APPENDIX K

Site Grading and Storm Drainage Study

SITE GRADING AND STORM DRAINAGE

Proposed Gaming Facility
North Fork Rancheria of Mono Indians
Madera County, California

SITES I AND II

CIVIL ENGINEERS

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August 2005
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SECTION-I
Site I
Alternate Layouts A, B, & C

SITE GRADING AND
STORM DRAINAGE (SITE I)
PROPOSED GAMING FACILITY
NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

INTRODUCTION

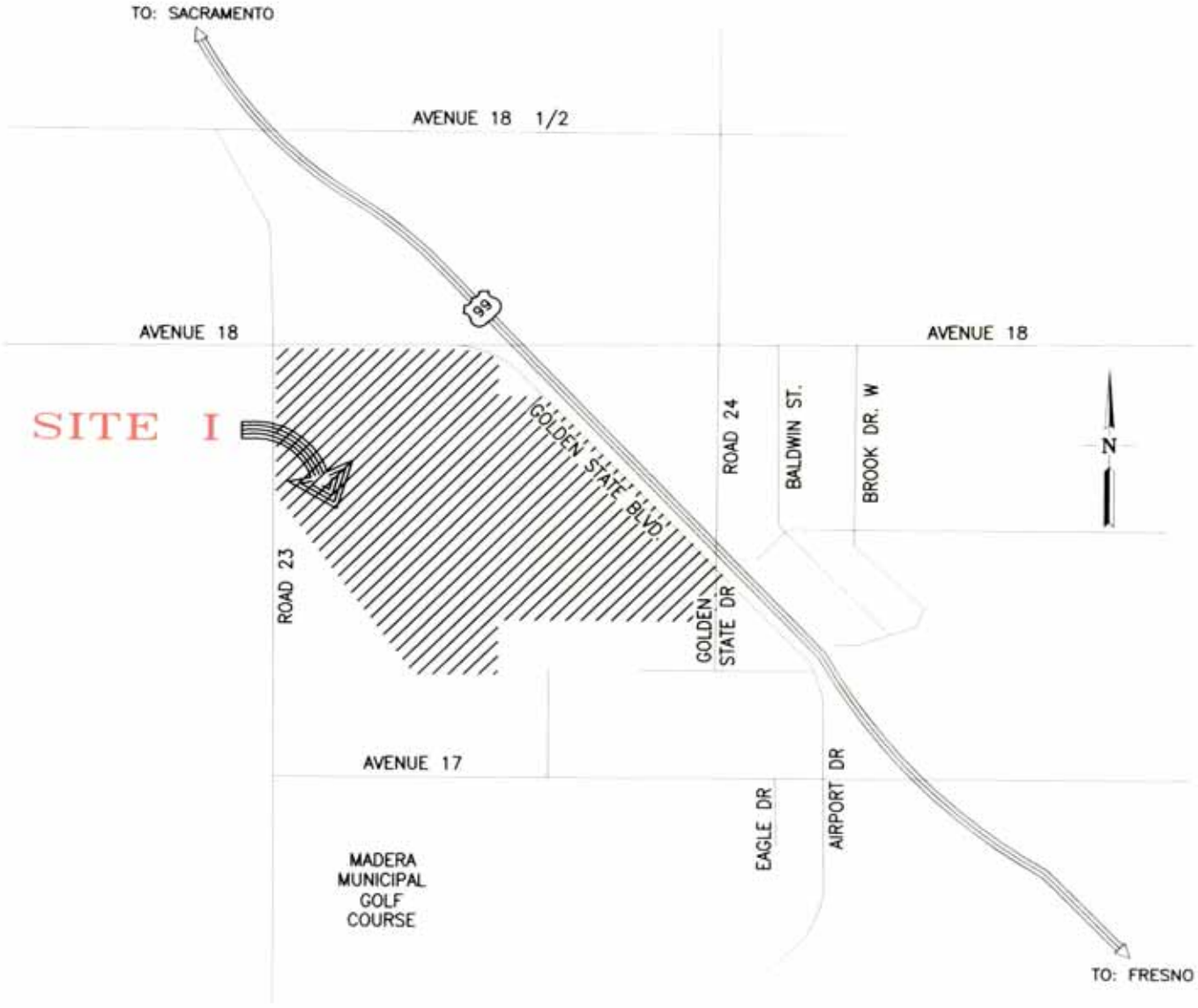
This report presents preliminary site grading and storm drainage plans for the proposed Gaming Facility in Madera County located on the west side of State Highway 99, South of Avenue 18, and East of County Road 23 in Madera County, California (See Figure 1).

The plans were based upon preliminary architectural layouts options A-1, Reduced Intensity & B-1 within the proposed project boundaries. Architectural layouts A-1 and Reduced Intensity are alternate layouts for the Casino and hotel and Layout B-1 is for Retail and Restaurants. This report and associated plans were intended to provide information for the environmental analysis of the project. The final architectural design and site development plan for the project may require revisions to the plans presented in this report.

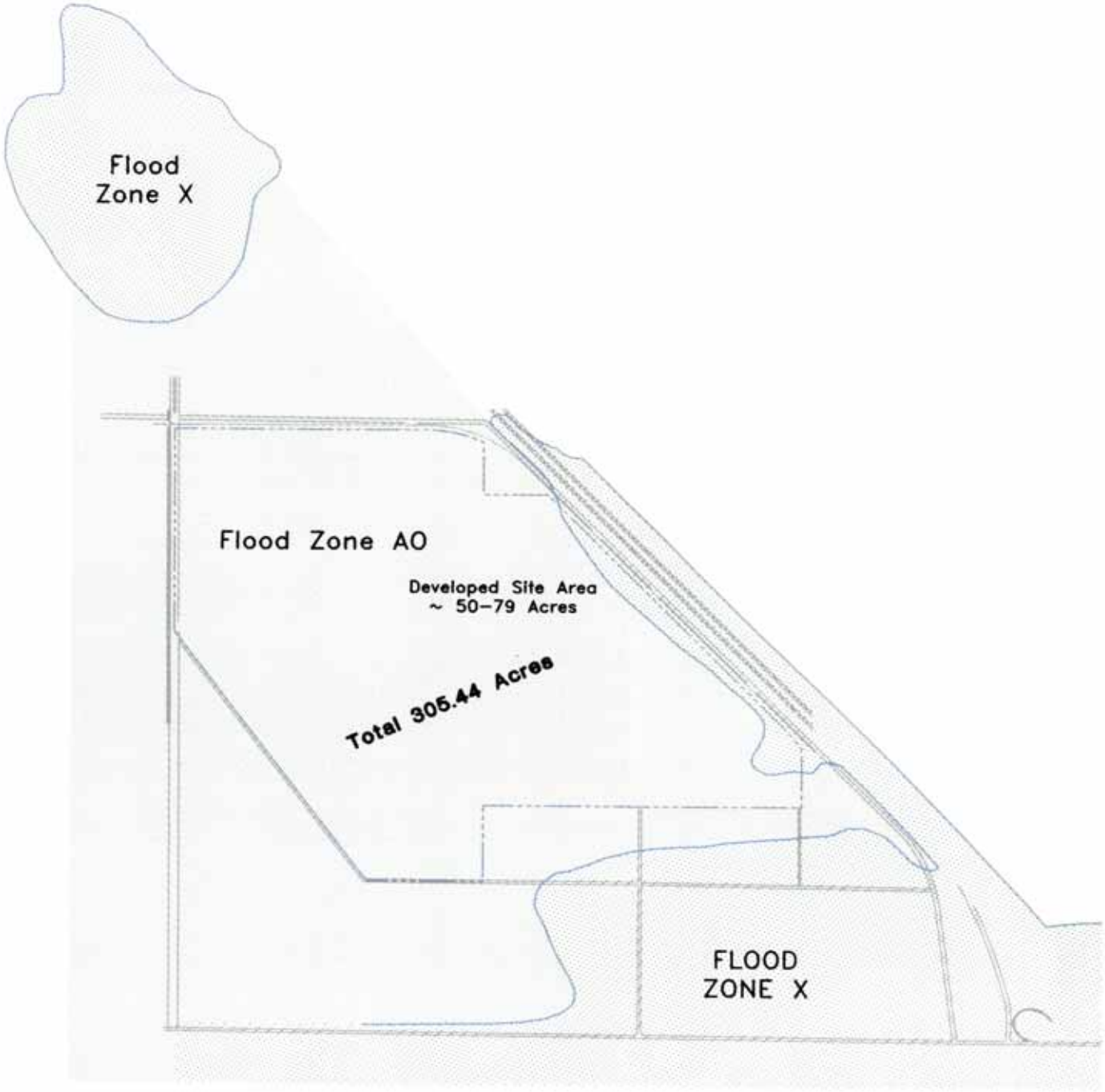
The Flood Insurance Rate Map entitled "Madera County, California (Unincorporated Areas) Community Panel Number 060170 0600B and 060170 0605 B" designates a portion of the project as located within the 100 year flood zone A0 of Schmidt Creek (See Figure 2).

The grading and drainage plan incorporates fill to elevate the proposed Gaming Facility above the 100-year flood plain and creates a series of stormwater detention ponds to attenuate the increase in peak flow of the storm runoff created by the development of the project. The increase in peak flow is created by fill in the flood plain and increasing the impervious area by constructing the project.

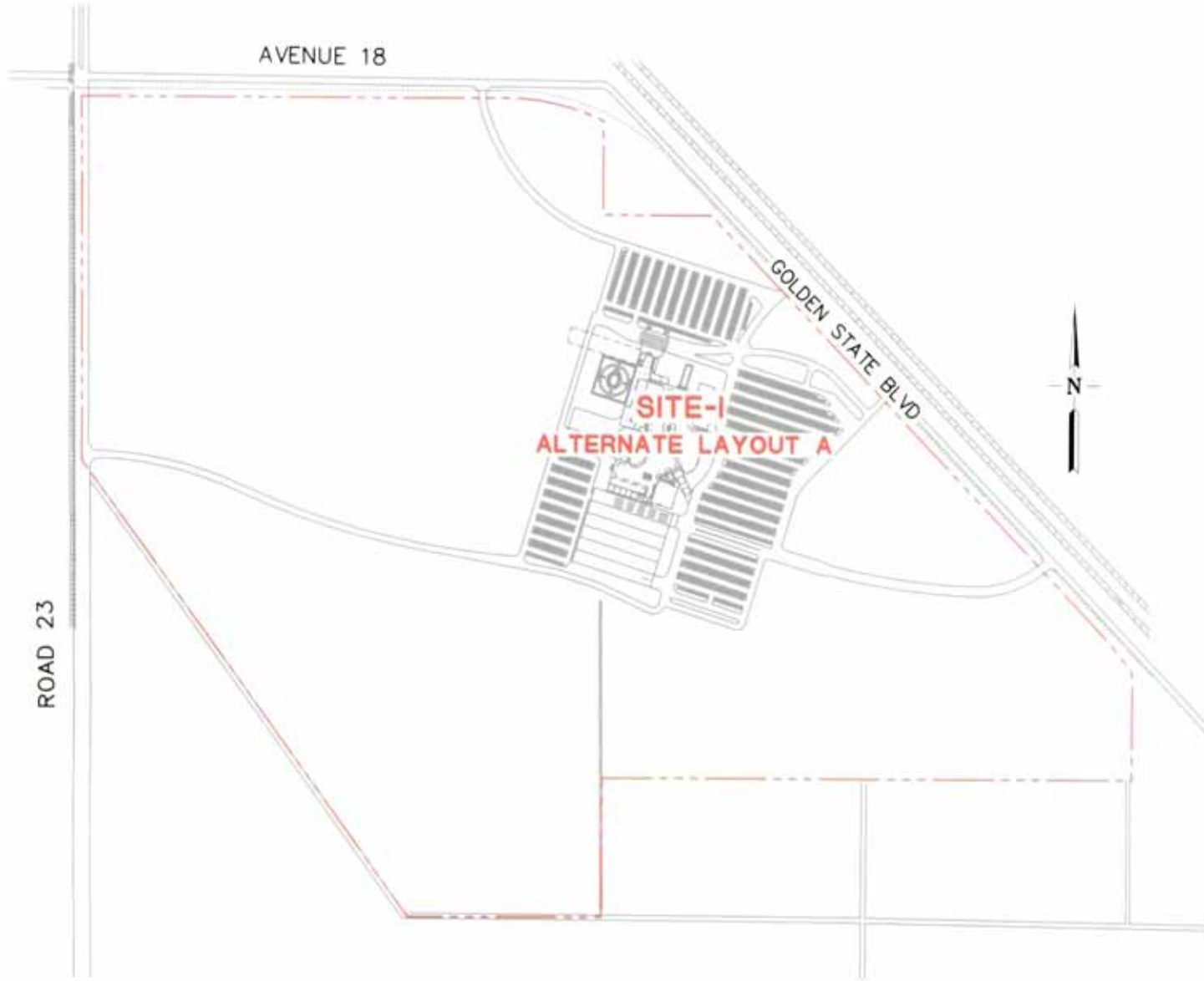
The project has been analyzed with three alternate layouts on the site location. All three layouts are depicted on Figures 3a, 3b, & 3c.



PROJECT BOUNDARY
FIGURE I



FLOOD PLAIN BOUNDARY
Site I
FIGURE 2



SITE-I LOCATION
LAYOUT A
FIGURE 3a

SITE-I LOCATION
LAYOUT B
FIGURE 3b

SITE-I LOCATION
LAYOUT C
FIGURE 3c

EXISTING SITE DESCRIPTION

The site consists of approximately 305 acres of grazing and pastureland. The site is bounded by Avenue 18 on the north, Road 23 on the west, State Highway-99 on the east, and undeveloped property on the south.

The existing topography is relatively flat. The site slopes from its easterly boundary to Road 23 passing through the property at an average slope of 0.1 %.

Schmidt Creek flows westerly through the site from State Highway-99 to Road-23 and into Dry Creek. Existing storm runoff from the site sheet flows to Schmidt Creek.

PROJECT FLOODPLAIN STUDY

The floodplain evaluation for this project requires the assessment of two (2) aspects to managing floodwaters in proximity to the proposed project site. These two aspects are: a) management of project-induced excess rainfall runoff volumes including mitigation for floodplain storage lost as a result of the project improvements, and b) potential impacts to the hydraulic grade line or water surface for with-project conditions.

For the purposes of this investigation, evaluation of the 10-year and 100-year events will be reviewed to quantify the site characteristics and response to excess rainfall runoff volumes in the vicinity of the proposed project. The investigation will consider the existing conditions versus improved conditions with respect to total rainfall versus net excess rainfall contributing to runoff after accommodating infiltration and surface interception losses.

With respect to the hydraulic grade line evaluation, only the 100-year will be considered. It is assumed that local drainage channels, ditches, etc. can accommodate the bulk of the 10-year runoff with nominal, temporary overbank or floodplain storage.

The Floodplain Study is included with this report as appendix A-site I. Project Floodplain Study.

STORMWATER DETENTION ANALYSIS

To mitigate the project induced stormwater impacts identified in the project Floodplain Study it is proposed to construct a series of storm water detention basins. The Floodplain study was conducted using Layout A. Layout A is the most intense development and creates the greatest impact. Layouts B & C have a lesser impact and therefore the proposed mitigations will be valid for them as well.

The project creates an impact to the Floodplain in three different ways:

1. The loss of floodplain storage created by the encroachment of the facility, parking lots, treatment plant and wastewater storage basin into the floodplain.

2. The increase in storm runoff created by the new impervious surfaces.

3. The loss of floodplain storage created by the encroachment of the new storm water detention basin into the floodplain.

The proposed detention basins will incorporate approximately 105 Acre Feet of storage to mitigate the impacts stated above. The detention basins encompass a surface area of approximately 39 Acres. The 100 year storm runoff is expected to pond to a depth of approximately 3 feet within the detention basin.

The increase in volumes due to development and storage volumes for the site are shown in Table 1.

Although the proposed development of the project increases runoff and peak flow rates, the detention basins temporarily stores the runoff to limit the peak designed metering structures to pre-project levels. A preliminary plan showing the location of the detention basins is included as Figure 4.

TABLE 1 – Increased Volumes & Storage Volumes

INCREASED RUN-OFF

INCREASE DUE TO PROJECT FLOODPLAIN ENCROACHMENT = 53.5AcFt

INCREASE DUE TO IMPERVIOUS AREA = 9.9AcFt

INCREASE DUE TO DETENTION BASIN ENCROACHMENT = 39.0AcFt

TOTAL STORAGE REQUIRED = 102.4 ACFT

STORAGE VOLUMES

TOTAL STORAGE PROVIDED = 105 ACFT

DRAINAGE IMPROVEMENTS

The development of the project will include several storm drainage improvements. The following sections describe the recommended improvements.

Overland Drainage Release

As the project is developed, an overland drainage will be created to allow property to drain under overflow conditions. The overland drainage release will be around the perimeter of the sites and is shown on Figures 5, 6 and 7.

Detention Basin Grading

Figure 4 shows the proposed locations and volumes for the detention basins. A preliminary grading plan is included as Figure 8 that provides a more detailed grading analysis.

Future Development Impacts

A review of the proposed Madera Town Center project and other city facilities has been performed to determine its impact on this project. The Madera Town Center project proposes to limit the post-project storm runoff to be equal to the pre-project level by providing stormwater detention. If the Town Center project is approved with adequate detention neither the Gaming Facility or the Town Center project will have a significant impact to stormwater runoff in the Schmidt Creek Basin.

