PRELIMINARY ENGINEERING EVALUATION, LOS OSOS/BAYWOOD PARK COMMUNITY DRAINAGE PROJECT

FOR

SAN LUIS COUNTY SERVICE AREA No. 9J

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EXECUTIVE SUMMARY

This executive summary of the *Preliminary Drainage Evaluation, Los Osos/Baywood Park Community Drainage Project for San Luis County Service Area Number 9J*, along with the supplemental foldout maps provide an overview of the work performed and the recommendations of this study. This draft report was prepared under the direction of the County of San Luis Obispo Engineering Department for the Los Osos and Baywood Park Communities comprising County Service Area 9J (CSA-9J). The purpose of this report was to analyze existing drainage and flooding problems and provide recommendations for improvements to correct these existing problems.

The most significant residential flooding problems experienced by the Los Osos and Baywood Park communities are from natural sumps. The communities are situated adjacent to the Morro Bay estuary upon a sandy terrain which has approximately two major, and numerous other localized natural sumps. Historically they drained relatively quickly without flooding because of the high permeability of the soil and ample distance to groundwater. Over the last twenty years, development has lead to a reduction of the permeability of these sump areas, and groundwater levels have risen reducing the amount of immediate subsurface storage available. This has resulted in several areas becoming flood prone causing public and private property damage during storms.

In addition, CSA-9J has been experiencing increasing levels of nuisance flooding problems, including residential and street flooding documented from the mid 1970's. These problems are directly attributable to increased growth within the communities. This increase in flooding has resulted from to the paving of open space and the subsequent reduction of allowable infiltration area, construction within natural (topographic) drainage courses without provisions for rerouting surface drainage, and development of properties without containment of onsite drainage. Primary areas of flooding concern are Los Osos Valley Road in the town of Los Osos, and east of town near its intersection with Cimarron Road. These areas are of concern since Los Osos Valley Road provides the community one of only two access routes into, and out of the community.

For this report, CSA-9J was divided into 27 separate drainage areas which were defined based on the existing topographic features (see Map 1, Topographic Info.). These drainage areas relate only to surface conditions (the path a water droplet will follow along the surface within an area, and to a common point) and are irrespective to groundwater (subsurface) conditions. Within each of these 27 defined areas, existing drainage related problems have been identified. Based on the specific problem experienced, each of the 27 areas were further separated into seven categories. These categories include:

1. Shallow to Surfacing Groundwater in the Interdunal Depressions
2. Shallow to Surfacing Groundwater at the Bay Fringe
3. Excessive Concentration of Surfacing Runoff
4. Inadequate Surface Slopes
5. Closed Depressions having Limited Surface
6. Other Nuisance Problems
7. Other Areas with Negligible Problems

A substantial portion of the problems fall into the category of Shallow to Surfacing Groundwater in the Interdunal Depressions. Drainage problems in these areas typically include flooding due to elevated or surfacing groundwater conditions. Due to the limited depth to groundwater, there is little storage capacity available within the soil for surface water to infiltrate after a storm event. This causes long periods of time that water will remain ponded.

The regions of the study area that experience these drainage problems include the El Moro Depression, the 16th Street Depression, and the Ramona Depression. In each of these regions widespread residential flooding has been documented on a regular basis, with the extent of damage a function of a storm's severity. Typical storm related damages reported include property flooding, structure flooding, road flooding, and long term failure of septic systems due to an elevated groundwater table.

With the implementation of the proposed sewer project, infiltration from septic tank systems is expected to be substantially reduced. However, it is anticipated that groundwater levels will slowly lower. Although a long-term benefit would result from increase storage capacity in the aquifer for surface flow to infiltrate, there is still expected to be periods of short term flooding. Storm drain systems and future infiltration basins are recommended for areas in this category.

The most common solutions to drainage problems within the community include storm drains and retention basins. Although a number of alternative projects were originally considered (ranging from groundwater recharge to pumping long distances for domestic and agricultural usage), storm drains and retention basins proved to be the most cost effective, long-term solutions. Table ES-1 summarizes the solutions for each of the 27 defined drainage areas including the preferred project costs and its specific percentage of total community costs. All drainage calculations and alternative solutions identified in this report assumed build-out conditions.

Assuming that all projects presented in Table ES-1 were to be constructed under a single project scope of work, a construction schedule was developed. This schedule was broken into two components; environmental, and design & construction. The environmental component of the project schedule is expected to last a minimum of one year and would include and Environmental Impact Report for the entire project and the securing of all environmentally related permits. The design & construction component was estimated to last approximately 2 years. However, based on existing environmentally sensitive areas within the project area, the environmental component may well exceed one year.

In order to provide a construction schedule, each of the projects were ranked. This ranking divided the project into Community Projects and Localized Projects, with community projects given a higher construction priority. Localized Project were then added below Community Projects and ranked in accordance to complaint logs and drainage problem severity, as determined from the information presented in Appendices B1 and B2. This ranking is summarized in Table ES-1.

There are a number of methods available to distribute the costs associated with the community drainage projects. For this report, the Community Benefit Method was selected for cost distribution. Assuming this method of funding, all 5127 property owners within the CSA 9J area would share an equal portion of the cost of improvements. Referring to Table ES-1, the total cost of improvements for the entire community was estimated to be $21,218,513. Based on the assumptions presented in

Section V-D, the total cost to each property owner would then be approximately $376 per year for 20 years.

TABLE ES-1: ESTIMATED DRAINAGE IMPROVEMENT COST BREAKDOWN PER DRAINAGE AREA

Project Ranking	Cat.	Area	Project Location	Project Description	Cost	Percent Cost	Complaints Logged	Homes Flooded	EIR Required
1	3	16	Broderson, Skyline & Pine	Storm Drain	$1,209,700	8.6%	34	1	Y
2	3	27	Los Osos Valley Road at Cimmaron	Storm Drain	$240,150	1.7%	3	1	N
3	1	6	El Moro Depression, 300 Block to 1400 Block	Storm Drains	$1,214,500	8.6%	83	24	Y
4	1	7	Paso Robles Depression, 1400 Block and 1800 Block	Retention Basin	$3,766,350	26.6%	30	6	Y
5	1	8	Ramona/Pismo Depression from 300 Block to 1300 Block	Storm Drain	$3,324,250	23.5%	22	2	Y
6	2	14	Cuesta by the Sea, West	Regrade Roadway	$438,150	3.1%	16	0	N
7	4	17	Los Osos Valley South	Storm Drain	$1,284,900	9.1%	13	0	N
8	6	4	Santa Ysabel, 1300 Block to 1600 Block	Storm Drains	$257,200	1.8%	10	0	N
9	2	1	Santa Ysabel, Pasadena to 600 Block	Road Closure	$178,400	1.3%	4	0	N
10	6	23	South Bay Blvd. & Los Osos Valley Rd to Los Osos Creek	Cross Gutter	$10,900	0.1%	4	0	N
11	6	13	Monarch/Sea Pines	Swale	$10,950	0.1%	4	0	N
12	4	22	Fairchild Basin	Retention Basin	$455,300	3.2%	3	1	N
13	2	15	Cuesta by the Sea, East	Regrade Roadway	$206,400	1.5%	2	0	N
14	5	9	14th to 17th Street Depression between Pismo & Ramona	Storm Drain	$42,900	0.3%	1	0	N
15	5	10	San Luis Avenue, 1300 Block to South Bay Blvd	Retention Basin	$1,418,300	10.0%	1	0	N
16	6	11	Ramona, 1600 Block to South Bay Blvd	Swale	$64,200	0.5%	1	0	N
17	4	19	Santa Ynez at Mountain View	Swale	$23,125	0.2%	1	0	N
					$14,145,675	100.0%			

* EIR Required. Each project was evaluated individually in Section III although it is anticipated that a single EIR for all projects with be prepared.

Five large scale maps have been included as part of this report to provide a graphic representation of the information contained within. These maps are described as follows:

Map 1 provides the general topography of the study area. Topographic information was provided by the County of San Luis Obispo and was originally developed by *Metcalf & Eddy* for the sewer project. The large gaps in the topographic information are due to the sewer study's limited need for information outside the roadways and sewer project limits.

Map 2 provides a graphic presentation of the information provided in Appendices B1 and B2. This includes the documented community complaints, field observed flooding areas, and drainage patterns.

Map 3 provides a graphic representation of all known existing storm drainage facilities and pump stations as discussed in Appendices B3 and D2. The small boxed numbers, such as 21.2, refer to the Drainage Area (Area 21 in this example) and the item number (2 in this example) as presented in Appendix B3. The larger boxed numbers reflect the drainage area and related flowrates as presented in Appendix D2.

Map 4 provides a graphic representation of alternative projects as discussed in Report Section III. The boxed numbers, such as ALT 21.2, refer to the specific drainage area (Area 21 in this example) and the Alternative (2 in this example) as discussed in Section III.

Map 5 provides a graphic representation of the recommended alternative projects, as discussed in Report Section V.

SECTION I

INTRODUCTION

A. BACKGROUND

The Community of Los Osos/Baywood Park is situated adjacent to the Morro Bay estuary in the County of San Luis Obispo, State of California (see Exhibit I-1). The community has experienced increased flooding problems over the past 20 years primarily due to urban improvements and services associated with increased population growth[1]. In the late 1960's the population of the community was only a few thousand. Today, the population of the community exceeds 14,000. By the late 1970's flood related property damage had become a frequently reported problem within the community. This flooding has been attributed to the marked increase in residential density, septic system leach field discharge, rising groundwater elevations, domestic water supply practices of pumping from the lower aquifer and discharging to the upper aquifer, natural topographic features, and insufficient storm drainage infrastructure.

Almost all areas of the community experience flooding that ranges from roadway flooding and/or sediment deposition, to more severe residential and business flooding. Roadway flooding ranges from nuisance ponding and road closure in most of the low-lying areas. More severe roadway flooding occurs on Los Osos Valley Road just westerly of the downtown area, and again near its intersection with Cimmeron Way.

Business related flooding has been documented in the Los Olivos Avenue and southerly 17th Street areas of Los Osos, and the southeasterly side of 2nd Street in Baywood Park. Residential flooding and drainage problems have been documented in many areas of the community, with the most severe locations being in the El Moro Avenue depression, Paso Robles Avenue depression, Ramona Depression, and Pine Avenue areas.

B. PURPOSE

This report has been prepared for the County of San Luis Obispo on behalf of San Luis Obispo County Service Area Number 9J (CSA 9J). The project consists of the preparation of this report that details the investigation of drainage problems and solutions to eliminate flooding within the geographic boundary of CSA 9J. This report is intended to quantify the existing storm related problems, identify sources of the problems, and recommend solutions to relieve flood related damage within the community.

[1] California Office of Emergency Services, 1996, *Hazard Mitigation Grant Program Application:* prepared by San Luis Obispo County Engineering Department, January 30, 1996.

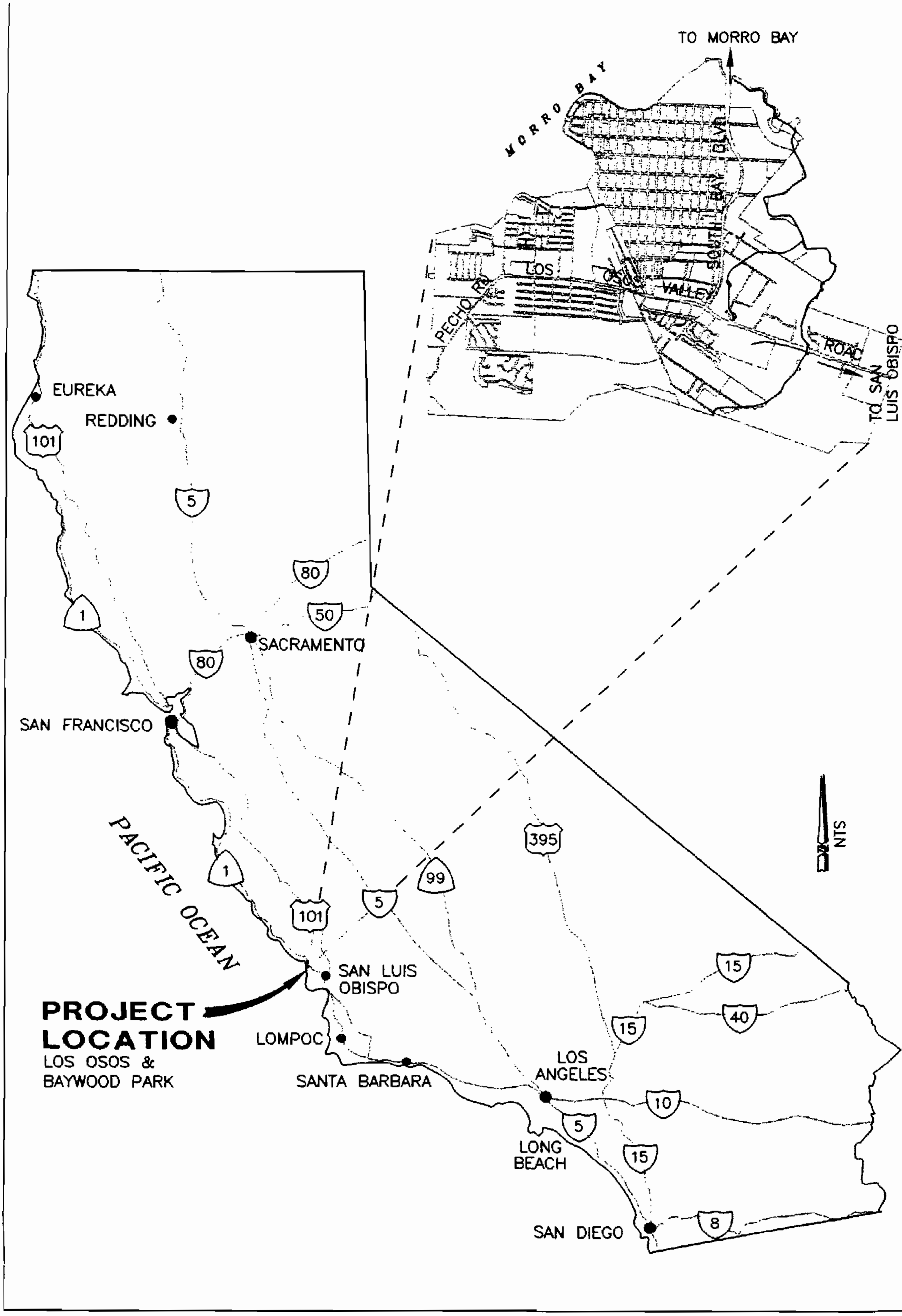

FIGURE I-1
VICINITY MAP

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ROAD AND PROPERTY ALIGNMENT INFORMATION PROVIDED BY THE COUNTY OF SAN LUIS OBISPO. THIS INFORMATION IS THE BEST AVAILABLE AT THE TIME OF CONTRACT AND HAS BEEN DETERMINED AS ACCEPTABLE FOR THE SCOPE OF THIS STUDY

C. METHODOLOGY & ORGANIZATION

This report is a compilation of two previous Working Papers which were submitted for review to the County of San Luis Obispo Engineering Department on December 2, 1996, and February 27, 1997, respectively. The first Working Paper included: Identification of existing drainage and flooding problems based on historic information, Community and County input together with site observations; Identification of existing drainage infrastructure based on County input and site investigations; Historic well information from the Spring of 1995 was used to establish groundwater elevations, and depth of groundwater from surface elevations; and, Categorization of alternative improvements for specific drainage problem areas based on defined screening criteria. This information is presented in greater detail in Sections II and III (Preliminary Evaluation & Screening) of this paper.

The second Working Paper expanded on the first Paper by including: Refinement of project alternative improvements for each identified community problem area based on the same screening criteria; Review of potential environmental and water quality impacts associated with each project alternative; Review of potential regulatory impacts associated with each project alternative; and, Preparation of cost estimates for each project alternative. This information is presented in this paper as Section III (Secondary Evaluation and Screening).

The drainage evaluation of Section III includes a discussion of each problem area and a summary of possible solutions which passed the screening criteria presented in Appendix E. The screening criteria consisted of a consideration of the following categories: Aesthetics, Cost, Disruption, Environmental & Regulatory processing, Flexibility, Land Area, and Technical Aspects. Each of the alternatives were subjectively screened based on these categories. Those drainage solutions achieving a positive score on the screening process continued for consideration in subsequent sections of the report (Section IV). This screening process was continued until the Recommended Alternative drainage project was determined in Section IV.

CSA-9J was divided into 27 separate drainage areas which were defined based on the existing topographic features. These drainage areas relate only to surface conditions (the path a water droplet will follow along the surface within an area, and to a common point) and are irrespective to groundwater (subsurface) conditions. Within each of these 27 defined areas, existing drainage related problems have been identified. Based on the specific problem experienced, each of the 27 areas were then separated into seven categories. These categories include:

1. *Areas of Shallow to Surfacing Groundwater in the Interdunal Depressions*-Drainage problems typically include flooding due to elevated or surfacing groundwater conditions. Due to the shallow depth to groundwater, there is little storage capacity available within the soil for surface water to infiltrate. With the implementation of the proposed sewer project (estimated start of construction is December 1997), the discharge from septic tank systems may be substantially reduced between 1 to 3 years. Although a benefit would result from increase storage capacity in the aquifer for surface flow to infiltrate, there is still expected to be periods of short term flooding. Storm drain systems and future infiltration basins are recommended for areas in this category.

   The regions of the study area that experience these drainage problems include the El Moro Depression, the 16th Street Depression, and the Ramona Depression. In each of theses regions widespread residential flooding has been documented to occur on a regular basis, with the extent of damage a function of a storms severity. Typical storm related damage incurred include property flooding, structure flooding, road flooding, and long term failure of septic systems due to an elevated groundwater table.

2. *Areas of Shallow to Surfacing Groundwater at the Bay Fringe*-Drainage problems typically include flooding due to elevated or surfacing groundwater conditions primarily a result of the areas proximity to the bay. Documented drainage problems are compounded by surface flows and tidal conditions. Since elevated groundwater conditions are not expected to decrease with the introduction of the sewer system, project alternatives in these areas typically consider the surface conveyance of surface runoff utilizing curb and gutters. The study area that primarily experiences these drainage problems is Cuesta by the Sea.

3. *Areas of Excessive Concentration of Surfacing Runoff*-Drainage problems typically include flooding due to severe accumulation of surface runoff compounded with inadequate surface water removal facilities. Areas experiencing these conditions include Los Osos Valley Road in the downtown area and near Cimmeron Road, and the Broderson-Skyline residential area that receives surface flows from the same watershed as that which floods the downtown area. Proposed alternatives for these areas include storm drains systems for storm water diversion, infiltration or sediment basins, and curb & gutter for surface conveyance.

4. *Areas with Inadequate Surface Slopes*-Drainage problems typically include flooding and ponding due to minimal topographic variations. Surface water tends to collect and pond in paved roadways or on properties until sufficient volume develops to spill into adjacent areas. However, flooding of adjacent properties usually occurs prior to spill. Typical solutions for these areas include a combination of storm drains and surface drains directed to outlet to proposed infiltration basins. Areas experiencing these problems are generally found easterly of downtown Los Osos on Los Olivos and Mountain View Drive. Flooding is generally confined to the streets with the exception of localized structure flooding (businesses).

5. *Areas with Closed Depressions having Limited Surface Drainage*-Drainage problems typically include flooding and ponding due to minimal topographic variations. Surface water tends to collect and pond in paved roadways or on properties until sufficient volume develops to spill into adjacent areas. However, flooding of adjacent properties usually occurs prior to spill. Typical solutions for these areas include a combination of storm drains and surface drains directed to outlet to proposed infiltration basins.

6. *Other Nuisance Problem Areas*-Drainage problems tend to vary between sediment deposition, minor localized ponding and crosslot drainage, and lack of regular maintenance. Each proposed solution presented in this paper is specific to the individual problem.

7. *Other Areas with Negligible Problems*-There are no known drainage problems within these areas or the existing drainage problems have little affect on the community.

Each of the 27 drainage areas were subjected to a preliminary screening of 41 possible solutions based on Aesthetics, Cost, Disruption, Flexibility, Land Area, and Technical Aspects (see Appendix E1 for additional information). A numeric value between 1 and 3 which was assigned based on the ranking criteria guidelines presented in Appendix E1. Solutions having a cumulative sum of 14 or better were further analyzed in Section III, with the final passing criteria becoming the recommended alternative projects presented in Section IV.

These recommend alternative solutions were then ranked based on the severity of the drainage problem and whether the problem was community wide, or more area specific. A construction schedule was then developed for the ranked projects to provide an estimation of time required for all the projects to be completed. Finally, a method of funding has been presented, and an estimate of individual annual property costs were determined. This information is presented in more detail in Section V of this report.

This paper presents information for a drainage *retrofit* of the Los Osos and Baywood Park communities. Typical of many other regions of the County, these communities did not have the benefit of planned and engineered development in its growing stages which would have accounted for storm drainage facilities and other public infrastructure. As a result, many unforeseen problems and hidden costs can be associated with retrofitting for community-wide drainage infrastructure.

D. FOLDOUT MAPS

Included as a portion of this report are five exhibit maps, all at 500 scale. Items contained on these maps are presented in Table I-1.

TABLE I-1: FOLDOUT MAPS

MAP NO.	TITLE	DESCRIPTION OF CONTENTS
Map 1	Topographic Info.	Map 1 is provided to show the general topography of the study area. Topographic information was provided by the County of San Luis Obispo and was originally developed by *Metcalf & Eddy* for the sewer project. The large gaps in the topographic information are due to the sewer study's limited need for information outside the roadways and sewer project limits. • Tributary boundary. • 5' contour information.
Map 2	Problem Area	Map 2 provides a graphic presentation of the information provided in Appendices B1 and B2. This includes the documented community complaints, field observed flooding areas, and drainage patterns. • Tributary boundary. • Identification of existing community problem areas. • Identification of existing sump areas.
Map 3	Existing Drainage	Map 3 provides a graphic presentation of existing storm drainage facilities and pump stations as discussed in Appendices B3 and D2. The small boxed numbers, such as $\boxed{21.2}$, refer to the Drainage Area (Area 21 in this example) and the item number (2 in this example) as presented in Appendix B3. The larger boxed numbers reflect the

		drainage area and related flowrates as presented in Appendix D2. • Tributary boundary. • Estimated existing tributary flow patterns. • Estimated existing tributary flowrates. • Existing community drainage infrastructure.
Map 4	Alternatives	Map 4 provides a graphic presentation of alternative projects as discussed in Report Section IV. The boxed numbers, such as ALT 21.2, refer to the specific drainage area (Area 21 in this example) and the Alternative (2 in this example) as discussed in Section IV. • Tributary boundary. • Future roads and drainage facilities. • Los Osos Fault. • Report Section IV alternative solutions.
Map 5	Recommended Alternative Projects	Map 5 provides a graphic presentation of the recommended alternative projects, as discussed in Report Section IV. • Tributary boundary. • Report Section V preferred solutions. • Future roads and drainage facilities.

SECTION II

DRAINAGE ISSUES

A. INTRODUCTION

The project area has documented drainage problems extending back to the late 1970's. These drainage problems range from nuisance road flooding which is prevalent in most of the flat or sump areas of the project area, to more severe road, residential, and commercial flooding caused by large amounts of surface runoff or sump conditions.

A major contributor to flooding in the sump areas is the elevated groundwater table. This section addresses these groundwater issues, and the geologic reasoning for their occurrence. Also discussed in this section is a general overview of water quality, water use and conservation, County drainage policies and standards, regulatory review and permitting considerations, and analysis of the existing Drainage infrastructure. Additional project specific information on these subjects is presented in subsequent sections of this report. Exhibit II-1 depicts the 27 defined Project Tributary Areas used throughout this report.

B. GROUNDWATER

Local concentrations of surface runoff may be exacerbated by groundwater conditions in several of the problem areas. The CSA 9J shallow well at 8th and El Moro is the best example of the relationship between shallow groundwater conditions and local flooding. This well was drilled originally as a municipal water supply well. This use was terminated because of increasing nitrate concentrations, but the well has been used for observation purposes since that time.

Figure II-2 is a plot of groundwater levels and nitrate concentrations in this well beginning in late 1959. Nitrate concentrations within the groundwater have exceeded the maximum containment level (MCL) since 1979. This is an important consideration for drainage alternatives that recommend pumping from the aquifer to lower the groundwater elevations. Refer to Section III for additional information.

The lower water levels shown in Figure II-2 (below about 25 feet through 1971) probably reflect local drawdown due to pumping, and the higher levels (about 18 feet and shallower) are probably more representative of static water levels in the area generally. These levels rose slightly up through 1978 (4 feet in 18 years), more abruptly during the wet period 1978 through 1980 (9 feet in 3 years), and then more gradually through the dry period of the mid- to late-80's (2 feet in 10 years). Increased rainfall since 1991 has caused groundwater levels to rise more abruptly, reaching the surface in 1993 and 1995. This shallow to surfacing groundwater not only prevents the infiltration of surface runoff during storms, but the continuing flow of groundwater to the local topographic depressions causes "flooding conditions" to persist long after storms have ceased.

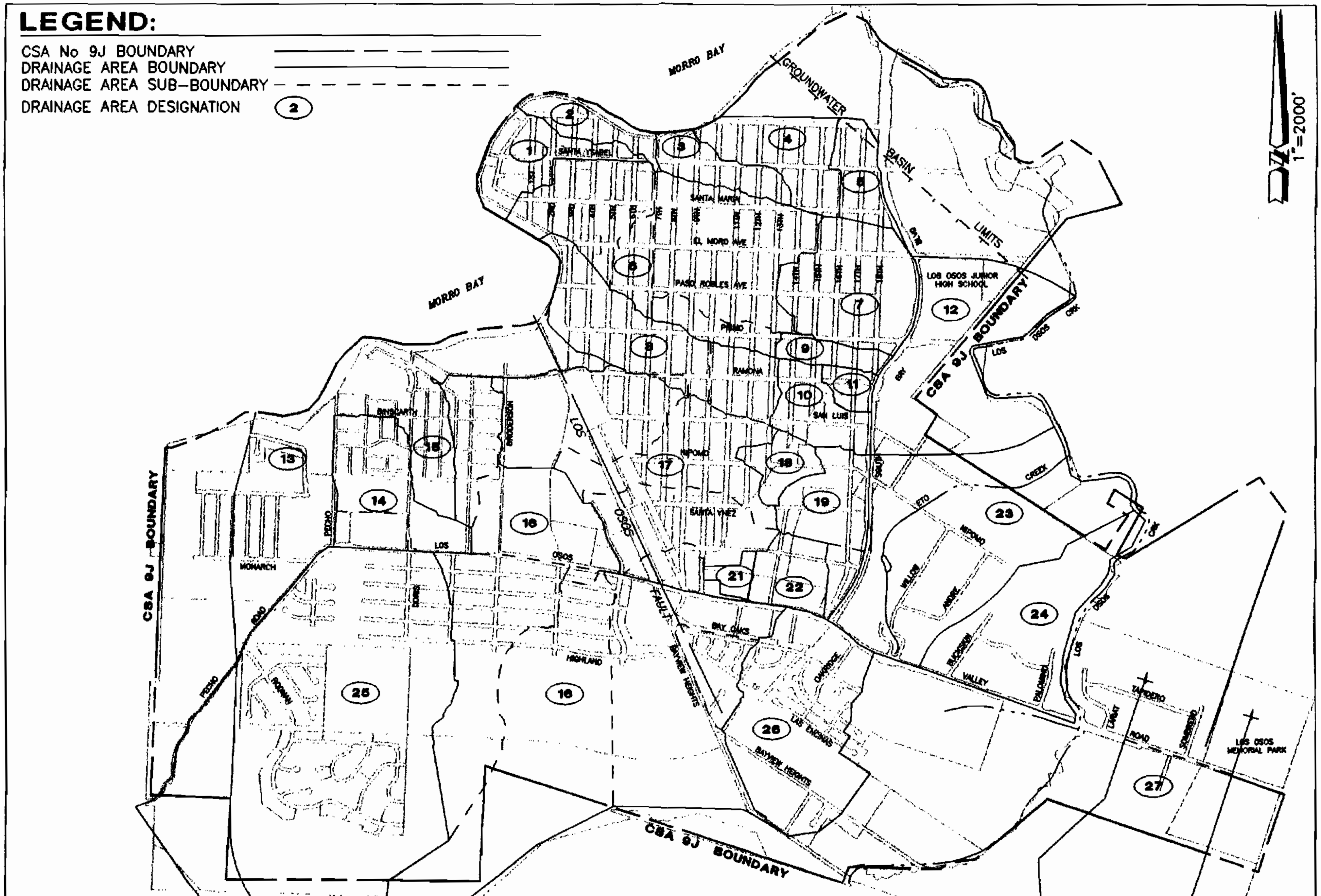

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FIGURE II-1
PROJECT TRIBUTARY AREAS

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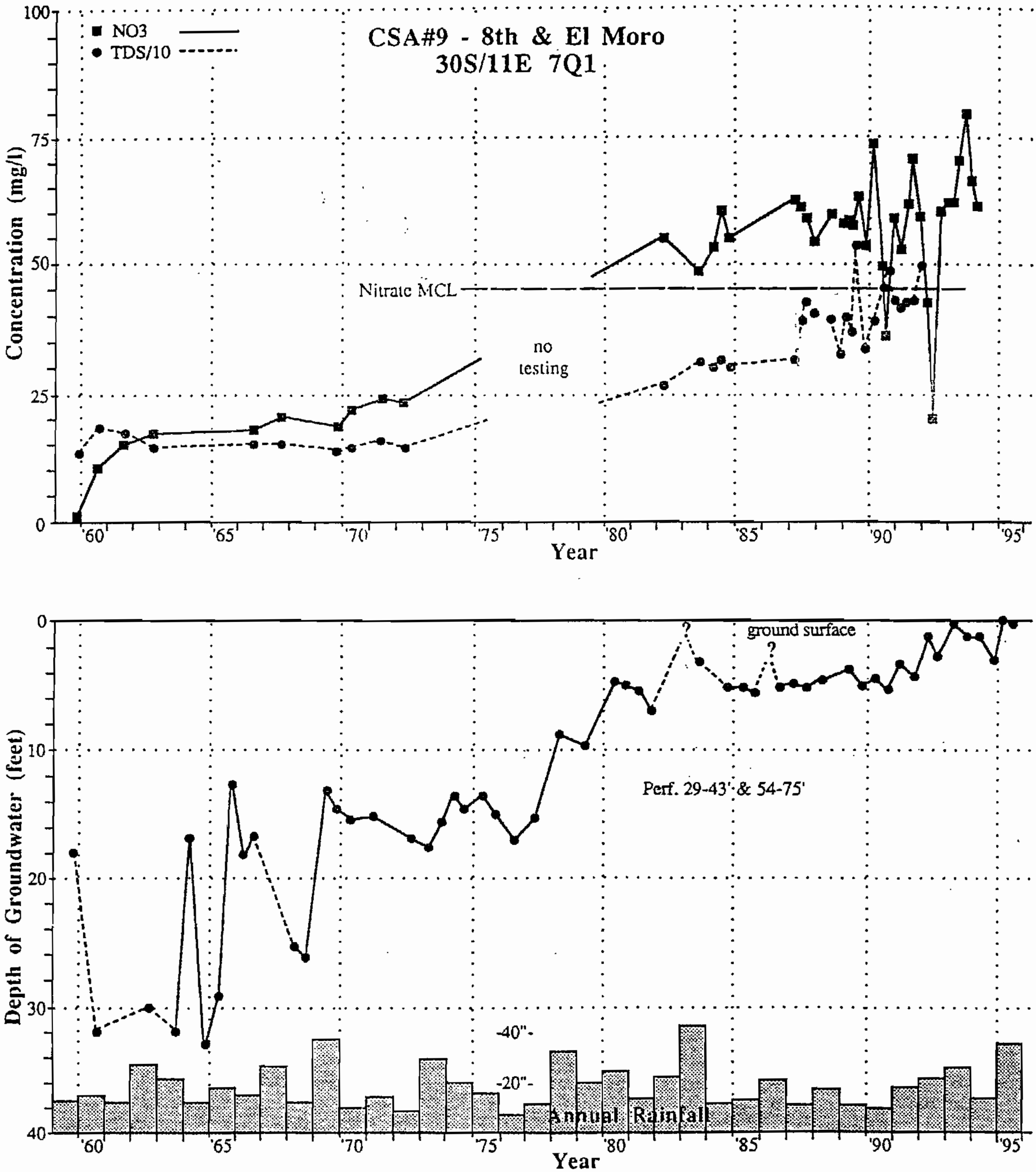

Figure II-2. Plot of depth of groundwater and annual rainfall (bottom) and concentrations of nitrate (NO3) and total dissolved solids (TDS) at well 30S/11E 7Q1 located at 8th and El Moro.

1. Geologic Units

For purposes of the analysis of drainage problems in the Los Osos/Baywood Park area, it is adequate to divide the soils/rocks into two categories: 1) the old sand dunes; and 2), the upper Paso Robles Formation (i.e., the shallow groundwater aquifer) that immediately underlies the old dune sands. The old dune sands are relatively homogeneous, and infiltrating rainfall, landscape irrigation and septic tank discharge tend to move vertically downward through the dune sands. The upper Paso Robles Formation, on the other hand, is composed of a bedded sands, silts and clays, and the downward percolation of infiltrating water is substantially impeded by the beds of silt and clay. As a result, groundwater tends to be perched above the clay zones, and/or move laterally along the tops of clayey or silty zones because the permeability (hydraulic conductivity) parallel to bedding is much higher than that across the bedding.

<u>1a. Old Dune Sands</u>

A commonly-held misconception that has developed in the community as a result of the terminology of most of the previous hydrogeologic studies is that the upper aquifer is dune sand, and that these sands extend to depths of 100 to 200 feet beneath the community. That this terminology is incorrect has been demonstrated by the logs of wells that include gravels in the upper aquifer. However, because the dune features are so obvious on the surface, and because the dune sands are difficult to distinguish from the sands of the upper Paso Robles Formation in well cuttings, this misconception has persisted.

The more logical interpretation of the shallow soil units was demonstrated by the excavations for the Monarch Grove School, particularly the deep cuts for the large leach field that underlies the playground at the west end of the site. These excavations were examined by the *Morro Group* almost daily after grading ceased in the afternoon. The cuts on the east side of the playground exposed layers of clayey silt inclined to the north approximately parallel to the natural ground surface, and the sand in the bottom of the excavation for the playground included medium to coarse grained units with gravel, including cobbles up to 4 inches in diameter. Thus, the geological unit beneath this site is not old dune sand, but rather the bedded sands and clayey silts of the upper Paso Robles Formation.

The distribution of old sand dunes in the area of the community generally north of Los Osos Valley Road is shown on Figure II-3. This figure is a portion of an aerial photograph taken by the Soil Conservation Service in June 1949 before development of the area had become significant, but with just enough of a road pattern to provide location. The lighter toned areas are old sand dunes with varying degrees of vegetative cover, while the linear areas of medium gray tone trending west-northwest are inter-dunal depressions underlain by upper Paso Robles Formation. The most obvious example is the area of medium gray tone south of the Junior High School site (i.e., beneath the track and soccer field) and extending westerly to approximately 14th Street between El Moro and Paso Robles Avenues. While these interdunal depressions are small in comparison to the areas of old sand dunes, it is these depressions that are now the locations of most of the drainage problems involving surfacing groundwater.

Figure II-3. Aerial photograph of the central and easterly parts of Los Osos/Baywood Park taken in 1949. The light areas are old sand dunes with varying degrees of vegetative cover, and the linear areas of medium grey tone are interdunal depressions underlain by Paso Robles Formation. The photograph was taken June 4, 1949 at near zero tide. Scale: 1"=1,500'.

1b. Upper Paso Robles Formation

The upper Paso Robles Formation is present beneath the old sand dunes and it is at or near the surface in the depressions between the sand dunes. This unit is composed primarily of sand, but it also includes beds of clayey silt, clayey fine sand and some clay between the beds of sand. These relationships are illustrated by the annotated electric log (E-log) of the CSA 9A deep well at 8th and El Moro shown on Figure II-4. This well was drilled in early 1986 to replace the shallow well at this location because of the increasing nitrate contamination of the shallow aquifer. The properties of the saturated soils/rocks measured by the E-log are explained at the bottom of the figure. Significant points to note include:

1. The upper 125 feet of this well penetrated the upper aquifer (upper Paso Robles Fm.). This unit is composed primarily of sands, but with one clayey zone and probably several silty zones with moderately reduced permeability. This zone is distinct in that the consistently high resistivity of the sand zones indicates consistently fresher water in these sands as compared to that of the sands below the thick clay zone (AT-2 on Figure II-4).

2. The upper aquifer is underlain by a 100-foot zone composed predominately of clay. This clay zone blocks the downward movement of infiltrating water, so that it has no place to go except move laterally in the shallow sands or rise to the surface as shown on Figure II-2.

2. Geologic Structure and Faulting

2a. Structure of the Los Osos Groundwater Basin

The Los Osos groundwater basin is shaped in the form of an asymmetric trough that is inclined toward the west (plunging syncline). Bedding on the south flank of the basin is inclined toward the north at about 10° (20%), and that on the north flank is inclined toward the southwest at about 1.5° to 2° (3-4%). The axis (i.e., bottom) of the basin is approximately parallel to and just north of Los Osos Valley Road (Figure II-5). The basin is bounded on the south by the Los Osos fault (Strand A), and on the northeast by the eroded edge of the water-bearing Paso Robles Formation.

2b. Los Osos Fault

Since completion of the studies of the groundwater basin by the USGS (Yates & Wiese, 1988) and the Department of Water Resources (DWR, 1989), evidence has mounted that the groundwater basin is cut by a strand of the Los Osos fault that extends from near the west end of Calle Cordoniz northwesterly generally along Bayview Heights Drive and Bush Street to Sweet Springs at the edge of Morro Bay. This fault is informally designated "Strand B" to distinguish it from the main strand of the Los Osos fault which trends east-west along the northerly fringe of the Irish Hills (Figure II-5). Near the library, groundwater levels are approximately 40 feet higher on the northeast side of the fault than on the southwest side (Figure II-6). To the southeast, the separation of groundwater levels across the fault appears to increase to about 100 feet.

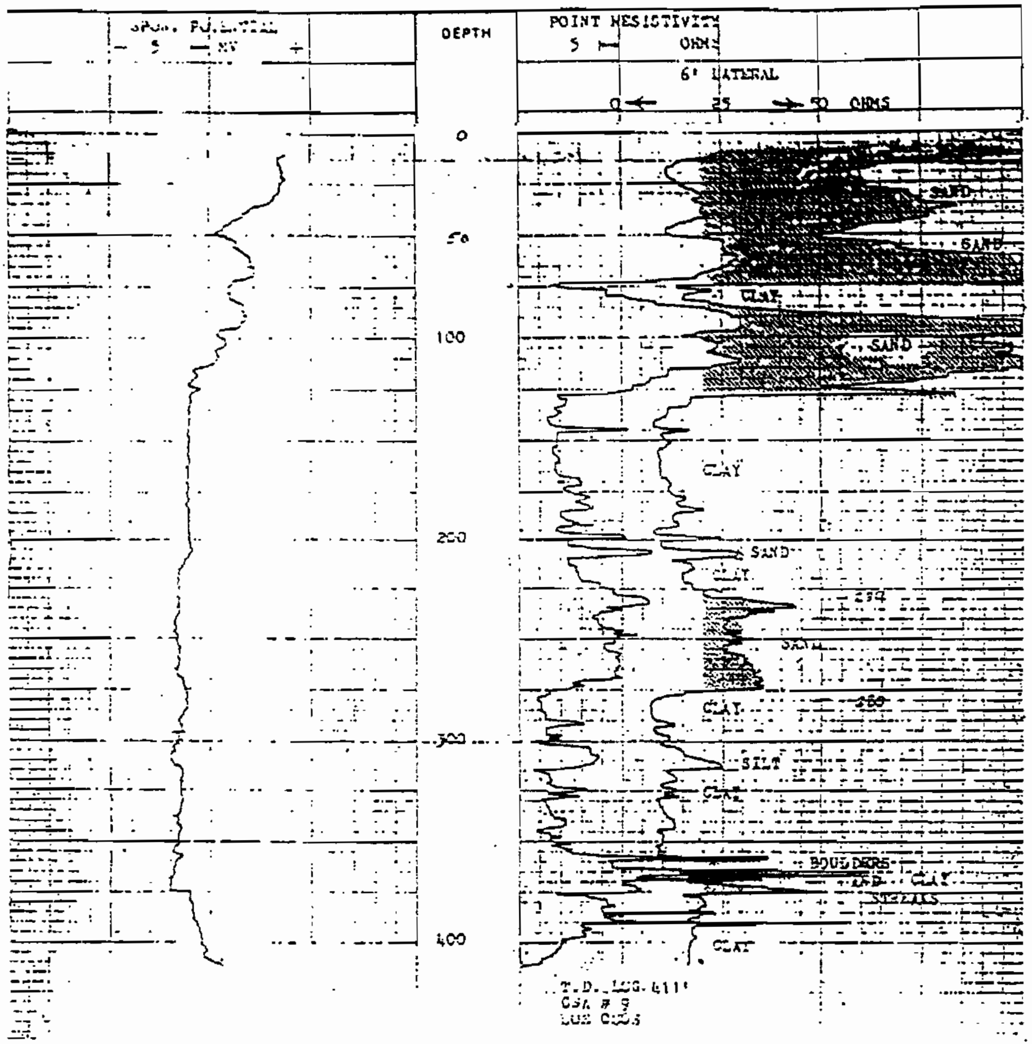

Figure II-4. Electric log (E-log) of CSA#9 deep well at 8th and El Moro (30S/11E 7Q3). The shallow sand section (upper aquifer) is shown in the interval from the surface to a depth of 125 feet. The shallow sands are separated from the deeper sand (lower aquifer) now being produced by the clay zone (aquitard AT-2) between 125 and 225 feet. The much higher resistivity of the shallow sands indicates that they contain less mineralized water. The interpretation of sand, silt and clay zones is by the logging technician.

Technical Explanation of Log

The two curves on the right are the point resistivity (shallow penetration) and 6' lateral (deeper penetration). Since the rock material is essentially non-conductive, the log measures the resistivity of the fluid in the rock and the continuity of the fluid (i.e., the degree to which the fluid is continuous and, therefore, capable of conducting an electric current).

The curve on the left is the self-potential (SP) or "battery-effect" between the drilling mud and the fluid in the rocks. Normally, a deflection to the left indicates sand. However, in this case, the fluid in the upper aquifer is fresher (less mineralized) than the drilling fluid, and the SP is "reversed" (right deflection indicates fresh-water sand).

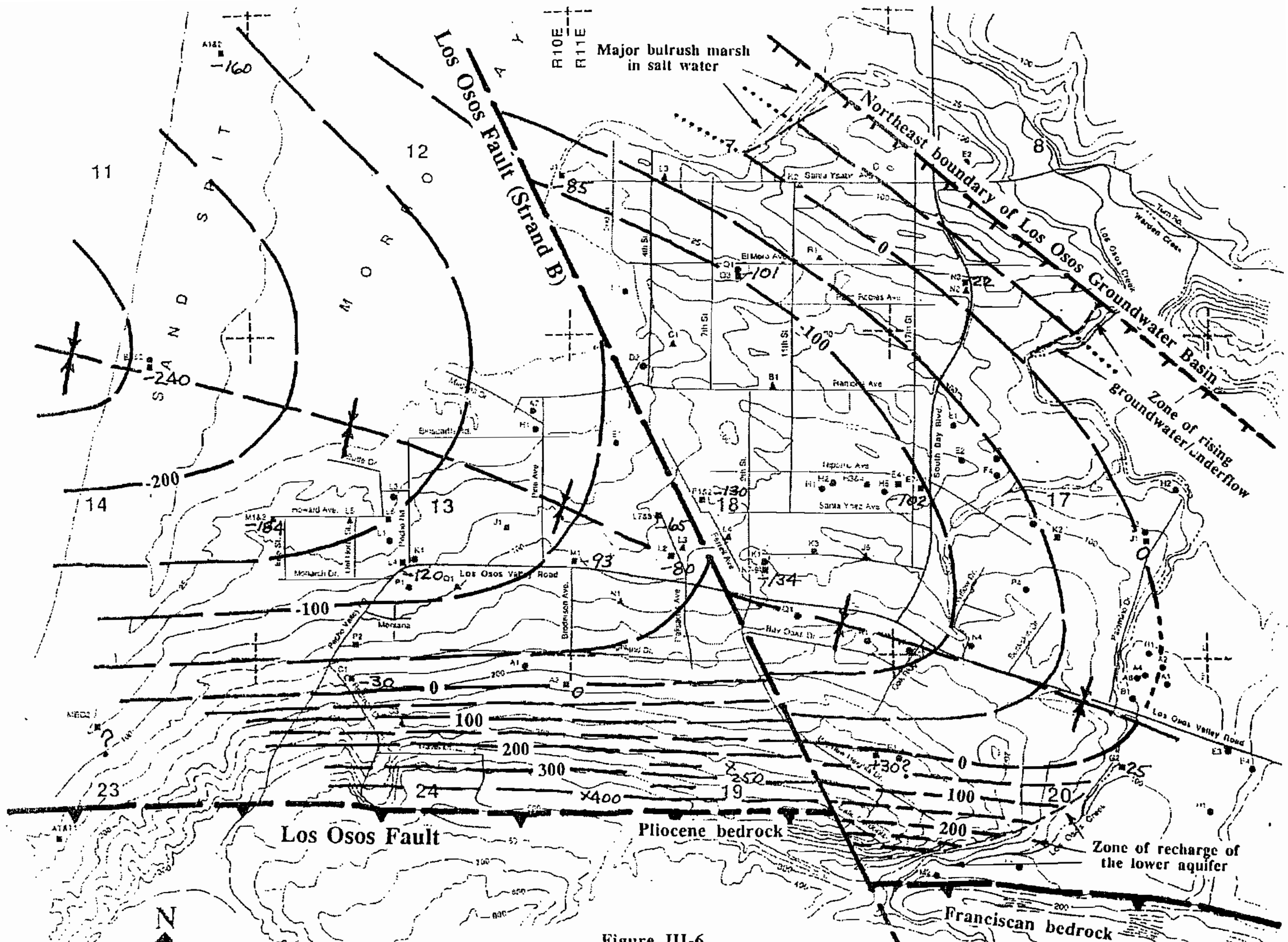

Figure III-6
STRUCTURE WITHIN THE SHALLOW AQUIFER
(Elevation top of AT-2)

WATER-LEVEL SEPARATION ACROSS THE LOS OSOS FAULT
at Monitoring Wells 30S/11E 18L3 &18L4 near Library

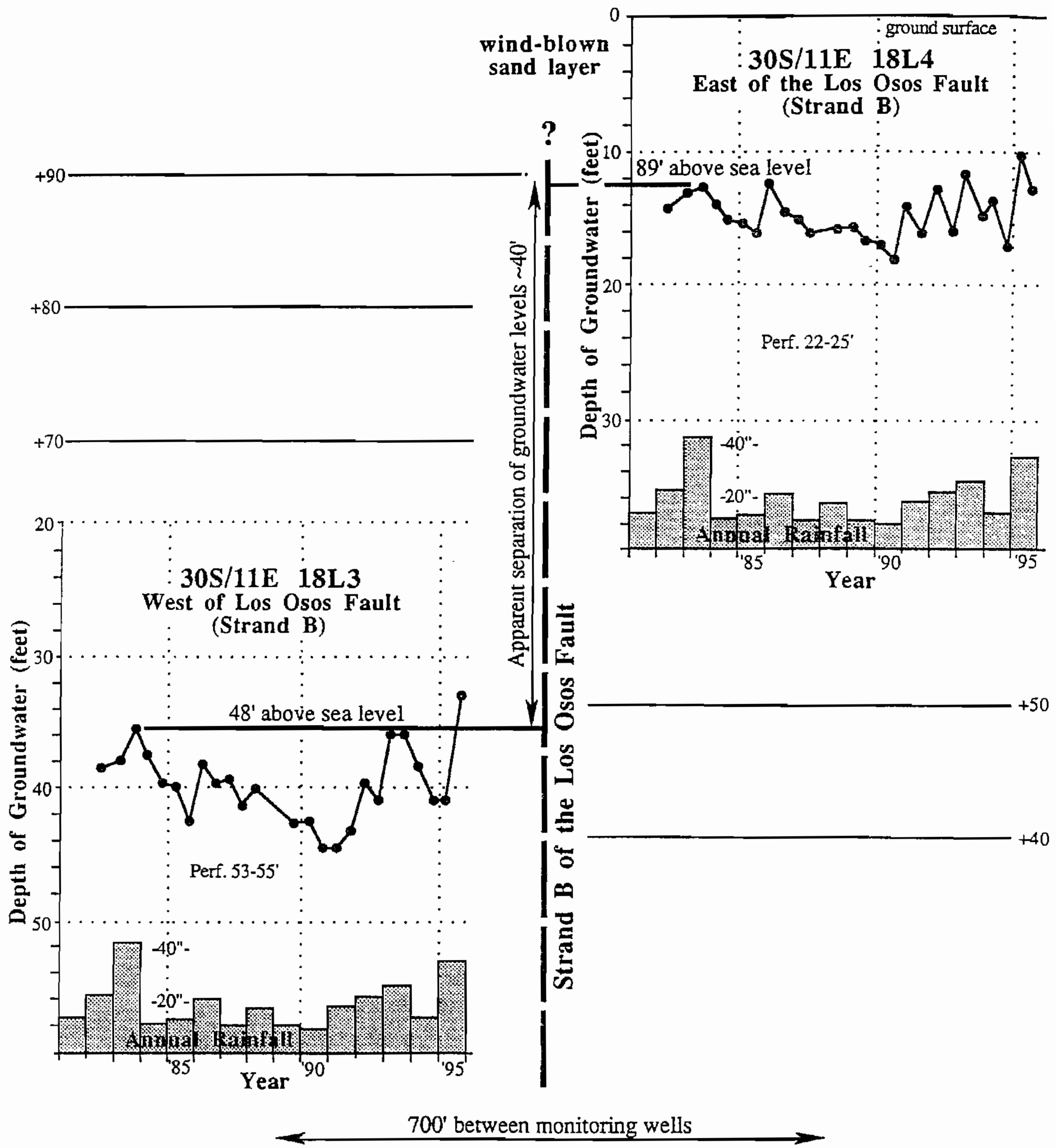

Figure II-6. Plot of water-level separation across Strand B of the Los Osos fault between monitoring well 30S/11E 18L3 on Ferrell St. and and 18L4 near the library.

The Strand B fault separates areas of very different groundwater conditions. Areas having shallow or surfacing groundwater are confined to the area northeast of Strand B. To the southwest of the fault, groundwater levels have fluctuated moderately with varying climatic conditions. However, they have not risen near-continuously as they have in some areas to the northeast of Strand B, and drainage problems to the southwest of the fault are limited to the low-lying areas near the Bay.

The potential for using ground-penetrating radar (GPR) to further define the location of the Los Osos fault has been recently investigated on an experimental basis by Gary Mann and Don Asquith. One line was run across Strand B in an open area just south of Ramona Avenue which clearly defined an anomaly at a point along the line only about 10 feet west of the location of the fault more generally located from the groundwater data. The GPR records and the geologic interpretation of these records are shown on Figure II-7. It is clear from this experimental data that there is good potential for further delineating this fault using this method. Confirming the details of the interpretation of the GPR data would require trenching to expose the fault relationships.

3. Elevation of Shallow Groundwater

3a. Data Sources

Figure II-7, Elevation of Shallow Groundwater, Spring 1995, has been constructed based on County monitored wells completed in the shallow zone, locations of surfacing groundwater, and other sources such as the test sites for the point-source nitrate study (B&V Waste Science, 1993, Table 3) and the monitoring wells drilled by Metcalf & Eddy (1996, Appendix B) for the study of the Broderson recharge site. The water-surface elevations from wells are based on Spring 1995, unless the Fall 1995 elevation was higher. Adjustments to well levels taken at other times and the reliability's of water levels in wells are summarized in Appendix C2. Areas of surfacing groundwater utilized in preparing Figure II-7 include Willow Creek (a.k.a. Eto Creek), Los Osos Creek east of the Los Osos Middle School, and the problem areas in the El Moro, Paso Robles and Ramona depressions.

3b. Areas of Differing Groundwater Conditions

The South Bay can be divided into three areas having substantially different groundwater conditions. The area west of Strand B of the Los Osos fault is characterized by relatively low groundwater elevations and groundwater gradients. The primary features in this area are a groundwater "high" in the area of concentrated surface recharge west of the library, and a modest "low" in the area of pumping of shallow groundwater west of Pecho Valley Road. Otherwise, groundwater elevations increase toward the Los Osos fault, suggesting significant flow through or over the top of the fault.

East of the Los Osos fault, groundwater elevations are generally higher and the gradients are steeper. The most prominent groundwater feature in this area is the "high" centered near the intersection of 13th Street and Ramona Avenue. The presence of this "high" is controlled in large part by the presence of surfacing groundwater in the Ramona and Paso Robles depressions.

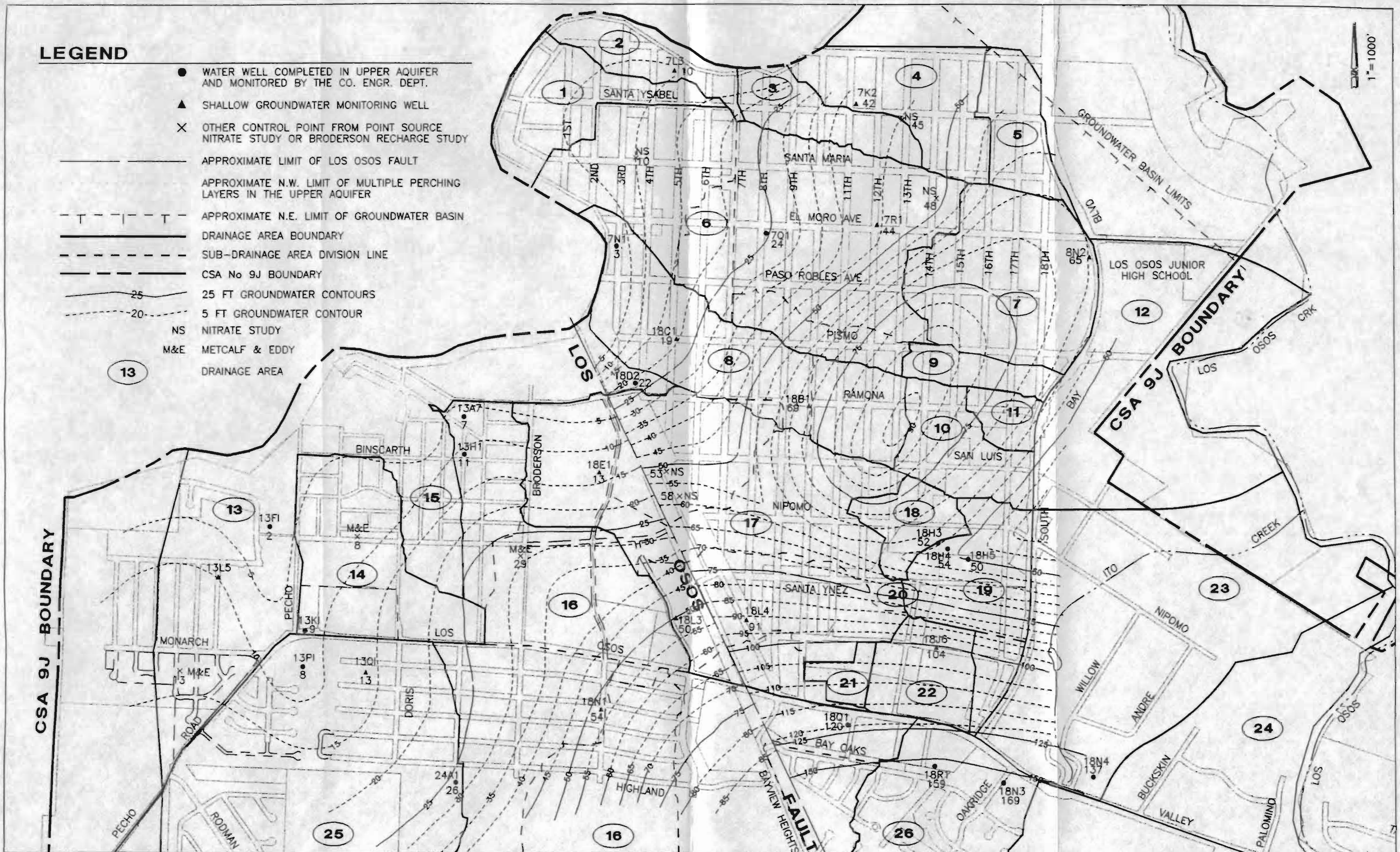

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FIGURE II-7
ELEVATION OF SHALLOW GROUNDWATER

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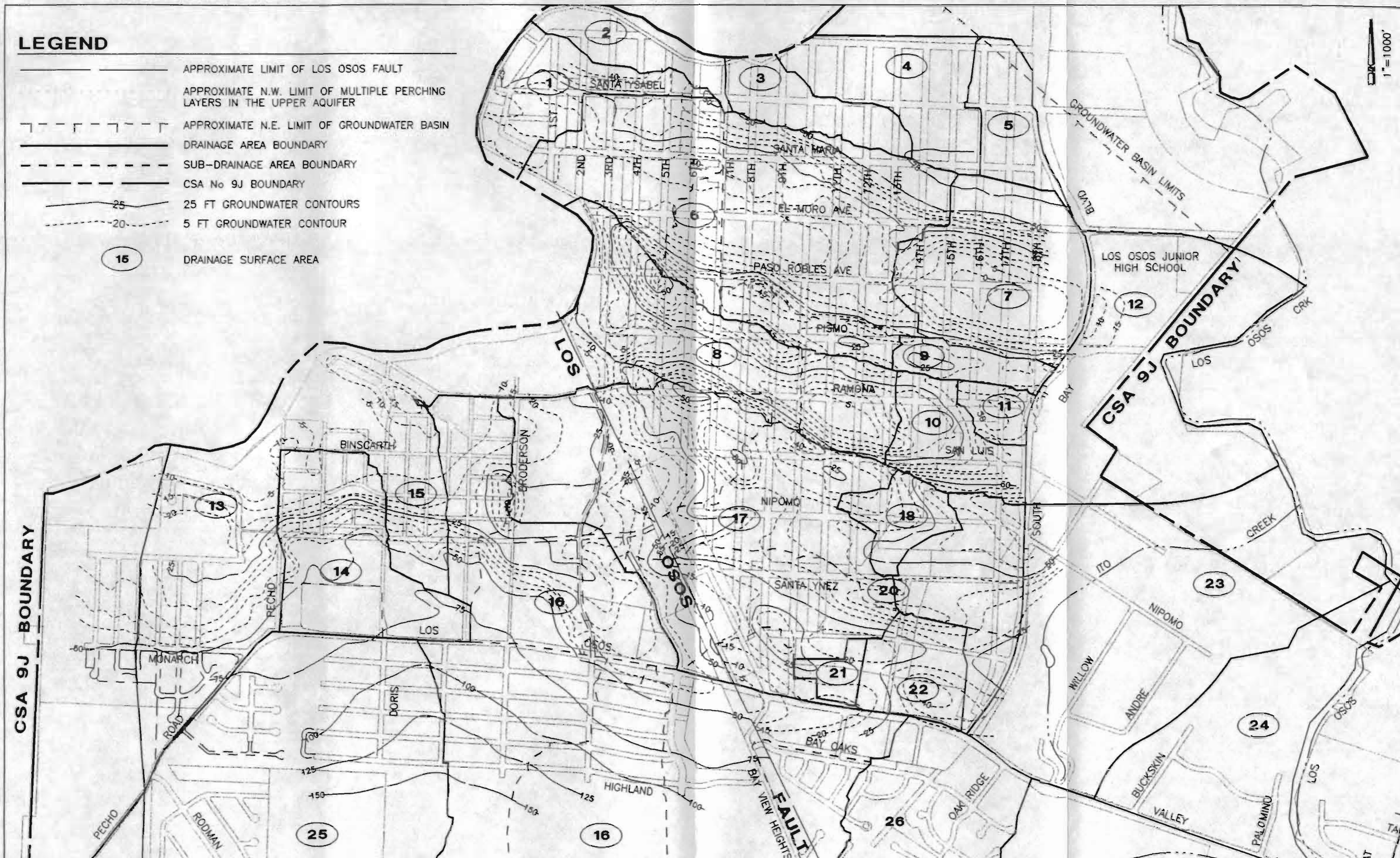

ROAD AND PROPERTY ALIGNMENT INFORMATION PROVIDED BY THE COUNTY OF SAN LUIS OBISPO. THIS INFORMATION IS THE BEST AVAILABLE AT THE TIME OF CONTRACT AND HAS BEEN DETERMINED AS ACCEPTABLE FOR THE SCOPE OF THIS STUDY

FIGURE II-8
DEPTH TO GROUNDWATER

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In the area east of the Los Osos fault and generally southeast of Los Olivos Avenue, these steeper gradients are complicated by a sequence of clayey layers in the upper aquifer that "perch" the shallowest groundwater at successively higher elevations toward the south. Groundwater conditions in this area are very complex, and well control is limited. Since no problems areas have been identified in the area south of Los Osos Valley Road, shallow groundwater contours have not been extended into the southerly part of this complex area.

4. Depth to Shallow Groundwater

4a. Map Preparation

Figure II-8 shows the Depth to Shallow Groundwater, Spring 1995, based on the difference between the elevation of shallow groundwater (Figure II-7) and surface elevations. The surface elevations are based on the most recent topography prepared for the sewer project (1-foot contour interval), supplemented by the topography (5-foot contour interval) prepared for the Phase Two - Basis of Design Report (Engineering-Science, 1997) in areas not contoured at the more detailed scale. Differences of up to 5 feet between the two sets of topographic data have been adjusted by paralleling the older topography between the presumably more accurate elevations from the more recent survey.

4b. Areas of Differing Depths to Groundwater

Areas having significantly different depths to groundwater follow generally the separation of groundwater conditions across the Los Osos fault. Except for the shallow groundwater at the fringe of the Bay, all of the areas having drainage problems controlled primarily by shallow groundwater are east of the fault, as are the areas of consistently surfacing groundwater along Willow Creek and the unnamed creek in the Los Osos Oak Preserve. In this area, depths to groundwater are primarily in the range of 5 to 40 feet with areas of deeper groundwater being limited primarily to narrow zones along the crests of the larger sand dunes.

West of the Los Osos fault, groundwater is consistently deeper over relatively large areas.

C. WATER QUALITY

A potential solution to the drainage problems in some of the areas is the pumping of accumulated runoff and surfacing groundwater to the bay. A system of this type has been in place in the El Moro depression since 1983, and a similar system was installed in the Paso Robles depression in 1995. The El Moro system pumps at 8th and El Moro and discharges from a pipe in the bay off of the west end of El Moro Avenue. The Paso Robles system pumps at 16th and Paso Robles Avenue and discharges to the surface drainage system east of 18th Street. From this point, the pumpage flows to Los Osos Creek and to the bay.

A significant environmental concern is associated in the operation of these systems is the quality of the water discharged to the bay, be it directly or via Los Osos Creek. It has been assumed that, because these waters include rising groundwater, they may include some component of septic-tank effluent. The septic tank effluent includes, at a minimum, nutrients such as nitrate, and in areas where the septic-tank leach fields have been "flooded-out", it may also contain pathogens.

A major concern of the community is that runoff be recharged to the shallow groundwater aquifer to the maximum extent feasible to minimize the need for imported water. The feasibility of increasing recharge of runoff as a part of any flooding solution will depend on location and climatic condition. That is, it is obvious from the existing distribution of shallow groundwater conditions (Figure II-8) that increasing recharge in the area northeast of the Los Osos fault would be highly problematic unless removing septic-tank discharge results in a very substantial lowering of the groundwater "high" in this area. And, even if significant lowering does occur in this area under normal conditions of rainfall, it may be necessary to have facilities in place to dispose of excess runoff during very wet years and wet climatic cycles such as occurred between 1978 and 1983.

On the other hand, most of the area southwest of the Los Osos fault has relatively deep groundwater conditions, and it should be feasible to store excess runoff in this area except perhaps in very wet years, and provided it is extracted for beneficial use before it reaches the areas of shallow groundwater at the fringe of the bay. This area is also proposed for recharge, storage and extraction of treated wastewater from all of the community because it is the only area suitable for this purpose. Therefore, any increased recharge of runoff in this area would have to be operated in close coordination with the recharge of wastewater from the Broderson site.

The State Department of Health Services (DHS) routinely monitors coliform contamination in bay waters as they may affect aquiculture in the bay. In the past, coliform concentrations have sometimes exceeded acceptable limits during periods of heavy runoff, and it has been necessary to temporarily shut down shellfish harvesting until the levels declined to below acceptable limits. However, it has been reported in recent meetings of the Urban Discharge Issue Group of the Morro Bay National Estuary Program (Mark Jeude, Preharvest Shellfish Sanitation Unit, Department of Health Services) that background levels of coliform have been increasing, and that it may soon be necessary to shut down shellfish harvesting for prolonged periods of time.

Based on data available at this time, the natural discharge of shallow groundwater at the bay fringe, and waters having significant components of groundwater that are pumped to the bay, are having an adverse effect on bay water quality, particularly as it affects aquiculture. Therefore, it is anticipated that solutions to flooding problems that involve increased discharge of surfacing groundwater directly to the bay may not be acceptable from an environmental standpoint, and alternative solutions may be required.

D. WATER USE & CONSERVATION

The rising groundwater conditions in the area of the community northeast of Strand B of the Los Osos fault is probably the result of changes in recharge and pumping as a result of urban development. The period from about 1963 through 1983, during which much of the rise occurred, was very wet in comparison to other wet and dry cycles in the 126-year rainfall history of the county. However, the reduced rainfall during the dry period from 1984 through 1990 did not result in comparable declines in water levels, and the problem must be attributed to a condition other than climate.

1. Septic Tank Discharge
At the present time, most of the water used for domestic purposes in the community is pumped from the lower aquifer. Of this pumpage, approximately 65% is used within the home, and essentially all of that is discharged to the upper aquifer from septic tanks. Based on the analysis by the USGS (Yates & Wiese, 1988), the volume of return water from this source for average conditions and 1986 development levels is 1,550 acre-feet per year. Depending on location within the basin, most of this discharge remains within the upper aquifer, and little, if any, returns to the lower aquifer from which is was pumped.

In the early stages of development of the area, most of the domestic water was pumped from the shallow aquifer. However, as nitrate concentrations in the shallow wells increased, it became necessary to drill to the deeper, uncontaminated aquifers to maintain acceptable quality. With implementation of the sewer project, it is expected that nitrate levels will decline, and the shallow groundwater can again be used for domestic purposes. This would substantially reduce or eliminate this component of the shallow groundwater problem as well as reducing the nitrate concentrations that now make widespread use of this water uneconomic.

2. Impacts of Proposed Sewer
Implementation of the sewer project is expected to result in a decline of existing groundwater levels at about 1 foot per year after cessation of septic-tank discharge (sewer hookup). Flooding problems related to surfacing groundwater should subside within 1 to 3 years after sewer implementation, depending on rainfall. As the groundwater subsides, depressed areas and cross-lot drainage would continue to experience short-term flooding during storm events due to surface water but the increased upper aquifer storage capacity should allow quicker percolation of these flows. Localized impacts of the proposed sewer on existing drainage and groundwater conditions are expanded upon for each of the 27 drainage areas in Report Sections III and IV.

3. Recharge of Urban Runoff
In most urban areas, increased runoff from the increased impervious surfaces, such as roofs, driveways and roads, is collected and disposed of by various types of flood control facilities. In the South Bay, however, flood control facilities are limited because: 1) major sections of the community were developed before such facilities were required; and 2), there was not an apparent need for such facilities in the early stages of urbanization because the high infiltration rates of the very sandy soils tended to naturally dispose of the increased runoff. However, as urbanization increased, the capabilities of the underlying soil to naturally dispose of increased urban runoff became saturated, particularly during wet years, and areas with flooding problems have progressively expanded.

4. Water Conservation Alternatives
Presently, the community uses approximately 1.2 MGD of water for domestic and irrigation purposes. With concerns about future water supply sources, many members of the present Blue Ribbon Drainage Committee and the Community have expressed a strong interest in developing a storm drainage infrastructure that incorporates water conservation and/or collection and storage facilities. Ideas have ranged from recharge of the existing groundwater aquifer to capturing storm flows and pumping to a reservoir for domestic or agricultural water use.

Many of these ideas have been considered in the first screening of alternative projects (Section III) but were not expanded upon due to excessive costs. For example, to capture storm flows from a collection system for pumping to a reservoir many of the following components would be required:

1. Collection Basin: In most cases a collection basin would be placed at the outfall of the collection system, or in the case of Los Osos/Baywood Park, at the Bay fringe where shallow depths to groundwater would require a significantly large basin surface area. This type of basin (shallow with large surface area) would require that existing land, residential, and commercial structures be purchased and demolished.

2. Storage Reservoir: A reservoir for recharge would be required resulting in an extensive geotechnical, environmental, and engineering evaluation for location and dam design.

3. Pumping Station and Infrastructure: It can be reasonably assumed that a series of staged pumping stations would be required to transmit the storm water from the Collection Basins to a Storage Reservoir. Costs would need to be considered for pumps, structures, piping and valves, and land or right-of-way easements.

A estimated cost estimate was prepared for the above example. This estimate has been included in Appendix D4 for comparative purposes.

Other conservation ideas have included using the upper aquifer as a commercial and institutional landscaping water source. There are no known environmental issues associated with this concept. However, since the community is primarily residential it is thought that this would have negligible impacts on reducing the groundwater level in those areas experiencing flooding due to an elevated groundwater table. Perhaps if residential landscaping was practical then minor benefits may be realized. However, this would require either numerous private wells or a separate landscape water distribution pipeline system. Cost may be prohibitive and the possibility of cross-connections with domestic supply sources would be a consideration.

In general, this report has recommended water conservation whenever practical by proposing the use of retention basins throughout the community.

E. COUNTY DRAINAGE POLICY AND STANDARDS

The County Standards followed for preliminary design alternatives, as presented in this report, are intended to apply to new construction. In the case of Los Osos/Baywood Park, a problem arises in that the construction has already been done and it now becomes an attempt to retrofit existing facilities to provide the level of drainage protection required for new development by County Standards. Since County Standards do not address the retrofit aspect of construction, the Community, the County, and the Design Engineer may need to work together to further define and develop design criteria that is reasonable and acceptable.

The analysis presented in this paper provides storm water conveyance alternatives which are designed for a 25-year storm event. County Standards (for new projects) requires designing for a 10-year storm event with the capacity (but no freeboard) to carry the 25-year event. The County Standards also require that building pads be one foot above the 100-year storm flood elevation. The costs of constructing storm drainage infrastructure, and the conveyance system components required to handle larger storm events (50-year, 100-year, etc.) may well be beyond the ability of the Community to afford. In addition, when designing for larger storm events the possibility of construction problems due to conflicts with existing support infrastructure, building, and/or available land may become more pronounced, especially in a retrofit condition.

Assuming a 25-year storm event retrofit design criteria for Los Osos/Baywood Park is acceptable to the Community, County, and Design Engineer, a second problem is posed. For storm events greater than the design storm event, existing properties that now experience flood related damage may continue to do so even after the infrastructure is designed and constructed, albeit less severe than existing because the 25-year event would be removed. The Community will need to work with the County to fully understand and evaluate their "comfortable level" of design criteria for drainage protection.

The "California Storm Water Best Management Practice Handbooks, Municipal", prepared for the **Stormwater Quality Task Force** by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, and Resources Planning Associates, March 1993, addresses the following issues. Sources of pollutants that may be expected from Urban Storm Runoff, development of a Storm Water Management Plan (SWMP), Best Management Selection (BMP) guidelines, Source Controls BMPs, Treatment Control BMPs, and Measuring BMP Performance.

The effects of urbanization on storm water pollutants of concern include Sediments, Nutrients, Bacteria and Viruses, Oxygen Demand Substances, Oil and Grease, Metals, Toxic Pollutants (pesticides, etc.), and Floatables. Sources of these pollutants entering a storm water system include, but are not limited to Automobiles, Landscaping, Industrial Activities, Construction Activities, Spills and Illegal Dumping, and Non-Stormwater Connections.

The State of California has enacted the Coastal Non-point Pollution Control Program, part of the Coastal Zone Act Reauthorization of 1990, which is administered by the United States Environmental Protection Agency (USEPA), State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB). Morro Bay falls under this Act and, as a result, the majority of storm drain alternatives identified in this report that discharge directly, or indirectly to Morro Bay may be subject to BMP conditions. These conditions may require that a Storm Water Management Program (SWMP) be initiated for some or all alternatives presented. An SWMP may be as simple as installing Fossil Filters® (or equivalent) at all road inlets to handle contaminants associated with the first flush, to incorporating more elaborated treatment operations. Conditions of specific project's approval may be further defined and/or determined by the regulating agencies and project designers at a more defined project submittal level. Additional environmental information is presented in Appendix C of this paper.

F. REGULATORY REVIEW AND PERMITTING

It is expected that implementation of most of the alternatives proposed in this report, except no project, would require the preparation of an EIR because: 1) most alternatives involve potentially significant impacts on federal- and/or state-listed endangered species; 2) most alternatives involve potentially significant impacts on federal and/or state water bodies, specifically direct or indirect discharge into the Morro Bay Estuary, which is listed on the National Estuary Program, and 3), these potential impacts may differ depending on the choice of the alternatives proposed herein, or other, now undefined potential alternatives, the consideration of which is required by the State and Federal Endangered Species Acts.

Responsible Agencies and Groups:

Preparation of the expected EIR, and implementation of an alternative may require input and/or permits from the following agencies and groups:

1. County of San Luis Obispo-Land Use and Grading Permits
2. Regional Water Quality Control Board-Discharge Permits
3. California Coastal Commission-Coastal Zone Permits in White Hole Areas
4. U.S. Fish and Wildlife Service-Biological Opinion
5. U.S. Corps of Engineers-Section 404 Permits

In addition to the permitting agencies, there are local groups that may wish to comment on a specific project. These include the following:

1. National Estuary Program
2. Bay Foundation of Morro Bay
3. Friends of the Estuary
4. Department of Fish and Game
5. Department of Parks and Recreation
6. Los Osos Citizen's Advisory Committee (LOCAC)
7. Los Osos/Baywood Park Chambers of Commerce
8. County Service Area 9 Advisory Committee
9. Other Special Interest Groups

G. BACKGROUND CONSIDERATIONS

Aside from the measurable, tangible considerations associated with a given alternative (traffic disruption, environmental displacement, costs, construction limitations, etc.), less measurable considerations may also be experienced. These less measurable considerations can be grouped as Social and Political Impacts. Social and political considerations may be further described as an alternative's ability to affect an existing community's character. These perceived affects include growth inducement, significant visual changes in physical layout (such as new curb and gutter), and NIMBY attitudes experienced by the community.

In general, many projects may generate a variety of social and political considerations, most of which cannot be clearly identified until such a time that comments from regulating agencies and the community are presented. The following is an attempt to address some of the considerations that may be presented:

Basins: In most cases the County will require that fences be placed around a retention or detention basin for safety. A large, fenced pit in the ground may be considered an eyesore or may have negative considerations on adjacent property values. However, if the basin can provide multiple uses, such as a play field or park during the summer months and clearly labeled as a "Groundwater Recharge" site, then positive considerations may be derived from its use. It is assumed that all basin alternatives listed in this report would be multi-use.

Berms & Trenches: Typically provide short-term scars and devegetated areas on the surrounding hillside resulting in a negative consideration (eye sore). However, if the design incorporates sensitive features, such as replanting or using natural materials as opposed to concrete or asphalt, the considerations may be minimized. Berms (mounds) may be considered less obtrusive then Trenches (channels).

Curb & Gutter: A negative consideration may be associated with the installation of curb & gutter in the community by promoting a feeling that the "rural" atmosphere would be lost. Whenever possible, an alternative roadside swale has been proposed in place of curb & gutter. Roadside swales may provide for adequate surface drainage while maintaining the "rural" feeling.

Storm Drains: In general, sub-surface storm drains should have little negative consideration on a community because the facilities would primarily be out of view (with the exception of inlets). Primary considerations would then be associated with the discharge point of the storm drain, whether it be at the bay or into another natural drainage course. Placement of the discharge point away from a land or water view corridor may alleviate some consideration. However, general knowledge of the facilities existence may always be an issue. Other considerations associated with potential illegal dumping or contaminated spills into a storm drain could provide fuel to the community for a projects denial.

H. EXISTING DRAINAGE INFRASTRUCTURE

A survey of existing drainage structures was performed to determine their respective locations and estimate their hydraulic capacities. Hydraulic capacities were estimated using the *Bureau of Public Roads (1963)* "Headwater Depths for C.M. Pipe Culverts with Inlet Control" and assuming a maximum headwater depth of 1.5 pipe diameters (HW/D). The results of this survey is presented in Appendix B3. The alternative designs proposed in this report consider the location and estimated capacities of these existing facilities.

SECTION III

AREA EVALUATION & ALTERNATIVE SCREENING AND ANALYSIS

A. INTRODUCTION

For purposes of surface drainage evaluation, the Los Osos/Baywood Park communities have been separated into 27 specific drainage areas as shown in Table III-1 (also refer to Map 1). These areas were defined based on the natural existing topographic features of the Community and analyzed for known drainage problem areas based on County and Community input, and recognized problem areas discovered during the analysis. These drainage areas do not incorporate all of Los Osos/Baywood Park because many portions of the community experience no specific drainage problems. In some cases, two or more sub-drainage areas may be contained within a single watershed.

TABLE III-1: IDENTIFIED DRAINAGE AREAS

DRAINAGE AREA No	LOCATION
1	Santa Ysabel, Pasadena to 600 Block
2	Santa Lucia
3	Santa Ysabel, 700 Block to 1200 Block
4	Santa Ysabel, 1300 Block to 1600 Block
5	Santa Ysabel, 1600 Block to South Bay Blvd.
6A to 6D	El Moro Depression, 300 Block to 1400 Block
7	Paso Robles Depression, 1400 Block and 1800 Block
8A to 8C	Ramona/Pismo Depression, 300 Block to 1300 Block
9	14th to 17th Street Depression between Pismo & Ramona
10	San Luis Avenue, 1300 Block to South Bay Blvd.
11	Ramona, 1600 Block to South Bay Blvd.
12	Los Osos Jr. High
13	Monarch & Sea Pines
14	Cuesta by the Sea, West
15	Cuesta by the Sea, East
16A to 16 F	The Broderson, Skyline & Pine Depression
17A to 17D	Los Osos Valley South
18	Nipomo, 1200 Block to Mountain View
19	Santa Ynez & Mountain View
20	Santa Ynez & Fairchild
21	Vons Basin
22	Los Olivos Depression
23	South Bay Blvd. & Los Osos Valley Rd to Los Osos Creek
24	Buckskin, Los Osos Valley Rd to Los Osos Creek
25	Cabrillo Estates & Vista de Oro
26	Bay Oaks & Oak Ridge
27	Los Osos Valley Road at Cimmeron

Within each of these 27 defined areas shown in Table III-1, existing drainage related problems were identified. Based on the specific problem determined, each of the 27 areas were further separated into seven categories. These categories include:

1. *Areas of Shallow to Surfacing Groundwater in the Interdunal Depressions*-Drainage problems typically include flooding due to elevated or surfacing groundwater conditions. Due to the limited depth to groundwater, there is little storage capacity available within the soil for surface water to infiltrate. The regions of the study area that experience these drainage problems include the El Moro Depression, the 16th Street Depression, and the Ramona Depression.

2. *Areas of Shallow to Surfacing Groundwater at the Bay Fringe*-Drainage problems typically include flooding due to elevated or surfacing groundwater conditions primarily a result of the areas proximity to the bay. Documented drainage problems are compounded by surface flows and tidal conditions.

3. *Areas of Excessive Concentration of Surfacing Runoff*-Drainage problems typically include flooding due to severe accumulation of surface runoff compounded with inadequate surface water removal facilities. Areas experiencing these conditions include Los Osos Valley Road in the downtown area and near Cimmeron Road, and the Broderson-Skyline residential area that receives surface flows from the same watershed as that which floods the downtown area.

4. *Areas with Inadequate Surface Slopes*-Drainage problems typically include flooding and ponding due to minimal topographic variations. Surface water tends to collect and pond in paved roadways or on properties until sufficient head develops to spill into adjacent areas. However, flooding of adjacent properties usually occurs prior to spill.

5. *Areas with Closed Depressions having Limited Surface Drainage*-Drainage problems typically include flooding and ponding due to minimal topographic variations. Surface water tends to collect and pond in paved roadways or on properties until sufficient head develops to spill into adjacent areas. However, flooding of adjacent properties usually occurs prior to spill.

6. *Other Nuisance Problem Areas*-Drainage problems tend to vary between sediment deposition, minor localized ponding and crossslot drainage, and lack of regular maintenance.

7. *Other Areas with Negligible Problems*-There are no known drainage problems within these areas or the existing drainage problems have little affect on the community.

<u>Preliminary Screening & Evaluation:</u>
This section provides a detailed analysis of each defined drainage area including its physical limits, groundwater considerations, existing drainage infrastructure, documented problems, and expected changes in existing drainage problems with the implementation of the proposed sewer. Table III-2 lists the location of other support documents to Section III.

Each of the 27 defined community drainage problem areas were placed in the Solution Matrix, shown in Appendix E. From this matrix each of the potential solutions were then evaluated and ranked for their particular benefits to correcting the drainage problems of the specific drainage area. The section provides a summary of results of this screening, addressing only those solutions which passed the preliminary screening criteria. These solutions have been expanded upon in the *Secondary Screening & Evaluation* sub-section to better define the alternative project scope.

Secondary Screening & Evaluation:
Section III together with Appendixes D, E, and F are intended to further analyze the alternate projects presented in the *Preliminary Screening & Evaluation* sub-section for conceptual design, constructability, cost, and environmental and other concerns. Initially, the alternative projects presented in the *Preliminary Screening & Evaluation* sub-section were derived using the screening process, as described in Appendix E2. This screening criteria, which included: *Aesthetics; Cost; Disruption; Environmental & Regulatory; Flexibility; Land Area*; and *Technical Aspects*, was again applied to each drainage area in the *Secondary Screening & Evaluation* sub-section. Projects that did not pass the secondary screening (see Appendix E3) were dropped, and only those alternative projects that passed are described in this sub-section.

In addition to a more refined alternative project description, this sub-section also provides more a more detailed analysis of each alternatives area of benefit, environmental effects, regulatory implications, and a preliminary construction cost estimate.

B. DISCUSSION

A brief discussion of other items of consideration that apply to most of the 27 drainage areas are discussed as follows:

Best Management Practices
The "California Storm Water Best Management Practice Handbooks, Municipal", prepared for the **Stormwater Quality Task Force** by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, and Resources Planning Associates, March 1993, addresses the follow sections. Sources of pollutants that may be expected from Urban Storm Runoff, development of a Storm Water Management Plan (SWMP), Best Management Selection (BMP) guidelines, Source Controls BMPs, Treatment Control BMPs, and Measuring BMP Performance.

The effects of urbanization on storm water pollutants of concern include Sediments, Nutrients, Bacteria and Viruses, Oxygen Demand Substances, Oil and Grease, Metals, Toxic Pollutants (pesticides, etc.), and Floatables. Sources of these pollutants entering a storm water system include, but are not limited to Automobiles, Landscaping, Industrial Activities, Construction Activities, Spills and Illegal Dumping, and Non-Stormwater Connections.

The State of California has enacted the Coastal Non-point Pollution Control Program, part of the Coastal Zone Act Reauthorization of 1990, which is administered by the United States Environmental Protection Agency (USEPA), State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB). Morro Bay falls under this Act and, as a result, the majority of storm drain alternatives identified in this report that discharge directly, or indirectly to Morro Bay may be subject to BMP conditions. These conditions may require that a Storm Water Management Program (SWMP) be initiated for some or all alternatives presented. An SWMP may be as simple as installing Fossil Filters® (or equivalent) at all road inlets to handle contaminants associated with the first flush, to incorporating more elaborated treatment operations. Conditions of specific project's approval may be further defined and/or determined by the regulating agencies and project designers at a more defined project submittal level. Additional environmental information is presented in Appendix C4 & C5 of this paper.

Costs Estimates

Alternative estimated project costs have been provided in this paper and are summarized in Appendix D3. These cost estimates are preliminary and subject to revision based on a more definitive project. Although material costs are current, adjustments for construction techniques and selection of project materials may vary. Contingency, Engineering, Surveying, and Permitting costs are typically estimated as a additive percentages of a the total project cost. These percentages have not been added to the alternative costs provided in Section IV so that multiple alternatives can be analyzed based on itemized costs. Instead, a simple computation as presented in Appendix D1 has been prepared so that the reader can easily apply a percentage to the itemized subtotal cost to get a Total Estimated Project Cost.

Final estimated project costs are summarized in Section IV. These estimated costs reflect changes to the Recommended Alternative Projects based on refinements.

Design Criteria

The County Standards followed for preliminary design alternatives, as presented in this report, are intended to apply to new construction. In the case of Los Osos/Baywood Park, a problem arises in that the construction has already been done and it now becomes an attempt to retrofit existing facilities to provide the level of drainage protection required for new development by County Standards. Since County Standards do not address the retrofit aspect of construction, the Community, the County, and the Design Engineer may need to work together to further define and develop design criteria that is reasonable and acceptable.

The analysis presented in this paper provides storm water conveyance alternatives which are designed for a 25-year storm event, full build-out conditions. County Standards (for new projects) requires designing for a 10-year storm event with the capacity (but no freeboard) to carry the 25-year event. The County Standards also require that building pads be one foot above the 100-year storm flood elevation. The costs of constructing storm drainage infrastructure, and the conveyance system components required to handle larger storm events (50-year, 100-year, etc.) may well be beyond the ability of the Community to afford. In addition, when designing for larger storm events the possibility of construction problems due to conflicts with existing support infrastructure, building, and/or available land may become more pronounced, especially in a retrofit condition.

Assuming a 25-year storm event retrofit design criteria for Los Osos/Baywood Park is acceptable to the Community, County, and Design Engineer, a second problem is posed. For storm events greater than the design storm event, existing properties that now experience flood related damage may continue to do so even after the infrastructure is designed and constructed, albeit less severe then existing because the 25-year event would be removed. The Community will need to work with the

County to fully understand and evaluate their "comfortable level" of design criteria for drainage protection.

Easements

Easements will be required for all storm drainage alignments running through existing lots. Easement width requirements (see County Standards, Section 11-351.1503) for these alignments may be narrower than necessary for surface access (trenching widths) to a storm drain. In such instances special construction techniques would be required for construction and maintenance. For purposes of this report it was assumed that these cross-lot easements could be obtained from individual property owners. However, some or all of these alternatives may not be viable if easements cannot be secured, and; therefore, the alternative would be dropped from the list.

Engineering

The alignments and limits of the alternative projects discussed in this paper were established on best engineering judgment and may be subject to change based on a more defined project. Pipe sizes shown were estimated using the County Engineering Standards and were conservatively estimated using a 25-year storm event per San Luis Obispo County Engineering Department Standard Improvement Specification and Drawings (County Standards). In sump areas, storm drain inlets (usually considered the most constricting and prone to failure item in a collection system) should provide for redundancy to allow for partial plugging of the inlet. Therefore it is suggested that, where feasible, inlets allow for a flowrate twice of that estimated for arrival. Retention basins were sized for 50-year storm events, also using County Standards. A more detailed discussion of the engineering assumptions and sample calculations used in this paper are presented in Appendix D1.

Potential Impacts Associated With Problem Solutions

The following is a very general breakdown and description of the potential impacts associated with several solutions in the individual problem areas, as presented below. For additional information, refer to the matrix sheets in Appendix E.

Pumping to bay, creek, or agriculture: Due to the unknown levels of contaminants in the discharge, this solution has potential to significantly impact water quality, riparian/wetland habitat, and rare, threatened, and/or endangered species. In most cases during the evaluation, this solution was considered a (class 2), significant but mitigable impact receiving a (2) on the matrix.

Storm Drain, French Drain, Channel, Curb & Gutter: In all areas where runoff discharges into creek or bay, this solution has potential to significantly impact water quality, riparian/wetland habitat, and endangered species due to the unknown levels of contaminants in the discharge. In most cases during the evaluation, this solution was considered a (class 2), significant but mitigable impact receiving a (2) on the matrix.

Swale, Channel: This solution has potential to significantly impact coastal scrub, oak woodland, and riparian habitat dependent on the exact location of each solution in the individual problem areas. In addition, removal or disturbance of such habitat can also have an adverse impact on endangered species in that area. In most cases during the evaluation, this solution was considered a (class 2), significant but mitigable impact receiving a (2) on the matrix.

Terminal/Recharge Basin, or Enlargement of Existing Basin: This solution has potential to significantly impact coastal scrub, oak woodland, and riparian habitat dependent on the exact location of each solution in the individual problem areas. In addition, removal or disturbance of such habitat can also have an adverse, unavoidable impact on rare, threatened, and/or endangered species in that area. In areas where there was known habitat or documentation of "species of special concern" previously found on site, the solution was considered a (class 1), unavoidable adverse impact receiving a (1) on the matrix. This occurred several times in area 16. However, in most cases during the evaluation this solution was considered a (class 2), significant but mitigable impact receiving a (2) on the matrix.

Other Considerations

Aside from the measurable tangible consideration associated with a given alternative (traffic disruption, environmental displacement, costs, construction limitations, etc.), less measurable considerations may also be experienced. These less measurable considerations can be grouped as Social and Political Impacts. Social and political considerations may be further described as an alternative's ability to affect an existing community's character. These perceived affects include growth inducement, significant visual changes in physical layout (such as new curb and gutter), and NIMBY attitudes experienced by the community.

In general, many projects may generate a variety of social and political considerations, most of which cannot be clearly identified until such a time that comments from regulating agencies and the community are presented. The following is an attempt to address some of the considerations that may be presented:

Basins: In most cases the County will require that fences be placed around a retention or detention basin for safety. A large, fenced pit in the ground may be considered an eyesore or may have negative considerations on adjacent property values. However, if the basin can provide multiple uses, such as a play field or park during the summer months and clearly labeled as a "Groundwater Recharge" site, then positive considerations may be derived from its use. It is assumed that all basin alternatives listed in this report would be multi-use.

Berms & Trenches: Typically provide short-term scars and devegetated areas on the surrounding hillside resulting in a negative consideration (eye sore). However, if the design incorporates sensitive features, such as replanting or using natural materials as opposed to concrete or asphalt, the considerations may be minimized. Berms (mounds) may be considered less obtrusive then Trenches (channels).

Curb & Gutter: A negative consideration may be associated with the installation of curb & gutter in the community by promoting a feeling that the "rural" atmosphere would be lost. Whenever possible, an alternative roadside swale has been proposed in place of curb & gutter. Roadside swales may provide for adequate surface drainage while maintaining the "rural" feeling.

Storm Drains: In general, sub-surface storm drains should have little negative consideration on a community because the facilities would primarily be out of view (with the exception of inlets). Primary considerations would then be associated with the discharge point of the storm drain, whether it be at the bay or into another natural drainage course. Placement of the discharge point away from a land or water view corridor may alleviate some consideration. However, general knowledge of the facilities existence may always be an issue. Other considerations associated with potential illegal dumping or contaminated spills into a storm drain could provide fuel to the community for a projects denial.

C. ALTERNATIVE PROJECTS

Refer to Map 4 for locations and graphical alignments of the following project alternatives. Additional reference material which applies to Section III is referenced in Table III-2.

TABLE III-2: SECTION III REFERENCED ITEMS

DESCRIPTION	REFERENCE
Alternative Solutions	Map 4
Existing Drainage Facilities	Map 3 and Appendix B3
Existing Problem areas	Map 2 and Appendix B1 & B2
Preliminary Engineering Cost Estimations and Assumptions	Appendices D1 & D3
Primary and Secondary Ranking Criteria	Appendices E1, E2, & E3
Supplementary Environmental Information	Appendix C
Topographic information and limits of drainage areas	Map 1
Tributary Flowrate Calculations and Assumptions	Appendices D1 & D2

CATEGORY 1: AREAS OF SHALLOW TO SURFACING GROUNDWATER IN THE INTERDUNAL DEPRESSIONS

Drainage Areas Included in Category 1:
- Area 6: The El Moro Depression, 300 Block to 1400 Block
- Area 7: Paso Robles Depression, 1400 Block to 1800 Block
- Area 8: Ramona/Pismo Depression, 300 Block to 1300 Block

C1A6: DRAINAGE AREA 6, EL MORO DEPRESSION, 300 BLOCK TO 1400 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C1A6.1f.

a. Drainage Area Considerations

The surface drainage region of Area 6 is approximately 207 acres. Contained within this drainage area are two natural topographic depressions and two cross lot depressions which result in the collection, concentration, and overland escape of all Area 6 surface flows. The two natural depressions are identified on Map 2 and 3 as sub-areas 6B and 6D. The subdivision of Los Osos was laid out on a grid with no attention paid to the natural drainage and, as a direct result, the two natural depressions (sub-areas 6A and 6C) extend somewhat diagonally through residential properties. Low areas such as this result in a high incidence of cross lot drainage. The majority of the drainage area either surface discharges to the bay, or is pumped to the bay, in either case the final outlet of Area 6 is southwest of the intersection of El Moro Avenue at 2nd Street. There are four distinct sub-areas within Area 6. The drainage pattern of these sub-areas is as follows:

Sub-Area 6A is a depression having a natural drainage course which extends midblock between El Moro and Santa Maria Avenues from 2nd to 6th Streets. Surface flows primarily move westerly within the sub-area from the upper northeasterly elevations of 2nd through 7th Streets. Flows from 7th Street migrate south to Santa Maria Avenue, then west on Santa Maria to 5th and 6th Streets, then south to midblock 5th and 6th Streets, then west spilling through residential lots to 4th, then through residential lots to 3rd Street, then through commercial lots to 2nd Street, then south on 2nd Street to just southerly of the intersection of 2nd at El Moro Avenue, then into inlet 6.1 which drains to the bay.

Sub-Area 6B is a natural sump providing concentration of surface water at the intersection of 8th Street at El Moro Avenue. Surface flows migrate from the upper northeasterly elevations of 7th Street through 15th Street towards El Moro Avenue, then west on El Moro Avenue to the 8th Street pump station. Cross lot drainage occurs beginning about midblock on 11th Street just south of El Moro Avenue. This surface flows migrate from 11th Street to 9th Street through residential lots, then north on 9th Street to El Moro where it ponds. The ponded water then spills west on El Moro to the 8th Street pump station. During high intensity storms or storms of long duration, the 8th

Street pump station ponds and spills over a small ridge on 7th Street to the 6th Street pump station causing additional flooding of the 6th Street at El Moro intersection and surrounding properties.

