodic releases, be kept. Analyzing a history of this information can provide insight into modifying BMPs. Also keep a record of maintenance activities or any other BMPs that are of an "action" nature. It is easy to demonstrate that a BMP which involves a physical change, such as berming or covering, has been accomplished. But actions that relate to good housekeeping can only be demonstrated by record keeping.

11.5.5 SWPPP Review and Modifications

During the course of construction unanticipated changes may occur which affect the SWPPP, such as schedule changes, phasing changes, staging area modifications, off-site drainage impacts and repeated failures of designed controls. These changes must be made known and the SWPPP revised accordingly. During the preparation and review of the modified SWPPP, construction may continue with temporary modifications to the erosion and sediment control BMPs.

Revisions to the SWPPP are also required when the properly installed systems are ineffective in the prevention of silt transport off the site. Revisions to the SWPPP are also required if there is a new, deleted, or moved activity that could result in a significant amount of pollutants discharged in the storm water.

11.6 Worksheets

The previous sections provide guidelines, organized by phase: planning, design and construction, directed at incorporating preparation of the SWPPP into the overall work effort. The following worksheets are included to aid in preparation of the SWPPP.

REVISIONS	DATE

NOI attached?
[ ] Yes
[ ] No

Storm Water Pollution Plan (SWPPP) Worksheet
California Construction General Permit

Worksheet 1. Project Information

Project Name: _____

Project Location: Street Address (or Equivalent): _____

City: _____ County: _____ Zip Code: _____

Project Owner: _____

Contact Person: _____ Phone No. _____

Owner's Mailing Address: Street Address (or Equivalent): _____

City: _____ County: _____ Zip Code: _____

[ ] Identify responsible personnel:

[ ] Implementing and revising the SWPPP: _____

[ ] Inspecting equipment: _____

[ ] Regular inspections of BMPs: _____

[ ] Training employees about BMPs affecting their job: _____

List all Contractors and Subcontractors responsible for implementing SWPPP for the project:

NAME	CONTACT PERSON	DATE WORK BEGINS	DATE WORK ENDS

Worksheet 2. Project Site Map Requirements

Please Check the Boxes, and provide supporting information as requested:

[ ] Topographic Base Map Attached? Map shows:

- [ ] An area extending one-quarter mile beyond the property boundaries of the construction site:
- [ ] The boundary of the construction site. Construction Area = ___ Acres.
- [ ] Nearby surface water bodies, including water courses, wetlands, springs and wells.
- [ ] The location(s) where storm water drains onto or off of the property.
- [ ] Boundary of off-site areas that drain into the construction site.

[ ] Site map(s) attached? Maps show:

- [ ] Temporary storm water structures used during construction.
- [ ] Areas used to store soils and construction waste.
- [ ] Areas of cut and fill.
- [ ] Drainage patterns and slopes anticipated after major grading activities, including the location of storm water structures to be constructed on the property (e.g., storm drains, detention ponds, channels).
- [ ] Areas of soil disturbance.
- [ ] Locations of potential soil erosion requiring BMPs during construction.
- [ ] Existing and proposed paved areas and buildings.

  Existing Area:____percent of site Proposed Area:____percent of site

- [ ] Estimated runoff coefficient before construction:_____after construction_____
  (See the local municipality for approved runoff coefficients for your community.)
- [ ] Locations where storm water structures and controls will be built to control storm water pollution after construction is complete.
- [ ] The boundary of the drainage area upstream of each location where storm water leaves the property.
- [ ] Any vehicles storage and service areas.
- [ ] Areas of existing vegetation.

Worksheet 3. Inventory of Contractor's Activities and Special Site Conditions

Provide a description to contractor's activities that could result in the discharge of pollutants in the storm water runoff from the site. In addition, provide a description of special site conditions that may impact pollutants in storm water discharges.