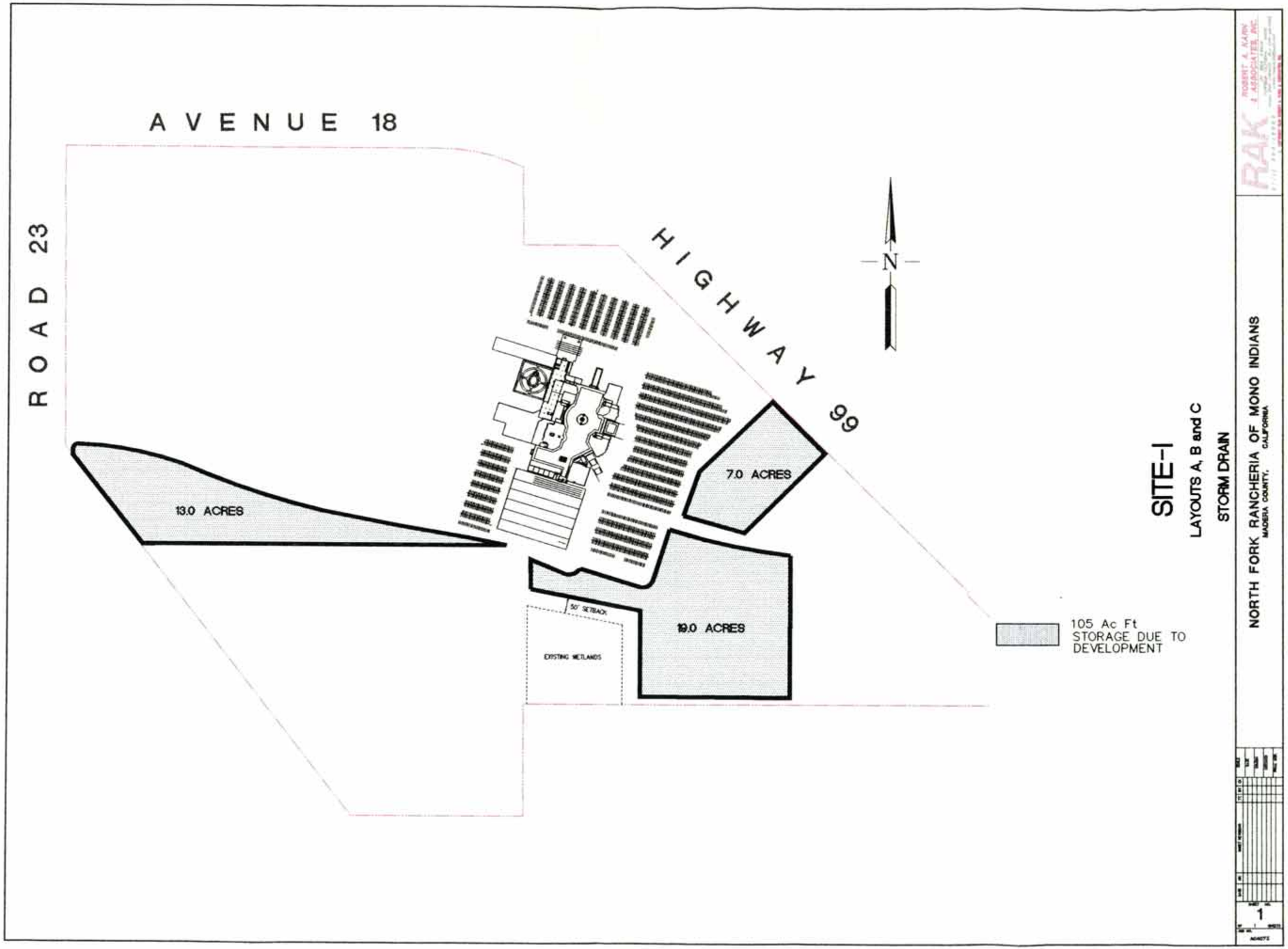
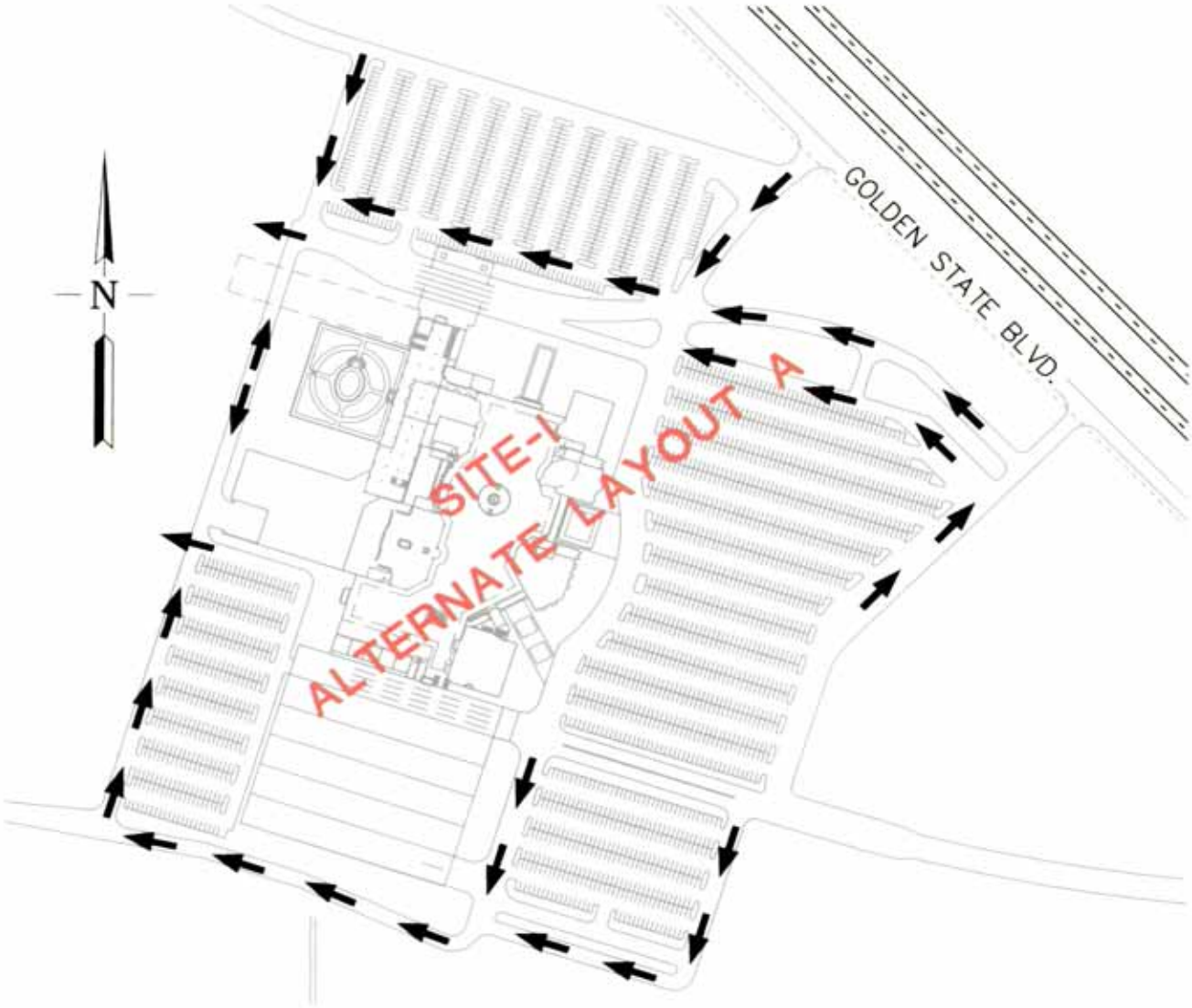
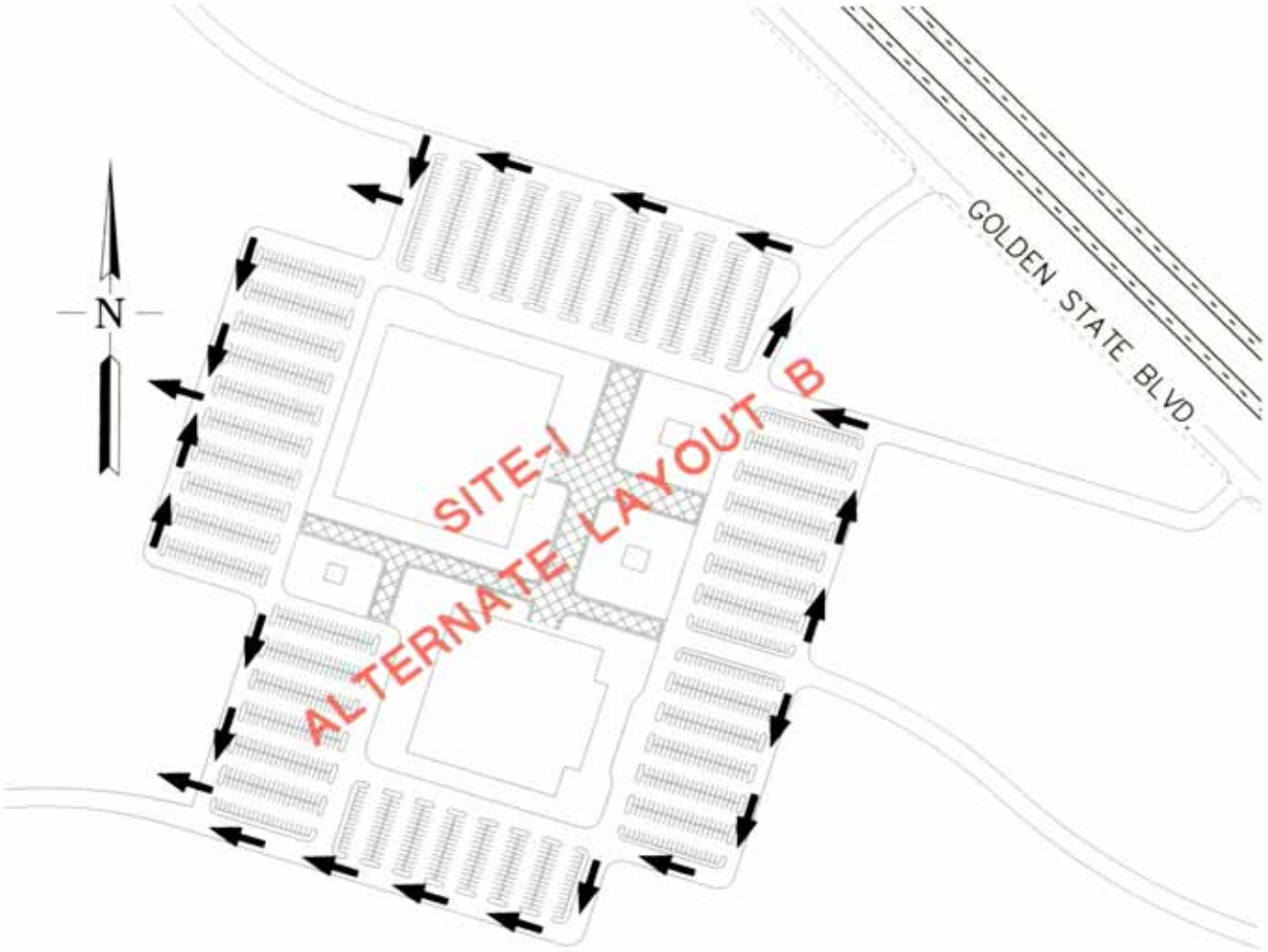

AVENUE 18
ROAD 23
HIGHWAY 99
N
13.0 ACRES
7.0 ACRES
19.0 ACRES
50' SETBACK
EXISTING WETLANDS
105 Ac Ft
STORAGE DUE TO
DEVELOPMENT
SITE-I
LAYOUTS A, B and C
STORM DRAIN
NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA
RAK
ROBERT A. KAHN & ASSOCIATES, INC.
1

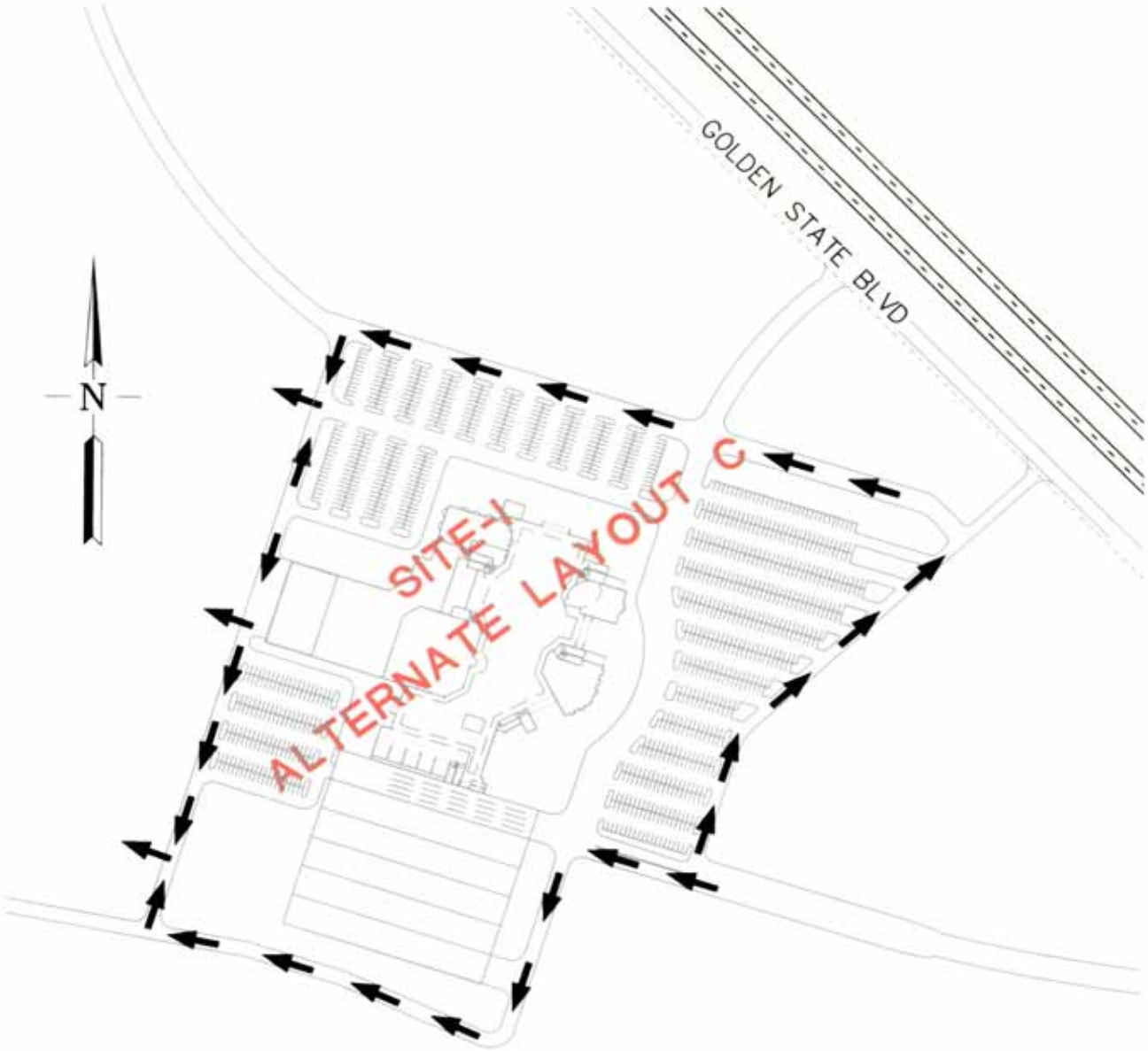
FIGURE 4



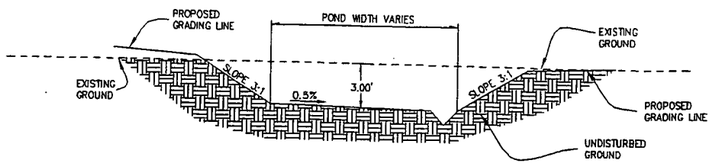
SITE-I
OVERLAND DRAINAGE RELEASE
FIGURE 5



SITE-I
OVERLAND DRAINAGE RELEASE
FIGURE 6

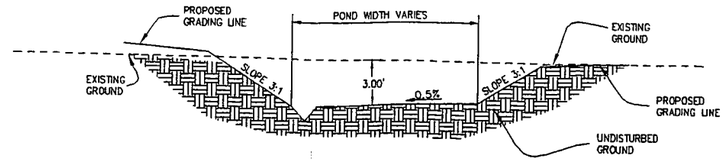


SITE-I
OVERLAND DRAINAGE RELEASE
FIGURE 7



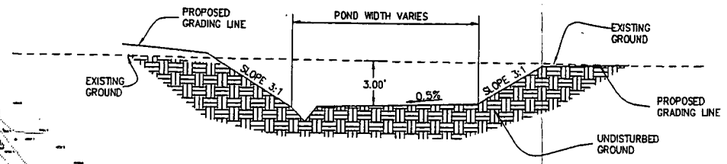
TYPICAL SECTION A-A

NOT TO SCALE



TYPICAL SECTION B-B

NOT TO SCALE



TYPICAL SECTION C-C

NOT TO SCALE

LEGEND

EXISTING CONTOUR	245
SWALE FLOW LINE ELEVATION	245.8± DITCH-FL
EXISTING SPOT ELEVATION	·2425
GRASSY SWALE	

GOLDEN STATE BLVD

DITCH-FL 245.01±

DITCH-FL 245.91±

DITCH-FL 245.7±

CASINO

Pole-A

Pole-B

DITCH-FL 245.8±

0.5%

DITCH-FL 244.8±

DITCH-FL 243.38±

DITCH-FL 243.08±

DITCH-FL 243.28±

DITCH-FL 243.5±

50' SETBACK

EXISTING WETLANDS

0.5%

A

B

C

WEST DRAINAGE

POND DEPTH = ±3.00 FEET

SOUTH DRAINAGE

POND DEPTH = ±3.00 FEET

EAST DRAINAGE

POND DEPTH = ±3.00 FEET

N

GRAPHIC SCALE

0 200 400 600

(IN FEET)

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NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

DATE	BY	SHEET REVISIONS	BY	DATE

SCALE 1"=200'
DATE FEB. 07
DRAWN PWP
CHECKED RAK
FIELD WORK RAK

SHEET NO. 1 OF 1 SHEETS

JOB NO. A04073

FIGURE 8

Building and Parking Lot Grading and Drainage

The finished floor of the building will be elevated above the FEMA 100 year flood plain elevations by incorporating fill from the detention basin excavation. It is estimated that 200,000 cubic yards of earthwork will be required for Site IA, 170,000 cubic yards for Site IB, and 150,000 cubic yards for Site IC. It is anticipated that the onsite grading will balance based upon the detention basin excavation and additional onsite borrowing if necessary.

Onsite drainage systems will consist of an underground piped drainage system. Inlets will be placed at appropriate intervals to capture runoff and convey to the grassy swales that surround the site. The grassy swales will convey the storm water to the detention basins.

Roof leaders should be connected directly to the pipe system and parking lots should be constructed with a 1% minimum slope and 5% maximum slope toward the inlets.

Preliminary Grading Plans for the 3 alternate land use plans are includes as Figures 9, 10, & 11.

EROSION CONTROL

An erosion control plan will be developed with the primary intent to decrease pollutants entering the water columns, with a secondary intent of trapping pollutants before they exit the site.

A Storm Water Pollution Prevention Plan should be prepared as part of the project to provide a level of protection equivalent to full compliance with the Statewide General Construction Activities Storm Water Permit adopted by the Storm Water Resources Control Board.

A partial list of Best Management Practices (BMP's) from the California Stormwater BMP Handbook is included as Appendix C.

The construction of the grassy swales, silt oil traps and the large shallow detention basins will function as a major component of the post construction BMP's.

GRAPHIC SCALE
0 100 200 300
(IN FEET)

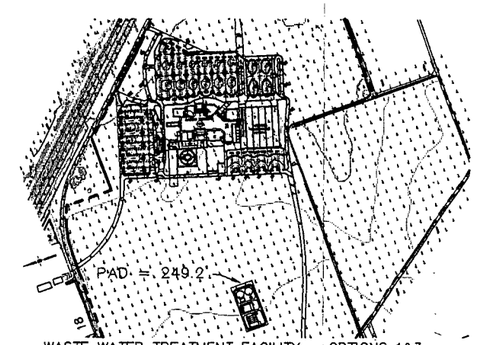
LEGEND

PROPOSED MAJOR CONTOUR	252.0
PROPOSED MINOR CONTOUR	251.0
EXISTING CONTOUR	252.0
CATCH BASIN	
GRATE ELEVATION	250.50 GRATE
EXISTING SPOT ELEVATION	242.5
RIDGE LINE	
GRASSY SWALE	

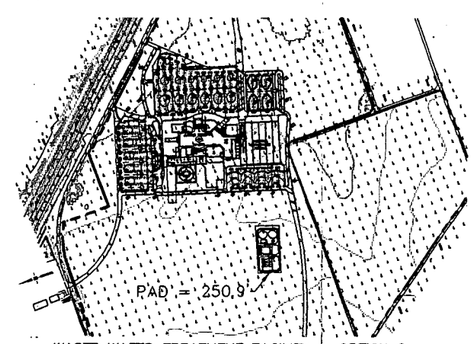
GOLDEN STATE BLVD

CASINO BUILDING
FF=254

PARKING STRUCTURE
FF=254



WASTE WATER TREATMENT FACILITY – OPTIONS 1&3
NOT TO SCALE



WASTE WATER TREATMENT FACILITY – OPTION 2
NOT TO SCALE

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PRELIMINARY GRADING PLAN (SITE-A)
NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