Sub-Area 6C is a depression having a natural drainage course which extends midblock between Paso Robles and Pismo Avenues from 7th to 10th Streets. Surface flows migrate from the upper southeasterly elevations of 7th Street through 13th Street. Surface flows tend to migrate west on Pismo Avenue to 10th Street, then north on 10th Street to about midblock, then west to 7th Street crossing through residential lots, then north on 7th Street to El Moro Avenue, then east on El Moro Avenue to the 8th Street pump station.

Sub-Area 6D is a natural sump providing concentration of surface water at the intersection of 6th Street at El Moro Avenue. Surface flows migrate from the upper southwesterly elevations of 5th Street through 7th Street. Surface flows tend to migrate northerly on 5th, 6th and 7th Streets to El Moro Avenue, then east (or west) on El Moro Avenue to the 6th Street pump station. A natural ridge (high point) on 7th Street separates sub-area 6D from sub-areas 6B and 6C.

In summary, surface flows from sub-areas 6B and 6C migrate to the natural sump near the intersection of 8th Street at El Moro Avenue. Surface flows from sub-area 6D migrate towards the natural sump at the intersection of 6th Street at El Moro Avenue. During rainfall events which cause flooding at the 8th Street pump station (sub-area 6B), spill from the intersection of 8th Street at El Moro Avenue collect at the 6th Street temporary pump station (sub-area 6D) causing flooding of this intersection. Spill from the 6th Street temporary pump station migrates northwesterly through residential lots to 5th Street, midblock between Santa Maria and El Moro Avenues, where it enters the existing depression and flows westerly to the bay through residential lots. This concentration of flow in the depression results in failed septic systems and flooding of lots, homes, garages and streets from 5th Street west to 2nd Street. In addition, when the pump stations backup, flooding occurs to properties adjacent to the pump station.

Flooding problems at the intersections of 6th Street and El Moro Avenue and 8th Street and El Moro Avenue are not due solely to surface runoff. Flooding is exacerbated by the shallow depth to groundwater. These sump areas can be visualized as a sand filled bowl. During the dry season the groundwater is just below the surface and continually being recharged by septic tanks and landscape watering. During a storm event the ground has a limited amount of storage available to percolate additional water, thus the bowl begins to fill above the surface of the sand, creating a lake. These conditions result in ponded water remaining for weeks until the water either evaporates or is pumped from the "bowl". The groundwater impacts in this basin are discussed further in the following paragraph.

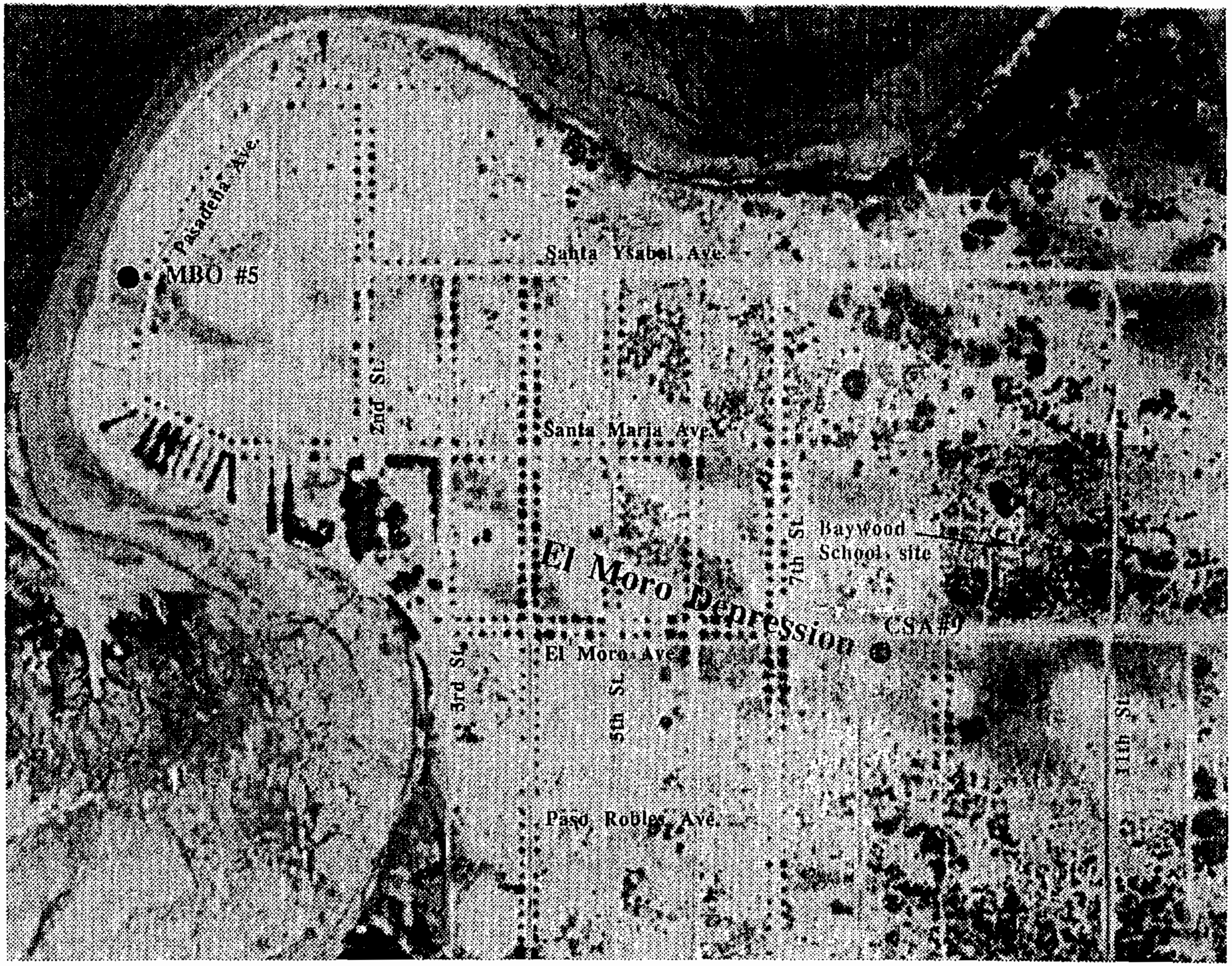


Figure III-1. Vertical aerial photograph of the El Moro depression and vicinity in 1949. The light areas are old dune sand generally devoid of vegetation. The grey tones in the depression are soils developed on the Paso Robles Formation. The photograph was taken June 4, 1949 at near zero tide. Scale: 1"=600'.

b. Groundwater Considerations
Figure II-8 depicts depth to groundwater near the intersections of 6th Street at El Moro Avenue and 8th Street at El Moro Avenue to be less than 5 feet (study based on 5 foot contour intervals). However, residents near these intersections state that the depth to groundwater is about 18 inches in the dry months (residents of this area have also stated that 20 years ago groundwater elevations were at 26'). In a letter from Louis G. Gibson of the County to Sorrel Marks at the Regional Water Quality Control Board, dated July 22, 1996, groundwater levels have risen 20 feet in the past 20 years. The depth to groundwater peaks at about 50 feet in the upland areas north and south of the El Moro sumps.

The rising groundwater condition in the El Moro depression is well documented by the record of well 7Q1 near the corner of 8th Street and El Moro Avenue (Figure II-2). The shallow groundwater condition has not only prevented infiltration of normal runoff in the depression, but it has also increased subsurface flow to the depression from the groundwater *high* to the east. These conditions are further exacerbated by the depression being underlain just below the surface by bedded Paso Robles Formation which has a lower vertical permeability than the wind-blown sand present on the nearby dunes. The interbedded sands, silts, and clays are shown by the darker tones on the aerial photograph on Figure III-1. The lighter toned areas within the depression are thin deposits of wind-blown sand. These conditions result in drainage problems being attributed to both surface runoff and the elevated groundwater conditions, with surface water not only being contaminated by septic tank discharge, but remaining ponded for several weeks after flooding occurred.

c. Existing Drainage Improvements
In 1984, a permanent pump station was installed at the southwest intersection of El Moro Avenue at 8th Street sub-area 6B) and two temporary pump stations were installed either side of El Moro Avenue on 6th Street (sub-area 6D) in 1995. These pumps collect ponded water from the existing depressions of the sub-areas with discharge westerly to the Bay. A 8 inch and a 12 inch force main extend west along El Moro from the pump station at 8th and El Moro to the bay, discharging southwesterly of the intersection of El Moro Avenue at 2nd Street. Two sumps, one north of El Moro Avenue and one south, are connected to this force main and have hookups for temporary pumps. Table III-3 provides an analysis of the existing pump station capacities for twelve possible pumping cases.

A French drain is located on the east side of 8th Street directly across from the 8th Street pump station and extends approximately 80 feet south. This French drain outlets to the 8th Street pump station. In the dry months, flow from the French drain register at approximate 8 gallons per minute. In addition to the pump stations, an inlet (6.1) located at the intersection of 2nd Street at El Moro Avenue collects drainage sub-area 6A.

TABLE III-3: 8TH AT EL MORO PUMP STATION DATA

Various Combinations of Pumps feeding 8th & El Morro Force Main System
6th Lead is submersible pump
6th Port #1 is portable pump attached to north side of 6th & El Morro
6th Port #2 is portable pump attached to south side of 6th & El Morro

Values are pump flow rate in gallons per minute

CASE	8th Lead	8th Lag	8th port	6th Lead	6th port 1	6th port 2	Total Flow
0	1048	1048	2048	111	1144	1047	6446
1	**2444**	0	0	0	0	0	2444
2	**2411**	0	0	**232**	0	0	2643
3	0	0	0	**248**	0	0	248
4	**1895**	**1895**	0	0	0	0	3790
5	**1864**	**1864**	0	213	0	0	3941
6	1373	1373	2291	0	0	0	5037
7	1207	1207	2172	0	1069	0	5655
8	1674	1674	0	205	1126	0	4679
9	1183	1183	2154	181	1065	0	5766
10	1222	1222	2179	0	0	1067	5690
11	1706	1706	0	154	0	1098	4664
12	1206	1206	2167	122	0	1049	5750

Boldface type Indicates pump exceeding capacity defined by pump curve this could indicate a potential for problems with motor horsepower being exceeded

Cases 9 and 12 are the most likely combinations during a severe flood

An evaluation of the existing pump stations (both 6th Street at El Moro Avenue and 8th Street at El Moro Avenue) determined that the system is adequately designed for removing ponded water at the intersection if given an extended period of time (refer to Table III-3). However, the pumps are insufficient to handle flow volumes associated with short duration, high intensity storms or for long duration low intensity storms. To achieve protection from these types of storm events would require:

1. Considerably larger and more expensive pumps be installed, or
2. Additional storage be provided, or
3. A combination of the above two.

The limitations associated with the above configurations are excessively high costs of equipment and land. With the installation of the sewer system, the depth to groundwater is expected to increase. This would provide additional storage capacity within the depression which may satisfy condition 2 above, thus the existing pump stations would be adequate for these types of storm events.

d. Problems within Drainage Area

Cross lot drainage through residential properties from 7th to 10th Streets in sub-area 6C, and from 2nd to 6th Streets in sub-area 6A. Cross lot drainage in sub-area 6A is exasperated during storm events which cause flooding (and spillage) of sub-areas 6B and 6D. This cross lot drainage causes failure of septic systems, flooding of residences and residential properties, road closures and health concerns due to contaminated surface water due to septic system failure.

Pump station overload and flooding in sub-areas 6A and 6B associated with high groundwater resulting from septic tank system discharge and runoff from urban development. During above normal storm events these pumps are insufficient to prevent flooding on El Moro Avenue. Ponded water in this area causes failure of septic systems, flooding of residences and residential properties, road closures and health concerns due to contaminated surface water due to septic system failure. In 1995, flooding occurred during January and March in as the pumping facilities were unable to remove surface water and the surfacing groundwater fast enough. Temporary pumps were brought in to pump water from 8th Street at El Moro Avenue to 2nd and 3rd Streets. In the summer of 1995, groundwater continued to surface at this location so a French Drain was installed. This French Drain produced flows ranging from 26 gpm in July 1995 to 12 gpm in June 1996. In November 1995, a new temporary pump station and a new 12 inch PVC discharge line were installed.

In general, when flooding occurs in Area 6 ponded water remains for extended periods of time in the depressed regions of sub-areas 6A, 6B and 6D. These ponds are contaminated by septic tank effluent which may pose a serious health concern for the community. Due to the size of the drainage area and the natural topographical features, the extent of flooding impacts numerous residences in Area 6 causing temporary relocation and/or uninhabitable homes. Over 80 complaints were documented in this report, with the majority of problems occurring in sub-areas 6A, 6B and 6D. This can be attributed to the sump conditions in sub-areas 6B and 6D, and the fact that 6A receives concentrated surface and subsurface flows from all of Area 6.

The existing French Drain at 8th Street at El Moro Avenue continues to receive flows year-round from:

1. Water from back-washing of the existing water treatment facility;
2. Irrigation runoff from Baywood Elementary School;
3. Groundwater, and;
4. Sump pumping from neighboring residences into ditch along 8th Street.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general west-northwesterly movement of the groundwater gradient under Area 6. Septic tank discharges in this area are expected to migrate in this direction towards the bay. Other drainage areas having discharges contributing to the groundwater elevations under Area 6 include portions of Areas 7, 8, 9, and 10. However, the primary contributing factor is Area 6, itself.

Implementation of the sewer project is expected to eliminate septic-tank discharge in the vicinity of the depression and also in the area of the groundwater "high" to the east (see Figure II-7) that contributes to the high groundwater in this area. Because of the relative contribution of septic tank discharge to the shallow groundwater problem as discussed in Appendix C3, it is estimated that elimination of septic tank discharge should result in a decline of about 5 feet in groundwater levels in 3 to 5 years provided rainfall is not excessive.

Further declines are probable, but the rate is somewhat conjectural because this local area is being fed by flow from the large "high" to the east. There is no long-term record of the growth of the "high" upon which to base an estimate of the rate at which it will decline with the elimination of septic tank discharge.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Flooding, 8th at El Moro & 6th at El Moro	6-1.1	Upgrade Pump Facilities	Upgrade existing pump facilities to provide maximum capacity during severe storm events.
		6-1.2	Diversion Pump	Provide continuous pumping of high ground water during the dry months to increase subsurface storage needed during the wet months. Pump to discharge in Areas 2 or 3, the bay, to Sweet Springs via 3rd Street, discharge at the fault, or find alternate use for water (agriculture)
		6-1.3	French Drain	Install French drain system to intercept surface and subsurface runoff. French drain extend from 13th Street west on El Moro to the bay
		6-1.4	Sewer	Temporary storm drain connection to the new sewer treatment plant. Phase I installation of the sewer mains should be to this area.
		6-1.5	Storm Drain	Install new storm drain system in El Moro extending from 13th Street westerly to the bay. Possibly concurrent installation with sewer project.
		6-1.6	Water Production	Change water production from lower aquifer to upper to alleviated groundwater surfacing problems.
2	Cross lot Drainage	6-2.1	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
		6-2.2	Cross lot swales	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.
		6-2.3	Water Production	Change water production from lower aquifer to upper to alleviated groundwater surfacing problems.
		6-2.4	Drain to Sewer	Temporary storm drain connection to the new sewer treatment plant for affected parcels only to drain yards.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C1A6-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
6.1	*No Project:*	
6.2	***Pump to Bay:*** Construct surface drainage facilities to improve conveyance of surface storm flows to the existing pump stations. Would include new curb, gutter, cross-gutters, with minor regrading on El Moro Avenue between 6th and 11th Street, and on 8th, 9th, and 10th Street from El Moro Avenue south to the existing low-points. As an alternative to curb & gutter, construct a roadside swale per Figure III-2 and install culverts at each intersection and driveway utilizing the alignment presented above. Maintain existing wet-weather pumping of surface water. No modifications to the existing pump stations are proposed. Present pumping facilities are considered inadequate only because of the lack of available storage (high groundwater elevations) in the basin. Over a period of time, the existing pumps are able to remove the surface water, but only after groundwater elevations have receded. Given these existing conditions, it would not be feasible to upgrade existing temporary pumps to handle even a 10-year storm event due to the pump sizes required. Surface improvements would reduce the number of "scattered" flooding problems and would allow for a single concentration and collection point. However, these same improvements may increase the time of surface flow arrival at the existing pumping facilities, thus increasing the incidence of short-term flooding. Not until long term reduction of the groundwater elevation (increased storage) due to the installation of the sewer will this alternative provide benefits.	$116

6.3	***Pump to Los Osos Creek:*** Similar surface improvements as Alternative 6.2 except that pump discharge to existing drainage facilities towards intersection of Paso Robles Avenue at 18th Street. Outlet to Los Osos Creek could be achieved by placement of a discharge main within the existing right-of-way extending from 8th Street at El Moro Avenue, east on El Moro Avenue, south on 11th Street, east on Paso Robles Avenue to 18th Street, then discharge to Walker Channel, or parallel the alignment of Walker Channel and discharge into the existing 54" culvert which extends under South Bay Boulevard and outlets to Los Osos Creek easterly of Los Osos Junior High School. With this alternative, the existing pump stations would be need to be modified or improved to increased provide the required head necessary to transfer flows to a discharge point. A more detailed analysis would be required to determine whether modifications to the existing pump (replace impellers) or new pumps would be required.	$170
6.4	***Expanded duration of pumping to Bay:*** Similar surface improvements as presented in Alternative 6.2 except that pumping would be extended into the dry season to lower groundwater levels by 5 to 8 feet so that septic tanks would function as intended and to provide an aquifer storage buffer for surface flows during storm events. Pumping should be performed from a designed well field (see below **Discussion**) that should be modeled based on further aquifer tests providing basin area, infiltration rates, average rainfall, verification of groundwater characteristics, porosity, and other relevant information. Based on the preliminary assumptions and calculations presented in Table III-4, it would be necessary to pump approximately 580 acre feet from the aquifer to lower the groundwater elevation by 5 feet. Pump sizes and time periods are presented in Table III-4 which estimate combinations required to lower the groundwater elevations. **Discussion:** *It is not correct to think of lowering the groundwater at each of the problem areas, it is more appropriate to think of lowering the ground water of the entire basin. The assumptions used to estimate the pumpage required assumes that we lower the groundwater basin all the way "upstream" (along the groundwater surface elevation maps), much the same way that you would define a watershed for runoff. Therefore, it is necessary to look at the basin as a whole.* *Placement of pumping wells could have a significant impact on the success of a pumping program. For example, if we put a well at 14th Street and Ramona Avenue, this "mound" in the groundwater surface may drop very quickly and,*	$236

	even drop more than the required 5 to 8 feet as the general groundwater falls. However, for maximum benefit it would probably be more appropriate to focus pumping lower down on the groundwater surface "slope". It is much too complex to address in this report but there are computer models available that would aid in designing a "well field". *It appears that the existing pumping plants on El Morro may be a good choice for pumping groundwater. However, this should be just one of multiple stations separated by (something like) 75% of the "radius on influence" of the wells, located low on the piezometric surface. Table III-4 provides pumping assumptions and data that can be applied to the concept of lowering the entire groundwater basin.* *It is unclear whether abandonment of the existing pumping facilities would be possible even after the groundwater elevation significantly drop. Since the existing pump facilities are located in depressed areas, surface drainage will continue to collect and the need to remove this surface water will continue. However, if the aquifer elevation is lowered, additional storage capacities are expected and, the amount of surface water heading to the depressions may be reduced due to increased infiltration.* *It is also unclear whether the groundwater will remain low after pumping <u>and</u> after the sewer is functioning. Historical data suggests that the rising of the groundwater elevations began in the 1970's, at a time of increased development within the watershed. Assuming that the rising groundwater elevations can be attributed solely to increased development, then the logical answer is that the well fields would be temporary and that flooding problems may subside. However, due to the increase in impermeable paved areas resulting from this same development, surface flooding may continue.*	
6.5	***Expanded duration of pumping to Los Osos Creek***: Similar surface improvements as presented in Alternative 6.3 except that pumping would be extended into the dry season to lower groundwater levels by 5 to 8 feet so that septic tanks would function as intended and to provide an aquifer storage buffer during severe storms. Refer to the ***Discussion*** in Alternative 6.4.	$236

6.6a	Due to the large drainage area, two storm drain systems within Area 6 may be required. The Santa Maria Avenue storm drain system would intercept flows coming from the northern reaches of the drainage area, while the El Moro Avenue storm drain system would drain the middle low-lying regions, and the southerly regions of the watershed. This combination would allow for smaller diameter pipes in the El Moro system, which would be beneficial assuming alignment between existing structures.	
	El Moro Storm Drain: Construct a 54" storm drain system extending from the Bay northerly on 2nd Street, then easterly following the existing depression between lots to 5th Street, south on 5th Street to El Moro Avenue, then east on El Moro Avenue to 11th Street. Branches off the El Moro storm drain would extend southerly on 9th and 10th Streets to drain existing low-points. Place road inlets at low-points along the storm drain alignment. Either provide swales or short sections of new curb & gutter along portions of storm drain alignment to provide positive drainage to alternative storm drain inlets and keep runoff from entering adjacent properties. The incorporation of new sewer project and Alternative 6.6a (or 6.6b) storm drain may allow for the eventual abandonment of the existing pumping facilities due to positive surface drainage from the existing depressions and additional storage capacity within the upper aquifer.	\$385.5
	Due to the shallow depths near the Bay Fringe, either multiple storm drain pipes or a box culvert may be required to convey flow under 2nd Street to the Bay. In general, the storm drain would be shallow (minimum cover) with the deepest excavation approximately 10 feet near the intersection of 5th Street at El Moro Avenue. Storm drain diameters of 54" may be required. This size storm drain would be difficult to construct between existing residential areas, and limited room for easements would be available. Construction would be expensive.	\$220.4
	Santa Maria Storm Drain: Storm drain system extending from the Bay northerly on 1st Street, then easterly under Santa Maria Avenue to Baywood Elementary School. It was estimated that a 30" storm drain would be sufficient to intercept and convey flows. Road inlets would be required at all intersections. Due to the beneficial natural topography along Santa Maria Avenue, relatively normal storm drain construction methods could be used (deep excavation not required).	

SECTION III: AREA EVALUATION & ALTERNATIVE SCREENING AND ANALYSIS

6.6b	***El Moro Storm Drain*** Similar alignment and facilities as Alternative 6.6a but keep storm drain under El Moro Avenue to the bay and not traverse low-points through residential areas from 2nd Street to 5th Street. Construct extensions from El Moro Avenue storm drain north on 3rd, 4th, and 5th Street to drain existing low-points. This alignment would require excavation in excess of 25 feet between the bay and 5th Streets, where an existing high point exists. The costs associated with deep excavation would be further compounded by the sandy soil and shallow depth to groundwater. ***Santa Maria Storm Drain:*** Similar to Alternative 6.6a with storm drain system extending from the Bay northerly on 1st Street, then easterly following under Santa Maria Avenue to its intersection with 2nd Street. Terminate storm drain at 2nd Street and continue east on Santa Maria Avenue using roadside swales per Figure III-2, and culverts under each intersection and driveway extending to Baywood Elementary School. Due to the shallow depth of the roadside swales, multiple culverts may be required at intersections and driveways having designed inlet and outlet structures.	$419.1 $281.9
6.6c	***El Moro Storm Drain*** Other combinations of 6.6a and 6.6b	

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Primary benefit of each of the Alternatives would be most realized in the depressed and flat regions of Area 6. Community benefits would be limited to reduced incidences of street flooding, especially along the 7th and 11th Street traffic corridors and on 2nd Street in Baywood Park.

Alternative 6.1: No Project

Implementation of the sewer project is expected to result in a decline of existing groundwater levels at about 1 foot per year after cessation of septic-tank discharge (sewer hookup). Flooding problems related to surfacing groundwater should subside within 1 to 3 years after sewer implementation, depending on rainfall. As the groundwater subsides, depressed areas and cross-lot drainage would continue to experience short-term flooding during storm events due to surface water but the increased upper aquifer storage capacity should allow quicker percolation of these flows.

Alternatives 6.2 & 6.3: Pump to Bay/Los Osos Creek

Reduction in localized road and certain residential lot flooding due to surface improvements. However, expect increased concentrations of surface runoff and a possible increase in flooding at the existing pump stations due to quicker times of surface flow arrival. Within 1 to 3 years after the sewer is in service, the majority of flooding should be associated only with surface runoff (see

Alternative 6.1). Existing pump stations would remain on-line during wet months to continue to pump surface flows from the existing pump sites.

TABLE III-4: LONG TERM AQUIFER PUMPING ASSUMPTIONS & RESULTS

Assume porosity = 0.25

Lower Entire NW side of groundwater basin

20250000 sq. ft — 464.9 ac — Assumes area of 4500' x 4500' (approx. scaled from map)

Total Volume of water that must be removed to lower piezometric surface by 5ft is:

25,312,500 cu ft
189,337,500 gal
581 ac-ft

Pump Q (gpm)	Time to Pump	
250	526	days
500	263	days
750	175	days
1000	131	days
1250	105	days
1500	88	days
1750	75	days
2000	66	days
2250	58	days
2500	53	days

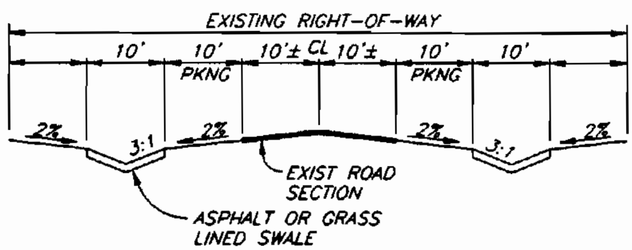
If average annual rainfall is	18	in/yr.
If the fraction that infiltrates is	90%	
Then an average of	16.2	in/yr. of surface water is added to the aquifer
This is the equivalent of	64.8	in/yr. of rise in water table due to average annual rainfall
To "maintain" water level about	27,337,500	cubic feet
	204,484,500	gallons
	627.6	ac-ft should be pumped from aquifer in average year

Pump Q (gpm)	Time to Pump	
100	1420	days
200	710	days
300	473	days
400	355	days
500	284	days
600	237	days
700	203	days
800	178	days
900	158	days
1000	142	days

Alternative 6.4 & 6.5: Expanded duration of pumping to Bay/Los Osos Creek
Community wide benefits of expanded pumping would be realized. Increased aquifer storage for stormwater runoff, ability to incorporate additional retention and detention basins in areas east of Los Osos Strand B fault line, reduced incidence of residential flooding, reduced storm related failure of existing septic systems, and reduced dewatering necessary for the sewer project.

Alternative 6.6a & 6.6b: Storm Drain
Localized benefits from a surface water drainage system. A storm drain system may allow for abandonment of the existing pump stations. Localized benefits would also be realized by placing collection facilities in the depressed and cross-lot drainage areas. From 1 to 3 years after installation of the sewer (assuming no extended pumping), the majority of flooding may be associated with surface runoff and the existing pump stations could be abandoned.

FIGURE III-2: ROADSIDE SWALE



c. Significant Environmental Effects of the Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below based on discussions in Appendix C4. Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are also summarized in Appendix C4 & C5.

Alternative 6.1, No Project:
With this alternative, the natural, subsurface flow of contaminated groundwater to the bay, and the pumpage of excess runoff and surfacing groundwater, contaminated by septic-tank discharge, would not change. Therefore, the existing levels of nitrate and bacterial contamination of the bay that may be attributed to these sources would continue until the proposed sewering of the South Bay communities is implemented.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to the bay should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

This Alternative would not alter the continuing changes in the biological communities along the Bay fringe occurring form existing levels of nitrate and bacterial contamination. The actual effects of the changes in biological communities are difficult to determine because of the many variables contributing to plant growth, but there is evidence that the nitrates are causing algae growth in the bay, refer to Appendix C4.

<u>Alternative 6.2. Pump to bay</u>:
With this alternative, the draining of accumulated runoff and surfacing groundwater to the pumping facilities would be improved, and pumping of contaminated waters to the bay would increase over that flowing to the bay in the subsurface. The total volume of contaminated groundwater reaching the bay should remain approximately the same. However, pumping an increased component of the contaminated water directly to the bay during flooding events would tend to increase the quantities of these contaminants in bay water during such events, but also reduce the subsurface flow to the bay during periods of no rainfall.

Thus, implementation of this alternative would involve trade-offs, primarily as to the distribution in time of the contaminant flow to the bay. With this alternative, contaminant flow would increase over existing conditions during periods of heavy rainfall, but decrease during dry periods. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

It is likely that this alternative would cause some potentially significant impacts to biological resources along the bay fringe and in the bay with the increase in concentrated flow to the bay, and may cause increase in algal blooms, affect sensitive plant and animal species, and alter the habitat either by increasing or decreasing native and non-native vegetative growth. Of particular concern are potential impacts to sensitive and endangered species along the bay fringe, such as the California black rail, tidewater goby, salt marsh bird's-beak, and California suaeda, and more inland species such as the Morro Bay Manzanita, Morro shoulderband snail and its coastal scrub habitat, Indian mountain balm, and lupine which supports the Morro blue butterfly. Specific impacts and degree of impact depends on location of the distribution system.

<u>Alternative 6.3. Pump to Los Osos Creek</u>:
With this alternative, potential effects would be similar to Alternative 6.2 above except that: 1) the travel distance and time would be increased by cycling the contaminated waters through the wetlands on Los Osos Creek; 2) nitrate concentrations would be reduced somewhat by cycling the waters through the wetlands; and 3), the bacterial concentrations may be reduced by cycling the waters through the wetlands. However, with the pumping period being confined largely to periods of high rainfall and streamflow in the winter months, the potentially beneficial effects of the wetlands would be minimized. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

Biological impacts would be similar to Alternative 6.2; however, the degree of impact would be different because the discharge would be to existing wetlands. The increase in nutrients may increase growth and, depending on the susceptibility of each species of concern and endangered species, it may or may not significantly affect them. Further study would be required to determine the extent of the wetlands habitat to be affected, potential for endangered species, and affects of discharge on the habitat.

In addition, the area of the wetlands is within a region of sensitive archaeological resources. It is also an area that was used as a campsite by Spanish explorers and there may be historical evidence as well. A cultural resources survey would be necessary to determine if any improvements associated with this alternative would have the potential to impact cultural resources.

Alternative 6.4. Expanded duration of pumping to bay:
With this alternative, the period of pumping would be expanded, and the depth of extraction extended, so as to draw down groundwater levels so that the septic-tank leach fields in the affected area would function as intended in removing bacterial contamination and denitrification. Drawing down groundwater levels would also provide a buffer as to the onset of flooding conditions during unusually wet periods.

Implementation of this alternative would result in a one-time initial discharge to the bay of contaminated groundwater. Maintaining the drawn-down levels until the sewer project is implemented would require annual pumping of runoff and some groundwater estimated at about the same amount, depending on rainfall. However, if the septic-tank leach fields can be maintained in a functional condition, then the contaminant levels of the annual pumping should be much lower then either the initial pumping or that of the groundwater now flowing naturally to the bay in the subsurface.

The trade-offs involved in this alternative would be to accept a one-time, major discharge to the bay of contaminated groundwater to restore the proper functioning of septic-tank systems in the areas now flooded by rising groundwater. If the proper function of the septic-tank systems can be restored, then the total volume of contaminants reaching the bay would be significantly reduced. With this alternative, it may also be possible to time the dry-season discharge to coincide with maximum tidal exchange so as to minimize the residence time of the contaminated waters. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

There is the potential for significant biological impacts associated with this alternative, the extent of which is not known at this time. Further biological evaluation would be required.

Alternative 6.5. Expanded duration of pumping to Los Osos Creek:
With this alternative, the pumping required to achieve the initial drawdown of groundwater levels and the annual pumping necessary to maintain the drawdown would be cycled through the wetlands on lower Los Osos Creek to reduce nitrate and bacterial concentrations. With this approach, the discharge through the wetlands would be largely during the growing season when nutrient uptake would be at a maximum and streamflow would be low, which would maximize residence time.

The primary drawback of this alternative is that the wetlands would smooth-out the flow, and it would probably not be feasible to time the discharges so that outflow from the wetlands to the bay could take advantage of maximum tidal exchange. However, there is the potential for significant biological impacts with this alternative which would require further study. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

d. Regulatory Implications:

Additional Environmental Review:
It is expected that implementation of any of the alternatives above, except no project, would require the preparation of an EIR because: 1) all of these alternatives involve potentially significant impacts on bay water quality and resources; and 2), these potential impacts are expected to differ depending on the choice of the alternatives to be addressed.

Responsible Agencies and Groups:
Preparation of the expected EIR, and implementation of an alternative in this problem area, would require input and/or permits (example listed) from the following agencies and groups:

1. County of San Luis Obispo-Land Use and Grading Permits
2. Regional Water Quality Control Board-Discharge Permits
3. Department of Fish and Game-Streambed Alteration Permits
4. Department of Health Services
5. Department of Parks and Recreation-Access Permits
6. California Coastal Commission-Coastal Zone Permits in White Hole Areas
7. U.S. Fish and Wildlife Service-Biological Opinion
8. U.S. Corps of Engineers-Section 404 Permits

In addition to the permitting agencies, there are local groups that may wish to comment on the project. These include the following:

1. National Estuary Program
2. Bay Foundation of Morro Bay
3. Friends of the Estuary
4. Los Osos Citizen's Advisory Committee (LOCAC)
5. Los Osos/Baywood Park Chambers of Commerce
6. County Service Area 9 Advisory Committee
7. Other Special Interest Groups

C1A7: DRAINAGE AREA 7, PASO ROBLES DEPRESSION, 1400 BLOCK TO 1800 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C1A7.1f.

a. Drainage Area Considerations

The surface drainage region of Area 7 is approximately 61 acres. A natural topographic depression exists resulting in all basin surface flows concentrating at Paso Robles Avenue between 13th and 18th Streets. Due to the relative flatness of Paso Robles Avenue, surface flows received from the upper elevations of the basin tend to pond rather than to drain. In addition, there is a high incidence of cross lot drainage of surface flows from the elevated areas migrating towards Paso Robles Avenue. Residential properties on 15th and 16th Streets, both north and south of Paso Robles Avenue are particularly susceptible due to lots being lower than the streets. Once water reaches Paso Robles Avenue, it migrates in an easterly direction towards the *Walker* channel with eventual discharge to Los Osos Creek.

In November of 1976 at least 15 homes in the Paso Robles depression were flooded. Since that time culverts, swales and a temporary pump station were installed. Background information as presented in Appendix B shows there were over 30 historic complaints of flooding, cross lot drainage, and septic tank failures identified during research for this paper.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 0 feet at the intersection of Paso Robles and 16th Street to over 75 feet in the most northerly reaches of the area. Drainage problems within this area are attributed to both surface runoff and to elevated groundwater conditions. The Paso Robles depression is characterized by old sand dunes in the upland areas of the drainage area and the less permeable Paso Robles Formation in the low lying areas. The low lying areas are subject to flooding with surface water remaining ponded for extended periods of time after a storm event due to shallow depth to groundwater and lack of positive drainage.

The Paso Robles depression is located along the southeasterly extension of the same inter-dunal depression as the El Moro depression. The shallow groundwater condition there is presumed to be somewhat analogous to that of the El Moro depression that is documented by the history of well 7Q1. However, the Paso Robles depression is a much wider feature, and it is located near the top of a groundwater *high* instead of well down the flank as in the El Moro depression.

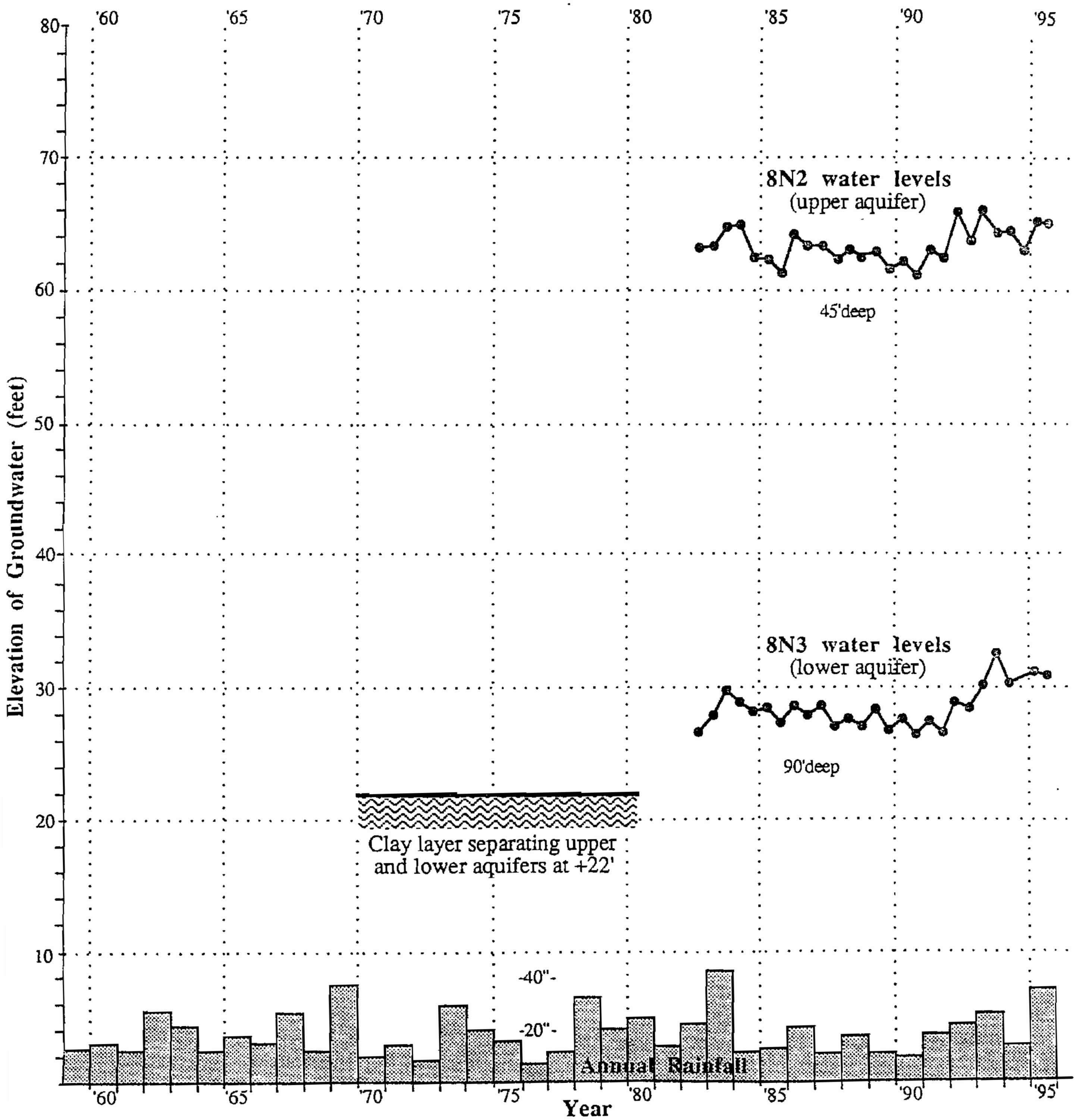


Figure III-3. Plot of groundwater elevations at wells 8N2 (upper aquifer) and 8N3 (lower aquifer) near the northerly edge of the Paso Robles depression.

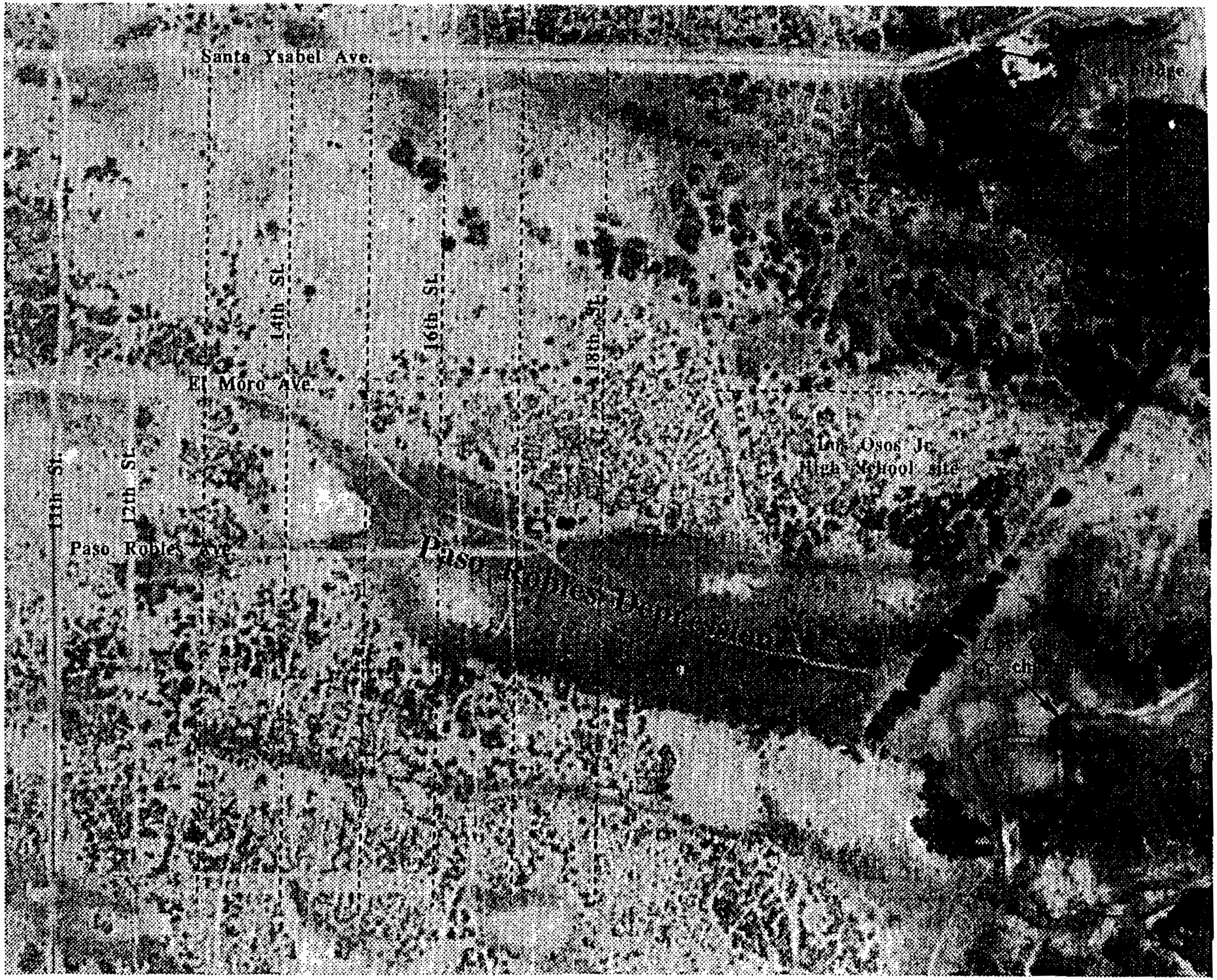


Figure III-4. Vertical aerial photograph of the Paso Robles depression and vicinity in 1949. The light areas are sparsely vegetated old dune sand. The medium grey area in the depression is underlain by Paso Robles Formation. The photograph was taken June 4, 1949. Scale: 1"=600'.

The nearest monitoring wells are 8N2 (shallow aquifer) and 8N3 (deep aquifer) located just west of South Bay Blvd. and between El Moro and Paso Robles Avenues (refer to Figure II-7). These wells were drilled in 1982 as a part of the Brown and Caldwell investigation, and groundwater levels monitored the County Engineering Department since that time are shown on Figure III-3. The variations in groundwater levels are relatively small and similar to those in well 8Q1, suggesting that the water levels on the *high* have *peaked out* (see Appendix C).

The extent of bedded Paso Robles Formation at the surface is shown as the darker tones on the 1949 aerial photograph Figure III-4. Roads in the area in 1949 were very limited, and dashed lines have been added to the photo to show the approximate locations of 13th through 18th Streets. The lighter toned areas near the westerly end of the depression are thin deposits of wind-blown sand.

c. Existing Drainage Improvements

In 1983 the *Walker* channel was constructed which is a concrete channel extending from the intersection of Paso Robles Avenue at 18th Street easterly to an existing 54" culvert which extends under South Bay Boulevard, then under Los Osos Junior High School playfield and into Los Osos Creek. At that time, swales either side of Paso Robles Avenue were constructed extending from 18th Street westerly to 17th Street with culverts placed on 18th Street to connect to the Walker channel. In 1995 a sump and temporary pump hookup was installed at the intersection of Paso Robles Avenue at 16th Street with an 8 inch force main extending easterly on Paso Robles Avenue with outlet to the Walker channel. In 1987 an inlet and pipe were constructed on the northerly side of Paso Robles Avenue to drain standing water from 16th Street to 17th Street.

Evaluation of the existing temporary pump has determined that the system is adequately sized for removing ponded water at the intersection over an extended period of time. However, the temporary pump is insufficient to handle flow volumes associated with short duration, high intensity storms or for long duration low intensity storms. To achieve protection from these types of storm events would require:

1. Considerably larger and more expensive pumps be installed, or
2. Additional storage be provided, or
3. A combination of the above two.

The limitations associated with the above configurations are excessively high costs of equipment and land. With the installation of the sewer system, the depth to groundwater is expected to increase. This would provide additional storage capacity within the depression which may satisfy condition 2 above, thus the existing pump stations would be adequate for higher intensity storms.

d. Problems within Drainage Area

Problems associated with Area 7 are similar to those experience in the sump regions of Area 6 and consist of an existing low area complicated by high groundwater resulting from septic tank system discharge and runoff from urban development. Residences in this low lying area are subject to flooding, road closure, and septic system failure. Flooding of the existing low areas is further complicated by a high ground water table. After storm events, water can be seen emerging from the upper elevations of 16th Street and flowing north to Paso Robles Avenue. In general, when flooding occurs in Area 7 ponded water remains for extended periods of time in Paso Robles Avenue. These ponds may be contaminated by septic tank effluent which could pose a serious health concern for the community.

In addition, cross lot drainage occurs due to the natural topography of the area resulting in flooding of residential properties. This cross lot drainage is aggravated by the street elevations being higher than the elevations of the adjacent lots and no road improvements (curb and gutter) to keep the flows contained in the streets.

Road closure due to ponded water occurs on Paso Robles Avenue, 16th Street both north and south of Paso Robles Avenue, and on 18th Street south of Paso Robles Avenue.

Several homes were flooded in February and March of 1995.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a groundwater gradient under Area 7 that is split diagonally across the drainage area from southwest to northeast. The westerly portion of the groundwater gradient tends to move in a northerly direction, with septic tank discharges in Area 7 migrating towards Areas 4, 5 and 6. The easterly portion of the groundwater gradient tends to move in an easterly direction towards Area 12 and Los Osos Creek. Other drainage areas having discharges contributing to the groundwater elevations under Area 7 include portions of Area 9. However, the primary contributing factor is Area 7, itself.

Implementation of the sewer project will eliminate septic-tank discharges in the vicinity of the depression and also in the area of the crest of the groundwater *high* to the south of the depression (see Figure II-7). While a decline in groundwater levels should result from the elimination of this source of recharge, that magnitude and rate of decline are conjectural because of the apparent "*peaking out*" of the groundwater rise (refer to Appendix C2).

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Paso Robles	7-1.1	Pump	Continue pumping as is.
		7-1.2	Permanent Pump	Install permanent pump station and provide continuous pumping of high ground water during the dry months to increase subsurface storage needed during the wet months. Pump to discharge in Area 4, 6,12, or find alternate use for water (agriculture)
		7-1.3	French Drain	Install French drain system to intercept surface and subsurface runoff. French drain would terminate at the *Walker* channel.
		7-1.4	Sewer	Temporary storm drain connection to the new sewer treatment plant. Phase I installation of the sewer mains should be to this area.
		7-1.5	Storm Drain	Install new storm drain system Paso Robles Street extending easterly to Los Osos Creek.
		7-1.6	Water Production	Change water production from lower aquifer to upper to alleviated groundwater surfacing problems.
2	Residential Flooding [1]	7-2.1	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
		7-2.2	Cross lot swales	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.
		7-2.3	Water Production	Change water production from lower aquifer to upper to alleviated groundwater surfacing problems.
		7-2.4	Drain to Sewer	Temporary storm drain connection to the new sewer treatment plant for affected parcels only to drain yards.

[1] The main problem is adequately draining the Paso Robles depression and lowering the groundwater table. Items 2 will only work in combination with Item 1, not alone.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C1A7-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
7.1	*No Project:*	
7.2	***Pump to Los Osos Creek:*** Construct surface drainage facilities to improve conveyance of surface storm flows to the existing pump stations. Would include new curb, gutter, cross-gutters, with minor regrading on Paso Robles Avenue between 14th and 18th Streets, and on 15th, 16th, and 17th Street from Paso Robles Avenue north to intercept hillside surface flows before entering adjacent properties. A roadside swale utilizing this same alignment may replace at certain sections in this Alternative. In either case, maintaining the existing temporary wet-weather pumping of surface water would continue. No modifications to the existing pump stations are proposed. Present pumping facilities are considered inadequate only because of the lack of available storage (high groundwater elevations) in the basin. Over a period of time, the existing pumps are able to remove the surface water, but only after groundwater elevations have receded. Given these existing conditions, it would not be feasible to upgrade existing temporary pumps to handle even a 10-year storm event due to the pump sizes required. Surface improvements would reduce the number of flooding and cross-lot drainage problems, and would allow for a single concentration and collection point. However, these same improvements may increase the time of surface flow arrival at the existing pumping facilities, thus increasing the incidence of short-term flooding of Paso Robles Avenue. Not until reduction of the groundwater elevation (increased storage) due to the installation of the sewer will this alternative provide significant benefits.	$183.4
7.3	***Expanded duration of pumping to Los Osos Creek***: Similar surface improvements as Alternative 7.2 except that pumping would be extended into the dry season to lower groundwater levels by 5 to 8 feet so that septic tanks would function as intended and to provide an aquifer storage buffer during severe storms. Pumping should be performed from a designed well field (refer to Alternative 6.3 *Discussion*) that should be modeled based on further aquifer tests providing basin area, infiltration rates, average rainfall, verification of groundwater characteristics, porosity, and other relevant information. Based on the preliminary assumptions and calculations presented in Table III-4, it would be necessary to pump approximately 580 acre feet from the aquifer to lower the groundwater elevation	$282.4

	by 5 feet. Pump sizes and time periods are presented in Table III-4 which estimate combinations required to lower the groundwater elevations.	
7.4	***Paso Robles Retention Basin:*** Considered a long term solution after sewer is implemented or at such time that groundwater elevations decline 6' or greater. Construct 16.3 acre foot retention basin on vacant property east of 18th Street and south of the existing "Walker Channel" (east end of Paso Robles Avenue). Assuming an 6' depth, the basin would require about 120,000 square feet of land. Provide positive drainage on Paso Robles Avenue and 15th and 16th Streets to the Alternative Paso Robles basin using curb, gutter, and cross-gutters, or roadside swales and 18" culverts at each intersection and driveway (modify existing drainage facilities), or 36" storm drain system in Paso Robles Avenue with road inlets.	$284.2

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 7.1. No Project:
Implementation of the sewer project is expected to result in a decline of existing groundwater levels at about 1 foot per year after cessation of septic-tank discharge (sewer hookup). Flooding problems related to surfacing groundwater should subside within 1 to 3 years after sewer implementation, depending on rainfall. As the groundwater subsides, depressed areas and cross-lot drainage would continue to experience short-term flooding during storm events due to surface water but the increased upper aquifer storage capacity should allow quicker percolation of these flows.

Alternatives 7.2: Surface Improvements
Reduction in localized road and certain residential lot flooding due to surface improvements. However, expect increased concentrations of surface runoff and a possible increase in flooding at the existing pump stations due to quicker times of surface flow arrival. Within 1 to 3 years after the sewer is in service, the majority of flooding should be associated only with surface runoff (see Alternative 7.1). The existing temporary pump station would remain on-line during wet months and continue to pump surface flows.

Alternative 7.3: Expanded duration of pumping to Los Osos Creek
Community wide benefits of expanded pumping would be realized. Increased aquifer storage for stormwater runoff, ability to incorporate additional retention and detention basins in areas east of Los Osos Strand B fault line, reduced storm related failure of existing septic systems, reduced dewatering necessary for the sewer project, and reduced incidence of residential flooding.

Alternative 7.4: Paso Robles Basin
Provides localized benefits beginning only at such a time that the groundwater elevation has dropped sufficiently to allow for basin construction and sufficient aquifer storage capacity. Community benefits include upper aquifer recharge, reduced maintenance costs.

c. Significant Environmental Effects of the Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below based on discussions in Appendix C. Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C4 and C5.

The potentially significant environmental effects of the alternative mechanisms of the disposal of runoff and surfacing groundwater in Area 7 are essentially the same as those for Area 6 in which the accumulated water would be pumped to Los Osos Creek. Based on the preliminary environmental review of alternatives for Area 6 above, pumping directly to the bay from Area 7 would appear to be more costly because of the increased transport distance and facilities required, and environmentally inferior to discharging to Los Osos Creek because of the contaminant reduction that would occur with the wetlands treatment. Therefore, these potential alternatives have been rejected for purposes of the review of Area 7.

Alternative 7.1. No Project:
With this alternative, the natural, subsurface flow of contaminated groundwater to lower Los Osos Creek, and the pumpage of excess runoff and surfacing groundwater contaminated by septic-tank discharge, would not change. Therefore, the presumed existing levels of nitrate and bacterial contamination of Los Osos Creek, and any associated affects to the biological resources, that may be attributed to these sources would continue until the proposed sewering of the South Bay communities is implemented. Very little data is available, and this condition is presumed to exist based on groundwater gradients (Figure II-7) and analogy to other, better documented areas. However, development in the areas draining to Los Osos Creek are less dense than those in areas to the west, and it is reasonable to assume that the levels of nitrate and bacterial contamination are also less.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to Los Osos Creek should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

Alternative 7.2. Pump to Los Osos Creek:
With this alternative, the rate of flow of the accumulated runoff and surfacing groundwater to Los Osos Creek would increase during periods of rainfall as a result of improving the drainage facilities. However, the total volume of runoff and contaminant to be disposed of would remain the same, and the increased flow when runoff is at its peak would be offset by decreased flow of surfacing groundwater after rainfall ceases.

The primary advantage of this alternative is that the flow of contaminants to the creek would occur when streamflow is at a maximum, and when it would be most rapidly carried through the riparian environments and through and out of the bay. On the other hand, the more rapid flow, and its occurrence during the winter months, would minimize the potentially beneficial effects of the wetlands in removing the contaminants. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

The potential for significant biological impacts would be the same as described for Alternative 6.3 and further study would be required to determine the potential impacts from increased nutrients and contaminants that would be discharged to the creek. Cultural resource impacts are potentially significant depending on the location of improvements associated with this alternative.

Alternative 7.3, Expanded duration of pumping to Los Osos Creek:
With this alternative, the period of pumping would be expanded, and the depth of extraction extended, so as to draw down groundwater levels so that the septic-tank leach fields in the affected area would function as intended in removing bacterial contamination and denitrification. Drawing down groundwater levels would also provide a buffer as to the onset of flooding conditions during unusually wet periods.

Implementation of this alternative would result in a one-time initial discharge to Los Osos Creek of contaminated groundwater estimated at about 1/3rd that of the El Moro depression or approximately 50 acre-feet. Maintaining the drawn-down levels until the sewer project is implemented would require annual pumping of runoff and some groundwater estimated at about the same amount, depending on rainfall. However, if the septic-tank leach fields can be maintained in a functional condition, then the contaminant levels of the annual pumping should be much lower then either the initial pumping or that of the groundwater now flowing naturally to Los Osos Creek in the subsurface.

The trade-offs involved in this alternative would be to accept a one-time, major discharge to Los Osos Creek of contaminated groundwater to restore the proper functioning of septic-tank systems in the areas now flooded by rising groundwater. If the proper function of the septic-tank systems can be restored, then the total volume of contaminants reaching the creek would be significantly reduced. With this alternative, it would be possible to time the dry-season discharge to coincide with the growing season of the wetland vegetation and the period when natural flow in Los Osos Creek is minimal to absent. However, there is the potential for significant biological impacts with this alternative which would require further study. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

d. Regulatory Implications:

Additional Environmental Review: It is expected that implementation of either of the alternatives above, excluding no project, would require the preparation of an EIR because: 1) both of these alternatives involve potentially significant impacts on creek and bay water quality and resources; and 2), these potential impacts are expected to differ depending on the choice of the alternatives to be addressed.

Responsible Agencies and Groups: Preparation of the expected EIR, and implementation of an alternative in this problem area, would require input and/or permits from the following agencies and groups:

1. County of San Luis Obispo-Land Use and Grading Permits
2. Regional Water Quality Control Board-Discharge Permits
3. Department of Fish and Game-Streambed Alteration Permits
4. Department of Health Services
5. Department of Parks and Recreation-Access Permits
6. California Coastal Commission-Coastal Zone Permits in White Hole Areas
7. U.S. Fish and Wildlife Service-Biological Opinion
8. U.S. Corps of Engineers-Section 404 Permits

In addition to the permitting agencies, there are local groups that may wish to comment on the project. These include the following:

1. National Estuary Program
2. Bay Foundation of Morro Bay
3. Friends of the Estuary
4. Los Osos Citizen's Advisory Committee (LOCAC)
5. Los Osos/Baywood Park Chambers of Commerce
6. County Service Area 9 Advisory Committee
7. Other Special Interest Groups

C1A8: DRAINAGE AREA 8, RAMONA/PISMO DEPRESSION, 300 BLOCK TO 1300 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C1A8.1f.

a. Drainage Area Considerations

The surface drainage region of Area 8 is approximately 96 acres. A natural topographic depression extends in an southeasterly direction from 4th Street at Pismo Avenue towards 13th Street at Ramona Avenue resulting in the collection and concentration of all Area 8 surface flows. Unfortunately, the subdivision of Los Osos was on a grid with no attention paid to the natural drainage and as a direct result, the Ramona/Pismo depression lies directly across residential properties. Area 8 can be divided into three sub-areas. The following is a description of each of these three sub-areas:

Sub-Area 8A is that area extending west of the intersection of Ramona Avenue at 10th Street (the *Ramona Lake* area) to the bay. As Ramona Lake spills, surface flows migrate westerly on Ramona Avenue to 9th Street (with some cross lot drainage occurring between 10th and 9th Streets), then north on 9th Street where it combines with flow exiting an existing culvert (8.2), then south through residential lots to 8th Street where flows again accumulate, then migrates west through residential lots to 7th Street. An existing culvert (8.4) collects a portion of this ponding water and directs it under 7th Street where it exits, migrating northerly across a driveway, then west again between residences to 6th Street. Surface flows emerging at 6th Street migrate north on 6th Street to Pismo Avenue, then west on Pismo Avenue to 4th Street. Once water reaches 4th Street at Pismo Avenue, it migrates westerly on Pismo Avenue towards the bay.

Sub-Area 8B surface flows begin to accumulate at a low point on 13th Street north of San Luis Avenue. Flows than migrate in a northeasterly direction through residential lots to 12th, then 11th Streets where they collect in a low spot on Ramona between 10th and 11th Streets (*Ramona Lake*). Sub-area 8B drains entirely to Ramona Lake.

Sub-Area 8C is that portion south of Ramona Avenue between 7th and 9th Streets. This natural depression is elevated above, and drained to the sub-area 8A depression via a culvert under Ramona at its intersection with 9th Street and into Sub-area 8A.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 0 feet at the bay to 50 feet in the upper dune areas. In the depression (sub-area 8A), depth to groundwater varies between 5 feet to about 20 feet. However, drainage problems within this area can be primarily attributed to surface runoff and not to elevated groundwater conditions. Almost directly under Ramona Avenue at 10th Street (*Ramona Lake*) and extending southeasterly to 13th Street (sub-area 8B), the depth to groundwater was estimated to be 5 feet or less. The Ramona Lake area is subject to flooding with surface water remaining ponded for extended periods of time after a storm event due to shallow depth to groundwater and lack of positive drainage.

The Ramona-Pismo depression (Area 8) is somewhat analogous to the Paso Robles depression (Area 6) in that it is an inter-dunal depression. The upper end of which is located near the top of the groundwater *high*. However, it is a much narrower and discontinuous feature than either the El Moro or Paso Robles depressions.

The nearest monitoring wells are 18B1 near 10th Street at Ramona Avenue, and 18C1 near 5th Street at Pismo Avenue (see Figure II-7). These wells were drilled in 1982 as a part of the Brown and Caldwell investigation, and groundwater levels monitored by the County Engineering Department since that time are shown on Figure III-5. The variations in groundwater levels are very similar to those at 8N2 near the Paso Robles depression, suggesting that the groundwater levels are responding in a similar way on both the northerly and southerly reaches of the *high*.

The extent of bedded Paso Robles Formation at the surface is shown as the darker tones on the 1949 aerial photograph, Figure III-6. The inter-dunal depression in this area is much narrower than the depressions to the north, and the area of exposed Paso Robles Formation is narrow and discontinuous.

c. Existing Drainage Improvements

County drainage improvements in this area consist of a culvert under 11th Street at Ramona Avenue (culvert 8.1), a culvert under Ramona Avenue at 9th Street (8.2), a culvert under 7th Street midway between Ramona and Pismo Avenues, and a French drain and culvert under 3rd Street (8.3) midway between El Moro Avenue and Pismo Avenue. A local residence's attempt to turn Ramona Avenue between 10th and 11th into a basin was thwarted by the County and the basin was refilled.

Culvert 8.1 drains the southerly portion of Ramona Avenue from 9th Street west to 7th Street (sub-area 8B). This drainage contributes to the problems experienced in sub-area 8A. The culvert extending under 7th Street is undersized resulting in the flooding of 7th Street and adjacent residences to the east. Being undersized, this culvert acts to meter flows from the flooded areas thus reducing downstream drainage impacts. Increasing the culvert capacity would result in additional downstream damage.

In addition to the County maintained drainage facilities, a number of residences in sub-area 8A have installed private drainage facilities to allow water to pass between lots.

d. Problems within Drainage Area

Over twenty-two documented incidences of flooding to property, garages, and residences is prevalent throughout the Area 8 depression. In addition, short term failure of septic systems has been documented suggesting a surge of surface and, possibly subsurface flow. Street flooding was noted during the October 29, 1996 storm at 11th, 9th, 8th, 7th and 4th Streets together with complete inundation of the Ramona Lake west of 10th Street. Complete washout of Pismo Avenue, west of 6th Street has been known to occur so severely as to expose existing underground utilities and undermining 6th and 4th Street road sections. Sediments washed from Pismo Avenue have completely filled the swale on Pismo Avenue between 3rd and 4th Streets.

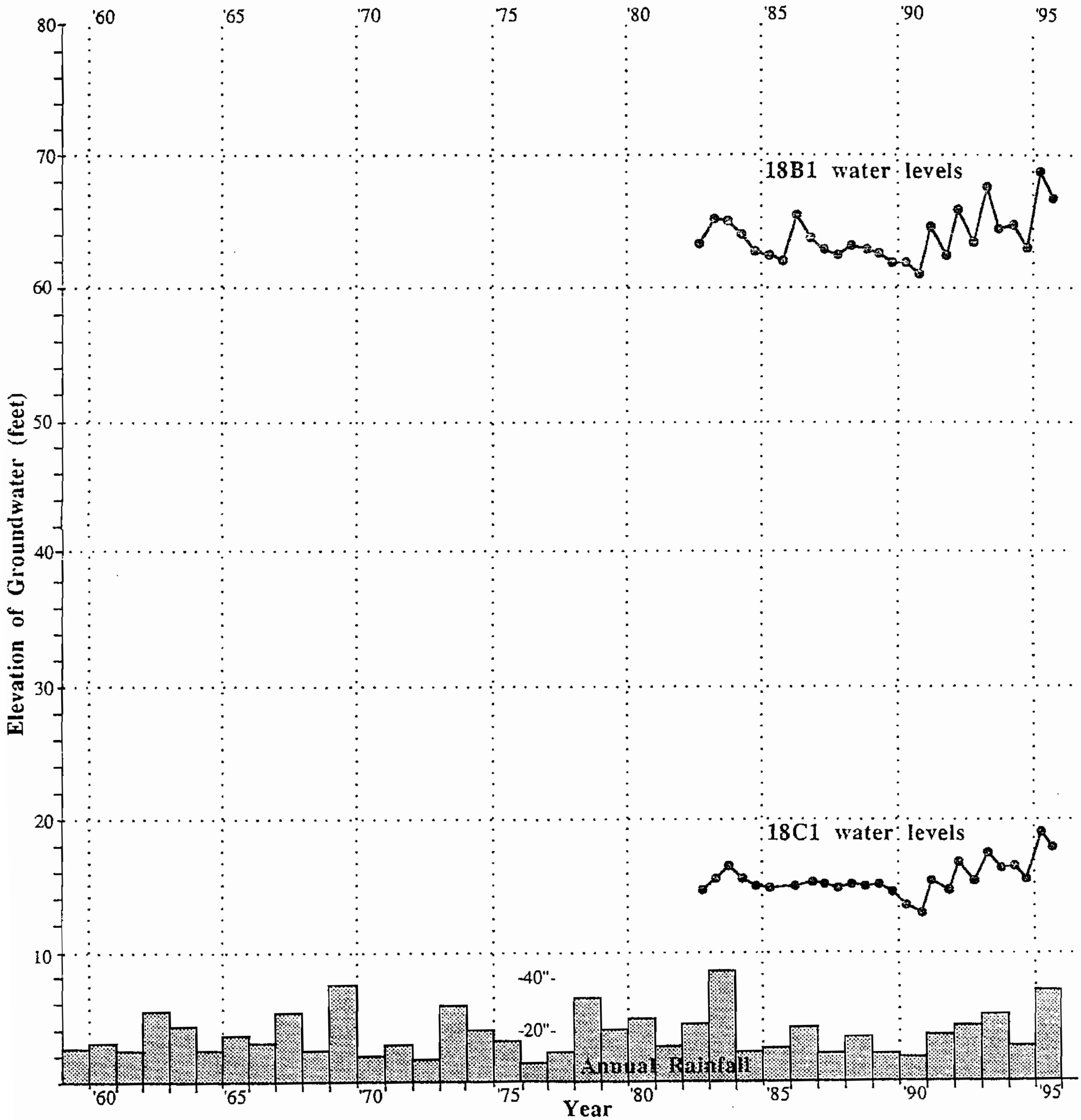


Figure III-5. Plot of groundwater elevations in the Ramona-Pismo depression. Monitoring well 18B1 is located near the area of surfacing groundwater at 10th and Ramona, and well 18C1 is located near the lower end of the depression.

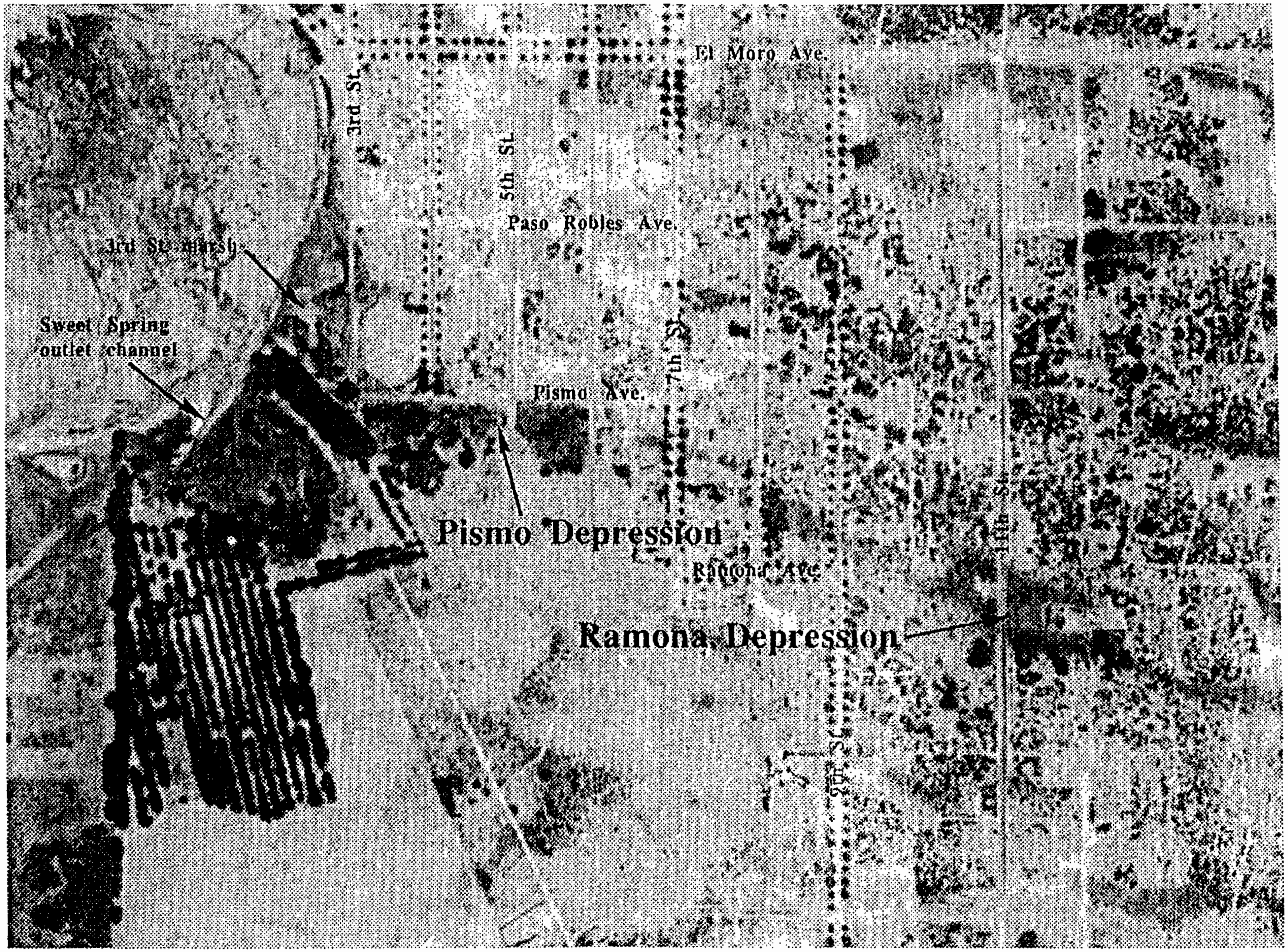


Figure III-6. Vertical aerial photograph of the Ramona-Pismo depression and vicinity in 1949. The light areas are old dune sand with varying degrees of vegetation. The grey tones in the depression are soils developed on the Paso Robles Formation. The photograph was taken June 4, 1949 at near zero tide. Scale: 1"=600'.

Residences within the depression have constructed drainage facilities to protect their properties. These facilities include swales, improved channels, walls, and berms. However, it has been noted that the surface flows arrive earlier and with more volume than in previous years suggesting that upstream residents are either increasing the amount of impermeable area (paving) or redirecting their drainage. Residents in the depression are concerned that their drainage improvements may not be capable of handling the increased flow volumes that they have been experiencing.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general northwesterly movement of the groundwater gradient under Area 8. Septic tank discharges in this area are expected to migrate in this direction towards the bay. No other drainage areas appear to have discharges contributing to the groundwater elevations under Area 8.

Implementation of the sewer project will eliminate septic-tank discharges in the vicinity of the depression and also in the area of the crest of the groundwater high to the north of the depression (refer to Figure II-7). While a decline in groundwater levels should result from the elimination of this source of recharge, the magnitude and rate of decline are conjectural because of the apparent peaking out of the groundwater rises (see Appendix C2).

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Residential Flooding	8-1.1	Storm Drain	Begin at 13th Street at Ramona, west down Ramona to 9th, north on 9th to exist low point, follow low point between residential lots to 7th Street, north of 7th Street to Pismo, west on Pismo to bay. Inlets at all intersections and additional storm drains laterally up 5th, 6th, 12th and 13th. Discharge to bay or to 8-1.3.
		8-1.2	Basins	Purchase lots in depression and create recharge basins. The Ramona Lake is not a good location due to shallow depth to groundwater.
		8-1.3	Linear Park	Turn Pismo into linear park from 4th Street east to 7th Street. Combination of storm drain, pumping, and through lot easements would be required.
		8-1.4	Pump	Install pump station at Ramona Lake to alleviate storm volumes on down grade residents. Pump easterly to discharge to culvert 12.2, pump to fault discharge,
		8-1.5	Cross lot swales	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.
		8-1.6	Sewer	Temporary storm drain connection to the new sewer treatment plant. Phase I installation of the sewer mains should be to this area.
		8-1.7	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C1A8-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
8.1	***No Project:***	
8.2	***Pump to Bay:*** Construct temporary pump station the intersection of 11th Street at Ramona Avenue (Ramona Lake). Construct discharge line west on Ramona Avenue to the existing high point then install a gravity discharge line extending west on Ramona with discharge to the 3rd Street Marsh. Provide surface drainage improvements to the pump stations per Alternative 8.8. A temporary pump station similar to that being currently used at 16th Street and Paso Robles Avenue should be sufficient. Removal of surface water at this location should reduce residential flooding problems within the Ramona depression; however, minor flooding can be expected to continue.	$126.3
8.3	***Pump to Los Osos Creek:*** Similar surface improvements and pump as presented in Alternative 8.2 except that pump discharge to existing culvert under South Bay Boulevard (Culvert 12.2). Alignment of discharge pipe would be east on Ramona Avenue to 18th Street, then northeasterly on 18th Street to existing 28"x20" CMPA. A temporary pump station similar to that being currently used at 16th Street and Paso Robles Avenue should be sufficient. Removal of surface water at this location should reduce residential flooding problems within the Ramona depression; however, minor flooding can be expected to continue.	$99.7
8.4	***Expanded duration of pumping to Bay:*** Similar surface improvements as Alternative 8.2 except that pumping would be extended into the dry season to lower groundwater levels by 5 to 8 feet so that septic tanks would function as intended and to provide an aquifer storage buffer during severe storms. However, for maximum benefit it would probably be more appropriate to focus pumping lower down on the groundwater surface "slope" and within a "well field". Pumping should be performed from a designed well field (refer to Alternative 6.3 *Discussion*) that should be modeled based on further aquifer tests providing basin area, infiltration rates, average rainfall, verification of groundwater characteristics, porosity, and other relevant information. Based on the preliminary assumptions and calculations presented in Table III-4, it would be necessary to pump approximately 580 acre feet from the aquifer to lower the groundwater elevation by 5 feet. Pump sizes and time periods are presented in Table III-4 which estimate combinations required to lower the groundwater elevations.	$246.3

8.5	***Expanded duration of pumping to Los Osos Creek*:** Similar surface improvements as Alternative 8.3 except that pumping would be extended into the dry season to lower groundwater levels by 5 to 8 feet so that septic tanks would function as intended and to provide an aquifer storage buffer during severe storms. However, for maximum benefit it would probably be more appropriate to focus pumping lower down on the groundwater surface "slope" and within a "well field". Pumping should be performed from a designed well field (refer to Alternative 6.3 *Discussion*) that should be modeled based on further aquifer tests providing basin area, infiltration rates, average rainfall, verification of groundwater characteristics, porosity, and other relevant information. Based on the preliminary assumptions and calculations presented in Table III-4, it would be necessary to pump approximately 580 acre feet from the aquifer to lower the groundwater elevation by 5 feet. Pump sizes and time periods are presented in Table III-4 which estimate combinations required to lower the groundwater elevations.	$253.5
8.6	***Ramona Storm Drain:*** Construct 48" storm drain beginning at 4th Street at Pismo Avenue, extending east up Pismo, south on 7th Street to existing low-point, east through existing residential to 8th Street, then on to 9th Street, south on 9th Street to Ramona Avenue, east on Ramona ending at 11th Street. Construct road inlets at each intersection along the alternative alignment, at the intersection of Ramona and 9th Street, and at each low-point in 7th, 8th, and 9th Streets. The storm drain would be designed for a 25 year storm event with special consideration for inlet design in sump areas to minimize plugging (oversized inlets). Storm drain extending under residential lots will require easements, pipe jacking or boring as required to minimize trenching between buildings. Overland escape channels between residences should be constructed to provide for positive overland escape in storms having significant intensities/duration or due to storm drain plugging. Channels would be designed for minimum disruption to the residences yet allowing maximum open channel capacities. Existing facilities may be used after an engineering evaluation has been performed on their existing capacities.	$232.3
8.7	***Channel:*** Construct lined channel through existing residential areas from existing 13th Street depression (between Ramona and San Luis Avenues) to 12th Street. Drain to 12th Street allowing alternative curb & gutter (per Alternative 8.8) to direct flows to Ramona Avenue.	$88.1

8.8	***Curb & Gutter:*** Construct curb & gutter on Ramona Avenue from 11th Street to 13th Street. Install 18" culverts under each side of Ramona Avenue to drain westerly under 11th Street. Construct cross-gutter at intersection of Ramona Avenue and 13th Street to keep surface flow on Ramona heading west and away from existing depression on 13th Street between Ramona and San Luis Avenues. Construct curb & gutter on 12th Street, providing minor regrading of 12th Street to direct surface flow northerly to Ramona. Construct cross-gutter on Ramona Avenue at its intersection with 12th Street to keep surface flow on Ramona Avenue directed westerly. Capture this surface flow with alternative inlets at the intersection of Ramona Avenue at 11th Street.	$86

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 8.1: No Project

Implementation of the sewer project is expected to result in a decline of existing groundwater levels at about 1 foot per year after cessation of septic-tank discharge (sewer hookup). Flooding problems related to surfacing groundwater should subside within 1 to 3 years after sewer implementation, depending on rainfall. As the groundwater subsides, depressed areas and cross-lot drainage would continue to experience localized flooding during storm events due to surface water but the increased upper aquifer storage capacity may allow quicker percolation of these flows.

Alternatives 8.2 & 8.3: Pump to Bay/Los Osos Creek

Localized reduction in road and certain residential lot flooding due to surface improvements, however, expect increased concentrations of surface runoff and possible flooding at the alternative pump stations (discharge point of surface drainage improvements). 1 to 3 years after installation of the sewer, the majority of remaining flooding should be associated with only surface runoff (see Alternative 8.1). Alternative pump station would remain on-line during wet months to continue to pump surface flows from the Alternative pump site.

Alternative 8.4 & 8.5: Expanded duration of pumping to Bay/Los Osos Creek

Community wide benefits of expanded pumping would be realized. Increased aquifer storage for stormwater runoff, ability to incorporate additional retention and detention basins in areas east of Los Osos Strand B fault line, reduced storm related failure of existing septic systems, reduced dewatering for the sewer project, and reduced incidence of flooding.

Alternative 8.6: Storm Drain

Locally, a surface water gravity drainage system should reduce future surface flooding in the depressed and cross-lot drainage areas. The natural surface drainage course extending through existing residential properties would be conveyed below the surface, thus reducing the surface flooding of the depressed lots. No community benefits from a storm drain would be realized.

Alternative 8.7: Channel

Localized benefit to small portion of Area 8 for channalization of storm surface flows between lots.

Alternative 8.8: Curb & Gutter

Localized benefit to Area 8 for channalization of storm surface flows on Ramona Avenue east of 11th Street, on 12th Street south of Ramona Avenue, to limit occurrence of cross-lot drainage between 11th and 12th Streets, and to intercept surface flows from the upper elevations of the watershed. Community benefits from the reduction of sedimentation and potential ponding on 11th Street, which may be considered a Collector roadway.

c. Significant Environmental Effects of the Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below based on discussions in Appendix C. Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C4 and C5.

The potentially significant environmental effects of the alternative mechanisms of the disposal of runoff and surfacing groundwater in Area 8 are essentially the same as those for Area 6 except that the area involved is about 2/3rds of Area 6, and the volumes of runoff and surfacing groundwater would be proportionally less. Therefore, the discussion below relies on the preliminary analysis for Area 6, modified only as necessary to account for the differences in the two areas.

Alternative 8.1, No Project:

With this alternative, the natural, subsurface flow of contaminated groundwater to the bay, contaminated by septic-tank discharge, would not change, and the existing effects of this discharge on the biological resources of the bay would continue unchanged. Therefore, the existing levels of nitrate and bacterial contamination of the bay that may be attributed to these sources would continue until the proposed sewering of the South Bay communities is implemented.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to the bay should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

Alternative 8.2. Pump to bay:
With this alternative, the draining of accumulated runoff and surfacing groundwater to the pumping facilities would be improved, and pumping of contaminated waters to the bay would increase over that flowing to the bay in the subsurface. The total volume of contaminated groundwater reaching the bay should remain approximately the same. However, pumping an increased component of the contaminated water directly to the bay during flooding events would tend to increase the concentrations of these contaminants in bay water during such events, but also reduce the subsurface flow to the bay during periods of no rainfall.

Thus, implementation of this alternative would involve trade-offs, primarily as to the distribution in time of the contaminant flow to the bay. With this alternative, contaminant flow would increase over existing conditions during periods of heavy rainfall, but decrease during dry periods. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative on the biological resources and water quality of the bay would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

Alternative 8.3. Pump to Los Osos Creek:
With this alternative, potential effects would be similar to Alternative 8.2 above except that: 1) the travel distance and time would be increased by cycling the contaminated waters through the wetlands on Los Osos Creek; 2) nitrate concentrations would be reduced somewhat by cycling the waters through the wetlands; and 3), the bacterial concentrations may be reduced by cycling the waters through the wetlands. However, with the pumping period being confined largely to periods of high rainfall and streamflow in the winter months, the potentially beneficial effects of the wetlands would be minimized and there would be an unknown impact to the biological resources of the bay. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

Alternative 8.4. Expanded duration of pumping to bay:
With this alternative, the period of pumping would be expanded, and the depth of extraction extended, so as to draw down groundwater levels so that the septic-tank leach fields in the affected area would function as intended in removing bacterial contamination and denitrification. Drawing down groundwater levels would also provide a buffer as to the onset of flooding conditions during unusually wet periods.

Implementation of this alternative would result in a one-time initial discharge to the bay of contaminated groundwater. Maintaining the drawn-down levels until the sewer project is implemented would require annual pumping of runoff and some groundwater estimated at about the same amount, depending on rainfall. However, if the septic-tank leach fields can be maintained in a functional condition, then the contaminant levels of the annual pumping should be much lower then either the initial pumping or that of the groundwater now flowing naturally to the bay in the subsurface.

The trade-offs involved in this alternative would be to accept a one-time, major discharge to the bay of contaminated groundwater to restore the proper functioning of septic-tank systems in the areas now flooded by rising groundwater. If the proper function of the septic-tank systems can be restored, then the total volume of contaminants reaching the bay would be significantly reduced, thus having an unknown but likely positive impact on the biological resources in the bay. With this alternative, it may also be possible to time the dry-season discharge to coincide with maximum tidal exchange so as to minimize the residence time of the contaminated waters. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

Alternative 8.5, Expanded duration of pumping to Los Osos Creek:
With this alternative, the pumping required to achieve the initial drawdown of groundwater levels and the annual pumping necessary to maintain the drawdown would be cycled through the wetlands on lower Los Osos Creek to reduce nitrate and bacterial concentrations. With this approach, the discharge through the wetlands would be largely during the growing season when nutrient uptake would be at a maximum and streamflow would be low, which would maximize residence time.

The primary drawback of this alternative is that the wetlands would smooth-out the flow, and it would probably not be feasible to time the discharges so that outflow from the wetlands to the bay could take advantage of maximum tidal exchange. However, it is likely that the wetlands would reduce the nitrate and bacterial concentrations entering into the bay and would result in a positive impact on the biological resources of the bay. Further study would be required to determine the level on impacts and benefits from this alternative. Any determination of the relative balance between the adverse, as opposed to beneficial effects of this alternative would require input from all the responsible agencies and groups involved, as well as the potentially affected members of the public.

d. Regulatory Implications:

Additional Environmental Review:
It is expected that implementation of any of the alternatives above, except no project, would require the preparation of an EIR because: 1) all of these alternatives involve potentially significant impacts on bay water quality and resources; and 2), these potential impacts are expected to differ depending on the choice of the alternatives to be addressed.

Responsible Agencies and Groups:
Preparation of the expected EIR, and implementation of an alternative in this problem area, would require input and/or permits from the following agencies and groups:

1. County of San Luis Obispo-Land Use and Grading Permits
2. Regional Water Quality Control Board-Discharge Permits
3. Department of Fish and Game-Streambed Alteration Permits
4. Department of Health Services
5. Department of Parks and Recreation-Access Permits
6. California Coastal Commission-Coastal Zone Permits in White Hole Areas
7. U.S. Fish and Wildlife Service-Biological Opinion
8. U.S. Corps of Engineers-Section 404 Permits

In addition to the permitting agencies, there are local groups that may wish to comment on the project. These include the following:

1. National Estuary Program
2. Bay Foundation of Morro Bay
3. Friends of the Estuary
4. Los Osos Citizen's Advisory Committee (LOCAC)
5. Los Osos/Baywood Park Chambers of Commerce
6. County Service Area 9 Advisory Committee
7. Other Special Interest Groups

CATEGORY 2: AREAS OF SHALLOW TO SURFACING GROUNDWATER AT THE BAY FRINGE

Drainage Areas Included in Category 2:
- Area 1: Santa Ysabel, Pasadena to 600 Block
- Area 14: Cuesta by the Sea, West
- Area 15: Cuesta by the Sea, East

C2A1: DRAINAGE AREA 1, SANTA YSABEL, PASADENA TO 600 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C2A1.1f.

a. Drainage Considerations

The surface drainage region of Area 1 is approximately 43 acres. Surface flows within the drainage area generally migrate towards Santa Ysabel Avenue, then westerly to First Street, then southerly on First Street to mid-block between Santa Ysabel and Baywood Way, then westerly through residential lots towards Pasadena Drive, where it sheet flows across Pasadena Drive, through the parking area with eventual discharge into the bay. The lowest improved point within the drainage area occurs on Pasadena Drive, midway between Santa Ysabel Avenue and Baywood Way. Storm water is concentrated at this point creating potentially hazardous surface flows to pedestrians and vehicles.

b. Groundwater Considerations

Depth to groundwater in this region ranges from 0 feet at the bay to 50 feet in the upper easterly reach of the drainage area. The surface water flooding problem on Pasadena Drive may be compounded due to the shallow depth to groundwater in this area (less than 5 feet estimated for analysis period). The shallow depth to groundwater may be attributed to the relative close proximity of the bay. In addition, Figure II-7 suggests that residences between the bay and 2nd Street may be subject to high groundwater during the wet months.

c. Existing Drainage Improvements

A three foot wide by six inch deep concrete cross gutter spans the width of Pasadena Drive at the low point. This cross gutter assists in directing nuisance water across the road but provides no drainage solution for allowing through traffic even during small storms. Other Drainage improvements include an 18 inch culvert near the intersection of 2nd at El Moro (1.1) Avenue which drains the northerly portion of Santa Maria Avenue southwesterly towards the bay.

d. Problems within Drainage Area

Documented problems associated with this area include ponded water in a residential yard on 2nd Street and street ponding at the low point of Pasadena Drive. The ponded residential water appears to be an isolated problem due to the low number of complaints in the area. Also, Pasadena Drive flooding occurs and is primarily due to the concentration of storm water, the shallow depth to groundwater, and the lack of sufficient drainage improvements in the area. Closure of Pasadena Drive may be frequent during storm events and contaminated surface water due to septic tank failure is likely. Cross-lot drainage occurs due to a "hump" in Pasadena Drive between Santa Lucia Avenue and Santa Ysabel Avenue which diverts surface flows from the roadway through existing residential lots, terminating in an existing low-lying undeveloped lot which acts as a retention basin.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general westerly movement of the groundwater gradient under Area 1. Septic tank discharges in this area are expected to migrate westerly towards the bay. Septic tank discharges from other areas that appear to contribute to the elevation of shallow groundwater below Area 1 include Area 6 and portions of Areas 7. Due to its close proximity to the bay and present surface runoff characteristics, current drainage problems on Pasadena may continue even with the implementation of the sewer project. However, the sewer will be beneficial during those periods of *suspected* septic tank failure by providing a medium for offsite disposal and reducing the contamination concentrations of surfacing groundwater.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Pasadena Road Flooding	1-1.1	Closure	Close Pasadena road between Santa Ysabel and Baywood and make it bay access parking. Create wetland.
		1-1.2	Storm Drain	Install storm drain beginning midblock on 1st Street to intercept flows from entering residential property. Either extend storm drain down Baywood or between residential lots, under Pasadena and discharge to bay.
		1-1.3	Storm Drain & Wetland	Combination of 1-1.1 & 1-1.2.
		1-1.4	Regrade road	Raise road and install culvert
2	Lot Flooding	1-2.1	Swale	Divert flows to street with the use of onsite swales and other diversion techniques across properties.
		1-2.2	Berm	Install curb and gutter, a.c. berm, driveway apron, or some other berming device to maintain flows in street.
		1-2.3	Swale through properties	Maintain existing flow pattern and install swales and obtain easement between properties.
3	Cross-Lot Drainage	1-3.1	Regrade Road	Regrade the "hump" out of Pasadena Road between Santa Lucia Ave and Santa Ysabel Ave. Install AC dike either side of regraded road to contain surface flows in Pasadena Road.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C2A1-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
1.1	***No Project:***	
1.2	***Earth Swale***: Construct earth swale beginning at westerly edge of Pasadena Road cross-gutter and extending westerly. Allow wet weather flows to continue to flow atop Pasadena Road and continue to provide temporary road closure during periods of road flooding.	$2.5
1.3	***Road Closure:*** Permanently close Pasadena Road. Demolish and remove existing road, reconstruct new Bay access parking lot and create wetland area.	$57.3
1.4	***Culvert***: Raise Pasadena Road and install 30" (or double 24") storm drain culvert under raised section of roadway. Would require regrading inlet and outlets to allow for 12" minimum cover above pipe or a slurry backfill. Construct 24' wide x 2' deep swale through existing parking area towards Bay to accommodate flows from 25-year storm event.	$8.2

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 1.1: No Project

Existing problems have little direct impact locally, or on a community wide basis. Palisades Drive is a Local road for which temporary closure due to storm events would have little impact on community access.

Alternative 1.2: Earth Swale adjacent to roadway

Local benefit only. Would provide an escape route for water ponding on the roadway. However, water would continue to flow across the surface of the roadway which, during even minor storm events, may cause the road to become impassable.

Alternative 1.3: Road Closure

Provides safety, reduced maintenance, and temporary road closure on a local scale. Community benefits include the creation of additional wetland area.

Alternative 1.4: Culvert
Local benefit of providing wet weather accessibility on Pasadena Drive.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 1.1. No Project:
Road flooding, surfacing of groundwater containing components of septic-tank failure, and the natural, subsurface flow to the bay of groundwater containing components of septic-tank failure, would not change with this alternative. Therefore, the existing levels of nitrate and bacterial contamination of the bay fringe that may be attributed to this area would continue until the proposed sewering of the South Bay communities is implemented.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to the bay should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

Alternative 1.2. Earth Swale:
With this alternative, the surface flow of stormwater would be directed through the earth swale across the roadway having potential to cause significant, but mitigable, short term impacts to traffic during periods of heavy rain. Surfacing groundwater containing septic-tank discharge would flow through the area having the potential to significantly impact water quality and wetland habitat at the bay fringe. However, vegetation of the swale has potential to provide a filtering system, possibly resulting in a reduction of contaminant and sedimentation levels in the water, in addition to improving visual resources in the area.

Alternative 1.3. Road Closure:
Road flooding, surfacing of groundwater containing components of septic-tank failure, and the natural, subsurface flow to the bay of groundwater containing components of septic-tank failure, would not change with this alternative. Therefore, the existing levels of nitrate and bacterial contamination of the bay fringe that may be attributed to this area would continue until the proposed sewering of the South Bay communities is implemented. Development of a wetland has potential to result in beneficial impacts by creating additional habitat for native wetland species and by providing a

natural storage basin for surface runoff. In addition, there is potential for significant, but mitigable, impacts to traffic on a local scale with the implementation this alternative.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to the bay should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

Alternative 1.4. Culvert:

Surfacing groundwater containing components of septic-tank failure combined with surface flow of stormwater, would be channeled through a culvert to the bay. The existing levels of nitrate and bacterial contamination that may be attributed to this area would have the potential to significantly impact the water quality and wetland habitat at the bay fringe. In addition, there will be the potential for significant, but mitigable, short term impacts to traffic on a local scale due to construction of this alternative.

d. Regulatory Implications:

Additional Environmental Review:

It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C2A14: DRAINAGE AREA 14, CUESTA BY THE SEA, WEST

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C2A14.1f.

a. Drainage Area Considerations

The surface drainage region of Area 14 is approximately 72 acres. The majority of surface flows within the drainage area tend to migrate in a northwesterly direction towards the area of Pecho Valley Road at Grove Street and Binscarth Road. The remaining portion of the drainage area flows directly north toward Binscarth Road. All surface flows eventually drain directly to the bay via sheet flow or localized channels.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 0 feet to 10 feet from the bay north to Henrietta Avenue, then jumps to 50 feet at Rosina Drive. Drainage problems in Area 14 can be primarily attributed to surface runoff complicated by shallow groundwater influences due to the areas close proximity to the bay.

c. Existing Drainage Improvements

There is a single storm drain on Rosina Drive (inlet 25.1) that was installed during construction of Monarch Elementary School. The playfield of Monarch Elementary School is used as a terminal basin for surface flow collected on the school site.

d. Problems within Drainage Area

The area having the most severe documented drainage problems is that bordered by Binscarth Drive south to Henrietta Avenue, and Pecho Valley Road east to Nancy Avenue where cross lot drainage, yard flooding and septic tank failures are a recurring problem. Binscarth Drive, from Pecho Valley Road to Sunny Hill Avenue, experiences flooding of roads and adjacent properties. Surface flow generating in the higher elevation of the drainage area sheet flow across Binscarth Road into northerly wetlands. The areas adjacent to Binscarth Road are further complicated by a lack of positive drainage in any direction and shallow depths to groundwater. Flooding documented in the area also includes a low lying portion of Pine Avenue just north of Los Osos Valley Road.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that groundwater gradient west of the Los Osos Fault generally migrates in a northwesterly direction towards the bay. Implementation of the sewer project will eliminate septic-tank discharge from the portions of Areas 14, 15 and 16, areas that due to the groundwater gradient partially contribute to Area 14 groundwater elevations. Due to its close proximity to the bay and present surface runoff characteristics, current drainage problems on Binscarth Drive may continue even with the implementation of the sewer project.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Flooding of Binscarth, Grove & Henrietta	14-1.1	Storm Drain	Install Storm drain on Henrietta west to Pecho Valley, on Grove west to Pecho Valley, and on Pecho Valley connecting the Henrietta and Grove systems. Outlet to Bay at Grove.
		14-1.2	French Drain	Install French Drain with same alignment as 14-1.1 to divert ground water flows westerly to bay (presently migrate northwesterly)
		14-1.3	Raise Foundation	Raise foundations of affected homes and regrade roads and driveways
		14-1.4	Drain to Sewer	Allow residents in the areas from Binscarth to Henrietta to connect private storm drain systems to the new sewer.
		14-1.5	Pump	Install pump station at Pecho Valley at Grove with swale and culverts providing positive drainage to pump. Discharge west to wetland.
		14-1.6	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
2	Septic Tank Failure	14-2.1	Sewer	Connect to new sewer system
3	Flooding of Pine	14-3.1	Basin	Construct recharge basin on eastside of Pine at low point
		14-3.2	Storm Drain	Install inlet and storm drain system northerly on Pine and tie to possible Henrietta storm drain system (see Solution 14-1.1 & 15-1.1)
		14-3.3	Swale	Install swale or graded ditch from low point in Pine northerly on Pine
		14-3.4	Curb & Gutter	Install curb, gutter, and driveway aprons on Pine to direct flows.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C2A14-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Problem 1: Binscarth Drive

Alt	Description	Cost[1]
14.1a	*No Project:*	
14.1b	***Curb & Gutter***: Construct curb & gutter both sides on Pecho Valley Road extending from Los Osos Valley Road north towards Binscarth Drive. The portion of Pecho Valley Road between Grove Street and Binscarth Drive will require minor regrading (lowering) to provide positive drainage northerly. Construct vegetated swale from edge of pavement north towards the Bay to allow for positive overland escape of surface flows. Construct curb & gutter the entire length of Grove Street, on Nancy Avenue between Henrietta Avenue and Binscarth Drive, and on Binscarth Drive from Pecho Valley Road to Pine Avenue (see Alternatives 15.2 & 16.3). The portion of Binscarth Drive between Nancy Avenue and Pecho Valley Road will require regrading (lowering) to provide positive drainage westerly to Pecho Valley Road. Drain new vegetated swale and north end of Pecho Valley Road.	$179.8
14.1c	***Storm Drain:*** Construct road inlet at the northeast intersection of Pecho Valley Road at Skyline Drive and install an 18" storm drain connecting new road inlet to the existing storm drain system under Pecho Valley Road.	$5

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

Problem 2: Pine Avenue

Alt	Description	Cost[1]
14.2a	***No Project:***	
14.2b	***Curb & Gutter:*** Construct curb & gutter on Pine Avenue just north of its intersection with Los Osos Valley Road. This is an existing low-point that will require minor regrading (raising) of the road to force a new high point. Due to the relatively small area contributing to flooding problems, redirection of these flows northerly on Pine Avenue should have little impact on down stream facilities (also see Alternative 16.4a)	$21.8
14.2c	***Swale:*** Construct roadside swale per Figure III-2 along easterly side (only) of Pine Avenue to drain existing low-point. Swale to extend approximately 200 feet north. Construct cross-gutter at low-point on Pine Avenue to adequately drain street into alternative swale. Due to the relatively small area contributing to flooding problems, redirection of these flows northerly on Pine Avenue should have little impact on down stream facilities.	$6
14.2d	***Storm Drain:*** Construct road inlets at low-point (just south of its intersection with Los Osos Valley Road). Extend storm drain northerly until it daylights into Pine Avenue, approximately 200 feet north of the existing low-point. Due to the relatively small area contributing to flooding problems, redirection of these flows northerly on Pine Avenue should have little impact on down stream facilities.	$14.6

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 14.1a: No Project-Binscarth

Continued localized road and residential flooding near the intersections of Binscarth Road and Grove Street with Pecho Valley Road.