Contractor's Activities

[ ] Describe toxic materials that are known to have been stored, disposed, spilled, or leaked in significant quantities onto the construction site:

[ ] Describe construction materials, equipment and vehicles that comes in contact with storm water:

[ ] Describe construction material loading, unloading and access areas/activities:

[ ] Describe equipment storage, cleaning, and maintenance areas/activities:

[ ] Describe storage and disposal of construction materials (on-site and off-site):

Special Site Conditions

[ ] Describe storm water structures and controls on the site prior to construction and how these structures/controls will be integrated into the SWPPP to reduce sediment and other pollutants in storm water discharge:

[ ] List materials/waters other than storm water which will flow from the site during dry weather, the approximate amount of flow, and methods for preventing other dry weather flows:

Worksheet 4. BMPs for Contractor Activities

Provide a list of BMPs selected to reduce pollutants associated with contractor activities (see Worksheet 3). For each BMP selected, identify the pollution(s) of concern (see Table 1.1). Attach modified BMP fact sheets and/or appropriate information for the BMP selected. (See Chapter 4, BMPs for Contractor Activities.)

Contractor Activities (Worksheet 3)	Construction Practices			Materials Management			Waste Management					Vehicle & Equipment Management			Primary Pollutant(s) of Concern
	CA1	CA2	CA3	CA10	CA11	CA12	CA20	CA21	CA22	CA23	CA24	CA30	CA31	CA32	
1. Toxic material on-site															
2. Construction material equipment & vehicles in contact with storm water															
3. Material loading, unloading and access areas/-activities															
4. Equipment storage cleaning, and maintenance areas/activities															
5. Storage and disposal of construction materials (on-site and off-site)															

Worksheet 5. BMPs for Erosion and Sedimentation Control

[ ] Describe the source and composition of the existing soil and fill material
(Soil Report Attached? Yes___ No___)

[ ] Provide a site map showing locations where BMPs for erosion and sediment control are placed. This map should be updated when BMPs are revised to meet evolving construction conditions. Provide a brief description of BMP selected, and, if appropriate, attach modified fact sheets or additional information for erosion and sedimentation control BMPs.

✓	BMPs SELECTED	DESCRIPTION OF BMPs FOR EROSION & SEDIMENTATION CONTROL
SITE PLANNING CONSIDERATIONS		
	Scheduling	
	Preservation of Existing Vegetation	
SOIL STABILIZATION		
	Seeding and Planting	
	Mulching	
PHYSICAL STABILIZATION		
	Geotextiles and Mats	
	Dust Control	
	Temporary Stream Crossing	
	Construction Road Stabilization	
	Stabilized Construction Entrance	

Worksheet 6. Post-Construction BMPs

Provide a site map locating treatment control BMPs which will be constructed as part of this project to reduce storm water pollution after construction is complete. Selection of these and other post-construction BMPs may be guided using the Municipal BMP Handbook, and must consider site-specific and seasonal conditions. Provide on the worksheet below the BMP selected, the responsible party for maintenance and operations, and source for funding the operation and maintenance.

✓	BMPs SELECTED	MAINTENANCE RESPONSIBILITY	FUNDING SOURCE FOR O&M
	TREATMENT CONTROL BMPs (See Chapter 5, Municipal Handbook)		
	Infiltration		
	Wet Ponds		
	Constructed Wetlands		
	Vegetated Swales and Strips		
	Extended Detention Basins		
	Media Filtration		
	Oil/Water Separators and Water Quality		
	Multiple Systems		
	SOURCE CONTROL BMPS (See Chapter 4, Municipal Handbook)		

Describe other measures which will be employed on the project site to control storm water pollution after construction is complete, and steps to be taken by the current owner to ensure that these measures are conducted.

Worksheet 7. Monitoring, Inspection and Maintenance Plan
(To be completed by personnel responsible for monitoring, inspection and maintenance)

[ ] Describe maintenance/repair efforts to ensure BMPs are in good and effective condition:

[ ] Describe inspection procedures and record keeping efforts:

[ ] Annual Inspection:

[ ] Pre-storm Inspection:

[ ] Post-storm Inspection:

[ ] Describe training program/material for site personnel responsible for installing, inspecting, and maintaining BMPs:

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name_____Title_____

Signature_____Date_____

This SWPPP was prepared by:

Name_____Title_____

Signature_____Date_____