DATE	INIT	SHEET REVISIONS	BY	CK

SCALE 1"=100'
DATE 08-01-05
DRAWN PMW
CHECKED RAK
PROJ. MGR. RAK

SHEET NO. 1 OF 1 SHEETS
JOB NO. A04073

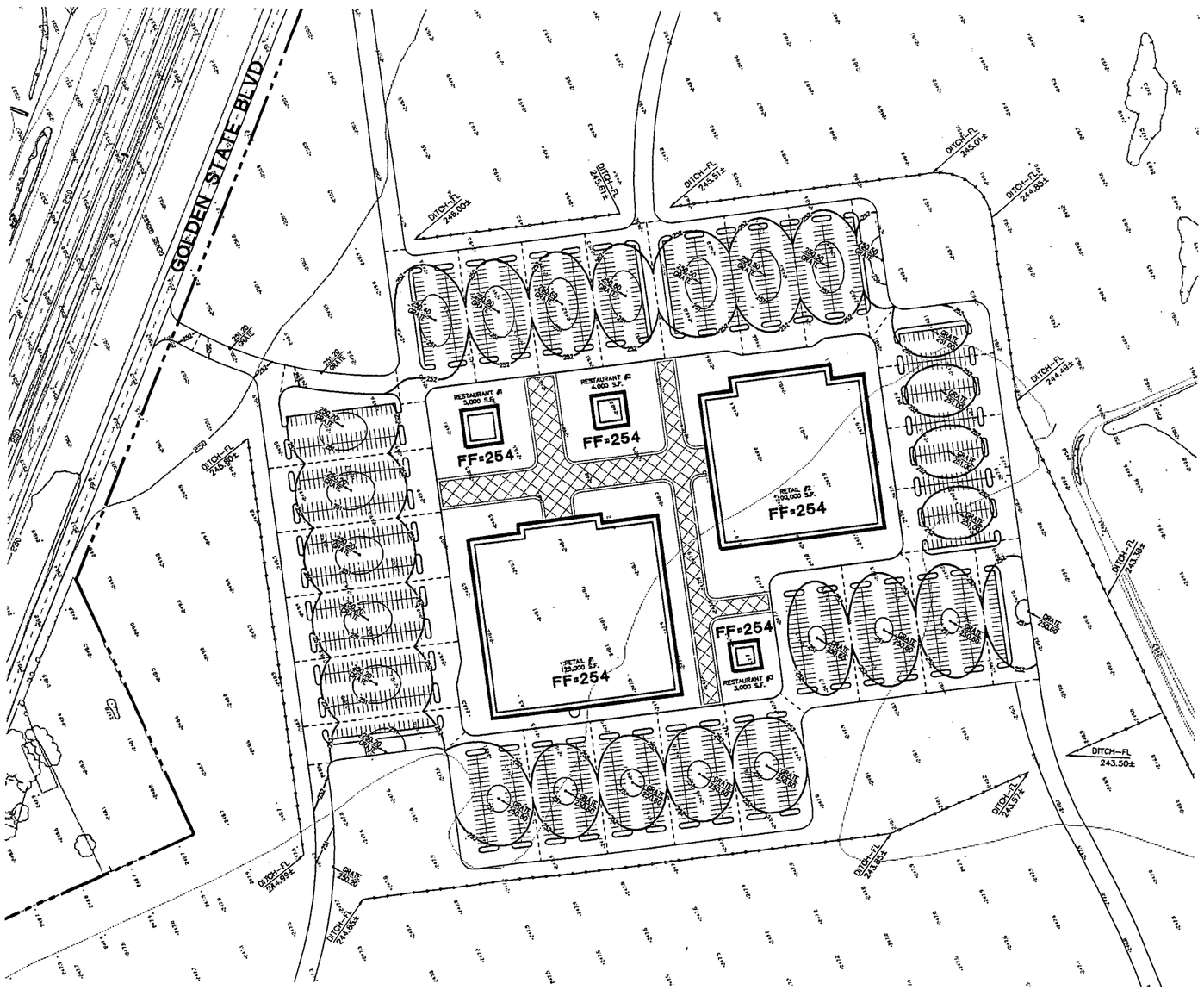
A04073\Report-July-05\Site-Plan-A.dwg

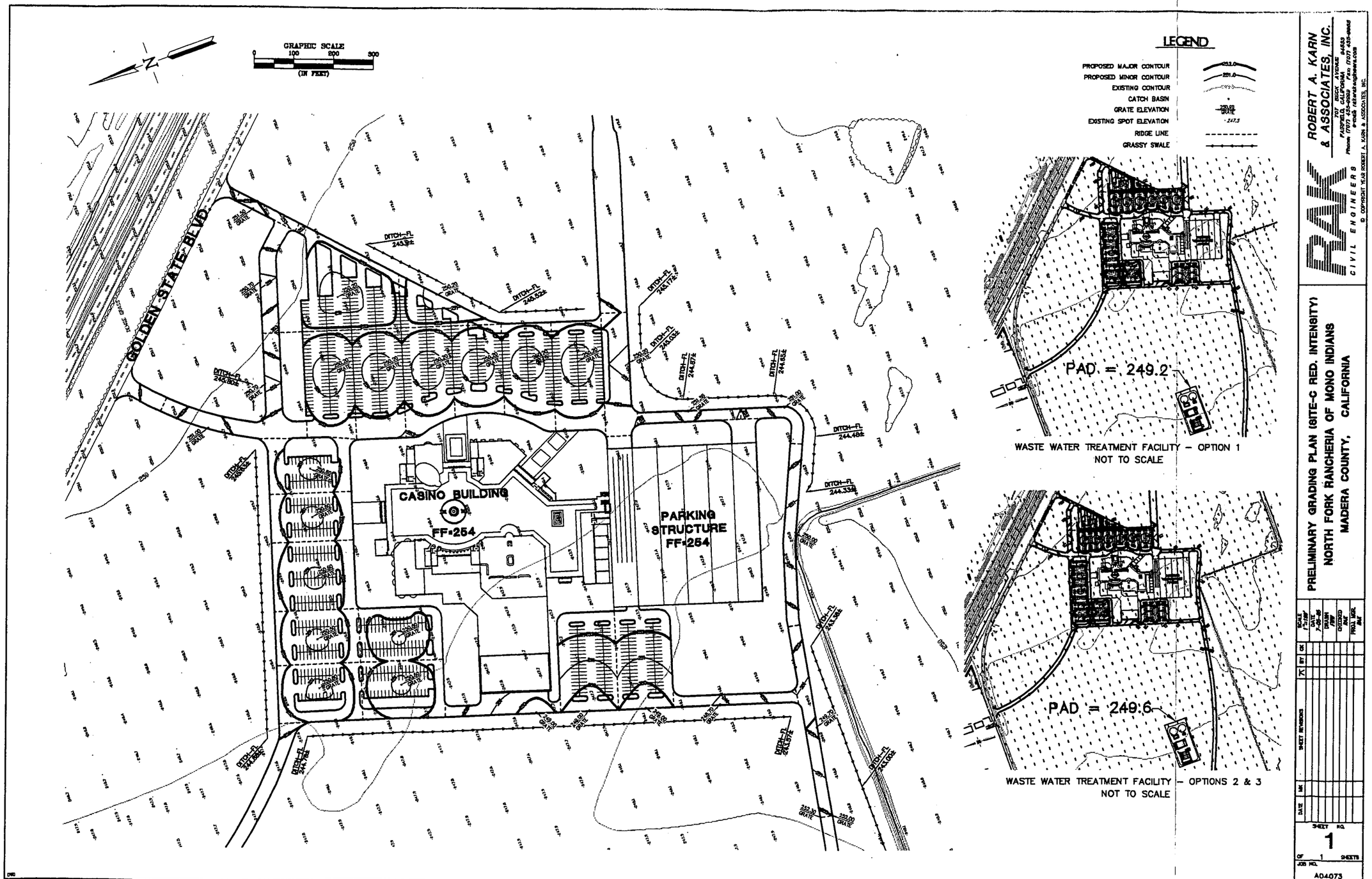
FIGURE 9

GRAPHIC SCALE
0 100 200 300
(IN FEET)

LEGEND

PROPOSED MAJOR CONTOUR	252.0
PROPOSED MINOR CONTOUR	251.0
EXISTING CONTOUR	249.0
CATCH BASIN	
GRATE ELEVATION	250.80 GRATE
EXISTING SPOT ELEVATION	249.5
RIDGE LINE	
GRASSY SWALE	


GOLDEN STATE BLVD
RESTAURANT #1 5,000 S.F.
FF=254
RESTAURANT #2 4,000 S.F.
FF=254
RETAIL #1 240,000 S.F.
FF=254
RETAIL #2 120,000 S.F.
FF=254
RESTAURANT #3 3,000 S.F.
FF=254
DITCH-FL 245.00±
DITCH-FL 245.61±
DITCH-FL 245.51±
DITCH-FL 245.01±
DITCH-FL 244.85±
DITCH-FL 244.49±
DITCH-FL 243.50±
DITCH-FL 243.57±
DITCH-FL 243.58±
DITCH-FL 244.95±
DITCH-FL 244.65±
GRATE 250.80
GRATE 250.80
GRATE 250.80


GRAPHIC SCALE
0 100 200 300
(IN FEET)
LEGEND
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING CONTOUR
CATCH BASIN
GRATE ELEVATION
EXISTING SPOT ELEVATION
RIDGE LINE
GRASSY SWALE
GOLDEN STATE BLVD.
CASINO BUILDING
FF=254
PARKING STRUCTURE
FF=254
PAD = 249.2
WASTE WATER TREATMENT FACILITY – OPTION 1
NOT TO SCALE
PAD = 249.6
WASTE WATER TREATMENT FACILITY – OPTIONS 2 & 3
NOT TO SCALE
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PRELIMINARY GRADING PLAN
NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA
SHEET NO.
1
OF 1 SHEETS
JOB NO.
A04073

FIGURE 11

SUMMARY

The impacts associated with floodplain encroachment, increase in storm runoff as a result of development can be mitigated through the creation of detention basins on the site. Alternate layouts would require a maximum of 105 acre feet of storage due to encroachment in the flood plain and additional storage due to development.

The excavation associated with the detention ponds would create adequate fill material to raise the finish floor of either Layout approximately 5 feet above the 100-year flood plain elevation. In addition, an overland drainage release for property can be maintained around the perimeter of the developed site.

SECTION-II
Alternate Site II

SITE GRADING AND
STORM DRAINAGE (SITE-II)
PROPOSED GAMING FACILITY
NORTHFORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

INTRODUCTION

This report presents a preliminary site grading and storm drainage plan for the proposed Gaming Facility in Madera County on Mission Drive in Madera County, California. (See Figure 12)

The plan was based upon preliminary architectural layout D for the Site-II location within the proposed project boundaries. This report and associated plans were intended to provide information for the environmental analysis of the project. The final architectural design and site development plan for the project may require revisions to the plans presented in this report.

The grading and drainage plan incorporates a stormwater detention basin to attenuate the increase in peak flow of the storm runoff created by the development of the project. The increase in peak flow is created by the additional runoff created by the expanded impervious area.

EXISTING SITE DESCRIPTION

The site consists of approximately 4.7 acres of mountain land located on the west side of Mission Drive.

The existing topography is steep with an average slope of 25% from the eastern portion of the project to the western portion of the project.

The site accepts runoff from the property east of Mission Drive and runoff sheet flows to the westerly property line.

PROJECT BOUNDARY & LOCATION MAP

NO SCALE

FIGURE 12

STORMWATER HYDROLOGY

A hydrologic investigation was performed to estimate the 100-year storm runoff for the pre and post development of the site.

The Haestad Pond Pack Software was utilized to develop Soil Conservation Service (SCS) unit hydrographs. The hydrographs were analyzed to determine the volume of storm drainage detention required.

Watershed area was calculated for the site based upon the preliminary architectural site plan.

The SCS Unit Hydrographs and the associated calculations are included with this report as Appendix B.

The Flood insurance Rate Map entitled "Madera County, California (Unincorporated Areas) Community Panel Number 060170 0375B" designates this property as being located within the Sierra National Forest as a "Zone D-Areas in which flood hazards are undetermined" and therefore is not located within a regulated flood hazard area.

In addition, based upon a review of the site topography and the above referenced map it was determined that flood hazards will not affect the site. The existing site topography slopes from east to west at approximately 25%. The preliminary grading plan cuts a pad out in the middle of the site. The edges of the site where the existing drainage swales are located will not be disturbed. All drainage will continue to flow southwesterly through the southern portion of the site at a slope of approximately 40% eliminating any flooding concern.

STORMWATER DETENTION ANALYSIS

To mitigate offsite impacts, the stormwater drainage system for the proposed project is designed to limit the peak flow from the developed site to predevelopment peak flows.

To accomplish this, stormwater detention has been incorporated into the southern portion of the project site. The storage pond size takes into account the increase in runoff created by increased impervious surfaces.

The stormwater detention basin has been sized to allow for 1 Acre foot of storm runoff with a depth of approximately 3 feet.

The increase in volumes due to development and storage volumes for the site are shown in Table 2.

Although the proposed development of the project increases runoff and peak flow rates, the detention basins temporarily stores the runoff to limit the peak flow. The peak flow from the detention basin will be metered to pre-project levels. A preliminary grading plan for the detention basin is included as Figure 13.

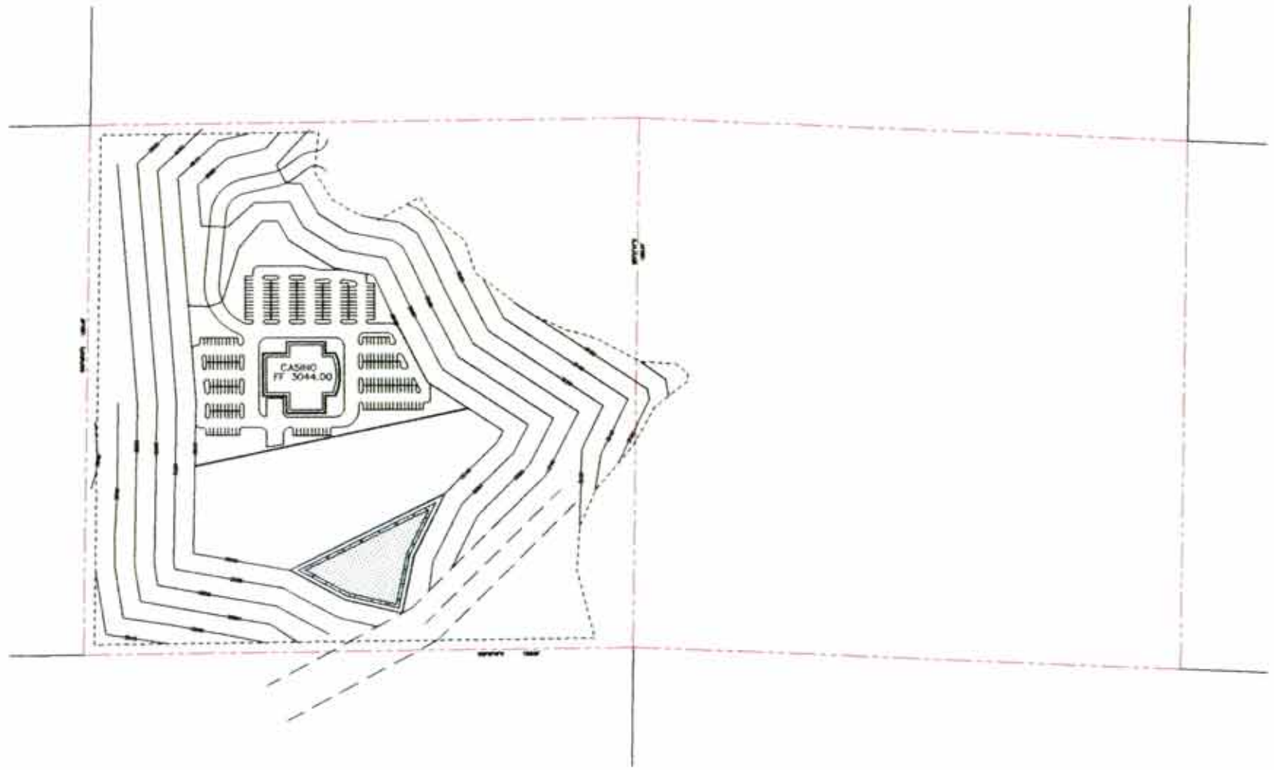
TABLE 2 – Increased Volumes & Storage Volumes

INCREASED RUN-OFF

TOTAL STORAGE REQUIRED = 0.55 AcFt

STORAGE VOLUMES

TOTAL STORAGE PROVIDED = 1.0 ACFT



1 Ac Ft
STORM WATER
DETENTION POND
DEPTH=4'±
SIDE SLOPES=2:1

SITE-II

LAYOUT D

STORM DRAIN

NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

RAK
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CIVIL ENGINEERS

1

FIGURE 13

DRAINAGE IMPROVEMENTS

The development of the project will include several storm drainage improvements. The following sections describe the recommended improvements.

Overland Drainage Release

An overland drainage release has been incorporated into the project design to enable the property east of Mission Drive to continue to drain through the project site. The overland drainage release also allows the building to be protected during peak storm runoff events. The overland drainage release is shown on Figure 14.

Building and Parking Lot Grading and Drainage

The total volume of earthwork is estimated to be 600,000 CYD to develop the site. Onsite drainage systems will consist of an underground piped drainage system. Inlets will be placed at appropriate intervals to capture runoff and convey to the detention basins.

Roof leaders should be connected directly to the pipe system and parking lots should be constructed with a 1% minimum slope and 5% maximum slope toward the inlets.

A Preliminary Grading Plan has been prepared and is included as Figure 15.

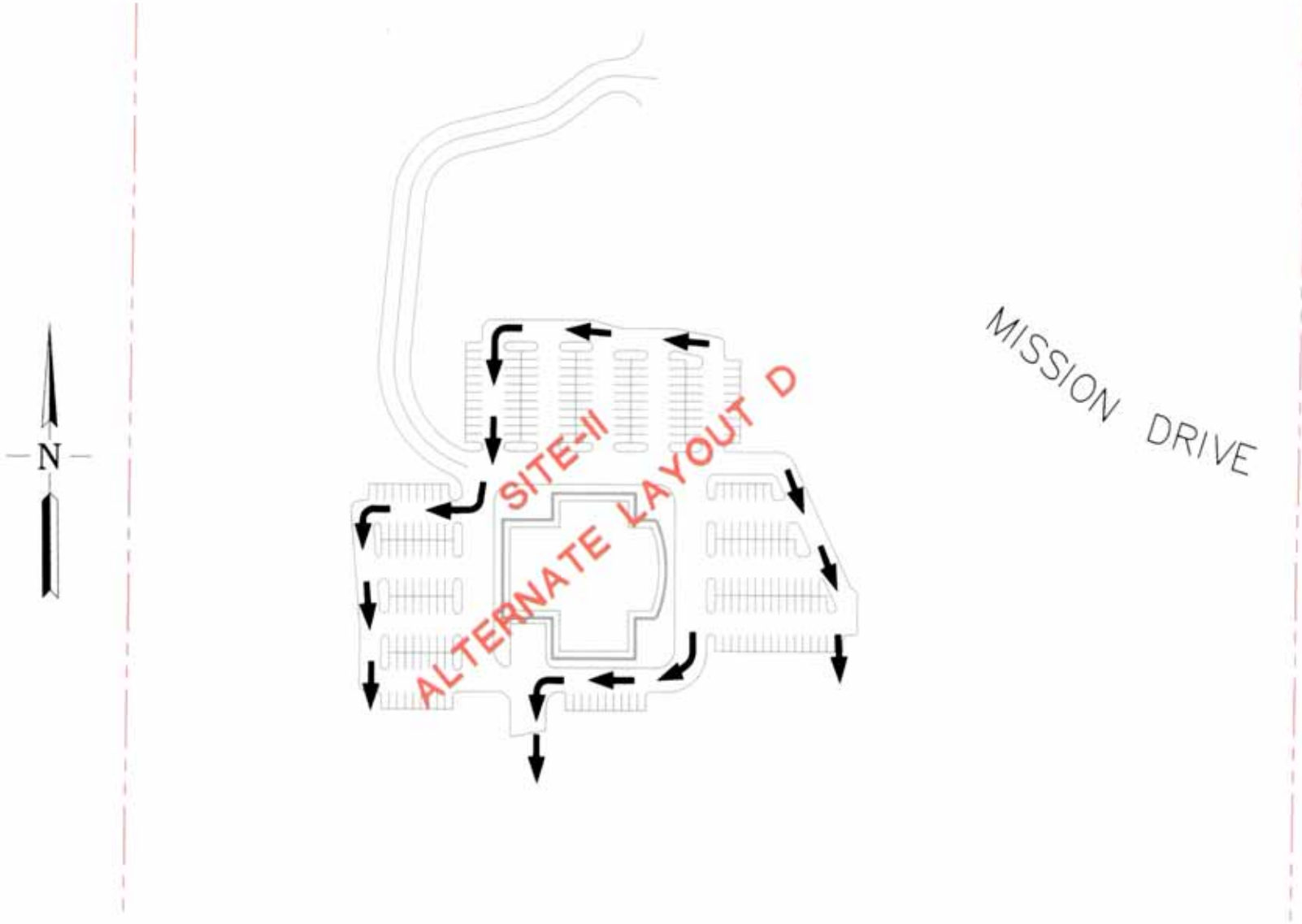
EROSION CONTROL

An erosion control plan will be developed with the primary intent to decrease pollutants entering the water columns, with a secondary intent of trapping pollutants before they exit the site.

A Storm Water Pollution Prevention Plan should be prepared as part of the project to provide a level of protection equivalent to full compliance with the Statewide General Construction Activities Storm Water Permit adopted by the Storm Water Resources Control Board.

A partial list of Best Management Practices (BMP's) from the California Stormwater BMP Handbook is included as Appendix C.