Alternative 14.1b: Curb & Gutter-Binscarth

Localized benefits resulting in positive roadway drainage near the intersections of Binscarth Road and Grove Street with Pecho Valley Road. Minor community benefits associated with vehicular access to adjacent areas (Area 15 and 16) which utilized these Local Streets.

Alternative 14.1c: Storm Drain-Binscarth

Only minor local benefits near the intersection of Binscarth Road, Pecho Valley Road, and Grove Street by diversion of Pecho Valley Road surface flows.

Alternative 14.2a: No Project-Pine
Existing problems causing minor road flooding would continue. Pine Avenue may be considered a Collector road and alternate bypass routes are available during severe flooding conditions. These bypass routes include Pecho Valley Road, Doris Avenue, and to a lesser extent, Ramona Avenue.

Alternative 14.2b: Curb & Gutter-Pine
Both a local and community benefit to the residential areas (Area 15 & 16) of Cuesta by the Sea and public access to Sweet Springs Park.

Alternative 14.2c: Swale-Pine
Same benefits as Alternative 14.2b but also maintains rural atmosphere of roadway by not constructing concrete curbs and gutters.

Alternative 14.2c: Storm Drain-Pine
Same benefits as Alternative 14.2c.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 14.1a, No Project:
Road flooding, surfacing of groundwater containing components of septic-tank failure, and the natural, subsurface flow to the bay of groundwater containing components of septic-tank failure, would not change with this alternative. Therefore, the existing levels of nitrate and bacterial contamination of the bay fringe that may be attributed to this area would continue until the proposed sewering of the South Bay communities is implemented.

At such time as the sewer project is implemented, nitrate and bacterial loading from septic tanks would cease, and the concentrations of these contaminants in subsurface flow to the bay should begin to decline as the existing contaminated groundwater is diluted by infiltrating rainfall. The period of time necessary for this to occur is unknown. However, it took about 15 to 20 years for the groundwater mounding and nitrate levels to rise to their present levels, and the decline to natural levels may take about the same period of time.

Alternative 14.1b. Curb & Gutter:
Surfacing groundwater containing components of septic-tank failure combined with flow of surface stormwater would be channeled through a curb and gutter system north along Pecho Valley Road to the bay. The existing levels of nitrate and bacterial contamination that may be attributed to this area would have the potential to significantly impact the water quality and wetland habitat at the bay fringe. However, vegetation of a swale has potential to provide a filtering system, resulting in a possible reduction of contaminant and sedimentation levels in the water, in addition to improving visual resources in the area. There is also potential for significant, but mitigable, short term impacts to traffic on a local scale due to construction of this alternative.

Alternative 14.1c. Storm Drain:
Surfacing groundwater containing components of septic-tank failure combined with surface flow of stormwater would be channeled through storm drains beneath Pecho Valley Road to the bay. The existing levels of nitrate and bacterial contamination that may be attributed to this area would have the potential to significantly impact the water quality and wetland habitat at the bay fringe. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale due to construction of this alternative.

Alternative 14.2a. No Project:
With this alternative, minor road flooding and ponding would continue, which may have the potential to cause significant, but mitigable, short term traffic impacts at a local scale during periods of severe floods.

Alternative 14.2b. Curb & Gutter:
All areas of flooding and ponding stormwater will flow through a curb and gutter system north along Pine Avenue towards Area 16. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area, therefore no potential significant impacts to water quality or wetland habitat are anticipated with implementation of this alternative. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 14.2c. Swale:
With this alternative, all areas of flooding and ponding stormwater will flow through an earth swale for 200 feet north along Pine Street into Area 16. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area, therefore no potential significant impacts to water quality or wetland habitat are anticipated. In addition, this alternative has potential to improve visual resources along Pine Avenue with vegetation included in the swale.

Alternative 14.2d. Storm Drain:
All areas of flooding and ponding stormwater will flow through a storm drain system north down Pine Avenue into Area 16. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area, therefore no potential significant impacts to water quality or

wetland habitat are anticipated. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C2A15: DRAINAGE AREA 15, CUESTA BY THE SEA, EAST

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C2A15.1f.

a. Drainage Area Considerations

The surface drainage region of Area 15 is approximately 30 acres. The area is topographically separate from adjoining Areas 14 and 16 but share similar characteristics. Surface flows generally migrate in a northerly direction down Doris, Donna and Fearn Avenues. A natural depression appears midblock of these three streets between Binscarth Drive and Lupine Street which directs surface flows in a northwesterly direction through existing private lots. West of Donna Avenue there is little development to be damaged by this northwesterly flow. However, on Donna Avenue there appears to be one home that may be impacted by this cross lot drainage pattern. Utilizing this depression, Area 15 drains directly to the bay.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 0 feet to 10 feet from the bay north to Henrietta Avenue, then jumps to 50 feet at Rosina Drive. Drainage problems in Area 15 can be primarily attributed to surface runoff complicated by shallow groundwater influences due to the areas close proximity to the bay.

c. Existing Drainage Improvements

There are no existing drainage facilities in Area 15.

d. Problems within Drainage Area

There was only one documented drainage complaint for Area 15 pertaining to flooding at the intersection of Doris Avenue and Binscarth Road. During our field visit of October 29, 1996, flooding of a garage was observed at the depression on Fearn Avenue just north of Binscarth Road.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that groundwater gradient west of the Los Osos Fault generally migrates in a northwesterly direction towards the bay. Implementation of the sewer project will eliminate septic-tank discharge from a portions of Area 16, that due to the groundwater gradient partially contributes to Area 15 groundwater elevations. Due to its close proximity to the bay and present surface runoff characteristics, current flooding of Binscarth Road at Doris Avenue may continue even with the implementation of the sewer project.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Flooding of Binscarth at Doris	15-1.1	Storm Drain	Extend Henrietta storm drain (Solution 14-1.1) easterly into Area 15 to intercept surface flows.
		15-1.2	French Drain	Extend Henrietta French drain (Solution 14-1.2) easterly into Area 15 to intercept subsurface flows.
		15-1.3	Swale	Install swale from the intersection northerly to the existing depression. May include a French drain or culvert extending under Binscarth to collect southerly ponding. May be ineffective during high groundwater conditions.
2	Residential Flooding	15-2.1	Curb & Gutter, swale	Install curb, gutter and driveway apron on westside of Fearn to direct flows north of existing residence. Install overside drain and swale in existing depression to direct flows west and between existing homes.
		15-2.2	Storm Drain	Per 15-1.1
		15-2.3	Swale	Install swale or graded ditch from low point in Pine northerly on Pine
		15-2.4	Sewer	Connect selective residential lots to new sewer system

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C2A15-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
15.1	*No Project:*	
15.2	***Curb & Gutter and Overside Drains-Binscarth/Lupine*** Construct curb & gutter on Binscarth Drive between Pecho Valley Road and Pine Avenue (see Alternatives 14.1b & 16.3), and cross-gutters at the intersection of Fearn Avenue with Binscarth Drive to divert flows from entering Fearn Avenue. This would redirect surface flows to Doris Avenue, north on Doris Avenue to existing low-point midblock between Binscarth Drive and Lupine Street. Construct curb & gutter on Doris Avenue with overside drain and cross-gutter at existing low-point. Surface flows would drain towards Bay.	$79
15.3	***Curb & Gutter and Overside Drain-Fearn*** Construct curb & gutter on Fearn Avenue from Binscarth Drive north to midblock. Construct overside drain on west side and cross-gutter on Fearn to drain road to the existing low-point. Construct vegetated swale from overside drain westerly towards Bay within existing low lying area. Will require drainage easement or property purchase.	$12.3

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 15.1: No Project

Continued localized road flooding on Binscarth Drive and residential flooding on Fearn Avenue north of its intersection with Binscarth Drive.

Alternative 15.2: Curb & Gutter and Overside Drain-Binscarth/Doris

Localized benefits resulting in positive roadway drainage near the intersection of Binscarth Road and Doris Avenue. Minor community benefits associated with vehicular access to adjacent areas (Area 15 and 16) utilized Binscarth Drive. Cross-gutters at the intersection of Binscarth Drive at Fearn Avenue should reduce flooding potential of a single residential lot on Fearn Avenue.

Alternative 15.2: Curb & Gutter and Overside Drain-Fearn

Single residential benefit to prevent flooding.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 15.1, No Project:
With this alternative, road flooding on Binscarth Drive and residential flooding on Fearn Avenue north of its intersection with Binscarth Drive would continue. Potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 15.2, Curb & Gutter and Overside Drain-Binscarth/Doris:
Surfacing groundwater containing components of septic-tank failure, combined with flow of surface stormwater would be channeled through a curb, gutter, and overside drain system north along Doris Avenue to the bay. The existing levels of nitrate and bacterial contamination that may be attributed to this area would have the potential to significantly impact the water quality and wetland habitat at the bay fringe. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 15.3, Curb & Gutter and Overside Drain-Fearn:
Surfacing groundwater containing components of septic-tank failure, combined with flow of surface stormwater would be channeled through a curb, gutter, and overside drain system north along Fearn Avenue to the bay. The existing levels of nitrate and bacterial contamination that may be attributed to this area would have the potential to significantly impact the water quality and wetland habitat at the bay fringe. However, vegetation of a swale has potential to provide a filtering system, resulting in a possible reduction of contaminant and sedimentation levels in the water, in addition to improving visual resources in the area. There is also potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:
Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

CATEGORY 3: AREAS OF EXCESSIVE CONCENTRATION OF SURFACE RUNOFF

Drainage Areas Included in Category 3:
- Area 16: Broderson, Skyline, & Pine
- Area 27: Los Osos Valley Road at Cimmeron

C3A16: DRAINAGE AREA 16, BRODERSON, SKYLINE & PINE

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C3A16.1f.

a. Drainage Area Considerations

The surface drainage region of Area 16 is approximately 570 acres. The area is topographically diverse yet shares the distinction of having surface outlet to a narrow, developed discharge point, namely the Broderson, Skyline & Pine area. Area 16 has been separated into sub-areas because the portion south of Los Osos Valley Road has direct impacts not only on the Broderson, Skyline & Pine area, but also on particular sections of Los Osos Valley Road.

Sub-Areas 16C through 16F are situated in relatively steep terrain. Surface flow from sub-area 16C generate in the undeveloped hillside south of Highland Drive. Surface flows migrate from the hillside onto Highland, then south on Broderson to Los Osos Valley Road (LOVR), east on Los Osos Valley Road to a culvert (16.1) which passes under LOVR and outlets to sub-area 16B. Similarly, surface flows from sub-area 16D migrate down Ravenna Avenue, east on Mar Vista, Lilac and Manzanita Drives to a storm drain system (inlets 16.2 to 16.9), which passes under LOVR and outlets to sub-area 16B. Sub-area 16E drains down Palisades and Bayview Heights to LOVR. Sub-area 16F drains to inlets (16.14) and (16.13), which drain to sub-area 16E.

Sub-Areas 16A and 16B are situated in relatively flat terrain. Surface runoff from sub-areas 16C through 16F are collected in sub-area 16B. Sub-area 16B then drains to sub-area 16A which is pumped to the bay from the permanent pump station located at Don Avenue at Mitchell Drive.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 0 feet at the bay, to about 25 feet near Skyline, to about 40 feet at LOVR. North of LOVR the depth to groundwater rises fairly rapidly due to the change in topography. Drainage problems in Area 16 can be primarily attributed to surface runoff complicated by shallow groundwater influences due to the area's close proximity to the Bay.

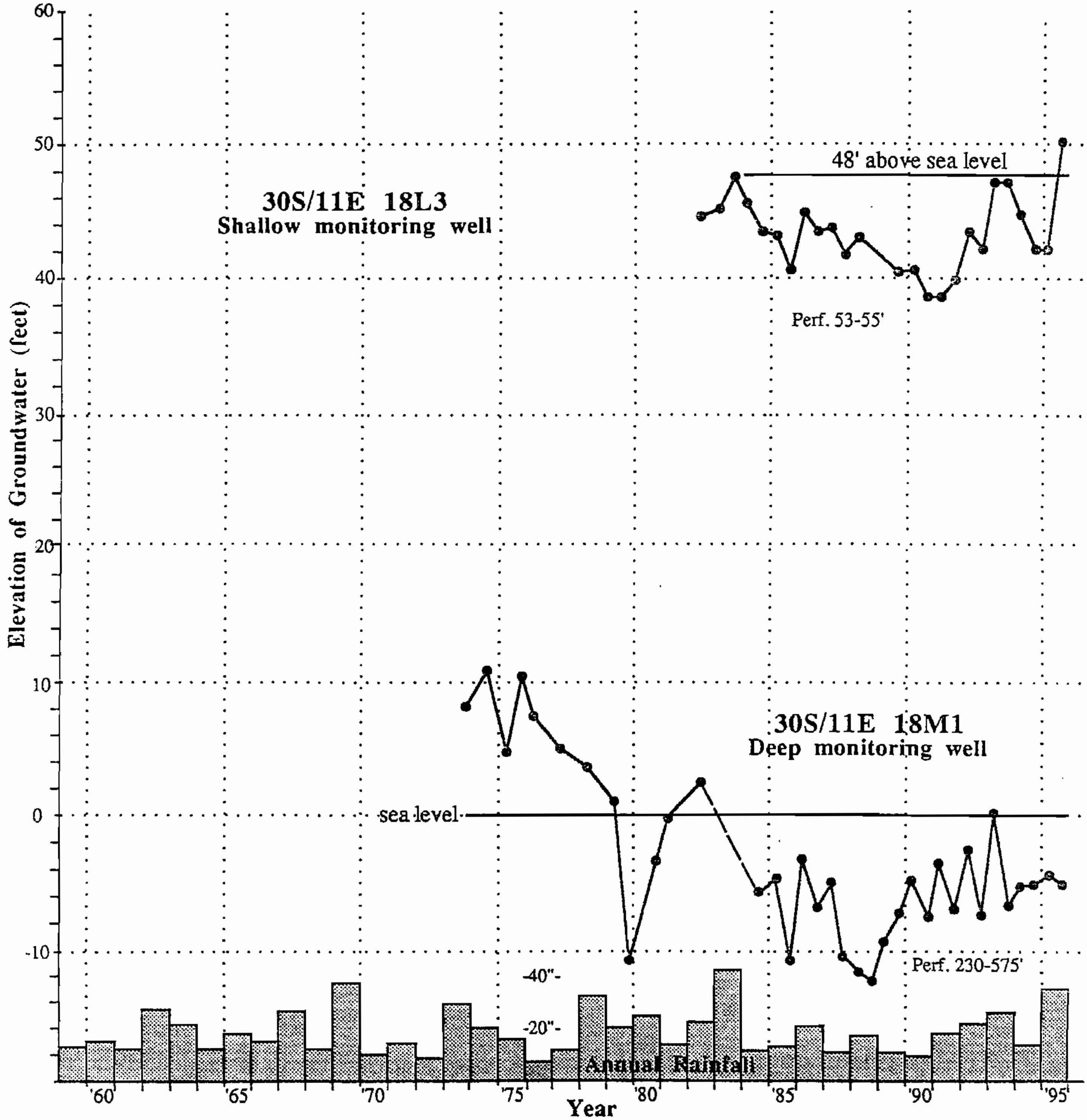


Figure III-7. Plot of groundwater levels in monitoring wells 18L3 and 18M1.

The Broderson, Skyline & Pine depression is located on the westerly side of the Los Osos fault, and shallow groundwater is not a significant problem except near the fringe on the bay (Figure II-8). The nearest monitoring wells are 18L3 located on Palisades Avenue across from the library (Figure II-7) and 18M1 near the intersection of Los Osos Valley Road and Broderson Avenue. Plots of groundwater levels for these wells are shown on Figure III-7. The plot for 18M1 is for informational purposes only as this well is completed in the lower aquifer where groundwater levels area substantially lower than in the shallow aquifer.

While groundwater levels in this area are not a significant cause of surface flooding, surface runoff from a large part of the community has historically drained to this area where it normally infiltrates into the subsurface. However, during periods of very heavy or prolonged rainfall, the capacity of the site (16B) to infiltrate runoff apparently becomes saturated, and flooding conditions develop near the corner of Skyline and Broderson. The concentrated recharge in this area has resulted in the development of a modest groundwater *high* beneath the depression (Figure II-7).
This condition is apparently complicated by the presence of the Paso Robles Formation at or near the surface in the vicinity of the depression as local residents report rising groundwater (a "spring") near the corner of Skyline at Broderson as flooding develops in this area. A monitoring well was drilled at this intersection in late 1995 as a part of the investigation of the Broderson recharge site by Metcalf and Eddy (1996), and no perching layers were encountered that could account for a "spring". The rising groundwater condition reported by local residents is apparently the result of temporary mounding of infiltrated runoff that saturates the recharge capacity of the site. This relationship will be important in the future operation of infiltration basin(s) on this site in conjunction with the recharge of treated wastewater at the Broderson site to the south.

<u>c. Existing Drainage Improvements</u>
Don Avenue at Mitchell Drive pump station consists of two pumps discharging to a 6 inch force main which extends northeasterly on Mitchell Drive, then northerly on Ramona Avenue to a discharge point in the bay. A retention basin (16.A) was constructed at the east end of Skyline Drive in January of 1991. There are two culverts crossing under Los Osos Valley Road, culvert (16.1) accepts flows from sub-area 16C and culvert (16.2) accepts flows from sub-areas 16D, 16E, 16F and inlets (16.3) through (16.9). Two inlets on Bay Oaks Drive (16.14 & 16.13) drain sub-area 16F to inlet 16.12 on Bayview Heights Drive. Inlet (16.12) drains to (16.11), which drains to two curb drains on Bayview Heights Drive, with flows entering Los Osos Valley Road at its intersection with Bayview Heights Drive.

Evaluation of the existing pump station determined that the system is adequately sized for removing ponded water at the intersection over an extended period of time. However, the existing pumps are insufficient to handle flow volumes associated with short duration, high intensity storms or for long duration low intensity storms. To achieve protection from these types of storm events would require:

1. Considerably larger and more expensive pumps be installed, or
2. Additional storage be provided, or
3. A combination of the above two.

The limitations associated with the above configurations are excessively high costs of equipment and land.

d. Problems within Drainage Area

The pump station at Don Avenue and Mitchell Drive has documented complaints of failure primarily associated with large volumes of storm water received during high intensity or long duration storm events. One of the primary drainage routes to the existing pump station is north on Pine Street. Complaints of storm water leaving Pine Street and flooding adjacent properties has also been documented. In addition, there are complaints of road and property flooding, sheet flow, and silt deposition at the intersection of Ramona Avenue at Pine Avenue.

The majority of complaints are related to property flooding in the Skyline, Ash, Broderson area. This areas appears to be the first to receive all drainage from sub-areas 16B through 16F. After storm flows move through the Skyline, Ash, Broderson area they migrate towards Pine Avenue and on to the existing pump station causing additional drainage related problems.

In addition to drainage problems in the lower elevations of the drainage area, silt deposition along Highland Drive and flooding of random properties have been documented in sub-areas 16C, 16D, 16E and 16F.

e. Expected Changes with Implementation of Sewer Project

Implementation of the sewer project will eliminate septic-tank discharge in the east and west areas of the watershed but a determination as to the sewering of southerly areas has not been made. In addition, operation of the Broderson recharge site at 1.85 million gallons per day is projected to result in mounding of 20 to 30 feet between wells 18L3 and 18M1 (see Metcalf & Eddy, 1966, Figure 5-11). The interaction of this groundwater recharge with the infiltration of surface runoff as it now exists could result in a significant increase in flooding events in this area if provision is not made to dispose of this excess runoff by some mechanism other than infiltration at this depression.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Pump Station	16-1.1	Pump Upgrade	Upgrade and expand to increase capacity.
		16-1.2	Force Main	Install large force main
2	Skyline, Ash Broderson	16-2.1	Storm Drain	Install storm drain from the intersection of Skyline Drive at Broderson Avenue to collect drainage and route storm drain either down Pine Avenue or down Broderson Avenue. A storm drain down Broderson Avenue may be incorporated with an over all storm drain system see 16-4.1.
		16-2.2	Linear Park	Create a linear park out of Broderson Avenue beginning at the intersection of Skyline Drive at Broderson Avenue.
		16-2.3	Basin	Create terminal basins for surface flows originating upstream sub-areas 6C through 6F to aid in groundwater recharge.
		16-2.4	Diversion	Install groundwater cutoff wall to divert subsurface flows towards Area 17
		16-2.5	Swale	Install surface and subsurface cutoff swale north on Broderson for discharge to bay
3	Pine Street	16-3.1	Curb & Gutter	Install curb and gutter to keep flows in Pine Avenue with direction to pump station
		16-3.2	Basin	Create terminal basins for surface flows originating upstream sub-areas 6C through 6F to aid in groundwater recharge.
		16-3.3	Storm Drain	Install storm drain north on Pine or connect to Henrietta storm drain (Solution 15-1.1)
4	Los Osos Valley Road	16-4.1	Storm Drain	A storm drain system tying existing inlets along Los Osos Valley Road to any proposed improvements to Tentative Tract 1643, thus providing an area wide storm drain collection, retention, and recharge improvements. Install additional inlets at LOVR at 9th Street, enlarge existing inlets, and combine storm drains
4	Los Osos Valley Road	16-4.2	Basin	Create terminal basins for surface flows originating upstream sub-areas 6C through 6F to aid in groundwater recharge.
5	Highland Drive	16-5.1	Basin	Construct sediment and recharge basin at southerly end of Broderson, Ravenna and Palisades. Install swales on Highland southerly right-of-way to intercept surface flows and direct to basin.
		16-5.2	Regrade Road	Regrade Highland Drive to provide crowned road section
6	Ramona	16-6.1	Regrade Road	Raise Ramona Avenue in certain sections to create new low point for collection of surface runoff
		16-6.2	Swale	Construct vegetated channel and culverts from the intersection of Pine Avenue at Ramona Avenue to existing swale at Broderson at Ramona. Reconstruct existing swale.
		16-6.3	French Drain	Install French drains along Ramona Avenue with outlet to existing swale at Broderson at Ramona

[1] Improvements to Tentative Tract 1643 property may include new termination basins. These basin should be incorporated into an overall storm drain system management for CSA 9J.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C3A16-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Problem 1: Sedimentation on Highland Drive

Alt	Description	Cost[1]
16.1a	***No Project:***	
16.1b	***Basin, Spill to Street:*** Construct 35 acre feet of retention basins in hillside, with three probable locations being at the southerly ends of Broderson, Ravenna and Palisades Avenues. Construct a series of staged diversion swales in the hillside running parallel to, and southerly of residential properties on Highland Drive, to capture surface flows and sediments. Diversion swales would outlet into the basins. Basin overland escape would be to their respective streets (Broderson, Ravenna and Palisades Avenues). Design should incorporate those proposed drainage facilities for the Broderson Recharge Site. The volume of retention, and the physical constraints in the hillside make this alternative potentially prohibitive. However, a lesser project including smaller detention basins (not retention) may be considered practical.	$650.3
16.1c	***Basin, Spill to Storm Drain:*** Same concept as presented in 16.1b only with basins to spill into storm drains rather than onto streets. Storm drains would extend down Broderson, Ravenna and Palisades Avenues and tie into the alternative Los Osos Valley Road Storm Drain system (see Alternatives 16.2b and c).	$824.7
16.1d	***Rock Berm:*** Construct a series of staged sediment berms (two or more rows) in the Highland Drive hillside, south of the residential development to slow surface flow velocities, and trap & filter sediments from the these surface flows (see Figure III-10). Would require easement, heavy construction equipment access for placement, and annual inspection and/or maintenance to clear trapped sediments. Is not expected to significantly reduce surface flows generating in the hillsides but may provide some infiltration potential as water ponds behind berm. Refer to Alternative 25.3b for extension of berm into Area 25.	$140.5
16.1e	***Intercept Channel:*** Construct intercept channel (see Figure III-9) extending from the State Park west of Pecho Valley Road, easterly along existing property lines, into a 60" culvert under Pecho Valley Road, then following property lines between Cabrillo Heights subdivision and Tract 2251, and onto the hillside area southerly, and parallel to Highland Drive. Continue channel easterly towards Bayview Heights Drive. Channel would be designed to maintain scouring velocities (keep it clear of sediments) and armored to reduce channel erosion. Channel armoring could achieved using concrete, asphalt, rock or fabric	$219.4

	materials. A regular maintenance program would be required to clean and repair channel as required. Assuming a design for a 25-year event, the channel required would be 6' wide, 2' deep and have 2:1 side slopes, or equivalent. This would require a minimum 20' access and maintenance easement. A 60" culvert would be required to convey flows under Pecho Valley Road. Construction of an intercept channel in the hillside would be difficult due to both physical and environmental constraints. Heavy equipment access during construction would be required. (Same as Alternative 25.3c)	

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

Problem 2: Control of Urban Runoff at Los Osos Valley Road

Alt	Description	Cost[1]
16.2a	*No Project:*	
16.2b	***Storm Drain to Ferrell Basin:*** Construct 60" storm drain with road inlets along Los Osos Valley Road. Alignment would include connection to existing storm drain system in Bayview Heights Drive (DI 16.11), new inlets on both sides of Los Osos Valley Road at its intersection with Bayview Heights Drive, Bush Drive, and would replace existing inlets on Los Osos Valley Road (DI 16.1 and DI 16.2) with new inlets on both sides of road. Storm drain would drain easterly and westerly under Los Osos Valley Road to a 60" collector under Palisades Drive, then northerly on Palisades Drive to the future Skyline Drive extension, the easterly on the future Skyline Drive extension to Ferrell Avenue, then northerly on Ferrell Avenue to alternative retention basin, Alternative 17.2a, at the north end of Ferrell Drive. Assuming this alignment, pipe sizes on Ferrell Avenue would need to be adjusted for Area 17 flows, and the Ferrell basin would be used for Los Osos Valley Road storm drain storage. The required basin retention capacity would be 55.4 acre feet. This additional volume would need to be added to the estimated retention capacity of 20 acre feet required by Alternative 17.2a. It is assumed that this size basin is impractical. Therefore, the Ferrell basin should be sized to retain Area 17 flows, then enlarged accordingly to act as a sediment basin for Area 16 flows. A basin discharge pipe would be required for this alternative. The pipe would be sized based on design storage of the Ferrell Basin, the portion of Area 17 flows, and Los Osos Valley Road flows. It is expected that a 72" storm drain may be required assuming alternative improvements to Areas 16 & 17 are made. Discharge storm drain alignment would be northerly towards Sweet Springs.	$881
16.2c	***Storm Drain to Morro Shores Basin:*** Similar Los Osos Valley Road storm drain alignment as Alternative 16.2b, but with the storm drain collection point being at LOVR and Ravenna Avenue rather than at Palisades Drive. The storm drain would extend north on the Ravenna Avenue (future improvement per Tract 1643, Morro Shores), connect	$625.3

	to the proposed basin for the Morro Shores Project, with basin discharge north on Broderson Avenue in a 72" storm drain to the Bay. To provide retention of Los Osos Valley Road storm flows, a 67.3 acre feet basin may be required. This amount of retention storage is not considered practical without purchasing a portion of Tract 1643 for basin recharge use. However, the proposed Tract 1643 basin could be designed as a sedimentation basin for both Los Osos Valley Road and Tract 1643 storm flows.	

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

Problem 3: Minor Local Problems and Typical Bay Fringe Conditions:
Installation of the alternative Los Osos Valley Road storm drain facilities is expected to greatly reduce the storm water volumes entering the Skyline, Ash & Broderson area and associated flooding problems. Any alternative improvements for this area may be postponed or eliminated (excluding curb & gutter alternative for Binscarth) assuming installation of the Los Osos Valley Road storm drain system.

Alt	Description	Cost[1]
16.3	***Curb & Gutter, Skyline, Binscarth:*** Construct curb & gutter on Binscarth Drive between Pecho Valley Road and Pine Avenue (see Alternatives 14.1b & 15.2 Category 2) and cross-gutters at the intersection of Don Avenue with Binscarth Drive. This would redirect surface flows to Doris Avenue, them north on Doris Avenue to an existing low-point midblock between Binscarth Drive and Lupine Street. Construct curb & gutter on Doris Avenue with overside drain and cross-gutter at the existing low-point to drain Doris Avenue. Surface flows would enter into Bay.	$160.1
16.4a	***Curb & Gutter, Pine Street:*** Construct curb & gutter on Pine Avenue from point of improvement per Alternative 14.2b northerly to Ramona Avenue. Construct cross-gutters to keep surface flows in Pine Avenue at its intersections with Skyline, Ash, Henrietta, Loma, Binscarth, Mitchell and Vine. Provide road inlets and 18" culverts under Ramona Avenue at its intersection with Pine Avenue to capture and drain surface flows into marsh area. Due to relatively flat grades, the 18" culverts may require concrete encasement under Ramona Drive.	$166.1
16.4b	***Storm Drain, Pine Street:*** Construct 24" storm drain in Pine Avenue from the marsh area southerly to Ash Street, then easterly on Ash Street to the existing low-point located midblock. Construct road inlets at low-point on Ash Street, at the intersection of Pine Avenue and Binscarth Drive, Pine Avenue at Mitchell Drive, and at the intersection of Pine Avenue at Ramona Avenue.	$331
16.5	***Cross-Gutter, Ramona Avenue:*** Construct cross-gutters on Ramona Avenue at its intersection with Pine Avenue and a vegetated swale from the edge of pavement north into the existing wetlands. This would allow for drainage of the intersection with by providing surface flows heading north on Pine Avenue to cross Ramona and enter into swale for dispersion into the wetlands.	$6.5

[1] Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 16.1a: Sedimentation on Highland Drive-No Project
Continued nuisance of sediment deposition on streets and flooding of residential properties in Sub-areas 16C through 16E.

Alternative 16.1b: Sedimentation on Highland Drive-Basin, Spill to Streets
Local and Community benefits associated with the collection and recharge of surface flows originating on the southerly hillsides. Should also reduce the volume of storm flow reaching Los Osos Valley Road.

Alternative 16.1c: Sedimentation on Highland Drive-Basin, Spill to Storm Drain
Same benefits as Alternative 16.1b.

Alternative 16.1d: Sedimentation on Highland Drive- Berms
Local benefits associated with the potential removal of sediments from surface flows originating on the southerly hillsides. Not expected to have any impacts on the volume of storm flow currently draining to Los Osos Valley Road.

Alternative 16.1e: Sedimentation on Highland Drive-Intercept Channel
Local and community benefits associated with the potential interception of surface flows originating on the southerly hillsides from reaching Los Osos Valley Road. Reduction in flow volumes would allow for reducing storm drain system pipe sizes, as presented in Alternative 16.2b and c.

Alternative 16.2a: Control of Urban Runoff-No Project
No benefits, continued severe flooding on Los Osos Valley Road, an Arterial road.

Alternative 16.2b: Control of Urban Runoff-Ferrell Basin
Community benefits from storm drain collection of storm surface flows on Los Osos Valley Road and potential recharge of the upper aquifer to limit salt water intrusion. Interception of surface flows on Los Osos Valley Road is expected to reduce flooding of the Skyline/Ash/Broderson area. Should also reduce surface volumes entering the existing pump station at Don Avenue at Mitchell Drive.

Alternative 16.2c: Control of Urban Runoff-Morro Shores Basin
Same benefits as Alternative 16.2b

Alternative 16.3: Minor Local Problems-Curb & Gutter, Binscarth

Local benefits include redirection of a portion of the storm flow from Pine Avenue, thus reducing flow volumes entering the existing pump station on Don Avenue at Mitchell Drive, and flow volumes reaching the intersection of Pine Avenue at Ramona Avenue.

Alternative 16.4a: Minor Local Problems-Curb & Gutter, Pine

Local benefits include channalization of surface storm flows on Pine Street and reducing adjacent lot flooding from flows leaving the street. May adversely increase the arrival time of surface flows reaching the existing pump station and the intersection of Don Avenue at Mitchell Drive, creating additional flooding concerns.

Alternative 16.4b: Minor Local Problems-Storm Drain, Pine

Local benefits include collection of surface storm flows on Pine and Ash Streets and reducing adjacent lot flooding. May reduce flow volumes entering the existing pump station on Don Avenue at Mitchell Drive, and flow volumes reaching the intersection of Pine Avenue at Ramona Avenue.

Alternative 16.5: Minor Local Problems-Cross Gutter, Ramona

Local benefits include channalization of surface storm flows on Ramona Avenue and reduce incidence of road flooding. Would provide an escape route for water ponding on the roadway. However, water would continue to drain across the surface of the roadway which, during even minor storm events, may cause the road to be impassable.

c. Significant Environmental Effects of the Alternatives:

1. No Project

With this alternative, the deposition of sediment on Highland Drive, uncontrolled runoff along and over Los Osos Valley Road, and flooding through residential areas near the intersection of Skyline and Broderson would continue and probably increase in severity. In particular, the conversion of the natural area south of Highland Drive from a "sheet flow" condition to a "concentrated runoff" condition, apparently as the result of use by equestrians, hikers and ORV's, has increased since the end of the drought of 1987-1991, and this problem may intensify as the channels of concentration become increasingly established. Also, as building resumes with implementation of the sewer project, runoff to Los Osos Valley Road will increase, and the flooding problems in this area and their associated environmental impacts will also increase if drainage improvements are not implemented prior to or concurrently with the increased development.

2. Problem Condition 1: Sedimentation on Highland Drive

The solution to Problem Condition 1 is proposed to be sedimentation basins at the upper ends of Broderson, Ravenna and Palisades Avenues with retention capacity to contain a 50-year storm. Alternative outlet systems to carry overflow from the basins in storms greater than 50-year frequency are proposed to be: 1) discharge to the streets; or 2), discharge to a storm drain system.

The potentially significant environmental effects of the proposed project and its alternative outlet systems are summarized below based on discussions in Appendix C4. Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are also summarized in Appendix C5.

Loss of essential habitat of the endangered Morro Bay kangaroo rat:

The locations of the proposed basins are within an area, the Bayview Site, previously designated as "essential habitat" of the endangered Morro Bay kangaroo rat. Surveys for the presence of this species at this location have not been conducted for more than 10 years. However, it is expected that, in the absence of an adopted recovery plan, any loss of the habitat of this species at this location would result in a significant and unavoidable impact on this endangered species.

Loss of habitat of the endangered Morro shoulderband snail:

The locations of the proposed basins are within an area previously mapped as coastal dune scrub, habitat of the endangered Morro shoulderband snail. Surveys for the presence of this species on the nearby Broderson recharge site have discovered the presence of this species, and it must be presumed that they are also present at the sites of the proposed basins. It is expected that, in the absence of an adopted recovery plan, any loss of the habitat of this species at this location would result in a significant and unavoidable impact on this endangered species.

Loss of habitat of other species of concern:

Based on mapping of this area conducted in 1986 for alternative locations for a wastewater recharge site (Morro Group, 1987, p. VII-27 to VIII-29), the sites of the proposed basins may be the locations of other species of concern including: dune almond, Morro Manzanita (federally threatened), Monterey spineflower, Blochman's leafy daisy, saint's daisy, San Luis Obispo wallflower and curly leaf mondarella. It is expected that potentially significant impacts to these species could be mitigated to insignificance by revegetation in the habitat outside the area needed for construction of the basins.

Based on the above, the potential for implementation of this problem solution must be considered minimal at best, at least until recovery plans for the Morro Bay kangaroo rat and the Morro Bay banded dune snail have been adopted and implemented. The Morro shoulderband snail problem has affected many projects in the South Bay, including the State-mandated sewer project, and it is likely that this issue will be resolved soon. However, the Bayview Site has, in the past, been considered a prime candidate to be set aside for recovery of the Morro Bay kangaroo rat, and resolution of this issue appears unlikely in the near future.

Feasible alternatives for extracting the sediment from the runoff from this area have not been identified. The choice of alternative outlet systems would not significantly affect this determination, nor would the choice of an outlet system result in significant impacts that cannot be mitigated by the implementation of routine measures.

3. Problem Condition 2: Control of Urban Runoff at Los Osos Valley Road

For purposes of evaluating environmental impacts, the alternatives for controlling the runoff along Los Osos Valley Road can be considered as consisting of two parts: 1) facilities for collecting, conveying and temporarily storing the runoff (collection system); and 2) the discharge of the runoff to the bay and/or the sensitive wetlands at the fringe of the bay.

Collection facilities:

The primary environmental concern related to either of the alternative collection systems is that they would both require the construction of a sedimentation/detention basin and associated storm drain facilities in what is now disturbed areas of coastal dune scrub that may be habitat for the banded dune snail. Until this situation is resolved, construction of these facilities may have a significant, unavoidable impact on the endangered Morro shoulderband snail.

Bay/Wetland discharge:

It is the perception of the environmental consultants preparing this report that, in general, increasing the discharge of fresh water to the bay, or to the freshwater/brackish water wetlands at the edge of the bay, would be environmentally beneficial provided these discharges do not carry significant amounts of sediment or contaminants. Since the proposed facilities would include at least one basin to extract excess sediment and infiltrate "first flush" runoff, these potential impacts can be avoided.

Potential impacts to the endangered saltmarsh bird's beak:

There is a more specific condition in the wetland at the north end of Broderson Avenue in that the existing discharge at this location does not flow directly to the bay, but rather disperses westerly in the Sweet Springs Preserve to a wetland feature previously described as a freshwater spring (see Appendix C4). This feature has previously been identified as habitat of the endangered saltmarsh bird's beak, and it is not known at this time if additional freshwater discharge through this marsh would be adverse or beneficial to this species.

This issue can be resolved during preparation of the expected EIR for this project, and the discharge facility designed accordingly. If additional freshwater discharge to the marsh would be beneficial to this species, then the new discharge could be released to flow through the marsh. If it would be adverse, then the additional discharge could be carried directly to the bay, leaving the existing, local discharge to the marsh unchanged.

d. Regulatory Implications:

Additional Environmental Review

It is expected that implementation of any of the alternatives above, except no project, would require the preparation of an EIR because: 1) all of these alternatives involve potentially significant impacts on federal- and/or state-listed endangered species; and 2), these potential impacts may differ depending on the choice of the alternatives proposed herein, or other, now undefined potential alternatives, the consideration of which is required by the State and Federal Endangered Species Acts.

Responsible Agencies and Groups:

Preparation of the expected EIR, and implementation of an alternative in this problem area, would require input and/or permits from the following agencies and groups:

1. County of San Luis Obispo-Land Use and Grading Permits
2. Regional Water Quality Control Board-Discharge Permits
3. California Coastal Commission-Coastal Zone Permits in White Hole Areas
4. U.S. Fish and Wildlife Service-Biological Opinion
5. U.S. Corps of Engineers-Section 404 Permits

In addition to the permitting agencies, there are local groups that may wish to comment on the project. These include the following:

1. National Estuary Program
2. Bay Foundation of Morro Bay
3. Friends of the Estuary
4. Department of Fish and Game
5. Department of Parks and Recreation
6. Los Osos Citizen's Advisory Committee (LOCAC)
7. Los Osos/Baywood Park Chambers of Commerce
8. County Service Area 9 Advisory Committee
9. Other Special Interest Groups

C3A27: DRAINAGE AREA 27, LOS OSOS VALLEY ROAD & CIMMERON

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C3A27.1f.

a. Drainage Area Considerations

Watershed 27 can be divided into two sub-areas. That area of the drainage area southerly of Los Osos Valley Road and the sub-area northerly of Los Osos Valley Road. The surface drainage region of Area 27 southerly of Los Osos Valley Road is approximately 175 acres. Surface flows generate primarily in the southerly hills and agricultural lands of the drainage area by an easterly high point. Because this drainage area is topographically separated from the Los Osos Creek drainage area, surface flows migrate northerly towards Los Osos Valley Road (which acts as a dam), through existing 30" and 36" culverts, then into a channel (northerly sub-area) which runs northerly and downslope from Los Osos Memorial Park with eventual outlet into Turri Creek.

b. Groundwater Considerations

Undetermined but appears that surfacing groundwater may be a consideration within this drainage area due to the topographical characteristics of being in a natural low lying area.

c. Existing Drainage Improvements

Los Osos Valley Road provides a damming affect for surface flows separating the southerly upper elevations from the northerly drainage area. In the late 1970's during the widening of Los Osos Valley Road (LOVR) a single culvert (27.1) under LOVR was extended to the adjacent land owners property, a second culvert (27.2), and a curb inlet (27.4) on the northerly side of Los Osos Valley Road which is connected to the existing culvert (27.3) via a storm drain were also added. There are three other localized culverts extending under Sombrero Drive which drain easterly with outlet towards the channel. The adjacent property owner later extended the existing culverts 27.1 & 27.2 further northerly under his property.

In addition, there exists an 18" CMP (27.7)culvert under Cimmeron Way at its intersection with Los Osos Valley Road. Flows heading easterly in the southerly Los Osos Valley Road swale have been documented as leaving the swale due to insufficient culvert capacities and flooding southerly properties along Cimmeron Way.

d. Problems within Drainage Area

Los Osos Valley Road Flooding: Water accumulates southerly of Los Osos Valley Road at the culvert inlets. When these inlets become overtaxed, the water migrates westerly and floods Los Osos Valley Road at its low point near Cimmeron. Local residents have stated that there have been a number of vehicle related accidents associated with the flooding of Los Osos Valley Road and that flooding occurs on a regular basis.

There appear to be two factors causing this overtaxation of the existing culverts. First, the culverts are inadequate based on existing conditions, requiring additional *water* head to pass a storm event through the culverts. This required head cannot be achieved without the breaching of Los Osos Valley Road. Second, the outlet condition of the culverts appears to be degraded. The existing channel is relatively flat and has experienced sedimentation thus reducing its hydraulic capacity for discharge.

Residential Flooding North of LOVR: Residential flooding east of Sombrero Drive has been documented due to the sedimentation and the natural sump conditions of the existing northerly channel with additional drainage problems at Lariat at Tapidero.

Residential Flooding South of LOVR: One residence on Cimmeron has reported frequent flooding of yard, garage and residence. A study prepared by John Wallace & Associated for Mr. Mitch Gantz on July 14, 1995, stated that this flooding may be due to a number of factors. These factors include the inadequate capacity of the existing culverts and uncontrolled drainage along Los Osos Valley Road.

e. Expected Changes with Implementation of Sewer Project

Not applicable, surface water problem.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Flooding of LOVR	27-1.1	Culverts [1]	Add additional culverts or replace existing.
		27-1.2	Berm	Construct an earth berm along the southerly edge of LOVR right-of-way to provide the head required to pass the storm.
		27-1.3	Improve Channel	Improve the existing channel from the culvert outlet northerly 300' (approx.). This option should be pursued in conjunction with all other solutions.
		27-1.4	Install Storm Drain	Install storm drain near the southeasterly corner of the intersection of Cimmeron Way at Los Osos Valley Rd, extending northerly under LOVR, then continuing northerly under Sombrero and through existing agricultural lands with discharge into the Warren Lake area.
2	Residential Flooding south of LOVR	27-2.1	Improve Channel	per 27-1.3
		27-2.2	Dike	Construct earth dike from culvert outlet past residential area
		27-2.3	Raise Foundation	Raise house foundation above flood level.
		27-2.4	Basin	
		27-2.5	Improve Channel	Per 27-1.4

3	Residential Flooding north of LOVR	27-3.1	Basin	Construct shallow detention basin on south side of LOVR. Use excavated material as berm. Since this is a naturally flat area, may be considered wetland.
		27-3.2	Dike	Same as 27-2.2
		27-3.3	Raise Foundation	Same as 27-2.3
		27-3.4	Improve Channel	Per 27-1.4

[1] The owner of the property northerly of Los Osos Valley Road and directly above the existing culverts has expressed that he would cooperate with the County if they want to pursue replacing the existing culverts. However, his cooperation may be contingent on replacement using concrete box culverts (only) and other property improvements.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C3A27-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
27.1	***No Project:***	
27.2	***Maintenance:*** Regrade swale from Los Osos Valley Road culvert outlets northerly approximately 1000 feet to improve outlet conditions of the exiting culverts extending under Los Osos Valley Road and better define channel flowline. Use excavated material to build low berm along westerly edge of channel which should provide additional protection to residences along Sombrero Drive.	$7.6
27.3	***Storm Drain:*** Construct storm drain near the southeasterly corner of the intersection of Cimmeron Way at Los Osos Valley Rd, extending northerly under LOVR, northerly under Sombrero Drive, then northeasterly to connect with the existing drainage channel located east of existing agricultural operations.	

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 27.1: No Project

Continue intermittent flooding of existing residential lots.

Alternative 27.2: Maintenance

Localized benefits to residential properties adjacent to the existing swale easterly of Sombrero Drive.

Alternative 27.3: Storm Drain

Community benefits with increased removal of ponding water on Los Osos Valley Road, considered an Arterial roadway, and may alleviate residential flooding either side of Los Osos Valley Road.

c. Significant Environmental Effects of Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C4.

Alternative 27.1, No Project:
With this alternative, intermittent flooding of existing lots on Cimmeron would continue. Potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 27.2, Maintenance:
The existing swale on Los Osos Valley Road would be regraded to improve outlet conditions of exiting culverts extending under Los Osos Valley Road. It is expected that no significant environmental impacts will result from implementation of this alternative. However, there is potential for significant, but mitigable, short term impacts to traffic due the construction process.

Alternative 27.3, Swale:
It is expected that no significant environmental impacts will result from implementation of this alternative. However, there is potential for significant, but mitigable, short term impacts to traffic due the construction process.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

CATEGORY 4: AREAS WITH INADEQUATE SURFACE SLOPES:

Drainage Areas Included in Category 4:
- Area 17: Los Osos Valley Road
- Area 19: Santa Ynez at Mountain View
- Area 20: Santa Ynez at Fairchild
- Area 21: Vons Basin
- Area 22: Fairchild Basin

C4A17: DRAINAGE AREA 17, LOS OSOS VALLEY SOUTH

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C4A17.1f.

a. Drainage Area Considerations

The surface drainage region of Area 17 is approximately 232 acres. Surface flows generally migrate in a westerly direction on Ramona, San Luis, Nipomo, and Santa Ynez Avenues and into undeveloped lands east of the trailer park. Storm flows entering Area 17 from Areas 20, 21, & 22 migrate west on Los Olivos Avenue, north on 11th Street, west between commercial properties in an improved concrete swale to 10th Street, north on 10th Street, then west on Santa Ynez Avenue. If surface flow volumes increase, then this flow pattern deviates through property at the northwest intersection of 10th Street at Santa Ynez Avenue. Eventually, all surface flow from Area 17 enters the bay near Sweet Springs.

b. Groundwater Considerations

Groundwater depths dramatically vary in this drainage area due to the Los Osos fault which traverses this sub-area. Groundwater depths in the westerly portion of this sub-area begin at 0 feet at the bay and increase southerly to 50 feet at Los Osos Valley Road. Depth to groundwater in the easterly portion begin at 0 feet at the bay and increase to only 25 feet at Los Osos Valley Road.

c. Existing Drainage Improvements

There are four existing drainage facilities on Ramona Avenue near Sweet Springs Park. They include a culvert (17.1) crossing under Ramona Avenue just west of 4th Street, an inlet (17.2) on the north side of Ramona Avenue and east of culvert 17.1, an inlet (17.4) on the northside of Ramona Avenue just east of Broderson Avenue, and an inlet on Broderson Avenue (17.3) which is piped into the main drainage collection system of the adjacent trailer park. Culvert 17.1 and inlet 17.2 drain directly into Sweet Springs Park. Inlets 17.3 and 17.4 are connected and drain to an open channel at the northerly end of Broderson Avenue. In addition to the facilities on Ramona Avenue, a 6" storm line (17.5) ties the existing water storage tank to the Fairchild basin (22.A) and a concrete channel provides drainage from 11th to 10th Street, between Santa Ynez and Los Olivos Avenues.

d. Problems within Drainage Area

Most drainage problems in Area 17 area associated with road flooding. During a field visit on October 29, 1996, numerous surface ponding areas were documented. There are documented or known instances of cross lot drainage and one instance of reported septic tank failure. Street ponding occurs at the intersection of Ferrell Avenue at Bush Drive, at three locations on Nipomo Avenue, at two on 7th Street, at one on 9th Street, at one on 11th Street at the sidewalk drain, and at one location on 12th Street. Cross lot drainage occurs on 7th Street between Nipomo and San Luis Avenues, and again between San Luis and Ramona Avenues. A small sump area occurs along Santa Ynez between 9th and 10th Streets due to flat topography. Water runs from Santa Ynez past existing cross gutter and northerly along 9th Street causing flooding problems to adjacent lots.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that groundwater gradient under Area 17 generally migrates in a northwesterly direction towards the bay. Implementation of the sewer project will eliminate septic-tank discharge from portions of Areas 16 and 26, that due to the groundwater gradient partially contribute to Area 17 groundwater elevations. With the possible exception of Ferrell Avenue, implementation of the sewer project should have negligible impacts on drainage problems in Area 17.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Road Flooding	17-1.1	Curb and gutter	Install curb, gutter, driveway aprons and cross gutters on Nipomo and on Los Olivos, direct to west end of Santa Ynez and install basin.
		17-1.2	Storm Drain	From 12th Street west to Ferrell, north on Ferrell to bay, recharge basin, or over fault. On Nipomo from 11th Street west to 7th, north on 7th, then west on San Luis Avenue to join Ferrell system. Inlets at all intersection with possibility of incorporating areas 18, 20, 21 & 22.
		17-1.3	Basins	Retention or recharge basins on Santa Ynez at 9th, Nipomo at 9th, Ferrell at Bush, west end of Santa Ynez.
		17-1.4	Street Basin	Due to the relatively small watershed, subsurface (plastic) percolation basins could be used under the streets in conjunction with a porous pavement. Inlets could drain directly into these subsurface basins.
		17-1.5	Culvert	9th at Santa Ynez & Nipomo at 9th.
		17-1.6	French Drain	French drain the Ferrell area with discharge to the fault.
2	Residential Flooding	17-2.1	Private Basins	Each affected residence turn backyard into wet weather recharge basin.
		17-2.2	Cross lot swales	Create drainage easement with improvement (channel or storm drain) between and behind private residences.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C4A17-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
17.1	***No Project:***	
17.2a	***Ferrell Recharge Basin:*** Construct 19.0 acre foot Ferrell retention basin which would be bounded by Ramona Avenue, Ferrell Drive, 5th Street, and Los Osos Fault Strand B. Approximately 7.5 acres of open land is presently available for recharge; however, purchase of the land would be required. The alternative Ferrell basin could also be used to recharge a portion of storm waters receive from Los Osos Valley Road (see Alternative 16.2b). However, the amount of storage required to recharge Los Osos Valley Road may be impractical. Refer to Alternative 16.2b for further discussion.	$304
17.2b	***Santa Ynez Basin:*** Construct a 6.6 acre foot retention basin in the vacant lot at the northeast corner of the intersection of Santa Ynez and 8th Street to capture and recharge a portion of Area 17C surface runoff. Will require land acquisition for the basin and minor regrading of the intersection of Santa Ynez Avenue and 9th Street to provide positive westerly surface drainage. May also require curb & gutter, or roadside swales & culverts at each driveway and at each intersection to convey surface flows to basin. These surface improvements would extend east on Santa Ynez from the proposed basin to 11th Street.	$175.2
17.3a	***San Luis Storm Drain:*** Construct San Luis Avenue 30" storm drain system from alternative Ferrell recharge basin easterly under San Luis Avenue to 11th Street, then south on 11th Street to existing low-point at midblock. Construct road inlets at low-point on 11th Street and at low-point on San Luis Avenue east of 9th Street. Construct storm drain extensions with road inlets from alternative San Luis Avenue storm drain southerly on 6th Street to existing low-point, and northerly and southerly on 7th Street to existing low-points. Construct curb & gutter or roadside swales (per Figure III-2) on San Luis Avenue to facilitate surface drainage to inlets.	$152.5
17.3b	***Ferrell/Nipomo Storm Drain:*** Construct Ferrell Drive 36" storm drain system from alternative Ferrell recharge basin southerly on Ferrell Drive to intersection of Ferrell Drive and Bush Drive, then westerly on Bush to existing low-point. Construct approximately 1000 linear feet of curb & gutter on Ferrell and Bush to drain streets to existing low-point.	$392.6

	Provide 18" storm drain branch from the alternative Ferrell Drive storm drain easterly to Nipomo Avenue and extending under Nipomo Avenue to existing low-point at the intersection of 13th Street (see Alternative 18.2). Construct storm drain extensions from the Nipomo branch northerly on 8th Street to drain existing low-point midblock. Continue Nipomo branch southerly on 11th Street to Los Olivos Avenue, then east on Los Olivos to the existing low-point west of Fairchild Avenue. Provide road inlets at all intersections along the Nipomo branch, at the existing low-points on 11th Street, and at the existing low-point on Los Olivos. Provide connection to existing Fairchild and Von's basins (see Alternatives 21.3 & 22.3). Will require storm drain easements and land acquisition between Nipomo Avenue and Ferrell Drive.	
17.4	***Curb & Gutter:*** Regrade 6th Street between Ramona and San Luis Avenue and construct curb & gutter to eliminate cross-lot drainage problems.	$46.2

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 17.1: No Project
Nuisance flooding of roadways and cross-lot drainage would continue within Area 17.

Alternative 17.2a: Ferrell Basin
Local and community benefits include a centralized location for the collection and recharge of surface storm water flows.

Alternative 17.2b: Santa Ynez Basin
Local benefits for Santa Ynez Avenue and Ferrell Avenue. Limits cross-lot drainage that presently occurs between these two streets. Would reduce residential flooding near the intersection of Ferrell Avenue at Bush Drive.

Alternative 17.3a: San Luis Storm Drain
Local benefit includes drainage of San Luis Avenue and diversion of surface flows entering low-points both northerly and southerly of San Luis Avenue. Local reduction in cross-lot drainage and drainage of existing low-point in San Luis Avenue.

Alternative 17.3b: Ferrell/Nipomo Storm Drain
Local benefit to the Ferrell Avenue and Bush Drive road and cross-lot flooding problems, and drainage of Nipomo Avenue, 11th Street, and Los Olivos Avenue. Community benefits include drainage of Nipomo Avenue low-point in Area 18, and provides bleeder for existing Fairchild and Von's basins.

Alternative 17.4: Curb & Gutter

Local benefits include channalization of surface storm flows on specified streets, reduction in road ponding, reduction in adjacent lot flooding from flows leaving the street, and reduction in cross-lot drainage.

c. Significant Environmental Effects of Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 17.1, No Project:

Flooding of roadways and cross-lot drainage would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 17.2a, Ferrell Recharge Basin:

A recharge basin would be constructed between Ramona Avenue, Ferrell Drive, 5th street and Los Osos Fault Strand B. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the basin, and no overflow or discharge reaches bay via Los Osos Fault. However, there is potential for significant, but mitigable, short term impacts to traffic and other resources due to the construction process.

Alternative 17.2b, Santa Ynez Basin:

A recharge basin would be constructed in the vacant lot at the northeast corner of the intersection of Santa Ynez and 8th Street. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the basin, and no overflow or discharge reaches bay. However, there is potential for significant, but mitigable, short term impacts to traffic and other resources due to the construction process.

Alternative 17.3a, San Luis Storm Drain:

A drainage system for San Luis Avenue and diversion of surface flows entering low-points both northerly and southerly of San Luis Avenue would be implemented. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the storm drain system and does not flow to bay. However, there is potential for significant, but mitigable, short term impacts to traffic and other resources from construction activities.

Alternative 17.3b, Ferrell/Nipomo Storm Drain:
A drainage system for Ferrell Drive to the intersection of Bush Drive, and 1,000 linear feet of curb and gutter would be implemented. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the storm drain system and does not flow to bay. However, there is potential for significant, but mitigable, short term impacts to traffic and other resources from construction activities.

Alternative 17.4, Curb & Gutter:
A curb, gutter, and cross-gutter system may be implemented with this alternative. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the storm drain system and does not flow to bay. However, there is potential for significant, but mitigable, short term impacts to traffic and other resources from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C4A19: DRAINAGE AREA 19, SANTA YNEZ & MOUNTAIN VIEW

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C4A19.1f.

a. Drainage Area Considerations

The surface drainage region of Area 19 is approximately 49 acres. Surface flows within the drainage area generally migrate northerly on Mountain View then easterly on Los Olivos Avenue and again on Santa Ynez Avenue. Santa Ynez Avenue also receives surface flows from the northerly section of Fairchild Avenue. Storm flows from Santa Ynez and Los Olivos Avenues enter a 42 inch culvert (23.3) extending under South Bay Boulevard with eventual discharge to Eto Creek (Area 23).

b. Groundwater Considerations

Depth to groundwater in Area 19 ranges from 25 feet nearest Los Osos Valley Road to 70 feet near the intersection of Nipomo Avenue at Mountain View Drive. Drainage problems within this area can be attributed primarily to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

An existing inlet (19.1) on Mountain View north of its intersection with Los Olivos Avenue accepts surface flows from the improved roadway section. A storm drain connects inlet (19.1) to a swale on the east side of Mountain View near Los Olivos Avenue. This swale is severely silted, which decreases the hydraulic efficiency of the storm drain. A second inlet between Mountain View and South Bay Boulevard (19.2) was constructed in July of 1992 and appears to be more a site specific drainage solution and less an area specific solution. Newer developments in Area 19 and along Los Olivos Avenue have installed onsite retention basins.

d. Problems within Drainage Area

The County identified street ponding at the intersection of Santa Ynez Avenue and Mountain Drive. During the October 29, 1996 storm event, ponding was also present on Mountain Drive just south of Nipomo Avenue. This ponding appeared to impact the driveway of an existing residence. No residential flooding problems were identified.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges in Area 19 will tend to migrate easterly. This easterly migration of subsurface flows reduces the possibility that septic tank discharge from this area impact groundwater problems associated with the El Moro and Paso Robles depressions. Also, with sufficient depth to groundwater and this easterly migration, expected changes with the implementation of the sewer project may be negligible.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Road Flooding	19-1.1	Basin	Construct recharge basin at the southwest intersection of Nipomo at Mountain View, drain Mountain View via swales to basin. Construct recharge basin at southwest intersection of Santa Ynez at Mountain View, drain using swales.
		19-1.2	Storm Drain	Install storm drain in Mountain View from Nipomo and from Los Olivos towards Santa Ynez, incorporate DI 19.1. Discharge to culvert 23.3.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C4A19-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
19.1	***No Project:***	
19.2	***Retention Basin:*** Construct 0.3 acre-foot retention basin at southwest corner of the intersection of Mountain View Drive and Nipomo Avenue. Assuming 4' depth, approximately 60 square feet of land would be required for purchase. Install an 18" storm drain with road inlets at existing low-points to drain Nipomo Avenue to basin, or use cross-gutters and overside drains.	$22.4
19.3	***Storm Drain:*** Provide an 18" storm drain under Nipomo Avenue from existing low-point at north westerly corner of Nipomo Avenue at Mountain View Drive southerly to existing low-point on Mountain View, and discharge into new vegetated swale which would extend towards existing 42" culvert (Culvert 19.2) under South Bay Boulevard.	$9.7
19.4	***Swale***: Construct roadside swales per Figure III-2 having alignment per Alternative 19.3 with 18" culverts under Nipomo Avenue and Mountain View Drive (at existing low-point). Outlet into new vegetated swale extending easterly from existing low-point towards South Bay Boulevard with discharge to existing 42" (Culvert 19.2) culvert under South Bay Boulevard.	$8.1

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 19.1: No Project
Street flooding on Nipomo Avenue, which can be considered a Collector, would continue, as would street flooding on Mountain View Drive.

Alternative 19.2: Recharge Basin
Localized benefits would include reduction of flooding on Nipomo Avenue and Mountain View Drive. Community benefits include upper aquifer recharge.

Alternative 19.3: Storm Drain
Localized benefits would include reduction of flooding on Nipomo Avenue and Mountain View Drive. Community benefits include upper aquifer recharge.

Alternative 19.4: Swale
Localized benefits would include reduction of flooding on Los Olivos Avenue. Community benefits include basin bleeder for the Von's and Fairchild basins. Other community benefits include basin recharge at the point of discharge of the storm drain (Alternative Ferrell Basin)

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 19.1, No Project:
Street flooding on Nipomo Avenue and Mountain View Drive would continue with the No Project Alternative. Potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 19.2, Recharge Basin:
With this alternative, a recharge basin with storm drain system would be installed on the intersection of Mountain View Drive and Nipomo Avenue. It is expected that potentially significant, but mitigable impacts may occur to species of special concern in the area for the proposed recharge basin due to the presence of coastal scrub habitat. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction.

Alternative 19.3, Storm Drain:
A storm drain system would be constructed under Nipomo Avenue extending for several blocks towards South Bay Boulevard. There is potential for significant, but mitigable, short term impacts to traffic on a local scale due to construction activities.

Alternative 19.4, Swale:
A vegetated swale would be constructed per alternative 19.3, extending towards South Bay Boulevard. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction. However, vegetation of a swale has the potential to provide a filtering system, resulting in a possible reduction of contaminant and sedimentation levels in the water, in addition to improving visual resources in the area.

d. Regulatory Implications:

Additional Environmental Review:

It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C4A20: DRAINAGE AREA 20, SANTA YNEZ & FAIRCHILD

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C4A20.1f.

a. Drainage Area Considerations

The surface drainage region of Area 20 is approximately 5 acres. This is a localized low area with surface flows within the region generally concentrating on Santa Ynez Avenue, then spilling westerly towards Area 17B.

b. Groundwater Considerations

Depth to groundwater in Area 20 is constant at about 45 feet. Drainage problems within this area can be attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

There are no existing drainage improvements in this area.

d. Problems within Drainage Area

Santa Ynez Avenue is a flat unimproved section with a relatively small tributary area having poor drainage. No problems were identified in this area.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges in Area 20 will tend to migrate easterly. This easterly migration of subsurface flows reduces the possibility that septic tank discharge from this area impact groundwater problems associated with the El Moro and Paso Robles depressions. Also, with sufficient depth to groundwater and this easterly migration, expected changes with the implementation of the sewer project may be negligible.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Street Ponding	20-1.1	Storm Drain	Extend Area 19 storm drain (Solution 19-1.2) up Santa Ynez to intercept low area. Construct storm drain to discharge to Area 19 basin at Santa Ynez at Mountain View (Solution 19-1.1)
		20-1.2	Basin	Construct terminal recharge basin southerly of Santa Ynez, use swales to direct flows to basin.
		20-1.3	Regrade Street	Redefine street high point to force water either east or west with potential negative impact on Area 17C or Area 19, respectively.

2. Secondary Evaluation & Screening

Based on further review of the existing topographical information, Area 20 has been incorporated with Area 17-B.

C4A21: DRAINAGE AREA 21, VONS BASIN

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C4A21.1f.

a. Drainage Area Considerations

The surface drainage region of Area 21 is approximately 8 acres. This is a paved area with surface flows within the region encompassing primarily the Vons Shopping Center. Topographically, surface flow not captured onsite by the existing basin (21.A) would collect on Los Olivos Avenue, migrate westerly to 11th Street and into Area 17C. Refer to Area 17C for continuation of flow.

b. Groundwater Considerations

Depth to groundwater in Area 21 is constant at about 20 feet. Drainage within this area is attributed to surface runoff due to a large paved area and not to elevated groundwater conditions.

c. Existing Drainage Improvements

An existing terminal basin (21.A) is used to capture all surface flows generated onsite and a portion of surface flows from a lot to the east. There is no offsite surface runoff entering the basin. The existing basin 21.A capacity was determined and is presented in Table III-5, below.

TABLE III-5: EXISTING CAPACITY, VONS BASIN

Storm Event	Basin 21A Water Surface Elevation
10 yr.	115.8 ft
50 yr.	118.1 ft
100 yr.	119.7 ft

d. Problems within Drainage Area

According to the County, the Vons basin had reportedly spilled and flooded adjacent properties to the west in 1995.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges and basin percolation in area 21 will tend to migrate northeasterly. This northeasterly migration of subsurface flows reduces the possibility that subsurface discharge from this area impact groundwater problems associated with the El Moro and Paso Robles depressions. Also, with sufficient depth to groundwater and this easterly migration, expected changes with the implementation of the sewer project may be negligible.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Basin Flooding	21-1.1	Basin	Enlarge existing basin.
		21-1.2	Basin	Hydraulically connect Vons basin to Fairchild Basin
		21-1.3	Basin	Construct new recharge basin in undeveloped area on north side of Los Olivos, hydraulically connect with Vons basin.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C4A21-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
21.1	***No Project:*** Private Basin	
21.2	***Retention Basin:*** Construct new 2.2 acre-foot retention basin at northeast intersection of Fairchild and Los Olivos Avenue and hydraulically connect all three basins (Vons, Fairchild, and new basin). Construct road inlets on Los Olivos Avenue to drain existing low-point into basins. Will required land acquisition and storm drain infrastructure.	$44.6
21.3	***Storm Drain:*** Connect Vons basin to alternative storm drain (see Alternative 17.3b) to allow spill to enter storm drain system and discharge to alternative Ferrell Drive recharge basin.	$392.6

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 21.1: No Project

The Von's basin is privately owned and maintained.

Alternative 22.2: Recharge Basin

Localized benefits would include reduction of flooding on Los Olivos Avenue. Community benefits include additional storage capacity for the Vons and Fairchild basins, and upper aquifer recharge.

Alternative 23.3: Storm Drain

Localized benefits would include reduction of flooding on Los Olivos Avenue. Community benefits include basin bleeder for the Von's and Fairchild basins. Other community benefits include basin recharge at the point of discharge of the storm drain (Alternative Ferrell Basin)

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 21.1. No Project:
With this alternative, the Von's basin would remain privately owned and maintained. Potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 21.2. Recharge Basins:
A new recharge basin would be constructed at the northeast intersection of Fairchild and Los Olivos Avenue, hydraulically connecting all three basins. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming that the vegetation in the proposed area for basin construction consists of non-native and/or exotic species, lowering the possibility for presence of "species of special concern". However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 21.3. Storm Drain:
A storm drain system would be constructed to allow spill from the Von's basin to discharge into the Ferrell Drive recharge basin. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C4A22: DRAINAGE AREA 22, FAIRCHILD BASIN

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C4A22.1f.

a. Drainage Area Considerations

The surface drainage region of Area 22 is approximately 29 acres. Topographically, surface flow not directed to the existing Fairchild basin (22.A) would collect on Los Olivos, migrate westerly to 11th Street and into Area 20. Refer to Area 20 for continuation of flow. The natural drainage course for Los Olivos Avenue was an easterly and westerly split but this existing drainage course has been disrupted by development. Presently, a high point on Fairchild splits water southerly to Los Osos Valley Road where existing inlets capture the flow and return it to the Fairchild basin. Surface flow migrating northerly on Fairchild is intercepted by additional inlets at the intersection of Fairchild at Los Olivos and directed into the basin. From the easterly boundary of Areas 22 and 19, surface flow runs westerly on Los Olivos Avenue. This flow, and flows not captured by the existing storm drain system tend to accumulate in the region called the Los Olivos Depression.

b. Groundwater Considerations

Depth to groundwater in Area 22 ranges from 20 feet near the intersection of Fairchild Avenue at Los Olivos Avenue to 40 feet in the southwesterly portion of the area. Drainage within this area is attributed to surface runoff due to a largely paved area and not to elevated groundwater conditions.

c. Existing Drainage Improvements

An existing storm drain collection system collects surface runoff beginning on Los Osos Valley Road at its intersection with Fairchild Avenue (inlets 22.5 & 22.6). The storm drain continues down Fairchild Avenue collecting surface runoff from road inlets (22.2, 22.3, & 22.4) and one inlet on Los Olivos Avenue (22.1). The storm drain system terminates at Fairchild basin (22.A). A privately owned basin (22.B) exists directly across Los Olivos Avenue from the Fairchild basin. Inlets (22.5) and (22.6) were installed as a result of flooding at the intersection of Fairchild Avenue at Los Osos Valley Road. The existing basin (22.A) capacity was calculated and is presented in Table III-6, below.

TABLE III-6: EXISTING CAPACITY, FAIRCHILD BASIN

Storm Event	Basin 22A Water Surface Elevation
10 yr.	123.5 ft
50 yr.	127.3 ft
100 yr.	130.4 ft

d. Problems within Drainage Area

Flooding of Los Olivos Avenue just east of the Fairchild basin is a regular event, even in minor storms. Existing businesses have flood related problems as a result of the Los Olivos depression. Additionally, infrequent pumping of the Fairchild basin is directed westerly on Los Olivos Avenue resulting in flooding problems in Area 17C (refer to Area 17). According to the County, the Fairchild Basin had reportedly filled in 1995.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges and basin percolation in Area 22 will tend to migrate northeasterly. This northeasterly migration of subsurface flows reduces the possibility that subsurface discharge from this area impact groundwater problems associated with the El Moro (Area 6) and Paso Robles (Area 7) depressions. Also, with sufficient depth to groundwater and this easterly migration, expected drainage related problems with the implementation of the sewer project may be negligible.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Los Olivos Flooding	22-1.1	Catch Basin	Install catch basin at the northwest corner of Fairchild at Los Olivos. Drain to basin 22.A or 22.B.
		22-1.2	Enlarge Existing Basin	Enlarge the Fairchild basin to accommodate Los Olivos water. Potential shallow depths to groundwater may be present during winter months, therefore basins should be enlarged horizontally, not vertically.
		22-1.3	Connect Basins	Hydraulically connect the Vons basin (21.A), Fairchild basin (22.A) and the private basin (22.B) and drain Los Olivos into basins. Enlarge as necessary or construct overflow storm drain easterly along Los Olivos for incorporation with *potential* Mountain View storm drain (Solution 19-1.2). All three basins share the same approximate top & bottom elevations (within a foot on the top, with the Von's basin being about 6' deeper than the others.
		22-1.4	Storm Drain	Construct storm drain easterly along Los Olivos for incorporation with *potential* Mountain View storm drain (Solution 19-1.2)
		22-1.5	Basin	Construct new recharge basin in undeveloped area on north side of Los Olivos, drain to basin with swale and culverts.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C4A22-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
22.1	***No Project:***	
22.2	***Retention Basin:*** Construct new 2.2 acre foot retention basin at northeast intersection of Fairchild and Los Olivos Avenue. Hydraulically connect the Fairchild and Vons basins to the new basin and provide storm drain and inlets at existing low-point in Los Olivos with discharge to Fairchild Basin (see Alternative 21.2).	$44.6
22.3	***Storm Drain:*** Connect Fairchild basin to alternative storm drain (see Alternative 17.3b) to allow spill to enter storm drain system and discharge to alternative Ferrell Drive recharge basin.	$392.6

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 22.1: No Project
Flooding of Los Olivos Avenue and possible future basin spillage could continue.

Alternative 22.2: Recharge Basin
Localized benefits would include reduction of flooding on Los Olivos Avenue. Community benefits include additional storage capacity for the Fairchild basin, which accepts flow volumes from portions of Areas 16, 22, and 26, and upper aquifer recharge.

Alternative 22.3: Storm Drain
Localized benefits would include reduction of flooding on Los Olivos Avenue. Community benefits include basin bleeder for the Fairchild basin, which accepts flow volumes from portions of Areas 16, 22, and 26. Other community benefits include basin recharge at the point of discharge of the storm drain (Alternative Ferrell Basin)

c. Significant Environmental Effects of Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 22.1, No Project:

With this alternative, flooding of Los Olivos Avenue and future basin spillage could continue. Potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 22.2, Recharge Basin:

A new recharge basin would be constructed at the northeast intersection of Fairchild and Los Olivos Avenue, hydraulically connecting all three basins, and providing storm drain and inlets at existing low points on Los Olivos. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming that the vegetation in the proposed area for basin construction consists of non-native and/or exotic species, lowering the possibility for presence of "species of special concern". However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 22.3, Storm Drain:

A storm drain system would be constructed to allow spill from the Fairchild basin to discharge into the Ferrell Drive recharge basin. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:

It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

CATEGORY 5: AREAS WITH CLOSED DEPRESSIONS HAVING LIMITED SURFACE DRAINAGE

Drainage Areas Included in Category 5:

- Area 9: 14th Street to 17th Street Depression between Pismo and Ramona
- Area 10: San Luis Avenue, 1300 Block to South Bay Boulevard
- Area 18: Nipomo, 1200 Block to Mountain View

C5A9: DRAINAGE AREA 9, 14TH TO 17TH STREET DEPRESSION BETWEEN PISMO & RAMONA

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C5A9.1f.

a. Drainage Area Considerations

The surface drainage region of Area 9 is approximately 16 acres. A natural topographic depression exists resulting in surface flows concentrating midblock of 14th through 18th Streets between Pismo and Ramona Avenues. Surface flow migrates through residential properties beginning east of 13th Street and continuing easterly in this cross-lot fashion to 18th Street. The outlet of this natural depression is towards an existing culvert (12.2) which extends under South Bay Blvd. (refer to Area 12) with ultimate outlet to Los Osos Creek.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 20 to 25 feet. Drainage problems within this area are attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

In 1987 a drop inlet (9.1) was installed midblock on 16th Street with a storm drain carrying flows to a new retention basin (9.A) located midblock on 17th Street. Basin (9.A) was installed having a basin bleeder pipe outlet midblock of 18th Street.

d. Problems within Drainage Area

Cross lot drainage occurs due to the natural topography of the area causing flooding of residential properties. In 1987 an inlet and pipe were constructed to drain standing water from 16th Street to 17th Street, where a detention basin was constructed. It is assumed that this has alleviated the drainage problems of 16th and 17th Streets. However, complaints of residential property flooding have been documented at 14th and 15th Streets.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the groundwater *high* traverses southwest to northeast between 14th and 15th Streets below Area 9. Due to this high, septic tank discharges in the region west of 14th Street may aggravate the groundwater problems experienced in both the Paso Robles (Area 7) and El Moro (Area 6) depressions, albeit a relatively small contributing factor. East of the groundwater high, the groundwater gradient suggests that discharges in this area migrate east towards the Eto Creek watershed. Although expected changes with the implementation of a sewer project may be negligible in Area 9, beneficial results may be experienced in other areas as a result.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	14th to 15th Cross Lot Drainage	9-1.1	Storm Drain	Continue 16th St. storm drain westerly through properties to 14th Street. Install catch basins in 14th and 15th Street and provide for residential lot connection to storm drain. May require that large pipe be installed at inlet 9.1, and increase in basin 9.A storage capacity.
		9-1.2	Basin	Purchase lots in depression and create recharge basins. The Ramona Lake is not a good location due to shallow depth to groundwater.
		9-1.3	Subsurface Basin	Due to the relatively small watershed, subsurface (plastic) percolation basins could be used under the streets in conjunction with a porous pavement. Inlets could drain directly into these subsurface basins.
		9-1.4	Cross lot swales	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.
		9-1.5	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
		9-1.6	Drain to Sewer	Temporary storm drain connection to the new sewer treatment plant for affected parcels only to drain yards.
		9-1.7	Pump	Install sump and sump pumps in the right-of-way at the low points of both 14th and 15th Streets. Discharge to fault.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C5A9-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
9.1	***No Project:***	
9.2	***Storm Drain:*** Install 18" storm drain on 15th from low point between Pismo and Ramona Avenues north on 15th Street and daylight to 15th Street north of Pismo Avenue. Install 18" storm drain on 16th from low point between Pismo and Ramona Avenues north on 16th Street and daylight to 16th Street north of Pismo Avenue. Flows daylighting from 15th and 16th Streets would enter Area 7 (Paso Robles Depression), a presently impacted drainage area, resulting in a surface flowrate increase of approximately 7 cfs during a 25-year storm event.	$33.4
9.3	***Cross Lot Drainage:*** Install 12" storm drain or surface drain from low-point on 15th Street easterly through residential area to low-point on 16th Street, then an 18" storm drain from low-point on 16th Street to 17th Street. Connect to and replace existing cross-lot storm drain with 18" culvert extending into the existing basin. Due to limited storage of the existing basin, and limited expansion area, the additional flows associated with this Alternative would need to be routed through the existing basin, and the bleeder pipe would need to be replaces with an 18", utilizing the same exiting discharge alignment.	$57.3
9.4	***Porous Pavement:*** Replace existing pavement on 15th and 16th Street between Ramona and Pismo Avenues with a porous pavement to increase surface permeability and facilitate surface drainage. A project of this type would provide the County with a "test case" that may yield information practical to its use in other areas of the community. Further analysis would be required to identify existing conditions prior to construction, thus providing a point of reference.	$45.8

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 9.1: No Project
Nuisance road flooding on 14th and 15th Streets and cross-lot drainage between from 14th Street to 15th Street, between Pismo and Ramona Avenues. There is little community benefit by reducing the ponding on the streets in this area since they can be considered Local roadways.

Alternative 9.2: Storm Drain
Localized benefit in the depressed lots and roadways of Areas 9. Alternative storm drain would increase storm volumes entering Area 7, an already impacted drainage basin which is also in a depressed area.

Alternative 9.3: Cross-lot Drainage
Localized benefit to allow positive drainage for the residential lots and streets within the existing depression. Installation of the culvert across existing lots will aid in reducing localized road ponding on 14th and 15th Streets. Would require enlargement of existing basin or increasing the size of the basin bleeder pipe. Community benefits can be associated with the recharge of the upper aquifer.

Alternative 9.4: Porous Pavement
Localized benefit to allow positive drainage for the residential lots and streets within the existing depression. Community benefits can be associated with the recharge of the upper aquifer.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 9.1, No Project:
Flooding of roadways and cross-lot drainage would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 9.2, Storm Drain:
With this alternative, a storm drain system would be installed to alleviate the road flooding and cross-lot drainage in area. There is potential for significant, but mitigable, short term impacts to traffic on a local scale due the construction process of this alternative.

Alternative 9.3. Cross Lot Drainage:
A storm drain or surface drain would be constructed to drain easterly through residential area between 15th and 16th, into the existing basin on 17th Street. There is potential for significant, but mitigable, short term impacts to traffic and other resources on a local scale from construction activities.

Alternative 9.4. Porous Pavement:
With this alternative, porous pavement would replace existing asphalt roadway. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C5A10: DRAINAGE AREA 10, SAN LUIS AVENUE, 1300 BLOCK TO SOUTH BAY BOULEVARD

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C5A10.1f.

a. Drainage Area Considerations

The surface drainage region of Area 10 is approximately 34 acres. Surface flows within the drainage area generally migrate southerly on 14th and 15th Street to San Luis Avenue, then easterly on San Luis Avenue towards South Bay Blvd.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 10 feet west of 14th Street to 65 feet nearest South Bay Blvd. Drainage problems within this area are primarily attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

There are no drainage facilities in this area.

d. Problems within Drainage Area

There are three naturally occurring sump areas, two areas where street ponding occurred during the October 29, 1996 storm, and one County noted area of erosion and cross lot drainage. However, there were no complaints from the community regarding specific drainage problems threatening residential properties.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the groundwater ***high*** traverses southwest to northeast between 13th and 14th Streets below Area 10. Due to this high, septic tank discharges in the region west of 13th Street may slightly contribute to the groundwater problems experienced in both the Paso Robles and El Moro depressions. East of this high, the groundwater gradient suggests that discharges in this area primarily migrate towards the Eto Creek watershed. Although expected changes with the implementation of a sewer project may be negligible in Area 10, a small benefit may be experienced in other areas as a result.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	14th to 15th Cross Lot Drainage	10-1.1	Basin	Purchase lots in depression and create recharge basins.
		10-1.2	Subsurface Basin	Due to the relatively small watershed, subsurface (plastic) percolation basins could be used under the streets in conjunction with a porous pavement. Inlets could drain directly into these subsurface basins.
		10-1.3	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
		10-1.4	Drain to Sewer	Temporary storm drain connection to the new sewer treatment plant for affected parcels only to drain yards.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C5A10-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
10.1	***No Project:***	
10.2	***15th Street Basin:*** Construct 1.6± acre-foot retention basin at southerly end of 15th Street in existing depression. Assuming 6' maximum depth, approximately 12,000 square feet of land would be required. Construct roadside swale per Figure III-2 from Ramona Avenue, between 15th and 16th Streets, westerly on Ramona Avenue, then southerly on 15th Street and drain to alternative recharge basin. Construct road inlets and 18" storm drain from existing low-point on 14th Street between Ramona and San Luis Avenues, easterly to alternative recharge basin. Basin would require land acquisition and easements would be required for the cross-lot storm drain which drains 14th Street.	$189.2
10.3	***San Luis Avenue Basin:*** Construct 5± acre-foot recharge basin at the southeast corner of San Luis Avenue at 17th Street. Assuming 6' maximum depth, approximately 36,500 square feet of land would be required. Install 24" storm drain from existing depressions on San Luis Avenue west of 17th Street easterly under 17th Street into alternative recharge basin. Construction should be in combination with Alternative 10.2. Basin would require land acquisition.	$390.8
10.4	***San Luis Avenue Swale:*** Construct roadside swale per Figure III-2 either side of San Luis Avenue easterly to 17th Street, construct 24" culverts under 17th Street, then continue east with swales connecting to exist low-point. Construction should be in combination with Alternative 10.2.	$13

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 10.1: No Project

Nuisance road flooding on San Luis Avenue and cross-lot drainage from 14th Street to 15th Street, between Ramona and San Luis Avenues. There is little community benefit by reducing the ponding on the streets in this area since they can be considered Local roadways. There were no complaints from the community regarding residential flooding in the existing depression between 14th and 15th Streets.

Alternative 10.2: 15th Street Basin
Localized benefit to allow positive drainage for the residential lots within the existing depression. Installation of the culvert across existing lots will aid in reducing localized road ponding on 14th Street. Community benefits can be associated with the recharge of the upper aquifer.

Alternative 10.3: San Luis Avenue Basin
Localized benefit to allow positive drainage for San Luis Avenue and reduce road ponding. Community benefits can be associated with the recharge of the upper aquifer.

Alternative 10.4: San Luis Swale
Same benefits as Alternative 10.2 and 10.3.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 10.1, No Project:
Flooding of roadways and cross-lot drainage would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 10.2, 15th Street Basin:
With this alternative, a recharge basin would be constructed at the southerly end of 15th Street, in conjunction with a swale along Ramona Avenue. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the basin. In addition, this alternative has potential to improve water quality and visual resources along Ramona Avenue by removing sediment and providing a visual buffer with a vegetated swale. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 10.3, San Luis Avenue Basin:
A recharge basin on the southeast corner of San Luis Avenue at 17th Street would be installed, in conjunction with a storm drain system. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the basin. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 10.4, San Luis Swale:
A vegetated swale would be constructed on either side of San Luis Avenue draining easterly to 17th Street, in conjunction with Alternative 10.2. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction. However, a vegetated swale has potential to provide a filtering system, which may reduce contaminant and sediment levels in the water, in addition to improving visual resources in the area.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C5A18: DRAINAGE AREA 18, NIPOMO, 1200 BLOCK TO MOUNTAIN VIEW

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C5A18.1f.

a. Drainage Area Considerations

The surface drainage region of Area 18 is approximately 20 acres. Surface flows within the drainage area generally migrate easterly on Nipomo Avenue from 12th Street, and westerly on Nipomo Avenue from Mountain View to a natural depression at the intersection of 13th Street at Nipomo Avenue.

b. Groundwater Considerations

Depth to groundwater in Area 18 ranges from 80 feet in the northerly most area to 55 feet at the easterly most boundary of Areas 18 and 19. Drainage problems within this area can be attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

There are no existing drainage improvements in this area.

d. Problems within Drainage Area

Flooding of homes at 1877 and 1878 12th Street. Flooding occurs even in moderate storms. An increase of building in the area may also have contributed to the regularity of flooding. Most surface runoff appears to come off of Nipomo Avenue.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges in area 18 will tend to migrate south-southeasterly. This south-southeasterly migration of subsurface flows reduces the possibility that septic tank discharge from this area impact groundwater problems associated with the El Moro (Area 6) and Paso Robles (Area 7) depressions. Also, with sufficient depth to groundwater and this south-southeasterly migration, expected changes with the implementation of the sewer project may be negligible.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Flooding	18-1.1	Basin	Construct recharge basin at the on Nipomo easterly of 13th Street to intercept Nipomo drainage, drain 12th and 13th Streets via swales and culverts.
		18-1.2	Storm Drain	Install storm drain in Nipomo and from 13th towards Mountain view, incorporate with possible Mountain View storm drain (Solution 19-1.2)
		18-1.3	Culvert	Install concrete culvert (due to relatively flat grades) along Nipomo draining towards Mountain View.
		18-1.4	Pump	Install temporary pump stations (similar to that existing at 16th and Paso Robles Ave) at 13th and Nipomo. Outlet to Mountain Drive would require drainage improvements in Area 19.
		18-1.5	Curb & Gutter	Install curb and gutter to keep flows in street.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C5A18-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
18.1	***No Project:***	
18.2	***Storm Drain:*** Connect to storm drain system per Alternative 17.3b.	$392.6
18.3	***Retention Basin:*** Construct 4.3 acre-foot retention basin on Nipomo Avenue east of its intersection with 13th Street. Assuming 8' deep (maximum), approximately 150 square feet of land would be required. Construct roadside swale southerly on 13th Street per Figure III-2 beginning at low-point, then extending easterly on Nipomo Avenue with discharge to alternative terminal basin. Basin will require land acquisition from adjacent land owners.	$94.1

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 18.1: No Project

Nuisance road flooding on Nipomo Avenue and potential lot flooding would continue.

Alternative 18.2: Storm Drain

Localized benefit to drain the existing depression at the intersection of Nipomo Avenue at 13th Street, this providing positive drainage for existing adjacent residential lots. Reducing roadway flooding on Nipomo Avenue, which could be considered a Collector roadway, would provide a community benefit.

Alternative 18.3: Recharge Basin

Same benefits as Alternative 18.2

c. Significant Environmental Effects of Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 18.1, No Project:

Flooding of roadways and residential lots would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 18.2, Storm Drain:

With this alternative, a storm drain system would be constructed to drain the existing depression at the intersection of Nipomo Avenue at 13th Street. There is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 18.3, Recharge Basins:

A recharge basin would be constructed on Nipomo Avenue, in conjunction with a vegetated swale on 13th Street, which will extend easterly into Nipomo Avenue. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the basin. In addition, this alternative has potential to improve water quality and visual resources along Ramona Avenue by removing sediment, and providing a visual buffer with a vegetated swale. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:

It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

CATEGORY 6: OTHER NUISANCE PROBLEM AREAS

Drainage Areas Included in Category 6:

- Area 2: Santa Lucia
- Area 3: Santa Ysabel, 700 Block to 1200 Block
- Area 4: Santa Ysabel, 1300 Block to 1600 Block
- Area 5: Santa Ysabel, 1600 Block to South Bay Boulevard
- Area 11: Ramona, 1600 Block to South Bay Boulevard
- Area 12: Los Osos Junior High School
- Area 13: Monarch/Sea Pines
- Area 23: South bay Boulevard & Los Osos Valley Road to Los Osos Creek
- Area 24: Los Osos Valley Road & Buckskin to Los Osos Creek
- Area 25: Cabrillo Estates Basin
- Area 26: Bay Oaks & Oak Ridge

C6A2: DRAINAGE AREA 2, SANTA LUCIA

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A2.1f.

a. Drainage Considerations

The surface drainage region of Area 2 is approximately 26 acres. Surface flows within the drainage area generally migrate northerly down 2nd, 3rd and 4th Street to Santa Lucia, then easterly on Santa Lucia to 3rd Street where it runs northerly off the street and into the bay.

b. Groundwater Considerations

Depth to groundwater in this region ranges from 0 feet at the Bay to 50 feet in the upper southeasterly reaches of the drainage area. The general groundwater gradient is not fully defined due to lack of well data but appears to move northwesterly towards the bay.

c. Existing Drainage Improvements

Asphalt concrete channel at northerly end of 4th Street was installed April 1985 to provide positive drainage into the bay.

d. Problems within Drainage Area

Sediment deposition at the intersection of Santa Lucia Avenue and 3rd Street. This sediment deposition appears to be a nuisance rather than a problem. No other reported problems.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general northwesterly movement of the groundwater gradient under Area 2. Septic tank discharges in this area are expected to migrate in this direction towards the bay. Septic tank discharges from small portion of Areas 3 and 6 appear to contribute to the groundwater elevations below Area 2. However, sufficient depth to groundwater under developed portions and this northwesterly groundwater gradient suggests that installation of the sewer in this area may have no impact on existing drainage problems.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Sedimentation	2-1.1	Channel	Install concrete channel from the north end of Santa Lucia at 3rd Street to bay, grade to drain.
		2-1.2	Curb & Gutter	Install curb and gutter to keep flows in street and maintain velocities to carry sediments to 1-1.1 (Area 1, Solution 1.1)
		2-1.3	Erosion Control	Place haybales and/or silt fences at areas known to contribute to sedimentation.
		2-1.4	Maintenance	Clear roads after storm events or at the end of each season.
		2-1.5	Storm Drain	Intercept water and sediments with discharge to bay.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A2-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
2.1	***No Project:***	
2.2	***Maintenance***: Clean sediments from northerly end of Santa Lucia Avenue and 3rd Street as part of a regular maintenance program.	
2.3a	***Curb & Gutter:*** Construct curb & gutter on Santa Lucia Avenue between 2nd & 3rd Streets and on 3rd Street from Santa Lucia Avenue south to high point to maintain flow velocities to carry sediments with positive grade to new overside drain (per Caltrans) to be placed at the intersection of 3rd Street and Santa Lucia Avenue. Overside drain would extend northeasterly to Bay with rock rip-rap embankment protection at terminus. Construct road inlet and 18" culvert (County minimum) from southwesterly corner of intersection with outlet to overside drain.	$44.1
2.3b	***Swale:*** Construct roadside swale per Figure III-2 having same alignment as Alternative 2.3a, and overside drain per Alternative 2.3a. Construct 18" culvert from southwesterly corner of intersection with outlet to overside drain.	$56

1. Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 2.1: No Project

No benefits, nuisance sedimentation on Santa Lucia would continue.

Alternative 2.2: Maintenance

Removal of nuisance sedimentation on Santa Lucia Avenue would provide localized benefits to Area 2, but only in the region of Santa Lucia Avenue and 3rd Street.

Alternatives 2.3a & 2.3b: Curb & Gutter/Swale

Localized benefit to Area 2 for channalization of storm surface flows on Santa Lucia Avenue and 3rd Street. Should reduce street ponding and sediment deposition.

c. Significant Environmental Effects of Alternatives:

The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 2.1. No Project:

Sedimentation on Santa Lucia would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 2.2. Maintenance:

With this alternative, all sediments from north Santa Lucia Avenue and 3rd Street would be cleaned as necessary. No potentially significant environmental impacts are not expected to result with this activity.

Alternative 2.3a & 2.3b: Curb & Gutter/Swale:

A curb and gutter or roadside swale system would be constructed on Santa Lucia between 2nd and 3rd Street with positive grade to drain to new concrete channel at the intersection of 3rd Street and Santa Lucia. This includes the installation of an overside drain and culvert with outlet to new channel extending northeasterly to bay. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland, and/or coastal scrub habitat, and species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of surface runoff to the bay. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:

It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A3: DRAINAGE AREA 3, SANTA YSABEL, 700 BLOCK TO 1200 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A3.1f.

a. Drainage Considerations

The surface drainage region of Area 3 is approximately 29 acres. Surface flows within the drainage area generally migrate to the intersections of Santa Ysabel and 8th Street and Santa Ysabel and 9th Street where flows migrate northerly on 8th and 9th Streets then into the bay.

b. Groundwater Considerations

Although partially undefined, depth to groundwater in this region can be expected to range from 0 feet at the Bay to 75 feet in the upper southeasterly reaches of the drainage area. The groundwater gradient appears to be in a northwesterly direction.

c. Existing Drainage Improvements

Single 18" CMP culvert near the intersection of 10th Street at Santa Ysabel drains southeasterly portions of the drainage area across Santa Ysabel, then west on Santa Ysabel to 9th Street with eventual discharge to the bay, north of the end of 9th Street.

d. Problem Areas within Drainage area

Erosion and sediment deposition on Santa Ysabel between 8th and 9th Streets suggest that water concentrates, ponds and then spills northerly in this general area. Ponding (reduction in flow velocity) allows for the settling of sediments being carried in a storm flow. A single residence on the 1200 block of 12th Street has experienced flooding problems due to water entering the property from the street.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general northwesterly movement of the groundwater gradient under Area 3. Septic tank discharges in this area are expected to migrate in this direction towards the bay. Septic tank discharges from portions of Area 4 may contribute to groundwater elevations under Area 3. Sufficient depth to groundwater and this northwesterly groundwater gradient suggests that installation of the sewer in this area may have no impact on reducing drainage problems.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Sedimentation	3-1.1	Curb & Gutter	Install curb and gutter to keep flows in street and maintain velocities to carry sediments to 1-1.1 (Area 1, Solution 1.1)
		3-1.2	Erosion Control	Place haybales and/or silt fences at areas known to contribute to sedimentation.
		3-1.3	Maintenance	Clear roads after storm events or at the end of each season.
		3-1.4	Storm Drain	Intercept water and sediments with discharge to bay.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A3-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
3.1	***No Project:***	
3.2	***Curb & Gutter:*** Construct curb & gutter and cross gutters on Santa Ysabel Avenue from 7th Street to 13th Street, and on 9th Street from Santa Ysabel Avenue northerly to end of road. Allow positive surface drainage of Santa Ysabel Avenue onto 9th Street. Construct asphalt overside drain (per Caltrans) at northerly end of 9th Street with rock rip-rap at discharge point for slope protection.	$145.3
3.3	***Roadside Swale:*** Construct roadside swale per Figure III-2 having the same alignment as Alternative 3.2. Install 24" culvert under Santa Ysabel Avenue to drain southerly swale to 9th Street swale. Would require installation of 24" culverts (minimum) under each driveway on 9th Street along alignment. Install rock rip-rap and other slope protection discharge point. May also require earth berms between roadway and properties to minimize surface flows from entering adjacent lots if driveway culverts become plugged.	$222.9
3.4a	***Storm Drain:*** Install road inlets on Santa Ysabel Avenue at its intersection with 9th Street. Continue 24" storm drain north on 9th Street to end of road, construct rock rip-rap at discharge point, and allow overland flow to Bay utilizing slope protection techniques.	$30.8
3.4b	Same as 3.4a except daylight storm drain into roadside swale on 9th Street per Alternative 3.3.	$250.8
3.5	***Maintenance:*** Clean roads as necessary.	

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 3.1: No Project
No benefits, nuisance sedimentation and street flooding on Santa Ysabel would continue.

Alternative 3.2 & 3.3: Curb & Gutter/Swale
Localized benefit to Area 3 for channalization of storm surface flows on Santa Ysabel Avenue and to intercept surface flows from the southerly, upper elevations of the watershed. Community benefits from the reduction of sedimentation and potential ponding on Santa Ysabel Avenue, a Collector roadway.

Alternative 3.4a and 3.4b: Storm Drain
Localized benefit to Area 3 for collecting and routing surface flows from Santa Ysabel Avenue. Community benefits from reduction of sedimentation and potential ponding on Santa Ysabel Avenue, a Collector roadway.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 3.1, No Project:
Sedimentation and street flooding on Santa Ysabel would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 3.2 & 3.3, Curb and Gutter/Swale:
Curb, gutter, and cross gutters would be installed on Santa Ysabel from 7th Street to 13th Street, intercepting flows from the upper elevations of the watershed and discharging to bay or vacant lot for retention and recharge. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland, and/or coastal scrub habitat, and species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of surface runoff to the bay. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 3.4a and 3.4b. Storm Drain:
A culvert would be installed under Santa Ysabel at 9th Street, flowing into a new earth swale, with a final discharge to the bay. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland, and/or coastal scrub habitat, and species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of surface runoff to the bay. The implementation of a vegetated swale has the potential to improve water quality and visual resources by removing sediment and providing a visual buffer for residents in the area. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A4: DRAINAGE AREA 4, SANTA YSABEL, 1300 BLOCK TO 1600 BLOCK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A4.1f.

The primary contributing factors associated with storm drainage problems within Area 4 can be attributed to concentrated urban runoff and soil conditions.

a. Drainage Considerations

The surface drainage region of Area 4 is approximately 50 acres. Surface flows from easterly portion of the drainage area (14th, 15th and easterly portions of Santa Ysabel) migrate northerly on 14th Street, then generally flow across lots in a northwesterly direction towards the bay.

b. Groundwater Considerations

Although partially undefined, depth to groundwater in this region can be expected to range from 0 feet at the Bay to 55 feet in the upper southerly reaches of the drainage area. The groundwater gradient appears to be in a northwesterly direction. Portions of the groundwater gradient under Area 4 flow towards Area 3.

c. Existing Drainage Improvements

Single 18" CMP culvert near the intersection of 14th Street at Santa Ysabel drains southerly areas of the drainage area under Santa Ysabel and down 14th Street, which may partially contribute to the cross lot drainage problems midblock on 10th through 14th Streets, north of Santa Ysabel. Flows continue in this cross-lot direction to 10th Street then out to the bay. In addition to County drainage improvements, residences located midblock on 10th through 14th Streets have constructed drainage facilities to protect property, including swales and channels. In October of 1984, the County installed an inlet and swale (4.2) between 10th and 11th Street to assist in cross lot drainage and reduce residential flooding in this area.

d. Problems within Drainage Area

This drainage area is characterized by two distinct problems, flooding on 14th Street and cross-lot drainage. 14th Street immediately north of Santa Ysabel is a low lying area that easily floods, with ponded water remaining for extended periods of time. The area northerly of 14th Street has surface flows generating in the east and flowing westerly midblock through the residential areas of 14th, 13th, 12th and 11th Streets, then into an existing cross lot channel between 10th and 11th Streets, with final discharge to the bay. This cross lot drainage is primarily attributed to the natural topographic features of the drainage area. The community related complaints are primarily related to 14th Street cross lot drainage and street ponding.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general westerly movement of the groundwater gradient under Area 4. Septic tank discharges in this area are expected to migrate in this direction towards the bay. Area 5 contributes to the groundwater elevations under Area 4. However, due to sufficient depth to groundwater and this westerly groundwater gradient, installation of the sewer in this area may have no impact on reducing drainage problems.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	14th Ponding	4-1.1	Storm Drain	Gravity discharge to bay through lots beginning at 14th Street (required easements). Connect exist 18" culvert to proposed storm drain in 14th sump area and install curb and gutter to contain.
		4-1.2	Diversion Storm Drain	Storm drain Santa Ysabel from 15th westerly to 11 Street then down 11th St.
		4-1.3	Sewer	Gravity discharge to new sewer
		4-1.4	Pump	Install pump station in 14th sump area and discharge to existing Area 5 basin, Area 7 or bay.
		4-1.5	Drain across Private Property	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.
		4-1.6	French Drain	Would require easements or property purchase through existing developed lots. Used primarily for draining the ponded areas. Should be considered only in combination with Solution 1-1.1 (Area 1, solution 1.1)
		4-1.7	Subsurface Basin	Create subsurface recharge basins under 11th, 12th, 13th and 14th streets.
		4-1.8	Basin	Purchase lots or arrange with owners to provide basins on private property, drain road to basin.
		4-1.9	Curb & Gutter	Contain flows in street, would require additional drainage facilities to transport ponded water.
2	Cross lot drainage	4-2.1	Basin	Purchase lots or arrange with owners to provide basins on private property.
		4-2.2	Drain to Sewer	Temporary solution to reduce street & residential flooding.
		4-2.3	Drain across Private Property	Install surface or subsurface drainage improvements and easements through existing affected parcels which follow the existing problem drainage course.

2. Secondary Evaluation & Screening

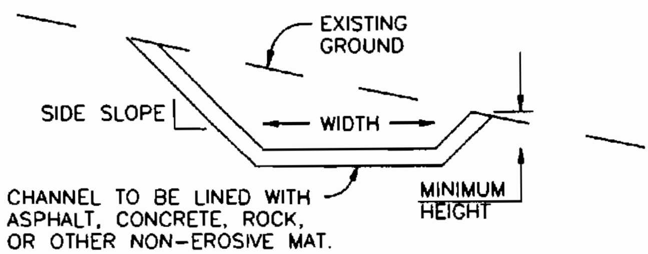
Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A4-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
4.1	***No Project:***	
4.2	***Diversion Swale:*** Construct lined diversion swale north of residential area that extends from high point near the north end of 16th Street westerly to approximately the north end of 10th Street. The swale outlet would require rock rip-rap slope protection and further design considerations to reduce the potential of hillside erosion. The channel required to intercept the 25-year storm event would be a lined V-ditch, 1 foot deep with 2:1 side slopes.	$26.1
4.3	***Storm Drain:*** Construct cross-lot 36" storm drainage system beginning with inlets at the low-point on 15th Street and extending westerly through properties to 10th Street, then northerly on 10th Street with outlet to existing open area. Construct road inlets at all low points on 10th, 11th, 12th, 13th, 14th, and 15th Streets with additional storm drain extension and road inlets on 14th Street at the second low-point, just north of its intersection with Santa Ysabel Avenue. This alternative should be placed in combination with the diversion swale (Alternative 4.2).	$97.7
4.4	***Diversion Storm Drain:*** Construct 24" storm drain on Santa Ysabel Avenue from 14th Street east to outlet at the existing Santa Ysabel Basin. This storm drain would intercept flows from the southern hillside reaches of the drainage area. The existing basin would require enlarging by 2.9 acre feet for the recharge of these additional flows.	$125.9
4.5	***Alternative Combination:*** A combination of Alternatives 4.2 and 4.4 may reduce the contributing surface drainage area entering the existing low-point by about half. Due to this reduction, cross-lot drainage problems may be reduced significantly such that Alternative 4.3 may not be necessary.	

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

FIGURE III-8: LINED SWALE ON SLOPE



b. Discussion of Alternative Improvements:

Alternative 4.1: No Project
Road flooding and cross-lot drainage would continue.

Alternative 4.2: Diversion Swale
Localized benefit to residential lots lying in the existing depression. Would reduce the volume of surface water entering the depression by diverting it directly to the Bay.

Alternative 4.3: Storm Drain
Localized benefit to residential lots lying in the existing depression. Would provide positive drainage for the depressed areas within Area 4, reducing street flooding and cross-lot drainage.

Alternative 4.4: Diversion Storm Drain
Similar benefits to Alternative 4.2. Would intercept the volume of surface flow prior to entering the depression areas of 14th and 15th Streets and direct it (via storm drain) to the existing Santa Ysabel basin. This would require increasing the capacity of the Santa Ysabel Basin (Area 5).

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 4.1, No Project:
Cross-lot drainage and road flooding would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 4.2, Diversion Swale:
A earth diversion swale would be constructed to reduce the volume of surface water entering the depression by diverting it to bay. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland, and/or coastal scrub habitat, and species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of surface runoff to the bay. The implementation of a vegetated swale has the potential to improve water quality and visual resources by removing sediment and providing a visual buffer for residents in the area. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 4.3, Storm Drain:
A storm drainage system would be constructed throughout Area 4, in conjunction with Alternative 4.2. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland, and/or coastal scrub habitat, and species of special concern are anticipated from sedimentation and other "first flush" contaminants, assuming discharge of drainage system to the bay. The implementation of a vegetated swale (Alternative 4.2), has the potential to improve water quality and visual resources by removing sediment and providing a visual buffer for residents in the area. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 4.4, Diversion Storm Drain:
A storm drain would be constructed on Santa Ysabel from 14th Street east to existing Santa Ysabel Basin. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the existing Santa Ysabel recharge basin. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A11: DRAINAGE AREA 11, RAMONA, 1600 BLOCK TO SOUTH BAY BOULEVARD

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A11.1f.

a. Drainage Area Considerations

The surface drainage region of Area 11 is approximately 11 acres. Surface flows within the drainage area generally migrates southerly on 16th Street to Ramona Avenue, then easterly on Ramona Avenue to 17th Street where it merges with surface runoff migrating south on 17th Street. Just south of the intersection of 17th Street at Ramona Avenue, surface flows turn southeasterly and cross private property towards South Bay Blvd.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 30 feet to 35 feet. Drainage problems within this area are primarily attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

There are no drainage facilities in this area.

d. Problems within Drainage Area

There are two areas where street ponding was noted during the October 29, 1996 storm, and one County noted problem area. There were no complaints from the community regarding specific residential threats due to drainage although street ponding south of the intersection of 17th Street at Ramona Avenue appeared to restrict access to two residential driveways.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flow from septic tank discharges in area 11 will tend to migrate southeasterly. This southeasterly migration of subsurface flows reduces the possibility that septic tank discharge from this area impact groundwater problems associated with the El Moro and Paso Robles depressions. Also, with the sufficient depth to groundwater and this south-southeasterly groundwater gradient, the implementation of the sewer project may have negligible affects on existing drainage problems.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	14th to 15th Cross Lot Drainage	11-1.1	Basin	Purchase lots in depression and create recharge basins.
		11-1.2	Subsurface Basin	Due to the relatively small watershed, subsurface (plastic) percolation basins could be used under the streets in conjunction with a porous pavement. Inlets could drain directly into these subsurface basins.
		11-1.3	Curb & Gutter	Install curb, gutter, and driveway aprons on streets to direct flows. Should be in combination with drainage facilities.
		11-1.4	Drain to Sewer	Temporary storm drain connection to the new sewer treatment plant for affected parcels only to drain yards.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A11-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
11.1	***No Project:***	
11.2a	***Retention Basin:*** Construct 2.1 acre foot retention basin on east side of 17th Street midblock between Ramona and San Luis Avenues (existing low-point of Area 11). Assuming 8' maximum depth, basin would require 110 square feet of surface area. Construct curb & gutter on 17th Street from Ramona Avenue south to alternative basin to provide positive surface drainage, and provide asphalt overside drain or road inlets on 17th Street discharging to the basin. Would require property purchase for basin and minor road regrading (rising) to provide positive drainage to basin.	$87.7
11.2b	***Retention Basin:*** Construct basin per 11.2a but utilize roadside swales (per Figure III-2) and storm drain culverts to drain area to basin. Culverts would be 18" minimum diameter.	$23.8
11.3	***Swale:*** Construct asphalt lined swales and culverts to drain area to existing low-point on 17th Street (south of Ramona Avenue). Construct swales from 17th Street easterly to South Bay Boulevard to drain roadway.	$12

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 11.1: No Project

Nuisance flooding of 17th Street would continue.

Alternative 11.2a: Recharge Basin

Localized benefit to reduce road flooding on 17th Street. This portion of 17th Street can be considered a Local roadway (low ADT) and therefore minimal community benefits are anticipated.

Alternative 11.2b: Recharge Basin

Same as benefit for Alternative 11.2a

Alternative 11.3: Swale
Same as benefit for Alternative 11.2a

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 11.1, No Project:
With this alternative, 17th Street flooding would continue to be a nuisance to local residence. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 11.2a, Recharge Basin:
A recharge basin would be constructed on the east side of 17th Street between Ramona and San Luis Avenues. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in the recharge basin. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 11.2b, Recharge Basin:
With this alternative, swales and culverts would be utilized to drain area into recharge basin per alternative 11.2a. Same as Impacts for alternative 11.2a.

Alternative 11.3, Swale:
Swales and culverts would be constructed to drain area to 17th Street, south of Ramona Avenue. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is detained in culverts and swales with no discharge to bay. However, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A13: DRAINAGE AREA 13, MONARCH/SEA PINES

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A13.1f.

a. Drainage Area Considerations

The surface drainage region of Area 13 is approximately 104 acres. Surface flows within the drainage area migrate down Pecho Valley Road, west on Skyline Drive, then north on Solano Street to existing inlets (13.1 & 13.2). Similarly, surface flows migrate north along Glenn, Fresno, El Dorado and Del Norte Streets to Howard Avenue, east on Howard Avenue to Solano Street and into inlets (13.1) and (13.2). A portion of the Sea Pines Golf Course and all of Butte Drive also drain to these inlets. Flow reaching inlets (13.1) and (13.2) are conveyed directly to the bay.

b. Groundwater Considerations

Figure II-8 depicts depth to groundwater ranging from 5 feet at the intersection of Solano Avenue at Butte Drive to over 75 feet at the most southerly end of the drainage area. Although the limited depth to groundwater is nearest the bay, drainage problems documented within this area are attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

Two inlets located at the intersection of Butte Drive at Solano Avenue collect the majority of storm flow in this drainage area. A single inlet on Pecho Valley Road (13.3) has been constructed to intercept storm flows into the Monarch Grove subdivision currently being constructed. An internal storm drain system and terminal basin being proposed for this subdivision will, upon completion, reduce the overall size of drainage area 13 by approximately 22 acres. In addition to the existing and proposed drainage facilities, a series of staged basins are located in Area 13 but these basins serve for storm drainage discharge of Area 25.

d. Problems within Drainage Area

Only nuisance problems were identified in this area. Road flooding was noted during a field visit at the intersections of Howard Avenue with Fresno, El Dorado and Del Norte Streets. This is primarily attributed to the installation of cross gutters at the time of subdivision construction with the intention that the roads would continue through the (now existing) Sea Pine Golf Course. Removal of these cross gutters and installation of new curb and gutter on the northside of Howard Avenue would solve this street flooding. In addition to Howard Avenue flooding, a county map identified sand and silt deposition problems at inlets 13.1 & 13.2.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that groundwater gradient west of the Los Osos Fault generally migrates in a northwesterly direction towards the bay. Implementation of the sewer project will eliminate septic-tank discharge from the portions of Areas 14, 16 and 25, areas that due to the groundwater gradient partially contribute to Area 13 groundwater elevations. Expected changes with the implementation of the sewer project may be negligible in regions of the drainage area nearest the bay.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Road Flooding	13-1.1	Repair Intersection	For Howard at Fresno, El Dorado, Del Norte (and Humbolt) remove existing cross gutters, regrade intersections, and install curb and gutter on Howard to provide positive drainage from Glenn Street easterly on Howard.
		13-1.2	Basin	Create recharge basins on golf course and drain to basins
		13-1.3	Storm Drain	Install storm drain on Howard and extend to inlets on Solano, discharge to bay. Install storm drain on Howard and discharge to proposed Monarch Grove basin.
		13-1.4	Install graded swale on golf course	Provide positive drainage from intersection listed in 13-1.1 onto golf course and install swale in golf course to direct flows to new point of discharge.

2. Secondary Evaluation & Screening

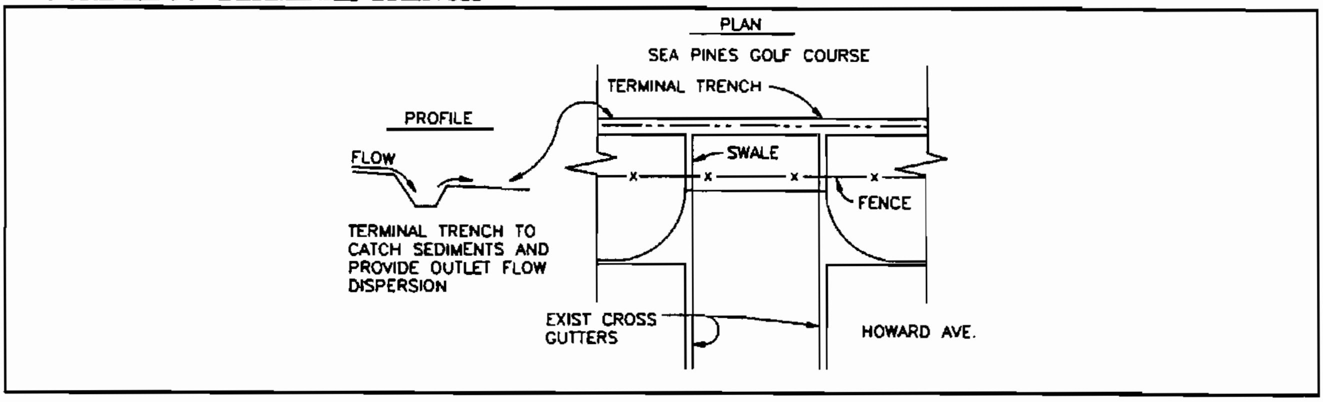
Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A13-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
13.1	***No Project:***	
13.2	***Swale/Terminal Trench:*** Remove existing earth berms between Howard Avenue and the golf course to provide positive drainage from the intersections of El Dorado, Del Norte, and Humbolt at Howard onto the golf course. Construct earth swale within the golf course property to divert flows westerly to new point of concentrated discharge, or provide a terminal trench (see Figure III-9) to catch sediments and provide overflow dispersion of concentrated flows onto the golf course.	$18.9
13.3	***Curb & Gutter:*** Remove existing cross gutters, reconstruct intersections, and match existing northerly curb face along Howard Avenue at its intersections with Fresno, El Dorado, Del Norte and Humbolt Streets. The majority of surface flow would then be redirected east on Howard Avenue, then north on Solano Avenue to the existing road inlets (DI 13.1 & DI 13.2). Based on a 25-year design storm, the flow contribution would be approximately 22 cfs. The existing culvert at the intersection of Solano Avenue and Butte Drive would need to be removed and replaced with a 36" culvert, or install an overside drain for positive overland escape and allow temporary intersection flooding. Outlet of the overside drains would be easterly to the Bay (marsh area).	$90.5

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

FIGURE III-9: TERMINAL TRENCH



b. Discussion of Alternative Improvements:

Alternative 13.1: No Project
Construction of the Monarch Grove Subdivision (Tract 1589) will include storm drain and inlets on Monarch Road. These storm drain improvements should reduce the amount of flow and sediments reaching (and ponding) on Howard.

Alternative 13.2: Swale
Localized benefit for vehicle and pedestrian traffic utilizing Howard Avenue.

Alternative 13.3: Curb & Gutter
Same benefit as Alternative 13.2. However, increased surface flow volumes would be directed towards the storm drain facilities at the intersection of Solano Street at Butte Drive. Increased potential of road flooding at that intersection may require improvement to existing facilities.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 13.1. No Project:
The Construction of Monarch Grove Subdivision with the appropriate drainage improvements should alleviate all existing sedimentation and ponding problems. Potentially significant environmental impacts are not expected to result, with improvement of drainage system.

Alternative 13.2. Swale:
A swale would be installed in golf course to divert flows off of Howard Avenue. It is expected that no significant environmental impacts will result from implementation of this alternative, assuming all storm water is filtered through swales on golf course, with no discharge to bay.

Alternative 13.3. Curb & Gutter:
Curb and gutters would be constructed along Howard to direct flows towards existing storm drain facilities on Solano Street. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, wetland habitat, and/or species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of drainage system to the bay. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A23: DRAINAGE AREA 23, SOUTH BAY BLVD & LOS OSOS VALLEY RD TO LOS OSOS CREEK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A23.1f.

a. Drainage Area Considerations

The surface drainage region of Area 23 is approximately 218 acres (excludes a relatively small area south of Los Osos Valley Road and Area 19). Surface flows within the drainage area generally migrate northerly on Willow Drive and Andre Avenue, and westerly on Nipomo Avenue flows are intercepted via existing overside drains having outlet into Eto Creek. An existing low point on Willow Drive accepts surface flow of portions of Willow Drive and Andre Avenue. This sump area drains via an inlet (23.1) to Eto Creek, with eventual outlet to Turri Creek.

b. Groundwater Considerations

Undetermined but appears that surfacing groundwater may be a consideration but only with respect to the flow volumes in Eto Creek.

c. Existing Drainage Improvements

A culvert in Eto Creek and overside drains (23.5) located on Nipomo Avenue drain the majority of the area into Eto Creek. Inlet (23.1) drains a portion of Willow Drive westerly to Eto Creek and inlet (23.4) allows drainage east of the intersection of Willow Drive at Los Osos Valley Road to enter Eto Creek. Also, an existing culvert under South Bay Boulevard (23.3) drains Area 19 easterly towards Eto Creek.

d. Problems within Drainage Area

Temporary roadway flooding together with sand and silt deposition were identified as problems on Sage Avenue at Hollister Lane, Nipomo Avenue at Eto Creek, at the low point on Willow Drive at road inlet (23.1), and near the first curve on Willow Drive just north of Los Osos Valley Road. During the storm of October 29, 1996, street ponding was noted at inlet (23.1). No flooding of Nipomo Avenue at Eto Creek was noted although this condition may exist during severe storm events.

e. Expected Changes with Implementation of Sewer Project

Figure 11-7 suggests that the subsurface flows from septic tank discharges in Area 23 will tend to migrate towards Eto Creek. Septic tank and storage basin discharges from portions of Areas 9, 10, 11, 18, 19, 22, and 26 may be decreasing the depth to groundwater in Area 23 but due to gaps in information this can not be validated. Implementation of the sewer project will eliminate septic tank discharge to the west but with no groundwater related flooding in the area, negligible affects to existing drainage problems are anticipated.

f. Summary of Possible Solutions for Further Consideration

Item	Problem	No	Solution	Description
1	Nipomo at Eto Creek[1]	23-1.1	Regrade Road	Raise Nipomo Road and install large culverts for Eto Creek
		23-1.2	Basin	Enlarge existing private (upstream) reservoir for recharge.
2	Willow at DI 23.1	23-2.1	Replace existing road inlet	Replace existing road inlet on west side of Willow and add second inlet on east side. Upgrade existing storm drain to Eto Creek as necessary.
		23-2.2	Basin	Construct terminal basin west of existing inlet on undeveloped property. Install inlets per 23-2.1 with terminus to basin.
		23-2.3	Channel	Construct channel from Willow west to Eto Creek and install inlets per 23-2.1 with terminus to channel.
3	Sage at Hollister	23-2.4		

[1] Undefined problem. No action may be necessary on Nipomo at Eto Creek

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A23-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Alt	Description	Cost[1]
23.1	***No Project:***	
23.2	***Storm Drain:*** Repair or replace existing road inlet (DI 23.1) on west side of Willow Drive and add second inlet on east side of Willow Drive. Connect road inlets with 30" storm drain. Extend 30" storm drain westerly and discharge to Eto Creek or into existing conveyance facility.	$7.9
23.3	***Cross Gutter:*** Remove existing road inlet (DI 23.1), construct cross gutter spanning Willow Drive, and construct asphalt overside drain on westerly side of Will Drive to provide positive roadway drainage. Discharge into the existing conveyance facility.	$6.1

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

b. Discussion of Alternative Improvements:

Alternative 23.1: No Project
Existing problems causing minor road flooding would continue. Willow is a local road (low ADT) and alternate bypass routes are available during severe flooding conditions (Andre Avenue).

Alternative 23.2: Storm Drain
Localized benefit. Reduction in street flooding at a single low-point in the roadway.

Alternative 23.3: Cross Gutter
Same benefit as Alternative 23.2.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard

mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 23.1, No Project:
Minor road flooding would continue to be a nuisance to local residence with the No Project Alternative. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 23.2, Storm Drain:
The existing road inlet would be repaired or replaced with this alternative. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, riparian habitat, and/or species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of drainage system to the creek. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

Alternative 23.3, Cross Gutter:
With this alternative, a cross gutter would be constructed to drain roadway. It is expected that surfacing groundwater containing components of septic-tank failure is not present in this area. However, potential significant, but mitigable impacts to water quality, riparian habitat, and/or species of special concern are anticipated from sedimentation and other "first flush" contaminants with discharge of drainage system to the bay. In addition, there is potential for significant, but mitigable, short term impacts to traffic on a local scale from construction activities.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

C6A25: DRAINAGE AREA 25, CABRILLO ESTATES & VISTA DE ORO

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. Utilizing the preliminary screening process as presented in Appendix E2, each of the defined solutions were evaluated as a possible solution to this area's drainage problems. The results of this evaluation are the preliminary alternative projects presented in section III.C6A25.1f.

a. Drainage Area Considerations

There are three subdivisions within this drainage area, they include Cabrillo Estates, Vista de Oro, and portions of Redfield Woods. The surface drainage region of Area 25 is approximately 406 acres. Surface flows within Cabrillo Estates are directed, via a series of storm drains and road inlets, into the Madera terminal basin (25.C). Similarly, surface flows within the Vista de Oro area are directed into the Los Arboles terminal basin (25.B).

Surface flow which bypasses the storm drain system in Cabrillo Estates enters Pecho Valley Road and flows northerly towards an inlet at the intersection of Pecho Valley Road at Los Osos Valley Road (25.3). A portion of this flow will be intercepted (13.3) and taken into the proposed Monarch Grove subdivision storm drain system. Surface flow which bypasses the inlet on Pecho Valley Road at Montana Way (25.9) also enter Pecho Valley Road and flows into inlet (25.3).

Surface flow from the westerly area of Highland Drive migrate either northerly down Doris Avenue to an existing inlet (25.4) on Los Osos Valley Road, or westerly into an existing concrete channel (26.5) which drains to a inlet (25.4). A storm drain connects inlet (25.4) to the Pecho Valley Road at Los Osos Valley Road inlet (25.3).

Via storm drains (and surface flow during severe storm events), surface flow from drainage Area 25 migrates northerly on Pecho Valley Road and eventually terminates at the Sea Pines staged basins (25.A) and into the bay.

b. Groundwater Considerations

Undetermined but appears that surfacing groundwater is not a consideration within this drainage area.

c. Existing Drainage Improvements

Cabrillo Estates: This storm drain system and basin was installed with the construction of the subdivision, and later expanded as the subdivision enlarged. The main branch of the storm drain extends from the Madera basin southwesterly on Madera Street, then southeasterly up Rodman Drive with nine road inlets collecting storm flows. A branch to the Rodman Drive storm drain extends easterly on Bowie Drive (25.26 & 25.27). The Bowie Drive branch also drains Austin Circle (25.32) and San Jacinto Drive (25.28 & 25.29).

Initially, Alamo Drive and the easterly end of Rodman Drive were drained easterly off the subdivision via an existing culvert (25.34) which resulted in extreme erosion problems on the easterly subdivision boundary. In June of 1989, an inlet was installed at the southeast corner of Rodman Drive at Alamo Drive (25.33) to intercept flow from Alamo Drive (and the hillside above Alamo Drive) with outlet to a curb drain on Rodman Drive west of Alamo Drive, thus reducing the boundary erosion.

Initially, the Travis Drive storm drain system was a series of separate grouped inlets (25.16-.18, 25.19-.21, & 25.22-.24) which individually drained northerly with termination on the hillside north of the residential properties causing erosions and gullies. In June 1989, a new storm drain was extended from Rodman Drive easterly on Travis Drive to connect this existing inlets. The outlets to the hillside were plugged and the erosion reduced.

Vista de Oro: The basin and storm drain system was installed with construction of the subdivision. Drainage from Vista Court, Montana Way and Los Padres migrate to Los Arboles, then northerly into existing inlets at the end of Los Arboles (25.6 & 25.7). These inlets are connected to the Los Arboles basin (25.B). A grade break at the westerly end of Vista Court and Montana Way directs surface flows into an existing road inlet (25.8) and inlet (25.9), respectively. A storm drain connects inlet (25.8) to (25.9) and into the Los Arboles basin. The Los Arboles basin also acts as a sewer disposal area.

Redfield Woods: An existing concrete channel (26.5) intercepts surface flows from Highland Drive, Mar Vista Drive, Lilac Drive, Manzanita Drive, and Woodland Drive westerly of Doris Avenue. The channel terminates at inlet 25.4 where flows enter into a storm drain system which connects inlets (25.4), (25.3), (25.2) and (25.1) (Rosina Drive) with outlet to the Sea Pines staged basins (25.A). Prior to construction of the concrete channel and inlet (25.4), flooding problems occurred on Woodland Drive, Manzanita Drive and Lilac Drive west of Doris Avenue.

Los Osos Valley Road: Partially due to flooding problems at the intersection of Pecho Valley Road and Los Osos Valley Road, road inlets (25.2 & 25.3) and a storm drain system were installed from the intersection north to Skyline Drive, then northwesterly to a staged basin discharge (25.A) on the Sea Pine Golf Course.

d. Problems within Drainage Area

Cabrillo Heights: In March of 1995 the Cabrillo Estates retention basin spilled, causing flooding in the *proposed* Monarch Grove Subdivision. A portion of Madera Street, south of Rodman Drive is subject to erosion and severe sand and silt accumulation. Hillside erosion was reported north of Travis Drive but may be stabilized since the installation of the Travis Drive storm drain system and subsequent removal of the overside drains north of Travis Drive.

Vista de Oro: Silt and sand deposition at the intersection of Vista Court and Los Arboles Way, possibly due to hillside erosion. The County believes that the Los Arboles basin filled during the storm of 1995.

Redfield Woods: Silt and sand deposition at the intersection of Highland Drive and Alexander Avenue, possibly due to hillside erosion.

Los Osos: Ponding at the intersection of Pecho Valley Road and Los Osos Valley Road (inlet 25.3) which extends into the eastbound travel lane.

e. Expected Changes with Implementation of Sewer Project

Not applicable.

f. Summary of Possible Solutions for Further Consideration

	Problem	No	Solution	Description
1	Madera Basin	25-1.1	Maintenance	Maintenance program to ensure basin is free of sediment and to scarify basin bottom to promote percolation
		25-1.2	Enlarge basin	Increase storage capacity of basin
		25-1.3	Modify outlet	Extend existing 54" basin outlet westerly towards bay. Will require drainage easement from property owners west of Pecho Valley Road.
2	Madera St. erosion	25-2.1	Lot Grading	Grade all existing undeveloped lots on San Ricardo and Madera south of Rodman to provide onsite storage and sediment containment.
		25-2.2	Basin	Construct sediment and recharge basin on Madera southwest of Rodman and existing residence to intercept flow and sediments.
3	Vista at Los Arboles	25-3.1	Basin	Construct sediment and recharge basin at southerly end of Los Arboles. Install swales at southerly property boundaries to intercept surface flows and direct to basin.
4	Highland at Alexander	25-4.1	Basin	Construct sediment and recharge basin at southerly end of Alexander. Install swales on Highland southerly right-of-way to intercept surface flows and direct to basin.
5	Pecho Valley at LOVR	25-5.1	Modify Inlet	Modify hydraulic capabilities of existing inlet 25.3
		25-5.2	Basin	Construct recharge basin at southerly intersection of Pecho Valley at LOVR with overflow spill to existing storm drain system.

2. Secondary Evaluation & Screening

Utilizing the secondary screening process as presented in Appendix E3, the initial area specific alternative projects presented in C6A25-1f were further analyzed. The results of this evaluation are the secondary alternative projects as presented below:

a. Alternative Project Solutions:

Problem 1: Cabrillo Estates

Alt	Description	Cost[1]
25.1a	***No Project:***	
25.1b	***Maintenance:*** Provide a regular maintenance schedule for Cabrillo Estates Basin which includes cleaning and rescarification to maintain design volumes and aid in percolation. Improvements on Pecho Valley Road due to the construction of the Monarch Grove Subdivision, which include additional curb, gutter, sidewalk, and two road inlets may aid in intercepting future spills from the basin.	$2.5
25.1c	***Grading:*** Grade all undeveloped lots on San Ricardo and Madera south of Rodman to provide onsite retention of surface flow and sediment containment. Install haybales at property boundaries to reduce erosion, and retain sediments on the lot. Grading of existing lots could be the responsibility of the owner.	$11.3

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

Problem 2: Vista de Oro

Alt	Description	Cost[1]
25.2a	***No Project:*** A new subdivision (Tract 2251) is being proposed for the hillside area south of Vista de Oro. It is anticipated that storm drainage improvements, including basin, installed as a part of this subdivision should alleviate the existing problem of sediments being washed onto Vista Court and Los Arboles Way from the hillside.	

Problem 3: Redfield Woods

Alt	Description	Cost[1]
25.3a	***No Project:***	
25.3b	***Rock Berm:*** Construct a series of staged sediment berms (two or more rows) in the hillside south of the residential development to slow surface flows velocities, and trap and filter sediments from the surface flows (see Figure III-10). Would require easement, heavy construction equipment access for placement, and annual inspection and/or maintenance to clear trapped sediments. Is not expected to significantly reduce surface flows generating in the hillsides but may provide some infiltration potential as water ponds behind berm. (Refer to Alternative 16.1d)	$90
25.3c	***Intercept Channel:*** Construct intercept channel (see Figure III-9) extending from the State Park west of Pecho Valley Road, easterly along existing property lines, into a 60" culvert under Pecho Valley Road, then following property lines between Cabrillo Heights subdivision and Tract 2251, and onto the hillside area southerly, and parallel to Highland Drive. Continue channel easterly towards Bayview Heights Drive. Channel would be designed to maintain scouring velocities (keep it clear of sediments) and armored to reduce channel erosion. Channel armoring could achieved using concrete, asphalt, rock or fabric materials. A regular maintenance program would be required to clean and repair channel as required. Assuming a design for a 25-year event, the channel required would be 6' wide, 2' deep and have 2:1 side slopes, or equivalent. This would require a minimum 20' access and maintenance easement. A 60" culvert would be required to convey flows under Pecho Valley Road. Construction of an intercept channel in the hillside would be difficult due to both physical and environmental constraints. Heavy equipment access during construction would be required. (same as Alternative 16.1e)	$222

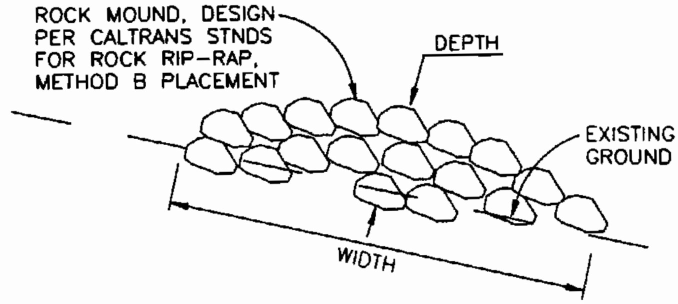
1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

Problem 4: Los Osos Valley Road at Pecho Valley Road

Alt	Description	Cost[1]
25.4a	***No Project:*** Ponding at the intersection of Los Osos Valley Road at Pecho Valley Road, identified as a problem area in previous sections has been removed from the list of problem areas after further consideration. The existing drainage facilities appear to be sufficient unless plugging occurs. Overland flows resulting from the plugging of these existing inlets directly affects flooding problems associated with the Binscarth, Grove and Pecho Valley Road areas (Area 15).	
25.4b	***Maintenance:*** Maintain existing inlets to reduce plugging and maintain inlet capacities.	

1 Cost presented in thousands of dollars. Add 50% to get Total Alternative Project Cost, see Appendix D1

FIGURE III-10: ROCK BERM (SEDIMENT TRAP)



b. Discussion of Alternative Improvements:

Alternative 25.1a: Cabrillo Estates-No Project
Existing conditions will remain. Eventual development of existing undeveloped lots in the Cabrillo Heights subdivision should result in less sedimentation entering Madera Street. The existing basin's should presently be designed to handle the increased volumes associated with this future development.

Alternative 25.1b: Cabrillo Estates-Maintenance
Spill prevention of the basin could provide community benefits by reducing flood related impacts of downstream properties including Pecho Valley Road and the Monarch Grove subdivision (Area 13).

Alternative 25.1c: Cabrillo Estates-Grading
Localized benefits within Area 25 with the reduction of sediments entering Madera Street and the existing Cabrillo Heights basin.

Alternative 25.2a: Vista de Oro-No Project
See Alternative 25.2a *Description.*

Alternative 25.3a: Redfield Woods-No Project
Existing conditions will remain. Sediment loads surface flows from the hillside would continue to enter into the Redfield Subdivision.

Alternative 25.3b: Redfield Woods-Rock Berm
Local benefits associated with the potential removal of sediments from surface flows originating on the southerly hillsides. Not expected to have any impacts on the volume of storm flow currently draining to Redfield Woods.

Alternative 25.3c: Redfield Woods-Intercept Channel
Local and community benefits associated with the potential interception of surface flows originating on the southerly hillsides from reaching Los Osos Valley Road and Redfield Woods. Reduction in flow volumes would also benefit Area 14.

Alternative 25.4a: Los Osos Valley Road-No Project
See Alternative 25.4a *Description.*

Alternative 25.4b: Los Osos Valley Road-Maintenance
Community benefit in reducing the incidence of plugging of the existing road inlets at the intersection of Pecho Valley Road and Los Osos Valley Road. May reduce potential flooding problems in the northwesterly regions of Area 14.

c. Significant Environmental Effects of Alternatives:
The potentially significant environmental effects of the suggested alternatives are summarized below. Majority of the individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash. Alternatives which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, requiring some standard mitigation prior to implementation. Other Environmental effects expected to be insignificant under CEQA Guidelines, or mitigable by routine measures, are summarized in Appendix C.

Alternative 25.1a, No Project:
Existing conditions will remain the same with the No Project Alternative. Potentially significant environmental impacts are not expected.

Alternative 25.1b, Maintenance:
With this alternative, a regular maintenance program will be implemented. Potentially significant environmental impacts are not expected to result, with implementation of this program.

Alternative 25.1c, Grading:
Grading would be performed on undeveloped lots to provide onsite retention of surface flow. Proposed grading of these areas has the potential to significantly impact sensitive coastal scrub habitat and/or species of special concern, (e.g., Morro shoulderbanded snail, Morro Bay kangaroo Rat), during the construction process.

Alternative 25.2a, No Project:
A new subdivision is being proposed for the hillsides south of Vista De Oro, which will include storm drainage systems to alleviate sediment flows. Potentially significant environmental impacts are not expected to result with improvement of existing area drainage.

Alternative 25.3a. No Project:
With this alternative, existing conditions will remain. Potentially significant environmental impacts are not expected.

Alternative 25.3b. Rock Berm
A series of staged sediment berms would be constructed on the hillsides to intercept sediments from surface flows. Proposed construction this area has the potential to significantly impact sensitive coastal scrub habitat and/or species of special concern, (e.g., Morro shoulderbanded snail, Morro Bay kangaroo Rat).

Alternative 25.3c. Intercept Channel
A series of staged diversion trenches would be constructed on the hillsides to intercept surface flows and sediment. Proposed terracing of these areas has the potential to significantly impact sensitive coastal scrub habitat and/or species of special concern, (e.g., Morro shoulderbanded snail, Morro Bay kangaroo Rat), during the construction process.

Alternative 25.4a. No Project:
With this alternative, minor road flooding would continue to be a nuisance to local residence. However, potentially significant environmental impacts are not expected to result, if existing conditions remain the same.

Alternative 25.4b. Maintenance:
Existing inlets would be maintained on a regular basis with this alternative. Potentially significant environmental impacts are not expected to result.

d. Regulatory Implications:

Additional Environmental Review:
It is not expected that implementation of any of the alternatives above would require the preparation of an EIR, however these alternatives may require the preparation of an Expanded Initial Study or Mitigated Negative Declaration because: 1) all of these alternatives involve insignificant and/or potentially significant, but mitigable impacts on water quality and resources; and 2), these potentially significant, but mitigable impacts are expected to differ depending on the choice of the alternatives to be addressed.

CATEGORY 7: OTHER AREAS WITH NEGLIGIBLE PROBLEMS

Drainage Areas Included in Category 7:
• Area 5: **Santa Ysabel, 1600 Block to South Bay Boulevard**
• Area 12: **Los Osos Junior High**
• Area 24: **Los Osos Valley Road & Buckskin to Los Osos Creek**
• Area 26: **Drainage Area 26: Bay Oaks & Oak Ridge**

C7A5: DRAINAGE AREA 5, SANTA YSABEL, 1600 BLOCK TO SOUTH BAY BOULEVARD

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. These remaining areas were not determined to have significant drainage problems. Therefore, although an analysis of each of the areas was performed, no alternative projects have been recommended.

a. Drainage Area Considerations

The surface drainage region of Area 5 is approximately 26 acres. Surface flows from the southerly reaches of 17th Street enter an existing inlet at the southwest intersection of Santa Ysabel at 17th Street. Surface flows from 16th Street migrate southerly to Santa Ysabel, then easterly along Santa Ysabel into existing roadway basins west of the intersection of Santa Ysabel at 17th Street. Storm flow on the north side of Santa Ysabel then migrates across 17th Street into a inlet at the northeast intersection of 17th Street, and flows southerly on Santa Ysabel migrates to the existing inlet on 17th Street just south of the intersection.

b. Groundwater Considerations

Although partially undefined, depth to groundwater in this region can be expected to range from 50 feet to 65 feet in the upper southerly reaches of the drainage area. The groundwater gradient appears to be in a north-northwesterly direction. Portions of the groundwater gradient under Area 5 flow towards Area 4.

c. Existing Drainage Improvements

Two small earth channels are located northwest and southwest of the intersection of Santa Ysabel at 17th Street. These roadway channels provide positive drainage for Santa Ysabel Avenue. As they fill, water either extends easterly to an existing drop inlet located on the northeasterly corner (5.1), or southerly on 17th St. into a second exiting drop inlet (5.2). Inlet (5.1) outlets to an existing swale at the southeasterly corner. This swale extends easterly towards South Bay Blvd. then southerly towards an existing terminal basin (5C). Table III-7 shows the estimated existing capacity of basin 5C. Inlet (5.2) is connected directly to basin (5.C) via a storm drain. The storm drain facilities and basin (5.C) were constructed in December of 1986. Basins (5.A) and (5.B) were constructed in December of 1988.

TABLE III-7: EXISTING BASIN CAPACITY, SANTA YSABEL

Storm Event	Basin 5C Water Surface Elevation
10 yr.	82.3 ft
50 yr.	83.7 ft
100 yr.	84.8 ft

d. Problems within Drainage Area

Sediment deposition at the low point in 17th Street near inlet (5.2). No other reported problems.

e. Expected Changes with Implementation of Sewer Project

Figure II-7 shows a general westerly movement of the groundwater gradient under Area 5 towards Area 4. Septic tank discharges in this area are expected to migrate in this direction. Portions of Areas 7 and 9 may contribute to the groundwater elevations under Area 5. However, due to sufficient depth to groundwater and this westerly groundwater gradient, and no significant drainage problems documented, installation of the sewer in this area may have little impact.

f. Summary of Possible Solutions for Further Consideration

None required.

C7A12: DRAINAGE AREA 12, LOS OSOS JUNIOR HIGH

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. These remaining areas were not determined to have significant drainage problems. Therefore, although an analysis of each of the areas was performed, no alternative projects have been recommended.

a. Drainage Area Considerations

The surface drainage region of Area 12 is approximately 145 acres. Surface flow within the drainage area generally migrates easterly from South Bay Boulevard to Los Osos Creek. Areas contributing to surface runoff in Area 12 include Areas 7, 9 and 11 via culverts extending under South Bay Boulevard.

b. Groundwater Considerations

The groundwater contours were not mapped for this area. However, review of Figure II-8 infers that a depth to groundwater may range from 0 feet at Los Osos Creek to 80 feet at the southwesterly corner of the drainage area. Drainage problems within this area can be primarily attributed to surface runoff and not to elevated groundwater conditions.

c. Existing Drainage Improvements

Existing facilities include the storm drain continuation from culvert (12.1) extending easterly through the playing field of Los Osos Junior High School to Los Osos Creek and culvert (12.2) terminating at the east edge of South Bay Boulevard south of its intersection with Pismo Street.

d. Problems within Drainage Area

There are no documented drainage problems associated with Area 12.

e. Expected Changes with Implementation of Sewer Project

Not applicable.

f. Summary of Possible Solutions for Further Consideration

None required.

C7A24: DRAINAGE AREA 24, LOS OSOS VALLEY ROAD & BUCKSKIN TO LOS OSOS CREEK

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. These remaining areas were not determined to have significant drainage problems. Therefore, although an analysis of each of the areas was performed, no alternative projects have been recommended.

a. Drainage Area Considerations

The surface drainage region of Area 24 is approximately 105 acres. Surface flows within the drainage area migrate northwesterly on Buckskin Drive, easterly on Martingale Avenue and northerly on Palomino Drive where surface flows are intercepted via existing road inlets (24.1 & 24.2) having outlet to Los Osos Creek.

b. Groundwater Considerations

Undetermined but appears that surfacing groundwater is not a consideration within this drainage area.

c. Existing Drainage Improvements

Two existing inlets are located on Palomino Drive at its intersection with Martingale Avenue. Inlet (24.1) is connected to inlet (24.2), from which a storm drain extends easterly with outlet in Los Osos Creek.

d. Problems within Drainage Area

The County identified two minor problem within the drainage area. These included street ponding and silt deposition at the northerly end of Buckskin Drive, and private property flow obstruction near the intersection of Palomino Drive at Martingale Avenue. There is no residential improvements at the end of Buckskin Drive and no other community complaints noted in this drainage area, therefore no solutions will be addressed.

e. Expected Changes with Implementation of Sewer Project

Not applicable.

f. Summary of Possible Solutions for Further Consideration

None required.

C7A26: DRAINAGE AREA 26, BAY OAKS & OAK RIDGE

1. Preliminary Evaluation & Screening

The following provides a detailed analysis of each defined drainage area within the project area. Refer to the Maps, Figures and Appendices for documentation and additional surface and sub-surface drainage information. These remaining areas were not determined to have significant drainage problems. Therefore, although an analysis of each of the areas was performed, no alternative projects have been recommended.

a. Drainage Area Considerations

The surface drainage region of Area 26 is approximately 135 acres. Surface flows within the drainage area are primarily routed into existing retention basins within the subdivision or extend northerly down Oak Ridge Drive. Flows from Oak Ridge Drive enter into Los Osos Valley Road storm drain system, with outlet to Los Osos Creek. Flows bypassing the Oak Ridge Drive road inlets enter onto Los Osos Valley Road and migrate westerly into the Fairchild Basin storm drain system.

b. Groundwater Considerations

Undetermined but appears that surfacing groundwater is not a consideration within this drainage area.

c. Existing Drainage Improvements

The Bay Oaks/Oak Ridge subdivision was constructed in 1977. There are eleven storm drain inlets which intercept storm water and redirect it into five existing terminal basins. The Bay Oaks Drive terminal basin (26.A) accepts flows from Bay Vista Lane, Crest Avenue, Del Mar Drive, and Bay Oaks Drive. According to the County, a portion of the water stored in the Bay Oaks basin is pumped easterly to Creek drainage area. A storm drain collects water from the Bay Vista Lane cul-de-sac with outlet to the Green Oaks Drive cul-de-sac. The Tierra Drive terminal basin (26.B) accepts flows from portions of Encinas Drive and Tierra Drive. In addition, there are two smaller terminal basins located at the westerly and easterly ends of Las Encinas Drive.

d. Problems within Drainage Area

Only nuisance problems were identified in this area. Road flooding was noted during a field visit at the intersections of Bayview Heights Drive at Covey Lane and at Cottontail Lane. A County map identified erosion, cross lot drainage, sand and silt deposition, and street ponding, also near the intersection of Bayview Heights Drive at Covey Lane.

e. Expected Changes with Implementation of Sewer Project

Not applicable.

f. Summary of Possible Solutions for Further Consideration

None required.

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SECTION IV

RECOMMENDED ALTERNATIVES

A. INTRODUCTION

This section provides a compilation of all information presented in the preceding sections of this report with emphasis on a preferred project for each of the identified drainage problem areas. In general, preferred projects typically resulted in those historically proven to provide long term benefits at lower operating and maintenance costs, such as storm drains. Whenever applicable, and based on existing conditions, terminal basins have been recommended to provide water conservation by utilizing groundwater recharge.

The general consensus of the presently appointed CSA-9J Advisory Committee was to recommend that storm water be recycled for reuse either by groundwater recharge or surface storage. Each of the recommended alternative projects listed in this section were evaluated for their potential to reuse storm water utilizing detention basins or other methods and, whenever possible these alternatives were selected.

The Recommended Alternative Solutions presented in this section were determined using the same screening process outlined in Appendices E1 through E3. However, this screening process was expanded upon by adding two additional screening criteria, *Water Conservation* and *Flood Risk*. Utilizing the initial screening criteria in combination with these two additional parameters (see Appendix E4), the Recommended Alternative Solution was generated for each of the drainage areas.

This section addresses the results of this final screening process and summarizes the information presented in preceding sections to provide a more complete project overview. The summary includes a description of the specific drainage area storm related problems, the alternative projects addressed in previous sections, a more comprehensive description of the recommended alternative drainage project, a more comprehensive estimated project cost summary, and reference to other report sections pertaining to area specific applicable regulations, groundwater issues, influence on the proposed sewer project, and water quality discharge. Finally, water reuse options are presented where applicable.

TABLE IV-1: SECTION IV REFERENCED ITEMS

DESCRIPTION	REFERENCE
Engineering Cost Estimations and Assumptions	Appendices D1
Recommended Alternative Solutions	Map 5 and Appendices E1 & E4
Supplementary Environmental Information	Appendix C

B. RECOMMENDED ALTERNATIVES

The following sub-section address the final recommended alternatives for each of the 27 drainage areas based on the seven categories. Each of the final recommended alternatives are presented by Category and Drainage Area. Refer to Map 5 for the location of each recommended alternative and additional information.

CATEGORY 1: AREAS OF SHALLOW TO SURFACING GROUNDWATER IN THE INTERDUNAL DEPRESSIONS

Drainage Areas Included in Category 1:

- Area 6: The El Moro Depression, 300 Block to 1400 Block
- Area 7: Paso Robles Depression, 1400 Block to 1800 Block
- Area 8: Ramona/Pismo Depression, 300 Block to 1300 Block

C1A6: Area 6, El Moro Depression, 300 Block to 1400 Block

PROBLEM DESCRIPTION:

Cross lot drainage through residential properties from 7th to 10th Streets in sub-area 6C, and from 2nd to 6th Streets in sub-area 6A. Cross lot drainage in sub-area 6A is exasperated during storm events which cause flooding (and spillage) of sub-areas 6B and 6D. This cross lot drainage causes failure of septic systems, flooding of residences and residential properties, road closures and health concerns due to contaminated surface water due to septic system failure.

Pump station overload and flooding in sub-areas 6A and 6B associated with high groundwater resulting from septic tank system discharge and runoff from urban development. During above normal storm events these pumps are insufficient to prevent flooding on El Moro Avenue. Ponded water in this area causes failure of septic systems, flooding of residences and residential properties, road closures and health concerns due to contaminated surface water due to septic system failure. In 1995, flooding occurred during January and March in as the pumping facilities were unable to remove surface water and the surfacing groundwater fast enough. Temporary pumps were brought in to pump water from 8th Street at El Moro Avenue to 2nd and 3rd Streets. In the summer of 1995, groundwater continued to surface at this location so a French Drain was installed. This French Drain produced flows ranging from 26 gpm in July 1995 to 12 gpm in June 1996. In November 1995, a new temporary pump station and a new 12 inch PVC discharge line were installed.

In general, when flooding occurs in Area 6 ponded water remains for extended periods of time in the depressed regions of sub-areas 6A, 6B and 6D. These ponds are contaminated by septic tank effluent which may pose a serious health concern for the community. Due to the size of the drainage area and the natural topographical features, the extend of flooding impacts numerous residences in Area 6 causing temporary relocation and/or uninhabitable homes. Over 80 complaints were documented in this report, with the majority of problems occurring in sub-areas 6A, 6B and 6D. This can be attributed to the sump conditions in sub-areas 6B and 6D, and the fact that 6A receives concentrated surface and subsurface flows from all of Area 6.

ALTERNATIVES:

Upgrade existing Pump Station, Diversion Pumping, French Drains, Drain to Sewer, Storm Drain, Water Production from Upper Aquifer, Curb & Gutter, and Cross-Lot Swales.

RECOMMENDED ALTERNATIVE:

Storm Drains on El Moro Avenue and on Santa Maria Avenue. The El Moro Storm Drain would consist of a storm drain system extending from the Bay easterly on El Moro Avenue to 11th Street. Storm drain laterals off the main El Moro storm drain would extend northerly on 3rd, 4th and 5th Streets, and southerly on 9th and 10th Streets to drain existing low-points. Road inlets would be located at all low-points along the storm drain alignment. Either provide roadside swales or sections of new curb & gutter along portions of storm drain alignment to provide positive drainage to the storm drain inlets and reduce the incidence of runoff from entering adjacent properties. The incorporation of new storm drain, in combination with the new sewer may allow for abandonment of the existing pumping facilities along El Moro Avenue due to positive surface drainage from the existing depressions and additional storage capacity within the upper aquifer. Deep excavation of the storm drain would be required for the El Moro storm drain between the Bay and 5th Street.

A second interceptor storm drain would be constructed in Santa Maria Avenue to lessen the storm flows entering the El Moro depression. This storm drain system would extend from the Bay northerly on 1st Street, then easterly under Santa Maria Avenue towards Baywood Elementary School. Road inlets would be constructed along the route, and cross-gutters constructed at the intersections. Due to the beneficial natural topography along Santa Maria Avenue, relatively normal storm drain construction methods could be used (deep excavation not required).

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 6					
EL MORO STORM DRAIN					
A.C. PAVEMENT	110,000	SF	$1.5	$165,000	EL MORO ROAD WIDENING
CATCH BASIN	20	EA	$2,500.	$50,000	
CLEAR & GRUB	3	AC	$1,500.	$4,500	REMOVAL FROM ROW (TREE, FENCE, ETC)
CROSS-GUTTER	15	EA	$3,500.	$52,500	AT INTERSECTIONS
CURB & GUTTER	9,000	LF	$15.	$135,000	
DRIVEWAYS	75	EA	$800.	$60,000	WHERE CURB & GUTTER SPECIFIED
MANHOLE	25	EA	$2,500.	$62,500	
OUTLET STRUCTURE	1	EA	$5,000.	$5,000	TO BAY
SEDIMENT CAPTURE	20	EA	$600.	$12,000	FOSSIL FILTER
54" STORM DRAIN	1,000	LF	$100.	$100,000	
48" STORM DRAIN	1,000	LF	$62.	$62,000	
42" STORM DRAIN	400	LF	$55.	$22,000	
36" STORM DRAIN	400	LF	$45.	$18,000	
30" STORM DRAIN	400	LF	$40.	$16,000	
24" STORM DRAIN	1,800	LF	$35.	$63,000	
SANTA MARIA STORM DRAIN					
A.C. PAVEMENT	75,000	SF	$1.5	$112,500	SANTA MARIA WIDENING
CATCH BASINS	15	EA	$2,500.	$37,500	
CLEAR & GRUB	3	AC	$1,500.	$4,500	
CROSS GUTTERS	6	EA	$3,500.	$21,000	AT INTERSECTIONS
DRIVEWAYS	25	EA	$800.	$20,000	WHERE CURB & GUTTER SPECIFIED
MANHOLE	16	EA	$2,500.	$40,000	
OUTLET STRUCTURE	1	EA	$5,000.	$5,000	TO BAY
SEDIMENT CAPTURE	15	EA	$600.	$9,000	FOSSIL FILTER
30" STORM DRAIN	1,800	LF	$40.	$72,000	
24" STORM DRAIN	1,300	LF	$35.	$45,500	
18" STORM DRAIN	800	LF	$25.	$20,000	
			GRAND TOTAL:	$1,214,500	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-25
Groundwater Issues	III-12
Influence on Proposed Sewer	III-14
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
Not applicable due to limited available open area for retention and shallow depth to groundwater.

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C1A7: Area 7, Paso Robles Depression, 1400 Block to 1800 Block

PROBLEM DESCRIPTION:

Problems associated with Area 7 are similar to those experience in the sump regions of Area 6 and consist of an existing low area complicated by high groundwater resulting from septic tank system discharge and runoff from urban development. Residences in this low lying area are subject to flooding, road closure, and septic system failure. Flooding of the existing low areas is further complicated by a high ground water table. After storm events, water can be seen emerging from the upper elevations of 16th Street and flowing north to Paso Robles Avenue. In general, when flooding occurs in Area 7 ponded water remains for extended periods of time in Paso Robles Avenue. These ponds may be contaminated by septic tank effluent which could pose a serious health concern for the community.

In addition, cross lot drainage occurs due to the natural topography of the area resulting in flooding of residential properties. This cross lot drainage is aggravated by the street elevations being higher than the elevations of the adjacent lots and no road improvements (curb and gutter) to keep the flows contained in the streets. Road closure due to ponded water occurs on Paso Robles Avenue, 16th Street both north and south of Paso Robles Avenue, and on 18th Street south of Paso Robles Avenue.

ALTERNATIVES:

Permanent Pump Station, French Drain, Drain to Sewer, Storm Drain, Change Water Production to Upper Aquifer, Curb & Gutter, and Cross-lot Swales.

RECOMMENDED ALTERNATIVE:

Considered a long term solution after sewer is implemented or at such time that groundwater elevations decline 6' or greater. Construct 16.3± acre foot Paso Robles retention basin on vacant property east of 18th Street and south of the existing "Walker Channel" (easterly end of Paso Robles Avenue).

Construct a storm drain in Paso Robles Avenue with catch basins at each intersection and outlet to the proposed Paso Robles basin. Construct curb & gutter on Paso Robles Avenue and 15th, 16th, and 17th Streets to provide positive overland drainage to the Paso Robles Avenue storm drain, and reduce the incidence of cross-lot drainage.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 7					
BASIN	16	AF	$16,000.	$260,800	
CLEAR & GRUB	4	AC	$1,500.	$5,550	
CROSS-GUTTERS	8	EA	$3,500.	$28,000	
CURB & GUTTER	6,800	LF	$15.	$102,000	
DRIVEWAY	140	EA	$800.	$112,000	
INLET STRUCTURE	1	EA	$1,500.	$1,500	
MANHOLE	3	EA	$2,500.	$7,500	
OUTLET STRUCTURE	1	EA	$1,500.	$1,500	TO SD 12.1
PURCHASE PROPERTY	120,000	SF	$25.	$3,000,000	
REMOVE WALKER CHANNEL	3,000	SF	$1.25	$3,750	
ROAD INLET	8	EA	$2,500.	$20,000	
SEDIMENT CAPTURE	8	EA	$600.	$4,800	FOSSIL FILTER
36" STORM DRAIN	1,100	LF	$45.	$49,500	
18" STORM DRAIN	250	LF	$25.	$6,250	
WIDEN ROADWAY	81,600	SF	$2.	$163,200	12' EACH SIDE
			GRAND TOTAL:	$3,766,350	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-33
Groundwater Issues	III-25
Influence on Proposed Sewer	III-29
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Proposed Paso Robles basin would be used for recharge after groundwater elevations are reduced by the proposed sewer system.

C1A8: Area 8, Ramona/Pismo Depression, 300 Block to 1300 Block

PROBLEM DESCRIPTION:

Over twenty-two documented incidences of flooding to property, garages, and residences is prevalent throughout the Area 8 depression. In addition, short term failure of septic systems has been documented suggesting a surge of surface and, possibly subsurface flow. Street flooding was noted during the October 29, 1996 storm at 11th, 9th, 8th, 7th and 4th Streets together with complete inundation of the Ramona Lake west of 10th Street. Complete washout of Pismo Avenue, west of 6th Street has been known to occur so severely as to expose existing underground utilities and undermining 6th and 4th Street road sections. Sediments washed from Pismo Avenue have completely filled the swale on Pismo Avenue between 3rd and 4th Streets.

Residences within the depression have constructed drainage facilities to protect their properties. These facilities include swales, improved channels, walls, and berms. However, it has been noted that the surface flows arrive earlier and with more volume than in previous years suggesting that upstream residents are either increasing the amount of impermeable area (paving) or redirecting their drainage. Residents in the depression are concerned that their drainage improvements may not be capable of handling the increased flow volumes that they have been experiencing.

ALTERNATIVES:

Storm Drain, Retention and Detention Basins, Linear Park, Pump Station, Cross-lot Swales, Drain to Sewer, and Curb & Gutter.

RECOMMENDED ALTERNATIVE:

Construct a storm drain beginning at 4th Street at Pismo Avenue, extending east up Pismo, south on 7th Street to existing low-point, east through existing residential to 8th Street, then on to 9th Street, south on 9th Street to Ramona Avenue, east on Ramona ending at 12th Street. Construct road inlets at intersections along the alignment, at the intersection of Ramona and 9th Street, and at each low-point in 7th, 8th, and 9th Streets. The storm drain should be designed for a 25 year storm event with special consideration for inlet design in sump areas to minimize plugging (oversized inlets). Construct velocity reducing basin having sediment capture abilities southerly of Pismo Avenue between 3rd Street and 4th Street.

Storm drain extending under residential lots will require easements, pipe jacking or boring as required to minimize trenching between buildings. Overland escape channels between residences should be constructed to provide for positive overland escape in storms having significant intensities/duration or due to storm drain plugging. Channels would be designed for minimum disruption to the residences yet allowing for maximum open channel capacities. Existing overland facilities may be used after an engineering evaluation has been performed on their existing capacities.

Construct curb & gutter on 5th Street, 6th Street, 7th Street, 8th Street, and 9th Street between Pismo Avenue and Ramona Avenue to facilitate surface drainage to the proposed catch basins.

Construct lined channel through existing residential areas from existing 13th Street depression (between Ramona and San Luis Avenues) to 12th Street. Construct curb & gutter on 12th Street, providing minor regrading of 12th Street to capture surface flows and direct it northerly to Ramona.

Construct curb & gutter on Ramona Avenue from 11th Street to 13th Street. Construct east/west cross-gutters at the intersections of Ramona Avenue at 12th Street ant 13th Street to keep surface flows on Ramona heading west Construct north/south cross gutters on 11th Street at its intersection with Ramona Avenue to facilitate drainage to the proposed inlets.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE						
CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 8						
	SEDIMENT BASIN	6	AF	$16,000.	$96,000	SEDIMENT CAPTURE & VELOCITY REDUCING
	BASIN STRUCTURE	2	EA	$1,500.	$3,000	
	CATCH BASIN	21	EA	$2,500.	$52,500	
	CLEAR & GRUB	2	AC	$1,500.	$3,000	
	CONCRETE SWALE	450	LF	$15.	$6,750	CROSS-LOT
	CROSS GUTTER	12	EA	$3,500.	$42,000	
	CURB & GUTTER	12,000	LF	$15.	$180,000	
	DRIVEWAYS	160	EA	$800.	$128,000	
	MANHOLE	19	EA	$2,500.	$47,500	
	PURCHASE PROPERTY	90,000	SF	$25.	$2,250,000	
	SEDIMENT CAPTURE	21	EA	$600.	$12,600	FOSSIL FILTER
	48" STORM DRAIN	2,200	LF	$62.	$136,400	
	36" STORM DRAIN	1,300	LF	$45.	$58,500	
	18" STORM DRAIN	800	LF	$25.	$20,000	
	WIDEN ROADWAY	144,000	SF	$2.	$288,000	12' EACH SIDE
				GRAND TOTAL:	$3,324,250	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-44
Groundwater Issues	III-36
Influence on Proposed Sewer	III-40
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable due to limited available open area for retention.

CATEGORY 2: AREAS OF SHALLOW TO SURFACING GROUNDWATER AT THE BAY FRINGE

Drainage Areas Included in Category 2:
- Area 1: Santa Ysabel, Pasadena to 600 Block
- Area 14: Cuesta by the Sea, West
- Area 15: Cuesta by the Sea, East

C2A1: Area 1, Santa Ysabel, Pasadena to 600 Block

PROBLEM DESCRIPTION:
Closure of Pasadena Drive may be frequent during storm events and contaminated surface water due to septic tank failure is likely. Cross-lot drainage occurs due to a "hump" in Pasadena Drive between Santa Lucia Avenue and Santa Ysabel Avenue which diverts surface flows from the roadway through existing residential lots, terminating at an existing low-lying undeveloped lot which acts as a retention basin.

ALTERNATIVES:
Road Closure, Storm Drains, Wetlands, Regrade roadway, Swales, Berms, and Cross-lot swales.

RECOMMENDED ALTERNATIVE:
Permanent closure of Pasadena Drive between Santa Ysabel Avenue and Baywood Way with removal of existing pavement section and barricade Pasadena Drive at Santa Ysabel Avenue. Install new Bay access parking area using decomposed granite or other permeable surface with access from the south.

Regrade approximately 700 linear feet of Pasadena Drive to remove existing "hump" in road. Reconstruct new pavement section with positive cross-slope to the west. Install asphalt berm on the west side of the new road section to catch surface drainage. New asphalt berm to discharge surface flows at the southwest corner of Pasadena Drive and Santa Ysabel Avenue and into new swale leading to low-point. Collect surface flows in a lined (erosion reducing) swale for conveyance to bay discharge.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE						
CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 1						
	BARRICADE	1	EA	$1,000.	$1,000	
	CLEAR & GRUB	1	AC	$1,500.	$1,500	
	DECOMPOSED GRANITE	5,000	SF	$1.25	$6,250	PARKING AREA
	DRIVEWAY	16	EA	$800.	$12,800	
	REGRADE EXISTING ROADWAY	24,000	SF	$4.	$96,000	40' WIDTH
	REMOVE A.C. PAVEMENT	18,000	SF	$2.5	$45,000	ASSUME 20' WIDTH
	SWALE	100	LF	$8.5	$850	LINED
	WETLAND RESTORATION		LS	$15,000.	$15,000	OPTIONAL
				GRAND TOTAL:	$178,400	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-51
Groundwater Issues	III-48
Influence on Proposed Sewer	III-19
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable due to close proximity to bay fringe.

C2A14: Area 14, Cuesta by the Sea, West

PROBLEM DESCRIPTION:

The area having the most severe documented drainage problems is that bordered by Binscarth Drive south to Henrietta Avenue, and Pecho Valley Road east to Nancy Avenue where cross lot drainage, yard flooding and septic tank failures are a recurring problem. Binscarth Drive, from Pecho Valley Road to Sunny Hill Avenue, experiences flooding of roads and adjacent properties. Surface flow generating in the higher elevation of the drainage area sheet flow across Binscarth Road into northerly wetlands. The areas adjacent to Binscarth Road are further complicated by a lack of positive drainage in any direction and shallow depths to groundwater. Flooding documented in the area also includes a low lying portion of Pine Avenue just north of Los Osos Valley Road.

ALTERNATIVES:

Storm Drain, French Drain, Raise Foundations, Drain to Sewer, Curb & Gutter, Retention Basins, and Swales.

RECOMMENDED ALTERNATIVE:

Construct curb & gutter both sides on Pecho Valley Road extending from Los Osos Valley Road north towards Binscarth Drive. The portion of Pecho Valley Road between Grove Street and Binscarth Drive will require minor regrading (lowering) to provide positive drainage northerly. Construct vegetated swale from edge of pavement north into wetlands and towards the Bay to allow for positive overland escape of surface flows. Install catch basin at the intersection of Pecho Valley Road with Skyline Drive and connect to existing storm drain facility to the west.

Construct curb & gutter the entire length of Grove Street, on Nancy Avenue between Henrietta Avenue and Binscarth Drive, and on Binscarth Drive from Pecho Valley Road to Pine Avenue (match to curb and gutter improvements recommend for Areas 15 and 16). The portion of Binscarth Drive between Nancy Avenue and Pecho Valley Road will require regrading (lowering) to provide positive drainage westerly towards Pecho Valley Road. Drain new vegetated swale at north end of Pecho Valley Road.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 14					
CATCH BASIN	2	EA	$2,500.	$5,000	
CURB & GUTTER	8,200	LF	$15.	$123,000	
DRIVEWAYS	60	EA	$800.	$48,000	
MANHOLE	2	EA	$2,500.	$5,000	
REGRADE ROADWAY	32,000	SF	$4.	$128,000	BINSCARTH & PORTION OF PECHO VALLEY
ROAD WIDENING	49,500	SF	$2.5	$123,750	6' EACH SIDE
SEDIMENT CAPTURE	2		$600.	$1,200	FOSSIL FILTER
18" STORM DRAIN	100	LF	$25.	$2,500	
SWALE	200	LF	$8.5	$1,700	
			GRAND TOTAL:	$438,150	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-57
Groundwater Issues	III-53
Influence on Proposed Sewer	III-54
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable due to close proximity to bay fringe.

C2A15: Area 15, Cuesta by the Sea, East

PROBLEM DESCRIPTION:

There was only one documented drainage complaint for Area 15 pertaining to flooding at the intersection of Doris Avenue and Binscarth Road. During our field visit of October 29, 1996, flooding of a garage was observed at the depression on Fearn Avenue just north of Binscarth Road.

ALTERNATIVES:

Storm Drain, French Drain, Swale, Curb & Gutter, and Drain to Sewer.

RECOMMENDED ALTERNATIVE:

Construct curb & gutter on Binscarth Drive between Pecho Valley Road and Pine Avenue (match recommended alternatives for Areas 14 and 16), and north/south cross-gutters at the intersections of Fearn Avenue and Dorris Avenue with Binscarth Drive to divert flows northerly on the respective roads. This would redirect surface flows northerly on Doris Avenue to the existing low-point midblock between Binscarth Drive and Lupine Street. Construct curb & gutter on Doris Avenue with overside drain and cross-gutter at existing low-point. Surface flows would drain into new swale and towards Bay.

Construct curb & gutter on Fearn Avenue from Binscarth Drive north to midblock. Construct overside drain on west side and cross-gutter on Fearn to drain road to the existing lots. Construct vegetated swale from overside drain westerly towards Bay within existing low lying area. Install culvert under Doris Avenue. Will require drainage easement or property purchase.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 16						
	CROSS GUTTER	5	EA	$3,500.	$17,500	
	18" CULVERT	60	LF	$25.	$1,500	
	CURB & GUTTER	2,700	LF	$15.	$40,500	
	DRIVEWAYS	20	EA	$800.	$16,000	
	OVERSIDE DRAIN	3	EA	$1,200.	$3,600	
	ROAD WIDENING	16,200	SF	$2.5	$40,500	
	SWALE	800	LF	$8.5	$6,800	
	REGRADE ROADWAY	20,000	SF	$4.	$80,000	ASH St
	REQUIRES CURB & GUTTER ON					
	ALL OF BINSCARTH ROAD					
				GRAND TOTAL:	$206,400	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-63
Groundwater Issues	III-60
Influence on Proposed Sewer	III-60
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable due to close proximity to bay fringe.

CATEGORY 3: AREAS OF EXCESSIVE CONCENTRATION OF SURFACE RUNOFF

Drainage Areas Included in Category 3:
• Area 16: Broderson, Skyline, & Pine
• Area 27: Los Osos Valley Road at Cimmeron

C3A16: Area 16, Broderson, Skyline & Pine

PROBLEM DESCRIPTION:
The pump station at Don Avenue and Mitchell Drive has documented complaints of failure primarily associated with large volumes of storm water received during high intensity or long duration storm events. One of the primary drainage routes to the existing pump station is north on Pine Street. Complaints of storm water leaving Pine Street and flooding adjacent properties has also been documented. In addition, there are complaints of road and property flooding, sheet flow, and silt deposition at the intersection of Ramona Avenue at Pine Avenue.

The majority of complaints are related to property flooding in the Skyline, Ash, Broderson area, and Los Osos Valley Road flooding. These areas appear to be the first to receive all drainage from sub-areas 16B through 16F. After storm flows move across Los Osos Valley Road, and through the Skyline, Ash, Broderson area they migrate towards Pine Avenue and on to the existing pump station causing additional drainage related problems.

In addition to drainage problems in the lower elevations of the drainage area, silt deposition along Highland Drive and flooding of random properties have been documented in sub-areas 16C, 16D, 16E and 16F.

ALTERNATIVES:
Upgrade Pump Station, Increase Force Main Size, Storm Drains, Linear Park, Retention Basin, Diversion French Drain, Cutoff Swale, and Curb & Gutter.

RECOMMENDED ALTERNATIVE:

Los Osos Storm Drain:
Construct storm drain with road inlets along Los Osos Valley Road. Alignment would include connection to existing storm drain system in Bayview Heights Drive (DI 16.11), new inlets on both sides of Los Osos Valley Road at its intersection with Bayview Heights Drive, Bush Drive, and would replace existing inlets on Los Osos Valley Road (DI 16.1 and DI 16.2) with new inlets on both sides of road. Storm drain would drain easterly and westerly under Los Osos Valley Road to a collector under Palisades Drive, then northerly on Palisades Drive to the future Skyline Drive extension, the easterly on the future Skyline Drive extension to Ferrell Avenue, then northerly on Ferrell Avenue to the proposed Ferrell Basin (see Area 17), at the north end of Ferrell Drive.

Assuming this alignment, pipe sizes on Ferrell Avenue would need to be adjusted for Area 17 flows, and the Ferrell basin would be used for Los Osos Valley Road storm drain storage. The required basin retention capacity would be 55.4± acre feet. This additional volume would need to be added to the estimated retention capacity of 20± acre feet required by for Area 17. It is assumed that this size basin is impractical for the available land area and site topography. Therefore, the Ferrell basin should be sized to retain Area 17 flows, then enlarged accordingly to allow for sediment capture of Area 16 flows.

A basin discharge pipe would be required for this alternative. The pipe would be sized based on design storage of the Ferrell Basin, the portion of Area 17 flows, and Los Osos Valley Road flows. It is expected that storm drain may be required assuming alternative improvements to Areas 16 & 17 are made. Discharge storm drain alignment would be northerly towards Sweet Springs.

Curb & Gutter, Skyline, Binscarth:
Construct curb & gutter on Binscarth Drive between Pecho Valley Road and Pine Avenue (match recommended project for Areas 14 and 15), on Pine Avenue from Skyline Drive northerly to Ramona Avenue, and on Ash Street from Pine Avenue to Broderson Avenue. Construct cross-gutters at all intersections on Pine Avenue and at the intersection of Binscarth Avenue at Don Avenue. Drain Pine Avenue using cross-gutter across Ramona Drive and construct swale northerly into wetland area.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 16					
Los Osos Valley Road					
CATCH BASIN	9	EA	$2,500.	$22,500	
CONNECT TO EXIST SD	1	LS	$500.	$500	BAYVIEW HEIGHTS
MANHOLES	16	EA	$2,500.	$40,000	
MODIFY EXIST CATCH BASIN	1	LS	$1,000.	$1,000	LOVR WESTERLY OF PALISADES
PURCHASE PROPERTY	10,000	SF	$25.	$250,000	
SEDIMENT CAPTURE	10	EA	$600.	$6,000	FOSSIL FILTER
STAGED SEDIMENT BASINS	12	AF	$16,000.	$192,000	
54"-70" STORM DRAIN	3,200	LF	$100.	$320,000	LARGE
30"-48" STORM DRAIN	1,000	LF	$62.	$62,000	MEDIUM
18"-36" STORM DRAIN	1,600	LF	$45.	$72,000	NORMAL
REFER TO AREA 17 FOR BASIN COSTS					
Broderson, Skyline, & Pine					
CROSS GUTTERS	16	EA	$3,500.	$56,000	
CURB & GUTTER	5,000	LF	$15.	$75,000	
DRIVEWAYS	45	EA	$800.	$36,000	
ROAD WIDENING	30,000	SF	$2.5	$75,000	6' EACH SIDE
SWALE	200	LF	$8.5	$1,700	
REQUIRES CURB & GUTTER ON					
ALL OF BINSCARTH ROAD					
			GRAND TOTAL:	$1,209,700	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-73
Groundwater Issues	III-64
Influence on Proposed Sewer	III-67
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Storm flows to outlet into proposed Ferrell Basin. Coordinate with Morro Shores development to drain all, or portions of Los Osos Valley Road into the future Morro Shores basins.

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C3A27: Area 27, Los Osos Valley Road & Cimmeron

<u>*PROBLEM DESCRIPTION*</u>:

Los Osos Valley Road Flooding: Water accumulates southerly of Los Osos Valley Road at the culvert inlets. When these inlets become overtaxed, the water migrates westerly and floods Los Osos Valley Road at its low point near Cimmeron. Local residents have stated that there have been a number of vehicle related accidents associated with the flooding of Los Osos Valley Road and that flooding occurs on a regular basis.

There appear to be two factors causing this overtaxation of the existing culverts. First, the culverts are inadequate based on existing conditions, requiring additional head to pass a storm event through the culverts. This required head cannot be achieved without the breaching of Los Osos Valley Road. Second, the outlet condition of the culverts appears to be degraded. The existing channel is relatively flat and has experienced sedimentation thus reducing its hydraulic capacity for discharge.

Residential Flooding North of LOVR: Residential flooding east of Sombrero Drive has been documented due to the sedimentation and the natural sump conditions of the existing northerly channel with additional drainage problems neat Lariat at Tapidero.

Residential Flooding South of LOVR: One residence on Cimmeron has reported frequent flooding of yard, garage and residence. A study prepared by John Wallace & Associated for Mr. Mitch Gantz on July 14, 1995, stated that this flooding may be due to a number of factors. These factors include the inadequate capacity of the existing culverts and uncontrolled drainage along Los Osos Valley Road.

<u>*ALTERNATIVES*</u>:

Culverts, Berm, Improve Channel, Storm Drain, and Raise Foundations.

<u>*RECOMMENDED ALTERNATIVE*</u>:

Construct storm drain near the southeasterly corner of the intersection of Cimmeron Way at Los Osos Valley Road, extending northerly under LOVR, northerly under Sombrero Drive, then northeasterly to connect with the existing drainage channel located east of existing agricultural operations.

Also construct earth berm behind existing residential lots easterly of Sombrero Drive to keep flows within existing channel.

expand per culverts listed

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE						
CAT.	**ITEM**	**QUANT**	**UNIT**	**COST/UNIT**	**COST**	**DESCRIPTION**
AREA 27						
	BERM	8,000	CY	$2.5	$20,000	
	CULVERTS	100	LF	$40. 25	$4,000	UNDER CIMARRON WAY
	HEADWALL	2	EA	$1,200.	$2,400	
	MANHOLE	5	EA	$2,500.	$12,500	
	OUTLET STRUCTURE	1	EA	$1,500.	$1,500	
	ROAD INLETS	5	EA	$2,500.	$12,500	
	SEDIMENT CAPTURE	5	EA	$600.	$3,000	FOSSIL FILTER
	54" STORM DRAIN	2,500	LF	$68.	$170,000	
	18" STORM DRAIN	400	LF	$25.	$10,000	
	SWALE	500	LF	$8.5	$4,250	SD TO WARREN LAKE THRU AG LAND
				GRAND TOTAL:	**$240,150**	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-80
Groundwater Issues	III-77
Influence on Proposed Sewer	III-78
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable.

CATEGORY 4: AREAS WITH INADEQUATE SURFACE SLOPES

Drainage Areas Included in Category 4:
• Area 17: Los Osos Valley Road
• Area 19: Santa Ynez at Mountain View
• Area 20: Santa Ynez at Fairchild
• Area 21: Vons Basin
• Area 22: Fairchild Basin

C4A17: Area 17, Los Osos Valley South

PROBLEM DESCRIPTION:
Most drainage problems in Area 17 area associated with road flooding. During a field visit on October 29, 1996, numerous surface ponding areas were documented. There are documented or known instances of cross lot drainage and one instance of reported septic tank failure. Street ponding occurs at the intersection of Ferrell Avenue at Bush Drive, at three locations on Nipomo Avenue, at two on 7th Street, at one on 9th Street, at one on 11th Street at the sidewalk drain, and at one location on 12th Street. Cross lot drainage occurs on 7th Street between Nipomo and San Luis Avenues, and again between San Luis and Ramona Avenues. A small sump area occurs along Santa Ynez between 9th and 10th Streets due to flat topography. Water runs from Santa Ynez past existing cross gutter and northerly along 9th Street causing flooding problems to adjacent lots.

ALTERNATIVES:
Curb & Gutter, Storm Drain, Retention Basin, Culverts, Street Basin, French Drain, Private Retention Basins, and Cross-lot Swales.

RECOMMENDED ALTERNATIVE:
Ferrell Detention Basin:
Construct a detention basin which would be bounded by Ramona Avenue, Ferrell Drive, 5th Street, and Los Osos Fault Strand B. Approximately 7.5± acres of open land is presently available for recharge; however, purchase of the land would be required. The alternative Ferrell basin could also be used to recharge a portion of storm waters receive from Los Osos Valley Road.

San Luis Storm Drain:
Construct San Luis Avenue storm drain system from the proposed Ferrell detention basin easterly under San Luis Avenue to 11th Street, then south on 11th Street to existing low-point at midblock. Construct road inlets at low-point on 11th Street and at low-point on San Luis Avenue east of 9th Street. Construct storm drain extensions with road inlets from alternative San Luis Avenue storm drain southerly on 6th Street to existing low-point, and northerly and southerly on 7th Street to existing low-points. Construct curb & gutter or roadside swales (per Figure III-2) and cross-gutters on San Luis Avenue to facilitate surface drainage to inlets.

Ferrell/Nipomo Storm Drain:
Construct Ferrell Drive storm drain system from proposed Ferrell basin southerly on Ferrell Drive to intersection of Ferrell Drive and Bush Drive, then westerly on Bush to existing low-point. Construct approximately 1000 linear feet of curb & gutter on Ferrell and Bush to drain streets to existing low-point.

Provide storm drain branch from the alternative Ferrell Drive storm drain easterly to Nipomo Avenue and extending under Nipomo Avenue to existing low-point at the intersection of 13th Street to drain Area 18. Construct storm drain extensions from the Nipomo branch northerly on 8th Street to drain existing low-point midblock. Continue Nipomo branch southerly on 11th Street to low-point south of Santa Ynez Avenue. Provide road inlets along the Nipomo branch and at existing low-points on 11th Street. This storm drain will require easements and between Nipomo Avenue and Ferrell Drive. Construct curb & gutter or roadside swales (per Figure III-2) and cross-gutters on Nipomo Avenue to facilitate surface drainage to inlets.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 17					
SAN LUIS STORM DRAIN					
STAGED SEDIMENT BASINS	12	AF	$16,000.	$192,000	FERRELL BASIN
CATCH BASIN	10	EA	$2,500.	$25,000	
CROSS GUTTER	14	EA	$3,500.	$49,000	
CURB & GUTTER	5,000	LF	$15.	$75,000	
INLET STRUCTURE	1	EA	$1,500.	$1,500	TO FERRELL BASIN
MANHOLE	12	EA	$2,500.	$30,000	
PURCHASE PROPERTY	10,000	SF	$25.	$250,000	
SEDIMENT CAPTURE	10	EA	$600.	$6,000	FOSSIL FILTER
30" STORM DRAIN	1,000	LF	$40.	$40,000	
24" STORM DRAIN	700	LF	$35.	$24,500	
18" STORM DRAIN	1,700	LF	$25.	$42,500	
WIDEN ROADWAY	60,000	SF	$2.5	$150,000	12' WIDENING EACH SIDE
NIPOMO STORM DRAIN					
CATCH BASIN	14	EA	$2,500.	$35,000	
CROSS GUTTER	8	EA	$3,500.	$28,000	
CURB & GUTTER	3,000	LF	$15.	$45,000	
INLET STRUCTURE	1	EA	$1,500.	$1,500	
MANHOLE	16	EA	$2,500.	$40,000	
SEDIMENT CAPTURE	14	EA	$600.	$8,400	FOSSIL FILTER
36" STORM DRAIN	800	LF	$45.	$36,000	LARGE-TO BASIN
30" STORM DRAIN	1,200	LF	$40.	$48,000	MEDIUM
18" STORM DRAIN	2,700	LF	$25.	$67,500	NORMAL
WIDEN ROADWAY	36,000	SF	$2.5	$90,000	12' EACH SIDE
			GRAND TOTAL:	$1,284,900	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-86
Groundwater Issues	III-82
Influence on Proposed Sewer	III-83
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Construct a 6.6 acre foot retention basin in the vacant lot at the northeast corner of the intersection of Santa Ynez and 8th Street to capture and recharge a portion of Area 17C surface runoff. Will require land acquisition for the basin and minor regrading of the intersection of Santa Ynez Avenue and 9th Street to provide positive westerly surface drainage. May also require curb & gutter, or roadside swales & culverts at each driveway and at each intersection to convey surface flows to basin. These surface improvements would extend easterly on Santa Ynez from the proposed basin to 11th Street.

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C4A19: Area 19, Santa Ynez & Mountain View

PROBLEM DESCRIPTION:

An existing inlet (19.1) on Mountain View north of its intersection with Los Olivos Avenue accepts surface flows from the improved roadway section. A storm drain connects inlet (19.1) to a swale on the east side of Mountain View near Los Olivos Avenue. This swale is severely silted, which decreases the hydraulic efficiency of the storm drain. A second inlet between Mountain View and South Bay Boulevard (19.2) was constructed in July of 1992 and appears to be more a site specific drainage solution and less an area specific solution. Newer developments in Area 19 and along Los Olivos Avenue have installed onsite retention basins.

ALTERNATIVES:

Retention Basin and Storm Drain.

RECOMMENDED ALTERNATIVE:

Construct roadside swales per Figure III-2 on Nipomo Avenue and Mountain View Drive with culverts under Nipomo Avenue and Mountain View Drive (at existing low-point). Outlet into new cross-lot swale extending easterly from existing low-point towards South Bay Boulevard with discharge to existing 42" (Culvert 19.2) culvert under South Bay Boulevard.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 19						
	18" CULVERTS	120	LF	$25.	$3,000	UNDER ROADWAYS
	18" CULVERTS	120	LF	$25.	$3,000	UNDER DRIVEWAYS
	ROADSIDE SWALE	500	LF	$30.	$15,000	MOUNTAIN VIEW DR & NIPOMO AVE
	SWALE	250	LF	$8.5	$2,125	CROSS-LOT
				GRAND TOTAL:	$23,125	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-91
Groundwater Issues	III-88
Influence on Proposed Sewer	III-88
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

As an option, purchase property at the southwesterly intersection of Nipomo Avenue at Mountain View Drive and construct retention basin.

C4A20: Area 20, Santa Ynez & Fairchild

PROBLEM DESCRIPTION:
Santa Ynez Avenue is a flat unimproved section with a relatively small tributary area having poor drainage. No problems were identified in this area.

ALTERNATIVES:
Storm Drain, Retention Basin, and Regrade Street.

RECOMMENDED ALTERNATIVE:
None. Area 20 has been added to Area 17.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 20					
NOT APPLICABLE					
			GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-95
Groundwater Issues	III-93
Influence on Proposed Sewer	III-93
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
Not applicable.

C4A21: Area 21, Vons Basin

PROBLEM DESCRIPTION:
According to the County, the Vons basin had reportedly spilled and flooded adjacent properties to the west in 1995.

ALTERNATIVES:
Enlarge existing Basin, Construct new Basin and Hydraulically connect.

RECOMMENDED ALTERNATIVE:
No Project. Maintenance of existing basin including sediment removal and scarification of basin bottom to improve percolation.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE						
CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 21						
	NOT APPLICABLE					
				GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-98
Groundwater Issues	III-95
Influence on Proposed Sewer	III-95
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
Recharge using existing retention basin.

C4A22: Area 22, Fairchild Basin

PROBLEM DESCRIPTION:
Flooding of Los Olivos Avenue just east of the Fairchild basin is a regular event, even in minor storms. Existing businesses have flood related problems as a result of the Los Olivos depression. Additionally, infrequent pumping of the Fairchild basin is directed westerly on Los Olivos Avenue resulting in flooding problems in Area 17C (refer to Area 17). According to the County, the Fairchild Basin had reportedly filled in 1995.

ALTERNATIVES:
Catch Basin, Enlarge Existing Basin, hydraulically Connect Basins, Storm Drain, and Construct New Retention Basin.

RECOMMENDED ALTERNATIVE:
Construct new 2.2± acre-foot retention basin at northeast intersection of Fairchild and Los Olivos Avenue and hydraulically connect the two basins (Fairchild and new basin). Construct road inlets on Los Olivos Avenue to drain existing low-point into basins. Will required land acquisition and storm drain infrastructure.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 22					
BASIN HEADWALLS	2	EA	$1,200.	$2,400	FAIRCHILD & NEW BASIN
CATCH BASIN	2	EA	$2,500.	$5,000	DRAIN TO FAIRCHILD BASIN
PURCHASE PROPERTY	16,000	SF	$25.	$400,000	
RETENTION BASIN	2	AF	$16,000.	$35,200	
SEDIMENT CAPTURE	2	EA	$600.	$1,200	FOSSIL FILTER
36" STORM DRAIN	200	LF	$45.	$9,000	HYDRAULICALLY CONNECT BASINS
18" STORM DRAIN	100	LF	$25.	$2,500	CB TO FAIRCHILD BASIN
			GRAND TOTAL:	$455,300	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-102
Groundwater Issues	III-99
Influence on Proposed Sewer	III-100
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
Recharge using existing and new retention basins.

CATEGORY 5: AREAS WITH CLOSED DEPRESSIONS HAVING LIMITED SURFACE DRAINAGE

Drainage Areas Included in Category 5:
- Area 9: 14th Street to 17th Street Depression between Pismo and Ramona
- Area 10: San Luis Avenue, 1300 Block to South Bay Boulevard
- Area 18: Nipomo, 1200 Block to Mountain View

C5A9: Area 9, 14th to 17th Street Depression between Pismo & Ramona

PROBLEM DESCRIPTION:
Cross lot drainage occurs due to the natural topography of the area causing flooding of residential properties. In 1987 an inlet and pipe were constructed to drain standing water from 16th Street to 17th Street, where a detention basin was constructed. It is assumed that this has alleviated the drainage problems of 16th and 17th Streets. However, complaints of residential property flooding have been documented at 14th and 15th Streets.

ALTERNATIVES:
Storm Drain, Retention Basin, Subsurface Basin, Cross-lot Swales, Curb & Gutter, Drain to Sewer, and Pump Station.

RECOMMENDED ALTERNATIVE:
Install storm drain on 15th from low point between Pismo and Ramona Avenues north on 15th Street and daylight to 15th Street north of Pismo Avenue. Install storm drain on 16th from low point between Pismo and Ramona Avenues north on 16th Street and daylight to 16th Street north of Pismo Avenue.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 9					
CATCH BASINS	4	EA	$2,500.	$10,000	14th & 15th ST
MANHOLE	2	EA	$2,500.	$5,000	
OUTLET STRUCTURE	2	EA	$1,500.	$3,000	DAYLIGHT TO ROADWAY
SEDIMENT CAPTURE	4	EA	$600.	$2,400	FOSSIL FILTER
18" STORM DRAIN	900	LF	$25.	$22,500	
			GRAND TOTAL:	$42,900	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-106
Groundwater Issues	III-103
Influence on Proposed Sewer	III-104
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
No undeveloped land available for recharge basins.

C5A10: Area 10, San Luis Avenue, 1300 Block to South Bay Boulevard

PROBLEM DESCRIPTION:
There are three naturally occurring sump areas, two areas where street ponding occurred during the October 29, 1996 storm, and one County noted area of erosion and cross lot drainage. However, there were no complaints from the community regarding specific drainage problems threatening residential properties.

ALTERNATIVES:
Retention Basin, Subsurface Basin, Curb & Gutter, and Drain to Sewer.

RECOMMENDED ALTERNATIVES:
15th Street Basin:
Construct 1.6± acre-foot retention basin at southerly end of 15th Street in existing depression. Assuming 6' maximum depth, approximately 12,000 square feet of land would be required. Construct road inlets and storm drain from existing low-point on 14th Street between Ramona and San Luis Avenues, easterly to proposed basin. Basin would require land acquisition and easements would be required for the cross-lot storm drain which drains 14th Street.

San Luis Avenue Basin:
Construct two 2.5± acre-foot recharge basins at the southeast and southwest corners of San Luis Avenue at 17th Street. Assuming 6' maximum depth, approximately 36,500 square feet of land would be required. Hydraulically connect basins with culvert extending under 17th Street.