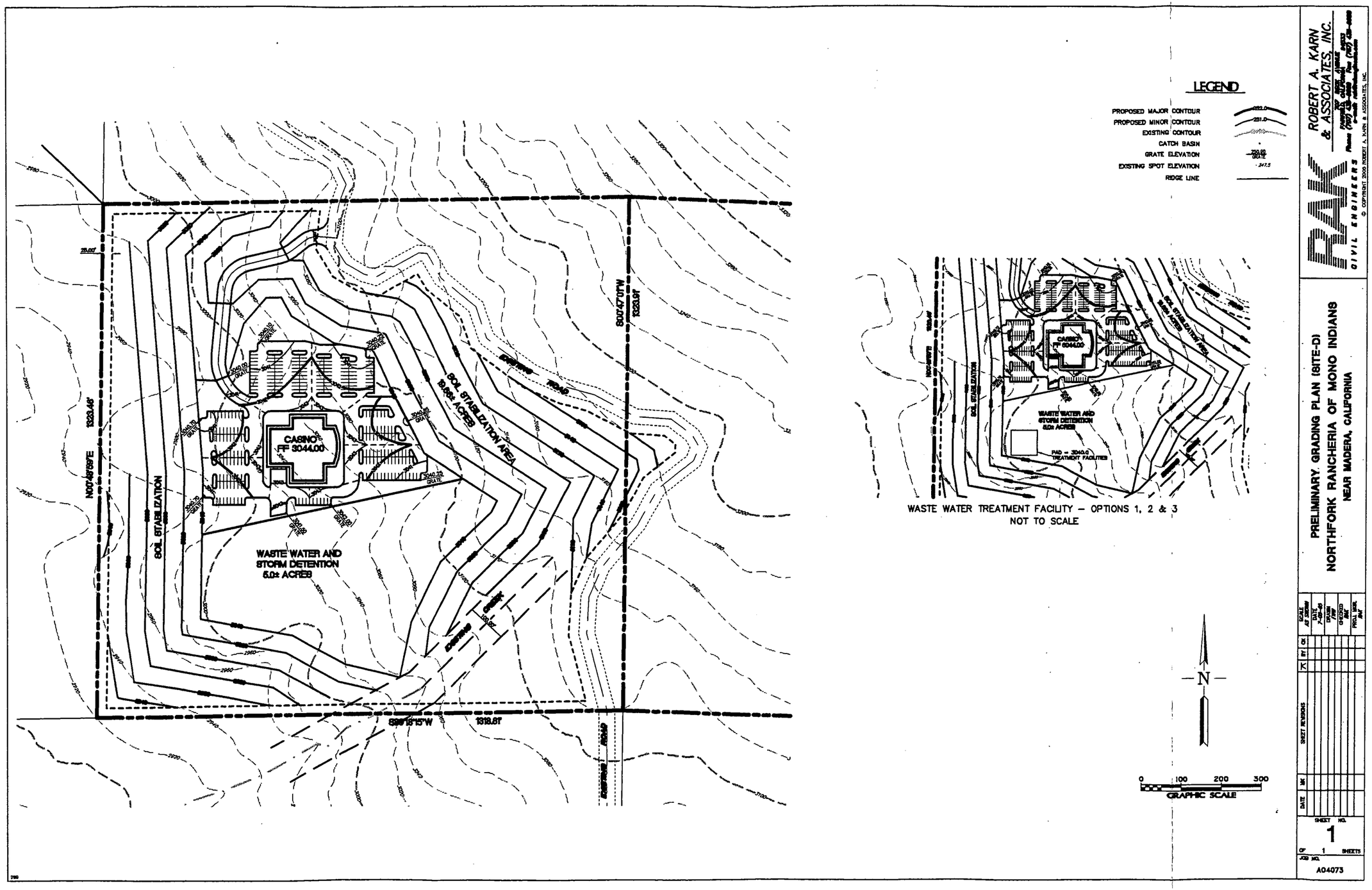
The major components of the Post Construction BMP's will be the stormwater detention basin and silt oil traps.



SITE II
LAYOUT D

OVERLAND DRAINAGE RELEASE

FIGURE 14


LEGEND
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING CONTOUR
CATCH BASIN
GRATE ELEVATION
EXISTING SPOT ELEVATION
RIDGE LINE
CASINO
FF 3044.00
WASTE WATER AND
STORM DETENTION
5.0± ACRES
SOIL STABILIZATION
SOIL STABILIZATION
10.8± ACRES
N00°48'59"E
1323.46'
S00°47'01"W
1323.97'
S89°13'15"W
1319.87'
WASTE WATER AND
STORM DETENTION
5.0± ACRES
PAD = 3040.0
TREATMENT FACILITIES
WASTE WATER TREATMENT FACILITY – OPTIONS 1, 2 & 3
NOT TO SCALE
N
0 100 200 300
GRAPHIC SCALE
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CIVIL ENGINEERS
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PRELIMINARY GRADING PLAN (SITE-D)
NORTHFORK RANCHERIA OF MONO INDIANS
NEAR MADERA, CALIFORNIA
SHEET NO.
1
OF 1 SHEETS
JOB NO.
A04073

FIGURE 15

SUMMARY

The impacts associated with an increase in storm runoff as a result of development can be mitigated through the creation of the stormwater detention basin.

The onsite excavation associated with the project will generate a balanced site. In addition, an overland drainage release has been designed to handle storm runoff from the eastern side of the site.

The site consists of 2:1 slopes, which will be stable with proper compaction, hydroseeding, straw fiber rolls and a geotechnical review.

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APPENDIX A

SITE I

Project Floodplain Study

Project Floodplain Study

North Fork Rancheria of Mono Indians
Madera County, California

August 2006

Prepared by

RAK
CIVIL ENGINEERS

ROBERT A. KARN & ASSOCIATES
707 BECK AVENUE
FAIRFIELD, CALIFORNIA 94533

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Section 1

Introduction and Background

The floodplain evaluation for this project requires the assessment of two (2) aspects to managing floodwaters in proximity to the proposed project site. These two aspects are: a) management of project-induced excess rainfall runoff volumes including mitigation for floodplain storage lost as a result of the project improvements, and b) potential impacts to the hydraulic grade line or water surface for with-project conditions.

For the purposes of this investigation, evaluation of the 10-year and 100-year events will be reviewed to quantify the site characteristics and response to excess rainfall runoff volumes in the vicinity of the proposed project. The investigation will consider the existing conditions versus improved conditions with respect to total rainfall versus net excess rainfall contributing to runoff after accommodating infiltration and surface interception losses.

With respect to the hydraulic grade line evaluation, only the 100-year will be considered. It is assumed that local drainage channels, ditches, etc. can accommodate the bulk of the 10-year runoff with nominal, temporary overbank or floodplain storage.

Section 2

Floodplain Volume Evaluation

This evaluation is divided into floodplain characterization, precipitation and site response, and rainfall runoff production for both existing and improved conditions.

Floodplain Characterization

The proposed project site is currently situated within the boundaries of a delineated special flood hazard inundation zone as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps [1] (FIRM). The specific inundation zone is "Zone A0", which represents an area with

> "... *flood depths of 1 to 3 feet (usually sheet flow on sloping terrain);...*"

In this instance, the FIRM indicates a depth of 1.0 foot of inundation in the vicinity of the project site. Figure 1 depicts the delineated 100-year floodplain boundary in relationship to the project property. Floodwaters progress from east to west (right to left in Figure 1) as a result of excess runoff associated with Dry Creek and Schmidt Creek. A review of Figure 1 reveals that an average floodplain width in proximity to the project site is about 11,100 feet (2+ mi.), and the overall terrain slope is mild from east to west (right to left in Figure 1).

Precipitation and Site Response

A review of the total storm precipitation was made for the 10- and 100-year return period storms for the proposed site. The results are based on data published in the NOAA Atlas 2 [2], and depicted in isopluvial (spatially varying rainfall depth) maps covering the project vicinity. The 24-hour storm duration was chosen as it most represents an expected extreme storm event in the San Joaquin valley, and produces more rainfall volume than the 6-hour storm event. This also produces a conservative approximation of potential rainfall runoff response for the subject project area.

---

[1] Project site is depicted on two (2) FIRMs: Madera County, California Panel 600 of 775, Community Panel No. 060170 0600B (Aug 4, 1987), and Madera County, California Panel 605 of 775, Community Panel No. 060170 0605B (Aug 4, 1987).

[2] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Precipitation-Frequency Atlas of the Western United States, Region IX – California, 1973.

According to NOAA Atlas 2, the total precipitation for the 10- and 100-year 24-hour events is estimated at:

- 10-Yr, 24-Hr Event: 1.81 inches
- 100-Yr, 24-Hr Event: 2.45 inches

Figure 2 shows portions of NOAA Atlas 2 Figures 40 and 43 in the vicinity of the project site. The location of Madera California was used as the reference point in Figure 2 to ascertain the rainfall totals.

Determination of an expected site response to rainfall requires a comparison of pre-project and post-project conditions to ascertain project-induced rainfall effects. Under the pre-project conditions, interception of rainfall and infiltration and wetting of the top layer of soil occurs until that point at which the soils can no longer capture and retain rainfall. Rainfall above and beyond this point is considered excess or net rainfall that produces runoff from the site. Under with-project conditions, increased impervious surfaces associated with site improvements reduce the interception and infiltration potential, and result in increased net rainfall that produces more runoff than under pre-project conditions.

Interception/infiltration loss rates are customarily characterized by an initial loss rate, followed by a constant loss rate. The initial loss rate is greater, and accommodates rainfall lost to adhesion to soils, wetting of the top layer of soil, and attraction to plants or other surfaces. The constant loss rate represents that residual loss potential as rainfall permeates the soil layer and infiltrates into the near surface ground mass. Generally, it is assumed that runoff from excess rainfall does not occur until both the initial and constant loss rate has been accommodated.

At the time of this evaluation, no empirical data on initial or constant loss rates for the project vicinity were readily available. Therefore, assumptions of initial and constant loss rates were made for the basis of this assessment.

Rainfall Runoff Production

Under existing (pre-project) conditions, rainfall runoff production will be estimated in terms of depth (inches) of total rainfall. These values can then be compared to with-project conditions to quantify the induced runoff volume associated with proposed improvements. (For the purposes of this evaluation, it is assumed that a single storm event occurs [i.e. no storm nesting] since

multi-storm precipitation data for the project site was not readily available at the time of this evaluation.)

The following pre-project, site-specific losses were assumed:

- 0.24 inches/hr (for the first hour)[3]
- 0.10 inches/hr (subsequent hours)[4]

It was further assumed that the storm characteristics for the San Joaquin valley result in a majority of the rainfall occurring over a six-hour period nested within the 24-hour total storm period. (This is commonly observed in the Sacramento/San Joaquin valleys for wet-season storms whereby the bulk of the rainfall occurs in a shorter, nested timeframe within the larger general rain period for a given storm.) This 6-hour precipitation period can be represented by percent of rainfall per hour. The percentage breakdown over the 6-hour period used for this evaluation is: 10%, 11%, 14%, 37%, 13%, and 10%[5]. An estimation of rainfall runoff for pre-project conditions is shown below:

10-Year Event Excess Rainfall Runoff Estimate: Pre-project Conditions
(Total Rainfall: 1.81 in.)

Time Period	% of Total	Rainfall (in/hr)	Loss (in/hr)	Net Rainfall Runoff (in)
Hr 1:	10%	0.18	0.24	0.00
Hr 2:	11%	0.20	0.06* + 0.10	0.04
Hr 3:	14%	0.25	0.10	0.15
Hr 4:	37%	0.67	0.10	0.57
Hr 5:	13%	0.24	0.10	0.14
Hr 6:	10%	0.18	0.10	0.08
> 6 Hrs:	5%	0.09	0.10	0.00
Totals:	100%	1.81 in.	0.84 in.	0.97 in.

- Residual loss carryover from previous hour; only count 0.18 in. of loss in first hour for totals.

[3] EM 1110-2-1417 suggests that initial losses can range from 10-20% of the total rainfall for forested areas, and around 0.1-0.2 inches for urban areas. For the agricultural area around the project site, 10% of the total rainfall was chosen.

[4] Table 5-1. SCS soil groups and infiltration loss rates (SCS, 1986); assumed soil group C, clay loams, shallow sandy loam, soils low in organic content, and soils usually high in clay; loss rate range of 0.05-0.15 in/hr.

[5] Percentage distribution concept of the 6-hr rainfall period based on EM1110-2-1411; percentages modified to produce 95% of rainfall in the 6-hour period, with the remaining 5% to occur over the remaining 18 hrs for the 24-hour event.

100-Year Event Excess Rainfall Runoff Estimate: Pre-project Conditions
(Total Rainfall: 2.45 in.)

Time Period	% of Total	Rainfall (in/hr)	Loss (in/hr)	Net Rainfall Runoff (in)
Hr 1:	10%	0.25	0.24	0.01
Hr 2:	11%	0.27	0.10	0.17
Hr 3:	14%	0.34	0.10	0.24
Hr 4:	37%	0.91	0.10	0.81
Hr 5:	13%	0.32	0.10	0.22
Hr 6:	10%	0.25	0.10	0.15
> 6 Hrs:	5%	0.11	0.10	0.01
Totals:	100%	2.45 in.	0.84 in.	1.61 in.

* Residual loss carryover from previous hour; only count 0.18 in. of loss in first hour for totals.

In summary, net rainfall producing runoff volume for the project site is estimated at 0.97 inches and 1.61 inches for the 10-year, and 100-year events, respectively.

Under with-project conditions, site improvements will increase runoff as a result of increased imperviousness for a portion of the project property. For the purposes of this evaluation, it is assumed that depression storage and wetting of hardened, paved, or other impervious (improved) surfaces will capture 5% of the total event, with 95% of the total rainfall resulting in runoff. The following impervious surfaces were estimated from Improvement Plan A, Spray Field treatment (See Figure 3):

- Treatment Plant ..... 2.43 Ac.
- Buildings, Parking, Streets ..... 42.83 Ac.

45.26 Ac.

With 95% of the total rainfall producing runoff, the total precipitation for the 100-year event generating runoff volume from impervious surfaces is 2.33 inches. This represents a project induced runoff volume of 8.8 ac.ft. from impervious surfaces associated with project improvements.

With respect to landscaped areas, it was assumed that net rainfall producing runoff was equivalent to the pre-project net rainfall amount of 1.61 inches. An estimate of the amount of landscaping around the new buildings and parking lot associated with project improvements is:

- Landscaping ..... 8.5 Ac.

This represents a project induced runoff volume of 1.1 ac.ft. from improved, landscaped areas.

Therefore, the total estimated with-project induced runoff volume attributed to site improvements is approximately 9.90 ac.ft.

Additionally, the project improvements are required to exist a minimum of 1.0 feet above the estimated floodplain. Thus, in addition to induced runoff volume, the project must mitigate for flood volume displaced as a result of project improvements within the delineated 100-year flood boundary. For this evaluation, preliminary estimates were made on areas of improvements to be removed from the floodplain. A review of the preliminary site plan design indicates an allowance for some nominal storage of floodwaters in and around drainage inlets. However, for this estimation, this nominal storage is disallowed, although landscaped areas were not excluded from temporary floodplain storage in the event of a rare, infrequent event such as a 100-year storm event. The estimated improved areas excluded from floodplain storage include:

- Treatment Plant ..... 2.4 Ac.
- Facility and Parking Lots ..... 42.8 Ac.
- Wastewater Storage Basin ..... 8.3 Ac.

53.5 Ac.

Utilizing the FIRM estimated depth of flooding in the vicinity of the project site of 1.0 feet results in a displaced flood volume of 53.5 ac.ft.

Therefore, project-induced flood volume storage demand associated with increased runoff and displaced floodplain is estimated at 63.4 ac.ft. If the project designates a portion of land dedicated to flood storage, this property would also need to displace floodplain storage, and thus its surface acreage times 1-foot of depth would need to be added to the storage volume.

Development or set-aside of a portion of the project property dedicated solely for flood storage was not part of this evaluation. In the context of a 2-mile wide, 1-foot depth floodplain running for 5-8 miles upstream and downstream of the project site, the project-induced flood volume is minimal in comparison to that of the floodplain.

Section 3

Potential Impacts to Hydraulic Gradeline

The purpose of this section is to evaluate, at a preliminary level, the potential for impacts to the water surface profile in the vicinity of the project as a result of site improvements.

For this evaluation, normal depth calculations only will be performed. A detailed hydraulic study of the subject floodplain will not be performed. There have been more detailed hydraulic studies performed upstream of the project on each of the creeks contributing runoff to the project property. However, the downstream limits of these detailed studies terminate significantly upstream from the subject property. Relevant hydraulic information representing peak discharges will be utilized for this evaluation.

For normal depth calculations, peak flowrates, average invert slope, average roughness ("n" values), and representative geometry is used to calculate a normal depth and estimated water surface elevation. To make normal depth calculations reasonable, it is assumed that features or topography exist in proximity to FEMA's floodplain boundaries sufficient to contain the floodplain. (In the event that this is not the case, then the computed water surface elevation is conservative, and actually higher than the real floodplain elevation would be for a commensurate storm used in the calculations. Also, calculations will only be performed for the 100-year event so as to relate the results back to the approximated FEMA floodplain conditions depicted on the FIRMs.

Peak Discharge Estimation

A peak discharge rate for this evaluation is based on combining the 100-year peak flows from Schmidt and Dry Creeks, and then adding some additional amount to represent that added flow associated with contributions to runoff between the upstream detailed studies and the project site. It was assumed, for purposes of this study, that the peak flows in the two creeks were concurrent; i.e. – they are in phase and peak at the same time when flows reach the vicinity of the proposed project. The estimated peak discharge for this evaluation is:

- Schmidt Creek ..... 1,270 cfs (FEMA detailed study)
- Dry Creek ..... 2,830 cfs (FEMA detailed study)

- Additional Contribution [6] ..... 900 cfs (20%+)

Normal Depth Peak Discharge: ..... 5,000 cfs

Invert Slope Estimation

An average invert slope of the floodplain was estimated from three (3) slopes representing the floodplain characteristics near the project site. These are labeled S1, S2 and S3 on Figure 1. Thus, the average slope is:

$$S = 0.0021 \text{ ft./ft.}$$

Typical Geometry and Roughness Estimation

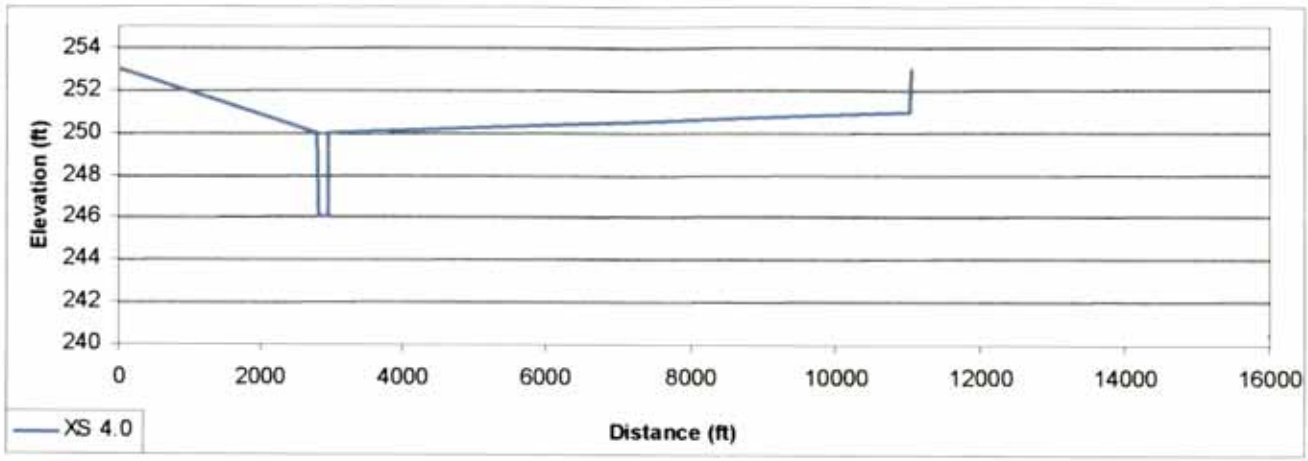
To perform the normal depth calculations, three (3) cross-sections were developed to represent the floodplain hydraulic regime in proximity to the proposed project site. For each of these, an average Manning's roughness value ("n") was estimated based on review of the USGS quad mapping and aerial photography. The three cross-sections are shown in Figure 1 as: XS 4.0, XS 4.5, and XS 5.0. Note that XS 4.0 passes directly through the proposed project site. This cross section geometry will be modified to depict exclusion attributable to project improvements (with-project conditions) and its water surface elevation will be computed for comparison against the pre-project results to identify whether the project produces a hydraulic impact as a result of site improvements.