San Luis Avenue Swale:
Construct roadside swales per Figure III-2 either side of San Luis Avenue easterly towards 17th Street and discharge to proposed basin. Construct culvert under San Luis Avenue to drain northerly swale to proposed basin.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 10					
16th ST BASIN					
CATCH BASIN	4	EA	$2,500.	$10,000	
CLEAR & GRUB	1	AC	$1,500.	$1,350	
MANHOLE	2	EA	$2,500.	$5,000	
PROPERTY PURCHASE	12,000	SF	$25.	$300,000	FOR BASIN
RETENTION BASIN	2	AF	$16,000.	$25,600	16th ST BASIN
SEDIMENT CAPTURE	4	EA	$600.	$2,400	FOSSIL FILTER
18" STORM DRAIN	400	LF	$25.	$10,000	CROSS-LOT
17th ST BASIN					
CLEAR & GRUB	2	AC	$1,500.	$2,700	
18" CULVERTS	200	LF	$25.	$5,000	UNDER DRIVEWAYS-SAN LUIS AVE
PROPERTY PURCHASE	36,500	SF	$25.	$912,500	
RETENTION BASIN	5	AF	$16,000.	$80,000	17th ST BASIN
ROADSIDE SWALE	2,000	LF	$30.	$60,000	SAN LUIS AVE
18" STORM DRAIN	150	LF	$25.	$3,750	CONNECT BASINS
			GRAND TOTAL:	$1,418,300	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-111
Groundwater Issues	III-108
Influence on Proposed Sewer	III-108
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Recharge using proposed retention basins.

C5A18: Area 18, Nipomo, 1200 Block to Mountain View

PROBLEM DESCRIPTION:

Flooding of homes at 1877 and 1878 12th Street. Flooding occurs even in moderate storms. An increase of building in the area may also have contributed to the regularity of flooding. Most surface runoff appears to come off of Nipomo Avenue.

ALTERNATIVES:

Retention Basin, Storm Drain, Culverts, Pump Station, and Curb & Gutter.

RECOMMENDED ALTERNATIVE:

Extension of Area 17 Nipomo Avenue storm drain.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 18					
REFER TO AREA 17-NIPOMO SD					
			GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-116
Groundwater Issues	III-113
Influence on Proposed Sewer	III-113
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Limited undeveloped land area available for retention basin.

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CATEGORY 6: OTHER NUISANCE PROBLEM AREAS

Drainage Areas Included in Category 6:

- Area 2: Santa Lucia
- Area 3: Santa Ysabel, 700 Block to 1200 Block
- Area 4: Santa Ysabel, 1300 Block to 1600 Block
- Area 5: Santa Ysabel, 1600 Block to South Bay Boulevard
- Area 11: Ramona, 1600 Block to South Bay Boulevard
- Area 13: Monarch/Sea Pines
- Area 23: South bay Boulevard & Los Osos Valley Road to Los Osos Creek
- Area 24: Los Osos Valley Road & Buckskin to Los Osos Creek
- Area 25: Cabrillo Estates Basin
- Area 26: Bay Oaks & Oak Ridge

C6A2: Area 2, Santa Lucia

PROBLEM DESCRIPTION:
Sediment deposition at the intersection of Santa Lucia Avenue and 3rd Street. This sediment deposition appears to be a nuisance rather than a problem. No other reported problems.

ALTERNATIVES:
Curb & Gutter, Erosion Control, Concrete Channel, Storm Drain, and Maintenance

RECOMMENDED ALTERNATIVE:
No project. Maintenance program to clear streets of sedimentation.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 2					
NOT APPLICABLE					
			GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-120
Groundwater Issues	III-117
Influence on Proposed Sewer	III-118
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable.

A6A3: Area 3, Santa Ysabel, 700 Block to 1200 Block

PROBLEM DESCRIPTION:
Erosion and sediment deposition on Santa Ysabel between 8th and 9th Streets suggest that water concentrates, ponds and then spills northerly in this general area. Ponding (reduction in flow velocity) allows for the settling of sediments being carried in a storm flow. A single residence on the 1200 block of 12th Street has experienced flooding problems due to water entering the property from the street.

ALTERNATIVES:
Curb & Gutter, Erosion Control, Maintenance, and Storm Drains.

RECOMMENDED ALTERNATIVE:
No project. Maintenance program to clear streets of sedimentation.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE						
CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 3						
	NOT APPLICABLE					
				GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-124
Groundwater Issues	III-121
Influence on Proposed Sewer	III-121
Water Quality Discharge	II-13

WATER REUSE OPTIONS:
Not applicable.

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C6A4: Area 4, Santa Ysabel, 1300 Block to 1600 Block

PROBLEM DESCRIPTION:

Flooding on 14th Street and cross-lot drainage. 14th Street immediately north of Santa Ysabel is a low lying area that easily floods, with ponded water remaining for extended periods of time. The area northerly of 14th Street has surface flows generating in the east and flowing westerly midblock through the residential areas of 14th, 13th, 12th and 11th Streets, then into an existing cross lot channel between 10th and 11th Streets, with final discharge to the bay. This cross lot drainage is primarily attributed to the natural topographic features of the drainage area. The community related complaints are primarily related to 14th Street cross lot drainage and street ponding.

ALTERNATIVES:

Storm Drain, Diversion Storm Drain, Sewer, Pump to Area 5 Basin, Drain across Private Property, French Drain, Subsurface Basin, Retention Basin, and Drain to Sewer.

RECOMMENDED ALTERNATIVE:

Construct lined diversion swale north of residential area that extends from high point near the north end of 16th Street westerly to approximately the north end of 10th Street. Outlet the swale into a storm drain which connects with the proposed storm drain described below.

Construct cross-lot storm drainage system beginning with inlets at the low-point on 15th Street and extending westerly through properties to 10th Street, then northerly on 10th Street with outlet to existing open area. Construct road inlets at all low points on 10th, 11th, 12th, 13th, 14th, and 15th Streets with additional storm drain extension and road inlets on 14th Street at the second low-point, just north of its intersection with Santa Ysabel Avenue. Construct outlet structure with rock rip-rap slope protection from outlet to Bay discharge point.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 4					
CLEAR & GRUB	1	AC	$1,500.	$1,200	HILLSIDE AREA
CULVERT	200	LF	$500.	$100,000	CONNECT SWALE TO NEW STORM DRAIN SYSTEM
DROP INLET	12	EA	$2,500.	$30,000	
HEADWALL	1	EA	$1,500.	$1,500	
MANHOLES	10	EA	$2,500.	$25,000	
ROCK RIP-RAP	12	TON	$150.	$1,800	TO OUTLET
SEDIMENT CAPTURE	12	EA	$600.	$7,200	FOSSIL FILTER
36" STORM DRAIN	1,000	LF	$45.	$45,000	
30" STORM DRAIN	400	LF	$40.	$16,000	
24" STORM DRAIN	200	LF	$35.	$7,000	
18" STORM DRAIN	900	LF	$25.	$22,500	
			GRAND TOTAL:	$257,200	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-130
Groundwater Issues	III-126
Influence on Proposed Sewer	III-127
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Restricted. Limited usable open area for storm water collection or recharge capabilities. Would require purchase of existing developed residential lands to construct reuse facilities.

C6A11: Area 11, Ramona, 1600 Block to South Bay Boulevard

PROBLEM DESCRIPTION:

There are two areas where street ponding was noted during the October 29, 1996 storm, and one County noted problem area. There were no complaints from the community regarding specific residential threats due to drainage although street ponding south of the intersection of 17th Street at Ramona Avenue appeared to restrict access to two residential driveways.

ALTERNATIVES:

Retention Basin, Subsurface Basin, Curb & Gutter, and Drain to Sewer.

RECOMMENDED ALTERNATIVE:

Construct earth swales on 17th Street and on Ramona Avenue with under-road culverts to drain area to existing low-point on 17th Street (south of Ramona Avenue). Construct swales from 17th Street low-point easterly to South Bay Boulevard to drain roadway through private property.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 11					
CROSS-LOT SWALE	200	LF	$8.5	$1,700	PRIVATE PROPERTY
18" STORM DRAIN	100	LF	$25.	$2,500	UNDER 17th ST & UNDER RAMONA AVE
ROADSIDE SWALE	2,000	LF	$30.	$60,000	RAMONA AVE & 17th ST
			GRAND TOTAL:	$64,200	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-135
Groundwater Issues	III-132
Influence on Proposed Sewer	III-132
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

As an option, purchase property at 17th Street low-point (midway between Ramona and San Luis Avenues) and construct retention basin.

C6A13: Area 13, Monarch/Sea Pines

PROBLEM DESCRIPTION:

Only nuisance problems were identified in this area. Road flooding was noted during a field visit at the intersections of Howard Avenue with Fresno, El Dorado and Del Norte Streets. This is primarily attributed to the installation of cross gutters at the time of subdivision construction with the intention that the roads would continue through the (now existing) Sea Pine Golf Course. Removal of these cross gutters and installation of new curb and gutter on the northside of Howard Avenue would solve this street flooding. In addition to Howard Avenue flooding, a county map identified sand and silt deposition problems at inlets 13.1 & 13.2.

ALTERNATIVES:

Remove Existing Road Improvements to Promote Drainage, Retention Basins, Storm Drain, and Graded Swales.

RECOMMENDED ALTERNATIVE:

Remove existing earth sediment berms between Howard Avenue and the golf course to provide positive drainage from the intersections of El Dorado, Del Norte, and Humbolt at Howard onto the golf course. Construct earth swale within the golf course property to divert flows westerly to new point of concentrated discharge, or provide a terminal trench (see Figure III-9) to catch sediments and provide overflow dispersion of concentrated flows onto the golf course.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 13					
CLEAR & GRUB	1	AC	$1,500.	$750	SEDIMENT & SWALE CONST
CONSTRUCT EARTH SWALE	1,200	LF	$8.5	$10,200	IN GOLF COURSE
			GRAND TOTAL:	$10,950	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-140
Groundwater Issues	III-137
Influence on Proposed Sewer	III-138
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Dispersion across existing golf course.

C6A23: Area 23, South Bay Boulevard & Los Osos Valley Rd to Los Osos Creek

PROBLEM DESCRIPTION:

Temporary roadway flooding together with sand and silt deposition were identified as problems on Sage Avenue at Hollister Lane, Nipomo Avenue at Eto Creek, at the low point on Willow Drive at road inlet (23.1), and near the first curve on Willow Drive just north of Los Osos Valley Road. During the storm of October 29, 1996, street ponding was noted at inlet (23.1). No flooding of Nipomo Avenue at Eto Creek was noted although this condition may exist during severe storm events.

ALTERNATIVES:

Regrade Roadway, Retention Basin, Upgrade Existing Culverts, and Construct Channel.

RECOMMENDED ALTERNATIVE:

Remove existing road inlet (DI 23.1), construct cross gutter spanning Willow Drive, and construct asphalt overside drain on westerly side of Will Drive to provide positive roadway drainage. Construct earth swale across private property to convey surface flows to Eto Creek.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 23					
CONST 12' CROSS GUTTER	1	EA	$4,500.	$4,500	2" DEPRESSION
CONST EARTH SWALE	400	LF	$8.5	$3,400	TO ETO CREEK
CONST OVERSIDE DRAIN	1	EA	$1,500.	$1,500	PER CALTRANS
REMOVED EXISTING CATCH BASIN	1	LS	$500.	$500	
SAWCUT & REMOVE AC PAVEMENT	500	SF	$2.	$1,000	
SWALE EASEMENT REQ					
			GRAND TOTAL:	$10,900	

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-144
Groundwater Issues	III-142
Influence on Proposed Sewer	III-142
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Drain to Eto Creek for recharge.

C6A25: Area 25, Cabrillo Estates & Vista de Oro

PROBLEM DESCRIPTION:

Cabrillo Heights: In March of 1995 the Cabrillo Estates retention basin spilled, causing flooding in the proposed Monarch Grove Subdivision. A portion of Madera Street, south of Rodman Drive is subject to erosion and severe sand and silt accumulation. Hillside erosion was reported north of Travis Drive but may be stabilized since the installation of the Travis Drive storm drain system and subsequent removal of the overside drains north of Travis Drive.

Vista de Oro: Silt and sand deposition at the intersection of Vista Court and Los Arboles Way, possibly due to hillside erosion. The County believes that the Los Arboles basin filled during the storm of 1995.

Redfield Woods: Silt and sand deposition at the intersection of Highland Drive and Alexander Avenue, possibly due to hillside erosion.

Los Osos: Ponding at the intersection of Pecho Valley Road and Los Osos Valley Road (inlet 25.3) which extends into the eastbound travel lane.

ALTERNATIVES:

Maintenance, Enlarge Basin, Modify Basin Outlet, Lot Grading, Rock Berm, Intercept Swale, and Retention Basin

RECOMMENDED ALTERNATIVE:

No Project. The undeveloped open space south of Redfield Woods and Highland Drive may be home to endangered species.

PROJECT COSTS:

REVISED CONSTRUCTION COST ESTIMATE					
CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
AREA 25					
NOT APPLICABLE					
			GRAND TOTAL:		

PROJECT CONSIDERATIONS:

ITEM	REFERENCE
Applicable Regulations	III-152
Groundwater Issues	III-146
Influence on Proposed Sewer	III-148
Water Quality Discharge	II-13

WATER REUSE OPTIONS:

Not applicable.

CATEGORY 7: OTHER AREAS WITH MINIMAL PROBLEMS

Drainage Areas Included in Category 7:
- Area 5: **Santa Ysabel, 1600 Block to South Bay Boulevard**
- Area 12: **Los Osos Junior High**
- Area 24: **Los Osos Valley Road & Buckskin to Los Osos Creek**
- Area 26: **Drainage Area 26: Bay Oaks & Oak Ridge**

No drainage recommendations were made for the following drainage areas.

C7A5: Area 5, Santa Ysabel, 1600 Block to South Bay Boulevard
Not applicable

C7A12: Area 12, Los Osos Junior High
Not applicable

C7A24: Area 24, Los Osos Valley Road & Buckskin to Los Osos Creek
Not applicable

C7A26: Area 26, Drainage Area 26: Bay Oaks & Oak Ridge
Not applicable

C. SUMMARY RECOMMENDED ALTERNATIVES

The below Table IV-2 summarizes the recommended project alternatives and estimated costs as presented in this section.

TABLE IV-2: SUMMARY OF ALTERNATIVE PROJECTS

Area	Description	Project	Cost	% of Total
1	Santa Ysabel, Pasadena to 600 Block	Road Closure	$178,400	1.3%
2	Santa Lucia	Maintenance	No Project	
3	Santa Ysabel, 700 Block to 1200 Block	Maintenance	No Project	
4	Santa Ysabel, 1300 Block to 1600 Block	Storm Drains	$257,200	1.8%
5	Santa Ysabel, 1600 Block to South Bay Blvd	Not Applicable	No Project	
6	El Moro Depression, 300 Block to 1400 Block	Storm Drains	$1,214,500	8.6%
7	Paso Robles Depression, 1400 Block and 1800 Block	Retention Basin	$3,766,350	26.6%
8	Ramona/Pismo Depression from 300 Block to 1300 Block	Storm Drain	$3,324,250	23.5%
9	14th to 17th Street Depression between Pismo & Ramona	Storm Drain	$42,900	0.3%
10	San Luis Avenue, 1300 Block to South Bay Blvd	Retention Basin	$1,418,300	10.0%
11	Ramona, 1600 Block to South Bay Blvd	Swale	$64,200	0.5%
12	Los Osos Jr. High	Not Applicable	No Project	
13	Monarch/Sea Pines	Swale	$10,950	0.1%
14	Cuesta by the Sea, West	Regrade Roadway	$438,150	3.1%
15	Cuesta by the Sea, East	Regrade Roadway	$206,400	1.5%
16	Broderson, Skyline & Pine	Storm Drain	$1,209,700	8.6%
17	Los Osos Valley South	Storm Drain	$1,284,900	9.1%
18	Nipomo, 1200 Block to Mountain View	Storm Drain	No Project	
19	Santa Ynez at Mountain View	Swale	$23,125	0.2%
20	Santa Ynez at Fairchild	Not Applicable	No Project	
21	Vons Basin	Not Applicable	No Project	
22	Fairchild Basin	Retention Basin	$455,300	3.2%
23	South Bay Blvd. & Los Osos Valley Rd to Los Osos Creek	Cross Gutter	$10,900	0.1%
24	Los Osos Valley Road & Buckskin to Los Osos Creek	Not Applicable	No Project	
25	Cabrillo Estates & Vista de Oro	Maintenance	No Project	
26	Bay Oaks & Oak Ridge	Not Applicable	No Project	
27	Los Osos Valley Road at Cimmeron	Storm Drain	$240,150	1.7%
		Subtotal:	$14,145,675	100.0%
		Contingency (20%):	$2,829,135	
		Engineering/Surveying/Construction Management (15%):	$2,121,851	
		Permitting/Environmental (15%):	$2,121,851	
		TOTAL:	**$21,218,513**	

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SECTION V

PRIORITIZATION & BENEFIT ASSESSMENT

A. INTRODUCTION

The information presented in preceding sections to this report have dealt specifically with existing drainage problems, alternative solutions to those problems, environmental considerations of the specific solutions, and estimated construction costs. This section of the report presents the final analysis by providing a prioritization of the improvements, project financing, and an estimated construction schedule.

Although each of the individual area projects could be considered separate and distinct construction projects, this section of the report will address each of these separate alternatives as a combined single project. If it is later determined that individual projects be removed from the overall alternative projects list then adjustments to the information presented in this section is neccessary.

B. PRIORITIZATION OF ALTERNATIVE PROJECTS

Table IV-2 summarizes the recommended Alternative Projects as addressed in Section IV. Using these alternative projects, a prioritization of project importance was needed to provide a preliminary construction schedule for the overall project. The overall project is defined as the combination of all recommended alternative projects as a single project.

The first step in considering the overall project was to begin a prioritization process of each of the alternative projects. This prioritization consisted of first removing all drainage areas from the list that had a "No Project" status. This resulted in 17 remaining projects which requiring ranking based on necessity of importance.

The second step was to classify the 17 remaining projects as either localized projects or community projects. Localized projects were defined as those projects that, if constructed, would have primary benefit to that fraction of the population living in close proximity to the project. A community project was defined as those projects that the majority of the community may derive benefit from regardless of proximity to the project.

Two projects fell into the Community Project classification, both of which included Los Osos Valley Road (Areas 16 and 27). Since Los Osos Valley Road is one of only two surface links out of the Los Osos-Baywood Park communities these projects were considered as having the highest construction priority for safety concerns. The high community usage of Los Osos Valley Road (approximately 14,000 ADT), combined with the safety considerations of having potentially hazardous roadway conditions during storm events, or emergency conditions, placed these projects as top priority community projects. The third step in the prioritization process was to evaluate these two community projects and rank them according to the number of complaints and the severity of the drainage problem.

The final step in the process was to evaluate the localized projects and rank them according to the number of complaints, and the severity of the drainage problem (residential flooding). Ranking information pertaining to complaint logs and drainage problem severity was determined for both community and localized projects from the information presented in Appendix B1 and B2. The results of this ranking process are presented in Table V-1.

TABLE V-1: RANKING ALTERNATIVE PROJECTS

Project Ranking	Cat.	Area	Project Location	Project Description	Cost	Percent Cost	Complaints Logged	Homes Flooded	EIR Required
1	3	16	Broderson, Skyline & Pine	Storm Drain	$1,209,700	8.6%	34	1	Y
2	3	27	Los Osos Valley Road at Cimmeron	Storm Drain	$240,150	1.7%	3	1	N
3	1	6	El Moro Depression, 300 Block to 1400 Block	Storm Drains	$1,214,500	8.6%	83	24	Y
4	1	7	Paso Robles Depression, 1400 Block and 1800 Block	Retention Basin	$3,766,350	26.6%	30	6	Y
5	1	8	Ramona/Pismo Depression from 300 Block to 1300 Block	Storm Drain	$3,324,250	23.5%	22	2	Y
6	2	14	Cuesta by the Sea, West	Regrade Roadway	$438,150	3.1%	16	0	N
7	4	17	Los Osos Valley South	Storm Drain	$1,284,900	9.1%	13	0	N
8	6	4	Santa Ysabel, 1300 Block to 1600 Block	Storm Drains	$257,200	1.8%	10	0	N
9	2	1	Santa Ysabel, Pasadena to 600 Block	Road Closure	$178,400	1.3%	4	0	N
10	6	23	South Bay Blvd & Los Osos Valley Rd to Los Osos Creek	Cross Gutter	$10,900	0.1%	4	0	N
11	6	13	Monarch/Sea Pines	Swale	$10,950	0.1%	4	0	N
12	4	22	Fairchild Basin	Retention Basin	$455,300	3.2%	3	1	N
13	2	15	Cuesta by the Sea, East	Regrade Roadway	$206,400	1.5%	2	0	N
14	5	9	14th to 17th Street Depression between Pismo & Ramona	Storm Drain	$42,900	0.3%	1	0	N
15	5	10	San Luis Avenue, 1300 Block to South Bay Blvd	Retention Basin	$1,418,300	10.0%	1	0	N
16	6	11	Ramona, 1600 Block to South Bay Blvd	Swale	$64,200	0.5%	1	0	N
17	4	19	Santa Ynez at Mountain View	Swale	$23,125	0.2%	1	0	N
					$14,145,675	100.0%			

*EIR Required. Each project was evaluated individually in Section III although it is anticipated that a single EIR for all projects with be prepared.

As shown in Table V-1, the Los Osos Valley Road projects ranked in the number 1 and 2 positions and, therefore, would be considered first for construction. Based on the ranking presented, construction of the Los Osos Valley Road projects would be followed by the El Moro storm drain, the Paso Robles basin, the Ramona storm drain, etc. It is important to note that construction of the Paso Robles basin is contingent upon the lowering of the groundwater elevations in Area 7 (see discussion in Section III.C1A7.2). If funding for the overall storm drainage project becomes available prior to that time when the groundwater elevations are anticipated to lower due to installation of the sewer, then the basin project will need to be postponed until there is sufficient separation to groundwater.

C. CONSTRUCTION SCHEDULE

Using the ranking criteria from Section V-B, a construction schedule was developed. For flexibility, the construction schedule was divided into two main components. These components include the environmental review process, and the actual construction schedule.

1. Environmental Review Process

Development of a permitting process schedule for a project of this type can only be roughly estimated due to the many variables discussed in the preceding sections of this report, and an inability to accurately predict the scrutiny to which this project may be subjected by government agencies, state and local organizations, and the public. There are a number of endangered species of flora and fauna known to inhabit portions of the overall project site as discussed in preceding sections, together with the Morro Bay estuary, a direct and indirect receiving body for all proposed storm drain systems, being a protected estuary. Due to these constraints, the overall project may be debated from an environmental standpoint for a number of years.

Based on the information presented in this report and knowledge of other projects having similar environmental constraints, the environmental review and permitting process can be expected to take a minimum of one year.

2. Construction Schedule

Development of a construction schedule assumed that, at most, three of the projects presented in Table V-1 could be constructed and inspected simultaneously. This assumption considered project management, inspection, and community disruption would be within manageable limits.

Survey & Design assumptions included securing of a full-time engineering staff having the ability to dedicate full resources to the projects. At minimum, this would include a Hydrologist, two Design Engineers, one to two Drafters, and a Geotechnical engineer. In addition, the design process would also require a survey staff including 2-man field crew, and office surveyor for preparation of basemap information, research of existing easements and property lines, and writing and recording new easements.

Construction assumptions would include securing a contractor with the experience and resources to adequately provide the services itemized in this report. Construction surveying is included as part of the schedule.

TABLE V-2: PRELIMINARY CONSTRUCTION SCHEDULE

CONSTRUCTION SCHEDULE					YEAR 1														YEAR 2													
RANK	AREA	PROJECT DESCRIPTION	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	16	Los Osos Valley Road Storm Drain & Ferrell Basin																										
2	27	Cimarron Storm Drain																										
3	6	El Moro Storm Drain																										
4	7	**Paso Robles Retention Basin*																										
5	8	Ramona Storm Drain																										
6	14	Regrade Roadway																										
7	17	San Luis Ave & Nipomo Ave Storm Drain																										
8	4	Storm Drain																										
9	1	Regrade Roadway & Road Closure																										
10	23	Cross Gutter																										
11	13	Golf Course Swale																										
12	22	Retention Basin																										
16	15	Regrade Roadway																										
14	9	Storm Drain																										
15	10	Retention Basin																										
16	11	Road Swale																										
17	19	Road Swale																										

SURVEY & DESIGN
CONSTRUCTION
EXPECT RAIN DELAYS IN CONSTRUCTION FROM NOVEMBER1 TO MARCH 31.
* NO PROJECT UNTIL GROUNDWATER ELEVATIONS ARE LOWERED.

As shown in Table V-2, completion of the overall project can be expected to take at least two years. Other items considered during the preparation of this schedule included commencing the design phase in the winter months (during the rainy season) so as to start construction at the beginning of April (the dry season). A maximum of three projects would be under construction at any one time to reduce community disruption and provide for acceptable inspection coverage. However, the design phases could be overlapped. Finally, note that the Paso Robles Retention Basin would not be constructed until that time when there exists sufficient separation between the bottom of the proposed basin and the seasonal high groundwater elevation.

D. BENEFIT ASSESSMENT ANALYSIS

There are a number of methods available to distribute the costs associated with the community drainage project including distribution based on Community Benefit, Area Benefit, Volume of Flood, Distance Weighting, and Area Weighting. For this report, a Community Benefit Method was selected for cost distribution. The remaining methods are summarized in Appendix F1.

The Community Benefit method would consist of all 5127 properties within the geographically defined Community Service Area 9J equally contributing to the drainage improvements throughout the Service Area. Assuming all Recommended Alternatives were to be constructed as one contract (overall project), Table V-3 summarizes an estimated annual costs per residence of approximately $376 per year.

Other assumptions in the preparation of Table V-3 included the estimated total costs, as presented in Section IV and Table IV-2, and a 20 year improvement loan at 6.5 percent interest rate. Table V-3 provides the estimated annual principal and interest payments, remaining balance, and estimated annual cost per residence.

TABLE V-3: IMPROVEMENT COSTS PER RESIDENCE

Principal:	**$21,218,513**
Interest Rate:	**6.50%**
Term (Years):	**20.00**
Payment per Year:	**1.00**
Payment (year):	**$1,925,716**

Payment Number	Beginning Payment	Principal Payment	Interest payment	Extra Payment	Ending Balance
1	$21,218,513	$546,512	$1,379,203		$20,672,000
2	$20,672,000	$582,036	$1,343,680		$20,089,964
3	$20,089,964	$619,868	$1,305,848		$19,470,096
4	$19,470,096	$660,159	$1,265,556		$18,809,937
5	$18,809,937	$703,070	$1,222,646		$18,106,867
6	$18,106,867	$748,769	$1,176,946		$17,358,098
7	$17,358,098	$797,439	$1,128,276		$16,560,658
8	$16,560,658	$849,273	$1,076,443		$15,711,386
9	$15,711,386	$904,476	$1,021,240		$14,806,910
10	$14,806,910	$963,267	$962,449		$13,843,643
11	$13,843,643	$1,025,879	$899,837		$12,817,764
12	$12,817,764	$1,092,561	$833,155		$11,725,203
13	$11,725,203	$1,163,577	$762,138		$10,561,626
14	$10,561,626	$1,239,210	$686,506		$9,322,416
15	$9,322,416	$1,319,759	$605,957		$8,002,657
16	$8,002,657	$1,405,543	$520,173		$6,597,114
17	$6,597,114	$1,496,903	$428,812		$5,100,211
18	$5,100,211	$1,594,202	$331,514		$3,506,009
19	$3,506,009	$1,697,825	$227,891		$1,808,184
20	$1,808,184	$1,808,184	$117,532		$0
	Totals:	$21,218,513	$17,295,802		

SUMMARY:

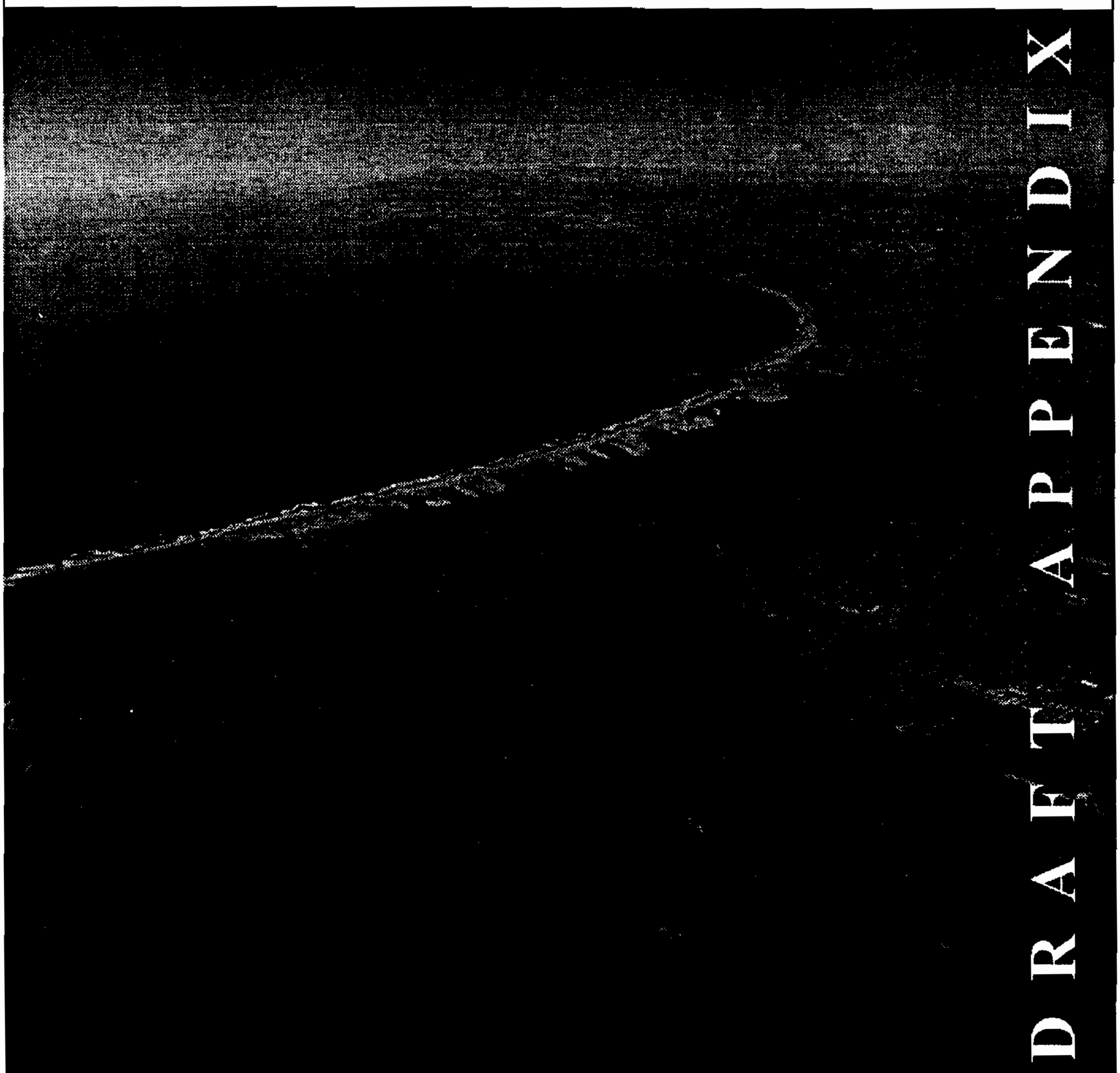
Payment per year:	**$1,925,716**
Number of residences:	**5,127**
Payment per Residence per year:	**$376**

PRELIMINARY ENGINEERING EVALUATION, LOS OSOS/BAYWOOD PARK COMMUNITY DRAINAGE PROJECT

FOR

SAN LUIS COUNTY SERVICE AREA No. 9J

December 1997



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APPENDIX CONTENTS

APPENDIX A

DEFINITIONS

Appendix A1
DEFINITION OF TERMS

Aquifer: Porous water-bearing formation of permeable rock, sand, or gravel capable of yielding significant quantities..

Detention or Retention Basin: A constructed depression in the surface of the land to hold water temporarily or for infiltration.

Drainage Area (Basin): A topographical area from which runoff collects to a point. Bounded peripherally by a water parting.

Groundwater: Water in an aquifer or directly above the surface of an aquifer.

Watershed: A region or area from which runoff collects to a particular watercourse or body of water. Bounded peripherally by a water parting.

Appendix A2
DEFINITION OF ALTERNATIVES

Paper Street Note:
Ownership to centerline of road right-of-ways is to the adjacent land owner. Construction of surface improvements, including basins and linear parks, on these right-of-ways within the community would require special consideration regarding condemnation and purchase of property. These right-of-ways may be used for roads and utilities (including storm drains) only.

Basin: Provides a collection and storage point for surface water. Typically used in combination with other surface collection improvements such as storm drains or curb and gutter. *Terminal/Recharge* basin for groundwater recharge or *Detention* Basin to collect and provide metered discharge. May requires land acquisition. *Subsurface* basins are special storage structures that are typically installed below parking lots and used for storm water storage and percolation. A major advantage of using subsurface basins is the reduction of land area normally required for surface basins

Channel: Typically refers to an improved watercourse, such as a concrete or asphalt concrete open channel (i.e.: The *Walker* Channel) that functions by use of gravity. Channels can be used adjacent to roadways or across properties to collect surface drainage

Connect to Sewer: Septic tanks are considered a major contributor to the increase in the upper aquifer groundwater elevations. The reduction and/or elimination of septic tank discharge into the upper aquifer is expected to reduce groundwater surface elevations, thus allowing for additional storage capacity of the basin to percolate surface runoff, and reduce flooding.

Curb & Gutter: Provides for the containment of flows within the street right-of-way. Driveways or other mountable berms may also be required at property entrances to provide access to property while maintaining flows in street.

Diversion around Community: Diversion specifically relates to surface runoff by redirection of surface flow out of a specific groundwater basin, thus reducing over taxation of a basins storage capacity (reduction of flood events). Diversion may require incorporation of pump stations, storm drains, French drains, channels, swales, berms, or some combination of these systems.

Drain to New Sewer System: Phase the proposed sewer system such that the low lying (sump) areas are connected first, then use the extra capacity of the treatment facility in the early stages of laying sewer lines to pump the groundwater from these sump areas to the treatment facility. This would have a two stage benefit. First, the contribution of the septic tanks in these sump areas would be eliminated. Second, the groundwater elevation would be reduced due to pumping, thus allowing additional subsurface storage capacity for percolation of future surface runoff.

Erosion Control: Refers to short term solutions where haybales, silt fences, or other devices can be used to capture sediments (sands and silts) present in surface flows.

French Drain: Convention solution to collect and remove subsurface water. May require additional improvements including outlet structures, and pumping facilities. May also require land acquisition and/or easements.

Linear Park: Areas such as open lots or unpaved streets that can be dedicated to accept surface storm water. This would require designating this right-of-way for broad, vegetated shallow basins used to retain storm water surface runoff thus promoting sedimentation deposition and the removal of contaminants. A series of basins could be proposed for retention, treatment, then discharge which would be hydraulically connected via storm drains, with ultimate discharge into the Bay or other source. During the dry season, these areas could provide passive community recreation possibilities.

Maintenance Program: Many comments received by the community stated regular preventative maintenance program would assist in eliminating some problems. Includes regular cleaning of existing ditches, channels, storm drain facilities, etc., and maintenance of existing diversion and containment facilities.

Porous Pavement: Allows for percolation of runoff through a hard surface, such as a roadway or parking area. Costs associated with the installation and live expectancy of porous pavement are considerable when compared to typical road pavement material.

Pump: Allows for the transfer of collected surface or subsurface water to an alternate discharge site. Alternate discharge sites could include the Bay, agricultural sites, wetlands, linear parks, basins, less impacted aquifers, streams, or the sewer treatment facility. Other pumping alternatives suggest lower of the entire groundwater aquifer to provide storage for storm flows via percolation. Lowering of the groundwater basin may impact existing wetlands, specifically in Los Osos Creek watershed.

Production from Lower to Upper Aquifer: Present water production for the community drinking and landscaping is from the deeper (lower) aquifer due to contamination in the upper aquifer. One possible solution is to change landscape water production for commercial and institutional to the upper aquifer, thus lower the groundwater table of the upper.

Presently the water quality of the upper aquifer has high concentrations of nitrates that prohibits its use as a public water source therefore the lower aquifer is being used. Use of the lower aquifer as a water supply and the upper aquifer as collection (from septic tank discharge etc.) has been determined to be a major contributor to the elevated groundwater levels in the upper aquifer, and subsequent increase in flooding in the Paso Robles and El Moro corridors.

Property Purchase: Acquisition of properties subject to frequent flooding. This property could them be used as a dry weather park, wetland habitat, or similar use.

Raise Foundation: Raising building foundations would eliminate flooding damage of a structure. However, access to the structure would also need to be corrected.

Reconstruct Roadway: Typically applies to paved roads that require horizontal and/or vertical realignment to allow for positive drainage.

Road Closure: Closure of flooded roadways can be used as a short term solution to limit the wave damage produced by vehicular traffic moving through flooded intersections. This wake can aggravate flooding of properties adjacent to roadways.

Storm Drain: Conventional solution to collect and remove surface water. Requires additional improvements including inlets, outlets, and in some cases, pumping facilities. May also require land acquisition and easements. Storm drain systems may be coordinated for installation with the proposed sewer system to save costs. Outlet of a proposed storm drain could be to the Bay, Creeks, recharge sites, basins, linear park, or other locations.

Swale: Refers to a graded swale, such as those found in the El Moro corridor, which are not improved by use of concrete, steel or other materials. Vegetating a graded swale allows for energy dissipation (reduced incidence of erosion) and aids in contaminant removal from surface flows.

Wetland Construction: Similar in function to a *Basin* however wetlands need to be developed in sump areas where ground stays moist year-round. May require acquisition of land.

APPENDIX B

SUMMARY OF EXISTING COMMUNITY PROBLEM AREAS & FACILITIES

B1: Compilation of Documented Drainage Problems
B2: Drainage Problem Addendum Prepared by Drainage Subcommittee
B3: CSA 9J Storm Drain Facilities

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
1.1	1	Patrick McGibney	Blue Ribbon Survey, 1995-96	1178 2nd Street	Standing water in yard		
1.2	1	Public Comments	CSA 9J Meeting 7/11/96	Amhurst, Santa Ysable, Pasadena Drive and into marsh area			
1.3	1		County Map		Street ponding and sand and silt deposition		
1.4	1		County Map		Cross lot drainage, street ponding, natural sump, and flat grades		
1.5*	1	Marie Smith	Phone conversation 5/27/97	Pasadena, 1st Street, & Santa Lucia	Hump in Pasadena Road diverts surface flows easterly towards residence. Cross lot drainage through two residential lots with discharge to low-lying undeveloped lot where water ponds. No home flooding.	Provide dike or curb and gutter on Pasadena Dr. to keep flows in roadway and flatten existing hump in road	
1.6*	1	Lenord Ambroso	CSA-9J Meeting 6/3/97	Pasadena, 1st Street, & Santa Lucia (owner at 1161 1st St.)	Water on Pasadena has no place to go and travels across his neighbor's yard through his yard to a vacant lot. Same as Item 1.5	Same as Item 1.5	
2.1	2		County Map		Street ponding		
3.1	3	Andrew & Jane Evancho, Jr	Letter to County	1221 12th Street	Property has been subject to flooding after heavy rains for the past 10 years. Believe that flooding was a direct result of the paving of Santa Ynez Ave, 10 years ago. Also belief that the drainage ditch located near the corner of South Bay Blvd. at Los Olivos Ave may also contribute to additional flows.		
3.2	3		County Map		Erosion and Sand/silt deposition		
3.3	3	Paul Reynolds & Marianne Tolchin	Letter to County	1221 12th Street	For the past 10 years the property subject to flooding, have owned property for 12 years. Flooding became more prominent after the County constructed a swale at the corner of South Bay Blvd. & Los Olivos Rd.		
4.1	4	Jeff Rowan	EDA Survey 7/11/96	1188 & 1187 14th St.	Storm water runs from 15th St. through backyard of 1186 14th St. causing flooding of 1188 & 1187 14th St. and long term ponding in 14th St.	1. All uphill homes have water flowing through yard to the downhill (west) homes. 1187 14th St. has a berm in the backyard not allowing water to pass west to 13th-12th-etc. St.	Water remains for months and has covered the entire road on occasion making walking and mail retrieval impossible.
4.2	4	Mike Sylvia	County File	1194 14th St.	The section of 14th Ave north of Santa Ysable floods every winter		
4.4	4	Public Comments	CSA J9 Meeting 7/11/96	1100 block of 14th St.			

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
4.5	4	SLO CO	County File	14th Ave north of Santa Ysable			
4.6	4		County Map		Cross lot drainage		
4.7	4		County Map		Cross lot drainage		
4.8	4		County Map		Cross lot drainage		
4.9	4		County Map		Cross lot drainage		
4.10	4		County Map		Erosion and sand/silt deposition		
5.1	5		County Map		Silt and sand		
6.1	6		EDA Survey 7/11/96		The County feels that flooding of mid blocks between Santa Maria & El Moro (above) is due to spillage of the 7th St. basin. However, this is a preexisting condition		see letter
6.2	6		EDA Survey 7/11/96	Between Pismo & Paso Robles		1. Build basin on unpaved portion of Pismo east of 11th St.	
6.3	6	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Properties at 8th @ El Moro	Surface flooding and septic tank failure. At least 2 homes flooded		
6.4	6	Alison Ball	EDA Survey 7/11/96	10th St., westside, 2-3 houses north of Pismo	One house regularly floods, localized problem		
6.5	6	Alison Ball	Letter to County 5/8/95	1412 7th Street	Moved to Los Osos in 1979 and realized that lived in flood prone area. In 1983 home flooded for the first time. Neighbors flooded with only moderate storm events. The storms of 1995 affected even more homes not previously affected. Septic tank failure. Included names of other affected from El Moro, Ramona Lake, Pismo Swale, 15th-16th Streets, Fairchild, Santa Ynez, 11th Ave, Pine @ Ash, Pecho @ Grove, Cimarron	Install culvert along El Moro that could be used for other areas to drain to.	
6.6	6	August Gioia	Blue Ribbon Survey, 1995-96	1352 5th Street	Wash through yard		
6.7	6	Barry & Nancy Rice	Blue Ribbon Survey, 1995-96	1355 5th Street	Wash through yard		
6.8	6	Bill Fellows	Blue Ribbon Survey, 1995-96	1405 9th Street	Septic tank problems, wash through yard, standing water in yard, and single incidence of residential and or garage flooding.		
6.9	6	Bill Hall, Mackie Hall & Tony Hall	Blue Ribbon Survey, 1995-96	1388 6th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residential and or garage flooding, and pumping required to clear yard and residence and or		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					garage.		
6.10	6	Bill Richmond	EDA Survey 7/11/96	4th, 5th, & 6th Streets at midblock between El Moro & Santa Maria	Flood homes, two flooded for days after moderate storm. Eleven homes have septic tank problems. FLOOD DAMAGE: 4th: 1334, 1346, 1360, & 1331 5th: 1352, 1346, 1332, 1339, 1345, & 1355 6th: 1365 FLOODING AFTER MOD. STORM 4th: 1346 5th: 1332 6th: many homes	1. Storm drain 2. Berms	
6.11	6	Brian Bailey Valerie Bailey	Letter to County 5//95	915 El Moro Avenue	Intersection of 8th Ave @ El Moro Ave flooded and ran towards 7th Street. Neighbors flood, septic tanks fail.		
6.12	6	CeCe Simpson & Joyce Stockton	Blue Ribbon Survey, 1995-96	1361 6th Street	Wash through yards and single incidence of residential and or garage flooding.		
6.13	6	Charles & Rosemary Sibus	Letter to County	1198 El Moro	El Moro between 12th & 13th Streets sustains substantial water erosion damage from heavy runoff down 13th Street.		Picture of erosion "gully" along El Moro
6.14	6	County Eng. Picture	County File	Flood house near intersection of 7th at El Moro	3/1395 flooding		
6.15	6	County Eng. Picture	County File	6th @ El Moro	3/15/95 flooding		
6.16	6	County Eng. Picture	County File	Flood driveway on El Moro between 6th & 7th St.	3/1395 flooding		
6.17	6	Danielle Rogers	Blue Ribbon Survey, 1995-96	1421-B 7th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard and residence and or garage, and failure of existing storm drain facilities.		
6.18	6	David Whitehead	Blue Ribbon Survey, 1995-96	1421 10th Street	Septic tank problems, wash through yard, and single incidence of residential and or garage flooding.		
6.19	6	Deb Hutchins	Blue Ribbon Survey, 1995-96	1380 6th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residential and or garage flooding, and pumping required to clear yard and residence and or garage.		
6.20	6	Debby Cardinali & Jim Shisler	Blue Ribbon Survey, 1995-96	1415 6th Street	Standing water in yard and pumping required to clear yard due to multiple incidences of water entering residence and or garage		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
6.21	6	Deborah Hutchins	Letter to County 5/1/95	1380 6th Street	One and a half feet of water damaged house on 3/10/96. Rest of neighborhood suffered severe damage due to flooding.		
6.22	6	Deena Richmond & Bill Richmond	Blue Ribbon Survey, 1995-96	1345 5th Street	Septic tank problems, wash through yards, and single incidence of residence and or garage flooding.		
6.23	6	Don Bearden	Blue Ribbon Survey, 1995-96	1421 7th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear residence and or garage, and failure of existing storm drain facilities.		
6.24	6	Don Walters & Donna Walters	Blue Ribbon Survey, 1995-96	1346 5th Street	Wash through yard and single incidence of residence and or garage flooding.		
6.25	6	Donald & Eldra Avery	Blue Ribbon Survey, 1995-96	1313 4th Street	Septic tank problems, wash through yard, and standing water in yard.		
6.26	6	Donald Avery	EDA Survey 7/11/96	Center of block bounded by 3rd, 4th, Santa Maria, & El Moro	Runoff for Santa Maria sheets across intersection of 4th & Santa Maria collecting at low portion of block between 3rd & 4th St. Ponding can last for weeks. 1331 4th is flooded regularly in normal years. In combination with excess 7th St. runoff septic systems are under water through the block due to excess ponding. When ponding daylights over 3rd St., additional flooding occurs at 3rd & Santa Maria, subsequently through center of block of 2nd & 3rd Streets and into Business District	1. Storm drains at center of 3rd, 4th & 6th Streets between El Moro & Santa Maria. 2. Storm drains at intersection of 3rd & Santa Maria 3. Divert runoff from Santa Maria from entering 4th St. (this would increase flooding at 3rd & Santa Maria and the Baywood Business District)	see sketch
6.27	6	Donald Lee Avery	Letter to County 5/4/95	Mid block 1300's between 3rd and 4th Streets	Region becomes a virtual lake during heavy rains, flooding of one house, failure of septic systems. On two occasion the "lake" crested the north side of 3rd Ave, filling the intersection of 3rd @ Santa Maria and flooding several businesses on 3rd & 2nd Streets.		
6.28	6	Evelyn Moberg & Steven Moberg	Blue Ribbon Survey, 1995-96	1334 4th Street	Wash through yard and standing water in yard.		
6.29	6	Evelyn Vickerson	Letter to County	9th St.	Contacted Risk Management regarding flood damage in 1992		
6.30	6	G.B. & Arlene Blanchard	Letter to County	APN 038.292.019	Existing properties have channalized their storm flows towards our home	Uphill on 10th St. is a vacant lot that could be used to store water	Curb and gutter
6.31	6	George Boddeker &	Blue Ribbon	1421 8th Street	Septic tank problems, standing water in yard,		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
		Denise Boddeker	Survey, 1995-96		multiple incidences of residential and or garage flooding, prolonged pumping required to clear residence and or garage, and failure of existing storm drain facilities.		
6.32	6	George Marchenko	EDA Survey 7/11/96	Between 10th & 8th	Flow drains along a natural swale through the lots and through holes in fences. Damming occurs when holes are fixed, flooding homes and creating potential for dam failure	1. Divert water down 10th St. (north)	see sketch
6.33	6	Glen Berkovitz & Jane Kerkovitz	Blue Ribbon Survey, 1995-96	870 El Moro	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear residence and or garage, and failure of existing storm drain facilities.		
6.34	6	Glenn E. Harrell	Blue Ribbon Survey, 1995-96	890 El Moro	Septic tank problems and wash through yard		
6.35	6	James Hickok	County File	1404 10th Street	Sandbagging of home to protect from flooding. Runoff threatens property via an area between residences at 1099 11th St. and 1415 11th St. Approximately a 70 acre watershed. The water is being diverted by the County Street via private property, flooding garages etc. on its way towards 8th St. @ El Moro	Storm drain connected to a culvert down El Moro St. from 11th St. to the Bay	
6.36	6	Jeff Loring & Margen Loring	Blue Ribbon Survey, 1995-96	1319 5th Street	Wash through yard		
6.37	6	Jim MacDonald	Blue Ribbon Survey, 1995-96	1337 5th Street	Wash through yard		
6.38	6	Jim Marak & Vera Marak	Blue Ribbon Survey, 1995-96	899 El Moro	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard residence and or garage, and failure of existing storm drain facilities.		
6.39	6	Joe Forlippa	Blue Ribbon Survey, 1995-96	1441 10th Street	Septic tank problems, wash through yard, and single incidence of residential and or garage flooding.		
6.40	6	John Ball & Allison Ball	Blue Ribbon Survey, 1995-96	1412 7th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear residence and or garage, and failure of existing storm drain facilities.		
6.41	6	Judith Reilly	Blue Ribbon	1411 7th Street	Septic tank problems, standing water in yard,		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
			Survey, 1995-96		multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard and residence and or garage, and failure of existing storm drain facilities.		
6.42	6	Judith S. Reilly	Letter to County 5/7/95	1411 7th Street	Home was flooded three times. Flooded water remains two months after the last flood. Septic system continues to fail		
6.43	6	Judith S. Reilly	EDA Survey 7/11/96	SW corner of 7th and El Moro	1411 7th St. house floods (inhabitable). Septic tank failure due to flooding	1. Storm drain. 2. Make uphill property owners retain their portions of runoff.	1411 7th St. house began flooding annually beginning 4 years ago
6.44	6	Laurie Johnson	Blue Ribbon Survey, 1995-96	1331 4th Street	Septic tank problems, water through yard, standing water in yard, and multiple flooding of residence and or garage.		
6.45	6	Lesa Duncan	Blue Ribbon Survey, 1995-96	1346 4th Street	Septic tank problems, wash through yard, and single incidence of flooding of residence and or garage		
6.46	6	Margie Dist	Blue Ribbon Survey, 1995-96	1378 6th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residential and or garage flooding, and pumping required to clear yard and residence and or garage.		
6.47	6	Mark Alirevic & Alice Alirevic	Blue Ribbon Survey, 1995-96	1361 4th Street	Septic tank problems		
6.48	6	Mary Martin	Blue Ribbon Survey, 1995-96	1412 6th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard and residence and or garage, and failure of existing storm drain facilities.		
6.48	6	Ms. Spellacy	County File	Water ponding at 8th @ El Moro			
6.50	6	Public Comments	CSA J9 Meeting 7/11/96	1345 5th St. Standing water on 4th, 5th & 6th Streets			
6.51	6	Public Comments	CSA J9 Meeting 7/11/96	3rd & 4th Santa Maria to El Moro			
6.52	6	Public Comments	CSA J9 Meeting 7/11/96	1572 9th St. between Paso and Pismo			
6.53	6	Ray Fitch & Lynn Fitch	Blue Ribbon Survey, 1995-96	1378 6th Street	Wash through yards, standing water in yard, and pumping necessary to clear yard.		

*Item added since submittal of WP 1.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
6.54	6	Richard Bruner & Alice Bruner	Blue Ribbon Survey, 1995-96	1325 4th Street	Septic tank problems, wash through yard, standing water in yard, flooding of residence and or garage		
6.55	6	Rob Crowe	Letter to County	929 El Moro	Contacted Risk Management regarding flood damage in 1992		
6.56	6	Ronald Lyman & Edie Lyman	Blue Ribbon Survey, 1995-96	1360 4th Street	Wash through yard and standing water in yard.		
6.57	6	Ruth Coafer	Blue Ribbon Survey, 1995-96	1411 8th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear residence and or garage, and failure of existing storm drain facilities.		
6.58	6	Sandy Griswold	Blue Ribbon Survey, 1995-96	1368 5th Street	Wash through yard		
6.59	6	Sandy Vidak	Blue Ribbon Survey, 1995-96	1368 5th Street	Wash through yard and single incidence of residence and or garage flooding.		
6.60	6	SLO CO	County File	El Moro Corridor from 11th Ave west to 3rd Ave			
6.61	6	SLO CO	County File	El Moro Corridor			
6.62	6	South Bay Community Council	County File 2/24/83	8th @ El Moro			
6.63	6	Telegram Tribune	County File	8th @ El Moro	County storm drain and pump cannot keep up with storm flows		
6.64	6	Thomas Kwid	Letter to County 4/29/94	1400 6th Street	Have lived at this address for 23 years and this year water flooded home to 25". A second less sever storm (3" fell) again flooded home to 14" deep. Neighbors have also flooded for the first time.		
6.65	6	Thomas Kwid	County File	1400 6th St.	26 year resident now experiencing flooding due to increase ground water elevations		
6.66	6	Tom Gutry	Blue Ribbon Survey, 1995-96	1373 5th Street	Wash through yard, standing water in yard, and single incidence of residence and or garage flooding.		
6.67	6	Tony & Ann Skelton	Blue Ribbon Survey, 1995-96	1339 5th Street	Wash through yard		
6.68	6	Tony Kwid & Katherine Kwid	Blue Ribbon Survey, 1995-96	1400 6th Street	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard and residence and or garage, and failure of existing storm drain facilities.		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
6.69	6	Unknown	County File 3/15/96		County of Emergency Services performed a PDA and found flood damage to 28 homes. The worst hit areas were on 6th, 7th, 8th Streets in the 1400 block where waters rose up to 4 feet		
6.70	6	Valerie Bailey & Brian Bailey	Blue Ribbon Survey, 1995-96	915 El Moro	Septic tank problems, standing water in yard, multiple incidences of residential and or garage flooding, prolonged pumping required to clear yard residence and or garage, and failure of existing storm drain facilities.		
6.71	6	Louis Gibson Hyd. Plan. Engr	County File to RWQCB 7/22/96	8th Ave Pump Station	1984 pump station constructed due to 1983 flooding. Purpose was to drain sump of storm water within 24 hrs. Pump station was unable to keep up with 1995 flood. Groundwater levels have risen 20 feet in 20 years. Groundwater continued to rise in the summer of 1995. County drilled holes in vault and added French drain. November 1995 new 12" force main and temporary pump added. Continued year-round pumping due to groundwater, irrigation from school, backwash from treatment plant, and neighboring homes sump pumps.		
6.72	6		County Map		Cross lot drainage and street ponding		
6.73	6		County Map		Street ponding and insufficient culvert capacity		
6.74	6		County Map		Insufficient swale capacity and street ponding		
6.75	6		County Map		Insufficient swale capacity, street ponding, and natural sump		
6.76	6		County Map		Insufficient swale capacity, cross lot drainage, street ponding, sump conditions, insufficient culvert capacity and sand/silt		
6.77	6		County Map		Erosion		
6.78	6		County Map		Erosion and sand/silt		
6.79	6		County Map		Erosion and Sand/silt		
6.80	6		County Map		Erosion and Sand/silt		
6.81	6		County Map		Erosion and Sand/silt		
6.82	6		County Map		Street ponding and natural sump		
6.83	6		County Map		Erosion and cross lot drainage		
7.1	7	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Properties on both sides of Paso Robles between 15th	Includes surface drainage and septic tank failure. 15 homes flooded. Depths of 4' were recorded on		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
				and 18th	16th just north of Paso Robles. Installed side culverts to reduce road flooding.		
7.2	7	Barbara Coleman	County File	1503 17th Ave & Corner of 17th Ave at Paso Robles Ave	Water ponds at base of driveway and remains for several days.		
7.3	7	Barbara Hope	County File	16th @ Paso Robles	Flooded home	Maintain exist drainage ditch	
7.4	7	CO photos 3/9/95	County File	16th St. @ Paso Robles	Water recharges from groundwater.		
7.5	7	County Note	County File	16th @ Paso Robles	Severe ponding		
7.6	7	County Note	County File	Paso Robles between 15th and 16th Streets	Severe ponding		
7.7	7	Irina Hanley	County File	1360 Paso Robles Ave	House flooded due to septic tank "backup" during storm. Drainage enter the tank via the leach field, which 20' from the exiting CO drainage system	Fix the existing adjacent drainage system to provide better drainage.	
7.8	7	John DeBacker	Blue Ribbon Survey, 1995-96	1539 18th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, and prolonged pumping of yard and residence and or garage.		
7.9	7	John Lopez & Julie Lopez	Blue Ribbon Survey, 1995-96	1491 16th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by storm volumes.		
7.10	7	Kath Chaves & Louis Chaves	Blue Ribbon Survey, 1995-96	1495 16th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by storm volumes.		
7.11	7	Laura John	County File	1515 17th St.		Install culvert in front of house to divert water into the existing ditch on Paso Robles Ave Request house next door stops her septic system for flooding her property	
7.12	7	Leonor Cunningham	Blue Ribbon Survey, 1995-96	1488 16th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					storm volumes.		
7.13	7	Mark Seaton	Blue Ribbon Survey, 1995-96	1480 16th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by storm volumes.		
7.14	7	Mr & Mrs S. Asuncion	Blue Ribbon Survey, 1995-96	1475 16th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by storm volumes.		
7.15	7	Paul Reynold	County File	15th Street	House on 16th St. (white house" is digging wall and is concerned that water will back up to flood neighbors		
7.16	7	Richard Miller	Letter to County	1503 17th Street	County response to problems.	Clean ditches in the vicinity of 17th St. and Paso Robles Ave. Drainage across private property in the vicinity of 10th St. and El Moro Ave. Install drain pipe from 11th St. to the pumps at 8th & El Moro	
7.17	7	Robert & Leigh Livick	County File	1475 16th Street	Flooding of homes, septic tank failure, flooding of intersection.	Continue storm drain along north side of Paso Robles St. to 15th St. to advert it from crossing properties.	
7.18	7	Sandy Robinson & John Robinson	Blue Ribbon Survey, 1995-96	1450 15th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residence and or garage flooding, prolonged pumping of yard and residence and or garage, and existing storm drainage facilities overcome by storm volumes.		
7.19	7	SLO CO	County File	Paso Robles Ave between 14th and 18th Ave			
7.20	7	South Bay Community Council	County File 2/24/83	16th @ Paso Robles			
7.21	7	South Bay Sun Bulliten	3/3/83	16th Ave @ Paso Robles, Lake Los Osos	Coverage of South Bay Community Council meeting. Groundwater quoted by Clinton Milne to		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					be 18" below surface.		
7.22	7	Tom Esser	County File	Downhill from 1438 16th Street	Flooding of homes, ponding of water on 16th St. Added gutter on one side of street to 100' from intersection, other still erodes. Installed swale towards South Bay Blvd. but ineffective.		County allowed homes to be built in low lying areas and CO created "quick fixes" that need to be reengineered.
7.23	7	Wilkes/Kwid/Boyd	County File	Paso Robles between 16th & 17th Streets	Sump conditions seen during field trip on 10/19/95		
7.24	7	William Moore	County File	1548 15th Street	Water from 15th Street flood garage at 1546 15th St., and house on occasion. Water comes downhill from the street across the front yard of the adjacent property to the east and uphill then spills into driveway.	Repair exiting swale and berm. Better maintenance program.	
7.25	7	Kathleen N. Chavez	EDA Survey 7/11/96	1400 block of 15th & 16th St. Paso Robles St.	Water on 16th begins on 15th in both the 1400 & 1500 blocks. 7 homes flooded Mar 95. Water towers on 16th overflow to culvert.	1. Drain on 15th and 16th St. 2. Curbs on streets so water does not go through properties	Use pipes instead of culverts. Culverts ineffective and dangerous
7.26	7	Public Comments	CSA J9 Meeting 7/11/96	1442 15th Street			
7.27	7		County Map		Erosion and silt/sand		
7.28	7		County Map		Erosion		
7.29	7		County Map		Erosion, Insufficient culvert capacity, street ponding, and natural sump		
7.30	7		County Map		Cross lot drainage, street ponding, and natural sump		
8.1	8	County Note	County File	Ramona @ 10th	Water overtops 10th Large pond in house at NW corner No ponding on 9th N of Ramona Water crosses through backyard of 1672 8th St. (1660?) Minimal flow at 8th St.		
8.2	8	Dandra Grisback	County File	1700 10th St.	Contacted Risk Management regarding flood damage in 1992		
8.3	8	Jane Lovett	County File	1703 11th Street	County response to Ramona St. drainage problems.		
8.4	8	John Richards	EDA Survey 10/23/96	1650 8th Street	8" deep by 30' wide river in front of home runs into neighbors garage and under their home. Even during dry weather, car wash and/or landscape watering sends water into neighbors home.		
8.5	8	Lorna Bostwick	EDA Phone Conversation	1616 6th Street	Ramona lake created by water flowing from Ramona above 11th, from both sides of 11th.		Pictures of: Drain on east side of 7th

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
			and meeting 10/29/96. Walk site 11/22/96		When the lake overflows 10th St. it follows a diagonal course through and between properties on 10th, 9th, 8th & 7th St. An existing inlet below Ramona is insufficient. The drain extends under Ramona and daylights into a hole on the left side of a 1635 7th St. Flow goes under their driveway and down the side of a 1625 7th St. Overflow follows the same course. Water sheet flows across the backyard and down the north side of 1616 6th St. Water continues to 5th, 4th and then to the Bay Water is coming sooner and with more volume due to more upstream people diverting the water.		below Ramona. Water entering driveway at 1635 7th St. and going to left side of 1625 7th St. Water sheeting across backyard of 1625 7th St. towards back fence of 1616 6th St. Channalized water passing through backyard of 1616 6th St. Channalized water crossing 6th St. diagonally to Pismo and down to Bay
8.6	8	Pavvo Ogren	County File	County Memo to Noel King	7th Street/Ramona swale	Linear Park along Pismo Avenue	
8.7	8	Sandra Grisback	County File	1700 10th St.	Property flooding	Dig and remove all debris from the basin Barricade area during events Plug culvert under 11th St. to keep water from entering basin. Pipe from basin to Ramona Ave to Sweet Springs Build wall around house Raise house County purchase house (lake Ramona)	
8.8	8	Scott Martin	County File	4th St. @ Pismo Ave		Purchase existing home for sale for incorporation of sewer and storm drain lift station.	
8.9	8	SLO CO	County File	The Ramona Avenue Pismo Avenue swale from 11th Ave west to 3rd Ave			
8.10	8	SLO CO	County File	1700 10th Ave			
8.11	8	SLO CO	County File	Linear Park along Pismo Ave	Erosion		
8.12	8	Wayne Gilder	Letter to EDA 10/28/96	1056 Ramona Ave	During rains, Ramona is flooded between 10th to 11th Street. Road closed, cars stuck. Due to road closure, residents must pass through a dangerous intersection. Septic tank failures		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					causing flooding of home.		
8.13	8	Carol Ann Reinman	EDA Survey 7/11/96	3rd between El Moro and Pismo	Asphalt in front of 1520 3rd St. buckles and is inundated every winter. Very slow percolation	1. Add more gravel road base	County maintenance
8.14	8	Lorna Bostwick	Blue Ribbon Survey, 1995-96	1616 6th Street	Wash through yard		
8.15	8	Richard Ruffel	Blue Ribbon Survey, 1995-96	1681 9th Street	Wash through yard		
8.16	8	Seth & Sansaca Landrum	Blue Ribbon Survey, 1995-96	1630 7th Street	Septic tank problems, wash through yard, standing water in yard, multiple incidences of residential and or garage flooding, and failure of existing storm drain facilities		
8.17	8	Betty Field-Haley & John Haley	County File	4th at Pismo	Water accumulates and floods across 4th St. at Pismo. Pismo appears to be a mini-river		
8.18	8		County Map		Erosion		
8.19	8		County Map		Inadequate culvert capacity and cross lot drainage		
8.20	8		County Map		Erosion and natural sump conditions		
8.21	8	Henry Gentry	Ramona swale ltr Oct 96	1651 8th Street	Property located in the Ramona swale. During intense or even less than intense rainfall, the runoff concentrates at the south end of driveway, cascades northerly over driveway and against garage door, then flows west along the north side of property.		see sketch
8.22	8	Richard Ruffel	Ramona swale ltr 11/4/96	1684 9th Street	Water from Ramona at 9th and from "Lake Ramona" accumulates at driveway and into channel that was constructed by resident. The problem is exasperated when "Lake Ramona" spills. Up to 20 wheel barrels of sand have been removed from front of home after bad storm.		see sketch
9.1	9	Don Asquith	Letter to County 10/6/96	14th & 15th Between Ramona & Pismo	Closed depression on 14th & 15th Streets between Ramona and Pismo.		
10.1	10		County Map		Erosion and cross lot drainage		
11.1	11		County Map		Erosion, insufficient culvert capacity and street ponding		
12.1	12		County Map		Cross lot drainage, sump conditions, and private property obstruction		
13.1	13		County Map		Sand/silt		
13.2	13		County Map		Sand/silt, inadequate culvert capacity, and street ponding		
13.3	13		County Map		Sand/silt, inadequate culvert capacity, and street		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					ponding		
13.4	13		County Map		Silt/sand		
14.1	14		EDA Survey 7/11/96	Doris runoff to Rosina to Pecho (opposite school)			
14.2	14	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Pecho @ Grove	Two leach fields flooded		
14.3	14	Bod Hoffmeyer	Blue Ribbon Survey, 1995-96	510 Henrietta	Septic tank yard, wash through yard, and standing water in yard.		
14.4	14	County Note	County File	Pecho @ Henrietta		Culvert	
14.5	14	County Note	County File	Pecho @ Binscarth	Ponding south to east		
14.6	14	Glen Priddy	Letter to County	Sunnyside and Monarch Grove Schools	Flooding of LOVR at pedestrian access.		
14.7	14	Jo Olmstead	Blue Ribbon Survey, 1995-96	308 Grove	Septic tank problems, wash through yard, standing water in yard and multiple incidences of residence and or garage flooding.		
14.8	14	Melis Wegner	Blue Ribbon Survey, 1995-96	310 Grove	Septic tank problems, wash through yard and standing water in yard.		
14.9	14	Public Comments	CSA J9 Meeting 7/11/96	Southside of Grove Henrietta has an underground spring			
14.10	14	Serna Benson	Blue Ribbon Survey, 1995-96	305 Grove	Septic tank problems, wash through yard and standing water in yard.		
14.11	14	SLO CO	County File	Pecho Rd and Grove Ave			
14.12	14	Thomas & Mary Housel	County File	348 Binscarth Road	Almost every winter the septic tank fills with water. Have it pumped and within 6 hours it refills. Receive runoff from adjacent properties.		
14.13	14	Gradon Stinton	County File	1952 Pine	Contacted Risk Management regarding flood damage in 1992		
14.14	14	James Bower	EDA Survey 7/11/96	Binscarth between Nancy & Maple	Total runoff and erosion south of LOVR dumped on private property north of LOVR. Upland retention basins overflow on to unimproved streets and flows run through yards instead of staying in the streets	1. Storm drain for LOVR and Broderson 2. Curb & Gutter for Ravenna and Palisades north of LOVR 3. Debris basin south of Highland, horizontal diversion collect, treat, recharge 4. Private retention basins for upland property owners	CSA No. 9 community wide drain system for buildout. NEP requires "clean water", min. debris, sediment removal. F&G wants water in Los Osos Creek for steelhead
14.15			County Map		Erosion, cross lot drainage, Sand/silt, and inadequate culvert capacity		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
14.16			County Map		Erosion, inadequate culvert capacity, cross lot drainage, and Sand/silt		
15.1	15	County Note	Letter to County	Doris @ Binscarth	Ponding	Create dip crossing to the north	
15.2	15	Public Comments	CSA J9 Meeting 7/11/96	Dorris @ Binscarth			
16.1	16		EDA Survey 7/11/96	Erosion south of Highland			
16.2	16	Jeffery & Karen Huskey	County File	2316 Bayview Heights	Flooding primarily from Bayview Heights Dr. Sandbagging was necessary	Regrade Bayview Heights, create surface impoundment's, curb and gutter, storm drains.	
16.3	16	Michael Read	County File County File	1234 Bayview Heights	Contacted Risk Management regarding flood damage in 1992		
16.4	16	Public Comments	CSA J9 Meeting 7/11/96	1818 LOVR			
16.5	16	Public Comments	CSA J9 Meeting 7/11/96	Calle Cordoniz "river" empties into existing home at 2595 Bay Vista			
16.6	16	SLO CO	County File	LOVR from 10th Ave to the area west of Palisades Ave			
16.7	16		EDA Survey 7/11/96	Ramona & Pine	Roadbed breaking up from high ground water		
16.8	16		EDA Survey 7/11/96	Pine Ave downstream of Henrietta, west side of street	Sheet flow down Pine (15 cfs Jan 95). Sandbagging required for homes on north side of Henrietta	1. Basin for AREA 5 2. Storm drain pipe on Pine into bay	Have information on sediment loading, flowrates and percolation for AREA 5
16.9	16		EDA Survey 7/11/96	510 Henrietta	Sandbagging required to save lower story of home.		
16.10	16		EDA Survey 7/11/96	Ramona West of Pine			
16.11	16		EDA Survey 7/11/96	LOVR 10th to Broderson			
16.12	16		EDA Survey 7/11/96		Floods of 1994 eroded Ash causing ponding at 536 Ash. Water drains along side of house and through backyard	1. Grade Ash	Improvements can only increase property values, thus increase tax base
16.13	16	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Don @ Mitchell	Two properties lost use of leach fields		
16.14	16	Barbara McGee	County File	Skyline @ Ash	Contacted Risk Management regarding flood damage in 1992		
16.15	16	Dorthy Tomilson	County File	567 Ash St.	Contacted Risk Management regarding flood		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					damage in 1992		
16.16	16	Greg Norton	County File	590 Skyline	Contacted Risk Management regarding flood damage in 1992		
16.17	16	Jack Feist	County File	550 Ash St.	Contacted Risk Management regarding flood damage in 1992		
16.18	16	Jeffery Edwards	County File	Pump Station at Don & Mitchell	Existing pumps could not keep up with storm flows during storm event of 3/10/95	Add more pumps or increase size of existing pumps.	
16.19	16	Mrs King	County File	Skyline @ Ash	Contacted Risk Management regarding flood damage in 1992		
16.20	16	Public Comments	CSA J9 Meeting 7/11/96	Don, Mitchell, and Los Olivos near Rain Tech			
16.21	16	Robert Hoffmeyer	EDA Survey 7/11/96	Corner of Don & Mitchell	End flow point for water sheet-flowing north of Fern Ave, Don Ave and west side of Pine. Pooled water 3' deep and 100' dia (Jan 95)	1. Storm drain along Pine, Don and Fern and retain AREA 5 flows. 2. Install gravity drainage to replace the pressurized drain pipe into the bay (Pump suction at SE corner of Don @ Mitchell)	Would like to see storm water storage and aquifer recharge
16.22	16	SLO CO	County File	The Pine Ash Broderson area			
16.23	16	Tony & Judy Campisi	EDA Survey 7/11/96	Ash between Pine and Broderson	During extreme storms ponding occurs at Broderson & Skyline. Flow through upper properties-down Ash-through lower properties and out to Pine	1. Storm drain for Skyline at Broderson	Use tax revenues to grade and pave all Los Osos streets. Coordinate drainage improvements with sewer improvements.
16.24	16	Walter Karpourczi	County File	530 Ash St.	Contacted Risk Management regarding flood damage in 1992		
16.25	16	Walter Karpowicz & Margaret Karpowicz	Blue Ribbon Survey, 1995-96	530 Ash	Wash through yard and multiple incidences of residence and or garage flooding.		
16.26	16	Public Comments	CSA J9 Meeting 7/11/96	Pine, Ash and AREA 5 (from Exhibit) should be extended beyond Henrietta sump. AREA 5 extended from LOVR uphill of Highland			
16.27	16		County Map		Sand/silt		
16.28	16		County Map		Sand/silt		
16.29	16		County Map		Sand/silt		
16.30	16		County Map		Sand/silt and erosion		

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
16.31	16		County Map		Erosion, inadequate culvert capacity, street ponding and sand/silt		
16.32	16		County Map		Sump area		
16.33	16		County Map		Erosion and sand/silt		
16.34	16		County Map		Inadequate culvert capacity		
16.35*	16	Robert Hoffmeyer	CSA 9J Mtg 6/3/97	Ash St erosion	Surface flows erode Ash Street carrying deposits onto and down Pine Ave for deposition at Mitchell Drive.	Provide sediment trap on Ash Street to contain sediments.	
17.1	17	SLO CO	County File	Santa Ynez at 9th Ave			
17.2	17	SLO CO	County File	Santa Ynez at 11th Ave			
17.3	17	Esther Susoeff	Blue Ribbon Survey, 1995-96	1758 7th Street	Septic tank problems and standing water in yard		
17.4	17	Norma Galloway	Letter to County	Central Coast Coffee	Contacted Risk Management regarding flood damage in 1992 Possibly due to the poor performance of the William Brothers basins		
17.5	17	Larry O'Hanlon	County File	1836 6th Street	Rear property floods lot. This rear property receives flows from the street.		
17.6	17	D. Paul Wilson	EDA Survey 7/11/96	9th St. @ Santa Ynez	Water flows past channel on Santa Ynez and down 9th Street flooding 1976 9Th	1. Storm swale at 9th & Santa Ynez could be lowered to ensure high velocity flow down 9th St. from Los Olivos is intercepted and directed down Santa Ynez 2. Berms to contain water in street	see sketch
17.7			County Map		Sand/silt and cross lot drainage		
17.8			County Map		Sand/silt and cross lot drainage		
17.9			County Map		Sand/silt and cross lot drainage		
17.10			County Map		Erosion, inadequate swale capacity, cross lot drainage, private property obstruction, and sand-silt		
17.11			County Map		Erosion and street ponding		
17.12			County Map		Erosion and street ponding		
17.13			County Map		Cross lot drainage and street ponding		
18.1	18		County File	Nipomo @ 13	Water ponding even in light storms		
18.2	18	Daniel & Kathie Sperow	EDA Survey 7/11/96	Nipomo @ 12th	Floods 1878 12th St. Most water appears to come off Nipomo. Problem was worsened due to County regarding shoulder area	1. Storm drain	Regrade and improvements of contributing properties should require retention. Increase in building has

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
							increase flooding over the years
18.3	18	Linsy Jackson	EDA Survey 7/11/96	1877 12th Street	Water runs under walls		phone conversation
18.4	18	Public Comments	CSA J9 Meeting 7/11/96	1878 12th Street Nipomo @ 13th St.			
19.1	19	County Note	County File	Santa Ynez @ Mountain View	Ponding		
20.1	20	SLO CO	County File	Santa Ynez at Fairchild west to 11th Ave			
22.1	22	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Los Olivos	Surface flooding of 1173 Los Olivos and the next three properties westerly		
22.2	22	Clinton Milne County Engineer	County Memo 3/6/92		Basin at Los Olivos and Fairchild designed to handle LOVR widening runoff, 50 yr-10 hr event. An inlet was installed to reduce the flooding along Los Olivos and Fairchild. This basin was not intended to fix this flooding area.		
22.3	22	South Bay Community Council	County File 2/24/83	Los Olivos @ PTK Elect Don @ Mitchell			
23.1	23		County Map		erosion and sand/silt		
23.2	23		County Map		erosion and sand/silt		
23.3	23		County Map		sand/silt		
23.4	23		County Map		sand/silt		
23.5*	23	Mark Connelly	Ltr from Greg M. 6/3/97	1782 Sage Ave	The County maintains a ditch along Sage to its northerly end. As part of the subdivision, a drainage easement was dedicated on his property, which is not regularly maintained. Due to sediment loading, water in the street ponds up to two feet making driveway inaccessible. Homes do not flood.		
24.1	24		County Map		Street ponding and sand/silt		
24.2			County Map		Private property flow obstruction		
25.1	25		EDA Survey 7/11/96	Overflow of County Basin			
25.2	25	"Drainage Problems in Los Osos Area"	County File (no date, 11/76)	Cabrillo Estates	Erosion problems from runoff originating from Cabrillo Estates and carried north from Travis Way		
25.3	25	CSA #9 Advisory Group Meeting	9/30/82	Erosion problems	Erosion problems from Cabrillo Estates. End of Rodman Drive and north of Travis Drive		
25.4	25	John & Rosella	Letter to County	2500 Quail Lane			

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ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
		Pavelich					
25.5	25	South Bay Community Council	County File 2/24/83	Erosion of Cabrillo Estates at end of Rodman			
25.6	25	Susy Bauman	Letter to County	2626 Rodman Dr.	Property is in a low area that receives drainage from adjacent properties and tends to accumulate in septic tank		
25.7	25	Wayne Hoit	EDA Survey 7/11/96	Monarch Grove	Cabrillo Estates basin has overflowed and flooded the Monarch Grove area	1. County should scarify bottom of basin at least once per year to increase basin percolation. 2. Route basin drainage into pipe which connect to exist pipe on east side of golf course (installed for Sunset Terrace project)	
25.8	25		County Map		Sand/silt		
25.9	25		County Map		Sand/silt		
25.10	25		County Map		Sand/silt		
25.11	25		County Map		Sand/silt		
26.1	26		County Map		Erosion, cross lot drainage, street ponding and silt -sand deposition		
27.1	27	Mitch & Amy Alter-Gantz	Blue Ribbon Survey, 1995-96	2210 Cimarron	Wash through yard and multiple incidences of residence and or garage flooding		
27.2	27	SLO CO	County File	LOVR at Cimarron			
27.3	27		County Map		Erosion, cross lot drainage, street ponding, and sand/silt		
27.4*	27	Jennifer McCalb	CSA 9J Mtg 6/3/97	LOVR at Cimarron	Water floods over Cimarron at LOVR causing dangerous traffic conditions.	Culvert under LOVR and down Sombrero with outlet north of the existing Agricultural fields.	
		"Drainage Problems in Los Osos Area"	County File (no date, 11/76)		About 50 "bird baths", principally the Baywood Park area.		
		County Board of Supervisors	Board Order 10 4/12/83		Construct Walker Ditch and culverts in the Paso Robles sump Install pump station with Bay discharge at 8th @ El Moro Install pump station with Bay discharge at Don @ Mitchell Install pump station at Los Olivos with discharge easterly in Los Olivos, northerly in Fairchild,		

*Item added since submittal of WP I.

ITEM	DRAIN AREA	NAME OF RESPONDEE	FILE	LOCATION OF PROBLEM	RESPONDEES DESCRIPTION	RESPONDEES SOLUTION	RESPONDEE'S COMMENTS
					easterly in Santa Ynez to an existing drainage easement under S. Bay Blvd. and into Eto Creek.		
		Hazard Mitigation Grant Program Application	1/24/96	Flooding problems began to be documented with the storms of 1978 & 1983.	Population of the area jumped from a few thousand to 14,000 between the late 1960's and to the end of the 1980's.		
		Unknown	County File 3/78		In 1978 the Army Corps indicated that minor channel damage occurred as a result of flooding. It is likely that minor localized flooding of 2 to 3 homes occurred as well.		

*Item added since submittal of WP I.

ATTACHMENT TO SWAMP MAP #1
FOR
EDA DRAINAGE AREA STUDY 6 / 97

IN INTERPRETING THIS MAP / LEGEND THE FOLLOWING CONDITIONS MUST BE ACKNOWLEDGED:

1) IN NO WAY DOES THIS DOCUMENT CLAIM TO CONTAIN ALL OF THE ADDRESSES OF PEOPLE AND PROPERTIES SUSTAINING FLOOD / STORM DAMAGE AND PROBLEMS DURING THE WINTER STORMS OF 1995.

2) THE ADDRESSES DESIGNATED ON SWAMP MAP #1 WERE DERIVED FROM LISTS DEVELOPED BY INTERESTED RESIDENTS AT LOCALLY ORGANIZED MEETINGS, WERE THE RESULTS OF NEIGHBORS CANVASSING DOOR TO DOOR IN THEIR NEIGHBORHOODS, WERE TAKEN FROM LETTERS SENT BY RESIDENTS TO COUNTY OFFICIALS AND WERE TAKEN FROM DOCUMENTS PREPARED BY E.D.A.

3) NOT ALL ADDRESSES EXPERIENCING 1995 STORM / FLOODING PROBLEMS LOCATED IN ZONE J ARE LISTED AS:

A) NOT ALL RESIDENTS ARE / WERE AVAILABLE FOR COMMENT AND NO ADDRESS WAS LISTED WITHOUT DIRECT REFERRAL AS NOTED IN #2 ABOVE.
B) NOT ALL RESIDENTS ARE / WERE WILLING TO DISCUSS THEIR PROBLEMS WITH THOSE CANVASSING NEIGHBORHOODS.
C) SOME OF THE SOURCES USED FOR THE INFORMATION PRESENTED ARE NOW TWO AND A HALF YEARS OLD, AND CURRENT OWNERS OR RENTERS MAY BE DIFFERENT AND MAY BE UNAWARE OF PAST PROBLEMS OR POTENTIAL FUTURE PROBLEMS.

4) CONDITIONS HAVE CHANGED SINCE THE 1995 STORMS / FLOODING AS ZONE J HAS MADE SOME CHANGES, INDIVIDUAL RESIDENTS HAVE ATTEMPTED TO SOLVE THEIR OWN PROBLEMS BY VARIOUS MEANS AND OTHER RESIDENTS MAY NOW EXPERIENCE PROBLEMS BECAUSE OF THE ABOVE CHANGES.

5) PROBLEMS AFFECTING LARGE AREAS, SUCH AS FOUND ALONG LOS OSOS VALLEY ROAD IN THE CIMMERON AREA AND BETWEEN MONARCH SCHOOL AND THE SHOPPING DISTRICT, THE DOCUMENTED PROBLEMS AND FAILURES OF THE RETENTION PONDS FOR THE CABRILLO ESTATES AND THE BAYVIEW HEIGHTS DEVELOPMENTS AS WELL AS THE EFFECTS OF HIGH GROUND WATER IN VARIOUS AREAS HAVE BEEN OMITTED FROM THIS MAP / LEGEND.

6) AND ANY NEW COMMUNITY SURVEY WOULD BRING FORTH MANY MORE PROBLEMS THAT HAVE NOT YET COME TO LIGHT. AN EXAMPLE CAN BE FOUND IN THE JUNE 3RD 1997 DRAINAGE BLUE RIBBON COMMITTEE MEETING AT WHICH NEW PROBLEM RELATED TO THE 1995 FLOODING WERE BROUGHT TO LIGHT.

FLOOD RELATED DAMAGE CATEGORIES

DAMAGE CATEGORIES TO PERSONAL PROPERTY

SEPTIC PROBLEMS

2) WASH THROUGH YARD

3) STANDING WATER IN YARD

4) WATER ENTER HOUSE/GARAGE/BUSINESS ONCE

5) WATER ENTER HOUSE/GARAGE/BUSINESS MULTIPLE DUE TO SURFACE FLOOD

6) WATER ENTER HOUSE/GARAGE/BUSINESS MULTIPLE DUE TO SURFACE FLOOD AND RISING GROUND WATER

7) PUMPING NECESSARY TO CLEAR YARD DUE TO #5

8) PUMPING NECESSARY TO CLEAR YARD DUE TO #6

9) PUMPING NECESSARY TO CLEAR HOUSE/GARAGE DUE TO #5

10) PUMPING NECESSARY TO CLEAR HOUSE/GARAGE DUE TO #6

11) PUMPING NECESSARY OVER A PROLONGED PERIOD DUE TO #6

12) EXISTING STORM WATER CONTAINMENT FACILITIES OVERCOME BY SURFACE FLOODING

FLOOD ADDRESS / CATEGORY / PHONE LIST

EL MORO CORRIDOR

NAME		ADDRESS	CATEGORIES	PHONE
Mark Alfirevic	8	1361 4th	1	528-5246
Alice Alirevic				
Richard Bruner	3	1325 4th	1,2,3,4	528-1637
Barbara Bruner				
Lesa Duncan	6	1346 4th	1,2,4	528-7226
Laurie Johnson	4	1331 4th	1,2,3,5	
Ronald Lyman	7	1360 4th	2,3	528-4650
Edie Lyman				
Evelyn Moberg	5	1334 4th	2,3	528-3206
Steven Moberg				
Donald & Eldra Avery	2	1313 4th	1,2,3	528-6114
Tom Gutry	17	1373 5th	2,3,4	
Jeff Loring	9	1319 5th	2	528-0911
Margen Loring				
Deena Richmond	12	1345 5th	1,2,4	528-2431
Bill Richmond				
Sandy Vidak	16	1368 5th	2,4	
Don Walters	13	1346 5th	2,4	
Donna Walters				
Jim Mac Donald	10	1337 5th	2	528-7680
Barry & Nancy Rice	15	1355 5th	2	528-4943
Tony & Ann Skelton	11	1339 5th	2	
August Gioia	14	1352 5th	2	
Sandy Griswold	16	1368 5th	2	
Lorna Bostwick	26	1616 6th	2	528-5392
Debby Cardinali	25	1415 6th	3,7	528-2950
Jim Shisler				
Margie Dist	19	1378 6th	1,2,3,5,7,9	534-0201
Ray Fitch	20	1379 6th	2,3,7	528-2783
Lynn Fitch				
Bill Hall	22	1388 6th	1,2,3,5,7,9	528-4074

Mackie Hall				
Tony Hall				528-4118
Deb Hutchins	21	1380 6th	1,2,3,5,7,9	528-3227
Tony Kwid	23	1400 6th	1,3,6,8,10,11,12	528-0169
Katherine Kwid				
Mary Martin	24	1412 6th	1,3,6,8,10,11,12	528-8632
CeCe Simpson	18	1361 6th	2,4	528-1098
Joyce Stockton				
John Ball	28	1412 7th	1,3,6,10,11,12	528-0429
Allison Ball				
Don Bearden	29	1421 7th	1,3,6,10,11,12	528-6216
Judith Reilly	27	1411 7th	1,3,6,8,10,11,12	528-3579
Danielle Rogers	29	1421-B 7th	1,3,6,8,10,11,12	528-4124
Esther Susoeff	31	1758 7th	1,3	528-5905
Seth Landrum	30	1630 7th	1,2,3,6,12	528-7534
Zanzara Landrum				
George Boddeker	33	1421 8th	1,3,6,10,11,12	528-5740
Denise Boddeker				
Ruth Coafer	32	1411 8th	1,3,6,10,11,12	528-1466
Kathy West	44	1431 8th	1,3,6,10,11,12	
Bill Fellows	34	1405 9th	1,2,3,4	528-3872
Richard Ruffel	35	1681 9th	2	929-1343
Joe Forlippa	37	1441 10th	1,2,4	528-4861
David Whitehead	36	1421 10th	1,2,4	934-0094(h)
Valerie Bailey	42	915 El Moro	1,3,6,8,11,12	534-1003
Brian Bailey				
Glen Berkovitz	43	870 El Moro	1,3,6,10,11,12	310-397-4105
Jane Berkovitz				
Glenn E. Harrell	40	890 El Moro	1,2	
Jim Marak	41	899 El Moro	1,3,6,8,10,11,12	528-2184
Vera Marak				

ROMONA SWALE

	58	1600 4th	2,3
Scott Martin	59	1597 4th	2,3

Don Fox	60	1598 4th	3	
Suzan Berry Richard Berry	61	1600 5th	1,4	
Lynn Nagahara Ken Nagahara	62	1605 6th	2,4	528-7373
Pat Johnson	63	1612 6th	1,2,4	528-2227
		1625 7th	2,3,5	
Mike Gorman	64	1638 7th	1	
Dorothy Pierce	66	1672 8th	2	
Dianne Draeger	67	1657 8th	2	
Hank Gentry	68	1651 8th	2,3,5	
Tom Cujini	69	1641 8th	2	
John Richards	70	1650 8th	2	
	71	1660 8th	2	
	72	1673 9th	2	
	77	1690 9th	2,3	
	78	1696 9th	2,3	
Josie Freitas	73	1030 Ramona	2,3	
Packard	74	1056 Ramona	2,3	
Jane Lovett	75	1703 11th	1,3,6	
Ed Quitana	76	1695 11th	road access problems	

FLOOD ADDRESS / CATEGORY / PHONE LIST

GROVE

NAME		ADDRESS	CATEGORIES	PHONE
Serma Benson	52	305 Grove	1,2,3	528-2395
Jo Olmstead	53	308 Grove	1,2,3,6	528-5155
Melia Wegner	54	309 Grove	1,2,3	528-7424

ASH

NAME		ADDRESS	CATEGORIES	PHONE
Walter Karpowicz	55	530 Ash	2,5	528-1463
Margaret Karpowicz				
Dorthy Tomilson	56	567 Ash	2,5	528-7701

HENRIETTA

Bob Hoffmeyer	57	510 Henrietta	2	534-9535

FLOOD ADDRESS / CATEGORY / PHONE LIST

16TH AND AJOINING AREA[1]

NAME		ADDRESS	CATEGORIES	PHONE
Mr&Mrs S. Asuncion	45	1475 16th	1,2,3,4,5,7,9,11,12	534-1633
Kathy Chaves	46	1495 16th		528-5345
Louis Chaves				
Leonor Cunningham	47	1488 16th		534-0925
John Lopez	48	1491 16th		528-5238
Julie Lopez				
Sandy Robinson	49	1450 15th		528-3728
John Robinson				
Mark Seaton	50	1480 16th		528-8688
John DeBacker	51	1539 18th	1,2,3,4,5,7,9,11	528-6522

[1]At least seven addresses not listed above need to be added to this list but were no available at this printing.

AREA 1	Santa Ysable, Pasadena to 600 Block			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
1.1	1	SANTA MARIA	SW SANTA MARIA @ PASADENA	CMP CULVERT	SUMP	SWALE	9" SILT	18	40	CMP	3.6
1.2	2	PASADENA	PASADENA AT PARK	CROSS GUTTER	SUMP	SWALE				CONC	
AREA 2	Santa Lucia			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
2.1	1	4TH	N END OF 4TH ST	1'x1' TRAP CHNL	OPEN	BAY		NA	20	AC	109
AREA 3	Santa Ysable, 700 Block to 1200 Block			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
3.1	1	SANTA YSABLE	SANTA YSABLE @ 10TH	CMP CULVERT	SUMP	SWALE		18	60	CMP	10
AREA 4	Santa Ysable, 1300 Block to 1600 Block			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
4.1	1	SANTA YSABEL	NE SANTA YSABLE @ 14th	CMP CULVERT	SUMP	SWALE	9" SILT	18	60	CMP	10
4.2	2	11TH	N END OF 11TH	TYPE C3	SUMP	10TH		18	250	ACP	10
AREA 5	Santa Ysable, 1600 Block to South Bay Blvd.			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
5.1	1	SANTA YSABEL	NE SANTA YSABLE @ 17tH	6x3 DI	SUMP	SWALE	GOOD	18	60	CMP	10
5.2	2	17th	SW 17th @ SANTA YSABLE	6x3 DI	SUMP	BASIN 5.C	GOOD	18	350	CMP	10
AREA 5 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
5.A	4	ROAD BASIN	0.03 AF	TERMINAL	NA	NA	NA	NA	NA	NA	NA
5.B	5	ROAD BASIN	0.03 AF	TERMINAL	NA	NA	NA	NA	NA	NA	NA
5.C	6	SANTA YSABLE	0.35 AF	TERMINAL	PROJECT	15	ACP	NA	NA	NA	NA
AREA 6	El Moro Depression, 300 Block to 1400 Block			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
6.1	1	2nd	NE 2nd @ EL MORO	4x3 DI	SUMP	BAY		18	150	CMP	10

AREA 7	Paso Robles Depression, 1400 Block and 1800 Block			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
7.1	1	PASO ROBLES	N PASO ROBLES @ 17TH	CULVERT	SUMP	SWALE	9" SILT	18	50	CMP	10
7.2	2	PASO ROBLES	BET 17TH & 18TH	CULVERT	SUMP	OMP 7.3		15	60	PVC	6
7.3	3	PASO ROBLES	NW PASO ROBLES @ 18TH	36" OMP	SUMP	SWALE		18	50	CMP	10
7.4	4	PASO ROBLES	SW PASO ROBLES @ 18TH	CULVERT	SUMP	WALKER CHNL		18	50	CMP	10
7.5	5	WALKER DITCH	PASO ROBLES @ 18TH	2'x2.5' CHNL	OPEN	54" CULVERT	GOOD	NA	700	CONC	183

AREA 8	Ramona/Pismo Depression, 300 Block to 1300 Block			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
8.1	1	RAMONA	S RAMONA @ 11th	CULVERT	SUMP	SWALE	PLUGGED	18	40	CMP	10
8.2	2	RAMONA	S RAMONA @ 9th	CULVERT	SUMP	SWALE		18	50	CMP	10
8.3	3	3rd STREET	BET PISMO & EL MORO	CULVERT	SUMP	BAY		24	50	HDPE	20

AREA 9	14th to 17th Depression between Pismo & Ramona			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
9.1	1	16TH	16TH BET PISMO & RAMONA	TYPE G3 INLET	SUMP	BASIN 9.A		6	350	PVC	1

AREA 9 BASINS					INLET				OUTLET		
		NAME	STORAGE	TYPE	TYPE	DIA	MAT	TYPE	PIPE	MAT	DEST
9.A	2	17TH ST BASIN	0.08 AF	RETENTION	CHNL		CONC	PROJ	6	PVC	CMPA

AREA 12	14th to 17th Depression between Pismo & Ramona			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
12.1	1	SOUTH BAY BLVD.	L.O. Jr. HIGH	CULVERT	SUMP	LOS OSOS CRK	GOOD	54	800	CMP	150
12.2	2	SOUTH BAY BLVD.	S OF PISMO	CULVERT	SUMP	LOS OSOS CRK	GOOD	28x20	100	CMPA	17

AREA 13	Monarch & Sea Pines			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
13.1	1	SOLANO	NE SOLANO @ BUTTE	4x2 DI	SUMP	BAY		18	40	CMP	10
13.2	2	SOLANO	SW SOLANO @ BUTTE	4x2 DI	SUMP	DI 13.1		18		CMP	10
13.3	3	PECHO VALLEY	SE PECHO @ MONTANA	4x3 DI	INTERCEPT	MONARCH		18		HDPE	10
13.4	4	PECHO VALLEY	E PECHO @ RODMAN	ARCH	SUMP	SWALE		43x27	100	CMPA	45
13.5	5	RODMAN	E PECHO @ RODMAN	TYPE 2 INLET	INTERCEPT	CMPA 13.4		24	34	CMP	20

AREA	The Broderson, Skyline & Pine Depression			INLET		OUTLET	COND		PIPE		Q
16	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
16.1	1	LOVR	E OF RAVENNA	CMP CULVERT	SUMP	SWALE		18	80	CMP	10
16.2	2	LOVR	E OF PALISADES	CMP CULVERT	SUMP	SWALE		36	80	CMP	55
16.3	3	N WOODLAND	BET RAVENNA & PALISADES	3x2 DI	SUMP	CMP 16.2		18	200	CMP	10
16.4	4	S WOODLAND	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.3		18	50	CMP	10
16.5	5	N MANZANITA	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.4		18	200	CMP	10
16.6	6	S MANZANITA	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.5		18	50	CMP	10
16.7	7	N LILAC	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.6		18	200	CMP	10
16.8	8	S LILAC	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.7		18	50	CMP	10
16.9	9	N MAR VISTA	BET RAVENNA & PALISADES	3x2 DI	SUMP	DI 16.8		18	200	CMP	10
16.10	10	BROADERSON	BET BROADERSON & RAVENNA	CHANNEL	SUMP	LOVR		NA	1100	CONC	
16.11	10	BAYVIEW HEIGHT	W BAY VIEW BET BAY OAKS & LOVR	4x3 DI	INTERCEPT	CURB DRAIN		12	40	RCP	3.5
16.12	11	BAYVIEW HEIGHT	E BAY VIEW BET BAY OAKS & LOVR	4x3 DI	INTERCEPT	DI 16.11		30	40	RCP	35
16.13	12	BAY OAKS	S SIDE E OF BAYVIEW HEIGHTS	4x3 DI	SUMP	DI 16.12		30	250	RCP	35
16.14	13	BAY OAKS	N SIDE E OF BAYVIEW HEIGHTS	4x3 DI	SUMP	DI 16.13		24	40	RCP	20
16.15	15	PALISADES	PALISADES @ LOVR	CULVERT	SUMP	DITCH		18	40	CMP	10

AREA 16 BASINS						INLET			OUTLET		
		NAME	STORAGE	TYPE	TYPE	DIA	MAT	TYPE	PIPE	MAT	DEST
16.A	14	SKYLINE BASIN	0.40 AF	TERMINAL	NA	NA	NA	NA	NA	NA	NA

AREA	Los Osos Valley South			INLET		OUTLET	COND		PIPE		Q
17	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
17.1	1	RAMONA	RAMONA NEAR SWEET SPINGS PARK	CULVERT	SUMP	SWALE	GOOD	12	70	CMP	3.5
17.2	2	RAMONA	RAMONA NEAR SWEET SPINGS PARK	TYPE C3 DI	SUMP	SWALE	GOOD	18	30	CMP	10
17.3	3	BROADERSON	SE RAMONA @ BRODERSON	6x3 DI	SUMP	SWALE	POOR	24	175	CMP	20
17.4	4	RAMONA	NE RAMONA @ BRODERSON	4x3 DI	SUMP	CMP	GOOD	18	30	CMP	10
17.5	5	LOS OLIVOS	LOS OLIVOS	RISER		BASIN (22.A)		6	1150	PVC	1
17.6	6	11TH	BET LOS OLIVOS & SN YNEZ	2'x0.5' CHNL		10TH ST			250	CONC	

AREA	Santa Ynez & Mountain View			INLET		OUTLET	COND		PIPE		Q
19	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
19.1	1	MOUNTAIN	NW MOUNTAIN @ LOS OLIVOS	3x2 DI	INTERCEPT	SWALE	PLUGGED	12	80	CMP	3.5
19.2	2	S. BAY BLVD.	BET MOUNTAIN @ S. BAY BLVD.		SUMP	42" CMP		6	400	PVC	1

AREA	Vons Basin			INLET		OUTLET	COND		PIPE		Q
21	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
AREA 21 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
21.A	1	VONS BASIN	1.1 AF	TERMINAL	PROJECT	12	CMP	NA	NA	NA	NA
AREA	Fairchild Basin			INLET		OUTLET	COND		PIPE		Q
22	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
22.1	1	LOS OLIVOS	SE LOS OLIVOS @ FAIRCHILD	6x3 DI	SUMP	DI 22.2		18	40	CMP	10
22.2	2	FAIRCHILD	SE FAIRCHILD @ LOS OLIVOS	6x3 DI	INTERCEPT	DI 22.3		18	40	CMP	10
22.3	3	FAIRCHILD	SW FAIRCHILD @ LOS OLIVOS	6x3 DI	INTERCEPT	BASIN 22.A		18	40	CMP	10
22.4	4	FAIRCHILD	E SIDE N OF LOVR	4x3 DI	INTERCEPT	MH		18	30	CMP	10
22.5	5	LOVR	NE LOVR @ FAIRCHILD	6x3 DI	INTERCEPT	MH		24	45	CMP	20
22.6	6	LOVR	SE LOVR @ FAIRCHILD	6x3 DI	INTERCEPT	DI 22.5		18	45	CMP	10
AREA 22 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
22.A	7	FAIRCHILD BASIN	2.4 AF	TERMINAL	HW	18	CMP	NA	NA	NA	NA
22.B	8	PRIVATE BASIN	1.5 AF	TERMINAL				NA	NA	NA	NA
AREA	South Bay Blvd. & Los Osos Valley Rd to Los Osos Creek			INLET		OUTLET	COND		PIPE		Q
23	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
23.1	1	WILLOW	W SIDE WILLOW N OF ANDRE	3x2 BOX	SUMP	ETO CRK	GOOD	12			10
23.2	2	LOVR	LOVR @ S. BAY BLVD.	SWALK DRAIN	INTERCEPT	SWALE		NA	NA	NA	
23.3	3	S. BAY BLVD.	S. BAY BLVD.	CULVERT	SUMP	SWALE		42	150	CMP	85
23.4	4	WILLOW	WILLOW @ LOS OSOS VALLEY RD	DBL. CMP	SUMP	SWALE	GOOD	15	60	CMP	13
23.5	5	NIPOMO	NIPOMO @ ETO CREEK	CULVERT	SUMP	ETO CREEK			40		
AREA	Los Osos Valley Rd & Buckskin to Los Osos Creek			INLET		OUTLET	COND		PIPE		Q
24	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
24.1	1	PALOMINO	NW PALOMINO @ MARTINGALE	3x2 DI	SUMP	DI 24.2	GOOD	24	40	RCP	20
24.2	2	PALOMINO	NE PALOMINO @ MARTINGALE	3x2 DI	SUMP	LOS OSOS CRK	2" SILT	18	250	CMP	10

AREA	Cabrillo Heights & Vista de Oro			INLET		OUTLET	COND		PIPE		Q
25	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
25.1	1	ROSINA	SE ROSINA @ PECHO	4x3 DI	INTERCEPT	MH		18	150	RCP	10
25.2	2	LOVR	N SIDE LOVR AT SCHL PLAYGRND	4x3 DI	INTERCEPT	MH		18	400	RCP	10
25.3	3	LOVR	S LOVR @ PECHO	6x3 BOX	SUMP	MH		30		RCP	35
25.4	4	LOVR	S LOVR @ CULVERT OUTLET	6x3 BOX	INTERCEPT	DI 25.3		30		RCP	35
25.5	5	DORIS	W OF DORIS & PARALLEL	2x2 CHNL	OPEN	DI 25.4	GOOD		1360	CONC	120
AREA 25 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
25.A	6	SEA PINES BASINS	NA	STAGED	HW	30	RCP	SWALE	NA	NA	BAY
AREA	Cabrillo Heights & Vista de Oro			INLET		OUTLET	COND		PIPE		Q
25	*No*	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
25.6	7	LOS ARBOLES	NW LOS ARBOLES @ LOS PADRES	3x2 DI	INTERCEPT	BASIN 25.B		18	150	CMP	10
25.7	8	LOS ARBOLES	NE LOS ARBOLES @ LOS PADRES	3x2 DI	INTERCEPT	DI 25.6		18	40	CMP	10
25.8	9	VISTA	W END OF VISTA CI	3x2 DI	SUMP	DI 25.9		12	300	CMP	3.5
25.9	10	PECHO	NE PECHO @ MONTANA	3x2 DI	INTERCEPT	BASIN 25.B		18	50	CMP	10
AREA 25 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
25.B	11	LOS ARBOLES BASIN	0.55 AF	TERMINAL	HW	12 & 18	CMP	NA	NA	NA	NA

AREA 25	Cabrillo Heights & Vista de Oro			INLET		OUTLET	COND		PIPE		Q
	No	ROAD	LOCATION	TYPE	COND	TO		DIA	LGTH	MAT	(max. est)
25.10	1	MADERA	N OF MADERA @ SAN DOMINICO	4x3 DI	SUMP	MADERA 25.C	GOOD	36	25	CMP	55
25.11	2	MADERA	S OF MADERA @ SAN DOMINICO	4x3 DI	SUMP	MH	GOOD	36	25	CMP	55
25.12	3	MADERA	NW OF MADERA @ RODMAN	4x3 DI	SUMP	MH	GOOD	18	25	ACP	10
25.13	4	MADERA	SW OF MADERA @ RODMAN	4x3 DI	SUMP	MH	GOOD	27	0	ACP	28
25.14	5	RODMAN	SE OF RODMAN @ MADERA	4x3 DI	INTERCEPT	MH	GOOD	18	52	ACP	10
25.15	6	RODMAN	NE OF RODMAN @ TRAVIS	9x3 DI	SUMP	MH	GOOD	33	40	ACP	45
25.16	7	TRAVIS	N OF TRAVIS @ CROCKETT	3x3 DI	INTERCEPT	MH	GOOD	15	40		6.5
25.17	8	TRAVIS	SW OF TRAVIS @ CROCKETT	3x3 DI	INTERCEPT	MH	GOOD	15	10		6.5
25.18	9	TRAVIS	SE OF TRAVIS @ W CROCKETT	3x3 DI	INTERCEPT	DI 25.16	GOOD	24	50	CMP	20
25.19	10	TRAVIS	N OF TRAVIS @ E CROCKETT	TYPE C3 INLET	INTERCEPT	MH	GOOD	15	25		6.5
25.20	11	TRAVIS	SW OF TRAVIS @ E CROCKETT	3x3 DI	INTERCEPT	MH	GOOD	15	25		6.5
25.21	12	TRAVIS	SE OF TRAVIS @ E CROCKETT	3x3 DI	INTERCEPT	DI 25.20	GOOD	24	60	CMP	20
25.22	13	TRAVIS	NW AT ELBOW	3x3 DI	SUMP	MH	GOOD	15	20		6.5
25.23	14	TRAVIS	NE AT ELBOW	3x3 DI	SUMP	DI 25.22	GOOD	15	30		6.5
25.24	15	TRAVIS	S AT ELBOW -END	3x3 DI	SUMP	24"	GOOD	15	15		6.5
25.25	16	RODMAN	NW OF RODMAN @ BOWIE	20x3 SIDE INLET	INTERCEPT	PIPE	GOOD		5		
25.25	17	BOWIE	N SIDE BOWIE	4x3 DI	SUMP	PIPE	GOOD	18	20	ACP	10
25.27	18	BOWIE	S SIDE BOWIE	4x3 DI	SUMP	PIPE	GOOD	18	20	ACP	10
25.28	19	SAN JACINTO	N SIDE SAN JACINTO	4x3 DI	SUMP	DI 25.27	GOOD	18	318	ACP	10
25.29	20	SAN JACINTO	S SIDE SAN JACINTO	4x3 DI	SUMP	DI 25.28	GOOD	18	40	ACP	10
25.30	21	RODMAN	S SIDE RODMAN	20'x3' SIDE INLET	INTERCEPT	PIPE	GOOD		0		
25.31	22	RODMAN	S SIDE RODMAN-END	20'x3' SIDE INLET	INTERCEPT	BEGIN	GOOD		0		
25.32	23	AUSTIN	W END OF AUSTIN	BOX INLET	SUMP	BOWIE CURB	GOOD	18	255	CMP	10
25.33	24	RODMAN	SE RODMAN @ ALAMO	6x2 DI	INTERCEPT	RODMAN CURB	GOOD	18	250	PVC	10
25.34	25	RODMAN	E END OF RODMAN	CULVERT	SUMP	SWALE	GOOD	18	25	CMP	10

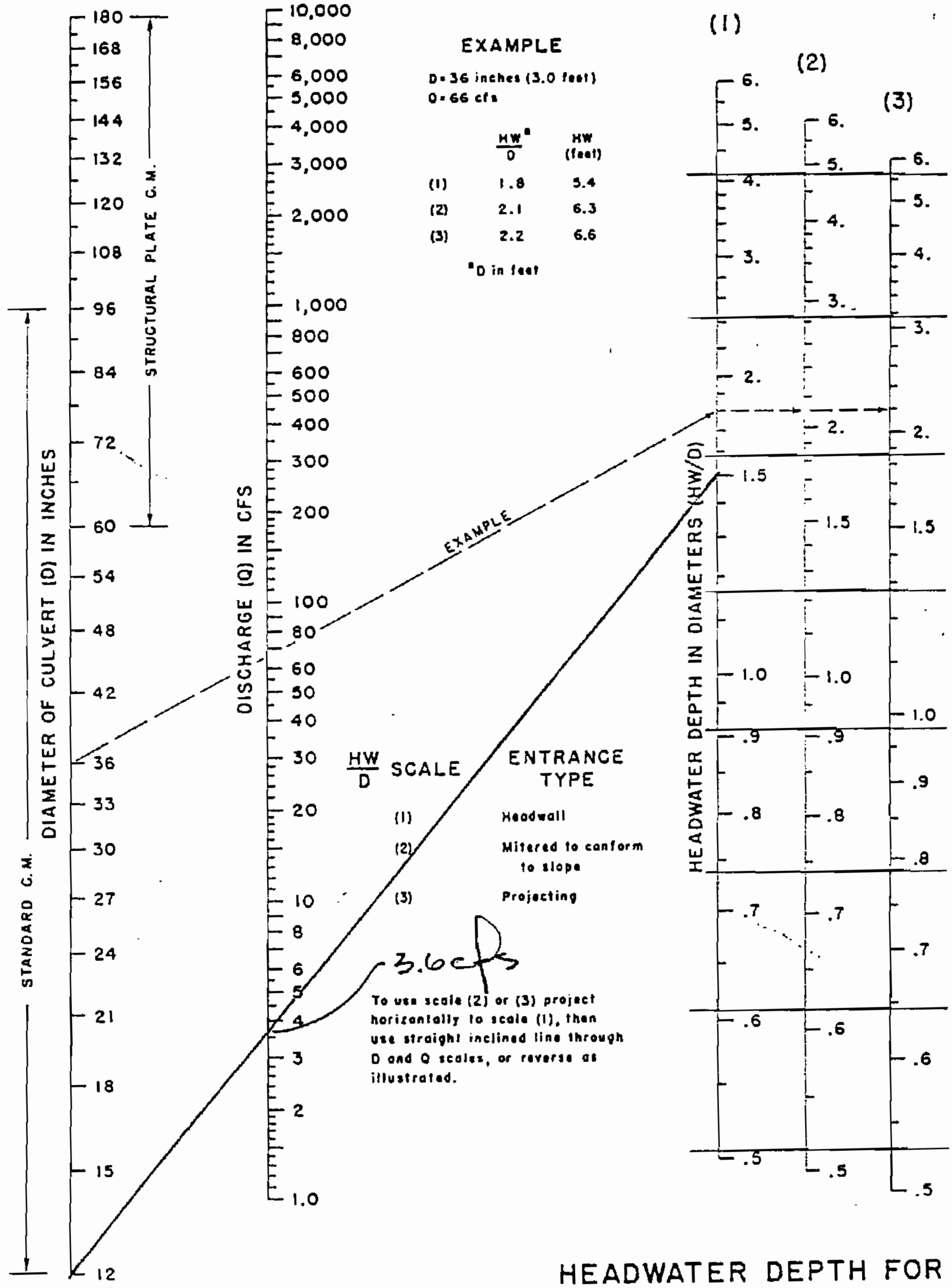
AREA 25 BASINS					INLET			OUTLET			
		NAME	STORAGE	TYPE	TYPE	DIA	MAT	TYPE	PIPE	MAT	DEST
25.C	25	MADERA	6.6 AF	TERMINAL	HW	36	AC	SPILL	42	AC	PECHO

AREA 26	Bayridge & Oak Ridge			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
26.1	1	BAY OAKS DRIVE	N BAY OAKS @ DEL MAR	4x3 DI	SUMP	BASIN 26.A	GOOD	24	35	CMP	20
26.2	2	BAY OAKS DRIVE	S BAY OAKS @ DEL MAR	4x3 DI	SUMP	DI 26.1	GOOD	24	40	CMP	20
26.3	3	TIERRA WAY	N BET OAK RIDGE & REDWOOD	2x2 DI	SUMP	BASIN 26.B	GOOD	18	20	CMP	10
26.4	4	TIERRA WAY	S BET OAK RIDGE & REDWOOD	2x2 DI	SUMP	DI 26.3	GOOD	18	40	CMP	10
26.5	5	LAS ENCINAS	W CUL-DE-SAC	3x2 DI	SUMP	BASIN 26.C	GOOD	12	125	CMP	3.5
26.6	6	LAS ENCINAS	E CUL-DE-SAC	4x3 DI	SUMP	BASIN 26.D	GOOD	18	100	CMP	10
26.7	7	TIERRA WAY	E CUL-DE-SAC	4x3 DI	SUMP	BASIN 26.E	GOOD	18	100	CMP	10
26.8	8	BAY VISTA LN	BET BAY VISTA & GREEN OAKS	CULVERT	SUMP	GREEN OAKS	GOOD	30"	220		35

AREA 26 BASINS						INLET			OUTLET		
		NAME	*STORAGE*	*TYPE*	*TYPE*	*DIA*	*MAT*	*TYPE*	*PIPE*	*MAT*	*DEST*
26.A	9	BAY OAKS BASIN	3.0 AF	TERMINAL	HW	24	CMP	SPILL	NA	NA	LOVR
26.B	10	TIERRA BASIN	0.7 AF	TERMINAL	HW	18	CMP	NA	NA	NA	NA
26.C	11	LAS ENCINAS W	0.03 AF	TERMINAL	HW	12	CMP	NA	NA	NA	NA
26.D	12	LAS ENCINAS E	0.07 AF	TERMINAL	HW	18	CMP	NA	NA	NA	NA
26.E	13	TIERRA E	0.15 AF	TERMINAL	HW	18	CMP	NA	NA	NA	NA

AREA 27	Los Osos Valley Road at Cimmaron			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
27.1	1	SOMBRERO	N END OF SOMBRERO	CULVERT	SUMP	SWALE	SILT	18	40	CMP	10
27.2	2	LOVR	UNDER LOVR E OF SOMBRERO	CULVERT	SUMP	SWALE	GOOD	36	225	CMP	55
27.3	3	LOVR	UNDER LOVR E OF SOMBRERO	CULVERT	SUMP	SWALE	GOOD	30	225	CMP	35
27.4	4	LOVR	N LOVER, E OF SOMBRERO	3x2 DI	INTERCEPT	SWALE	GOOD	12	10	CMP	3.5
27.5	5	LOVR	SOMBRERO	CULVERT	SUMP	SWALE	SILT	8	40	CMP	1
27.6	6	LOVR	SOMBRERO	CULVERT	SUMP	SWALE	SILT	6	40	CMP	1
27.7	7	CIMMERON	LOVR	CULVERT	SUMP	SWALE	SILT	18	40	CMP	10

AREA LOVR	Los Osos Valley Road			INLET		OUTLET	COND		PIPE		Q
	No	*ROAD*	*LOCATION*	*TYPE*	*COND*	*TO*		*DIA*	*LGTH*	*MAT*	*(max. est)*
LOVR.1	1	LOVR	S LOVR @ LOS OSOS CRK	OL-7 DI	INTERCEPT	LOS OSOS CRK	GOOD	30	0	RCP	35
LOVR.2	2	LOVR	S LOVR @ LOS OSOS CRK	OL-7 DI	INTERCEPT	24" RCP	GOOD	30	0	RCP	35
LOVR.3	3	LOVR	N LOVR @ LOS OSOS CRK	3.5x2 DI	INTERCEPT	LOS OSOS CRK	GOOD			RCP	
LOVR.4	4	LOVR	S LOVR @ BUCKSKIN	OL-10 DI	INTERCEPT	24" RCP	GOOD	18	50	RCP	10
LOVR.5	5	LOVR	NW LOVR @ BUCKSKIN	OL-7 DI	INTERCEPT	24" RCP	GOOD	18	115	RCP	10
LOVR.6	6	LOVR	N LOVR BET WILLOW & BUCKSKIN	OL-7 DI	INTERCEPT	24" RCP	GOOD	18	20	RCP	10
LOVR.7	7	LOVR	S LOVR BET WILLOW & BUCKSKIN	OL-7 DI	INTERCEPT	24" RCP	GOOD	18	120	RCP	10
LOVR.8	8	LOVR	LOVR @ WILLOW	CULVERT	SUMP	2.5x6" CHNL	GOOD	18	146	CMP	10
LOVR.9	9	OAK RIDGE	SE OAK RIDGE @ LOVR	GT-3 DI	INTERCEPT	21" RCP	GOOD	21	0	RCP	14
LOVR.10	10	OAK RIDGE	E OAK RIDGE	OL-14 DI	INTERCEPT	DI LOVR.6	GOOD	18	100	RCP	10



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

ENGINEERING DEVELOPMENT
ASSOCIATES, INC.
1320 Nipomo Street
SAN LUIS OBISPO, CALIFORNIA 93401
(805) 549-8658 FAX 549-8704

JOB

SHEET NO. OF

CALCULATED BY DATE

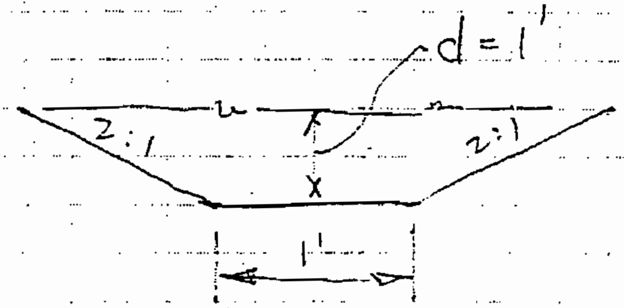
CHECKED BY DATE

SCALE

A.C. LINED 2.1

$a = 3$
$P = 5.47$
$r = .55$
$S = .30$

$Q = \frac{1.486}{.015}(.55)^{2/3} \times 3 \times .3^{1/2}$
$= 107$ CFS



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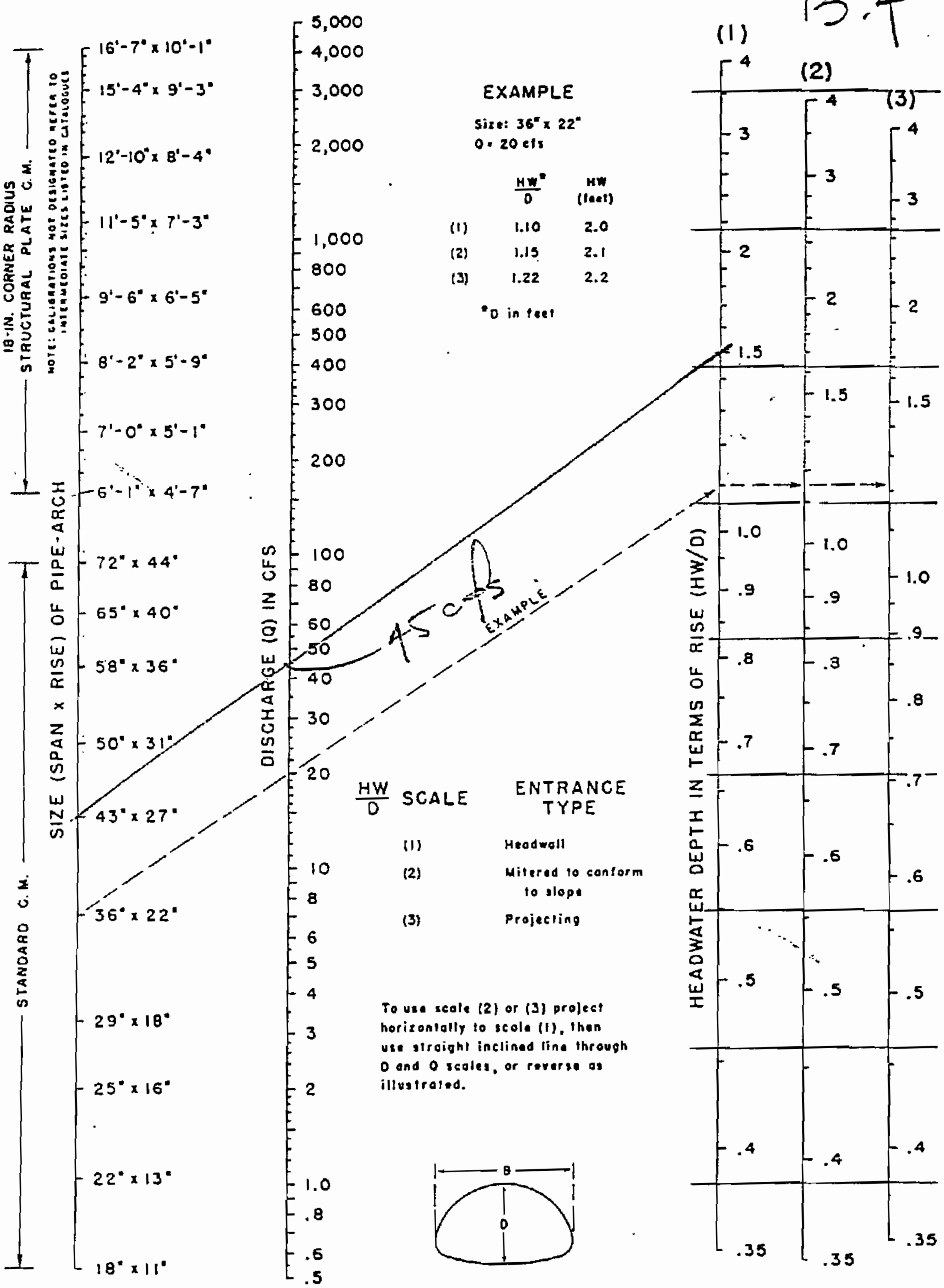

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

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APPENDIX C

SUPPLEMENTARY ENVIRONMENTAL DATA

C1: Recharge of the Los Osos Groundwater Basin from Septic Tank Discharge, Rainfall, and Landscape Irrigation
C2: Clarification of Well Level Data
C3: Groundwater Issues
C4: Environmental Considerations of Selected Alternatives
C5: Ranking of Alternatives Based Upon Environmental Impacts

Appendix C1
RECHARGE OF THE LOS OSOS GROUNDWATER BASIN FROM SEPTIC-TANK DISCHARGE, RAINFALL AND LANDSCAPE IRRIGATION

A. PURPOSE OF THIS APPENDIX

The rising groundwater conditions in several of the problem areas of the community are attributed in large part to increased recharge of the shallow groundwater due to: 1) septic-tank discharge; and 2), increased runoff from impervious surfaces in urbanized areas. Since implementation of a sewer project will substantially eliminate septic-tank discharge in many of the problem areas, estimation of the relative balance between septic-tank discharge and increased urban runoff is critical to any determination of the long-term need for, and extent of, drainage improvements.

This appendix addresses information relevant to this estimate based on: 1) information developed by the US Geological Survey (USGS) in their study of the groundwater basin; and 2), information that may be inferred from the variations in the rates of rising groundwater in certain wells as affected by variations in rainfall and densities of urbanization. This information is discussed below.

B. INFORMATION FROM THE USGS STUDY

1. Basin wide Relationships
The balance between recharge of groundwater from rainfall, return flow from landscape irrigation, and septic tank discharge can be extracted from the simulated water budgets in Table 6 of the USGS report for years 1970-77 and 1986 as follows:

Table C1-1
DISTRIBUTION OF RECHARGE OF THE LOS OSOS GROUNDWATER BASIN FOR YEARS 1970-77 AND 1986

	Recharge in AFY from:				Percent from:		
Year(s)	Septic-Tank Discharge	Landscape Returns	Rainfall	Total	Septic-Tank Discharge	Landscape Returns	Rainfall
1970-77	740	150	1,300	2,190	34%	7%	59%
1986	1,550	330	2,530	4,410	35%	7%	58%

That the percentage distributions of recharge from rainfall, septic-tank discharge and landscape returns are approximately the same for these two periods is apparently a coincidence. The level of development approximately doubled between 1970-77 and 1986, and septic-tank discharge and landscape returns increased accordingly. Year 1986 was a moderately wet year, and recharge from rainfall also doubled.

The USGS report has also estimated recharge from rainfall, septic-tank discharge and landscape returns under normal, wet and dry climatic conditions in Table 8, Alternative 1 (p. 52) for year-2010 development conditions, then estimated at a population of approximately 35,000, as follows:

Table C1-2
DISTRIBUTION OF RECHARGE OF THE LOS OSOS GROUNDWATER BASIN FOR WET, NORMAL AND DRY YEARS

	Recharge in AFY from:				Percent from:		
Type of Year	Septic-Tank Discharge	Landscape Returns	Rainfall	Total	Septic-Tank Discharge	Landscape Returns	Rainfall
Wet	2,600	580	8,950	12,130	21%	5%	74%
Normal	2,600	540	2,180	5,320	49%	10%	41%
Dry	2,600	610	1,250	4,460	58%	14%	28%

The values listed above apply to future conditions as envisioned during the preparation of the USGS report (year-2010 population of 35,000), and recharge from both septic-tank discharge and rainfall would be substantially less for an existing population of about 15,000 and also for lesser projected buildout populations. Also, these values for recharge are for the groundwater basin as a whole, and most of the areas with drainage problems are in the more densely urbanized portions of the community.

2. Relationships in Urbanized Areas

As a part of their analysis of groundwater recharge, the USGS developed rates of recharge for various densities of development. Runoff increases as urban density increases because impervious areas increase. In most communities, this increased runoff is carried away by storm drain systems. However, in much of Los Osos, the increased runoff infiltrates to the groundwater system because of: 1) an absence of drainage systems; 2) the sand-dune topography that includes undrained (i.e., closed) or poorly drained depressions; and 3), the high infiltration rates of the sand soils. Rates of recharge from septic-tank discharge and irrigation return flow also increase with increasing urban density. The rates of recharge of rainfall, septic-tank discharge, and return flow from landscape irrigation for various development conditions from USGS Tables 2 and 3 are as follows (see Figure C1-1):

Table C1-3
RECHARGE OF THE LOS OSOS GROUNDWATER BASIN FOR DIFFERING DEVELOPMENT INTENSITIES IN THE YEARS 1970-77 AND 1986

				Total Recharge (AFY) for:			
				1970-77 Conditions		1986 Conditions	
Zone	Type of Development	Approx. Units/ Acre	Area (acres)	Total	Per Acre	Total	Per Acre
1	High den. res.	4	1,162	760	0.654	2,000	1.721
2	Med. den. res.	2	271	110	0.406	270	0.996
4	Low den. res.	1	367	*110	0.300	*240	0.654
6	Undeveloped	0	1,142	*100	0.088	*150	0.131

* Values reversed from USGS Table 3 pending further clarification.

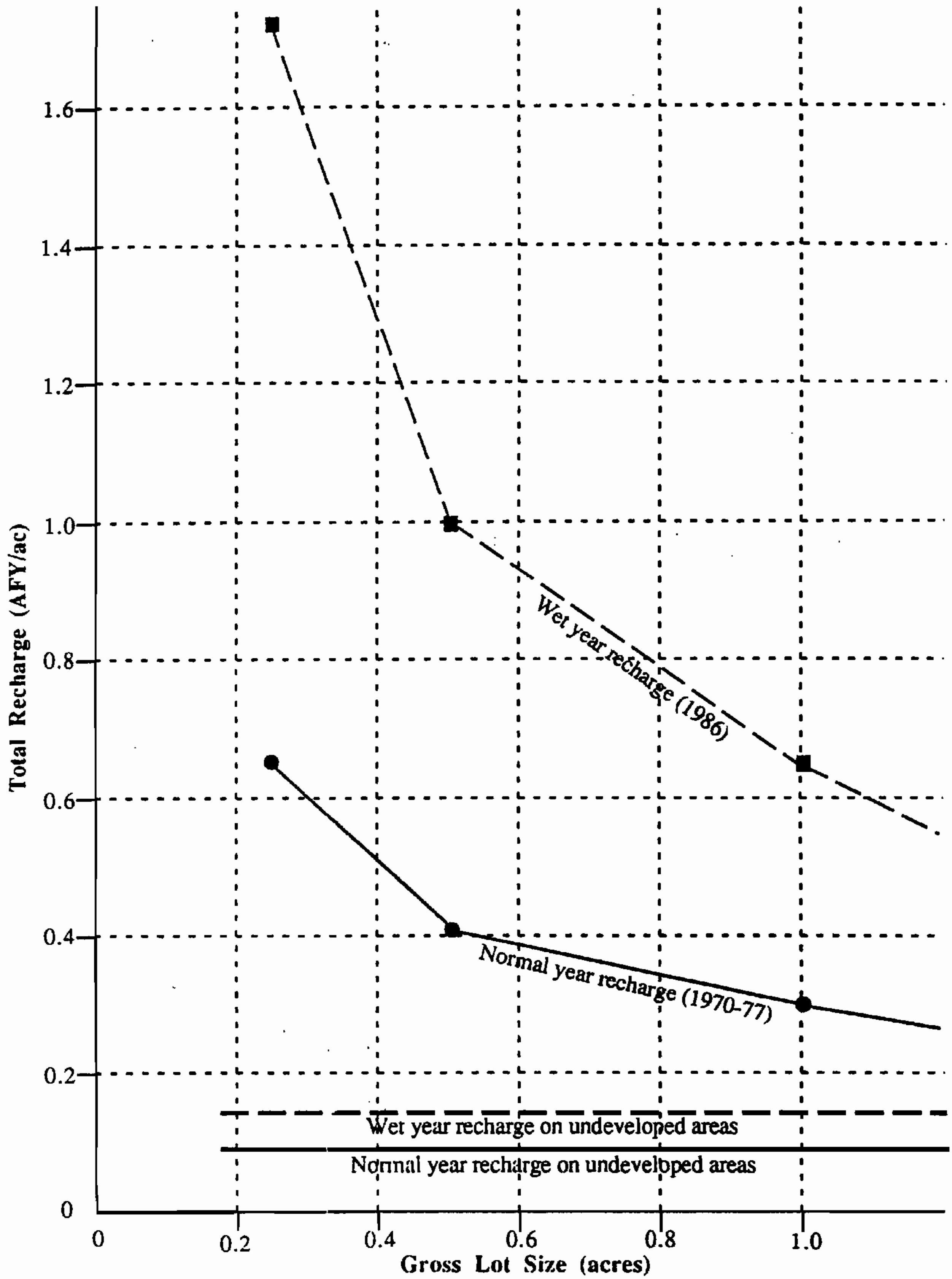

Figure C1-1. Plot of total recharge of rainfall, septic-tank discharge and landscape irrigation for normal and wet year climatic conditions at full buildout of 4, 2 and 1 unit/acre and undeveloped conditions from Table 1-3.

The component of recharge attributable to septic-tank discharge can be estimated from total recharge from this source and the number of residential units. For 1986 conditions, total recharge from septic-tank discharge is estimated at 1,550 AF (USGS, Table 6), and the number of residential units is reported by DWR (Figure 5) as approximately 5,600, which yields a rate of Figure C1-1. Recharge plot recharge of 0.277 AF/unit. If the 1986 value of 0.277 AF/unit for recharge from septic-tank discharge is applied to the values in the table above for 1986 conditions, the "split" recharge from rainfall and landscape irrigation for this year can be estimated as follows:

Table C1-4
DISTRIBUTION OF RECHARGE OF THE LOS OSOS GROUNDWATER BASIN
FOR DIFFERING DEVELOPMENT INTENSITIES IN 1986

		Approx.		1986 Recharge (AFY/ac):			
	Type of	Units/	Area	Recharge	Septic	Rainfall	Percent
Zone	Development	Acre*	(acres)	Total	Discharge	& Irrig.	Septic
1	High den. res.	4	1,162	1.721	1.108	0.613	64%
2	Med. den. res.	2	271	0.996	0.554	0.442	56%
4	Low den. res.	1	367	0.654	0.277	0.377	35%
6	Undeveloped	0	1,142	0.131	0.000	0.131	0%

* The assignment of these approximate development densities to the areas listed results in a total of 5,557 residential units.

For 1970-77 conditions, total recharge from septic-tank discharge is estimated at 740 AF, and the average number of residential units is reported by DWR as 2,900, which yields a rate of recharge of 0.255 AF/unit. This development condition is very close to half that of 1986 conditions, and the approximate number of units per acre are revised to half that in Table C1-4 above. If these revised densities and the 1970-77 value of 0.255 AF/unit for recharge from septic-tank discharge are applied to the values in Table A1-3 for 1970-77 conditions, the "split" in recharge from septic discharge and that from rainfall and landscape irrigation for this period can be estimated as follows:

Table C1-5
DISTRIBUTION OF RECHARGE OF THE LOS OSOS GROUNDWATER BASIN
FOR DIFFERING DEVELOPMENT INTENSITIES IN THE YEARS 1970-77

		Approx.		1970-77 Recharge (AFY/ac):			
	Type of	Units/	Area	Recharge	Septic	Rainfall	Percent
Zone	Development	Acre*	(acres)	Total	Discharge	& Irrig.	Septic
1	High den. res.	2	1,162	0.654	0.510	0.144	78%
2	Med. den. res.	1	271	0.406	0.255	0.151	63%
4	Low den. res.	.5	367	0.300	0.127	0.173	42%
6	Undeveloped	0	1,142	0.088	0.000	0.088	0%

* The assignment of these approximate development densities to the areas listed results in a total of 2,779 residential units.

3. Summary of Information from the USGS Report

Based on information provided in the USGS report:

1. On a basin-wide basis, recharge of the shallow groundwater body tends to be dominated by recharge of rainfall which is approximately 75% of recharge in wet years when flooding would be a significant problem, decreasing to about 40% in normal rainfall years, and 30% in dry years.

2. In the high density residential areas where flooding has been exacerbated by shallow groundwater conditions, septic-tank discharge tends to be the dominant component of recharge, ranging from about 80% of recharge in normal years down to about 65% in moderately wet years. Even in very wet years such as 1995, recharge from septic-tank discharge probably would have exceeded recharge from rainfall in the high density residential areas.

C. INFORMATION FROM WELL LEVEL CHANGES

1. Useful Well-Level Histories

It may be feasible to make estimates from well-level variations of the relative influence on ground-water recharge of septic-tank discharge and landscape irrigation versus infiltration of rainfall. Septic-tank discharge and returns from landscape irrigation should be roughly proportional to the level of urban development, while infiltration of rainfall should be roughly proportional to rainfall and development density.

Review of the water-level histories of wells in the Los Osos groundwater basin monitored by the County Engineering Department has identified two wells that exhibit water-level variations of sufficient magnitude to be potentially useful for this purpose. These are the old CSA No 9 shallow well at 8th and El Moro (7Q1) and the old well at the Chevron Station on Los Osos Valley Road (18Q1).

The variations in groundwater levels in these wells are shown on Figure C1-2. Both wells show a relatively steady rise in water levels up through about 1980 to 1984, after which the rates of rise are significantly less (7Q1) or the levels decline (18Q1). At both wells, the effects of the dry period beginning in 1984 resulted in declining groundwater levels except for a small rise in 1986. After 1986, groundwater levels were stable at well 7Q1 and strongly declining at well 18Q1 until the end of the drought in 1991 when the rising condition was reestablished.

2. Factors Influencing Rising Groundwater

Increased urbanization in the South Bay would have directly increased the recharge of the shallow aquifer in the South Bay by increasing septic-tank discharge and infiltration from landscape irrigation. The rate of increase of this component of recharge should have been approximately proportional to the rate of urbanization. The rate of rise or fall of the shallow groundwater would also be significantly influenced by the rainfall in any year as discussed in the section above.

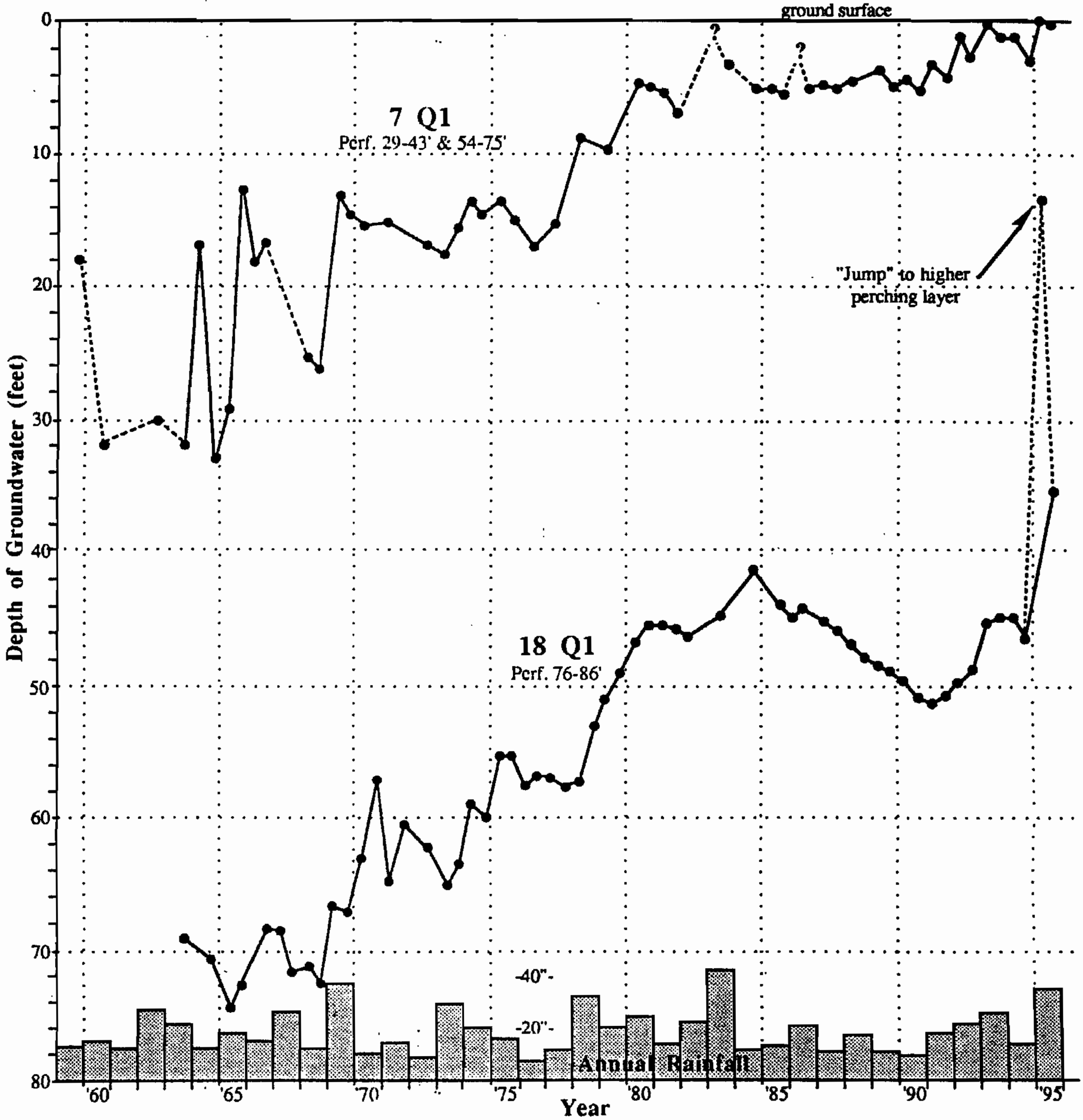

Figure C1-2. Plots of groundwater levels in wells 7Q1 at 8th and El Moro and 18Q1 at the Chevron Station for the period Fall 1959 through Fall 1995. The plot of annual rainfall at Los Osos is provided for comparison of rainfall with changes in groundwater levels.

These three factors affecting variations in groundwater levels are complicated by both rates of outflow and delays in recharge reaching the monitored wells. The rise in groundwater resulting from all sources of recharge is not directly proportional to recharge because, as groundwater rises, the rate of outflow increases due to the increased gradient. Thus, there is a limit to the extent to which increased recharge can produce a rise in groundwater level, and the closer the level is to that limit, the less the effect of yearly variations.

In addition, examination of the year-by-year variations in groundwater levels at the wells shown on Figure B1-2 indicates that there is often a delay in the effects of the recharge actually being recorded at a monitoring well. This delaying affect appears to be the most pronounced at well 18Q1 where there is a perching layer above the interval perforated in this well, but there also appears to be delaying effects at well 7Q1. Thus, a reliable quantitative analysis of well-level variations to extract the relative contributions of rainfall versus septic-tank discharge would require monitoring data from the uppermost portions of the saturated interval. This information is available for the most recently drilled monitoring wells, but most of the documented rise in groundwater occurred Figure C1-2 Well plot before these wells were drilled.

There may also be an additional complicating factor in that the old dune sands are significantly more permeable than the sands in the underlying Paso Robles Formation. Thus, should groundwater rise into these sands, it would drain off much more rapidly than if it were contained within the Paso Robles sands. Thus, there is theoretically a "lid" on the rising groundwater condition in that it probably cannot be maintained for any substantial period of time above the contact of the old dune sands with the Paso Robles Formation. There are strong indications that this condition is affecting shallow groundwater levels in that: 1) the problem areas significantly affected by shallow groundwater are in areas where the Paso Robles Formation is at or very near the surface; and 2), shallow groundwater levels in areas with significant thicknesses of underlying dune sand appear to have "peaked-out" in the early 1980's, and variations since that time have been minimal.

Based on the considerations above, well-level changes have not been used to extract more definitive relationships between groundwater changes due to recharge of septic-tank effluent and that due to variations in rainfall. However, it can be noted that the relatively consistent rise in groundwater in both of the wells shown on Figure C1-2 tends to substantiate that a large part of the effect is due to a constant condition, presumably septic-tank discharge. The effect is the most pronounced at well 7Q1 which is surrounded by high density development. It is less pronounced at well 18Q1 (significant decline during the 1984-1991 dry period) where development up gradient is lower density.

Appendix C2
CLARIFICATION OF WELL LEVEL DATA

1. Other Sources of Water Level Information

Point Source Nitrate Study

Location	Water Depth	Date	Ground Elev.	Water Elev.	1995 Elev.	Comments
1213 13th St.	57	Mar '92	102	45	45	No sig. change in near wells
1336 14th St.	57	Mar '92	105	48	48	No sig. change in near wells
740 Santa Maria	16	Mar '92	20	4	10	Est. from topo relationships
1810 Ferrell	10	Mar '92	57	47	49	Est. from 18L4
1850 Ferrell	10	Mar '92	63	53	55	Est. from 18L4

M&E Broderson Recharge Investigation

Location	Water Depth	Date	Ground Elev.	Water Elev.	1995 Elev.	Comments
M&E Boring #8	158	Nov. '95	185	27	27	No adjustment attempted
M&E Boring #9	42	Nov. '95	50	8	8	No adjustment attempted
M&E Boring #12	59	Nov. '95	70	11	13	Est. from 13L5
M&E Boring #14	21	Nov. '95	50	29	29	No adjustment attempted

2. Reliability of Data from Monitored Wells

During the course of preparation of the shallow groundwater elevation map, it became apparent that water levels in wells in the southeastern part of the community not only reflect the differing hydraulic heads of the upper and lower aquifers, but also differing heads depending on the level within the upper aquifer. The effect is most apparent in the area east of South Bay Boulevard and north of Los Osos Valley Road where the shallowest groundwater elevations are in the range of 30 to 40 feet while the elevations of surfacing groundwater in nearby Willow Creek (a.k.a. Eto Creek) are in the range of 50 to 75 feet. This effect is attributed to perching layers or "downward decreasing head gradients" as use in the USGS analysis.

For this reason, the monitoring data from shallow wells have been ranked as follows:

1. The monitoring wells drilled in 1982 for the Brown & Caldwell study (triangles on Figure II-7) were drilled only a few feet into the first groundwater encountered, and these wells are considered the most reliable measure of the elevation of, and depth to the shallowest groundwater as it may affect flooding conditions.

2. Areas of surfacing groundwater that are persistent (e.g., Willow Creek, the creek in the Oak Preserve) or that occur during and continuing after periods of heavy rainfall (e.g., the El Moro and Paso Robles depressions) are considered the next most reliable as indicating groundwater within approximately 5 feet of the surface.

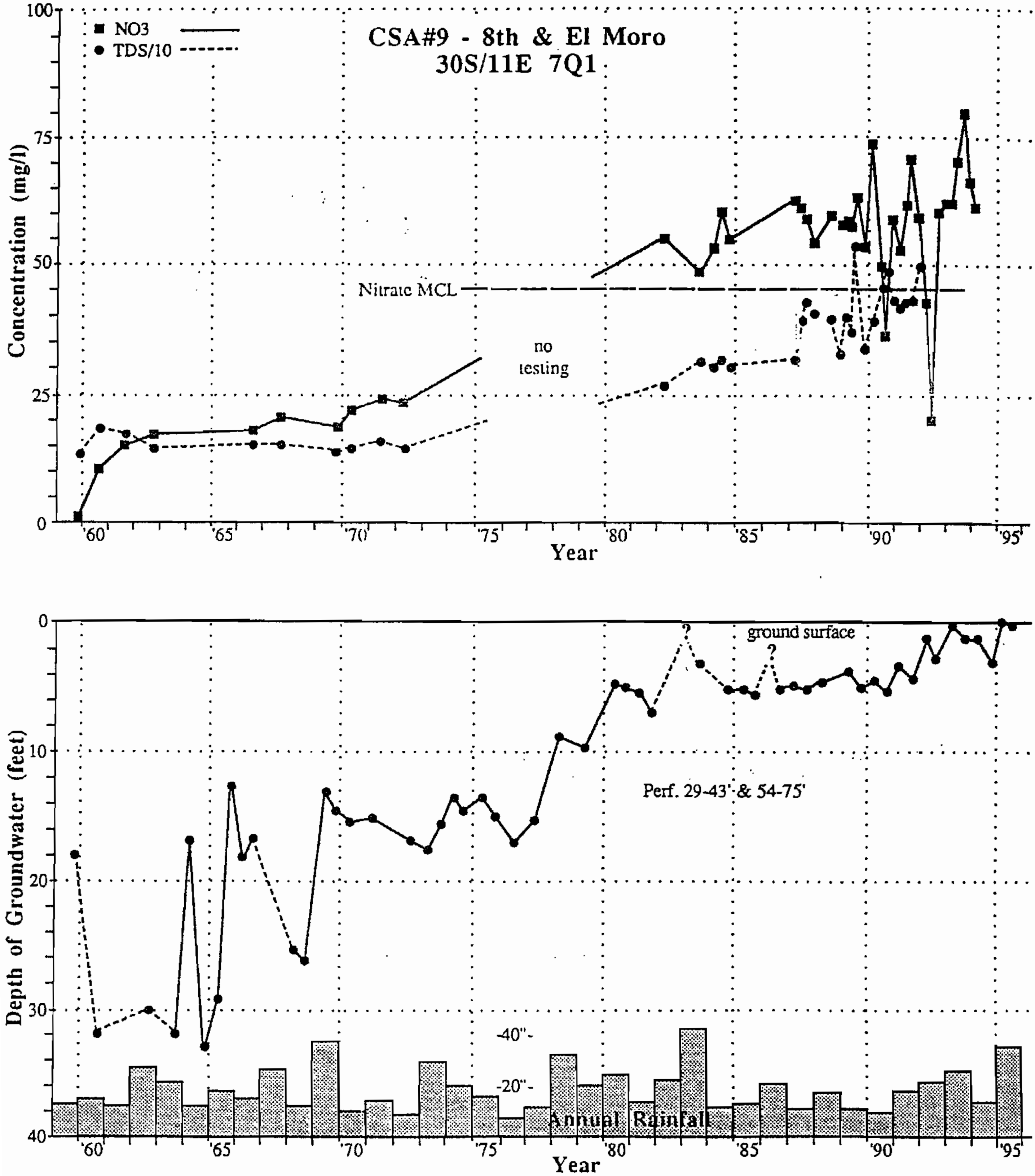

Figure C3-1 Plot of depth of groundwater and annual rainfall (bottom) and concentrations of nitrate (NO3) and total dissolved solids (TDS) at well 30S/11E 7Q1 located at 8th and El Moro.

The more logical interpretation of the shallow soil units was demonstrated by the excavations for the Monarch Grove School, particularly the deep cuts for the large leach field that underlies the playground at the west end of the site. These excavations were examined by the *Morro Group* almost daily after grading ceased in the afternoon. The cuts on the east side of the playground exposed layers of clayey silt inclined to the north approximately parallel to the natural ground surface, and the sand in the bottom of the excavation for the playground included medium to coarse grained units with gravel, including cobbles up to 4 inches in diameter. Thus, the geological unit beneath this site is not old dune sand, but rather the bedded sands and clayey silts of the upper Paso Robles Formation.

The distribution of old sand dunes in the area of the community generally north of Los Osos Valley Road is shown on Figure C3-2. This figure is a portion of an aerial photograph taken by the Soil Conservation Service in June 1949 before development of the area had become significant, but with just enough of a road pattern to provide location. The lighter toned areas are old sand dunes with varying degrees of vegetative cover, while the linear areas of medium gray tone trending west-northwest are inter-dunal depressions underlain by upper Paso Robles Formation. The most obvious example is the area of medium gray tone south of the Junior High School site (i.e., beneath the track and soccer field) and extending westerly to approximately 14th Street between El Moro and Paso Robles Avenues. While these interdunal depressions are small in comparison to the areas of old sand dunes, it is these depressions that are now the locations of most of the drainage problems involving surfacing groundwater.

b. Upper Paso Robles Formation

The upper Paso Robles Formation is present beneath the old sand dunes and it is at or near the surface in the depressions between the sand dunes. This unit is composed primarily of sand, but it also includes beds of clayey silt, clayey fine sand and some clay between the beds of sand. These relationships are illustrated by the annotated electric log (E-log) of the CSA 9A deep well at 8th and El Moro shown on Figure C3-3. This well was drilled in early 1986 to replace the shallow well at this location because of the increasing nitrate contamination of the shallow aquifer. The properties of the saturated soils/rocks measured by the E-log are explained at the bottom of the figure. Significant points to note include:

1. The upper 125 feet of this well penetrated the upper aquifer (upper Paso Robles Fm.). This unit is composed primarily of sands, but with one clayey zone and probably several silty zones with moderately reduced permeability. This zone is distinct in that the consistently high resistivity of the sand zones indicates consistently fresher water in these sands as compared to that of the sands below the thick clay zone (AT-2 on Figure C3-3).

2. The upper aquifer is underlain by a 100-foot zone composed predominately of clay. This clay zone blocks the downward movement of infiltrating water, so that it has no place to go except move laterally in the shallow sands or rise to the surface as shown on Figure C3-1.

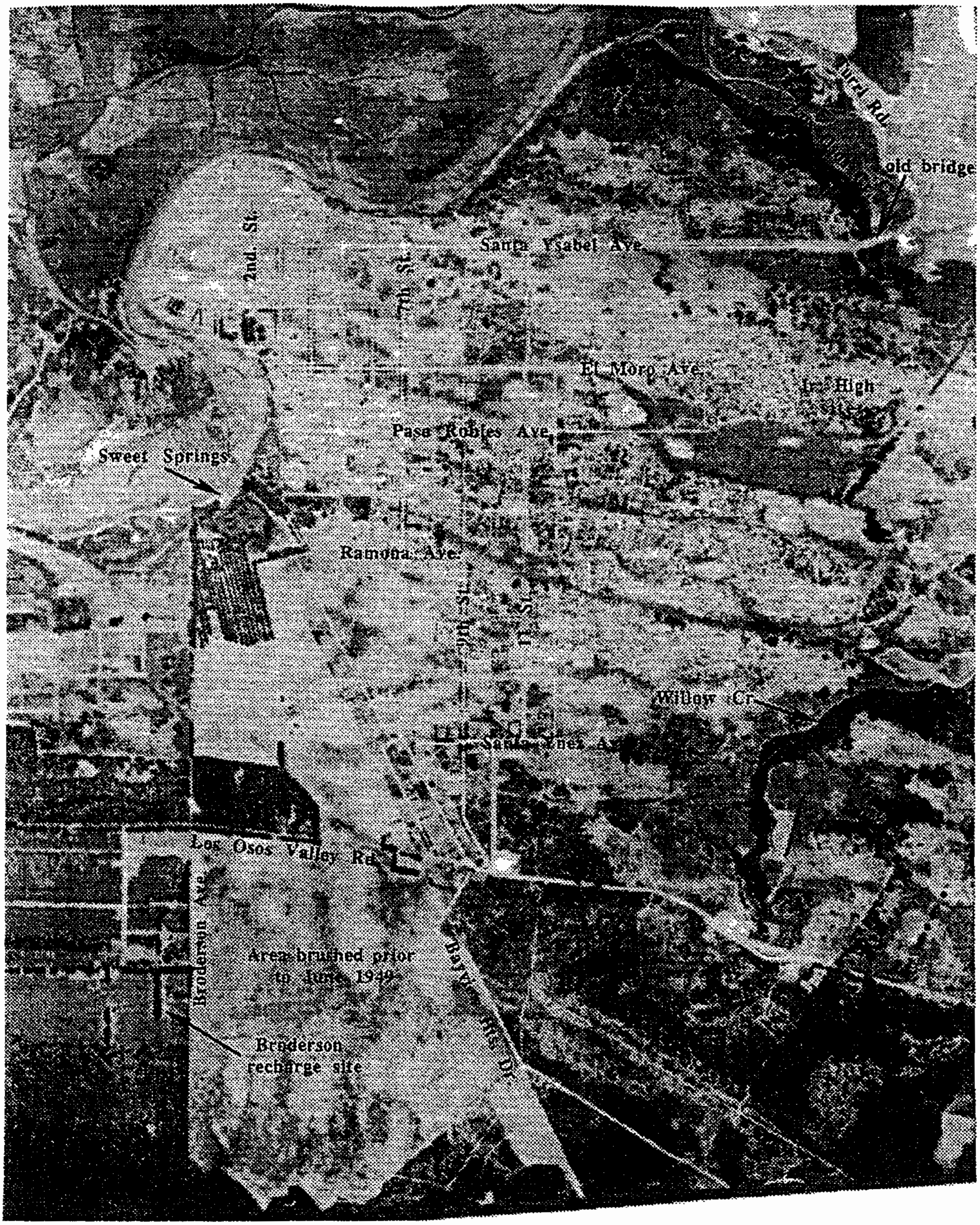

Figure C3-2 Aerial photograph of the central and easterly parts of Los Osos/Baywood Park taken in 1949. The light areas are old sand dunes with varying degrees of vegetative cover, and the linear areas of medium grey tone are interdunal depressions underlain by Paso Robles Formation. The photograph was taken June 4, 1949 at near zero tide. Scale: 1"=1,500'.

2. Geologic Structure and Faulting

a. Structure of the Los Osos Groundwater Basin

The Los Osos groundwater basin is shaped in the form of an asymmetric trough that is inclined toward the west (plunging syncline). Bedding on the south flank of the basin is inclined toward the north at about 10° (20%), and that on the north flank is inclined toward the southwest at about 1.5° to 2° (3-4%). The axis (i.e., bottom) of the basin is approximately parallel to and just north of Los Osos Valley Road (Figure C3-4). The basin is bounded on the south by the Los Osos fault (Strand A), and on the northeast by the eroded edge of the water-bearing Paso Robles Formation.

b. Los Osos Fault

Since completion of the studies of the groundwater basin by the USGS (Yates & Wiese, 1988) and the Department of Water Resources (DWR, 1989), evidence has mounted that the groundwater basin is cut by a strand of the Los Osos fault that extends from near the west end of Calle Cordoniz northwesterly generally along Bayview Heights Drive and Bush Street to Sweet Springs at the edge of Morro Bay. This fault is informally designated "Strand B" to distinguish it from the main strand of the Los Osos fault which trends east-west along the northerly fringe of the Irish Hills (Figure C3-4). Near the library, groundwater levels are approximately 40 feet higher on the northeast side of the fault than on the southwest side (Figure C3-5). To the southeast, the separation of groundwater levels across the fault appears to increase to about 100 feet.

The Strand B fault separates areas of very different groundwater conditions. Areas having shallow or surfacing groundwater are confined to the area northeast of Strand B. To the southwest of the fault, groundwater levels have fluctuated moderately with varying climatic conditions. However, they have not risen near-continuously as they have in some areas to the northeast of Strand B, and drainage problems to the southwest of the fault are limited to the low-lying areas near the Bay.

The potential for using ground-penetrating radar (GPR) to further define the location of the Los Osos fault has been recently investigated on an experimental basis by Gary Mann and Don Asquith. One line was run across Strand B in an open area just south of Ramona Avenue which clearly defined an anomaly at a point along the line only about 10 feet west of the location of the fault more generally located from the groundwater data. The GPR records and the geologic interpretation of these records are shown on Figure C3-6. It is clear from this experimental data that there is good potential for further delineating this fault using this method. Confirming the details of the interpretation of the GPR data would require trenching to expose the fault relationships.

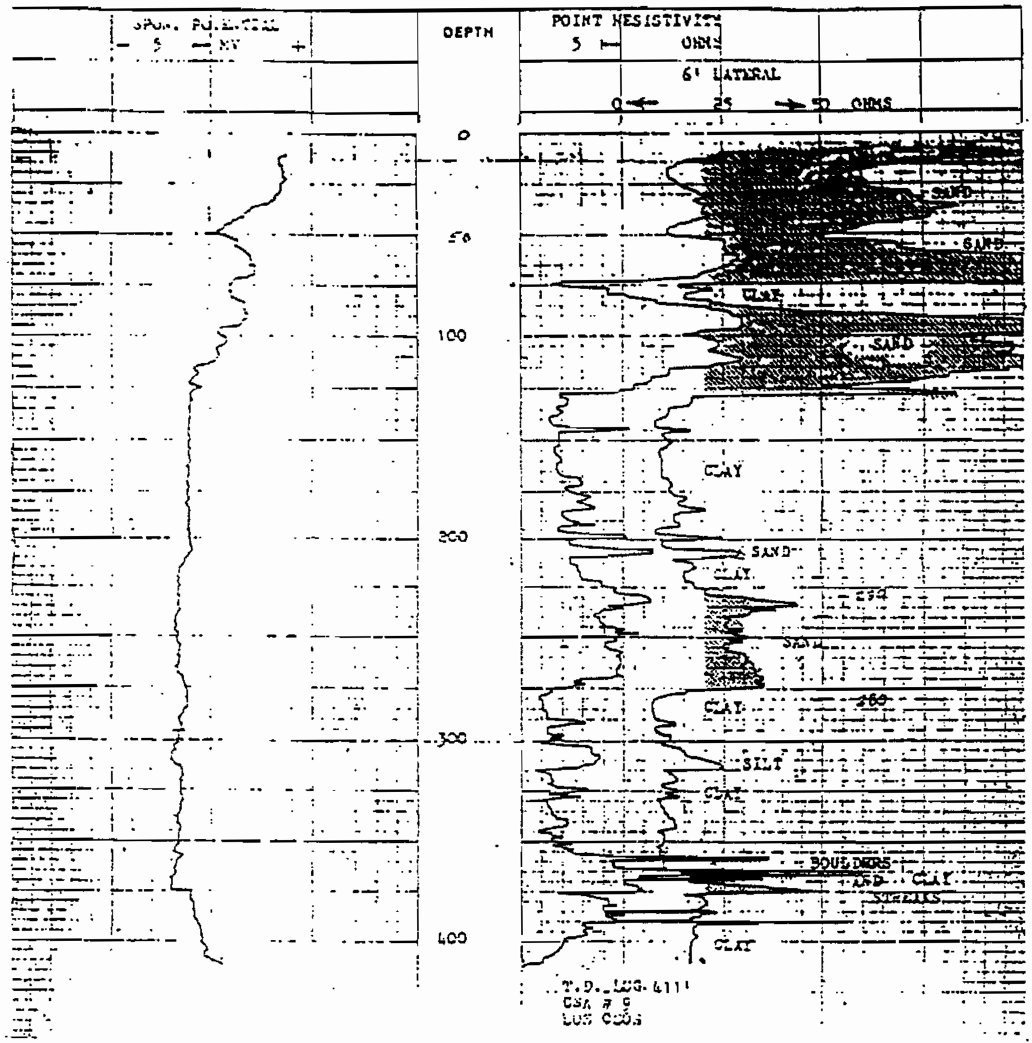

Figure C3-3 Electric log (E-log) of CSA#9 deep well at 8th and El Moro (30S/11E 7Q3). The shallow sand section (upper aquifer) is shown in the interval from the surface to a depth of 125 feet. The shallow sands are separated from the deeper sand (lower aquifer) now being produced by the clay zone (aquitard AT-2) between 125 and 225 feet. The much higher resistivity of the shallow sands indicates that they contain less mineralized water. The interpretation of sand, silt and clay zones is by the logging technician.

Technical Explanation of Log

The two curves on the right are the point resistivity (shallow penetration) and 6' lateral (deeper penetration). Since the rock material is essentially non-conductive, the log measures the resistivity of the fluid in the rock and the continuity of the fluid (i.e., the degree to which the fluid is continuous and, therefore, capable of conducting an electric current).

The curve on the left is the self-potential (SP) or "battery-effect" between the drilling mud and the fluid in the rocks. Normally, a deflection to the left indicates sand. However, in this case, the fluid in the upper aquifer is fresher (less mineralized) than the drilling fluid, and the SP is "reversed" (right deflection indicates fresh-water sand).

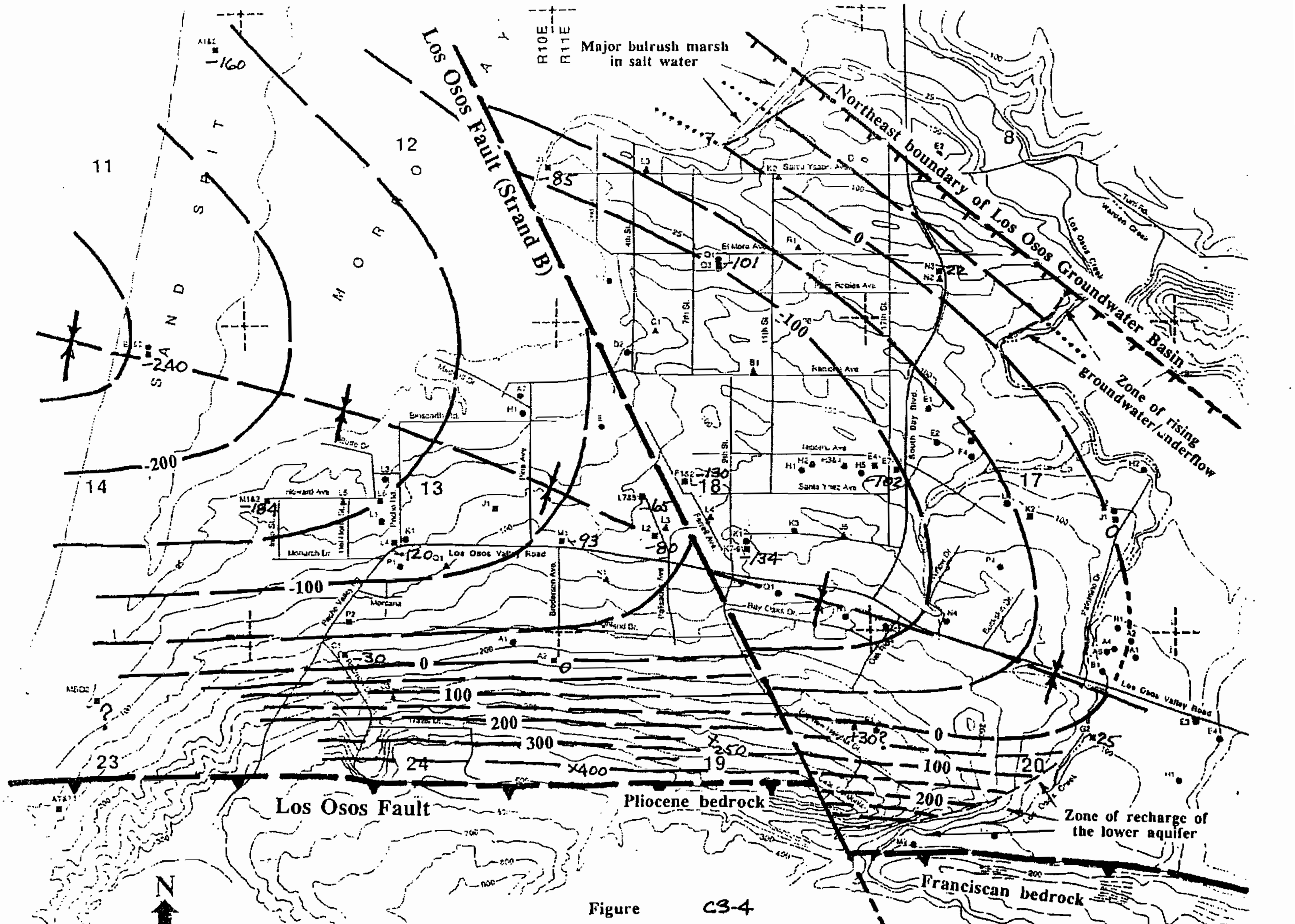

Figure C3-4

STRUCTURE WITHIN THE SHALLOW AQUIFER
(Elevation top of AT-2)

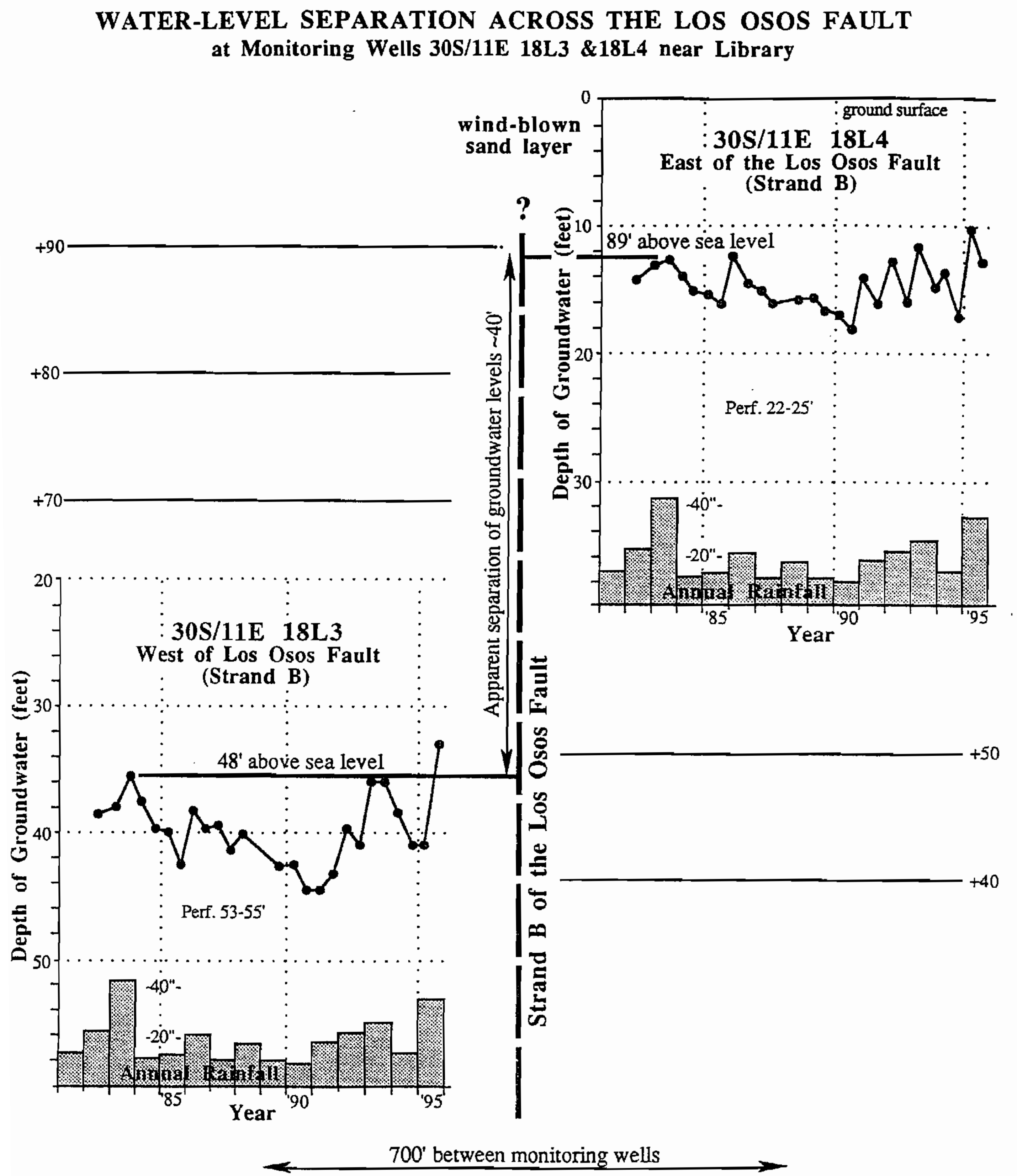

Figure C3-5 Plot of water-level separation across Strand B of the Los Osos fault between monitoring well 30S/11E 18L3 on Ferrell St. and and 18L4 near the library.

3. Elevation of Shallow Groundwater

a. Data Sources

Figure C3-6, Elevation of Shallow Groundwater, Spring 1995, has been constructed based on County monitored wells completed in the shallow zone, locations of surfacing groundwater, and other sources such as the test sites for the point-source nitrate study (B&V Waste Science, 1993, Table 3) and the monitoring wells drilled by Metcalf & Eddy (1996, Appendix B) for the study of the Broderson recharge site. The water-surface elevations from wells are based on Spring 1995, unless the Fall 1995 elevation was higher. Adjustments to well levels taken at other times and the reliability's of water levels in wells are summarized in Appendix A2. Areas of surfacing groundwater utilized in preparing Figure II-7 include Willow Creek (a.k.a. Eto Creek), Los Osos Creek east of the Los Osos Middle School, and the problem areas in the El Moro, Paso Robles and Ramona depressions.

b. Areas of Differing Groundwater Conditions

The South Bay can be divided into three areas having substantially different groundwater conditions. The area west of Strand B of the Los Osos fault is characterized by relatively low groundwater elevations and groundwater gradients. The primary features in this area are a groundwater "high" in the area of concentrated surface recharge west of the library, and a modest "low" in the area of pumping of shallow groundwater west of Pecho Valley Road. Otherwise, groundwater elevations increase toward the Los Osos fault, suggesting significant flow through or over the top of the fault.

East of the Los Osos fault, groundwater elevations are generally higher and the gradients are steeper. The most prominent groundwater feature in this area is the "high" centered near the intersection of 13th Street and Ramona Avenue. The presence of this "high" is controlled in large part by the presence of surfacing groundwater in the Ramona and Paso Robles depressions.

In the area east of the Los Osos fault and generally southeast of Los Olivos Avenue, these steeper gradients are complicated by a sequence of clayey layers in the upper aquifer that "perch" the shallowest groundwater at successively higher elevations toward the south. Groundwater conditions in this area are very complex, and well control is limited. Since no problems areas have been identified in the area south of Los Osos Valley Road, shallow groundwater contours have not been extended into the southerly part of this complex area.

4. Depth to Shallow Groundwater

a. Map Preparation

Figure II-8 shows the Depth to Shallow Groundwater, Spring 1995, based on the difference between the elevation of shallow groundwater (Figure C3-6) and surface elevations. The surface elevations are based on the most recent topography prepared for the sewer project (1-foot contour interval), supplemented by the topography (5-foot contour interval) prepared for the Phase Two - Basis of Design Report (Engineering-Science, 1997) in areas not contoured at the more detailed scale. Differences of up to 5 feet between the two sets of topographic data have been adjusted by paralleling the older topography between the presumably more accurate elevations from the more recent survey.

b. Areas of Differing Depths to Groundwater

Areas having significantly different depths to groundwater follow generally the separation of groundwater conditions across the Los Osos fault. Except for the shallow groundwater at the fringe of the Bay, all of the areas having drainage problems controlled primarily by shallow groundwater are east of the fault, as are the areas of consistently surfacing groundwater along Willow Creek and the unnamed creek in the Los Osos Oak Preserve. In this area, depths to groundwater are primarily in the range of 5 to 40 feet with areas of deeper groundwater being limited primarily to narrow zones along the crests of the larger sand dunes.

West of the Los Osos fault, groundwater is consistently deeper over relatively large areas.

C. EFFECTS OF URBAN DEVELOPMENT

The rising groundwater conditions in the area of the community northeast of Strand B of the Los Osos fault is probably the result of changes in recharge and pumping as a result of urban development. The period from about 1963 through 1983, during which much of the rise occurred, was very wet in comparison to other wet and dry cycles in the 126-year rainfall history of the county. However, the reduced rainfall during the dry period from 1984 through 1990 did not result in comparable declines in water levels, and the problem must be attributed to a condition other than climate.

1. Septic Tank Discharge

At the present time, most of the water used for domestic purposes in the community is pumped from the lower aquifer. Of this pumpage, approximately 65% is used within the home, and essentially all of that is discharged to the upper aquifer from septic tanks. Based on the analysis by the USGS (Yates & Wiese, 1988), the volume of return water from this source for average conditions and 1986 development levels is 1,550 acre-feet per year. Depending on location within the basin, most of this discharge remains within the upper aquifer, and little, if any, returns to the lower aquifer from which is was pumped. (See discussion of Upper Paso Robles Formation above.)

In the early stages of development of the area, most of the domestic water was pumped from the shallow aquifer. However, as nitrate concentrations in the shallow wells increased, it became necessary to drill to the deeper, uncontaminated aquifers to maintain acceptable quality. With implementation of the sewer project, it is expected that nitrate levels will decline, and the shallow groundwater can again be used for domestic purposes. This would substantially reduce or eliminate this component of the shallow groundwater problem as well as reducing the nitrate concentrations that now make widespread use of this water uneconomic.

2. Recharge of Urban Runoff

In most urban areas, increased runoff from the increased impervious surfaces, such as roofs, driveways and roads, is collected and disposed of by various types of flood control facilities. In the South Bay, however, flood control facilities are limited because: 1) major sections of the community were developed before such facilities were required; and 2), there was not an apparent need for such facilities in the early stages of urbanization because the high infiltration rates of the very sandy soils tended to naturally dispose of the increased runoff. However, as urbanization increased, the capabilities of the underlying soil to naturally dispose of increased urban runoff became saturated, particularly during wet years, and areas with flooding problems have progressively expanded.

3. Combined Effects of Urban Recharge
Recharge of the groundwater basin for various conditions of development were studied by the USGS (Yates & Wiese, 1988) as a part of the development of the computer-model of the basin, and this information has been examined in Appendix B1 to extract the components of recharge that will continue with implementation of the sewer project and those that will change. The conclusions of this analysis are as follows:

1. On a basin-wide basis, recharge of the shallow groundwater body tends to be dominated by recharge of rainfall which is approximately 75% of recharge in wet years when flooding would be a significant problem, decreasing to about 40% in normal rainfall years, and 30% in dry years.

2. In the high density residential areas where flooding has been exacerbated by shallow groundwater conditions, septic-tank discharge tends to be the dominant component of recharge, ranging from about 80% of recharge in normal years down to about 65% in moderately wet years. Even in very wet years such as 1995, recharge from septic-tank discharge probably would have exceeded recharge from rainfall in the high density residential areas.

In addition, long-term well histories that may provide additional insight into this question were examined, and it was concluded that there are so many variables involved, that individual well histories cannot be relied on at this time to substantially improve on the relative contributions of the various components of urban recharge as developed by the USGS in 1987. However, it can be noted that the relatively consistent rise in groundwater in both of the wells used for this analysis tends to substantiate that a large part of the effect is due to a constant condition, presumably septic-tank discharge. The effect is the most pronounced at the well at 8th and El Moro which is surrounded by high density development. It is less pronounced at the well on Los Osos Valley Road where development up gradient is lower density. These effects may be further clarified by re-examination of the groundwater model in a study now in progress by the water purveyors in the community.

D. DISPOSAL VERSUS CONSERVATION OF RUNOFF
A major concern of the community is that runoff be recharged to the shallow groundwater aquifer to the maximum extent feasible to minimize the need for imported water. The feasibility of increasing recharge of runoff as a part of any flooding solution will depend on location and climatic condition. That is, it is obvious from the existing distribution of shallow groundwater conditions (Figure C3-7) that increasing recharge in the area northeast of the Los Osos fault would be highly problematic unless removing septic-tank discharge results in a very substantial lowering of the groundwater "high" in this area. And, even if significant lowering does occur in this area under normal conditions of rainfall, it may be necessary to have facilities in place to dispose of excess runoff during very wet years and wet climatic cycles such as occurred between 1978 and 1983.

On the other hand, most of the area southwest of the Los Osos fault has relatively deep groundwater conditions, and it should be feasible to store excess runoff in this area except perhaps in very wet years, and provided it is extracted for beneficial use before it reaches the areas of shallow groundwater at the fringe of the bay. This area is also proposed for recharge, storage and extraction of treated wastewater from all of the community because it is the only area suitable for this purpose. Therefore, any increased recharge of runoff in this area would have to be operated in close coordination with the recharge of wastewater from the Broderson site.

E. BAY DISCHARGE AND WATER QUALITY

A potential solution to the drainage problems in some of the areas is the pumping of accumulated runoff and surfacing groundwater to the bay. A system of this type has been in place in the El Moro depression since 1983, and a similar system was installed in the Paso Robles depression in 1995. The El Moro system pumps at 8th and El Moro and discharges from a pipe in the bay off of the west end of El Moro Avenue. The Paso Robles system pumps at 16th and Paso Robles Avenue and discharges to the surface drainage system east of 18th Street. From this point, the pumpage flows to Los Osos Creek and to the bay.

A significant environmental concern in the operation of these systems is the quality of the water discharged to the bay, be it directly or via Los Osos Creek. It has been assumed that, because these waters include rising groundwater, they include some component of septic-tank effluent. The septic tank effluent includes, at a minimum, nutrients such as nitrate, and in areas where the septic-tank leach fields have been "flooded-out", it may also contain pathogens.

1. Nutrient Discharge

Nutrient discharges are occurring naturally at the known freshwater springs and marshes along the southerly edge of Morro Bay. Testing conducted in 1994 for the County Engineering Department yielded the following nutrient concentrations:

	Nutrient Concentration (mg/l)	
Location	as N	as NO3
Sweet Springs, at the spring	15.6	68.6
Small stream near north end of 7th St.	15.4	67.8
Marsh near north end of 11th St.	12.3	54.1

These values are about 150% of the maximum contaminant level (MCL) for nitrate in drinking water, and they are in the same range as the average concentrations of nitrates in the shallow groundwater in the community. While there is now no specific evidence to indicate that these nutrients are having a detrimental effect on the Bay (Morro Group/Tenera, 1990), the quality of these waters will be a significant consideration in the evaluation of the environmental impacts of problem solutions involving discharge to the bay.

2. Pathogen Discharge

Of greater concern is the concentration of potential pathogens in discharges to the bay. The Regional Water Quality Control Board (RWQCB) began testing for coliform bacteria in bay waters in 1996, including locations along the fringe of the South Bay. Based on this short period of testing, total coliform was as high as 5,000 MPN/100 ml and fecal coliform was as high as 1,700 MPN/100 ml on March 18, 1996 near the discharge pipe from the pumping from the El Moro corridor (data from Katie Kropp, RWQCB). The higher coliform concentrations tend to be associated with samples that are less diluted by seawater as indicated by lower electrical conductivity.

Samples taken in Cuesta by-the-Sea inlet recorded as high as 700 MPN/100 ml total coliform and 500 MPN/100 ml fecal coliform on this same date. These samples had conductivities indicating about 12% freshwater components, while the higher concentrations in the sample noted above from near the discharge pipe had a conductivity indicating a 70% freshwater component. The preliminary implications of these data are that septic-tank discharge in areas of shallow groundwater in the urbanized areas of the South Bay are contaminating freshwater flows to the bay fringe. And, where shallow groundwater surfaces and becomes a significant part of the urban runoff, this surface runoff would also contribute to contamination of the bay.

The State Department of Health Services (DHS) routinely monitors coliform contamination in bay waters as they may affect aquiculture in the bay. In the past, coliform concentrations have sometimes exceeded acceptable limits during periods of heavy runoff, and it has been necessary to temporarily shut down shellfish harvesting until the levels declined to below acceptable limits. However, it has been reported in recent meetings of the Urban Discharge Issue Group of the Morro Bay National Estuary Program (Mark Jeude, Preharvest Shellfish Sanitation Unit, Department of Health Services) that background levels of coliform have been increasing, and that it may soon be necessary to shut down shellfish harvesting for prolonged periods of time.

Based on data available at this time, the natural discharge of shallow groundwater at the bay fringe, and waters having significant components of groundwater that are pumped to the bay, are having an adverse effect on bay water quality, particularly as it affects aquiculture. Therefore, it is anticipated that solutions to flooding problems that involve increased discharge of surfacing groundwater directly to the bay may not be acceptable from an environmental standpoint, and alternative solutions may be required.

F. REFERENCES

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Appendix C4

ENVIRONMENTAL CONSIDERATIONS OF SELECTED ALTERNATIVES

A. SOLUTIONS INVOLVING DISCHARGE OF EXCESS GROUNDWATER TO MORRO BAY OR LOS OSOS CREEK (Category 1 Problem Areas)

Some potential solutions to flooding problems in areas affected by surfacing groundwater involve the disposal of this excess water by disposal to Morro Bay or to Los Osos Creek, a major tributary of the bay. The quality of this potential discharge is a significant concern because the shallow groundwater includes varying concentrations of septic-tank effluent, and evidence is increasing that the natural flow of this groundwater to the bay is having a detrimental effect on its water quality. While implementation of the Los Osos sewer project will eventually eliminate this effluent from the shallow groundwater, potential short-term solutions must take into account the quality of the shallow groundwater as it now exists.

It should be noted that the scope of this investigation has not included additional testing of groundwater or surface water quality, and the evaluation of potential impacts of the discharge of these waters to the bay or the creek is based on existing information. Should additional testing or further investigations of local areas be required to refine the impacts, these would be the subject of further environmental review as may be required for an identified solution.

1. Existing Conditions

A. Discharge of Shallow Groundwater to Morro Bay

1) Natural Discharge

a. Springs and Seeps
Existing discharges of shallow groundwater to Morro Bay were investigated as a part of the study of *Freshwater Influences on Morro Bay* by the Morro Group/Tenera (1990). This study identified numerous marshes and a few discrete springs (e.g., Sweet Springs) along the fringe of the back bay in Los Osos, Baywood Park and Cuesta-by-the-Sea, and also in Shark Inlet and on the sand spit. The distribution of these marshes and springs indicates that the source of the fresh water is the shallow aquifer of the Los Osos groundwater basin.

In addition to the known and observable discharges of shallow groundwater to the bay, there are various reports of springs and surfacing freshwater within the bay itself as discussed by the Morro Group/Tenera (1990, p. IV-19 to IV-26). While the reports of these springs are somewhat conjectural, the geologic conditions in the bay (e.g., the long-term stability of back bay channels) and the hydrologic conditions in the shallow aquifer almost require that they be there. These unseen discharges may substantially exceed the observable and measurable discharges.

b. Hydrogeologic Constraints on Groundwater Flow
The hydrogeologic constraints on groundwater flow in the upper (shallow) aquifer of the Los Osos groundwater basin are shown on Figure C4-1. This cross section extends from Los Osos Creek east of the Middle School, west-northwesterly through the Paso Robles depression, the El Moro depression, Baywood Point, and across the back bay to the sand spit. As shown on the section, the shallow groundwater is constrained from moving downward by the "confining beds" that Figure H-1 Hydrogeologic cross section separate the upper and lower aquifers. Since these confining beds are folded in the shape of a broad trough (Figure II-5), the only

direction that the groundwater can flow is westerly to northwesterly as shown by the arrows on the section.

To the west, there are two impediments to groundwater flow: the Los Osos fault (Strand B); and the saltwater wedge beneath the sand spit. The Los Osos fault is known to be a significant barrier to groundwater flow along its landward extent (Figures II-6 and II-7), and it is probably also a barrier beneath the back bay near Baywood Point. However, even if this fault is not a significant barrier to flow, the saltwater wedge beneath the sand spit would block any flow of freshwater that may get through the fault barrier. The presence of this wedge is documented by measurements in Sand Spit monitoring well #1 [well 11A1 (shallow) & 11A2 (deep)] which show salinities of 30 parts per thousand (ppt) in the upper aquifer (i.e., saltwater), and "relatively fresh" water in the upper part of the lower aquifer at 6 ppt (Yates and Wiese, 1988, Table 4, p. 30).

On the other hand, there are freshwater marshes on the sand spit along the margin of the bay, and there is a cluster of fresh water springs in a depression on the sand spit just south of the line of section of Figure H-1. These relationships are consistent with there being a saltwater wedge under the sand spit beginning at the shoreline on the ocean side, and inclined landward at a slope of about 40:1 as shown on Figure C4-1.

With this configuration, the accumulated groundwater (infiltrated rainfall and septic-tank discharge) flows westerly off the groundwater "high" (see Figure II-7) toward Strand B of the Los Osos fault which is known to be a significant barrier to groundwater flow along its landward extent. The most likely areas of groundwater surfacing in the bay would be south of Baywood Point between the fault and the 3rd Street marsh, and north of Baywood Point to the east of the main tidal channel. Any groundwater flow that manages to bypass the fault barrier would be forced upward and into the bay by the more dense saltwater wedge as shown by the arrows on Figure C4-1.

These relationships also apply to the groundwater flow on the west side of Strand B of the Los Osos fault. With a saltwater wedge beneath the Sand Spit, and the confining layer separating the upper and lower aquifers, all of the outflow from the shallow aquifer west of the Los Osos fault is constrained to rise within the bay. The only way it can "escape" is if the saltwater-freshwater interface is lower in Monitoring well #1 which would allow the flow of freshwater beneath the sand spit to the ocean. This cannot be disproved because the perforated intervals in the sand spit monitoring wells are in the lower part of the upper aquifer, and the E-logs of these wells do not extend to the surface. However, given the ready availability of the more dense seawater through the porous sands of the ocean shoreline, it is likely that the saltwater wedge begins at the westerly edge of the sand spit as shown on Figure C4-1.

c. Quality of Shallow Groundwater

The shallow groundwater in the South Bay is known to carry relatively large quantities of nutrients, and the concentrations of nitrate routinely measured in the shallow aquifer are in the range of 60 to 70 mg/l, or about 150% of the maximum contaminant level (MCL) for safe drinking water. In addition, during periods of prolonged rainfall, groundwater levels rise to the surface in some of the problem areas which "floods-out" the septic-tank leach fields and even the septic tanks themselves. This results in the direct discharge of unoxidized effluent to the shallow groundwater, and possibly also undigested fecal material from the septic tank. It should be emphasized that this process occurs whether the septic-tank system is otherwise in proper working order or not. Once the leach field becomes inundated by groundwater, it cannot function properly.

More recently, the County has tested some of the springs at the edge of the bay for nitrate and total dissolved solids, and the RWQCB has conducted testing of the bay water for both nitrate and coliform bacteria. This testing suggests that South Bay septic discharge is reaching the bay in relatively large amounts from both natural springs and seepage, and from pumpage from the areas of flooding along El Moro Avenue. (See also Section C3, Bay Discharge and Water Quality.)

2) Pumping to the Bay

The County now pumps accumulated runoff to the bay from the areas of flooding along El Moro Avenue. While the intent of this action is to pump surface water, it is clear that the waters at the surface of the ground also include rising groundwater, and that pumping some groundwater to the bay by this mechanism is unavoidable if the flooding in these areas is to be alleviated. It is also clear from the distribution of high coliform levels, both as to location and time, that the pumped water is only one source of the contamination, and that the natural flow of shallow groundwater to the bay is probably the much larger source.

a. Discharge of Shallow Groundwater to Los Osos Creek

Very little is known about the quality of the waters in lower Los Osos Creek. Testing was conducted by the County in late 1983 and 1984 of waters from Los Osos Creek at the horse ranch, at the Los Osos Valley Road bridge and near Eto Lake, and from Eto Creek at Nipomo Avenue, and from Eto Lake (Morro Group, 1987, Volume II, Appendix C-4, Surface Water Quality Data). None of these tests indicated unusually high concentrations of nitrate, and no testing for bacteria was conducted.

While there are no reliable data, it may be presumed from groundwater gradients, and conditions in the creek and its tributaries, that significant amounts of groundwater drain to Los Osos Creek. First, both Eto Creek and the creek in the Los Osos Oak Preserve are fed by surfacing groundwater. Second, the gradients on the east flank of the major groundwater "high" east of the Los Osos fault (see Figure II-7) are toward Los Osos Creek, with the closest point of the creek being near the east end of Pismo Avenue along the south side of the soccer field at the Middle School. Third, as Los Osos Creek begins to go dry below the Los Osos Valley Road bridge in the late spring or early summer, the underflow surfaces beginning at the east end of Pismo Avenue extended, and increases downstream into the wetland. Based on a comparison of 1949 aerial photographs (essentially pre-development) with existing conditions, the wetlands east of the Middle School have expanded several fold during this period (Figures C4-2 and C4-3).

The conditions described above suggest that relatively large amounts of groundwater are flowing to Los Osos Creek from developed areas to the west. Based on structure of the confining layer (Figure II-5), the flows from upstream of approximately Pismo Avenue extended are probably from the upper aquifer, while those from downstream are from the lower aquifer. Since the surface flow increases rapidly downstream of Pismo Avenue, most of the water flowing into the wetlands during the dry season is probably from the lower, uncontaminated aquifer. However, some flow from the contaminated upper aquifer is probably present, and moderately elevated nitrate and pathogen levels should be expected. However, the levels should be substantially lower than those in the shallow groundwater flowing directly to the bay as discussed in the section above.

b. <u>Biological Considerations associated with discharge to Bay or Los Osos Creek</u>

Nutrient enrichment has been identified as one of the primary problems confronting the nation's estuaries based on the *Morro Bay Nutrient Study Discussion Paper* , by the Morro Bay National Estuary Program (MBNEP), (1997). Impacts of nutrient enrichment include increased algal growth, decreased water clarity, and reduced dissolved oxygen levels. Fish kills and loss of estuary vegetation, such as, sea grass beds are common consequences of increased nutrient levels. In addition, high levels of bacteria can have adverse effects on vegetation and wildlife species utilizing estuaries.

Currently, high levels of nutrients and bacteria are being documented entering Morro Bay through its tributary creeks, natural seepage of shallow groundwater containing concentrations of septic-tank effluent, and from surface and groundwater discharge facilities. According to the MBNEP, the bay currently shows some indications of eutrophication, including large quantities of algae, such as, *Ulva* and *Enteromorpha* visible in the back bay, which are opportunistic in nutrient rich environments. Rapidly increasing coverage of intertidal mudflats with algae and temporary closures to commercial oyster harvest are indications of the increased levels of nitrates and bacteria in the bay. However, majority of the bay completely flushes during tidal changes and the overall impacts of nutrients and bacteria on the health of the estuary are uncertain. There is a need for further examination of the current impacts of nutrients and bacteria on the estuary, and an overall assessment of probable impacts associated with future projects. The MBNEP is planning to begin extensive studies on these issues in the near future.