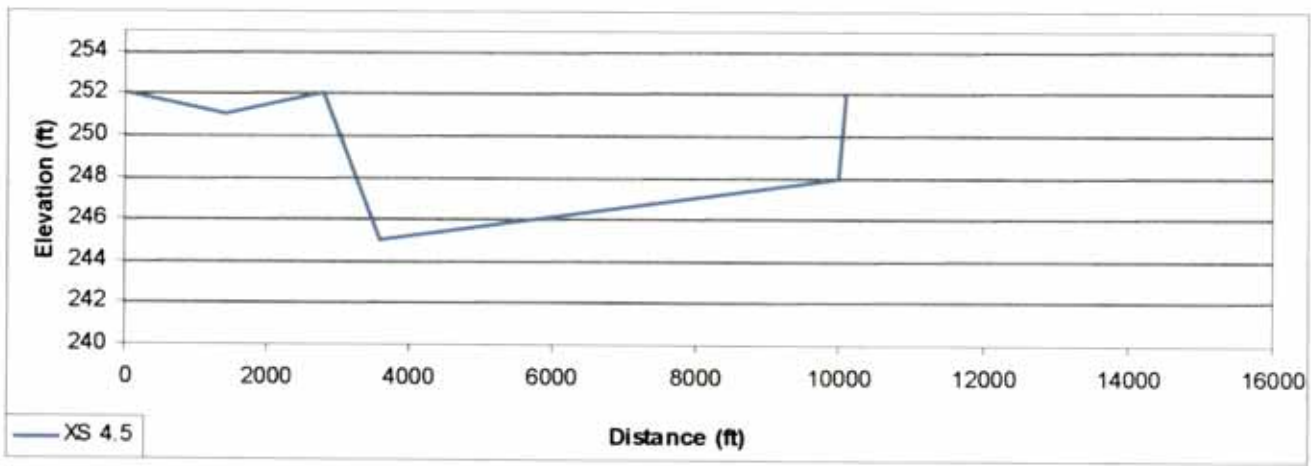
Average roughness values for each cross-section were computed as:

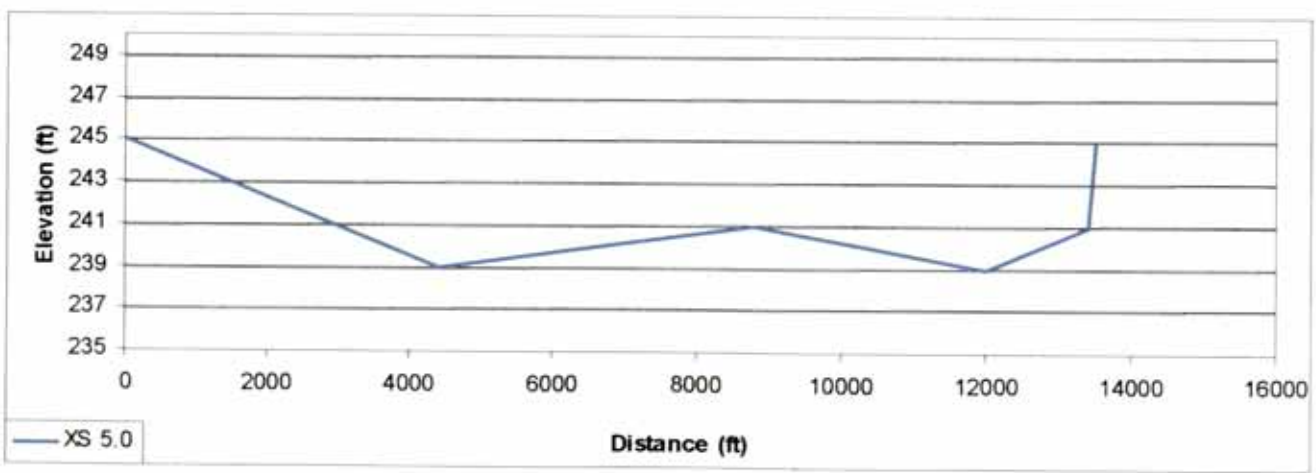
- XS 4.0 ..... 0.041
- XS 4.5 ..... 0.043
- XS 5.0 ..... 0.043

Pre-project cross-sections are shown in the following graphics (cross section orientation is facing downstream {east to west}):

[6] Estimated contribution associated with additional runoff between the detailed studies and the project site.







A simple normal depth computation application, Hydrocalc, was used to evaluate the hydraulic performance of the above cross sections. The results are tabulated below:

```
**********************************
HydroCalc ASCII Output  XS 4.0
**********************************

Input Parameters:
-----------------

Channel type: GENERAL
Flow =                 5000.000 cfs
Manning n =             0.04100
Bottom slope =          0.00210
Energy coeff =            1.000

Computed Results:
------------------

Normal depth =           250.922 ft
Normal velocity =          1.098 ft/s
Froude number =            0.264
Critical depth =         249.375 ft
Critical velocity =       10.271 ft/s
Flow area =             4553.596 sq ft
Wetted perimeter =      8472.320 ft
Top width =             8469.513 ft
Hydraulic radius =         0.537 ft
Hydraulic depth =          0.538 ft
```

```
**********************************
HydroCalc ASCII Output  XS 4.5
**********************************

Input Parameters:
-----------------

Channel type: GENERAL
Flow =                 5000.000 cfs
Manning n =             0.04300
Bottom slope =          0.00210
Energy coeff =            1.000

Computed Results:
------------------

Normal depth =           246.751 ft
Normal velocity =          1.449 ft/s
Froude number =            0.273
Critical depth =         246.042 ft
Critical velocity =        4.098 ft/s
Flow area =             3445.601 sq ft
Wetted perimeter =      3935.589 ft
Top width =             3935.581 ft
Hydraulic radius =         0.875 ft
Hydraulic depth =          0.876 ft
```

```
**********************************
HydroCalc ASCII Output  XS 5.0
**********************************

Input Parameters:
-----------------

Channel type: GENERAL
Flow =                 5000.000 cfs
Manning n =             0.04300
Bottom slope =          0.00210
Energy coeff =            1.000

Computed Results:
------------------

Normal depth =           240.276 ft
Normal velocity =          1.174 ft/s
Froude number =            0.259
Critical depth =         239.744 ft
Critical velocity =        3.469 ft/s
Flow area =             4260.394 sq ft
Wetted perimeter =      6677.736 ft
Top width =             6677.733 ft
Hydraulic radius =         0.638 ft
Hydraulic depth =          0.638 ft
```

In summary, the normal depth calculations indicate a range of average flow velocities from approximately 1 – 1.5 feet-per-second on the floodplain, and an average depth of between 0.5 – 1.0 foot deep. These results are consistent with the FIRM definition for a Zone A0 designation.

To evaluate the effects of the project improvements, the conveyance area for XS 4.0 (see Figure 1) is now modified to exclude a portion of the cross-section representing project improvements within the floodplain. A review of Figure 3 indicates that improvements produce approximately an 1,800-ft wide impediment to flows moving from east to west with roughly two-thirds of the width blocked by structures. The remaining one-third of the width encompassing parking spaces, curbs and landscaping are still susceptible to being submerged by shallow, passing flood flows. Thus, XS 4.0 was modified to exclude 1,200 linear feet from the cross-section, representing a loss in conveyance area commensurate to the typical project improvements. The normal depth calculations are made for this condition, and the results are shown in the table below:

```
****************************************
HydroCalc ASCII Output  XS 4.0 Modified
****************************************

Input Parameters:
-----------------
Channel type: GENERAL
Flow =                 5000.000 cfs
Manning n =             0.04100
Bottom slope =          0.00210
Energy coeff =            1.000

Computed Results:
------------------
Normal depth =           251.017 ft
Normal velocity =          1.102 ft/s
Froude number =            0.264
Critical depth =         250.568 ft
Critical velocity =        3.217 ft/s
Flow area =             4528.472 sq ft
Wetted perimeter =      8349.824 ft
Top width =             8349.625 ft
Hydraulic radius =         0.542 ft
Hydraulic depth =          0.542 ft
```

A review of the results indicates a negligible impact to the hydraulic grade line as a result of the project improvements.

- Change in water surface elevation .....+ 0.095 ft (~ 1.1 inches)
- Change in average velocity .....+ 0.004 ft/sec.
- Change in average hydraulic depth .....+ 0.004 ft.
- Change in flow area.....- 25± sq.ft.

Section 4

Summary

The following summarizes the results of the floodplain evaluation of potential impacts associated with proposed project improvements in the Madera County area.

Floodplain Storage Impacts

Implementation of the project improvements within the 100-year floodplain will require some temporary runoff volume storage to mitigate increased runoff and floodplain storage exclusion attributable to the project. An estimate of local storage needed is approximately 64 acre-feet plus that floodplain volume excluded in order to construct a temporary storage facility. This can be easily be accommodated within the remaining project boundary be shaping a shallow terminal basin. This terminal basin's invert should not be less than the nearby drainage infrastructure (agricultural ditches) if the basin is to drain by gravity. The terminal basin can also provide storm water quality benefits to the project by capturing and treating runoff from parking areas and improved lands about the proposed project.

Hydraulic Grade Line Impacts

Implementation of the project improvements within the 100-year floodplain will have negligible effects on the hydraulic conveyance and flow regime in proximity to the proposed project and downstream, possibly increasing the water surface of the 11,000+ foot-wide floodplain by nominal amount, not likely perceptible to properties in the floodplain. The level of accuracy of the delineated FEMA floodplains (likely determined by approximate mapping methods) is probably less than that level of accuracy in the empirical results normal depth computations. In addition, normal depth computations do not take into account downstream hydraulic backwater conditions. Thus, the near imperceptible change in the water surface may be negated by downstream flow regime conditions. Natural phenomena and/or manmade changes, irrespective of the project improvements, such as wind-wave setup, sediment transport, cropping patterns, County road maintenance (such as resurfacing, etc.), ditch maintenance, changes in upstream land use resulting in accelerated runoff or increased storage conditions, will likely have greater impacts on the floodplain than the empirical amount computed within this assessment.

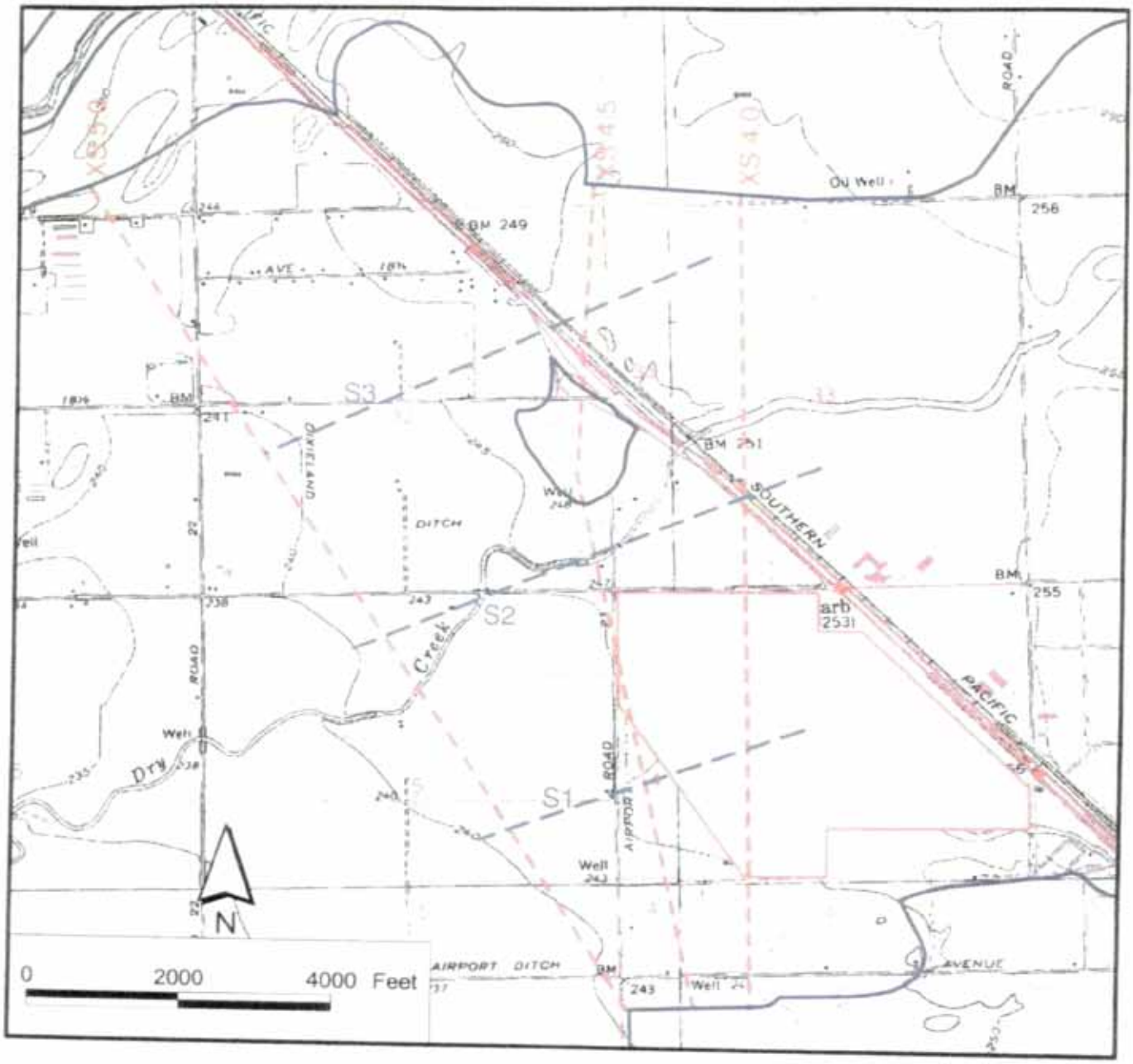
Conclusion

The purpose of this investigation was to ascertain the impacts, if any, to both the floodplain storage as well as the hydraulic conveyance through the floodplain as a result of project improvements implemented within the 100-year floodplain. This investigation has made with conservative assumptions erring on the safe side of hydraulic analyses in order to determine any mitigation requirements as a result of the project. It is the conclusion of this investigation that the project improvements have a inconsequential, nominal impact on the existing 100-year floodplain, and is likely imperceptible. It is reasonable to accept that the degree of accuracy in the approximate floodplain mapping is less than the minimal deviation derived by normal depth computations, which doesn't take into account downstream hydraulic conditions that likely dominate the miniscule value.

It is, therefore, the opinion of the undersigned that the project improvements will not have a detrimental impact to the surrounding area and its associated floodplain, and any changes as a result of the project would likely be imperceptible to those in the floodplain surrounding the project vicinity.

This evaluation was performed using prudent and reasonable judgment commensurate with the level of detail and accuracy of readily available information provided by the project design engineer.

PREPARED UNDER THE DIRECTION OF:
Robert A. Kam, PE
Robert A. Kam & Associates, Inc.



LEGEND:

- Approx. 100-Yr Floodplain
- Average Floodplain Slope
- Approx. XSEC Location
- Project Property

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FLOODPLAIN ENVIRONMENT NEAR PROJECT

NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

FIGURE 1

Clips taken from NOAA Atlas 2, Region IX – California, 1973.

Figure 40

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

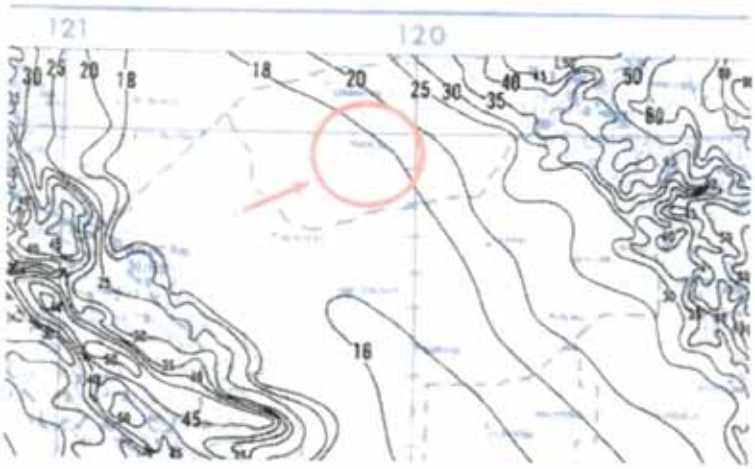
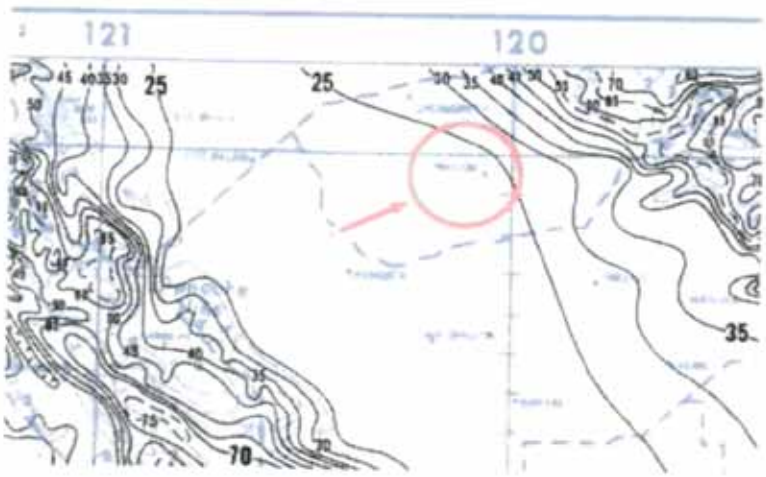


Figure 43

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH



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NOAA ATLAS 2 PRECIPITATION-FREQUENCY ESTIMATES
10- AND 100-YEAR 24-HOUR PRECIPITATION
NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

FIGURE 2

II - IMPROVED, IMPERVIOUS
IP - IMPROVED, PERVIOUS

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916-435-9999

ESTIMATED TYPICAL HYDRAULICS IMPEDIMENTS

NORTH FORK RANCHERIA OF MONO INDIANS
MADERA COUNTY, CALIFORNIA

FIGURE 3

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APPENDIX B

SITE II

Project Floodplain Study

Job File: S:\A04073\hydro\casino\SITE-D.PPW
Rain Dir: S:\A04073\hydro\casino\

JOB TITLE

Project Date: 8/30/2005
Project Engineer: KUMUDVATHI
Project Title: NORTH FORK CASINO PROJECT
Project Comments:

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```
*************************************************************************
*************************************************************************
*                                                                       *
*                                                                       *
*                        MODIFIED RATIONAL METHOD                       *
*            ---- Grand Summary For All Storm Frequencies ----          *
*                                                                       *
*                                                                       *
*************************************************************************
*************************************************************************
```

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Area = 5.340 acres Tc = .5000 hrs

Freq. years	Adjusted 'C'	Duration hrs	I in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow ac-ft	Storage ac-ft
100	.900	4.6333	.5084	2.46	1.85	.943	.550

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID MYSTORM

Return Event	Rainfall Type	IDF ID
100	I-D-F Curve	IDF-100

MASTER NETWORK SUMMARY
Modified Rational Method Network

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
DEVELOPED		AREA	100	.943		.5000	2.46		
*OUT 10		JCT	100	.943		.5000	2.46		
POND 10	IN	POND	100	.943		.5000	2.46		
POND 10	OUT	POND	100	.943		.5000	2.46		

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID =

Storm Tag Name =

Data Type, File, ID =
Total Rainfall Depth= .0000 in
Duration Multiplier = 0
Resulting Duration = .0000 hrs
Resulting Start Time= .0000 hrs Step= .0000 hrs End= .0000 hrs

	Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
	DEVELOPED		AREA	.943		.5000	2.46	
Outfall	OUT 10		JCT	.943		.5000	2.46	
	POND 10	IN	POND	.943		.5000	2.46	
	POND 10	OUT	POND	.943		.5000	2.46	

NETWORK SUMMARY -- LINKS
(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID =

Storm Tag Name =

Data Type, File, ID =
Total Rainfall Depth= .0000 in
Duration Multiplier = 0
Resulting Duration = .0000 hrs
Resulting Start Time= .0000 hrs Step= .0000 hrs End= .0000 hrs

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points	
ADDLINK 10	ADD	UN	.943		.5000	2.46	DEVELOPED	
		DL	.943		.5000	2.46		
		DN	.943		.5000	2.46	POND 10	IN
ROUTE 10	PONDrt	UN	.943		.5000	2.46	POND 10	IN
ROUTE 10			.943		.5000	2.46	POND 10	OUT
		DL	.943		.5000	2.46		
		DN	.943		.5000	2.46	OUT 10	

NETWORK RUNOFF NODE SEQUENCE

Runoff Data	Apply to Node	Receiving Link
Mod.Rat DEVELOPED	Subarea DEVELOPED	Add Hyd DEVELOPED

NETWORK ROUTING SEQUENCE

Link Operation	UPstream Node			DNstream Node		
Add Hyd ADDLINK 10	Subarea DEVELOPED			Pond	POND 10	IN
POND ROUTE TOTAL OUTFLOW...						
Total Pond Outflow	Pond	POND 10	IN	Outflow	POND 10	OUT
SET POND ROUTING LINK TO TOTAL POND OUTFLOW...						
Outlet ROUTE 10	Outflow	POND 10	OUT	Jct	OUT 10	

Title... Project Date: 8/30/2005
Project Engineer: KUMUDVATHI
Project Title: NORTH FORK CASINO PROJECT
Project Comments:

I-D-F DESIGN STORM SUMMARY

Storm Queue File,ID = MYSTORM

Storm Tag Name = 100

File: Type, ID = : I-D-F Storm... IDF-100
Storm Frequ. = 100 yr

Rainfall-Intensity-Duration Curve

Time, hrs	Intens., in/hr
.0833	4.8000
.1667	3.1800
.2500	2.5600
.5000	1.7200
1.0000	1.1500
2.0000	.7800
3.0000	.6200
6.0000	.4150
12.0000	.2800
24.0000	.1800

::::::

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::::::

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: S:\A04073\hydro\casino\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ROUTE 10	POND 10 IN	work_pad.hyg	ROUTE 10	100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	100	.943	.5000	2.46

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100	.943	.5000	2.46

TOTAL NODE INFLOW...
HYG file = S:\A04073\hydro\casino\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100

Peak Discharge	=	2.46 cfs
Time to Peak	=	.5000 hrs
HYG Volume	=	.943 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.25	.49	.74	.99
.2500	1.23	1.48	1.72	1.97	2.22
.5000	2.46	2.46	2.46	2.46	2.46
.7500	2.46	2.46	2.46	2.46	2.46
1.0000	2.46	2.46	2.46	2.46	2.46
1.2500	2.46	2.46	2.46	2.46	2.46
1.5000	2.46	2.46	2.46	2.46	2.46
1.7500	2.46	2.46	2.46	2.46	2.46
2.0000	2.46	2.46	2.46	2.46	2.46
2.2500	2.46	2.46	2.46	2.46	2.46
2.5000	2.46	2.46	2.46	2.46	2.46
2.7500	2.46	2.46	2.46	2.46	2.46
3.0000	2.46	2.46	2.46	2.46	2.46
3.2500	2.46	2.46	2.46	2.46	2.46
3.5000	2.46	2.46	2.46	2.46	2.46
3.7500	2.46	2.46	2.46	2.46	2.46
4.0000	2.46	2.46	2.46	2.46	2.46
4.2500	2.46	2.46	2.46	2.46	2.46
4.5000	2.46	2.46	2.46	2.38	2.14
4.7500	1.89	1.64	1.40	1.15	.90
5.0000	.66	.41	.16	.00	

Type.... Time-Elev
Name.... POND 10 OUT Tag: 100
File.... S:\A04073\hydro\casino\SITE-D.PPW
Storm... IDF-100 Tag: 100

Page 7.01
Event: 100 yr

TIME vs. ELEVATION (ft)

Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.00	.00	.00	.00
.2500	.00	.00	.00	.00	.00
.5000	.00	.00	.00	.00	.00
.7500	.00	.00	.00	.00	.00
1.0000	.00	.00	.00	.00	.00
1.2500	.00	.00	.00	.00	.00
1.5000	.00	.00	.00	.00	.00
1.7500	.00	.00	.00	.00	.00
2.0000	.00	.00	.00	.00	.00
2.2500	.00	.00	.00	.00	.00
2.5000	.00	.00	.00	.00	.00
2.7500	.00	.00	.00	.00	.00
3.0000	.00	.00	.00	.00	.00
3.2500	.00	.00	.00	.00	.00
3.5000	.00	.00	.00	.00	.00
3.7500	.00	.00	.00	.00	.00
4.0000	.00	.00	.00	.00	.00
4.2500	.00	.00	.00	.00	.00
4.5000	.00	.00	.00	.00	.00
4.7500	.00	.00	.00	.00	.00
5.0000	.00	.00	.00	.00	

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
3035.00	-----	.1902	.0000	.000	.000
3039.00	-----	.2540	.6640	.885	.885
3040.00	-----	.2714	.7881	.263	1.148

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: S:\A04073\hydro\casino\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	DEVELOPED	work_pad.hyg	DEVELOPED	100

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	DEVELOPED	100	.943	.5000	2.46

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	POND 10 IN	100	.943	.5000	2.46

TOTAL NODE INFLOW...
HYG file = S:\A04073\hydro\casino\work_pad.hyg
HYG ID = POND 10 IN
HYG Tag = 100

Peak Discharge	=	2.46 cfs
Time to Peak	=	.5000 hrs
HYG Volume	=	.943 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.25	.49	.74	.99
.2500	1.23	1.48	1.72	1.97	2.22
.5000	2.46	2.46	2.46	2.46	2.46
.7500	2.46	2.46	2.46	2.46	2.46
1.0000	2.46	2.46	2.46	2.46	2.46
1.2500	2.46	2.46	2.46	2.46	2.46
1.5000	2.46	2.46	2.46	2.46	2.46
1.7500	2.46	2.46	2.46	2.46	2.46
2.0000	2.46	2.46	2.46	2.46	2.46
2.2500	2.46	2.46	2.46	2.46	2.46
2.5000	2.46	2.46	2.46	2.46	2.46
2.7500	2.46	2.46	2.46	2.46	2.46
3.0000	2.46	2.46	2.46	2.46	2.46
3.2500	2.46	2.46	2.46	2.46	2.46
3.5000	2.46	2.46	2.46	2.46	2.46
3.7500	2.46	2.46	2.46	2.46	2.46
4.0000	2.46	2.46	2.46	2.46	2.46
4.2500	2.46	2.46	2.46	2.46	2.46
4.5000	2.46	2.46	2.46	2.38	2.14
4.7500	1.89	1.64	1.40	1.15	.90
5.0000	.66	.41	.16	.00	

POND ROUTED TOTAL OUTFLOW HYG...
HYG file = S:\A04073\hydro\casino\work_pad.hyg
HYG ID = POND 10 OUT
HYG Tag = 100

Peak Discharge	=	2.46 cfs
Time to Peak	=	.5000 hrs
HYG Volume	=	.943 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.25	.49	.74	.99
.2500	1.23	1.48	1.72	1.97	2.22
.5000	2.46	2.46	2.46	2.46	2.46
.7500	2.46	2.46	2.46	2.46	2.46
1.0000	2.46	2.46	2.46	2.46	2.46
1.2500	2.46	2.46	2.46	2.46	2.46
1.5000	2.46	2.46	2.46	2.46	2.46
1.7500	2.46	2.46	2.46	2.46	2.46
2.0000	2.46	2.46	2.46	2.46	2.46
2.2500	2.46	2.46	2.46	2.46	2.46
2.5000	2.46	2.46	2.46	2.46	2.46
2.7500	2.46	2.46	2.46	2.46	2.46
3.0000	2.46	2.46	2.46	2.46	2.46
3.2500	2.46	2.46	2.46	2.46	2.46
3.5000	2.46	2.46	2.46	2.46	2.46
3.7500	2.46	2.46	2.46	2.46	2.46
4.0000	2.46	2.46	2.46	2.46	2.46
4.2500	2.46	2.46	2.46	2.46	2.46
4.5000	2.46	2.46	2.46	2.38	2.14
4.7500	1.89	1.64	1.40	1.15	.90
5.0000	.66	.41	.16	.00	

DIVERTED HYDROGRAPH...
HYG file = S:\A04073\hydro\casino\work_pad.hyg
HYG ID = ROUTE 10
HYG Tag = 100

Peak Discharge =	2.46 cfs
Time to Peak =	.5000 hrs
HYG Volume =	.943 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.25	.49	.74	.99
.2500	1.23	1.48	1.72	1.97	2.22
.5000	2.46	2.46	2.46	2.46	2.46
.7500	2.46	2.46	2.46	2.46	2.46
1.0000	2.46	2.46	2.46	2.46	2.46
1.2500	2.46	2.46	2.46	2.46	2.46
1.5000	2.46	2.46	2.46	2.46	2.46
1.7500	2.46	2.46	2.46	2.46	2.46
2.0000	2.46	2.46	2.46	2.46	2.46
2.2500	2.46	2.46	2.46	2.46	2.46
2.5000	2.46	2.46	2.46	2.46	2.46
2.7500	2.46	2.46	2.46	2.46	2.46
3.0000	2.46	2.46	2.46	2.46	2.46
3.2500	2.46	2.46	2.46	2.46	2.46
3.5000	2.46	2.46	2.46	2.46	2.46
3.7500	2.46	2.46	2.46	2.46	2.46
4.0000	2.46	2.46	2.46	2.46	2.46
4.2500	2.46	2.46	2.46	2.46	2.46
4.5000	2.46	2.46	2.46	2.38	2.14
4.7500	1.89	1.64	1.40	1.15	.90
5.0000	.66	.41	.16	.00	

SUMMARY OF RATIONAL METHOD PEAK DISCHARGES
--- PREDEVELOPED CONDITIONS ---

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Tag	Freq	File	IDF Curve
100	100		IDF-100

Tc = .5000 hrs

Tag	Freq (years)	C	C adj factor	C final	I in/hr	Area acres	Peak Q cfs
100	100	.200	1.000	.200	1.7200	5.340	1.85

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----
Method I

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

```
*********************************************************************
*  RETURN FREQUENCY: 100 yr     |  Allowable Outflow: 1.85 cfs       *
*  'C' Adjustment: 1.000        |  Required Storage: .550 ac-ft      *
*-------------------------------------------------------------------*
*  Peak Inflow: 2.46 cfs                                             *
* .HYG File:   100                                                   *
*********************************************************************
```