Pumping of surfacing groundwater directly to the bay has potential to significantly impact existing biological resources due to the varying concentrations of septic-tank effluent being focused in a specific area of the estuary during periods of flooding. This alternative is not expected to significantly increase the overall levels of contamination of the bay, only focus the contamination in moderate quantities during short periods of time. The magnitude of impacts to biological resources as a result of short term pumping of surface water is uncertain until the overall impacts of nutrients and bacteria discharging naturally to the estuary are studied in further detail. There are many variables involved with this alternative as a project, requiring a detailed study and further evaluation of potential impacts to biological resources.

Expanded duration of pumping of both surface water and groundwater to the bay has potential to significantly impact existing biological resources of the estuary. This alternative would significantly increase the concentration of contaminants being discharged to the bay over a expanded period of time. The magnitude of impacts to biological resources as a result of expanded duration of pumping groundwater is uncertain until the overall impacts of nutrients and bacteria discharging naturally to the estuary are studied in further detail. As discussed above, there are many variables involved with this alternative as a project, requiring a detailed study and further evaluation of potential impacts to biological resources.

Discharging of surfacing groundwater directly to lower Los Osos Creek has potential to substantially reduce nutrient levels and pathogen content by allowing the groundwater to be filtered by the riparian and wetland vegetation before it reaches the bay. There is evidence and documentation that wetland vegetation is capable of reducing nitrate levels in wastewater discharge. However, dependent upon the amount of contaminants present and known capability of lower Los Osos Creek to filter contaminants of the discharged groundwater, this alternative has potential to significantly impact the riparian and wetland habitat of that area, (e.g., increase in vegetative growth of both native and non-native species, adverse impacts to rare, threatened, and/or endangered species). There are many variables involved with this alternative as a project, requiring a detailed study and further evaluation of potential impacts to biological resources in order to ensure that adequate mitigation measures are implemented. The balance of potential beneficial impacts to the bay and potential significant adverse impacts to lower Los Osos creek would have to be evaluated in further studies containing input from all responsible and regulating agencies.

c. Archaeological Implications
Archaeological resources are defined as any prehistoric site, object, or structure recognized by a community, ethnic group, or social group as having potential scientific, traditional, religious, or other value. Archaeological resources are remains associated with previous human activity, either prehistoric or historic.

The individual problem areas and solutions for the project are located within the territory historically occupied by the Chumash Indians. There are numerous significant Chumash archaeological sites located throughout the Los Osos area and in the vicinity of the problem area solutions. The significant amount of cultural resources found in Los Osos indicates it once had a major concentration of Chumash Indian activity. Problem area solutions which involve minor or heavy construction activities have the potential to significantly impact archaeological resources, regardless of the location or size of the project site. County requires archaeological surveys to be performed by qualified archaeologists prior to any ground disturbing activities as standard mitigation. In addition, the termination of all construction activities is required in the event that archaeological resources are discovered on site during the construction process of any project.

d. Social Considerations
The proposed problem areas solutions have the potential to impact the public services of the Los Osos area due to short term construction impacts. These services include the local school district, fire department, police department, and numerous other utility and service providers in the area. Each proposed solution may involve minor or heavy construction activities on problem area roadways causing temporary roadway closure or traffic diversions via alternate routes. Majority of these impacts will be considered less than significant, and of short duration with the requirement of some standard mitigation measures.

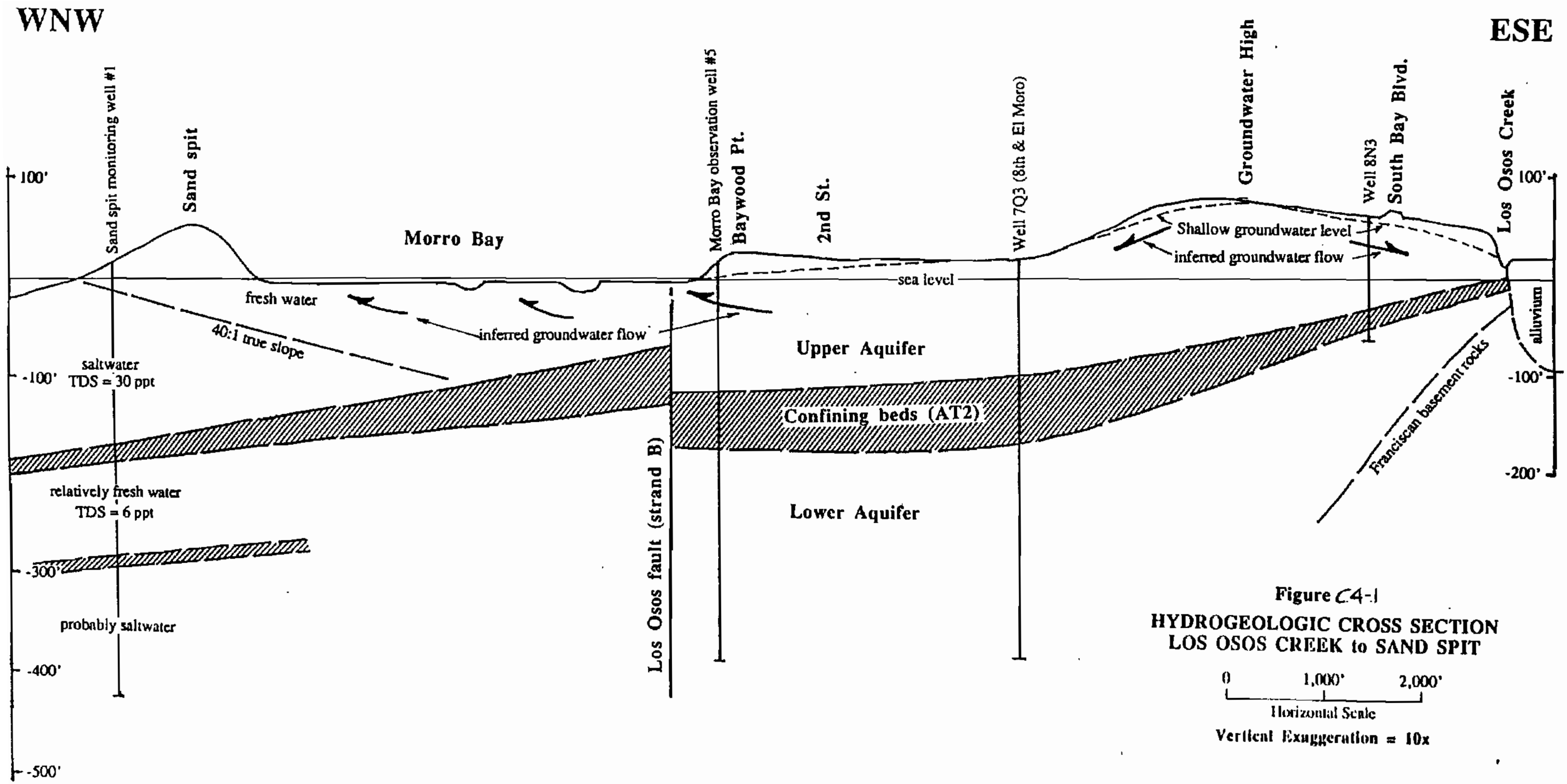


Figure C4-1
HYDROGEOLOGIC CROSS SECTION
LOS OSOS CREEK to SAND SPIT

Figure C4-2 Aerial photograph of lower Los Osos Creek in 1949 showing limits of wetland vegetation at that time. Vegetation types are based on comparison with existing conditions and vegetation height and topography from stereographic examination. Scale of photo is approximately 1"=700'. Ww = Willow woodland; Fm = Freshwater marsh; Sm = Salt marsh.

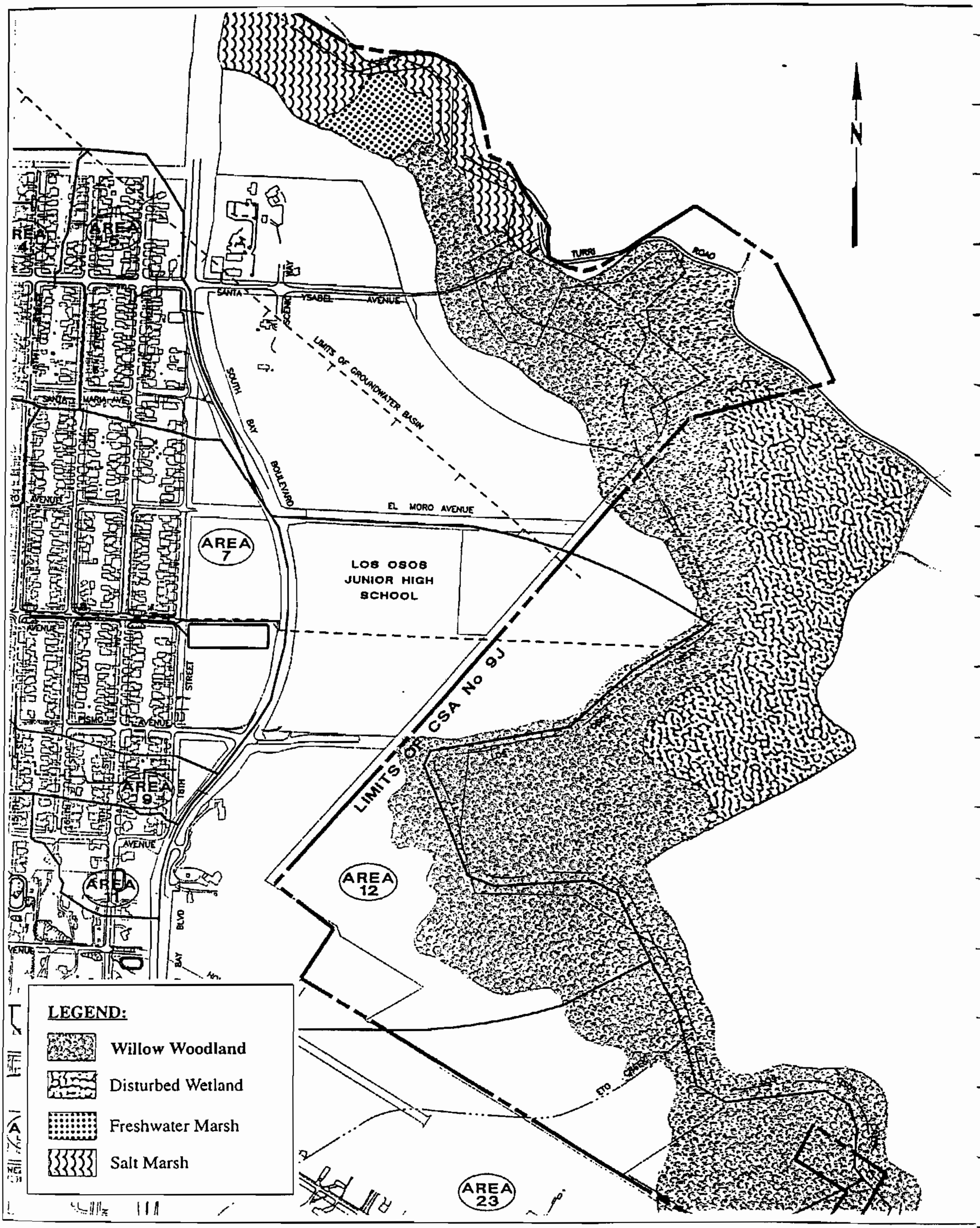


Figure C4-3
Approximate Extent of Wetland Vegetation Communities of lower Los Osos Creek
Approximate Scale: 1" = 700'

B. Alternative Solution Strategies

1) Inland Areas

Alternative solutions to those flooding problems exacerbated by surfacing groundwater, and not at the fringe of the bay, are based on the following considerations:

a. Implementation of the sewer project is expected to result in a decline of groundwater levels in the affected areas which would substantially alleviate the problem of persistent ponding, and also eliminate further additions of nutrients and pathogens to the underlying groundwater. Assuming the rate of decline after elimination of septic-tank discharge would approximate the average rate of rise during development, the average rate of decline in the El Moro depression is estimated at approximately 1 foot/year. The near-term period in which the problem may persist is estimated at 5 to 10 years, depending on rainfall, after cessation of septic-tank discharge.

b. The discharge of shallow groundwater carrying nutrients and pathogens to the bay is now occurring naturally, and any reduction in the nutrient and pathogen content would be an improvement. The only substantial differences between this natural flow to the bay and pumping the accumulated waters to the bay is that the pumped water is diluted by surface runoff, and as "a project", it would be subject to investigation and regulation.

c. A substantial reduction in the pathogen and nitrate content of the local groundwater may be achieved by lowering the depth to groundwater to 5 to 8 feet below the ground surface which would provide a zone of aeration normally associated with properly functioning septic-tank systems. Lowering the water table would require that pumping be expanded to periods when there is no flooding and inundation, and that the permits for existing facilities or new facilities be amended to include pumping of groundwater.

The volume of water to be pumped to achieve this condition would be substantial. In the El Moro depression, for example, to lower the groundwater in the flooded areas by about 8 feet, it would probably be necessary to extract the groundwater to an average depth of about 4 feet over an area of about 200 acres (area of Drainage Area 6). Assuming a specific yield of 18%, the volume of groundwater involved would be approximately 150 acre-feet. Maintaining the lowered condition until the sewer is functional would depend, in part, on the amount of rainfall, as most of the septic-tank discharge and infiltrating rainfall would have to be pumped out each year to maintain the condition.

d. A substantial reduction in nutrient content, and possibly some reduction in pathogen content, may be achieved by pumping the accumulated water to a wetland. The most likely location would be the wetland on Los Osos Creek east of the Middle School. Wetland vegetation is well known for reducing nitrate concentrations. The degree to which wetlands may also reduce pathogens is unknown.

Pumping the waters to Los Osos Creek, instead of directly to the bay, would increase annual costs by the additional pumping head of approximately 50 feet, and it would require the installation of pipe to connect the facilities on El Moro to those on Paso Robles Avenue. Directing all the discharge to the existing drainage facilities in the Paso Robles Avenue area could require significant improvements to these facilities. However, the primary thrust of combining dry-season pumping and discharge to Los Osos Creek would be to utilize the existing drainage facilities when they are otherwise not needed to convey local runoff.

e. The discharge of contaminants in "first flush" runoff events can be avoided by providing a retention/sedimentation basin as a part of solutions involving direct discharge to the bay or other sensitive receiving waters. The required retention capacity need not be large because "first flush" rainfall events normally generate a relatively small volume of runoff. This approach would be particularly applicable to solutions in problem areas requiring direct discharge to the bay from large urbanized areas such as Drainage Area 16.

Alternatively, it may be difficult to provide significant retention in some of the more developed sections of the community that also have shallow groundwater problems such as Area 6 (El Moro depression). These areas are relatively flat where runoff accumulates, and infiltration predominates over runoff in the early stages of the rainfall season. However, the discharge to the bay of some "first flush" runoff from areas of this type may be unavoidable if the flooding solution is to be viable in other respects.

Based on the considerations discussed above, alternative solutions to the near-term flooding problems involving surfacing groundwater in the inland areas include:

a. Pumping of surface water to Morro Bay during periods of inundation.
b. Expanded duration of pumping to Morro Bay to lower groundwater levels.
c. Pumping of surface water to Los Osos Creek during periods of inundation.
d. Expanded duration of pumping to Los Osos Creek to lower groundwater levels.

For the solutions above, "pumping" includes increased rates of pumping if existing facilities are inadequate, and "surface water" includes surfacing groundwater. "Pumping" in Alternatives "b" and "d" includes shallow groundwater as well as surface water.

In addition to the basic alternative scenarios related to discharge to the bay or Los Osos Creek, some alternatives involve a difference in approach as to collecting the runoff and surfacing groundwater. The basic scenario would be to continue with the existing system of street drainage which involves very little control because of the general absence of curb-and-gutter and storm drains. The modified scenarios would include curb-and-gutter to better control the street runoff, and the installation of some storm drains to pick up and dispose of the runoff better controlled by the curb-and-gutter.

With either of these sub-scenarios the total volume of water and the total volume of contaminant of a specified concentration would remain the same because the stabilized condition at the end of a particular "flooding" event requires a return to the conditions before the event occurred. With the controlled runoff sub-scenario, the initial discharge would have lower concentrations of contaminants because it would be higher in surface runoff as opposed to surfacing groundwater. However, the contaminant concentrations during the later stages of the "flooding" event, which involve primarily surfacing groundwater, would increase because the dilution of the septic-tank discharge by infiltrating runoff would be proportionally reduced.

The discussion above is intuitive and generalized because there are no data on the variations in contaminant concentrations in the accumulated waters over time in any of the "flooding" events that have occurred to date. Therefore, it is not possible to further refine or quantify the differences in contaminant concentrations that may result from either of these two approaches.

2) Bay Fringe

Application of the solution strategies, developed above for the inland problem areas, is probably not feasible for problem areas near the bay fringe because it would require a large number of extraction wells and a complex water-disposal system. Groundwater in these areas is naturally very shallow, and a rise of only a few feet results in "problem" conditions. Lowering the groundwater near the bay fringe by more than a few feet could result in seawater intrusion of the shallow aquifer, and maintaining the delicate balance between eliminating the problem condition but not inducing seawater intrusion could be very difficult and expensive. The state of the problems in these areas is probably not so great as to warrant such an undertaking to solve the near-term problems until the sewer is implemented.

3. Potential Impacts of Solutions

A. Water Quality

1) Nitrate Concentrations in Groundwater
A large amount of data is available on the nitrate concentrations in the shallow aquifer of the Los Osos groundwater basin. While the concentrations vary considerably both in time and by location, a reasonable average for estimating environmental effects is approximately 60 to 70 mg/l, or about 150% of the MCL for drinking water. This value is consistent with that measured at springs at the edge of the bay, and with that of "denitrified" percolating effluent below septic-tank leach fields in Los Osos.

2) Bacterial Concentrations in Groundwater
Bacterial concentrations are normally described in terms of the total and fecal coliform concentrations because it is an "indicator species" that is relatively easy to identify. The State Department of Health Services (DHS) standards require that total coliform at public beaches (i.e., public contact) should not exceed an average over a 30-day period of 1,000 MPN/100 ml. The Regional Water Quality Control Board (RWQCB) standard for public contact is based on the average fecal coliform not exceeding 200 MPN/100 ml in a 30-day period.

Recent monitoring by the RWQCB of the water quality in the back bay has revealed fecal coliform levels near Baywood Park pier as high as 1,700 MPN/100 ml at low tide, primarily freshwater in bay water, and as high as 5,000 MPN/100 ml in freshwater springs in Baywood Park (National Estuary Program, 1997). Much higher values have been measures during rainfall events, particularly "first flush" events in the fall, but it is the very high concentrations in the springs that is of the greatest concern in this review.

Bacteria concentrations in shallow groundwater are not normally a problem, even with septic-system disposal, because the zone of aeration beneath the leach field normally eliminates bacterial contamination. However, if the zone of aeration is eliminated by rising groundwater, then the bacteria from the septic system are not eliminated, and they become entrained in the shallow groundwater.

3) Combinations of Mixed Surface Water and Groundwater
The quality of potential discharges to Morro Bay or to Los Osos Creek from the problem areas involving surfacing groundwater would be expected to vary over a wide range depending on the intensity and duration of individual rainfall events and the groundwater level at the time of the event. For "first flush" events in the fall when the rainfall intensity is normally low, the runoff should be expected to be relatively high in bacterial and nutrient contamination, but very low in groundwater components. "First flush" runoff events are normally low in volume, and dilution in bay water would be expected to rapidly reduce contaminant concentrations.

As the rainfall season progresses and groundwater levels rise, the quality of the runoff should improve, but the component of contaminated groundwater is likely to increase. The volumes of these later events would be higher in total volume, and more significant as to ongoing effects on the bay. The quality of the potential discharge would depend on the balance between the relatively good-quality runoff and the more-contaminated groundwater. The poorest quality discharge would be expected as runoff declines and surfacing groundwater continues. Actual concentrations cannot be accurately predicted because these conditions have not be monitored. However, the worst-case condition is expected to be that for surfacing groundwater undiluted by runoff, which from the discussions above would be approximately 60-70 mg/l nitrate and 5,000 MPN/100 mg/l fecal coliform.

B. Potential Impacts of Alternatives

1) No Project

With the no project alternative, existing natural discharges of contaminated groundwater and occasionally contaminated surface runoff would continue. The pumping of excess surface water from the El Moro depression, which periodically includes surfacing groundwater, would also continue at existing rates. "Flooding" problems continue as in the past in problem areas. These conditions would be expected to continue until approximately 1 to 3 years after implementation of the sewer project in the affected areas, at which time groundwater levels and contaminant concentrations are expected to begin to decline.

2) Pumping of Surface Water to the Bay

Increasing the rate of pumping of surface water from the problem areas is not expected to significantly increase the overall levels of contamination of the bay. If these waters are not pumped to the bay on the surface, they would act to maintain higher hydraulic gradients over a longer period of time which increases the subsurface discharge of groundwater over this period. However, pumping the water to the bay on the surface hastens this process. This would result in higher volumes of contaminated groundwater reaching the bay during periods of pumping, but less when pumping ceases. Considering dilution by bay water, the resulting <u>concentrations</u> of contaminants would be expected to increase over existing conditions during periods of pumping, but decrease below existing conditions when pumping is not required.

The effects on the shellfish industry in the bay would depend on the tradeoffs between having temporarily higher levels of contaminants as compared to lower levels during periods when pumping is not required.

3) Expanded Duration of Pumping to the Bay

Increasing the duration, and possibly the rate of pumping of both surface water and groundwater to the bay to lower groundwater to a level that would allow proper functioning of the septic-tank systems would substantially increase the volume of contaminated groundwater added to the bay waters over the period of expanded pumping. Concentrations of contaminants would be expected to increase significantly over this period. However, if the groundwater levels can be drawn down in the problem areas so that they function properly, then the overall effect would be to significantly reduce the total bacterial contamination during the period until the sewer system is implemented in these areas.

As with the scenario above, the effects on the shellfish industry in the bay would depend on the tradeoffs between having temporarily higher levels of contaminants as compared to lower levels after groundwater levels have been lowered. The primary difference in the scenarios would be that the differences would be more pronounced.

4) Pumping of Surface Water to Los Osos Creek

Both of the above scenarios could be modified to pump the accumulated water to the wetland on lower Los Osos Creek. If this were to be limited to periods of flooding in the problem areas, the creek would likely be in a state of high flow and the wetland vegetation would be dormant. With these conditions, the potential benefits of circulating these waters through a wetland would probably be minimal.

5) Expanded Duration of Pumping to Los Osos Creek
With the expanded pumping scenario, however, discharge would continue into the dry season when the wetlands vegetation could act to reduce nutrient concentrations and possibly also the concentrations of bacteria.

4. Potential Mitigation Measures
With either of the two scenarios above involving pumping and discharge during the dry season, it may be feasible to concentrate discharge during those periods when the tidal flux is at a maximum, and when any discharge would be more rapidly carried out of the bay. This approach would be more easily controlled with direct discharge to the bay rather than cycling it through the wetlands on Los Osos Creek which would tend to smooth out the flow.

B. DISCHARGE OF SURFACE RUNOFF TO MORRO BAY NOT INVOLVING SURFACING GROUNDWATER (Category 2 Problem Areas)

A. Existing Conditions

1) Problem Conditions
The problem area most likely to result in solutions involving a significant increase in the discharge of surface runoff to Morro Bay is that in Drainage Area 16. Problem flooding is experienced primarily near the corner of Skyline and Broderson after large volumes of runoff have accumulated on the Morro Shores project site as a result of runoff from upslope in Drainage Areas 16B, C, D, E and F, a total of 570 acres.

Depths to groundwater near the corner of Skyline and Broderson in the spring of very wet years (i.e., 1995) are approximately 20 feet, which would appear to preclude surfacing groundwater as a significant cause of flooding in this area. However, from descriptions of surfacing groundwater by local residents, and the tendency of the problem to develop in the later stages of severe rainfall events, it appears that temporary mounding of groundwater is occurring during severe storms. Once the mounding reaches the surface, additional infiltration is precluded, and the runoff from upslope continues across the Morro Shores site and into the residences to the northwest.

The presence of the postulated temporary mounding has not been documented, as a monitoring well (M&E Boring #14, see Appendix B2) has only recently been established in this area, and the routine monitoring by the County Engineering Department is conducted twice a year, in the spring and the fall. To prove the existence of the mounding during severe storms, it would be necessary to install a stage recorder in a new well on the site, or in M&E Boring #14 near by, to get a continuous record of groundwater levels during severe storms.

2) Problem Solutions
If temporary mounding of groundwater is the root cause of the problem, then establishing an infiltration basin, or basins, on the Morro Shores site will not solve the problem. The only viable solution would be to convey the excess water to the bay or to some other infiltration site the location of which has not been identified.

3) Solutions with Sewer Implementation

Solutions to this problem must take into account the future operation of the Broderson recharge site which is now proposed to be located about a half mile to the south of this problem area. Modeling by Metcalf and Eddy (1996, Fig. 5-5) of the groundwater mound that would be generated by recharging treated wastewater at this site indicates that this approach is feasible. However, until the project is actually in operation, there will be questions as to how much additional recharge is feasible in this area during wet, normal and dry years from other sources such as runoff that has been captured in basins. Therefore, any solution in this problem area should have the flexibility of either discharging to the bay or infiltrating the runoff as recharge.

2. Potential Impacts of Solution

A. Discharge to the Bay

It is our understanding that an increase in the discharge of freshwater to the bay would be environmentally beneficial to the bay provided the discharge does not contain significant sediment or contaminants. The primary concern in this regard is the "first flush" rainfall event in the fall which tends to pick up most of the accumulated waste of the previous dry season, and is high in nitrates and bacterial contaminants. Since the first rains in the fall tend to be relatively low in volume, and groundwater levels would also be relatively low at the start of the recharge season, impacts of "first flush" runoff to the bay would be avoided as long as an infiltration basin capable of retaining the runoff from such events is included in system.

B. Point of Discharge

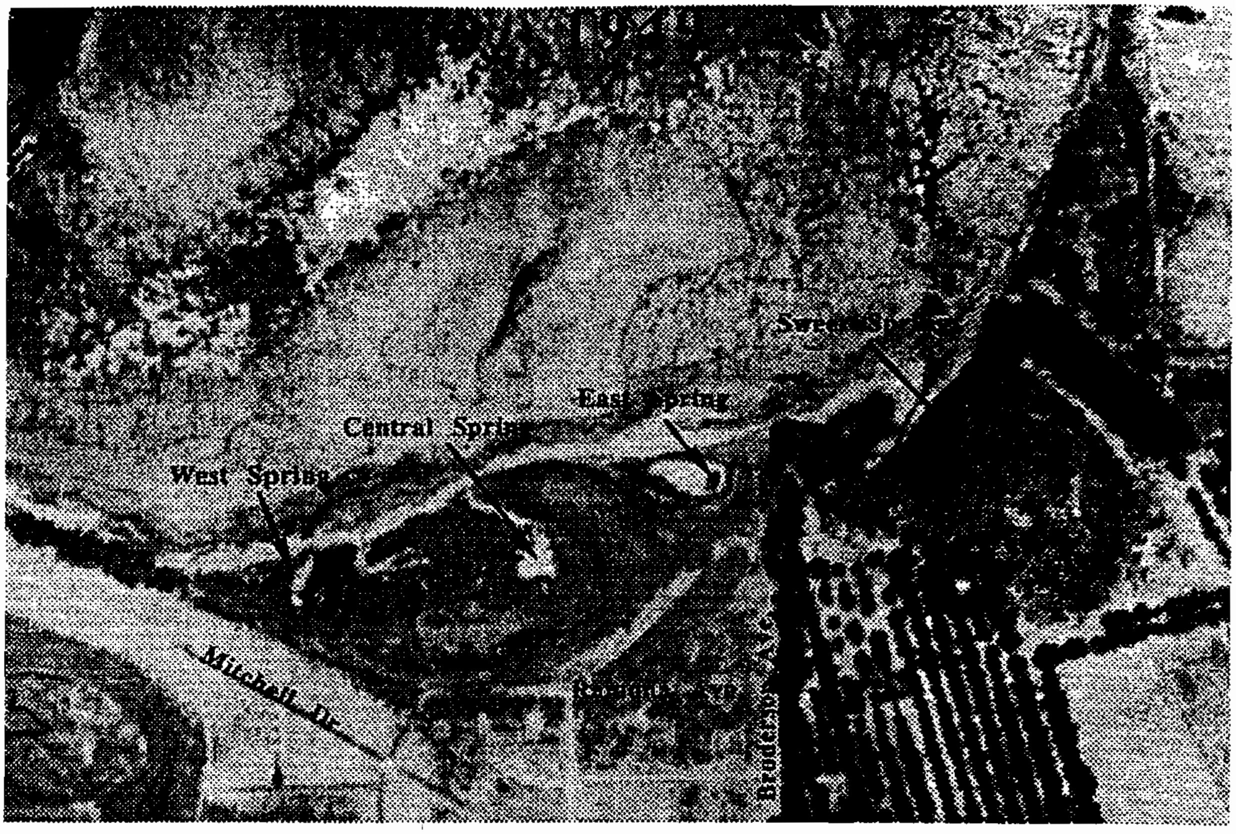
The point of discharge to the bay is also of concern, as there are numerous natural wetlands at the edge of the bay in the area downslope from this problem area. The most likely location is the existing area of discharge at the north end of Broderson Avenue. Figure C4-4 shows wetland features in this area in 1949 and 1990. The existing discharge system conveys runoff from the mobile home park and local streets northerly along the east side of Broderson Avenue in an open ditch and into the Sweet Springs Preserve. At this point, the runoff does not flow directly to the bay, but rather is diverted westerly by local topography into the area annotated "East Spring" on Figure C4-4.

This wetland feature, and the two to the west annotated "Central Spring" and "West Spring", are interpreted to be freshwater springs because they have persisted since the earliest aerial photographs of the area in 1949 and 1956. Monitoring by this author in 1990 and 1991 detected some reduced levels of salinity in these features, but it is unclear if this was due to rising groundwater within the features themselves or surfacing groundwater in the adjacent freshwater marshes.

It should also be noted that the "East Spring" has previously been identified (Perspective Planning, 1988) as habitat of the endangered saltmarsh bird's beak, a brackish-water plant that requires periodic freshwater inundation of otherwise salty environments. For this reason, it is assumed herein, for purposes of this review, that additional flow of freshwater into this marsh would probably not have a significant adverse impact on this species. However, additional environmental review of this issue would be required at such time as a specific project proposing increased freshwater discharge to this wetland feature would be developed.

3. Potential Mitigation Measures

The primary concern regarding increased freshwater discharge to the bay, and/or the wetlands at the edge of the bay, is the avoidance of significant sediment or contaminant inflow. This can be accomplished by including an infiltration/sedimentation basin in the design of the problem solution which would be capable of retaining and infiltrating the runoff from "first flush" events.



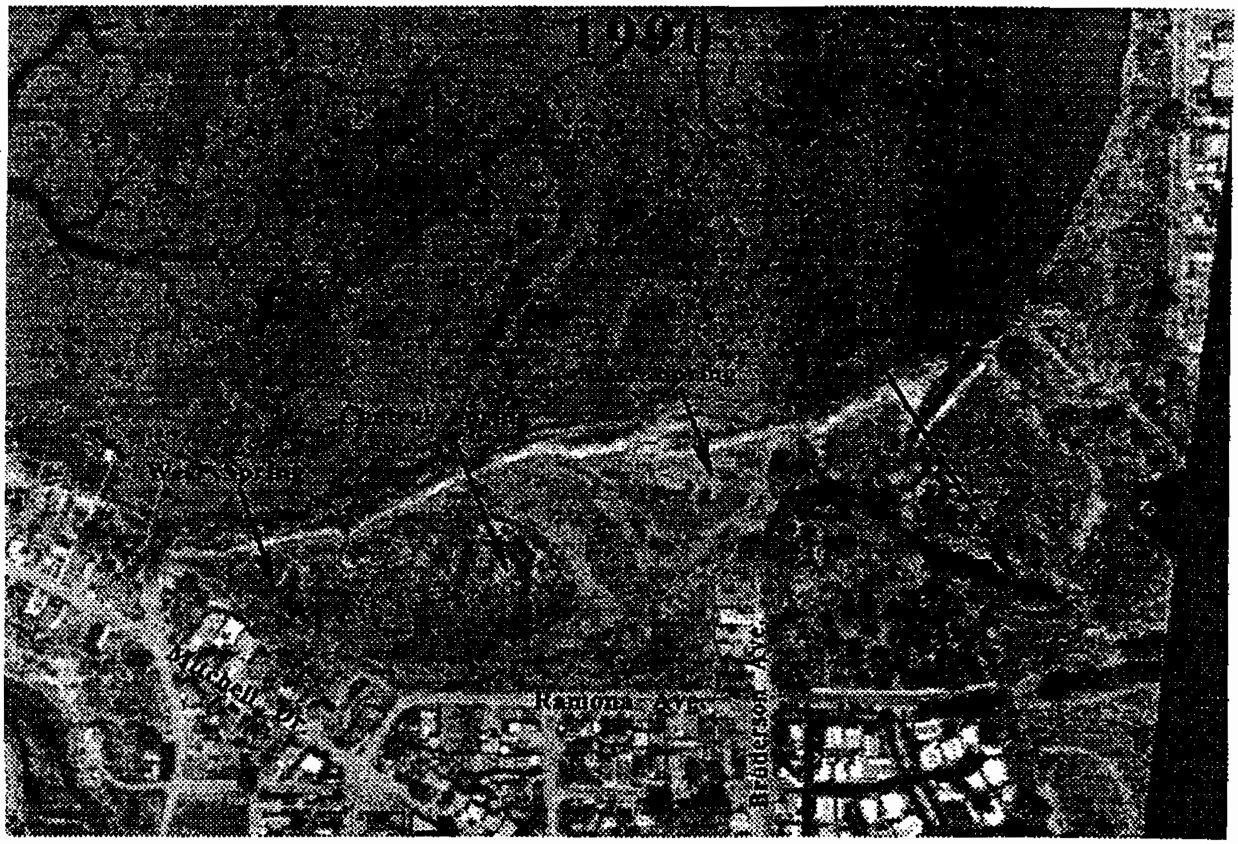


Figure C4-4Aerial photographs taken in 1949 (top) and 1990 (bottom) of the area in the vicinity of the existing discharge to the bay at the north end of Broderson Avenue. The scale of both photographs has been adjusted to approximately 1"=500'.

4. Other Points of Discharge to the Bay
While the north Broderson discharge point is expected to be the most significant point of additional freshwater discharge to the bay that may arise out of this study, additional discharge to the Pecho marsh between Butte Drive and Pecho Road or Cuesta inlet may occur as the result of drainage improvements in the western part of the community. Aerial photographs of the area of these bay fringe features in 1949 and 1990 are shown on Figure C4-5.

It is interesting to note that the area along the south side of Grove Street that now has shallow groundwater problems was apparently part of the Pecho marsh in 1949. Also, the area of what is now Cuesta inlet was a large spring-like feature before it was dredged in the late 1950's.

C. CONSERVATION OF POTENTIAL RECHARGE OF GROUNDWATER

Based on the analysis of groundwater conditions beneath the community in Section II, there is now no capacity in the shallow groundwater system east of the Los Osos fault to store excess runoff without exacerbating the existing "flooding" problems in the areas under review in this study. However, with implementation of the sewer project, the shallow groundwater levels east of the Los Osos fault should decline, and projects to conserve excess runoff as groundwater recharge may be feasible in the future. This condition should not be expected to develop sooner than about 5 to 10 years after sewer implementation.

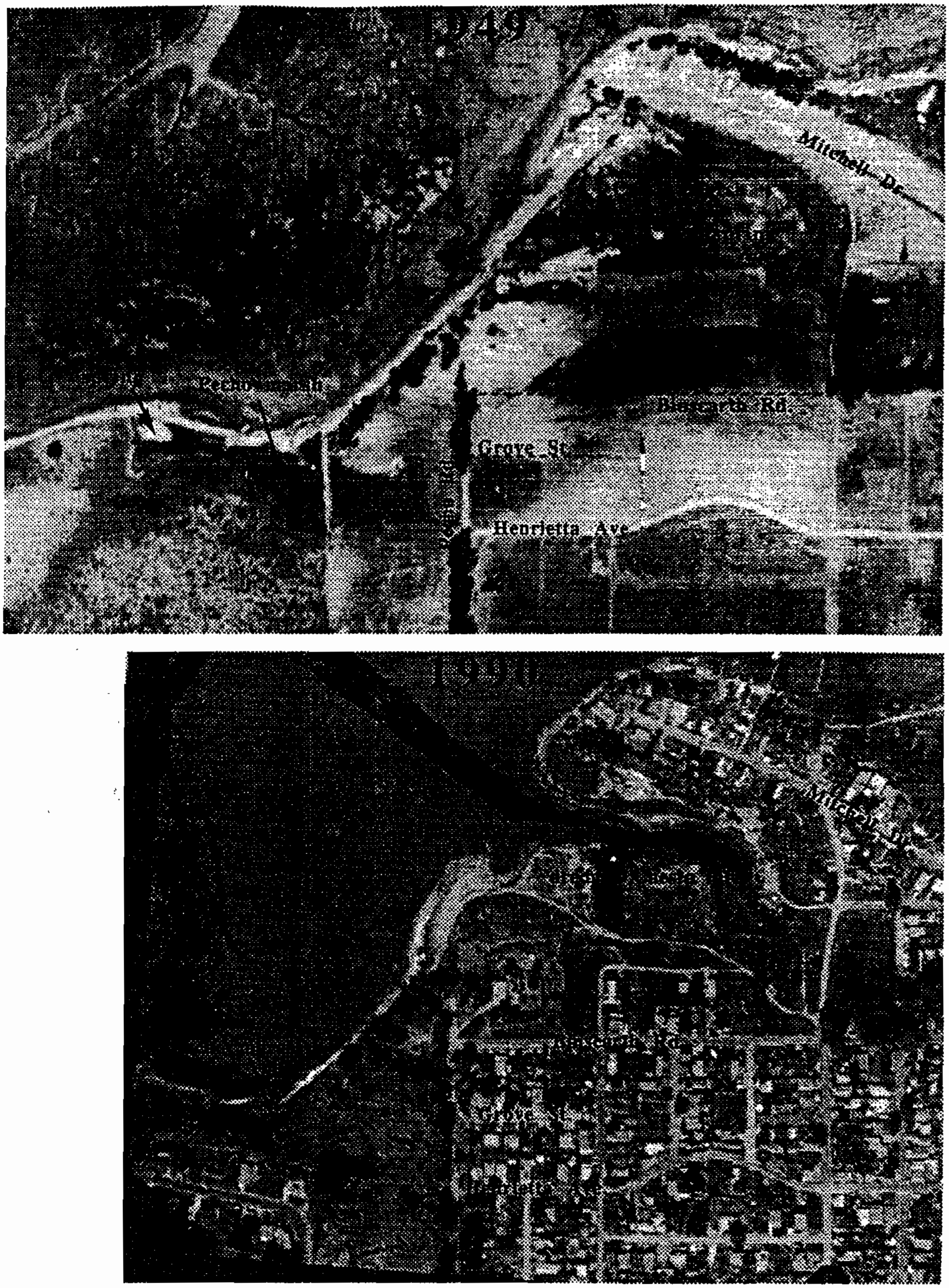
Small amounts of increased recharge of runoff may be feasible in the near-term in the area west of the Los Osos fault, particularly if drought conditions should return to the area. However, until the sewer project is functional, and shallow extraction wells can be implemented in the area south of the Henrietta bluff, increased recharge west of the Los Osos fault may exacerbate the surfacing groundwater conditions at the bay fringe north of Henrietta Avenue.

In the long-term, much of the storage capacity of the area west of the Los Osos fault may be required to store treated wastewater prior to its being extracted downslope and reused. The functioning of this recharge and extraction system will depend in large part on the degree to which the aquitard separating the upper and the lower aquifers prevents recharge of the lower aquifer from this source. Depending on how this system actually functions, recharging significant additional amounts of excess runoff to the groundwater may or may not be feasible.

D. ADDITIONAL REFERENCES

National Estuary Program, 1997, *Draft Bacteria Action Plan:* prepared by the staff of the National Estuary Program and published in "Turning the Tide", January 1997.

Perspective Planning, 1988, *Sweet Springs Marsh Resource Enhancement and Access Management Plan:* prepared for Morro Coast Audubon Society and the California Coastal Conservancy by Perspective Planning, March 1988.



FigureC4-5 Aerial photographs taken in 1949 (top) and 1990 (bottom) of the area in the vicinity of the Pecho marsh and the northerly part of Cuest-by-the-Sea. The Cuesta inlet and connecting channel were dredged in the late 1950's. The alignments of Binscarth Rd. and Grove St. have been added to the 1949 photo for ease of location. Note that, from the tone, the area on the south side of Grove St. was probably once part of the Pecho marsh. The scale of both photographs has been adjusted to approximately 1"=500'.

Appendix C5
RANKING OF ALTERNATIVES BASED UPON ENVIRONMENTAL IMPACTS

RANKING CRITERIA OF SOLUTIONS

The following is a breakdown and description of the various resource areas listed on the matrices used in the preliminary evaluation of the problem area solutions:

Water Quality: Evaluates solution's potential to impact Morro Bay or Los Osos Creek due to discharge of shallow groundwater or rain season first flush surface water containing components of failing septic-tank systems, (e.g., nitrates, coliform bacteria, etc.).

Riparian or Wetland Habitat: Evaluates solution's potential to impact the biological resources of the riparian or wetland habitat in or near each problem area, (e.g., Morro Bay Estuary).

Coastal Scrub or Oak Woodland: Evaluates solution's potential to impact the biological resources of coastal scrub or oak woodland habitat in or near each problem area.

Species of Special Concern: Evaluates solution's potential to impact rare, threatened, or endangered species and their habitat in or near each problem area. This includes those classified, or recommended for classification (i.e., "candidate"), as "endangered" or "threatened" under the federal Endangered Species Act, Calif. Fish and Game Code, Department of Fish and Game, and the Calif. Native Plant Society. (e.g., Morro shoulderband snail, red-legged frog, Morro Bay kangaroo rat, Morro Manzanita).

Archaeological Resources: Evaluates solution's potential during the construction process to impact archaeological resources in or near each problem area.

Visual Resources: Evaluates solution's potential to impact the visual resources in or near each problem area, (i.e., short term construction impacts and long term impacts visible from a public roadway in Los Osos).

Traffic: Evaluates solution's potential to impact the traffic flow in or near each problem area during the construction process of the proposed action.

Air Quality: Evaluates solution's potential to impact the air quality in or near each problem area during the construction process of the proposed action.

Noise: Evaluates solution's potential to increase noise volumes in or near each problem area during the construction process of the proposed action.

Public Services: Evaluates solution's potential to impact public services in or near each problem area during the construction process of the proposed action, (e.g., fire department, police department, local school system).

NUMBER CLASSIFICATION

The number classification system used on the matrices is designed to evaluate the full range of proposed solutions and their perspective impacts on the environment. The use of the matrices involved not only identifying potential impacts but also classifying them numerically by their severity or extent of impact to the environment. With this concept, each solution is classified with a numeric value of (1 through 4), based on the severity of impact to the individual ranking criteria. The following is a brief description of the numbering system used:

- **1** = Potentially significant unavoidable adverse impact, (class 1).
- **2** = Potentially significant but mitigable impact, (class 2).
- **3** = Less than significant impact with some standard mitigation required, (class 3).
- **4** = Insignificant impact, (class 4).

The number ratings on the matrices reflect increased degree of severity with the number (1) being the most severe. This preliminary evaluation did not consider, nor recommend the mitigation measures required to lessen each specific impact to a level of insignificance. The primary goal of the matrices was to identify the potential significant impacts and assign numeric values based on the degree of severity.

TABLE C5-1: APPROACH TO INTEGRATING ENVIRONMENTAL REVIEW REQUIREMENTS

Requirement	Scoping Process	Draft Document	Final Document	Decision Making
NEPA	Notice of Intent	Draft EIS	Final EIS	Lead Agency decision and Record of Decision
CEQA	Notice of Preparation	Draft EIR	Draft EIR	Lead Agency decision and Notice of Decision
ENDANGERED SPECIES ACT (7)	Request species list	Biological assessment	Biological opinion	
CLEAN WATER ACT (404)	Define objectives, Screen alternative; Submit permit application.	Draft 404(b)(1) analysis	Final 404(b)(1) analysis	Corps of Engineers issues 404 permit (after 401 certification or waiver)
NATIONAL HISTORIC PRESERVATION ACT (106)	Identify and evaluate historic and archeological properties	Draft effects assessment	Memorandum of Agreement	
CLEAN AIR ACT CONFORMITY (NON-TRANSPORTATION PROJECT)	Determine whether the conformity requirement applies	Preliminary analysis (comparison to de minimus levels)	Detailed modeling analysis if necessary	Federal agency issues conformity determination
PUBLIC INVOLVEMENT	Scoping meetings	Public comment; Public hearing	Public comment	

APPENDIX D

SUPPLEMENTARY ENGINEERING DATA

Appendix D1
GENERAL ASSUMPTIONS AND CALCULATION SHEETS

1. *Storm Drains, Channels & Swales:*
   Estimated capacities for proposed culverts and storm drains within the individual tributary areas were based on a 25-year design storm event, assuming full-buildout conditions, applying the Rational Equation (Q=CiA), and utilizing the *San Luis Obispo County Engineering Department Standard Improvement Specifications and Drawings,* Section 11-351.1504 and Drawing Numbers: D-2, D-3, D-4, & D-6. Note that for storm events exceeding the design standards used in this report, flooding problems are expected to reoccur at areas presently experiencing problems. Refer to Section IV-2, Design Criteria, for additional information.

   Pressure Flow
   All pipe diameters were estimated using the *Bureau of Public Roads* "Headwater Depth for Concrete Pipe Culverts with Inlet Control", with an initial headwater to depth ratio $(\frac{HW}{D})$ of 1.5 times the pipe diameter.

   Open Channel Flow
   Manning's Equation, $Q_{25}=\frac{1.49}{n}AR^{0.67}S^{0.5}$, was used for all open channel swale and channel estimated designs and sized for a 25-year storm event, no freeboard.

2. *Basins:*
   Estimated capacities for proposed detention basins and retention basins were determined as follows:

   Detention Basins:
   A two step process was used to estimate a detention (Retarding Basin per County definition) basin volumes. The first step was to determine the allowable bleeder flowrate ($Q_{bleeder}$) from a basin. This utilizes Rainfall-Intensity-Duration curves for a 2-year storm event, a C value assuming the drainage area is undeveloped, and the rational equation ($Q_{bleeder}=C_{undeveloped}iA$).

The second step utilizes County Standards for Rainfall-Intensity-Duration curves of a theoretical 50-year storm event, 10-hour intensity, and having a 10-hour duration. For every 5 minute duration interval, beginning at 10 minutes and continuing to 10 hours, a specific intensity is determined (from County Drawing C-6), and a corresponding flowrate and basin volume is calculated using the following equations:

Eq. 1. Flowrate in cubic feet per second: $Q_{50} = Ci_{duration}A = CAi_{duration}$ *(where CA remains constant)*

Eq. 2. Basin volume in acre feet: Vol. = $(Q_{50} - Q_{bleeder}) \times (\frac{60\ sec}{min}) \times$ (duration [minutes])

Equation 2 subtracts the bleeder flowrate from the estimated flowrate for a given duration and intensity. For each 5 minutes interval (duration), a unique basin volume is computed. The maximum volume computed over the 10 hour period is then applied as the estimated required basin capacity for the specific Alternative. A computer program, written by Keith Crowe of Engineering Development Associates, which applies this methodology was used to determine basin capacities.

Retention Basins:
The estimated volume for a proposed retention basin (Infiltration Basin per County definition) utilizes County Standards and was determined using the same methodology for Detention basins but not allowing for bleeder flows. The revised equations were used:

Eq. 1. Flowrate in cubic feet per second: $Q_{50} = Ci_{duration}A = CAi_{duration}$ *(where CA remains constant)*

Eq. 3. Basin volume in acre feet: Vol. = $(Q_{50}) \times (\frac{60\ sec}{min}) \times$ (duration [minutes])

3. *Pumping Assumptions*:
It is not correct to think of lowering the groundwater at each of the problem areas, it is more appropriate to think of lowering the ground water of the entire basin. The calculations used to estimate the pumpage required assumes that we lower the groundwater basin all the way "upstream" (along the groundwater surface elevation maps), much the same way that you would define a watershed for runoff. Therefore, it is necessary to look at the basin as a whole.

Placement of pumping wells could have significant impact on the success of a pumping program. For example, if we put a well at 14th Street and Ramona Avenue, this "mound" in the groundwater surface may drop very quickly and, even drop more than the required 5 to 8 feet as the general groundwater falls. However, for maximum benefit it would probably be more appropriate to focus pumping lower down on the groundwater surface "slope". It is much too complex to address in this report but there are computer models available that would help design the "well field".

It appears that the existing pumping plants on El Morro may be a good choice for pumping groundwater. However, this should be just one of multiple stations separated by (something like) 75% of the "radius on influence" of the wells, located low on the piezometric surface.

Possible problems? If we are all wrong and the groundwater is rising because of leakage between aquifers (or another reason) then pumping may not be a practical solution. Until the sewer is hooked up we will be battling septic tank contribution to the groundwater, and associated contamination risks. Pumping the groundwater could spread contamination through the aquifer (the contaminants move with the water). If the contamination is not already widespread then pumping could pose an environmental problem.

4. *Street Widening:*
Where curb and gutter improvements are proposed as an Alternative, the existing roadway will need to be widened per County Engineering Standards. The required width will need to be determined by County Engineering at the time the project is designed based on the road's classification (using Average Daily Traffic, ADT and other criteria) for the particular road. For purposes addressing this requirement in the cost estimation, existing roadways were assumed to be 20' wide (having two 10' travel lanes) and *would need* to be widened to 36' (having two 10' travel lanes and two 8' parking) at a minimum. A roadside swale has been presented as an alternative to curb & gutter. It is assumed that no existing street widening will be required for the roadside swale alternative.

5. *Costs:*
Estimated costs as presented in the worksheets include costs associated with construction only. The following percentages can be applied to the construction subtotal provided in the calculation sheets (Appendix D3).

Contingency:	20% of subtotal
Engineering, Surveying, Construction Management:	15% of subtotal
Permitting & Environmental:	15% of subtotal
Total	50%

Sample calculation:
If the construction subtotal cost for a particular alternative is $100,000, then the estimated grand total of the alternative's cost would be calculated as follows:

Subtotal (from calculation sheets)	**$100,000**
Contingency (20%)	$20,000
Engineering/Surveying/Construction (15%)	$15,000
Permitting (15%)	$15,000
Total Estimated Project Cost:	**$150,000**

Or, more simply, add 50% to the Subtotal to get the Total Estimated Project Cost:

$100,000 + (0.50 x 100,000) = **$150,000**

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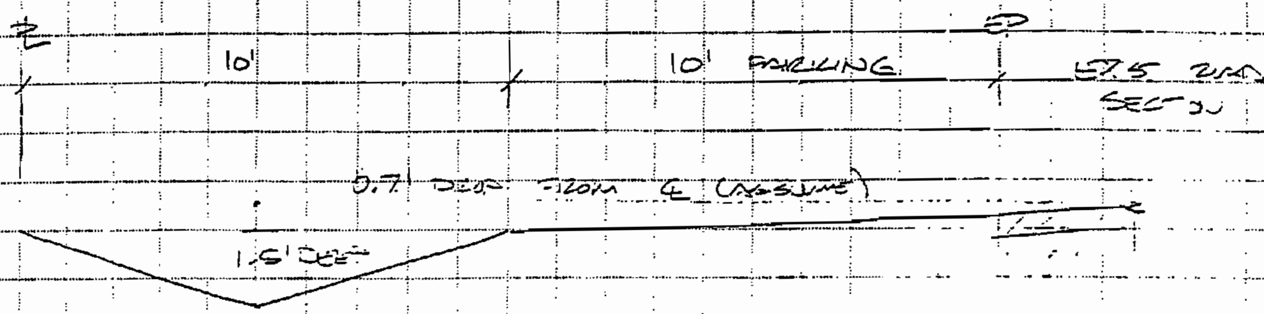
(805) 549-8658 FAX 549-8704

JOB: ROAD SIDE SWALE
SHEET NO.: 21 OF:
CALCULATED BY: DATE:
CHECKED BY: DATE:
SCALE:



$A = (2)(1/2)(5)(1.5) = 7.5$ SF

$P = (2)(\sqrt{(25)+(2.25)}) = 10.44$

$R = A/P = 7.5/10.44 = 0.718$

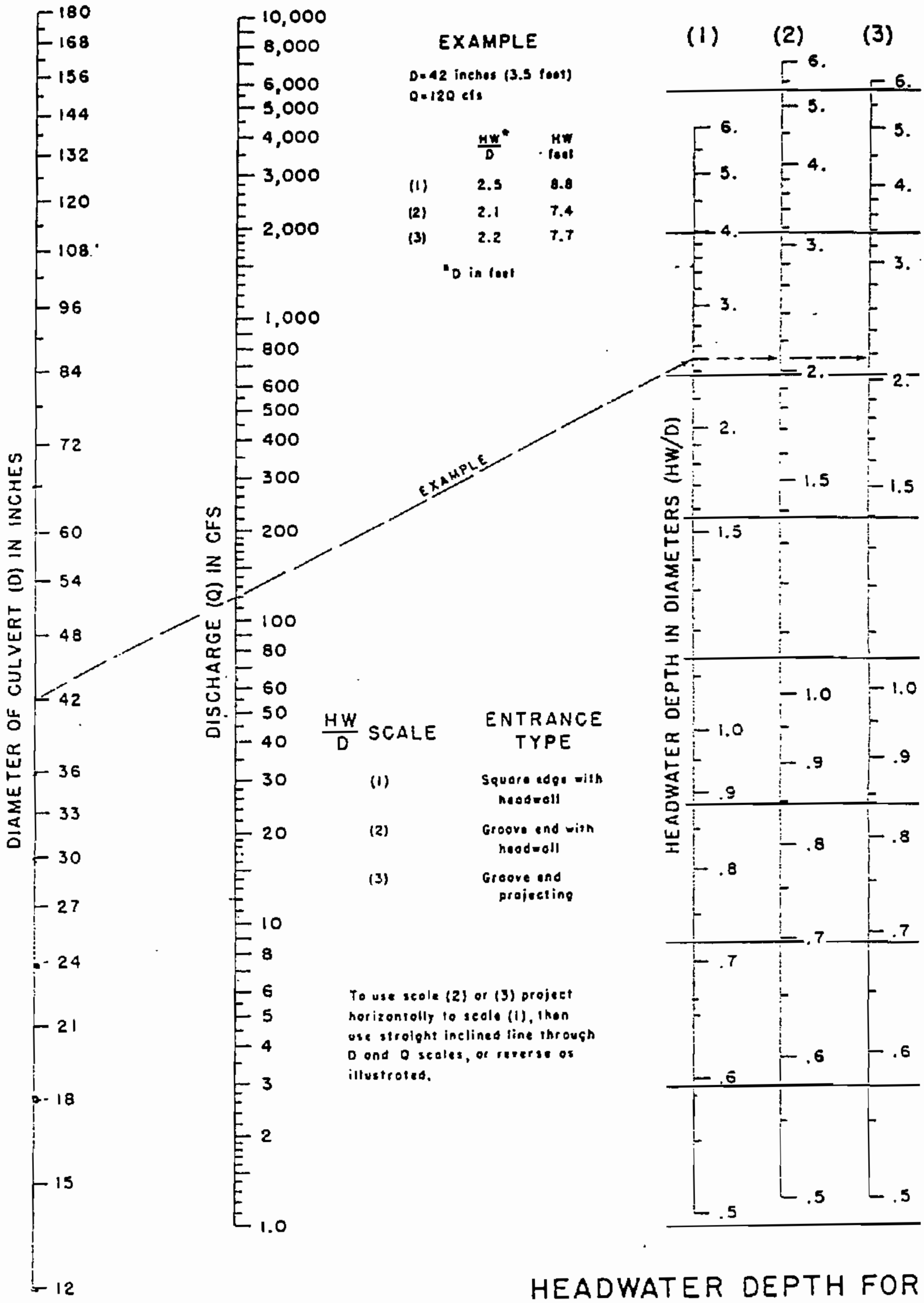
$n = 0.015$, $S = 2\%$

$Q = vA = \frac{1.49}{n} R^{2/3} S^{1/2} A$

$= \left(\frac{1.49}{0.015}\right)(0.718)^{2/3}(0.02)^{1/2}(7.5)$

$=$ <u>84 CFS</u> MAX CAPACITY @ 2% GRADE

MAX SIZE PRESENTED, ACTUAL CHANNEL WIDTH WILL DEPEND ON DRAINAGE AREA BEING CONSIDERED.



HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[signature]	9-3-75
				Recommended by Deputy Co. Eng.	[signature]	8/29/75

TABLE OF COEFFICIENT RUNOFF CHART

	TYPE OF DEVELOPMENT	TYPE OF SOIL**	COEFFICIENT OF RUNOFF FOR* SLOPE < 2%	2% to 10%	> 10%
URBAN	20,000 sq. ft.	C	.35	.40	.45
	"	S	.25	.35	.40
	10,000 sq. ft.	C	.40	.45	.55
	"	S	.30	.40	.45
	6,000 sq. ft.	C	.45	.55	.65
	"	S	.35	.40	.50
	APARTMENTS	C	.50	.60	.70
	"	S	.40	.50	.60
	INDUSTRIAL	C	.55	.65	.75
	"	S	.45	.55	.65
	COMMERCIAL	C	.75	.80	.85
	"	S	.70	.75	.80
RURAL	DENSE VEGETATION	C	.15	.25	.35
	"	S	.10	.15	.20
	MODERATE VEGETATION	C	.20	.30	.40
	"	S	.15	.20	.25
	SPARSE VEGETATION	C	.25	.35	.45
	"	S	.20	.25	.30
	IMPERVIOUS; PAVED, ETC.		.85	.90	.95

* Note: These values are intended to be a minimum; higher values may be required by the County Engineer.

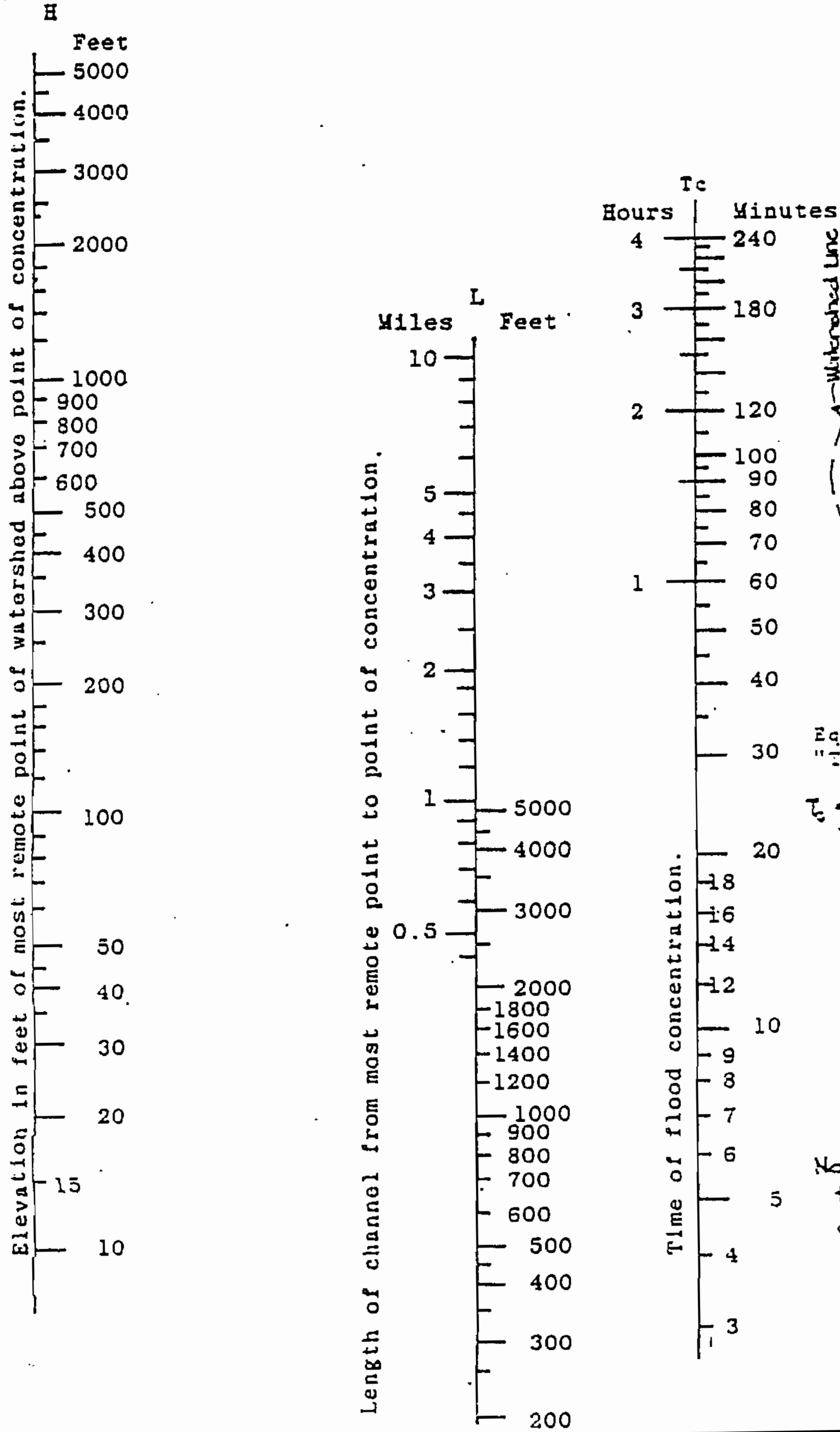
** Note: Soil Type

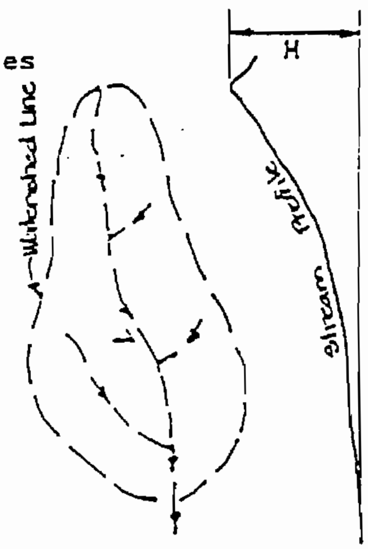
C = Clay, Adobe, Rock or Impervious Material

S = Sand, Gravel, Loam or Pervious Material

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	TABLE OF COEFFICIENT	Drawing No.

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible signature]	9-3-75
				Recommended by Deputy Co. Eng.	[illegible signature]	8/25/75





Equations for estimated "Time of Concentration"

$$T_c = \left(\frac{11.9 L^3}{H}\right)^{0.385}$$

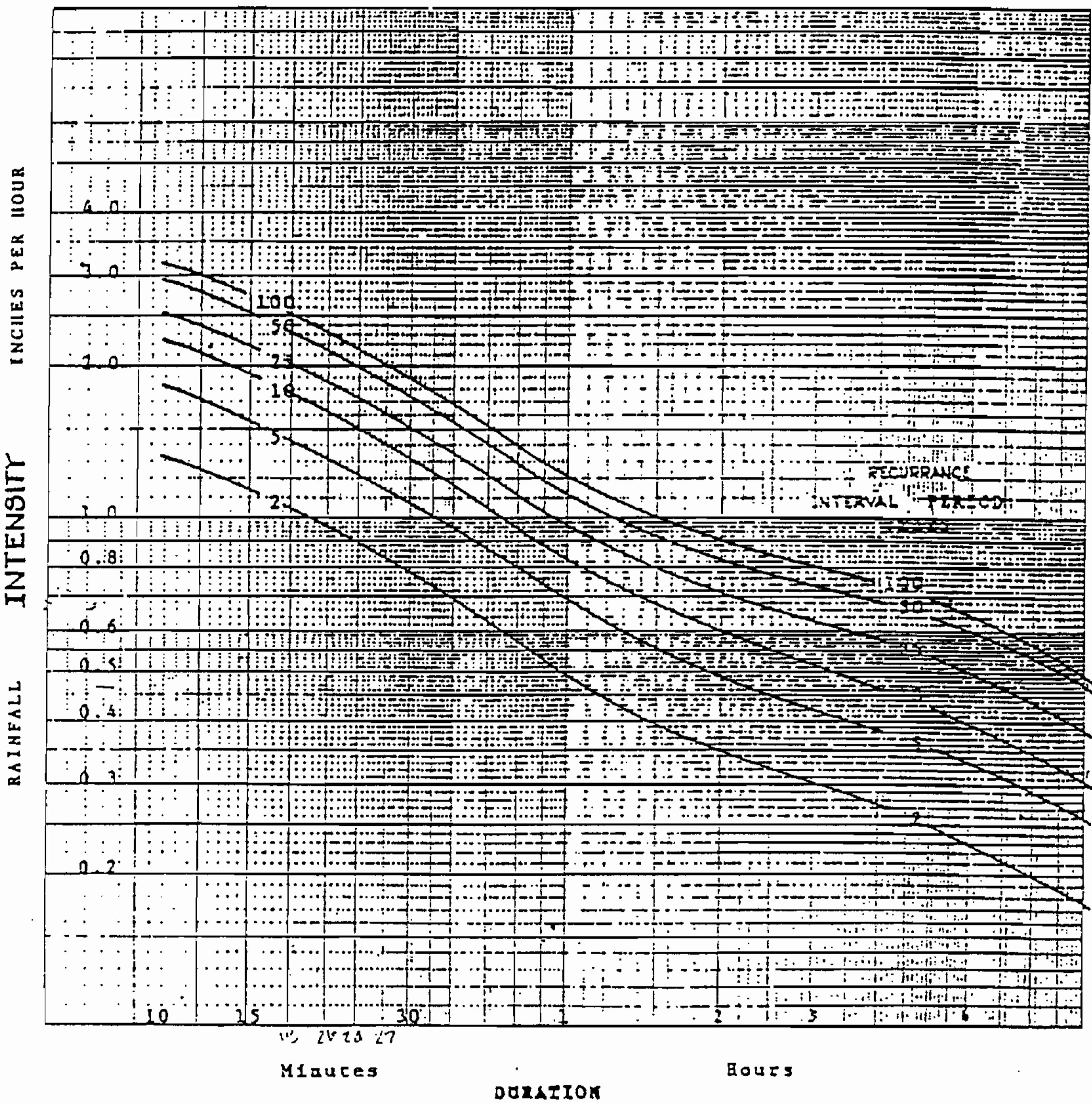
Tc=Time of concentration in hours.
L=Length of channel in miles.
H=Difference in elevation between most remote point and the point of concentration.

Note: This Nomograph is to be limited to areas of 200 acres or less.

Specification	Ref	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT NOMOGRAPH	Scale:
			Drawing No.

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[signature]	9-3-75
				Recommended by Deputy Co. Eng.	Clinton Milne	8/28/75

AREAS OF AVERAGE ANNUAL RAINFALL
OF 14 TO 18 INCHES



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.

Los Osos
Job Number 4.4

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 15 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	13050
15	2.5	16875
18	2.3	18630
21	2.1	19845
24	2	21600
27	1.8	21870
30	1.7	22950
35	1.6	25200
40	1.55	27900
45	1.4	28350
50	1.29	29025
55	1.19	29452
60	1.12	30240
66	1.07	31779
72	1.02	33048
78	.98	34398
84	.94	35532
90	.92	37260
96	.89	38448
102	.86	39474
108	.85	41310
114	.84	43092
120	.82	44280
150	.77	51975
180	.74	59940
210	.7	66150
240	.68	73440
270	.66	80190
300	.64	86400
330	.62	92070
360	.6	97200
420	.56	105840
480	.54	116640
540	.5	121500
600	.47	126900

aximum Volume is 126900 Cubic Feet
or a 600 Minute Storm

2.9 AF ADDITION TO
S.B. BLVD BASIN @
SANTA YSABEL

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SAN LUIS OBISPO, CALIFORNIA 93401
(805) 549-8658 FAX 549-8704

JOB ______
SHEET NO. 3 OF ______
CALCULATED BY ______ DATE ______
CHECKED BY ______ DATE ______
SCALE ______

ALT 6.6a & 6.6b (CONT)
El Moro Storm Drain

$Q_{25} = CiA$
$= (0.5)(1.7)(175 \text{ Ac})$
$= 150 \text{ cfs}$
USE 54" ø CULVERT

BOX CULVERT UNDER 2nd ST
$A = \left(\frac{\pi}{4}\right)(5.5)^2 = 24 \text{ SF}$ ADJUST EQUIV AREA TO [illegible] = 1
ALLOWABLE MAX HEIGHT = 3' [illegible] CHANNEL
$24/3 = 8'$
CHECK
$A = 24 \text{ SF}$
$P = (2 \times 3) + (2 \times 8) = 22$
$R = A/P = 24/22 = 1.10$
$S = 0.5\%$ $n = 0.025$

$Q = \left(\frac{1.49}{0.025}\right)(24)(1.10)^{2/3}(0.005)^{1/2} = 105 \text{ cfs} < 150 \text{ cfs}$

TRY 3×10
$A = 30$
$P = 26$ $Q_{25} = \left(\frac{1.49}{0.025}\right)(30)(1.16)^{2/3}(0.005)^{1/2} = 140 \text{ cfs} \approx 150 \text{ cfs}$
$R = 1.16$

USE 3x10

ALT 7.4 CULVERT
$Q_{25} = CiA$ $A = 6.4 \text{ Ac}$ $C = 0.5$ $i = 2.2$
$= (0.5)(2.2)(6.4)$
$= 70 \text{ cfs}$

USE 36" ø CULVERT

PUMP ENTIRE GROUNDWATER AQUIFER

ALT 6.4, 6.5, 7.3, 8 AND 8.5

Assume porosity = 0.25
Lower Entire NW side of groundwater basin
Area of groundwater basin tributary to 8th & El Morro
20250000 sq ft 464.9 ac
Assumes area of 4500' x 4500' (swag scaled from map)

Total Volume of water that must be removed to lower piezometric surface by:
5 ft

is 25312500 cu ft
1.89E+08 gal
581.095 ac-ft

Pump Q (gpm)	Time to Pump	
250	526	days
500	263	days
750	175	days
1000	131	days
1250	105	days
1500	88	days
1750	75	days
2000	66	days
2250	58	days
2500	53	days

If average annual rainfall is 18 in/yr
If the fraction that infiltrates is 90%

Then an average of 16.2 in/yr of surface water is added to the aquifer
This is the equivelant of 64.8 in/yr of rise in water table due to average annual rainfall

To "maintain" water level about 27337500 cubic feet
2.04E+08 gallons
627.6 ac-ft should be pumped from aquifer in average year

Pump Q (gpm)	Time to Pump	
100	1420	days
200	710	days
300	473	days
400	355	days
500	284	days
600	237	days
700	203	days
800	178	days
900	158	days
1000	142	days

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.
- 1994, Engineering Development Associates

Los Osos
Job Number Alt 7.4

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 84 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	73080
15	2.5	94500
18	2.3	104328
21	2.1	111131
24	2	120960
27	1.8	122472
30	1.7	128520
35	1.6	141120
40	1.55	156240
45	1.4	158760
50	1.29	162540
55	1.19	164934
60	1.12	169344
66	1.07	177962
72	1.02	185068
78	.98	192628
84	.94	198979
90	.92	208656
96	.89	215308
102	.86	221054
108	.85	231336
114	.84	241315
120	.82	247968
150	.77	291060
180	.74	335664
210	.7	370440
240	.68	411264
270	.66	449064
300	.64	483840
330	.62	515592
360	.6	544320
420	.56	592704
480	.54	653184
540	.5	680400
600	.47	710640

Maximum Volume is 710640 Cubic Feet 16.3 AF
For a 600 Minute Storm

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JOB ____
SHEET NO. 6 OF ____
CALCULATED BY ____ DATE ____
CHECKED BY ____ DATE ____
SCALE ____

ALT 8.2-8.3 CULVERT UNDER 11th ST

$Q_{25} = (0.5)(2.2)(18)$ AREA = 18 AC
$= 20$ CFS
USE 24" ϕ CULVERT OR 18" ϕ either side of street

ALT 8.1

$Q = CiA$
$= (0.5)(2.2)(96)$ OVERSIZE FOR FACTOR OF SAFETY, i = 2.2
$= 105$ CFS

USE 48" ϕ CULVERT [illegible]

ALT 9.2 15th & 12th STREETS

$Q_{25} = CiA = (0.5)(2.2)(2.8)$
$= 3.0$ CFS
USE 18" ϕ CULVERTS

ALT 9.1 - CROSS LOT

$Q_{25} = (0.5)(2.2)(5.6)$
$= 6.2$ CFS

USE 18" ϕ CULVERT

TO RETAIN ENTIRE AREA IN EXIST BASIN
$Q_{100/10/10} = (0.5)(0.47)(16) = 3.76$ CFS
$3.76 \times 3600 \times 10 \times 1/43560 = \underline{3.10\ AF}$ NO [illegible] FROM
PASS FLOW THRU
BASIN.

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.
- 1994, Engineering Development Associates

Los Osos
Job Number Alt 9.2

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 2.8 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	2436
15	2.5	3150
18	2.3	3477
21	2.1	3704
24	2	4032
27	1.8	4082
30	1.7	4284
35	1.6	4704
40	1.55	5207
45	1.4	5292
50	1.29	5417
55	1.19	5497
60	1.12	5644
66	1.07	5932
72	1.02	6168
78	.98	6420
84	.94	6632
90	.92	6955
96	.89	7176
102	.86	7368
108	.85	7711
114	.84	8043
120	.82	8265
150	.77	9702
180	.74	11188
210	.7	12348
240	.68	13708
270	.66	14968
300	.64	16127
30	.62	17186
360	.6	18144
420	.56	19756
80	.54	21772
40	.5	22680
600	.47	23688

ximum Volume is 23688 Cubic Feet 0.5 AF
r a 600 Minute Storm

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JOB ____
SHEET NO. 3 OF ____
CALCULATED BY ____ DATE ____
CHECKED BY ____ DATE ____
SCALE ____

ALT 10.2 - CULVERT BETWN 14th & 15th ST.

$Q_{25} = CiA$ AREA = 8 ac

$= (0.5)(2.2)(8)$

$= 9$ cfs

USE 18" ø CULVERTS

ALT 10.4 - CULVERT @ 17th ST

$Q_{25} = CiA = (0.5)(2.2)(26)$

$= 30$ cfs

USE 24" ø CULVERT

ALT 13.3 GRAND @ [illegible]

AREA 50 ac ARE

$Q_{25} = (0.5)(2.2)(50)$

$= 55$ cfs

36" ø CULVERT

ALT 14.1c - STORM DRAIN

AREA = 11 ac

$Q_{25} = (0.5)(2.2)(11)$

$= 12$ cfs

USE 15" ø CULVERT

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.

Los Osos
Job Number Alt 10.2

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 8 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	6960
15	2.5	9000
18	2.3	9936
21	2.1	10584
24	2	11520
27	1.8	11664
30	1.7	12240
35	1.6	13440
40	1.55	14880
45	1.4	15120
50	1.29	15480
55	1.19	15708
60	1.12	16128
66	1.07	16948
72	1.02	17625
78	.98	18345
84	.94	18950
90	.92	19872
96	.89	20505
102	.86	21052
108	.85	22032
114	.84	22982
120	.82	23616
150	.77	27720
180	.74	31968
210	.7	35280
240	.68	39168
270	.66	42768
300	.64	46080
330	.62	49104
360	.6	51840
420	.56	56448
480	.54	62208
540	.5	64800
600	.47	67680

aximum Volume is 67680 Cubic Feet 1.6 AF
or a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.

Los Osos
Job Number Alt 10.3

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 26 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	22620
15	2.5	29250
18	2.3	32292
21	2.1	34398
24	2	37440
27	1.8	37908
30	1.7	39780
35	1.6	43680
40	1.55	48360
45	1.4	49140
50	1.29	50310
55	1.19	51051
60	1.12	52416
66	1.07	55083
72	1.02	57283
78	.98	59623
84	.94	61588
90	.92	64584
96	.89	66643
102	.86	68421
108	.85	71604
114	.84	74692
120	.82	76752
150	.77	90090
180	.74	103896
210	.7	114660
240	.68	127296
270	.66	138996
300	.64	149760
330	.62	159588
360	.6	168480
420	.56	183456
480	.54	202176
540	.5	210600
600	.47	219960

Maximum Volume is 219960 Cubic Feet 5 AF
For a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.

Los Osos
Job Number Alt 11.2a

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 11 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	9570
15	2.5	12375
18	2.3	13662
21	2.1	14552
24	2	15840
27	1.8	16038
30	1.7	16830
35	1.6	18480
40	1.55	20460
45	1.4	20790
50	1.29	21285
55	1.19	21598
60	1.12	22176
66	1.07	23304
72	1.02	24235
78	.98	25225
84	.94	26056
90	.92	27324
96	.89	28195
102	.86	28947
108	.85	30294
114	.84	31600
120	.82	32472
150	.77	38115
180	.74	43956
210	.7	48510
240	.68	53856
270	.66	58806
300	.64	63360
330	.62	67518
360	.6	71280
420	.56	77616
480	.54	85536
540	.5	89100
600	.47	93060

ximum Volume is 93060 Cubic Feet 2.1 AF
r a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
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Keith V. Crowe, P.E.

Los Osos
Job Number Alt 16.1b

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 360 acres, with a C of .25

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	156600
15	2.5	202500
18	2.3	223560
21	2.1	238139
24	2	259200
27	1.8	262440
30	1.7	275400
35	1.6	302400
40	1.55	334800
45	1.4	340200
50	1.29	348300
55	1.19	353430
60	1.12	362880
66	1.07	381348
72	1.02	396576
78	.98	412776
84	.94	426384
90	.92	447120
96	.89	461376
102	.86	473688
108	.85	495720
114	.84	517103
120	.82	531360
150	.77	623700
180	.74	719280
210	.7	793800
240	.68	881280
270	.66	962280
300	.64	1036800
330	.62	1104840
360	.6	1166400
420	.56	1270080
480	.54	1399680
540	.5	1458000
600	.47	1522800

aximum Volume is 1522800 Cubic Feet 35 AF
or a 600 Minute Storm

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(805) 549-8658 FAX 549-8704

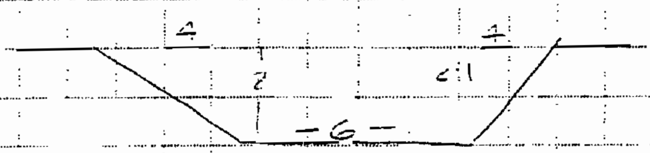
JOB
SHEET NO. 3 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

ALT 16.1c DIVERSION [illegible]

$Q_{25} = CiA$ C = 0.25, i = 2.2 A = 360 ac [illegible]

$= (0.25)(2.2)(360)$

$= 200$ cfs



S = 2%

n = 0.025

A = [illegible] = 18.3

P = [illegible] = 12.3

R = [illegible] = 1.5

$Q = \left(\frac{1.49}{0.025}\right)(18.3)(1.5)^{2/3}(0.02)^{1/2}$

= 200 cfs = 200 cfs ok

CULVERT UNDER [illegible] VALLEY

$Q_{25} = 200$ cfs

USE 60" ϕ CULVERT

ALT 16.2b [illegible]

AREA NORTH OF [illegible] = [illegible] ac [illegible] ac [illegible]

C = [(115 ac · 0.5) + (360 ac · 0.25)] / 475 = 0.3 [illegible]

$Q_{25} = (0.3)(1.9)(475)$ [illegible]

USE 60" ϕ PIPE IN [illegible]

VOL [illegible] TO [illegible] BASIN ([illegible]) = 55.4 AF

ALT 16.2c, [illegible]

ADD 50 AC OF AREA [illegible], A total = 50 + 475 = 525 ac

C = (360 · 0.25) + (165 · 0.5) / 5.5 = 0.33

$Q_{25} = (0.33)(1.8)(525) = 312$ cfs

USE 72" ϕ CULVERT

[illegible]

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.
- 1994, Engineering Development Associates

Los Osos
Job Number 16.2b

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 475 acres, with a C of .3

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	247950
15	2.5	320625
18	2.3	353970
21	2.1	377055
24	2	410400
27	1.8	415530
30	1.7	436050
35	1.6	478800
40	1.55	530100
45	1.4	538650
50	1.29	551475
55	1.19	559597
60	1.12	574560
66	1.07	603801
72	1.02	627912
78	.98	653562
84	.94	675108
90	.92	707940
96	.89	730512
102	.86	750006
108	.85	784890
114	.84	818748
120	.82	841320
150	.77	987525
180	.74	1138860
210	.7	1256850
240	.68	1395360
270	.66	1523610
300	.64	1641600
330	.62	1749330
360	.6	1846800
420	.56	2010960
480	.54	2216160
540	.5	2308500
600	.47	2411100

aximum Volume is 2411100 Cubic Feet 55.4 AF
or a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
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Keith V. Crowe, P.E.

Los Osos
Job Number Alt 16.2c

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 525 acres, with a C of .33

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	301455
15	2.5	389812
18	2.3	430353
21	2.1	458419
24	2	498960
27	1.8	505197
30	1.7	530145
35	1.6	582120
40	1.55	644490
45	1.4	654885
50	1.29	670477
55	1.19	680352
60	1.12	698544
66	1.07	734094
72	1.02	763408
78	.98	794593
84	.94	820789
90	.92	860706
96	.89	888148
102	.86	911849
108	.85	954261
114	.84	995425
120	.82	1022868
150	.77	1200622
180	.74	1384614
10	.7	1528065
40	.68	1696464
270	.66	1852389
300	.64	1995840
30	.62	2126817
60	.6	2245320
420	.56	2444904
80	.54	2694384
40	.5	2806650
600	.47	2931390

ximum Volume is 2931390 Cubic Feet 67.3 AF
a 600 Minute Storm

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JOB ____
SHEET NO. 16 OF ____
CALCULATED BY ____ DATE ____
CHECKED BY ____ DATE ____
SCALE ____

ALT 17.3A San Luis Storm Drain

Area = 42 ac, Tc = 20 min, i = 1.9

$Q_{25} = (0.5)(1.9)(42) = 40$ cfs

USE 30" ø CULVERT

ALT 17.3b. Nipomo Storm Drain

A = 56 ac i = 1.9

$Q_{25} = (0.5)(1.9)(56)$

$= 53$ cfs

USE 36" ø CULVERT

ALT 23.c - Replace Culvert

$Q_{25} = (0.5)(2.2)(10) = 11$ cfs

USE 15" ø CULVERT

ALT 16.4b

A = 25 ac i = 2.2

$Q_{25} = CiA = (0.5)(2.2)(25)$

$= 27.5$ cfs

USE 24" ø CULVERT

Modified Rational Method
for Detention Basin Volume
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Los Osos
Job Number Alt 17.2a

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 98 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	85260
15	2.5	110250
18	2.3	121716
21	2.1	129653
24	2	141120
27	1.8	142884
30	1.7	149940
35	1.6	164640
40	1.55	182280
45	1.4	185220
50	1.29	189630
55	1.19	192423
60	1.12	197568
66	1.07	207622
72	1.02	215913
78	.98	224733
84	.94	232142
90	.92	243432
96	.89	251193
102	.86	257896
108	.85	269892
114	.84	281534
120	.82	289296
150	.77	339570
180	.74	391608
210	.7	432180
240	.68	479808
270	.66	523908
300	.64	564480
330	.62	601524
360	.6	635040
420	.56	691488
480	.54	762048
40	.5	793800
600	.47	829080

ximum Volume is 829080 Cubic Feet 19 AF
r a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
Keith V. Crowe, P.E.

Los Osos
Job Number Alt 17.2b

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 34 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	29580
15	2.5	38250
18	2.3	42228
21	2.1	44981
24	2	48960
27	1.8	49572
30	1.7	52020
35	1.6	57120
40	1.55	63240
45	1.4	64260
50	1.29	65790
55	1.19	66759
60	1.12	68544
66	1.07	72032
72	1.02	74908
78	.98	77968
84	.94	80539
90	.92	84456
96	.89	87148
102	.86	89474
108	.85	93636
114	.84	97675
120	.82	100368
150	.77	117810
180	.74	135864
210	.7	149940
240	.68	166464
270	.66	181764
300	.64	195840
330	.62	208692
360	.6	220320
420	.56	239904
480	.54	264384
540	.5	275400
600	.47	287640

aximum Volume is 287640 Cubic Feet 6.6 AF
or a 600 Minute Storm

Modified Rational Method
for Detention Basin Volume
using County of San Luis Obispo IDF data
by
Engineering Development Associates
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Los Osos
Job Number Alt 18.3

Average Annual Rainfall between 14 and 18 in per year
50 Year Storm

Developed Area of 22 acres, with a C of .5

Release rate set at 0 cfs

Duration (min)	Intensity (in/hr)	Volume (cuft)
10	2.9	19140
15	2.5	24750
18	2.3	27324
21	2.1	29105
24	2	31680
27	1.8	32076
30	1.7	33660
35	1.6	36960
40	1.55	40920
45	1.4	41580
50	1.29	42570
55	1.19	43197
60	1.12	44352
66	1.07	46609
72	1.02	48470
78	.98	50450
84	.94	52113
90	.92	54648
96	.89	56390
102	.86	57895
108	.85	60588
114	.84	63201
120	.82	64944
150	.77	76230
180	.74	87912
210	.7	97020
240	.68	107712
270	.66	117612
300	.64	126720
330	.62	135036
360	.6	142560
420	.56	155232
480	.54	171072
540	.5	178200
600	.47	186120

ximum Volume is 186120 Cubic Feet 4.3 AF
r a 600 Minute Storm

ALT 21 & 22

Fairchild/Vons Basins

Basin	Capacity (ac-ft)	Runoff Generated 100-year (ac-ft)	50-year (ac-ft)	10-year (ac-ft)
Fairchild 1	2.6	7	5.6	3.8
Fairchild 2	0.6			
Von's 1	1.9	2.4	1.9	1.4
Von's 2	0.2			
Total	5.3	9.4	7.5	5.2

If all the basin are "connected" then an additional volume of to meet a 50-year storm criteria for Area 21 and Area 22 combined — 2.2 ac-ft, 3549 cu-yards

. *Tributary Area Flow Calculations, Appendix D2:*

Flowrates calculated for the individual tributary areas (Areas 1-27) were estimated utilizing the TR-20 method. The TR-20 method was used over the County's Rational Equation because of its to perform time-dependant analysis and to analyze tributary areas larger than 200 acres. TR-20 was used on tributary areas smaller than 200 acres to present comparable methods throughout the study area. The following information was used for TR-20 modeling:

Per the Soil Survey for San Luis Obispo County, California, Coastal Parts, soils in the Los Osos/Baywood Park area soil numbers 104 and 105.

104 Baywood Fine Sand, 2% to 9% slopes.

"This is a very deep, somewhat excessively drained, undulating and gently rolling is on stabilized sand dunes near the coast. It formed in deposits of windblown sand. Areas are irregular in shape and range for 10 to 3000 acres. The natural vegetation is mainly brush with small areas of conifers or hardwoods. Elevation ranges from 0 feet to 500 feet. The average annual precipitation ranges from 15 to 20 inches, and the average annual air temperature is about 58° F. The average frost-free season ranges from 325 to 350 days, depending on location. Permeability of this Baywood soil is rapid, and the available water capacity is low. Surface runoff is slow or medium. The hazard of soil blowing is high, and the hazard of water erosion is medium. The effective rooting depth is 60 inches or more. This soils repels water when dry but has a rapid intake rate once is moist."

105 Baywood fine Sands, 9% to 15% slopes.

(Same description as 104)

Baywood fine sand is hydrologic soil group A

Applicable Curve Numbers for soil group A"

Paved Roads	74-98
Dirt Roads	72-76
Urban	
Low density	69-71
Med. density	71-73
High density	73-75
Commercial	89
Industrial	81
(by lot size)	
1/8 ac or less (65% imp)	77
¼ ac (38% imp)	61
1/3 ac (30% imp)	57
½ ac (25% imp)	54
1 ac (20% imp)	51
2 ac (12% imp)	46
Scrub (native brush)	25-30
Grass-Oak (native oaks with understory of forbs and annual grass)	29-33

Per NOAA Atlas 2- Precipitation-Frequence Atlas of the western United States, VXI-California the following rainfall data applies to the Los Osos/Baywood Park area.

Freq.	Duration	Rainfall
100-yr	24 hr	5.5 to 6 in
50-yr	24 hr	5.0 in
25-yr	24 hr	4.5 in
10-yr	24 hr	4.0 in
5-yr	24 hr	3.0 to 3.5 in
2-yr	24 hr	2.5 in

Because the area is located west of the Sierras and south of San Francisco Bay, a Type I storm (as defined by SCS for TR-20/55) applies.

All calculations represent full buildout conditions with the selection a high applicable Curve Numbers for best representation of non-porous surfaces.

Calculation of Catchment Lag and Time of Concentration

There are many definitions and equations addressing catchment lag and time of concentration. I prefer to define catchment lag as time elapsed from the centroid of effective rainfall to the peak of runoff.

Time of concentration is defined (almost universally) as the time it takes for water to travel from the most remote point in the catchment to the point of concern.

There are loose relationships between the two, the most common being that $t_{lag}= 0.6t_c$.

County of San Luis Obispo Engineering Standards and Specifications uses the relationship $T_c = (11.9L^3/H)^{0.385}$ to determine time of concentration. However, the standard drawing carries the note that the equation is limited to areas of 200 acres or less. One reason for the area limitation is that a shape factor becomes more significant as area increases.

In the their report "San Luis Obispo County Streams Hydrology for Survey Report for Flood Control and Allied Purposes" (Plate 12) by the Army Corps of Engineers adopts the relationship $T_{lag} = 1.2(LxL_{ca} /S^{0.5})^{0.38}$.

By inspecting the two equations, it is apparent that their form is very close, i.e. both are expressions of length divided by slope raised to the 0.38 power, the Corps is really a function of L raised to the 5/2 power, the county's is L raised to the 6/2 power. What is the difference? the Corps lag expression accounts for the shape of the watershed by introducing the L_{ca} factor - accounting for the length to the center of the area of the watershed - a factor that is not considered in the county's equation.

Ponce, in Engineering Hydrology, Principles and Practices (Prentice Hall, 1989) says "In practice, catchment lag is empirically related to catchment characteristics. A general expression for catchment lag is the following:

$t_{LAG} = C(LL_{CA}/S^{0.5})^N$

where L describes length, L_{ca} is a measure of shape, and S relates to relief."

It is clear to me that the County's time of concentration is a simplification of the general equation. The simplification being that an average shape is assumed (no Lca). For comparison, the following table compares the results of the two equations for the special case that $L_{CA} = 0.20L$. It is obvious that similar results are achieved for the special case typical of small watersheds.