```
Q |              Td = 4.6333 hrs                    |  Return Freq: 100 yr
  /------- Approx. Duration for Max. Storage ------/  C adj.factor:1.000
  |                                                 |
  |                                                 |
  |                Tc= .5000 hrs                    |
  |                I = 1.7200 in/hr                 |  Area = 5.340 acres
  |              . Q = 8.34 cfs                     |  Weighted C = .900
  |            .|.                                  |  Adjusted C = .900
  |           . | .                                 |
  |          .  |  .            Required Storage    |
  |        .       .         .-- .550 ac-ft         |  Td= 4.6333 hrs
  |       .    |    .       |                      |  I = .5084 in/hr
  |      .     x x x x x x x|x x x x x x x x x x x  Q = 2.46 cfs
  |     .                   |
  |    .    x                                       x
  |   .                                               o   Q = 1.85 cfs
  |  .   x                                o          |x  (Allow.Outflow)
  |  .  x                       .     o              |
  |  . x              o       .        NOT TO SCALE  |   x
  | . x       o                .       ==========    |
  | o                          .                     |       x
  `-----------------------------------------------------|------------
                                                 4.7574 hrs      T
```

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

RETURN FREQUENCY: 100 yr `C' Adjustment = 1.000Allowable Q = 1.85 cfs

Hydrograph Storm Duration, Td = 4.6333 hrs Tc = .5000 hrs
Hydrograph File: 100

Wtd. 'C'	Adjusted 'C'	Duration hrs	Intens. in/hr	Area acres	Qpeak cfs	VOLUMES Inflow ac-ft	Storage ac-ft
.900	.900	.5000	1.7200	5.340	8.34	.344	.268
.900	.900	.6667	1.5300	5.340	7.41	.409	.319
.900	.900	.8333	1.3400	5.340	6.49	.447	.345
.900	.900	1.0000	1.1500	5.340	5.57	.461	.346
.900	.900	2.0000	.7800	5.340	3.78	.625	.433
.900	.900	3.0000	.6200	5.340	3.00	.745	.477
.900	.900	4.0000	.5517	5.340	2.67	.884	.539
**********						Storage	Maximum
.900	.900	4.6333	.5084	5.340	2.46	.943	.550
**********							
.900	.900	5.0000	.4833	5.340	2.34	.968	.547
.900	.900	6.0000	.4150	5.340	2.01	.997	.500
.900	.900	7.0000	.3925	5.340	1.90	1.100	.526
.900	.900	8.0000	.3700	5.340	1.79	Qpeak < Qallow	

MODIFIED RATIONAL METHOD HYDROGRAPH

Q = CiA * Units Conversion; Where Conversion = 43560 / (12 * 3600)

Tag	Freq	File	IDF Curve
100	100		IDF-100

Td = 4.6333 hrs

Tag	Freq (years)	C	C adj factor	C final	I in/hr	Area acres	Peak Q cfs
100	100	.900	1.000	.900	.5084	5.340	2.46

HYG file = S:\A04073\hydro\casino\work_pad.hyg
HYG ID = DEVELOPED
HYG Tag = 100

Peak Discharge = 2.46 cfs
Time to Peak = .5000 hrs
HYG Volume = .943 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.25	.49	.74	.99
.2500	1.23	1.48	1.72	1.97	2.22
.5000	2.46	2.46	2.46	2.46	2.46
.7500	2.46	2.46	2.46	2.46	2.46
1.0000	2.46	2.46	2.46	2.46	2.46
1.2500	2.46	2.46	2.46	2.46	2.46
1.5000	2.46	2.46	2.46	2.46	2.46
1.7500	2.46	2.46	2.46	2.46	2.46
2.0000	2.46	2.46	2.46	2.46	2.46
2.2500	2.46	2.46	2.46	2.46	2.46
2.5000	2.46	2.46	2.46	2.46	2.46
2.7500	2.46	2.46	2.46	2.46	2.46
3.0000	2.46	2.46	2.46	2.46	2.46

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
3.2500	2.46	2.46	2.46	2.46	2.46
3.5000	2.46	2.46	2.46	2.46	2.46
3.7500	2.46	2.46	2.46	2.46	2.46
4.0000	2.46	2.46	2.46	2.46	2.46
4.2500	2.46	2.46	2.46	2.46	2.46
4.5000	2.46	2.46	2.46	2.38	2.14
4.7500	1.89	1.64	1.40	1.15	.90
5.0000	.66	.41	.16	.00	

RATIONAL C COEFFICIENT DATA

Soil/Surface Description	C	Area acres	C x Area acres
Pre Developed CA	.2000	5.340	1.068
WEIGHTED C & TOTAL AREA --->	.2000	5.340	1.068

RATIONAL C COEFFICIENT DATA

Soil/Surface Description	C	Area acres	C x Area acres
Pre Developed CA	.9000	5.340	4.806
WEIGHTED C & TOTAL AREA --->	.9000	5.340	4.806

Appendix A

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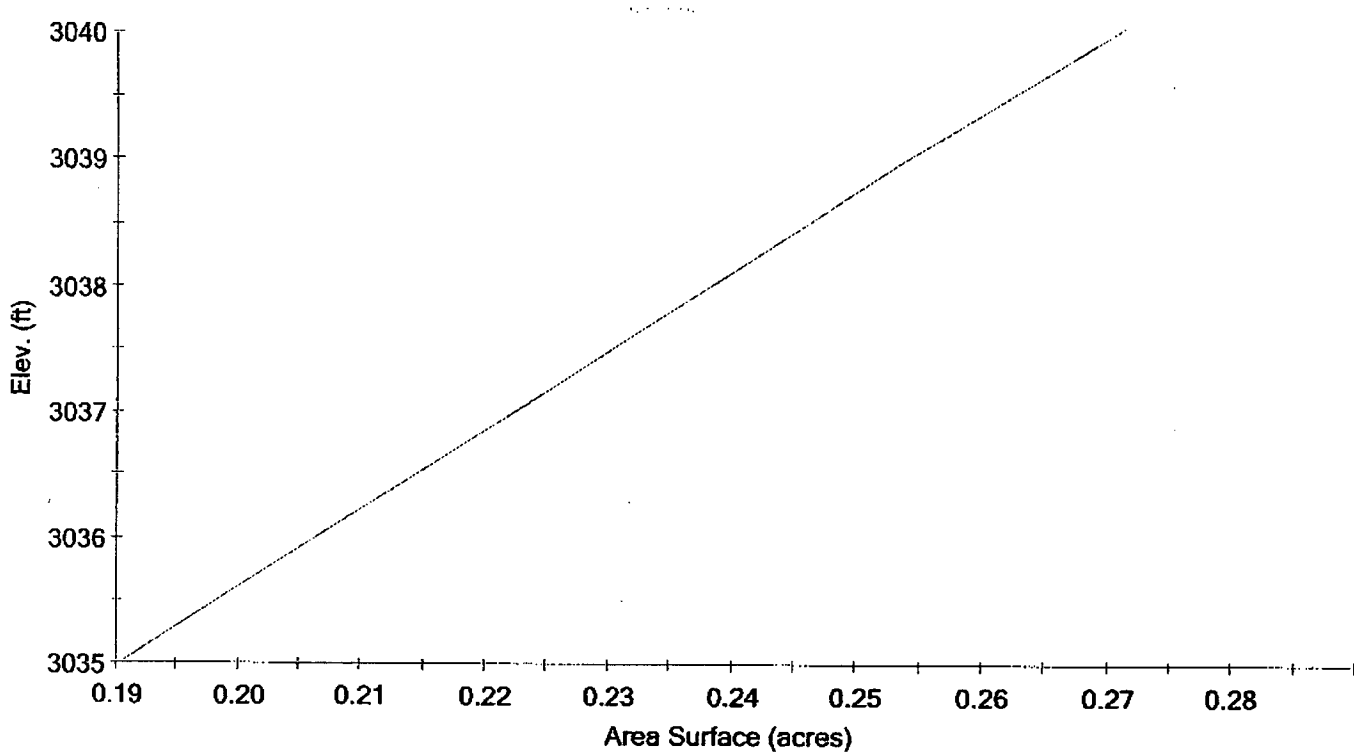
2.03

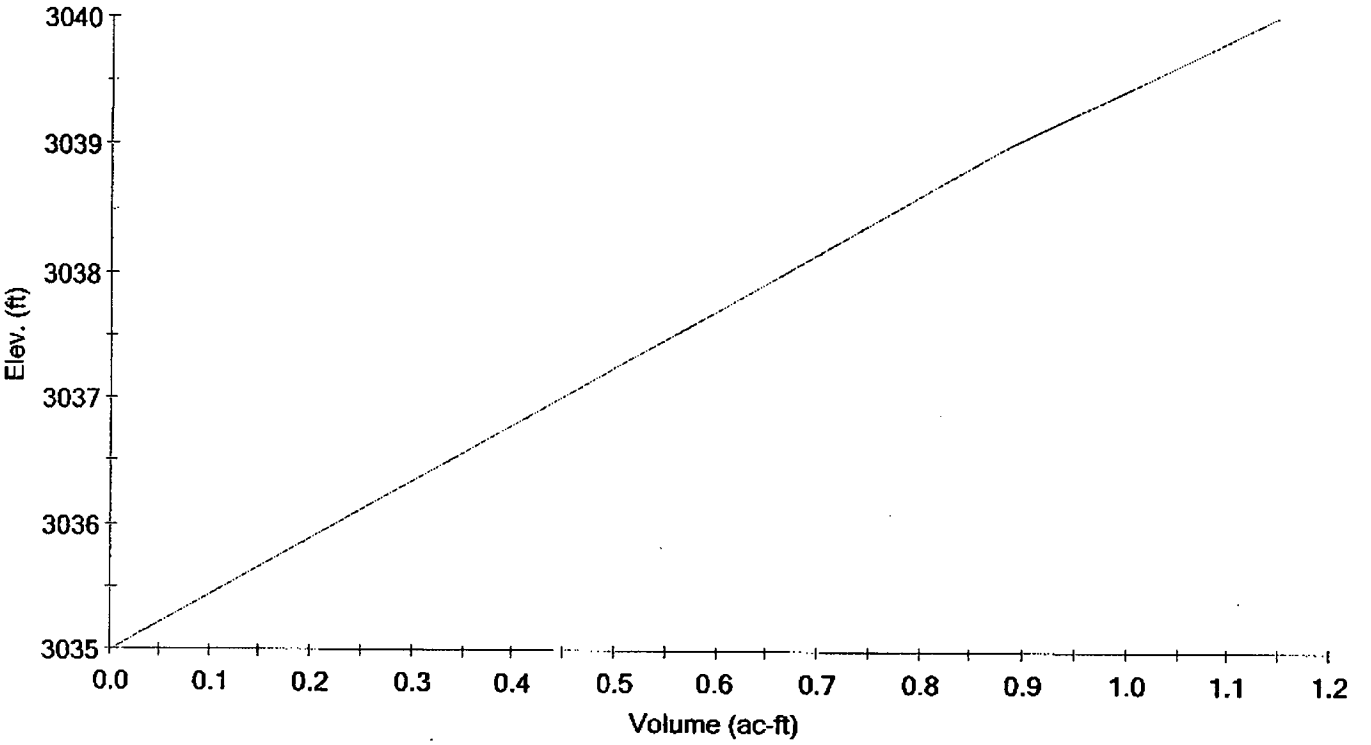
PondMaker Design Wizard

Return Event	Pre Dev Peak (cfs)	Pre Dev Volume (ac-ft)	Post Dev Peak (cfs)	Post Total Volume (ac-ft)	Estimated Storage (ac-ft)	Interp. W.S. Elev. (ft)	Freeboard Depth (ft)
100	1.8523	0.00000	2.4637	0.94339	0.88534	3039.0000	PASS

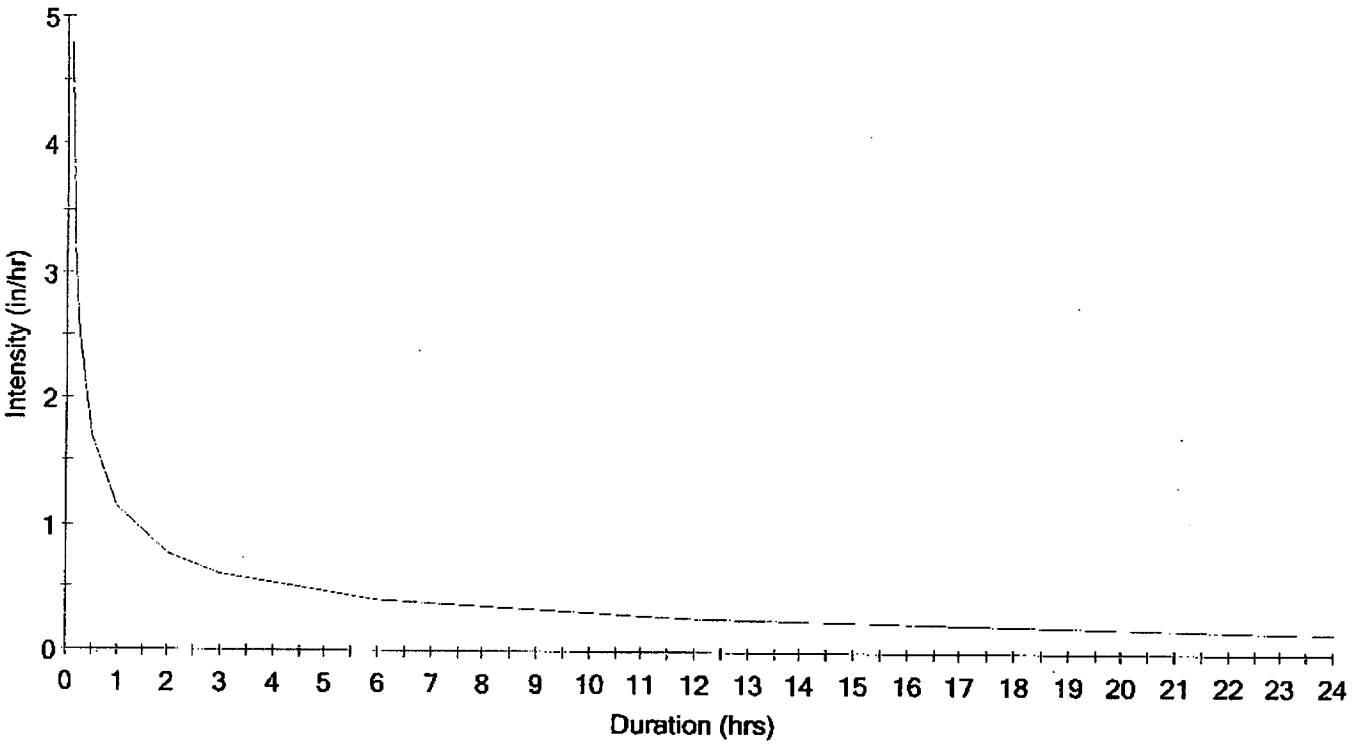
Elev. vs. Area Surface
POND 10



Elev. vs. Volume
POND 10



Intensity-Duration-Frequency
IDF-100 100



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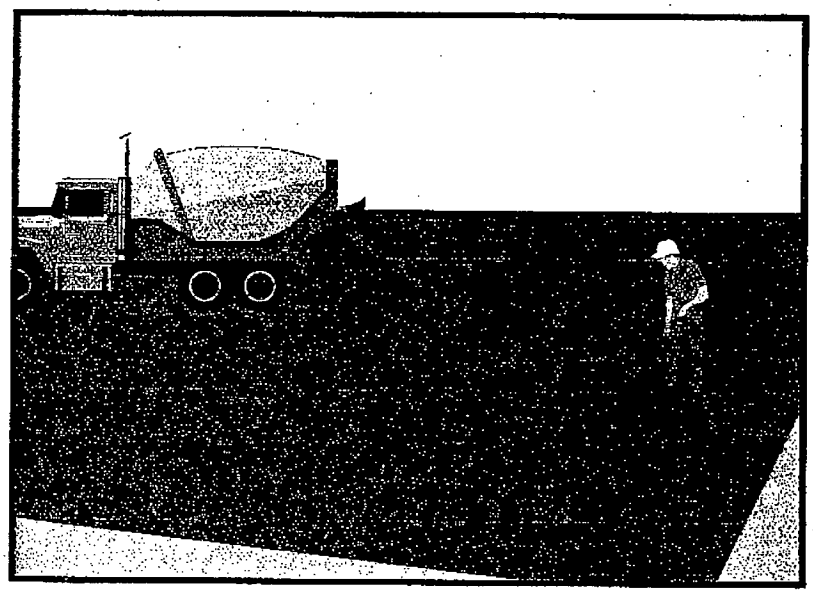
APPENDIX C

Sample Best Management Practices

Paving and Grinding Operations NS-3



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather.

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is in the forecast.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).

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- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- If paving involves an onsite mixing plant, follow the stormwater permitting requirements for industrial activities.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses, These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; or SE-5, Fiber Rolls.
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
  - Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 1 ft of material.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.

- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.

- Drainage inlet structures and manholes should be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

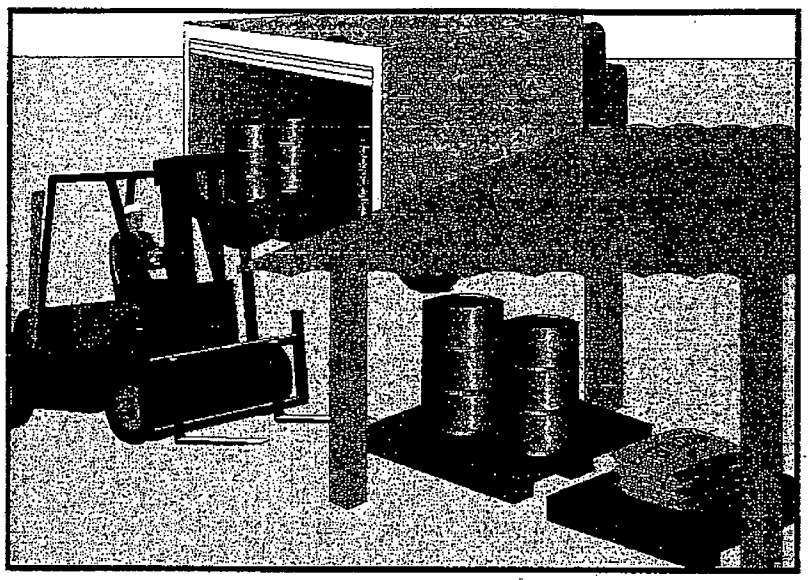
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Material Delivery and Storage WM-1



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease
- Asphalt and concrete components

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- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Temporary storage area should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located near the construction entrances, away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area which will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.
- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Chemicals should be kept in their original labeled containers.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, each temporary containment facility should be covered during non-working days, prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous materials.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep an ample supply of spill cleanup materials near the storage area.
- Keep storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

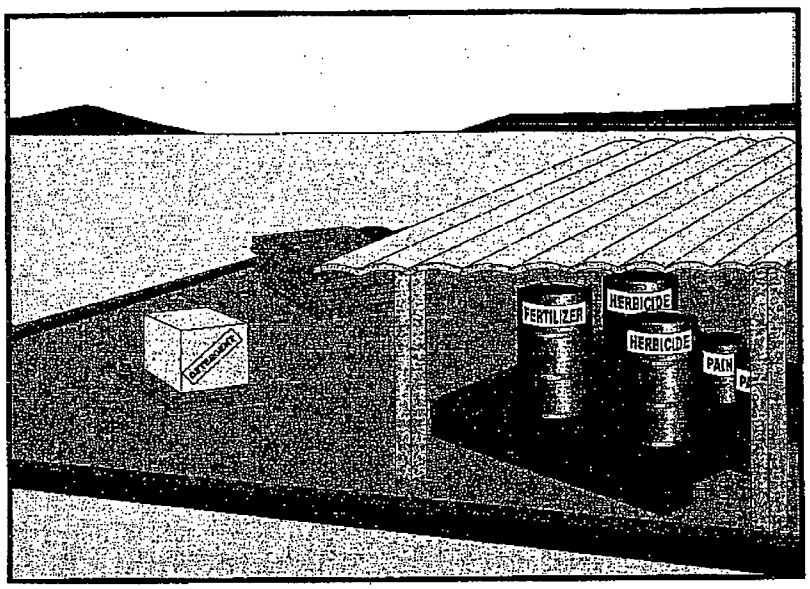
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use

WM-2



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

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Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydro seeding. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or into a concrete washout pit or temporary sediment trap. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.

- Require contractors to complete the "Report of Chemical Spray Forms" when spraying herbicides and pesticides.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two–week intervals in the non-rainy season to verify continued BMP implementation.
- Maintenance of this best management practice is minimal.
- Spot check employees and subcontractors throughout the job to ensure appropriate practices are being employed.

References

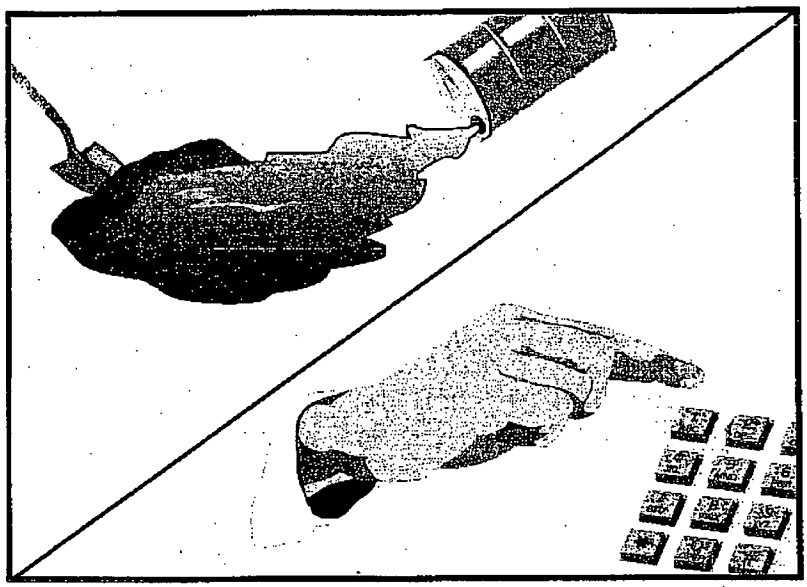
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Spill Prevention and Control WM-4



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

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- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

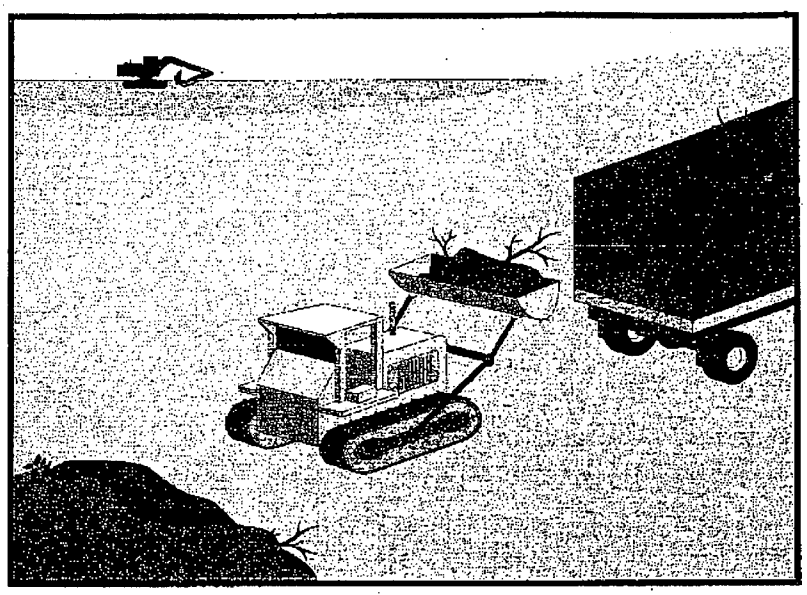
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials

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- Highway planting wastes, including vegetative material, plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

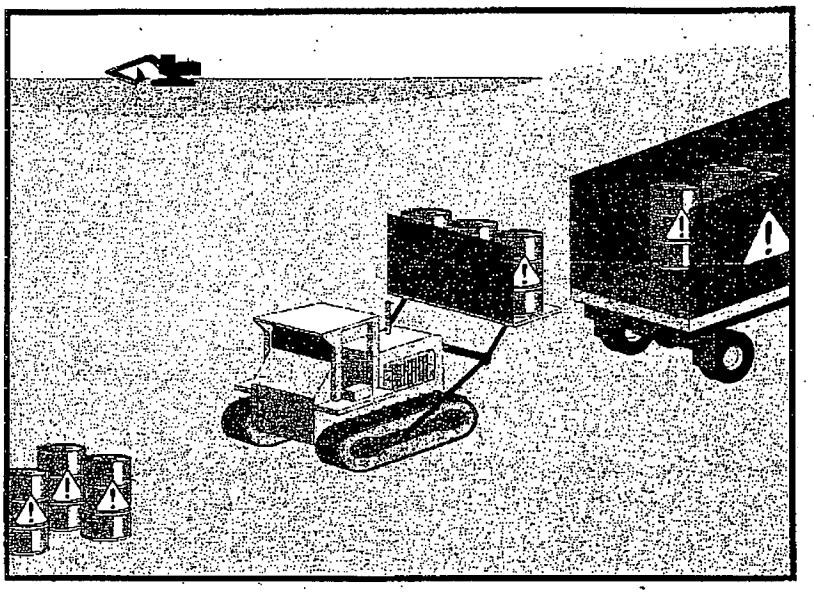
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Concrete Curing Compounds
- Palliatives
- Septic Wastes
- Stains
- Wood Preservatives
- Asphalt Products
- Pesticides
- Acids
- Paints
- Solvents
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

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In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:
  - Ensure that adequate hazardous waste storage volume is available.
  - Ensure that hazardous waste collection containers are conveniently located.
  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.
  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.
  - Segregate potentially hazardous waste from non-hazardous construction site debris.
  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.
- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.

- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

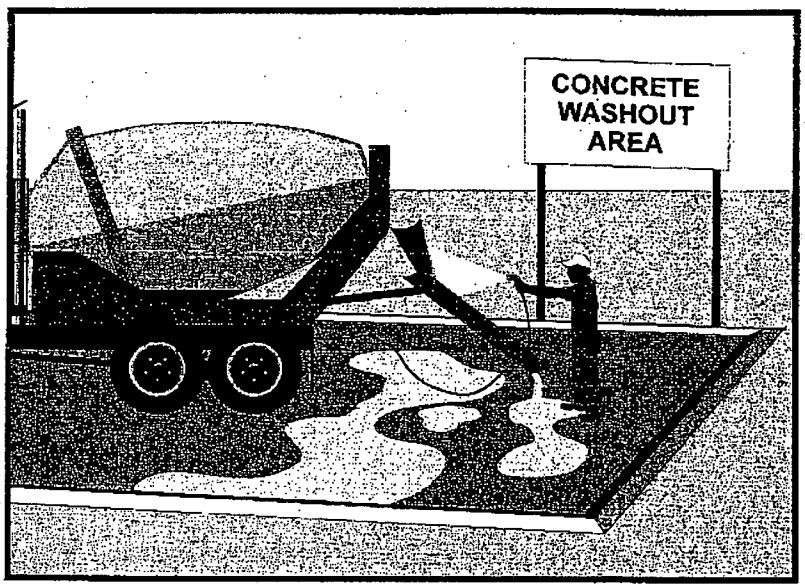
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, performing onsite washout in a designated area, and training employee and subcontractors.

Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result form demolition activities
- Slurries containing portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition
- Concrete trucks and other concrete-coated equipment are washed onsite
- Mortar-mixing stations exist
- See also NS-8, Vehicle and Equipment Cleaning

Limitations

- Offsite washout of concrete wastes may not always be possible.

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Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.
- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - Locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed properly.
- Avoid creating runoff by draining water to a bermed or level area when washing concrete to remove fine particles and expose the aggregate.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.

Concrete Slurry Wastes

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility.
- A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

- Below grade concrete washout facilities are typical. Above grade facilities are used if excavation is not practical.
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut PCC slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Slurry residue should be vacuumed and disposed in a temporary pit (as described in OnSite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and

minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

- Straw bales, wood stakes, and sandbag materials should conform to the provisions in SE-9, Straw Bale Barrier.
- Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and disposed of. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and disposed of.
- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures.

Inspection and Maintenance

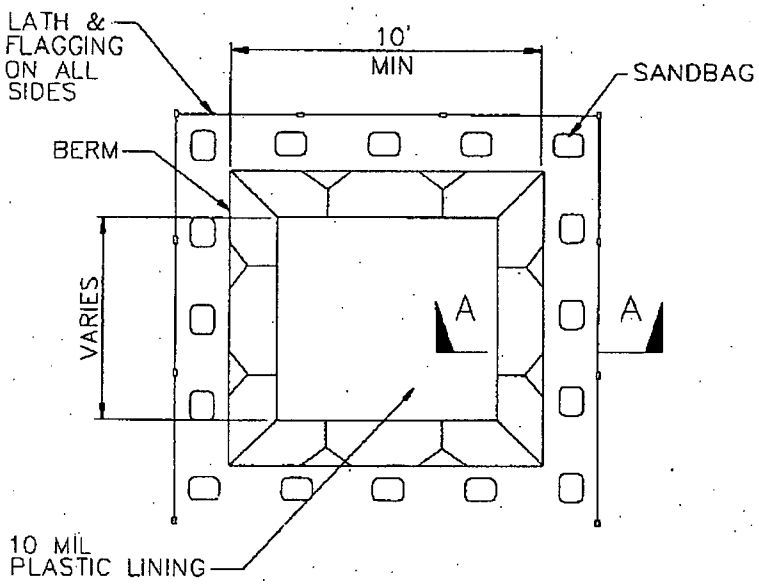
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and disposed of.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

References

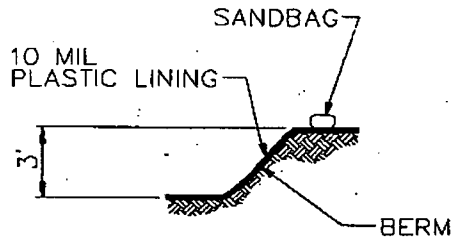
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

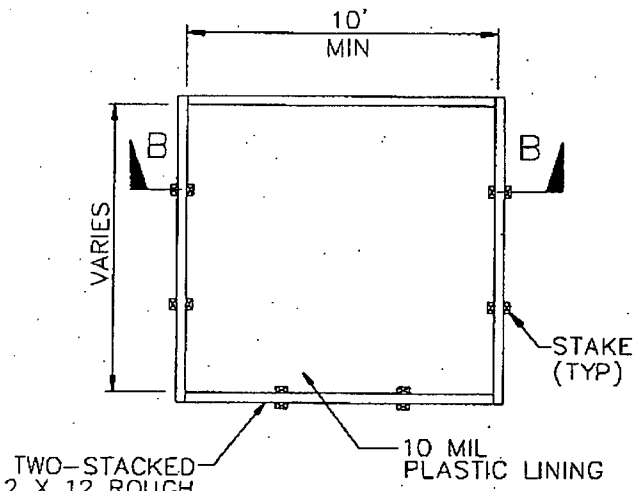
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



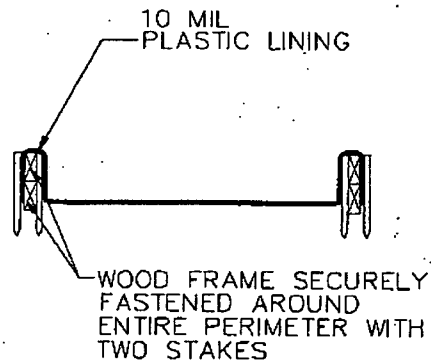
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



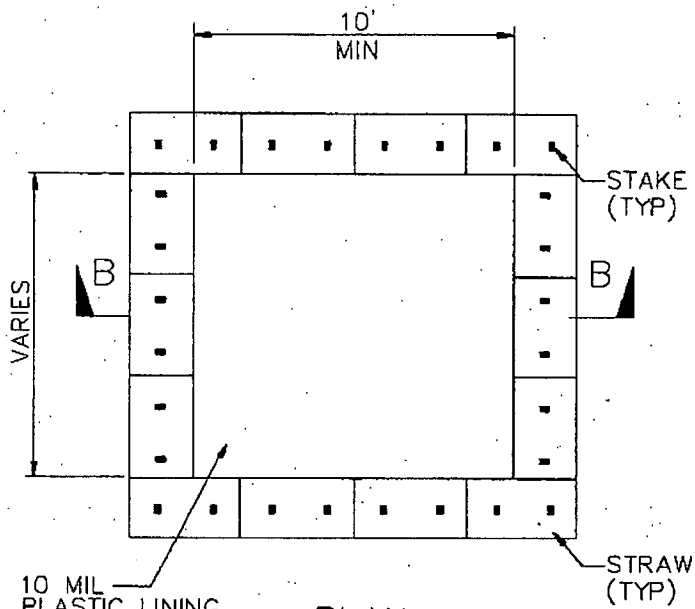
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



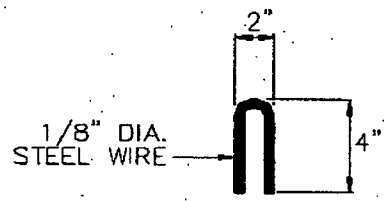
SECTION B–B
NOT TO SCALE

NOTES

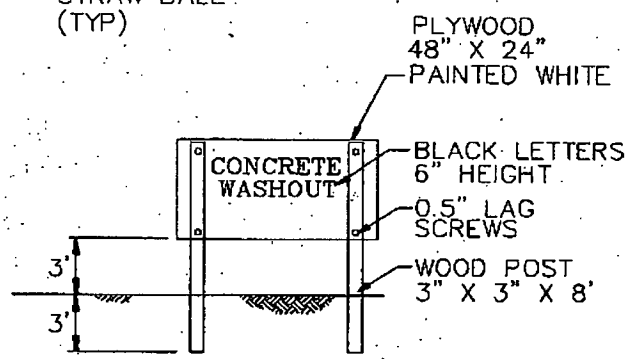
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



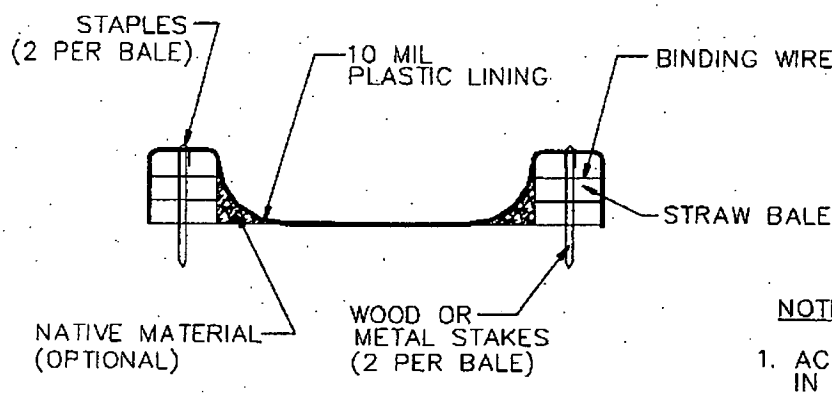
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

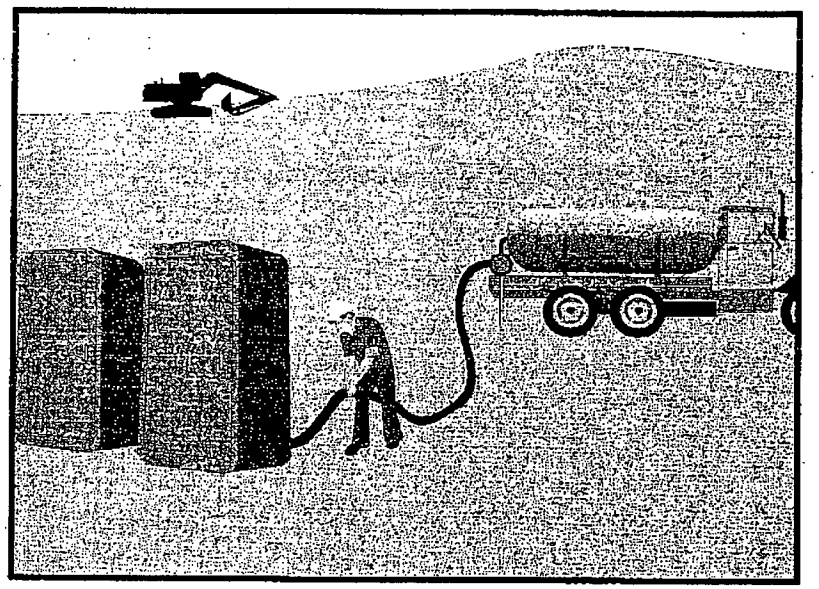


SECTION B–B
NOT TO SCALE

NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Sanitary/Septic Waste Management WM-9



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	✓
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	✓

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.
- Wastewater should not be discharged or buried within the project site.

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WM-9 Sanitary/Septic Waste Management

- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Untreated raw wastewater should never be discharged or buried.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

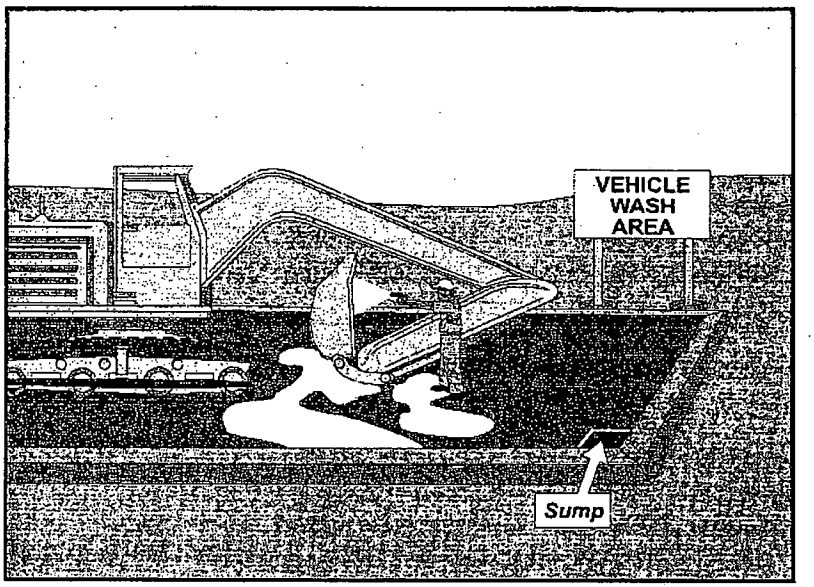
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Vehicle and Equipment Cleaning NS-8



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning by using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

Use an offsite commercial washing business as much as possible. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.

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- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and should not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

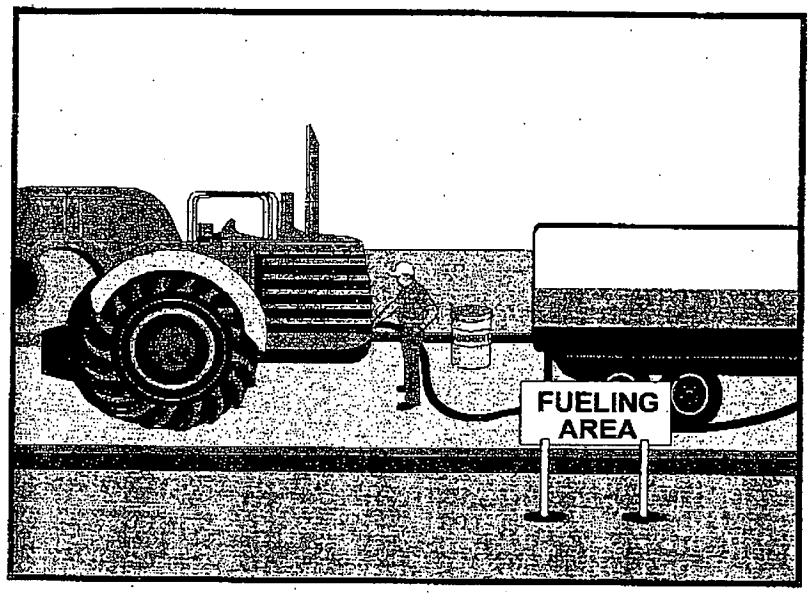
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives

None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

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- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

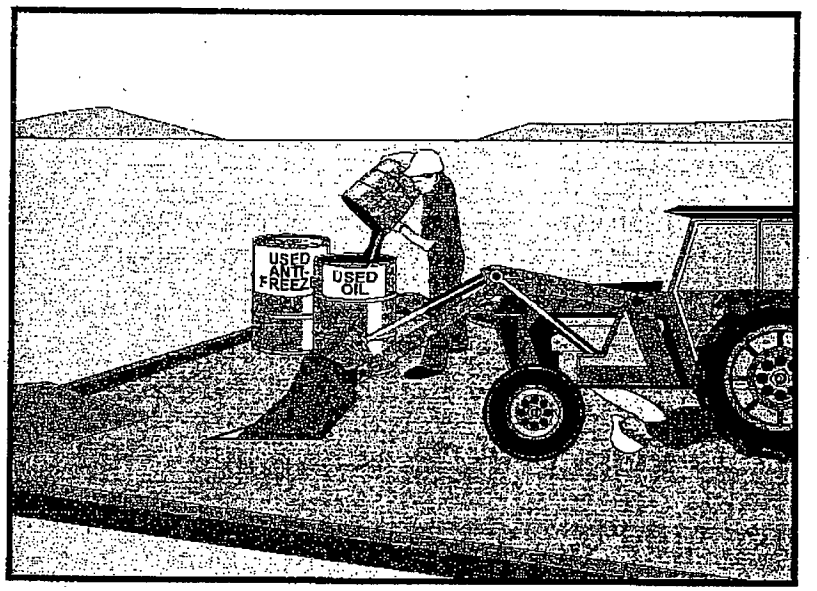
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	✓
Metals	
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

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NS-10 Vehicle & Equipment Maintenance

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.
- Repair leaks of fluids and oil immediately.

Vehicle & Equipment Maintenance NS-10

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

NS-10 Vehicle & Equipment Maintenance

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

References

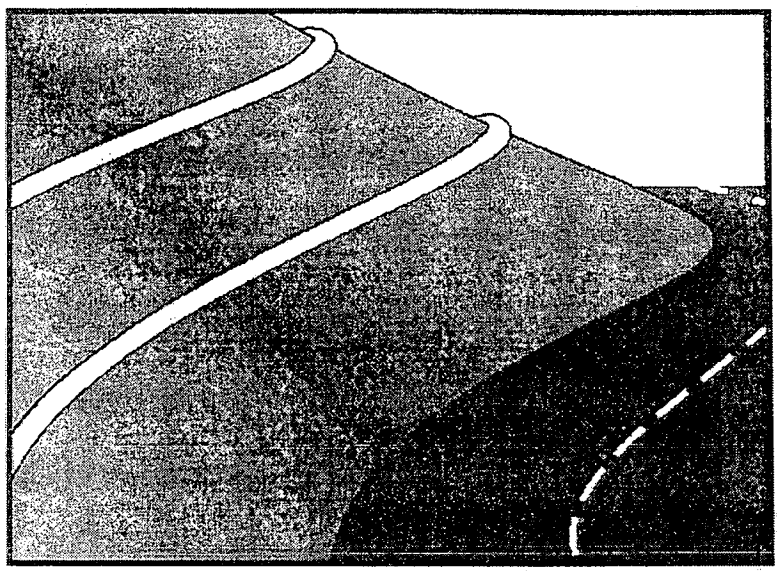
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Fiber Rolls

SE-5



Objectives

EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

Description and Purpose

A fiber roll consists of straw, flax, or other similar materials bound into a tight tubular roll. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- Along the perimeter of a project
- As check dams in unlined ditches
- Down-slope of exposed soil areas
- Around temporary stockpiles

Limitations

- Fiber rolls are not effective unless trenched

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- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 in. diameter or installations achieving the same protection (i.e. stacked smaller diameter fiber rolls, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Implementation

Fiber Roll Materials

- Fiber rolls should be either prefabricated rolls or rolled tubes of erosion control blanket.

Assembly of Field Rolled Fiber Roll

- Roll length of erosion control blanket into a tube of minimum 8 in. diameter.
- Bind roll at each end and every 4 ft along length of roll with jute-type twine.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into a 2 to 4 in. deep trench with a width equal to the diameter of the fiber roll.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.

Removal

- Fiber rolls are typically left in place.

- If fiber rolls are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

Costs

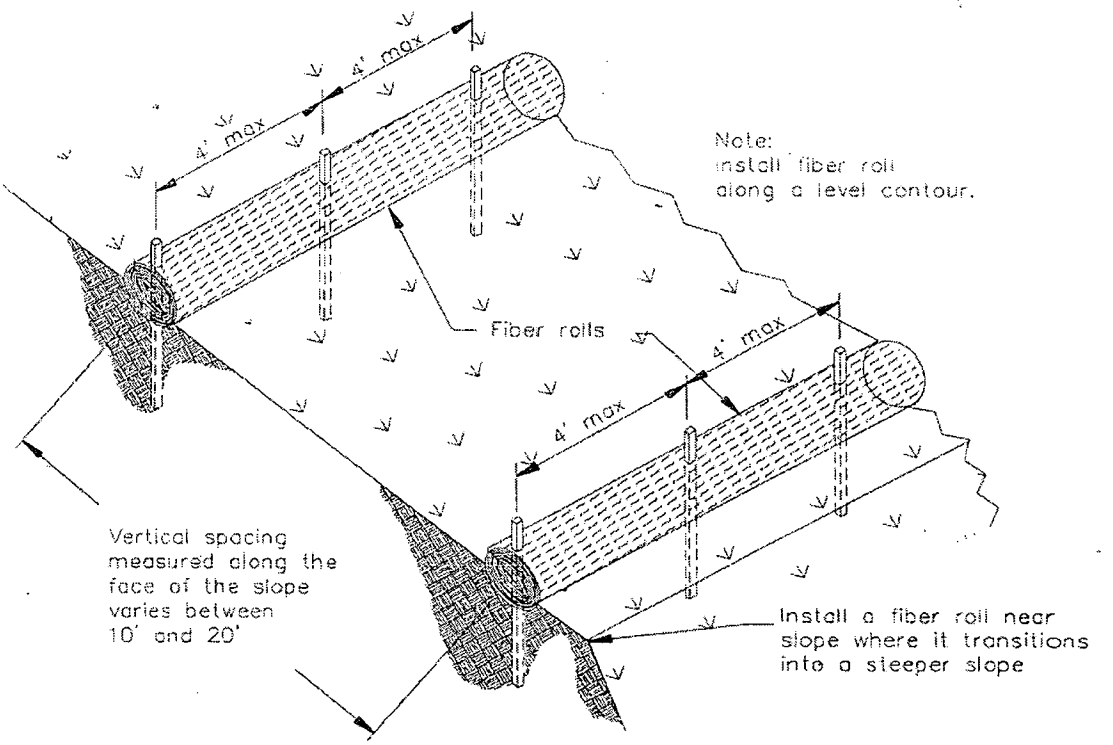
Material costs for fiber rolls range from $20 - $30 per 25 ft roll.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the fiber roll and the adjacent ground surface. Sediment removed during maintenance may be incorporated into earthwork on the site of disposed at an appropriate location.
- If fiber rolls are used for erosion control, such as in a mini check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



TYPICAL FIBER ROLL INSTALLATION

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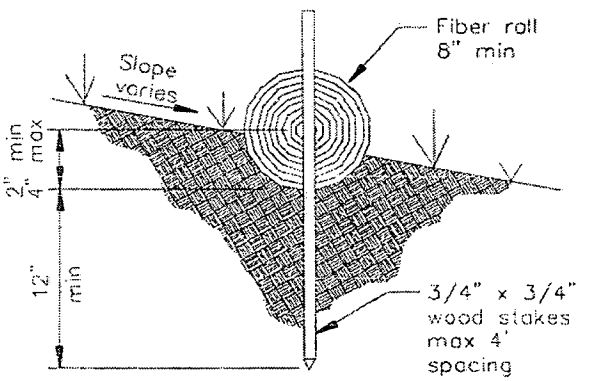
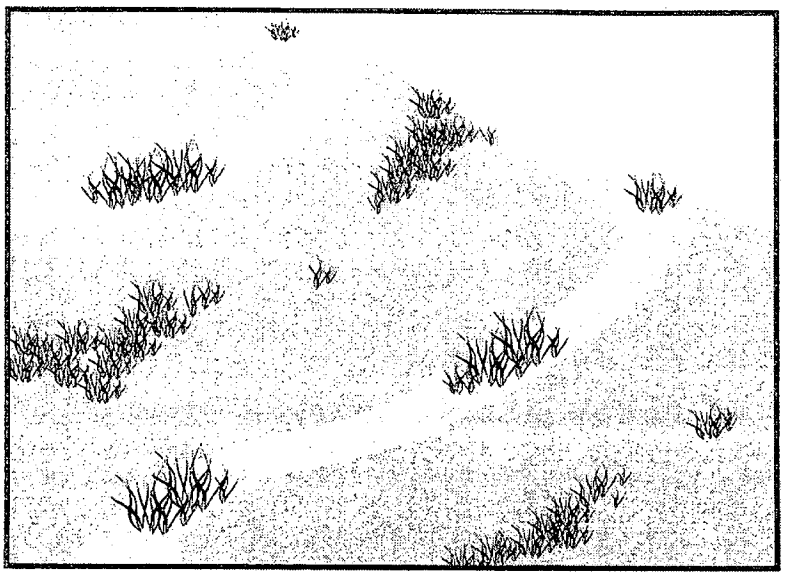


ENTRENCHMENT DETAIL

N.T.S.

Hydroseeding

EC-4



Objectives

EC	Erosion Control	✓
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	✓
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

Description and Purpose

Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily protect exposed soils from erosion by water and wind.

Suitable Applications

Hydroseeding is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short term inactivity.

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Implementation

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps shall be followed for implementation:

- Avoid use of hydroseeding in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow up applications shall be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average cost for installation and maintenance may vary from as low as $300 per acre for flat slopes and stable soils, to $1600 per acre for moderate to steep slopes and/or erosive soils.

Hydroseeding		Installed Cost per Acre
High Density	Ornamentals	$400 - $1600
	Turf Species	$350
	Bunch Grasses	$300 - $1300
Fast Growing	Annual	$350 - $650
	Perennial	$300 - $800
Non-Competing	Native	$300 - $1600
	Non-Native	$400 - $500
Sterile	Cereal Grain	$500

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems shall be inspected for complete coverage and adjusted as needed to maintain complete coverage.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.