Length (miles)	Length to CA	delta H	Tc County	Tc Corps
0.25	0.05	25	0.152 hr	0.158 hr
0.5	0.10	50	0.258 hr	0.267 hr
1	0.20	100	0.441 hr	0.452 hr
1.5	0.30	150	0.602 hr	0.616 hr

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JOB NM:	Los Osos/Baywood Drainage Study			(805)549-8658/eda@edainc.com
CALC BY:	kvc			
CHK BY:				

AREA 1

Tributary at Santa Ysabel at Pasadena / Morro Bay

Area		1853152	sq ft	Hydrigic Soil Group	A		
		43	ac	Average CN	75	6000 sq ft lots typ	
		0.066	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		72	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		6	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		2710	ft	24 hr 2 year rain	2.5	in	
		0.513	mi				
Average Slope		129	ft/mi				
Lca		1180	ft				
		0.223	mi				

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.21	hours
Time of Concentration	0.349078	hours

Peak Flows

100-year	**56**	**cfs**
50-year	**44**	**cfs**
25-year	**35**	**cfs**
10-year	**28**	**cfs**

				Engineering Development Associates
DATE:	28-Aug-97			**ENGINEERING DEVELOPMENT ASSOCIATES**
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JOB NM:	Los Osos/Baywood Drainage Study			(805)549-8658/eda@edainc.com
CALC BY:	kvc			
CHK BY:				

AREA 2

Tributary at north end of Third at Morro Bay (no distinct point of concentration)

Area	1119370	sq ft	Hydrigic Soil Group	A	
	26	ac	Average CN	75	6000 sq ft lots typ
	0.040	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	72	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	6	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	250	ft	24 hr 2 year rain	2.5	in
	0.047	mi			
Average Slope	1394	ft/mi			
Lca	75	ft			
	0.014	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.02	hours
Time of Concentration	0.031489	hours

Peak Flows

100-year	43	cfs
50-year	34	cfs
25-year	29	cfs
10-year	23	cfs

					Engineering Development Associates				
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JOB NM:	Los Osos/Baywood Drainage Study						(805)549-8658/eda@edainc.com		
CALC BY:	kvc								
CHK BY:									

AREA 3

Tributary at north end of Eighth St at Morro Bay

Area		1282506	sq ft		Hydrigic Soil Group		A	
		29	ac		Average CN		75	6000 sq ft lots typ
		0.046	sq mi		24 hr/100 year rain		5.75	in
					24 hr 50 year rain		5	in
Elev at High Point		123	ft msl		24 hr 25 year rain		4.5	in
Elev at Low Point		6	ft msl		24 hr 10 year rain		4	in
					24 hr 5 year rain		3.25	in
Longest Path		2200	ft		24 hr 2 year rain		2.5	in
		0.417	mi					
Average Slope		281	ft/mi					
Lca		685	ft					
		0.130	mi					

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.14	hours
Time of Concentration	0.226108	hours

Peak Flows

100-year	**42**	**cfs**
50-year	**33**	**cfs**
25-year	**28**	**cfs**
10-year	**22**	**cfs**

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Area 4

Tributary at north end of Tenth Street at Morro Bay

Area		2185113	sq ft	Hydrigic Soil Group	A	
		50	ac	Average CN	75	6000 sq ft lots typ
		0.078	sq mi	24 hr/100 year rain	5.75	in
				24 hr 50 year rain	5	in
Elev at High Point		150	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point		6	ft msl	24 hr 10 year rain	4	in
				24 hr 5 year rain	3.25	in
Longest Path		3110	ft	24 hr 2 year rain	2.5	in
		0.589	mi			
Average Slope		244	ft/mi			
Lca		1315	ft			
		0.249	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.20	hours
Time of Concentration	0.339238	hours

Peak Flows

100-year	66	cfs
50-year	52	cfs
25-year	43	cfs
10-year	34	cfs

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Area 5

Tributary to Basin at Santa Ysabel and South Bay Boulevard

Area		1143755	sq ft	Hydrigic Soil Group	A		
		26	ac	Average CN	75	6000 sq ft lots typ	
		0.041	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		120	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		77.5	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		1150	ft	24 hr 2 year rain	2.5	in	
		0.218	mi				
Average Slope		195	ft/mi				
Lca		150	ft				
		0.028	mi				

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.06	hours
Time of Concentration	0.106328	hours

Peak Flows			**Peak Elevation in Basin**	
100-year	41	cfs	84.8	msl
50-year	33	cfs	83.7	msl
25-year	28	cfs	83.1	msl
10-year	22	cfs	82.3	msl

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AREA 6A

Tributary to South end of Second Street at Morro Bay

Area	2680460	sq ft	Hydrigic Soil Group	A		
	62	ac	Average CN	75	6000 sq ft lots typ	
	0.096	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	80	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	6	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	2325	ft	24 hr 2 year rain	2.5	in	
	0.440	mi				
Average Slope	168	ft/mi				
Lca	860	ft				
	0.163	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.17	hours
Time of Concentration	0.277552	hours

Peak Flows

100-year	84	cfs
50-year	66	cfs
25-year	56	cfs
10-year	44	cfs

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Area 6B

Tributary to Eighth Street and El Morro Avenue

Area	4651490	sq ft	Hydrigic Soil Group	A	
	107	ac	Average CN	75	6000 sq ft lots typ
	0.167	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	112	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	24	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	2480	ft	24 hr 2 year rain	2.5	in
	0.470	mi			
Average Slope	187	ft/mi			
Lca	675	ft			
	0.128	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.15	hours
Time of Concentration	0.254126	hours

Peak Flows

100-year	150	cfs
50-year	118	cfs
25-year	97	cfs
10-year	77	cfs

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Area 6C

Tributary to Seventh Street near Paso Robles Avenue

Area	852260	sq ft	Hydrigic Soil Group	A	
	20	ac	Average CN	75	6000 sq ft lots typ
	0.031	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	116	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	60	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	2300	ft	24 hr 2 year rain	2.5	in
	0.436	mi			
Average Slope	129	ft/mi			
Lca	1160	ft			
	0.220	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.20	hours
Time of Concentration	0.325875	hours

Peak Flows

100-year	27	cfs
50-year	21	cfs
25-year	18	cfs
10-year	14	cfs

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Area 6D

Tributary to Sixth Street and El Morro Avenue

Area		775910	sq ft	Hydrigic Soil Group	A		
		18	ac	Average CN	75	6000 sq ft lots typ	
		0.028	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		70	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		21	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		1235	ft	24 hr 2 year rain	2.5	in	
		0.234	mi				
Average Slope		209	ft/mi				
Lca		255	ft				
		0.048	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.08	hours
Time of Concentration	0.131864	hours

Peak Flows

100-year	28	cfs
50-year	22	cfs
25-year	18	cfs
10-year	14	cfs

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Area 7A

Tributary to Pump at 16th & Paso Robles

Area	3624200	sq ft	Hydrigic Soil Group	A		
	83	ac	Average CN	75	6000 sq ft lots typ	
	0.130	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	150	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	70	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	1600	ft	24 hr 2 year rain	2.5	in	
	0.303	mi				
Average Slope	264	ft/mi				
Lca	1000	ft				
	0.189	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.14	hours
Time of Concentration	0.234039	hours

Peak Flows

100-year	**118**	**cfs**
50-year	**93**	**cfs**
25-year	**77**	**cfs**
10-year	**61**	**cfs**

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CHK BY:									
					Area 8A				
Tributary to W. End of Paso Robles Avenue at Morro Bay									
Area		2908928	sq ft		Hydrigic Soil Group		A		
		67	ac		Average CN		75	6000 sq ft lots typ	
		0.104	sq mi		24 hr/100 year rain		5.75	in	
					24 hr 50 year rain		5	in	
Elev at High Point		115	ft msl		24 hr 25 year rain		4.5	in	
Elev at Low Point		6	ft msl		24 hr 10 year rain		4	in	
					24 hr 5 year rain		3.25	in	
Longest Path		3226	ft		24 hr 2 year rain		2.5	in	
		0.611	mi						
Average Slope		178	ft/mi						
Lca		1475	ft						
		0.279	mi						
Time of Concentration/Lag Time									
for n = 0.05									
Lag Time		0.23	hours						
Time of Concentration		0.381502	hours						
Peak Flows									
100-year	86	cfs							
50-year	67	cfs							
25-year	56	cfs							
10-year	43	cfs							

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Area 8B

Tributary to Ninth and Ramona

Area	102922	sq ft	Hydrigic Soil Group	A		
	2	ac	Average CN	75	6000 sq ft lots typ	
	0.004	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	120	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	83	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	515	ft	24 hr 2 year rain	2.5	in	
	0.098	mi				
Average Slope	379	ft/mi				
Lca	100	ft				
	0.019	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.04	hours
Time of Concentration	0.059197	hours

Peak Flows

100-year	4	cfs
50-year	3	cfs
25-year	3	cfs
10-year	2	cfs

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Area 8C

Tributary to 10th adn Ramona

Area	1161512	sq ft	Hydrigic Soil Group	A		
	27	ac	Average CN	75	6000 sq ft lots typ	
	0.042	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	90	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	78	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	1450	ft	24 hr 2 year rain	2.5	in	
	0.275	mi				
Average Slope	44	ft/mi				
Lca	520	ft				
	0.098	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.15	hours
Time of Concentration	0.247482	hours

Peak Flows

100-year	38	cfs
50-year	30	cfs
25-year	25	cfs
10-year	20	cfs

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Area 9

Tributary to 18th, between Ramona and Pismo

Area	679862	sq ft	Hydrigic Soil Group	A		
	16	ac	Average CN	75	6000 sq ft lots typ	
	0.024	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	120	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	93	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	1860	ft	24 hr 2 year rain	2.5	in	
	0.352	mi				
Average Slope	77	ft/mi				
Lca	745	ft				
	0.141	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.17	hours
Time of Concentration	0.280292	hours

Peak Flows

100-year	26	cfs
50-year	20	cfs
25-year	18	cfs
10-year	14	cfs

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Area 10

Tributary to San Luis Ave. at South Bay Boulevard

Area		1484037	sq ft	Hydrigic Soil Group	A	
		34	ac	Average CN	75	6000 sq ft lots typ
		0.053	sq mi	24 hr/100 year rain	5.75	in
				24 hr 50 year rain	5	in
Elev at High Point		120	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point		90	ft msl	24 hr 10 year rain	4	in
				24 hr 5 year rain	3.25	in
Longest Path		1925	ft	24 hr 2 year rain	2.5	in
		0.365	mi			
Average Slope		82	ft/mi			
Lca		1000	ft			
		0.189	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.19	hours
Time of Concentration	0.313329	hours

Peak Flows

100-year	57	cfs
50-year	45	cfs
25-year	38	cfs
10-year	30	cfs

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Area 11

Tributary to South Bay Boulevard, S'ly of Ramona

Area	475216	sq ft		Hydrigic Soil Group	A	
	11	ac		Average CN	75	6000 sq ft lots typ
	0.017	sq mi		24 hr/100 year rain	5.75	in
				24 hr 50 year rain	5	in
Elev at High Point	120	ft msl		24 hr 25 year rain	4.5	in
Elev at Low Point	90	ft msl		24 hr 10 year rain	4	in
				24 hr 5 year rain	3.25	in
Longest Path	1100	ft		24 hr 2 year rain	2.5	in
	0.208	mi				
Average Slope	144	ft/mi				
Lca	510	ft				
	0.097	mi				

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.11	hours
Time of Concentration	0.176338	hours

Peak Flows

100-year	18	cfs
50-year	15	cfs
25-year	13	cfs
10-year	10	cfs

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Area 12

Area		6320000	sq ft		Hydrigic Soil Group	A		
		145	ac		Average CN	75	6000 sq ft lots typ	
		0.227	sq mi		24 hr/100 year rain	5.75	in	
					24 hr 50 year rain	5	in	
Elev at High Point		152	ft msl		24 hr 25 year rain	4.5	in	
Elev at Low Point		20	ft msl		24 hr 10 year rain	4	in	
					24 hr 5 year rain	3.25	in	
Longest Path		3000	ft		24 hr 2 year rain	2.5	in	
		0.568	mi					
Average Slope		232	ft/mi					
Lca		2000	ft					
		0.379	mi					
Time of Concentration/Lag Time								
for n = 0.05								
Lag Time		0.24	hours					
Time of Concentration		0.39625	hours					
Peak Flows								
100-year	129	cfs						
50-year	97	cfs						
25-year	71	cfs						
10-year	56	cfs						

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Area 13

Tributary to Solano and Butte

Area	4512292	sq ft	Hydrigic Soil Group	A
	104	ac	Average CN	75	6000 sq ft lots typ
	0.162	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	150	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	12	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	4430	ft	24 hr 2 year rain	2.5	in
	0.839	mi			
Average Slope	164	ft/mi			
Lca	1330	ft			
	0.252	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.25	hours
Time of Concentration	0.420208	hours

Peak Flows

100-year	**115**	**cfs**
50-year	**88**	**cfs**
25-year	**68**	**cfs**
10-year	**54**	**cfs**

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Area 14

Tributary to Pecho at Binscarth

Area	3150801	sq ft
	72	ac
	0.113	sq mi
Elev at High Point	110	ft msl
Elev at Low Point	8	ft msl
Longest Path	3515	ft
	0.666	mi
Average Slope	153	ft/mi
Lca	1270	ft
	0.241	mi

Hydrigic Soil Group	A	
Average CN	75	6000 sq ft lots typ
24 hr/100 year rain	5.75	in
24 hr 50 year rain	5	in
24 hr 25 year rain	4.5	in
24 hr 10 year rain	4	in
24 hr 5 year rain	3.25	in
24 hr 2 year rain	2.5	in

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.23	hours
Time of Concentration	0.38328	hours

Peak Flows

100-year	93	cfs
50-year	73	cfs
25-year	59	cfs
10-year	47	cfs

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Area 15

Tributary to Doris between Binscarth and Lupine

Area		1318661	sq ft	Hydrigic Soil Group	A		
		30	ac	Average CN	75	6000 sq ft lots typ	
		0.047	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		100	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		6	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		2100	ft	24 hr 2 year rain	2.5	in	
		0.398	mi				
Average Slope		236	ft/mi				
Lca		760	ft				
		0.144	mi				

Time of Concentration/Lag Time

for n = 0.05			
Lag Time		0.14	hours
Time of Concentration		0.238785	hours

Peak Flows

100-year	**42**	**cfs**
50-year	**33**	**cfs**
25-year	**28**	**cfs**
10-year	**22**	**cfs**

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Area 16A

East end of Skyline Drive

Area	1524600	sq ft	Hydrlgic Soil Group	A		
	35	ac	Average CN	75	6000 sq ft lots typ	
	0.055	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	105	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	50	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	2560	ft	24 hr 2 year rain	2.5	in	
	0.485	mi				
Average Slope	113	ft/mi				
Lca	890	ft				
	0.169	mi				

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.19	hours
Time of Concentration	0.314285	hours

Peak Flows

100-year	**48**	**cfs**
50-year	**38**	**cfs**
25-year	**32**	**cfs**
10-year	**25**	**cfs**

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JOB NM:	Los Osos/Baywood Drainage Study				(805)549-8658/eda@edainc.com
CALC BY:	kvc				
CHK BY:					

Area 16B

South Side LOVR - Sump w'ly of Ravenna							
Area		2831400	sq ft	Hydrigic Soil Group	A		
		65	ac	Average CN	75	6000 sq ft lots typ	
		0.102	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		600	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		98	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		5520	ft	24 hr 2 year rain	2.5	in	
		1.045	mi				
Average Slope		480	ft/mi				
Lca		2200	ft				
		0.417	mi				
Time of Concentration/Lag Time							
for n = 0.05							
Lag Time		0.27	hours				
Time of Concentration		0.451253	hours				
Peak Flows							
100-year	56	cfs					
50-year	41	cfs					
25-year	28	cfs					
10-year	22	cfs					

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Area 16C

Tributary to South Bay Boulevard, S'ly of Ramona

Area	4617360	sq ft
	106	ac
	0.166	sq mi
Elev at High Point	960	ft msl
Elev at Low Point	98	ft msl
Longest Path	6800	ft
	1.288	mi
Average Slope	669	ft/mi
Lca	2500	ft
	0.473	mi

Hydrigic Soil Group	A	
Average CN	75	6000 sq ft lots typ
24 hr/100 year rain	5.75	in
24 hr 50 year rain	5	in
24 hr 25 year rain	4.5	in
24 hr 10 year rain	4	in
24 hr 5 year rain	3.25	in
24 hr 2 year rain	2.5	in

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.29	hours
Time of Concentration	0.481425	hours

Peak Flows

100-year	115	cfs
50-year	88	cfs
25-year	68	cfs
10-year	54	cfs

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Area 16D

South Side LOVR - Sump w'ly of Palisades

Area	8760888	sq ft	Hydrigic Soil Group	A	
	201	ac	Average CN	75	6000 sq ft lots typ
	0.314	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	960	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	98	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	6800	ft	24 hr 2 year rain	2.5	in
	1.288	mi			
Average Slope	669	ft/mi			
Lca	2500	ft			
	0.473	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.29	hours
Time of Concentration	0.481425	hours

Peak Flows

100-year	95	cfs
50-year	61	cfs
25-year	30	cfs
10-year	24	cfs

					Engineering Development Associates				
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CALC BY:	kvc								
CHK BY:									
Area 16E & 16F									
South Side LOVR - Sump w'ly of Palisades									
Area		7139454	sq ft		Hydrigic Soil Group		A		
		164	ac		Average CN		75	6000 sq ft lots typ	
		0.256	sq mi		24 hr/100 year rain		5.75	in	
					24 hr 50 year rain		5	in	
Elev at High Point		360	ft msl		24 hr 25 year rain		4.5	in	
Elev at Low Point		98	ft msl		24 hr 10 year rain		4	in	
					24 hr 5 year rain		3.25	in	
Longest Path		5000	ft		24 hr 2 year rain		2.5	in	
		0.947	mi						
Average Slope		277	ft/mi						
Lca		2000	ft						
		0.379	mi						
Time of Concentration/Lag Time									
for n = 0.05									
Lag Time		0.28	hours						
Time of Concentration		0.46543	hours						
Peak Flows									
100-year	79	cfs							
50-year	51	cfs							
25-year	25	cfs							
10-year	20	cfs							

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CALC BY:	kvc			
CHK BY:				

Area 17A

Tributary to Ramona between Broderson and Fourth

Area		3691340	sq ft	Hydrigic Soil Group	A		
		85	ac	Average CN	75	6000 sq ft lots typ	
		0.132	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		105	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		25	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		2325	ft	24 hr 2 year rain	2.5	in	
		0.440	mi				
Average Slope		182	ft/mi				
Lca		780	ft				
		0.148	mi				

Time of Concentration/Lag Time

for n = 0.05			
Lag Time		0.16	hours
Time of Concentration		0.26351	hours

Peak Flows

100-year	119	cfs
50-year	94	cfs
25-year	77	cfs
10-year	61	cfs

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CALC BY:	kvc		
CHK BY:			

Area 17B

San Luis & Nipomo Ave east of 8th Street

Area	2998040	sq ft	Hydrigic Soil Group	A	
	69	ac	Average CN	75	6000 sq ft lots typ
	0.108	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	110	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	50	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	3483	ft	24 hr 2 year rain	2.5	in
	0.660	mi			
Average Slope	91	ft/mi			
Lca	1931	ft			
	0.366	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.30	hours
Time of Concentration	0.494527	hours

Peak Flows

100-year	83	cfs
50-year	64	cfs
25-year	53	cfs
10-year	42	cfs

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CALC BY:	kvc
CHK BY:	

Area 17C

Santa Ynez & Los Olivos Ave east of Palisades

Area	2674645	sq ft	Hydrigic Soil Group	A		
	61	ac	Average CN	75	6000 sq ft lots typ	
	0.096	sq mi	24 hr/100 year rain	5.75	in	
			24 hr 50 year rain	5	in	
Elev at High Point	130	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point	80	ft msl	24 hr 10 year rain	4	in	
			24 hr 5 year rain	3.25	in	
Longest Path	3620	ft	24 hr 2 year rain	2.5	in	
	0.686	mi				
Average Slope	73	ft/mi				
Lca	1180	ft				
	0.223	mi				

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.26	hours
Time of Concentration	0.434013	hours

Peak Flows

100-year	**76**	**cfs**
50-year	**59**	**cfs**
25-year	**48**	**cfs**
10-year	**38**	**cfs**

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CALC BY:	kvc
CHK BY:	

Area 17D

Downtown Los Osos

Area	725793	sq ft	
	17	ac	
	0.026	sq mi	
Elev at High Point	130	ft msl	
Elev at Low Point	105	ft msl	
Longest Path	1165	ft	
	0.221	mi	
Average Slope	113	ft/mi	
Lca	775	ft	
	0.147	mi	

Hydrigic Soil Group	A	
Average CN	75	6000 sq ft lots typ
24 hr/100 year rain	5.75	in
24 hr 50 year rain	5	in
24 hr 25 year rain	4.5	in
24 hr 10 year rain	4	in
24 hr 5 year rain	3.25	in
24 hr 2 year rain	2.5	in

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.13	hours
Time of Concentration	0.221136	hours

Peak Flows

100-year	24	cfs
50-year	19	cfs
25-year	15	cfs
10-year	12	cfs

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CHK BY:	

Area 18

Area	871200	sq ft	Hydrlgic Soil Group	A	
	20	ac	Average CN	75	6000 sq ft lots typ
	0.031	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	117	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	105	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	700	ft	24 hr 2 year rain	2.5	in
	0.133	mi			
Average Slope	91	ft/mi			
Lca	500	ft			
	0.095	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.10	hours
Time of Concentration	0.16099	hours

Peak Flows

100-year	29	cfs
50-year	23	cfs
25-year	19	cfs
10-year	15	cfs

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CALC BY:	kvc
CHK BY:	

Area 19A

Area		1808760	sq ft	Hydrigic Soil Group	A		
		42	ac	Average CN	75	6000 sq ft lots typ	
		0.065	sq mi	24 hr/100 year rain	5.75	in	
				24 hr 50 year rain	5	in	
Elev at High Point		132	ft msl	24 hr 25 year rain	4.5	in	
Elev at Low Point		100	ft msl	24 hr 10 year rain	4	in	
				24 hr 5 year rain	3.25	in	
Longest Path		1680	ft	24 hr 2 year rain	2.5	in	
		0.318	mi				
Average Slope		101	ft/mi				
Lca		600	ft				
		0.114	mi				
Time of Concentration/Lag Time							
for n = 0.05							
Lag Time		0.14	hours				
Time of Concentration		0.23587	hours				
Peak Flows							
100-year	59	cfs					
50-year	46	cfs					
25-year	38	cfs					
10-year	30	cfs					

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CALC BY:	kvc			
CHK BY:				

Area 19B

Area		465485	sq ft	Hydrigic Soil Group	A	
		11	ac	Average CN	75	6000 sq ft lots typ
		0.017	sq mi	24 hr/100 year rain	5.75	in
				24 hr 50 year rain	5	in
Elev at High Point		160	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point		120	ft msl	24 hr 10 year rain	4	in
				24 hr 5 year rain	3.25	in
Longest Path		1115	ft	24 hr 2 year rain	2.5	in
		0.211	mi			
Average Slope		189	ft/mi			
Lca		400	ft			
		0.076	mi			
Time of Concentration/Lag Time						
for n = 0.05						
Lag Time		0.09	hours			
Time of Concentration		0.153414	hours			
Peak Flows						
100-year	17	cfs				
50-year	13	cfs				
25-year	11	cfs				
10-year	9	cfs				

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CALC BY:	kvc				
CHK BY:					

Area 21

Von's Basin

Area	350550	sq ft	Hydrigic Soil Group	A		
	8	ac	Average CN	75	6000 sq ft lots typ
	0.013	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	135	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	118	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	890	ft	24 hr 2 year rain	2.5	in
	0.169	mi			
Average Slope	101	ft/mi			
Lca	365	ft			
	0.069	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.09	hours
Time of Concentration	0.153308	hours

Peak Flows			Peak Elevation in Basin	
100-year	14	cfs	119.7	msl
50-year	12	cfs	118.1	msl
25-year	10	cfs	117.0	msl
10-year	8	cfs	115.8	msl

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Area 22

Fairchild Basin

Area	1256240	sq ft	Hydrigic Soil Group	A	
	29	ac	Average CN	75	6000 sq ft lots typ
	0.045	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	160	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	120	ft msl	24 hr 10 year rain	4	in
	q		24 hr 5 year rain	3.25	in
Longest Path	1700	ft	24 hr 2 year rain	2.5	in
	0.322	mi			
Average Slope	124	ft/mi			
Lca	360	ft			
	0.068	mi			

Time of Concentration/Lag Time

for n = 0.05

Lag Time	0.11	hours
Time of Concentration	0.187451	hours

Peak Flows			Peak Elevation in Basin	
100-year	42	cfs	130.4	msl
50-year	34	cfs	127.3	msl
25-year	28	cfs	125.4	msl
10-year	22	cfs	123.5	msl

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JOB NM:	Los Osos/Baywood Drainage Study						(805)549-8658/eda@edainc.com		
CALC BY:	kvc								
CHK BY:									
					Area 23				
Fairchild Basin									
Area		9539640	sq ft		Hydrigic Soil Group		A		
		219	ac		Average CN		75	6000 sq ft lots typ	
		0.342	sq mi		24 hr/100 year rain		5.75	in	
					24 hr 50 year rain		5	in	
Elev at High Point		160	ft msl		24 hr 25 year rain		4.5	in	
Elev at Low Point		60	ft msl		24 hr 10 year rain		4	in	
					24 hr 5 year rain		3.25	in	
Longest Path		4000	ft		24 hr 2 year rain		2.5	in	
		0.758	mi						
Average Slope		132	ft/mi						
Lca		1500	ft						
		0.284	mi						
Time of Concentration/Lag Time									
for n = 0.05									
Lag Time		0.26	hours						
Time of Concentration		0.441181	hours						
Peak Flows									
100-year	270	cfs							
50-year	210	cfs							
25-year	172	cfs							
10-year	136	cfs							

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CALC BY:	kvc
CHK BY:	

Area 24

Fairchild Basin

Area	4750000	sq ft	Hydrigic Soil Group	A	
	109	ac	Average CN	75	6000 sq ft lots typ
	0.170	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	200	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	20	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	12500	ft	24 hr 2 year rain	2.5	in
	2.367	mi			
Average Slope	76	ft/mi			
Lca	500	ft			
	0.095	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.30	hours
Time of Concentration	0.497592	hours

Peak Flows

100-year	128	cfs
50-year	100	cfs
25-year	82	cfs
10-year	65	cfs

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CALC BY:	kvc				
CHK BY:					

Area 25

Tributary to Los Osos Valley Road at Pecho

Area	17689698	sq ft	Hydrigic Soil Group	A	
	406	ac	Average CN	75	6000 sq ft lots typ
	0.635	sq mi	24 hr/100 year rain	5.75	in
			24 hr 50 year rain	5	in
Elev at High Point	960	ft msl	24 hr 25 year rain	4.5	in
Elev at Low Point	70	ft msl	24 hr 10 year rain	4	in
			24 hr 5 year rain	3.25	in
Longest Path	6500	ft	24 hr 2 year rain	2.5	in
	1.231	mi			
Average Slope	723	ft/mi			
Lca	2200	ft			
	0.417	mi			

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.27	hours
Time of Concentration	0.444247	hours

Peak Flows

100-year	153	cfs
50-year	91	cfs
25-year	35	cfs
10-year	28	cfs

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JOB No.:	8/28/97
JOB NM:	Los Osos/Baywood Drainage Study
CALC BY:	kvc
CHK BY:	

Area 27

Tributary to Los Osos Valley Road at Cimarron

Area	8750000	sq ft		Hydrigic Soil Group	A	
	201	ac		Average CN	55	
	0.314	sq mi		24 hr/100 year rain	5.75	in
				24 hr 50 year rain	5	in
Elev at High Point	440	ft msl		24 hr 25 year rain	4.5	in
Elev at Low Point	80	ft msl		24 hr 10 year rain	4	in
				24 hr 5 year rain	3.25	in
Longest Path	5000	ft		24 hr 2 year rain	2.5	in
	0.947	mi				
Average Slope	380	ft/mi				
Lca	2000	ft				
	0.379	mi				

Time of Concentration/Lag Time

for n = 0.05		
Lag Time	0.26	hours
Time of Concentration	0.438162	hours

Peak Flows

100-year	**115**	**cfs**
50-year	**76**	**cfs**
25-year	**43**	**cfs**
10-year	**34**	**cfs**

CATEGORY: 1
AREA: 6
ALTERNATIVES: 6.2-6.5

ENGINEERING DEVELOPMENT ASSOCIATES
1320 Nipomo Street/San Luis Obispo, CA 93401
phone: (805)549-8658 fax: 805.549.8704 email: eda@edainc.com

PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 6.2						
	CURB & GUTTER	4,000	LF	13.00	$52,000	
	8' ROAD WIDEN, BOTH SIDES	32,000	SF	2.35	$75,200	2" AC / 6" base
	SUBTOTAL:				$127,200	
ALT 6.3						
	CURB & GUTTER	4,000	LF	13.00	$52,000	
	8' ROAD WIDEN, BOTH SIDES	32,000	SF	2.35	$75,200	2" AC / 6" base
	FORCE MAIN	4,500	LF	12.00	$54,000	
	SUBTOTAL:				$181,200	
ALT 6.4						
	CURB & GUTTER	4,000	LF	13.00	$52,000	
	8' ROAD WIDEN, BOTH SIDES	32,000	SF	2.35	$75,200	2" AC / 6" base
	INSTALL WELL FIELD	4	EA	20000.00	$80,000	
	HYDRAULIC STUDY	1	LP	15000.00	$15,000	
	DISCHARGE PIPING	1	LP	25000.00	$25,000	
	SUBTOTAL:				$247,200	
ALT 6.5						
	CURB & GUTTER	4,000	LF	13.00	$52,000	
	8' ROAD WIDEN, BOTH SIDES	32,000	SF	2.35	$75,200	2" AC / 6" base
	INSTALL WELL FIELD	4	EA	20000.00	$80,000	
	HYDRAULIC STUDY	1	LP	15000.00	$15,000	
	DISCHARGE PIPING	1	LP	25000.00	$25,000	
	SUBTOTAL:				$247,200	

CATEGORY: 1
AREA: 6
ALTERNATIVE: 6.6a

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 6.6a-SANTA MARIA AVE					
36" STORM DRAIN	1,400	LF	45.00	$63,000	
30" STORM DRAIN	1,000	LF	40.00	$40,000	
24" STORM DRAIN	800	LF	35.00	$28,000	
ROAD INLET	17	EA	2200.00	$37,400	
SAWCUT & REPLACE ROADWAY	3,200	LF	10.00	$32,000	
MANHOLES	8	EA	2500.00	$20,000	
SUBTOTAL:				**$220,400**	
WITH FULL CURB & GUTTER					
CURB & GUTTER	4,500	LF	13.00	$58,500	
8' WIDENING, BOTH SIDES	36,000	SF	2.35	$84,600	2" AC / 6" base
CROSS GUTTER & SPANDRELS	12	EA	3500.00	$42,000	
SUBTOTAL:				**$185,100**	
WITH HALF CURB & GUTTER					
CURB & GUTTER	2,250	LF	13.00	$29,250	
8' WIDENING, BOTH SIDES	18,000	SF	2.35	$42,300	2" AC / 6" base
CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
SUBTOTAL:				**$92,550**	
ALT 6.6a EL MORO AVE					
3'x5' BOX CULVERT UNDER 1st ST	500	LF	105.00	$52,500	
54" STORM DRAIN	1,400	LF	68.00	$95,200	
48" STORM DRAIN	700	LF	62.00	$43,400	
42" STORM DRAIN	600	LF	55.00	$33,000	
36" STORM DRAIN	600	LF	45.00	$27,000	
24" STORM DRAIN	400	LF	35.00	$14,000	
ROAD INLET	22	EA	2200.00	$48,400	
SAWCUT & REPLACE ROADWAY	4,200	LF	10.00	$42,000	
MANHOLE	12	EA	2500.00	$30,000	
SUBTOTAL:				**$385,500**	

CATEGORY: 1
AREA: 6
ALTERNATIVE: 6.6b

ENGINEERING DEVELOPMENT ASSOCIATES
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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 6.6b-SANTA MARIA AVE					
36" STORM DRAIN (DEEP)	1,100	LF	60.00	$66,000	
36" STORM DRAIN	300	LF	45.00	$13,500	
30" STORM DRAIN	1,000	LF	40.00	$40,000	
24" STORM DRAIN	1,800	LF	35.00	$63,000	
ROAD INLET	17	EA	2200.00	$37,400	
SAWCUT & REPLACE ROADWAY	4,200	LF	10.00	$42,000	
MANHOLES	8	EA	2500.00	$20,000	
SUBTOTAL:				$281,900	
WITH FULL CURB & GUTTER					
CURB & GUTTER	4,500	LF	13.00	$58,500	
8' WIDENING, BOTH SIDES	36,000	SF	2.35	$84,600	2" AC / 6" base
CROSS GUTTER & SPANDRELS	12	EA	3500.00	$42,000	
SUBTOTAL:				$185,100	
WITH HALF CURB & GUTTER					
CURB & GUTTER	2,250	LF	13.00	$29,250	
8' WIDENING, BOTH SIDES	18,000	SF	2.35	$42,300	2" AC / 6" base
CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
SUBTOTAL:				$92,550	
ALT 6.6b EL MORO AVE					
3'x5' BOX CULVERT UNDER 1st ST	500	LF	105.00	$52,500	
54" STORM DRAIN	1,400	LF	68.00	$95,200	
48" STORM DRAIN	700	LF	62.00	$43,400	
42" STORM DRAIN	600	LF	55.00	$33,000	
36" STORM DRAIN	600	LF	45.00	$27,000	
24" STORM DRAIN	400	LF	35.00	$14,000	
ROAD INLET	22	EA	2200.00	$48,400	
SAWCUT & REPLACE ROADWAY	4,200	LF	18.00	$75,600	
MANHOLE	12	EA	2500.00	$30,000	
SUBTOTAL:				$419,100	

CATEGORY: 1
AREA: 6
ALTERNATIVE: 6.6c

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 6.6c					
SWALE	6,000	LF	30.00	$180,000	Roadside swale, both sides
10' WIDENING, BOTH SIDES w/ BASE	60,000	SF	0.75	$45,000	4" CLASS II BASE
CULVERTS	12	EA	900.00	$10,800	
36" STORM DRAIN	1,200	LF	45.00	$54,000	Intercept at 1st St
CULVERTS	12	EA	900.00	$10,800	
MANHOLES	3	EA	2500.00	$7,500	
SUBTOTAL:				$308,100	
WITH FULL CURB & GUTTER					
CURB & GUTTER	4,500	LF	13.00	$58,500	
8' WIDENING, BOTH SIDES	36,000	SF	2.35	$84,600	2" AC / 6" base
CROSS GUTTER & SPANDRELS	12	EA	3500.00	$42,000	
SUBTOTAL:				$185,100	
WITH HALF CURB & GUTTER					
CURB & GUTTER	2,250	LF	13.00	$29,250	
8' WIDENING, BOTH SIDES	18,000	SF	2.35	$42,300	2" AC / 6" base
CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
SUBTOTAL:				$92,550	

CATEGORY: 1
AREA: 7
ALTERNATIVE: 7.2-7.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 7.2 w/ CURB AND GUTTER					
CURB & GUTTER	5,600	LF	13.00	$72,800	
8' WIDENING, BOTH SIDES	44,800	SF	2.35	$105,280	2" AC / 6" base
CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
SUBTOTAL:				$199,080	
ALT 7.2 w/ SWALES					
SWALE	5,600	LF	30.00	$168,000	AC Roadside swale, both sides
10' WIDENING, BOTH SIDES w/ BASE	56,000	SF	0.75	$42,000	4" CLASS II BASE
24" CULVERTS	12	EA	600.00	$7,200	
SUBTOTAL:				$217,200	
ALT 7.3 w/ CURB AND GUTTER					
CURB & GUTTER	5,600	LF	13.00	$72,800	
8' ROAD WIDEN, BOTH SIDES	44,800	SF	2.35	$105,280	2" AC / 6" base
INSTALL WELL FIELD	4	EA	20000.00	$80,000	
HYDRAULIC STUDY	1	LP	15000.00	$15,000	
DISCHARGE PIPING	1	LP	25000.00	$25,000	
SUBTOTAL:				$298,080	
ALT 7.3 w/ SWALES					
SWALE	5,600	LF	30.00	$168,000	AC Roadside swale, both sides
10' WIDENING, BOTH SIDES w/ BASE	56,000	SF	0.75	$42,000	4" CLASS II BASE
24" CULVERTS	12	EA	600.00	$7,200	
INSTALL WELL FIELD	4	EA	20000.00	$80,000	
HYDRAULIC STUDY	1	LP	15000.00	$15,000	
DISCHARGE PIPING	1	LP	25000.00	$25,000	
SUBTOTAL:				$337,200	

CATEGORY: 1
AREA: 7
ALTERNATIVE: 7.2-7.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 7.4 w/ CURB AND GUTTER						
	CURB & GUTTER	5,600	LF	13.00	$72,800	
	8' WIDENING, BOTH SIDES	44,800	SF	2.35	$105,280	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
	RETENTION BASIN	6	AF	16000.00	$100,800	
	SUBTOTAL:				$299,880	
ALT 7.4 w/ SWALES						
	SWALE	5,600	LF	30.00	$168,000	AC Roadside swale, both sides
	10' WIDENING, BOTH SIDES w/ BASE	56,000	SF	0.75	$42,000	4" CLASS II BASE
	CULVERTS	12	EA	600.00	$7,200	
	48" STORM DRAIN	700	LF	60.00	$42,000	
	30" STORM DRAIN	300	LF	40.00	$12,000	
	ROAD INLETS	7	EA	2200.00	$15,400	
	MANHOLES	3	EA	2500.00	$7,500	
	RETENTION BASIN	6	AF	16000.00	$100,800	
	SUBTOTAL:				$394,900	

CATEGORY: 1
AREA: 8
ALTERNATIVE: 8.2 - 8.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 8.2						
	CURB & GUTTER	2,600	LF	13.00	$33,800	
	8' WIDENING, BOTH SIDES	20,800	SF	2.35	$48,880	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	2	EA	3500.00	$7,000	
	18" CULVERT	50	LF	25.00	$1,250	
	SWALE TO PUMP STATION	150	LF	8.50	$1,275	
	PUMP STATION	1	EA	15000.00	$15,000	
	FORCE MAIN	2,200	LF	12.00	$26,400	
	SUBTOTAL:				$133,605	
ALT 8.3						
	CURB & GUTTER	2,600	LF	13.00		
	8' WIDENING, BOTH SIDES	20,800	SF	2.35	$48,880	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	2	EA	3500.00	$7,000	
	18" CULVERT	50	LF	25.00	$1,250	
	SWALE TO PUMP STATION	150	LF	8.50	$1,275	
	PUMP STATION	1	EA	15000.00	$15,000	
	FORCE MAIN	2,800	LF	12.00	$33,600	
	SUBTOTAL:				$107,005	

CATEGORY: 1
AREA: 8
ALTERNATIVE: 8.4-8.5

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 8.4						
	CURB & GUTTER	2,600	LF	13.00	$33,800	
	8' WIDENING, BOTH SIDES	20,800	SF	2.35	$48,880	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	2	EA	3500.00	$7,000	
	18" CULVERT	50	LF	25.00	$1,250	
	SWALE TO PUMP STATION	150	LF	8.50	$1,275	
	PUMP STATION	1	EA	15000.00	$15,000	
	FORCE MAIN	2,200	LF	12.00	$26,400	
	INSTALL WELL FIELD	4	EA	20000.00	$80,000	
	HYDRAULIC STUDY	1	LP	15000.00	$15,000	
	DISCHARGE PIPING	1	LP	25000.00	$25,000	
	SUBTOTAL:				$253,605	
ALT 8.5						
	CURB & GUTTER	2,600	LF	13.00	$33,800	
	8' WIDENING, BOTH SIDES	20,800	SF	2.35	$48,880	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	2	EA	3500.00	$7,000	
	18" CULVERT	50	LF	25.00	$1,250	
	SWALE TO PUMP STATION	150	LF	8.50	$1,275	
	PUMP STATION	1	EA	15000.00	$15,000	
	FORCE MAIN	2,800	LF	12.00	$33,600	
	INSTALL WELL FIELD	4	EA	20000.00	$80,000	
	HYDRAULIC STUDY	1	LP	15000.00	$15,000	
	DISCHARGE PIPING	1	LP	25000.00	$25,000	
	SUBTOTAL:				$260,805	

CATEGORY: 1
AREA: 8
ALTERNATIVE: 8.6-8.8

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 8.6						
	48" STORM DRAIN	1,700	LF	60.00	$102,000	
	48" STORM DRAIN THRU RESIDENTIAL	700	LF	75.00	$52,500	Through residential properties
	ROAD INLET	14	EA	2200.00	$30,800	
	MANHOLE	12	EA	2500.00	$30,000	
	SAWCUT & REPAIR STREET	1,700	LF	10.00	$17,000	
	SUBTOTAL:				$232,300	
ALT 8.7						
	CURB & GUTTER	2,500	LF	13.00	$32,500	
	8' WIDENING, BOTH SIDES	20,000	SF	2.35	$47,000	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	3	EA	3500.00	$10,500	
	18" CULVERT	50	LF	25.00	$1,250	
	CONSTRUCT CO. STD D-4	2	EA	850.00	$1,700	
	CONSTRUCT EARTH LINED SWALE	250	LF	8.50	$2,125	
	SUBTOTAL:				$95,075	
ALT 8.8						
	CURB & GUTTER	2,500	LF	13.00	$32,500	
	8' WIDENING, BOTH SIDES	20,000	SF	2.35	$47,000	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	3	EA	3500.00	$10,500	
	18" CULVERT	50	LF	25.00	$1,250	
	CONSTRUCT CO. STD D-4	2	EA	850.00	$1,700	
	SUBTOTAL:				$92,950	

CATEGORY: 2
AREA: 1
ALTERNATIVE: 1.2-1.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 1.2						
	SWALE TO BAY	200	LF	8.50	$1,700	
	CLEAR & GRUB	1	AC	1500.00	$750	
	SUBTOTAL:				$2,450	
ALT 1.3						
	DEMO & REMOVE ROAD	7,500	SF	2.50	$18,750	
	STREET BARRICADE	1	EA	1000.00	$1,000	
	GRADED PARKING AREA	10,000	SF	0.75	$7,500	Base material only
	WETLAND RESTORATION	1	LS	30000.00	$30,000	
	SUBTOTAL:				$57,250	
ALT 1.4						
	DOUBLE 18" CULVERT	100	LF	50.00	$5,000	
	SWALE TO BAY	200	LF	8.50	$1,700	
	CLEAR & GRUB	1	LS	1500.00	$1,500	
	SUBTOTAL:				$8,200	

CATEGORY: 2
AREA: 14
ALTERNATIVE: 14.1b-14.2d

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 14.1b					
CURB & GUTTER	6,000	LF	13.00	$78,000	
8' WIDENING, BOTH SIDES	48,000	SF	2.35	$112,800	2" AC / 6" base
REGRADE ROADWAY (RAISE)	800	LF	4.00	$3,200	
SWALE TO WETLAND	300	LF	8.50	$2,550	
SUBTOTAL:				$196,550	
ALT 14.1c					
18" STORM DRAIN	80	LF	25.00	$2,000	
ROAD INLET	1	EA	2200.00	$2,200	
SAWCUT & REPAIR STREET	80	LF	10.00	$800	
SUBTOTAL:				$5,000	
ALT 14.2b					
CURB & GUTTER	600	LF	13.00	$7,800	
8' WIDENING, BOTH SIDES	4,800	SF	2.35	$11,280	2" AC / 6" base
REGRADE ROADWAY (RAISE)	600	LF	4.00	$2,400	
RECONSTRUCT EXIST DRIVEWAY	3	EA	650.00	$1,950	
SUBTOTAL:				$23,430	
ALT 14.2c					
SWALE TO BAY	300	LF	8.50	$2,550	
CROSS-GUTTER IN EXIST PAVEMENT	1	EA	3500.00	$3,500	
SUBTOTAL:				$6,050	
ALT 14.2d					
18" STORM DRAIN	300	LF	25.00	$7,500	
ROAD INLET	1	EA	2200.00	$2,200	
SAWCUT & REPAIR STREET	300	LF	10.00	$3,000	
OUTLET STRUCTURE	1	EA	1850.00	$1,850	
SUBTOTAL:				$14,550	

CATEGORY: 2
AREA: 15
ALTERNATIVE: 15.2-15.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 15.2						
	CURB & GUTTER	2,400	LF	13.00	$31,200	
	8' WIDENING, BOTH SIDES	19,200	SF	2.35	$45,120	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	1	EA	3500.00	$3,500	
	OVERSIDE DRAIN	1	EA	650.00	$650	
	SWALE TO BAY	200	LF	8.50	$1,700	
	18" CULVERT (UNDER DORIS)	80	LF	35.00	$2,800	
	SAWCUT & REPAIR STREET	80	LF	10.00	$800	
	SUBTOTAL:				$85,770	
ALT 15.3						
	CURB & GUTTER	400	LF	13.00	$5,200	
	8' WIDENING, BOTH SIDES	3,200	SF	2.35	$7,520	2" AC / 6" base
	OVERSIDE DRAIN (FEARN)	1	EA	650.00	$650	
	SUBTOTAL:				$13,370	

CATEGORY: 3
AREA: 16
ALTERNATIVE: 16.1b-16.1e

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 16.1b					
RETENTION BASIN	35	AF	16000.00	$560,000	
DIVERSION SWALE	7,500	LF	8.75	$65,625	2" AC / 6" base
CLEARING AND GRUBBING	4	AC	2000.00	$8,000	
BASIN OVERFLOW	3	EA	4500.00	$13,500	
HYDROSEED	4	AC	1250.00	$5,000	
SUBTOTAL:				$652,125	
ALT 16.1c					
RETENTION BASIN	35	AF	16000.00	$560,000	
DIVERSION SWALE	7,500	LF	8.50	$63,750	
CLEARING AND GRUBBING	4	AC	2000.00	$8,000	
BASIN HEADWALL	3	EA	1800.00	$5,400	
24" STORM DRAIN	4,500	LF	35.00	$157,500	
STORM DRAIN MANHOLE	10	EA	2500.00	$25,000	
HYDROSEED	4	AC	1250.00	$5,000	
SUBTOTAL:				$824,650	
ALT 16.1d					
CLEARING AND GRUBBING	4	AC	2000.00	$8,000	
RIP-RAP DIVERSION SWALE	10,200	LF	12.50	$127,500	
HYDROSEED	4	AC	1250.00	$5,000	
SUBTOTAL:				$140,500	
ALT 16.1e					
CLEARING AND GRUBBING	4	AC	2000.00	$8,000	
GRADE SWALE	9,600	LF	12.50	$120,000	
GEOTEXTILE LINING	9,600	LF	9.00	$86,400	
HYDROSEED	4	AC	1250.00	$5,000	
SUBTOTAL:				$219,400	

CATEGORY: 3
AREA: 16
ALTERNATIVE: 16.2b-16.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 16.2b FERRELL BASIN STORM DRAIN					
72" STORM DRAIN	2,000	LF	100.00	$200,000	
60" STORM DRAIN	4,000	LF	80.00	$320,000	
54" STORM DRAIN	900	LF	68.00	$61,200	
48" STORM DRAIN	1,000	LF	62.00	$62,000	
42" STORM DRAIN	300	LF	55.00	$16,500	
24" STORM DRAIN	400	LF	35.00	$14,000	
ROAD INLET	12	EA	2200.00	$26,400	
SAWCUT & REPLACE ROADWAY	8,600	LF	18.00	$154,800	
MANHOLE	10	EA	2500.00	$25,000	
SEDIMENTATION BASIN	0.1	AF	16000.00	$1,120	
SUBTOTAL:				$881,020	
ALT 16.2c MORRO SHORES STORM DRAIN					
72" STORM DRAIN	2,000	LF	100.00	$200,000	
60" STORM DRAIN	3,000	LF	80.00	$240,000	
48" STORM DRAIN	1,000	LF	62.00	$62,000	
36" STORM DRAIN	300	LF	50.00	$15,000	
ROAD INLET	12	EA	2200.00	$26,400	
SAWCUT & REPLACE ROADWAY	3,100	LF	18.00	$55,800	
MANHOLE	10	EA	2500.00	$25,000	
SEDIMENTATION BASIN	0.1	AF	16000.00	$1,120	
SUBTOTAL:				$625,320	
ALT 16.3					
CURB & GUTTER	5,250	LF	13.00	$68,250	
8' WIDENING, BOTH SIDES	42,000	SF	2.35	$98,700	2" AC / 6" base
CROSS GUTTER & SPANDRELS	2	EA	3500.00	$7,000	
OVERSIDE DRAIN	1	EA	650.00	$650	
RIP-RAP VELOCITY REDUCER	2	TNS	100.00	$200	
SUBTOTAL:				$174,800	

CATEGORY: 3
AREA: 16
ALTERNATIVE: 16.4a-16.5

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 16.4a						
	CURB & GUTTER	4,800	LF	13.00	$62,400	
	8' WIDENING, BOTH SIDES	38,400	SF	2.35	$90,240	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
	SWALE TO BAY	200	LF	8.50	$1,700	
	18" CULVERT (UNDER RAMONA)	80	LF	35.00	$2,800	
	SAWCUT & REPAIR STREET	80	LF	10.00	$800	
	SLURRY CROSSING	80	LF	7.50	$600	
	SUBTOTAL:				$179,540	
ALT 16.4b						
	CURB & GUTTER	4,800	LF	13.00	$62,400	
	8' WIDENING, BOTH SIDES	38,400	SF	2.35	$90,240	2" AC / 6" base
	CROSS GUTTER & SPANDRELS	6	EA	3500.00	$21,000	
	18" STORM DRAIN	1,000	LF	30.00	$30,000	
	24" STORM DRAIN	900	LF	35.00	$31,500	
	ROAD INLET	7	EA	2200.00	$15,400	
	SAWCUT & REPLACE ROADWAY	4,800	LF	18.00	$86,400	
	MANHOLE	3	EA	2500.00	$7,500	
	SUBTOTAL:				$344,440	
ALT 16.5						
	CROSS GUTTER & SPANDRELS	1	EA	3500.00	$3,500	
	VEGETATED SWALE	200	LF	8.50	$1,700	
	HYDROSEED	1	AC	1250.00	$625	
	OVERSIDE DRAIN	1	EA	650.00	$650	
	SUBTOTAL:				$6,475	

CATEGORY: 3
AREA: 27
ALTERNATIVE: 27.2-27.3

ENGINEERING DEVELOPMENT ASSOCIATES
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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 27.2						
	CLEAN & IMPROVE EXIST CHANNEL	1,000	LF	5.50	$5,500	Improve exist flowline, remove sedimentation
	CREATE MOUND W/ EXCAVATED MAT.	600	LF	3.50	$2,100	Use sediments removed from exist channel to construct
	SUBTOTAL:				$7,600	low berm on westside of channel.
ALT 27.3						
	DOUBLE 18" RCP STORM DRAIN	80	LF	25.00	$2,000	Under Cimarron
	42" RCP STORM DRAIN		LF			East side of Sombrero. Tie to exist swale
	ROAD INLETS		EA			
	MANHOLES		EA			
	INLET/OUTLET STRUCTURE	2	EA	5000.00	$10,000	
	SUBTOTAL:				$12,000	

CATEGORY: 4
AREA: 17
ALTERNATIVE: 17.2a-17.3a

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 17.2a FERRELL RECHARGE BASIN					
CONSTRUCT RECHARGE BASIN	19	AF	16000.00	$304,000	
SUBTOTAL:				**$304,000**	
ALT 17.2b SANTA YNEZ BASIN w/ CURB & GUTTER					
CONSTRUCT RECHARGE BASIN	7	AF	16000.00	$105,600	
CURB & GUTTER	2,400	LF	13.00	$31,200	
8' WIDENING, BOTH SIDES	19,200	SF	2.35	$45,120	2" AC/4" base
SUBTOTAL:				**$181,920**	
ALT 17.2b SANTA YNEZ BASIN w/ SWALE					
CONSTRUCT RECHARGE BASIN	7	AF	16000.00	$105,600	
CONSTRUCT "V" DITCH	2,400	LF	30.00	$72,000	
BASE SHOULDER	24,000	SF	0.75	$18,000	
SUBTOTAL:				**$195,600**	
ALT 17.3a SAN LUIS STORM DRAIN					
18" STORM DRAIN	1,300	LF	30.00	$39,000	
24" STORM DRAIN	800	LF	35.00	$28,000	
30" STORM DRAIN	700	LF	40.00	$28,000	
ROAD INLET	10	EA	2200.00	$22,000	
SAWCUT & REPLACE ROADWAY	2,800	LF	10.00	$28,000	
MANHOLE	3	EA	2500.00	$7,500	
SUBTOTAL:				**$152,500**	

CATEGORY: 4
AREA: 17
ALTERNATIVE: 17.3b-17.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 17.3b FERRELL/NIPOMO STORM DRAIN					
CURB & GUTTER	1,000	LF	13.00	$13,000	
8' WIDENING, BOTH SIDES	8,000	SF	2.35	$18,800	2" AC / 6" base
18" STORM DRAIN	2,700	LF	30.00	$81,000	
30" STORM DRAIN	2,000	LF	40.00	$80,000	
36" STORM DRAIN	2,300	LF	35.00	$80,500	
ROAD INLET	18	EA	2200.00	$39,600	
SAWCUT & REPLACE ROADWAY	7,000	LF	10.00	$70,000	
MANHOLE	5	EA	2500.00	$12,500	
SUBTOTAL:				$395,400	
ALT 17.4 SANTA YNEZ BASIN					
CURB & GUTTER	1,400	LF	13.00	$18,200	
ROAD REGRADE AND PAVE	11,200	SF	2.35	$26,320	2" AC/6" base
SUBTOTAL:				$44,520	

CATEGORY: 4
AREA: 19
ALTERNATIVE: 19.2-19.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 19.2						
	18" STORM DRAIN	60	LF	25.00	$1,500	
	RECHARGE BASIN	0.8	AF	16000.00	$12,800	
	RETENTION BASIN	0.3	AF	16000.00	$4,800	
	SWALE	100	LF	8.50	$850	
	SAWCUT & REPAIR STREET	60	LF	10.00	$600	
	PURCHASE PROPERTY FOR BASIN	60	SF	30.00	$1,800	
	SUBTOTAL:				$22,350	
ALT 19.3						
	18" STORM DRAIN	250	LF	25.00	$6,250	
	SWALE	400	LF	8.50	$3,400	
	SAWCUT & REPAIR STREET	250	LS	10.00	$10	
	SUBTOTAL:				$9,660	
ALT 19.4						
	18" STORM DRAIN	120	LF	25.00	$3,000	
	SWALE	600	LF	8.50	$5,100	
	SAWCUT & REPAIR STREET	120	LS	10.00	$10	
	SUBTOTAL:				$8,110	

CATEGORY: 4
AREA: 21
ALTERNATIVE: 21.2-21.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 21.2					
36" STORM DRAIN	800	LF	45.00		Hydraulically connect basins
ROAD INLET	2	EA	2200.00	$4,400	
MANHOLE	2	EA	2500.00	$5,000	
RECHARGE BASIN	2	AF	16000.00	$35,200	
SUBTOTAL:				$44,600	
ALT 21.3					
(refer to Alternative 17.3b)					

CATEGORY: 4
AREA: 22
ALTERNATIVE: 22.2-22.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 22.2					
(Same as Alt 21.2)					
ALT 22.3					
(Same as Alt 17.3b)					

CATEGORY: 5
AREA: 9
ALTERNATIVE: 9.2-9.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 9.2						
	12" STORM DRAIN	800	LF	25.00	$20,000	
	ROAD INLET	2	EA	2200.00	$4,400	
	OUTLET ENCASEMENT	2	EA	500.00	$1,000	Daylight storm drain to existing roadway
	SAWCUT & REPAIR STREET	800	LF	10.00	$8,000	
	SUBTOTAL:				$33,400	
ALT 9.3						
	18" STORM DRAIN	800	LF	25.00	$20,000	
	12" STORM DRAIN	300	LF	25.00	$7,500	
	INLET	2	EA	1850.00	$3,700	
	SAWCUT & REPAIR STREET	1,100	LF	10.00	$11,000	
	REMOVE EXIST STORM DRAIN	300	LF	8.50	$2,550	
	INSTALL 18" BLEEDER PIPE	500	LF	25.00	$12,500	
	SUBTOTAL:				$57,250	
ALT 9.4						
	DEMO & REMOVE EXIST ROADWAY	14,000	LF	1.25	$17,500	
	GRAVEL FILL TO 15"	662	CY	30.00	$19,860	
	POROUS PAVEMENT	210	TN	40.00	$8,400	
	SUBTOTAL:				$45,760	

CATEGORY: 5
AREA: 10
ALTERNATIVE: 10.2-10.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 10.2						
	18" STORM DRAIN	300	LF	25.00	$7,500	through existing lots
	ROAD INLET	2	EA	2200.00	$4,400	
	RETENTION BASIN	1.6	AF	16000.00	$25,600	
	PURCHASE PROPERTY FOR BASIN	8,700	SF	10.00	$87,000	
	BASIN INLET STRUCTURE	1	EA	1850.00	$1,850	
	CONSTRUCT "V" DITCH	1,200	LF	30.00	$36,000	
	BASE SHOULDER	12,000	SF	0.75	$9,000	
	18" STORM DRAIN	320	LF	35.00	$11,200	
	ROAD INLET	3	EA	2200.00	$6,600	
	SUBTOTAL:				$189,150	
ALT 10.3						
	24" STORM DRAIN	100	LF	35.00	$3,500	
	DETENTION BASIN	1.8	AF	16000.00	$28,800	
	RETENTION BASIN	5.0	AF	16000.00	$80,000	
	ROAD INLET	1	EA	2200.00	$2,200	
	BASIN INLET STRUCTURE	1	LS	1850.00	$1,850	
	PURCHASE PROPERTY FOR BASIN	27,442	SF	10.00	$274,420	
	SUBTOTAL:				$390,770	
ALT 10.4						
	24" STORM DRAIN	100	LF	35.00	$3,500	
	SWALES	1,000	LF	8.50	$8,500	
	SAWCUT & REPAIR STREET	100	LF	10.00	$1,000	
	SUBTOTAL:				$13,000	

CATEGORY: 5
AREA: 18
ALTERNATIVE: 18.2-18.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 18.2						
	(Same as Alt 17.3b)					
ALT 18.3						
	DETENTION BASIN	1.5	AF	16000.00	$24,000	
	RETENTION BASIN	4.0	AF	16000.00	$64,000	
	SWALE	300	LF	8.50	$2,550	
	CROSS-GUTTER & SPANDREL	1	EA	3500.00	$3,500	In existing road
	SUBTOTAL:				$94,050	

CATEGORY: 6
AREA: 2
ALTERNATIVE: 2.2-2.3b

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 2.2						
	MAINTENANCE					Clean debris from roadway
	SUBTOTAL:					
ALT 2.3a						
	CURB & GUTTER	1,400	LF	13.00	$18,200	
	8' WIDENING, BOTH SIDES	11,200	SF	2.35	$26,320	2" AC / 6" base
	OVER SIDE DRAIN	1	EA	650.00	$650	
	18" STORM DRAIN	100	LF	25.00	$2,500	
	RIP-RAP VELOCITY REDUCER	3	TNS	100.00	$300	
	SUBTOTAL:				$47,970	
ALT 2.3b						
	CONSTRUCT "V" DITCH	1,400	LF	30.00	$42,000	
	BASE SHOULDER	14,000	SF	0.75	$10,500	
	OVER SIDE DRAIN	1	EA	650.00	$650	
	18" STORM DRAIN	100	LF	25.00	$2,500	
	RIP-RAP VELOCITY REDUCER	3	TNS	100.00	$300	
	SUBTOTAL:				$55,950	

CATEGORY: 6
AREA: 3
ALTERNATIVE: 3.2-3.4a

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 3.2						
	CURB & GUTTER	4,300	LF	13.00	$55,900	
	8' WIDENING, BOTH SIDES	32,000	SF	2.35	$75,200	2" AC / 6" base
	CROSS-GUTTER AND SPANDREL	7	SF	3500.00	$24,500	
	OVER SIDE DRAIN	1	EA	650.00	$650	
	RIP-RAP VELOCITY REDUCER	2	TNS	100.00	$200	
	SUBTOTAL:				$156,450	
ALT 3.3						
	CONSTRUCT "V" DITCH	4,300	LF	30.00	$129,000	
	BASE SHOULDER	43,000	SF	0.75	$32,250	
	24" STORM DRAIN	1,600	LF	35.00	$56,000	
	OVER SIDE DRAIN	1	EA	650.00	$650	
	RIP-RAP VELOCITY REDUCER	2	TNS	100.00	$200	
	SAWCUT & REPLACE ROADWAY	400	LF	12.00	$4,800	
	SUBTOTAL:				$222,900	
ALT 3.4a						
	24" STORM DRAIN	350	LF	35.00	$12,250	
	18" STORM DRAIN	100	LF	35.00	$3,500	
	ROAD INLET	4	EA	2200.00	$8,800	
	OVER SIDE DRAIN	1	EA	650.00	$650	
	RIP-RAP VELOCITY REDUCER	2	TNS	100.00	$200	
	SAWCUT & REPLACE ROADWAY	450	LF	12.00	$5,400	
	SUBTOTAL:				$30,800	

CATEGORY: 6
AREA: 3
ALTERNATIVE: 3.4b

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 3.4b						
	CONSTRUCT "V" DITCH	4,300	LF	30.00	$129,000	
	BASE SHOULDER	43,000	SF	0.75	$32,250	
	24" STORM DRAIN	1,600	LF	35.00	$56,000	
	18" STORM DRAIN	100	LF	35.00	$3,500	
	ROAD INLET	4	EA	2200.00	$8,800	
	OVER SIDE DRAIN	1	EA	650.00	$650	
	RIP-RAP VELOCITY REDUCER	2	TNS	100.00	$200	
	SAWCUT & REPLACE ROADWAY	1,700	LF	12.00	$20,400	
	SUBTOTAL:				$250,800	

CATEGORY: 6
AREA: 4
ALTERNATIVE: 4.2-4.4

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 4.2					
DIVERSION SWALE	1,800	LF	8.50	$15,300	
GEOTEXTILE LINING	1,800	LF	3.50	$6,300	
CLEAR, GRUB & GRADING	1,800	LF	2.50	$4,500	
SUBTOTAL:				$26,100	
ALT 4.3					
30" STORM DRAIN	1,000	LF	40.00	$40,000	
24" STORM DRAIN	300	LF	35.00	$10,500	
18" STORM DRAIN	600	LF	25.00	$15,000	
ROAD INLETS	6	EA	2200.00	$13,200	
SAWCUT & REPLACE ROADWAY	1,900	LF	10.00	$19,000	
SUBTOTAL:				$97,700	
ALT 4.4					
24" STORM DRAIN	1,400	LF	35.00	$49,000	
18" STORM DRAIN	300	LF	25.00	$7,500	
ENLARGE EXIST BASIN	3	AF	16000.00	$46,400	
PROPERTY PURCHASE FOR BASIN	200	SF	30.00	$6,000	
SAWCUT & REPLACE ROADWAY	1,700	LF	10.00	$17,000	
SUBTOTAL:				$125,900	

CATEGORY: 6
AREA: 11
ALTERNATIVE: 11.2a-11.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 11.2a						
	RETENTION BASIN	2.1	AF	16000.00	$33,600	
	DETENTION BASIN	0.8	AF	16000.00	$12,800	
	OVERSIDE DRAIN	1	EA	650.00	$650	
	CURB & GUTTER	1,400	LF	13.00	$18,200	
	8' WIDENING, BOTH SIDES	11,200	SF	2.35	$26,320	2" AC/6" base
	SUBTOTAL:				$91,570	
ALT 11.2b						
	RETENTION BASIN	2.1	AF	16000.00		
	DETENTION BASIN	0.8	AF	16000.00	$12,800	
	OVERSIDE DRAIN	1	EA	650.00	$650	
	SWALE	800	LF	8.50	$6,800	
	CROSS GUTTER IN EXIST STREET	1	EA	3500.00	$3,500	
	SUBTOTAL:				$23,750	
ALT 11.3						
	SWALE	1,000	LF	8.50	$8,500	
	CROSS GUTTER IN EXIST STREET	1	EA	3500.00	$3,500	
	SUBTOTAL:				$12,000	

CATEGORY: 6
AREA: 13
ALTERNATIVE: 13.2-13.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 13.2						
	SWALE	2,000	LF	8.50	$17,000	
	CLEAN EXIST DEBRIS	1	LS	1850.00	$1,850	
	SUBTOTAL:				$18,850	
ALT 13.3						
	CURB & GUTTER	300	LF	13.00	$3,900	
	REMOVE EXIST CROSS-GUTTER	8	EA	550.00	$4,400	
	REGRADE INTERSECTION	14,500	SF	2.35	$34,075	2" AC/6" base
	REPLACE EXIST CULVERT/INLETS	1	EA	1500.00	$1,500	Solano at Butte Drive
	DOUBLE 36" STORM DRAIN	400	LF	100.00	$40,000	
	ROAD INLET	2	LF	2200.00	$4,400	
	SUBTOTAL:				$88,275	

CATEGORY: 6
AREA: 23
ALTERNATIVE: 23.2-23.3

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT.	ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 23.2						
	30" STORM DRAIN	50	LF	40.00	$2,000	
	ROAD INLET	1	EA	2200.00	$2,200	
	SWALE	200	LF	8.50	$1,700	
	SAWCUT & REPAIR EXIST STREET	50	LF	10.00	$500	
	REPAIR EXIST INLET	1	LS	1500.00	$1,500	
	SUBTOTAL:				$7,900	
ALT 23.3						
	DEMO EXIST ROAD INLET	1	LS	1500.00	$1,500	
	INSTALL CROSS-GUTTER IN EXIST ROAD	1	EA	2200.00	$2,200	
	OVERSIDE DRAIN	1	EA	650.00	$650	
	SWALE	200	LF	8.50	$1,700	
	SUBTOTAL:				$6,050	

CATEGORY: 6
AREA: 25
ALTERNATIVE: 25.1b-25.4b

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PRELIMINARY CONSTRUCTION COST ESTIMATE

CAT. ITEM	QUANT	UNIT	COST/UNIT	COST	DESCRIPTION
ALT 25.1b					Scarify and remove sediments & debris on regular interval
BASIN MAINTENANCE	1	LS	2500.00	$2,500	
ALT 25.1c					
GRADE EXIST UNDEVELOPED LOTS	25	LOT	450.00	$11,250	
ALT 25.3b					
DIVERSION CHANNEL	3,000	LF	30.00	$90,000	Installed in densely vegetated hillside
ALT 25.3c					
DIVERSION CHANNEL	7,250	LF	30.00	$217,500	Installed in densely vegetated hillside
CLEAR, GRUB & GRADE	3	AC	1500.00	$4,500	
SUBTOTAL:				$222,000	
ALT 25.4b					
MAINTENANCE		LS			Clean exist inlets and area surrounding inlets

ENGINEERING DEVELOPMENT ASSOCIATES, INC.
1320 Nipomo Street
SAN LUIS OBISPO, CALIFORNIA 93401
(805) 549-8658 FAX 549-8704

JOB Los Osos Valley Road
SHEET NO. ______ OF ______
CALCULATED BY EDM DATE 4/16/97
CHECKED BY ______ DATE ______
SCALE ______

COUNTY STANDARDS REQUIRE DETENTION BASIN VOLUME BE BASED ON 50 YR EVENT, 10 HOUR DURATION, 10 HOUR INTENSITY. FOR PURPOSES OF SIZING, THE FOLLOWING ESTIMATED DESIGN IS FOR A 2 YR EVENT

ESTIMATED Q:

$Q_2 = CiA$
$= (0.25)(0.175)(295 ac)$
$= 13$ CFS

ESTIMATED VOLUME:

13 CFS × 3600 s × 10 hr = 468,000 CF

ASSUME 8' MAX DEPTH PER CO STD TO ESTIMATE SURFACE AREA:

$\frac{468000 CF}{8'} = 58500$ SF

AREA = 58500 SF (240' x 240')

SEE ATTACHED EXHIBIT

COST:

- DOUBLE EARTHWORK TO CATCH SLOPE
  (468,000 CF × 2)(43560) × 16000 $/AF = $343,800
- DIVERSION SWALES $127500

Σ = $471,300

+ 35% = $635000

TOTAL COST EXCLUDING EIR OR EIS REPORT
$ 635,000

D4-1

Area 4 Solution: Road Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE	3	1	3	3	1	3	2	16	N	SEE APPENDIX E3	1.7
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.8/2.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	1	3	3	17	N	SEE APPENDIX E3	1.9
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP	2	2	3	1	2	3	2	15	N	SEE APPENDIX E3	1.4
DIVERSION-STORM DRAIN									N		1.2
DRAIN TO NEW SEWER SYSTEM									N	SEE APPENDIX E3	1.3/2.2
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	3	3	1	2	2	16	N	SEE APPENDIX E3	1.6
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	SEE APPENDIX E3	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY	2	2	3	2	1	2	3	15	N	NAS-Would not solve problem	
ROAD CLOSURE	3	3	1	3	1	3	3	17	N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	3	3	2	2	3	3	18	Y		1.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	1	2	3	2	3	16	Y		1.5/2.3
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 5 Solution: Road Siltation	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL	2	3	2	3	3	3	3	19	Y		1.2
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM	3	3	3	3	3	3	3	21	Y		1.1
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 6 Solution: Cross lot drainage	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	SEE APPENDIX E3	
CURB AND GUTTER	2	2	3	2	2	2	3	16	Y		2.1
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N		1.2
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	3	1	3	2	2	3	2	16	N	SEE APPENDIX E3	1.4/2.4
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	2	1	2	2	2	14	N	SEE APPENDIX E3	1.3
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	SEE APPENDIX E3	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER	3	2	3	1	2	2	2	15	Y	Upgrade existing pump station	1.1
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	1	3	2	2	3	2	15	Y		1.5
STORM DRAIN-ACROSS PRIVATE PROPERTY ←									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	1	3	3	2	3	17	Y		2.2
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER	3	1	3	3	2	3	2	17	N	SEE APPENDIX E3	1.6/2.3
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 7 Solution: Cross lot drainage	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	2	2	2	3	16	Y		2.1
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	3	1	3	2	2	3	2	16	N	SEE APPENDIX E3	1.4/2.4
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	2	2	2	2	2	15	N	SEE APPENDIX E3	1.3
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	SEE APPENDIX E3	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER	2	2	3	2	2	3	2		N	Install permanent pumps	1.1/1.2
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N		1.5
STORM DRAIN-ACROSS PRIVATE PROPERTY	2	1	3	2	2	3	2	15	Y	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	1	3	3	2	3	17	N	SEE APPENDIX E3	2.2
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER	3	1	3	3	2	3	2	17	N	SEE APPENDIX E3	1.6/2.3
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 8 Solution: Cross lot drainage	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-disruption	
BASIN-SUBSURFACE									N	NAS-disruption	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY	2	2	1	3	3	2	3	16	N	SEE APPENDIX E3	1.5
CURB AND GUTTER	2	2	3	2	2	2	3	16	Y		1.7
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	SEE APPENDIX E3	
DRAIN TO NEW SEWER SYSTEM	3	1	3	2	2	3	2	16	N	SEE APPENDIX E3	1.6
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	SEE APPENDIX E3	
LINEAR PARK	3	2	1	2	3	2	3	16	N	SEE APPENDIX E3	1.3
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT	2	2	3	2	2	3	2	16	Y		1.4
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	SEE APPENDIX E3	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	2	3	2	15	Y		1.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 9 Solution: Cross lot drainage	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE	2	2	3	2	2	3	2	16	Y		1.3
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	2	2	2	3	16	N	SEE APPENDIX E3	1.5
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N		1.7
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	3	1	3	2	2	3	2	16	N	SEE APPENDIX E3	1.6
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	SEE APPENDIX E3	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	1	3	2	2	3	2	15	Y		1.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	1	3	3	2	3	17	Y		1.4
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 10 Solution: Road Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE	3	1	3	3	1	3	2	16	N	SEE APPENDIX E3	1.2
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.1
CHANNEL (CONCRETE)									N	NAS-Safety, cost, not a solution	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	1	3	3	17	N	SEE APPENDIX E3	1.3
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	3	2	3	2	2	2	2	16	N	SEE APPENDIX E3	1.4
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 11 Solution: Road Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE	3	1	3	3	1	3	2	16	N	SEE APPENDIX E3	1.2
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	1	3	3	17	N	SEE APPENDIX E3	1.3
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	3	2	3	2	2	2	2	16	N	SEE APPENDIX E3	1.4
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 12: No Reported Problems	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 13 Solution: Road Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	N	SEE APPENDIX E3	1.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	1	3	3	17	Y		1.1
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Required for new curb & gutter	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	3	3	2	2	3	3	18	Y		1.3
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	2	2	3	2	3	17	Y		1.4
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 14 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	3	2	2	2	15	Y		3.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	2	2	3	17	Y		1.6/3.4
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	2	2	3	1	3	3	2	16	N	SEE APPENDIX E3	1.4/2.1
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	3	2	3	2	3	18	N	SEE APPENDIX E3	1.2
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY	2	2	2	2	2	3	2	15	Y		1.5
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	SEE APPENDIX E3	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS	2	1	1	3	1	3	2	13	N	SEE APPENDIX E3	1.3
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	3	2	2	15	N	SEE APPENDIX E3	1.1/3.2
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE	2	3	2	2	3	2	3	17	N	SEE APPENDIX E3	3.3
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 15 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	2	2	3	17	Y		2.1
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM	2	2	3	1	3	3	2	16	N	SEE APPENDIX E3	2.4
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	3	2	3	2	3	18	N	SEE APPENDIX E3	1.2
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	2	3	2	15	N	SEE APPENDIX E3	1.1/2.2
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE	2	3	2	2	3	2	3	17	Y		1.3/2.3
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 16 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	3	2	2	2	2	15	Y		2.3/3.2/4.2/5.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	3	2	2	3	17	Y		3.1
DIVERSION-BERM	2	3	2	2	3	2	3	17	Y		2.4
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	SEE APPENDIX E3	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	3	2	3	2	3	2	3	18	N	SEE APPENDIX E3	6.3
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT	3	2	2	2	2	3	2	16	Y		2.2
LINEAR PARK									N	SEE APPENDIX E3	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER	2	2	2	2	2	3	2	15	N	SEE APPENDIX E3	1.1/1.2
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY	2	2	3	3	2	2	3	17	N	SEE APPENDIX E3	5.2/6.1
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	3	2	2	3	2	2	16	N	SEE APPENDIX E3	.1/3.3/4.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	3	2	2	3	2	3	17	Y		2.5/6.2
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 17 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-percolation	
BASIN-SUBSURFACE	3	2	3	2	2	3	2	17	N	SEE APPENDIX E3	1.4
BASIN-TERMINAL/RECHARGE	2	2	3	2	2	2	2	15	Y		1.3/2.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	SEE APPENDIX E3	
CURB AND GUTTER	2	2	3	3	2	2	3	17	Y		1.1
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	SEE APPENDIX E3	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN	2	2	3	2	2	2	2	15	N	SEE APPENDIX E3	1.6
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	3	2	2	15	Y		1.2
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY	2	2	2	3	2	2	2	15	Y		2.2
VEGETATED SWALE	2	3	2	2	3	2	3	17	Y		1.5
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 18 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.1
CHANNEL (CONCRETE)	2	2	2	3	2	2	2	15	Y		1.3
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER	2	2	3	2	2	2	3	16	N	SEE APPENDIX E3	1.5
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP	2	2	2	2	2	3	3	16	Y		1.4
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	SEE APPENDIX E3	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	3	3	2	2	3	17	Y		1.2
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 19 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	3	3	2	2	3	17	Y		1.2
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 20 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY	2	2	3	2	2	2	2	15	Y		1.3
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	3	3	2	2	3	17	Y		1.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 21 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY	2	2	3	2	2	2	2	15	Y		1.3
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	3	3	2	2	3	17	Y		1.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 22 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION	2	2	2	2	2	2	3	15	Y	enlarge existing	1.2
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	2	2	2	3	15	Y		1.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	3	3	2	2	3	17	Y		1.1/1.4
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 23 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	3	3	2	2	3	17	N	SEE APPENDIX E3	1.2/2.2
CHANNEL (CONCRETE)	2	2	2	2	2	2	3	15	Y		2.3
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY	2	2	3	3	2	2	3	17	Y		1.1
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	2	2	3	15	Y		2.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 24 Solution: Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM	3	3	3	3	3	3	3	21	Y		1.1
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Area 25 Solution-Madera Basin	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	3	2	2	2	15	Y		1.2/2.2/3.1/4.1/5.2
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM	3	3	3	3	3	3	3	21	Y		1.1
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS	2	2	3	3	3	3	3	19	Y	regrade lots	2.1
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	3	2	3	3	2	3	3	19	Y		1.3/5.1
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 26: Existing Basin Maintenance	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE									N	NAS-Safety, cost, not a solution	
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY									N	NAS-maintain surface runoff in roadway	
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM									N	NAS-No positive grade	
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	NAS-Depth to groundwater	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM	3	3	3	3	3	3	3	21	Y		1.1
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS									N	NAS-Cost	
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN									N	NAS-No positive drainage	
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	

EVALUATION CUTOFF: 14

LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)

Area 27 Solution-Flooding	Aesthetics	Cost	Disruption	Environmental & Regulatory	Flexibility	Land Area	Technical Aspects	POINTS	PROCEED W/ EVALUATION	Comments	Items
BASIN-DETENTION									N	NAS-depth to gw	
BASIN-SUBSURFACE									N	NAS-depth to gw	
BASIN-TERMINAL/RECHARGE	2	2	2	3	2	2	2	15	N	SEE APPENDIX E3	2.4/3.1
CHANNEL (CONCRETE)									N	NAS-Safety	
CHANNEL-ACROSS PRIVATE PROPERTY	2	3	3	2	3	2	3	18	Y		1.1/1.3/2.1/2.2/2.5/3.4
CURB AND GUTTER									N	NAS-Would not solve problem	
DIVERSION-BERM	2	2	2	2	3	2	3	16	N	SEE APPENDIX E3	1.2/3.2
DIVERSION-PUMP									N	NAS-Cost	
DIVERSION-STORM DRAIN									N	NAS-Against natural grade	
DRAIN TO NEW SEWER SYSTEM									N	NAS-Legal issues	
EROSION CONTROL									N	NAS-Would not solve problem	
FRENCH DRAIN									N	SEE APPENDIX E3	
FRENCH DRAIN WITH UTILITY									N	NAS-quantity of water	
FRENCH DRAIN-DIVERSION									N	NAS-quantity of water	
FRENCH DRAIN-OVER FAULT									N	NAS-distance	
LINEAR PARK									N	NAS-Landarea & cost	
MAINTENANCE PROGRAM									N	NAS-Would not solve problem	
POROUS PAVEMENT									N	NAS-Cost & lifespan	
PUMP TO AGRICULTURE									N	NAS-Cost	
PUMP TO ALTERNATE AQUIFER									N	NAS_Cost	
PUMP TO BAY									N	NAS-Cost	
PUMP TO CREEK									N	NAS-Cost	
PUMP TO FAULT									N	NAS-Cost	
PUMP-OTHER									N	NAS-Cost	
PURCHASE PROPERTY									N	NAS-Cost	
RAISE FOUNDATIONS	2	1	3	3	1	3	2	15	N	SEE APPENDIX E3	2.3/3.3
RECONSTRUCT ROADWAY									N	NAS-Would not solve problem	
ROAD CLOSURE									N	NAS-Would not solve problem	
STORM DRAIN W/ PIPE JACKING									N	NAS-Cost	
STORM DRAIN	2	2	2	2	3	2	2	15	Y		1.4
STORM DRAIN-ACROSS PRIVATE PROPERTY									N	NAS-Cost & tech aspects	
STORM DRAIN-CONCURRENT W/ SEWER									N	NAS-Proximity to new sewer	
STORM DRAIN-OVER FAULT									N	NAS-No positive drainage	
SWALE- ACROSS PRIVATE PROPERTY									N	NAS-Safety, would not solve problem	
VEGETATED SWALE									N	NAS-Would not solve problem	
PRODUCTION LOWER TO UPPER AQUIFER									N	NAS-Regulatory requirements	
WETLAND CONSTRUCTION									N	NAS-Location and cost	
EVALUATION CUTOFF: 14											
LEGEND: Y-YES, N-NO, NAS-Not a Solution, (refer to Appendix E1 for more definitions)											

Appendix E3
SECONDARY SCREENING OF ALTERNATIVES

REFINEMENT OF PRELIMINARY SCREENING ALTERNATIVE PROJECTS

Initially, the alternative projects presented in Appendix E2 were derived using the screening process, as described therein. These screening criteria, which included: *Aesthetics; Cost; Disruption; Environmental & Regulatory; Flexibility; Land Area*; and *Technical Aspects*, were applied to each drainage areas proposed project, and took into consideration the physical characteristics and limitations (surface and subsurface conditions).

In general, most alternatives presented in Section III were further analyzed in this paper. However, certain alternatives were omitted for the reasons outline below and by applying the same screening criteria:

Area 1 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Channel/Swale across Private Property	*Technical Aspects:* All alternatives were used as discussed in Section III. Lot flooding was an assumed problem and not a documented problem. Existing cross lot drainage is contained, no additional improvements required.
Curb & Gutter	*Technical Aspects:* Low lying area, curb & gutter will not be beneficial
Diversion Berm	*Technical Aspects:* Low lying area, no secondary outlet for diversion berm

Area 2 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Concrete Channel	Revised to overside drain, included in this report.
Erosion Control	*Disruption*: Would require erosion control adjacent to roadway, disrupting traffic and off street parking
Storm Drain to Bay	*Cost*: Surface improvements would be sufficient to provide drainage.

Area 3 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Erosion Control	*Disruption*: Would require erosion control adjacent to roadway, disrupting traffic and off street parking

Area 4 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Curb & Gutter	*Cost*: Surface improvements would be sufficient to provide drainage.
Diversion Pump	*Cost/Maintenance:* Surface (channel) or subsurface (storm drain) improvements would provide a better and less expensive long term solution.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Surface water problem. Long term maintenance and failure.
Purchase Property	*Cost*: Would require purchase of approximately eight developed lots.
Subsurface Basin	*Cost*: Approximately $250 per linear foot and the required storage exceeds the derived benefit

Area 6 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Channel/Swale Across Private Property	*Technical Aspects:* Quantity of expected flow may exceed available land area to construct surface conveyance system. Safety issue having major conveyance system running above ground and between homes.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Requires a long term solution. French drains subject to maintenance and limited life.
Pump to Agriculture	*Cost*: Long distance to agriculture would require expensive pump stations and support infrastructure. Water quality problems may limit agricultural crop usage.
Use Upper Aquifer	*Environmental & Regulatory*: May not be suitable for human contact or for landscaping vegetation.

Area 7 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Requires a long term solution. French drains subject to maintenance and limited life.
Pumping (Diversion to Agriculture, over fault)	*Cost*: Long distance to agriculture would require expensive pump stations and support infrastructure. Water quality problems may limit agricultural crop usage.
Swale Across Private Property	*Disruption:* Alternative surface improvements would be sufficient to provide drainage.
Use Upper Aquifer	*Environmental & Regulatory*: May not be suitable for human contact or for landscaping vegetation.

Area 8 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Basins	*Land Area*: Limited open space available to construct basin.
Channel/Swale Across Private Property	*Technical Aspects:* Quantity of expected flow may exceed available land area to construct surface conveyance system. Safety issue having major conveyance system running above ground and between homes.
Diversion Storm Drain	*Technical Aspects:* Low lying area, no secondary outlet for diversion storm drain that would adequately remove water from depressed areas.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain over Fault	*Technical Aspects:* Topography. Surface water problem. Long term maintenance and failure.
Linear Park	*Technical Aspects & Land Area*: Limited open space available to utilize, would require summer irrigation, severe slopes, road closure or engineered culverts.
Purchase Property	*Cost*: Would require purchase of approximately twelve developed lots.

Area 9 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Curb & Gutter	*Cost*: Other surface improvements would be sufficient to provide drainage at less cost.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
Pump Across Fault	*Cost*: Long distance to discharge would require expensive pump stations and support infrastructure. Other alternatives provide better cost/benefit ratios.

Area 10 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Curb & Gutter	*Cost*: Other surface improvements would be sufficient to provide drainage at less cost.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
Subsurface Basin	*Cost*: Approximately $250 per linear foot and the required storage exceeds the derived benefit

Area 11 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Curb & Gutter	*Cost*: Other surface improvements would be sufficient to provide drainage at less cost.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
Subsurface Basin	*Cost*: Approximately $250 per linear foot and the required storage exceeds the derived benefit

Area 13 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Basin	*Cost*: Not necessary since originally designed facilities need repair.

Area 14 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Bay influence groundwater will not drain.
Pump	*Technical Aspects*: Pumping of Bay influenced groundwater would require a well field of full time pump stations, and may induce saltwater intrusion.
Raise Foundations	*Cost*: Should be on a case by case basis and paid for by landowner.
Storm Drain (Diversion)	*Technical Aspects*: Bay influence, shallow depth to groundwater and flat slopes would cause construction and operational problems.
Swale	*Technical Aspects*: Bay influence, shallow depth to groundwater and flat slopes would cause operational problems.

Area 15 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Bay influence groundwater will not drain.
Storm Drain (Diversion)	*Technical Aspects*: Bay influence, shallow depth to groundwater and flat slopes would cause construction and operational problems.

Area 16 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution.
French Drain	*Technical Aspects*: Bay influence groundwater will not drain.
Linear Park	*Technical Aspects & Land Area*: Limited open space available to utilize, would require summer irrigation, road closure or engineered culverts.
Pump Station	*Cost*: Existing pump station should be adequate provided that drainage from Los Osos Valley Road in captured and rerouted.
Reconstruct Roadway	*Technical Aspects:* Would create damming affect along Ramona Drive which may compound flooding problems.
Storm Drain (Diversion)	*Technical Aspects*: Bay influence, shallow depth to groundwater and flat slopes may cause construction and operational problems.

Area 17 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Channel/Swale Across Private Property	*Technical Aspects:* Curb & Gutter or roadside swales would better contain surface runoff from leaving streets.
Drain to Sewer	*Environmental & Regulatory*: Not a long term solution. Large quantity of surface flows would be introduced.
French Drain	*Technical Aspects*: Requires a long term solution. French drains subject to maintenance and limited life.
Subsurface Basin	*Cost*: Approximately $250 per linear foot and the required storage exceeds the derived benefit

Area 18 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Curb & Gutter	*Cost*: Other surface improvements would be sufficient to provide drainage at less cost.
Pump (Diversion)	*Cost*: Long distance to agriculture would require expensive pump stations and support infrastructure. Water quality problems may limit agricultural crop usage.

Area 19 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
	All alternatives were used as discussed in Section III. Lot flooding was an assumed problem and not a documented problem

Area 20 Alternatives Not Further Considered in Section IV. *Incorporated with Area 17B. All alternatives were used.*

Area 21 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
	All alternatives were used as discussed in Section III. Lot flooding was an assumed problem and not a documented problem

Area 22 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
	All alternatives were used as discussed in Section III. Lot flooding was an assumed problem and not a documented problem

Area 23 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Basin	*Cost*: Other minor modifications should significantly offset costs associated with basin construction

Area 25 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Basin	*Cost*: Enlargement of exist basins may not be necessary.
Linear Park	*Technical Aspects:* Existing storm drain facility adequate. Incorporation of linear park would require purchase of existing developed lot and provisions for safe outlet across Skyline Drive.
Purchase Property	*Cost:* Existing problems not considered significant enough to condemn existing properties.

Area 27 Alternatives Not Further Considered in Section IV.

Project	Reason for Removal
Basin	*Technical Aspects*: Shallow depth to groundwater.
Diversion Berm	*Technical Aspects:* Diversion to Los Osos Creek may require excessive land and would significantly impact existing properties.
French Drain	*Technical Aspects*: Requires a long term solution. French drains subject to maintenance and limited life.
Raise Foundations	*Cost*: Should be on a case by case basis and paid for by landowner.

Appendix E4

Recommended Alternatives Projects

This calculation sheet provides a screening of the Alternative Projects as presented in Section IV of the Draft Report. The results (shown as capitalized and highlighted) are the Recommended Alternative Projects as presented in Section V of the Draft Report.

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	[redacted]	POSSIBLE PERMITS: SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 1: Santa Ysabel, Pasadena to 600 Block																			
1.2	1.2	No Project	-	- -	-	- -	-	-		Y									
1.2	1.2	Earth Swale	3	3	3	1	2	12		Y	Y		Y		Y			B	$2.5
1.3	**1.3**	**ROAD CLOSURE**	**2**	**3**	**3**	**2**	**3**	**13**		**Y**	**Y**				**Y**		**Y**	**B**	**$57.3**
1.4	1.4	Culvert	2	3	3	1	2	11		Y	Y	Y	Y	Y	Y	Y	Y	B	$8.2
Area 2: Santa Lucia																			
2.1	2.1	No Project	-	-	-	-	-	-											
2.2	**2.2**	**MAINTENANCE**	**3**	**3**	**3**	**1**	**2**	**12**											
2.3	2.3	Curb & Gutter	2	3	3	1	3	12		Y	Y	Y	Y	Y	Y	Y	Y	B	$44.1
2.4	2.4	Swale	2	3	2	1	3	11		Y	Y	Y	Y	Y	Y	Y	Y	B	$56.0

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	POSSIBLE PERMITS: EIR	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 3: Santa Ysabel 700 Block to 1200 Block																			
3.1	3.1	No Project	-	-	-	-	-	-											
3.2	3.2	Curb & Gutter	2	3	3	2	2	12		Y									$145.3
3.3	3.3	Roadside Swale	2	3	2	1	2	10		Y								B	$222.9
3.4a	3.4a	Storm Drain	1	2	3	1	3	10		Y	Y	Y	Y	Y	Y	Y	Y	B	$30.8
3.4b	3.4b	Storm Drain to Swale	1	2	2	1	2	8		Y	Y	Y	Y	Y	Y	Y	Y	B	$250.8
3.5	**3.5**	**MAINTENANCE**	**3**	**3**	**3**	**2**	**1**	**12**											
Area 4: Santa Ysabel, 1300 Block to 1600 Block																			
4.1	4.1	No Project	-	-	-	-	-	-											
4.2	**4.2**	**DIVERSION SWALE**	**3**	**3**	**3**	**2**	**2**	**13**		Y	Y		Y		Y	Y	Y	**B**	**$26.1**
4.3	**4.3**	**STORM DRAIN**	**2**	**2**	**3**	**1**	**3**	**11**		Y	Y		Y		Y	Y	Y	**B**	**$97.7**
4.4	4.4	Diversion Storm Drain	2	3	3	1	3	12		Y								D	$125.9
4.5	4.5	Alternative Combination	-	-	-	-	-	-		Y									
Area 6: El Moro Depression																			
6.1	6.1	No Project	-	-	-	-	-	-											
6.2	6.2	Pump to Bay	2	1	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	B	$116.0
6.3	6.3	Pump to Los Osos Creek	1	2	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$170.0
6.4	6.4	Pump to Bay-Expanded	2	1	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	B	$236.0
6.5	6.5	Pump to Los Osos Creek-Expanded	1	2	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$236.0
6.6a	**6.6a**	**EL MORO STORM DRAIN**	**3**	**2**	**2**	**1**	**3**	**11**		Y	Y	Y	Y	Y	Y	Y	Y	**B**	**$385.5**
		SANTA MARIA STORM DRAIN	**2**	**2**	**2**	**1**	**3**	**10**		Y	Y	Y	Y	Y	Y	Y	Y	**B**	**$220.4**
6.6b	**6.6b**	**EL MORO STORM DRAIN**	**3**	**2**	**2**	**1**	**3**	**11**		Y	Y	Y	Y	Y	Y	Y	Y	**B**	**$419.1**
		SANTA MARIA STORM DRAIN	**2**	**2**	**2**	**1**	**3**	**10**		Y	Y	Y	Y	Y	Y	Y	Y	**B**	**$281.9**
6.6c	6.6c	El Moro Storm Drain	-	-	-	-	-	-		Y	Y	Y	Y	Y	Y	Y	Y	B	

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	POSSIBLE PERMITS: [illegible]	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 7: Paso Robles Depression																			
7.1	7.1	No Project	-	-	-	-	-	-											
7.2	7.2	Pump to Los Osos Creek	2	2	3	1	2	10	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$183.4
7.3	7.3	Pump to Los Osos Creek-Expanded	2	2	3	1	2	10	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$282.4
7.4	**7.4**	**PASO ROBLES BASIN**	**2**	**2**	**2**	**3**	**3**	**12**		**Y**								**D**	**$284.2**
Area 8: Ramona/Pismo Depression																			
8.1	8.1	No Project	-	-	-	-	-	-											
8.2	8.2	Pump to Bay	2	1	3	1	2	9	Y	Y		Y	Y	Y	Y	Y	Y	B	$126.3
8.3	8.3	Pump to Los Osos Creek	1	2	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$99.7
8.4	8.4	Pump to Bay-Expanded	2	1	3	1	2	9	Y	Y		Y	Y	Y	Y	Y	Y	B	$246.3
8.5	8.5	Pump to Los Osos Creek-Expanded	1	2	3	1	2	9	Y	Y	Y	Y	Y	Y	Y	Y	Y	C	$253.5
8.6	**8.6**	**RAMONA STORM DRAIN**	**2**	**2**	**2**	**1**	**3**	**10**		**Y**	**Y**		**Y**	**Y**	**Y**	**Y**	**Y**	**B**	**$232.3**
8.7	**8.7**	**CHANNEL**	**3**	**3**	**3**	**2**	**3**	**14**		**Y**									**$88.1**
8.8	**8.8**	**CURB & GUTTER**	**3**	**3**	**3**	**2**	**3**	**14**		**Y**									**$86.0**
Area 9: 14th to 17th Street Depression between Pismo & Ramona																			
9.1	9.1	No Project	-	-	-	-	-	-											
9.2	**9.2**	**STORM DRAIN**	**2**	**2**	**3**	**2**	**2**	**11**		**Y**									**$33.4**
9.3	9.3	Cross Lot Drainage	2	3	2	2	1	10		Y									$57.3
9.4	9.4	Porous Pavement	2	3	3	3	2	13		Y									$45.8

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	POSSIBLE PERMITS:	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 10: San Luis Avenue, 1300 Block to South Bay Boulevard																			
10.1	10.1	No Project	-	-	-	-	-	-											
10.2	**10.2**	**15th STREET BASIN**	**2**	**3**	**2**	**3**	**3**	**13**		**Y**								**D**	**$189.2**
10.3	**10.3**	**SAN LUIS AVENUE BASIN**	**2**	**3**	**2**	**3**	**3**	**13**		**Y**								**D**	**$390.8**
10.4	**10.4**	**SAN LUIS SWALE**	**3**	**3**	**3**	**1**	**2**	**12**		**Y**									**$13.0**
Area 11: Ramona, 1600 Block to South Bay Boulevard																			
11.1	11.1	No Project	-	-	-	-	-	-											
11.2a	11.2a	Retention Basin	2	2	2	3	3	12		Y								D	$87.7
11.2b	11.2b	Retention Basin	2	2	2	3	3	12		Y								D	$23.8
11.3	**11.3**	**SWALE**	**3**	**3**	**3**	**1**	**2**	**12**		**Y**									**$12.0**
Area 13: Monarch/Sea Pines																			
13.1	13.1	No Project	-	-	-	-	-	-											
13.2	**13.2**	**SWALE/TERMINAL TRENCH**	**3**	**3**	**3**	**3**	**3**	**15**		**Y**									**$18.9**
13.3	13.3	Curb & Gutter	2	3	3	2	3	13		Y									$90.5

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	POSSIBLE PERMITS: [redacted]	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 14: Cuesta by the Sea, West																			
Binscarth Drive																			
14.1a	14A.1	No Project	-	- -	-	- -	- -	-											
14.1b	**14A.2**	**CURB & GUTTER**	**2**	**2**	**3**	**1**	**2**	**10**		**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**B**	**$179.8**
14.1c	**14A.3**	**STORM DRAIN**	**3**	**3**	**3**	**1**	**2**	**12**		**Y**									**$5.0**
Pine Avenue																			
14.2a	14B.1	No Project	-	-	-	-	-	-											
14.2b	**14B.2**	**CURB & GUTTER**	**2**	**3**	**3**	**2**	**2**	**12**		**Y**									**$21.8**
14.2c	14B.3	Swale	3	3	2	2	2	12		Y									$6.0
14.2d	14B4	Storm Drain	2	3	3	2	3	13		Y									$14.6
Area 15: Cuesta by the Sea, East																			
15.1	15.1	No Project	-	-	-	-	-	-											
15.2	**15.2**	**CURB & GUTTER-BINSCARTH**	**2**	**2**	**3**	**1**	**2**	**10**		**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**B**	**$79.0**
15.3	**15.3**	**CURB & GUTTER-FEARN**	**2**	**2**	**3**	**1**	**2**	**10**		**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**B**	**$12.3**

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA							POSSIBLE PERMITS										DISCHARGE POINT	COST (In thousands)
			COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL		EIR	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE			
Area 16: Broderson, Skyline & Pine (see Area 25)																					
Sedimentation on Highland Drive																					
16.1a	**16.A1**	**NO PROJECT**	-	-	-	-	-	-													
16.1b	16.A2	Basin, Spill to Street	1	1	1	3	2	8		Y*	Y			Y			Y			D	$650.3
16.1c	16.A3	Basin, Spill to Storm Drain	1	1	1	3	2	8		Y*	Y			Y			Y			D	$824.7
16.1d	16.A4	Rock Berm	3	2	3	1	1	10			Y										$140.5
16.1e	16.A5	Intercept Channel	2	2	2	2	2	10			Y	Y	Y	Y	Y	Y	Y	Y		B	$219.4
																* EIR/EIS due to endangered species					
Los Osos Valley Road																					
16.2a	16.B1	No Project	-	-	-	-	-	-													
16.2b	**16.B2**	**STORM DRAIN TO FERRELL BASIN**	1	2	2	3	3	11			Y									D	$881.0
		Basin per 17.2a)																			$304.0
16.2c	16.B3	Storm Drain to Morro Shores	1	2	2	3	3	11			Y									D	$625.3
Minor Local Problems																					
16.3	**16.C1**	**CURB & GUTTER-BINSCARTH**	2	3	3	1	2	11			Y	Y		Y	Y	Y	Y	Y		B	$160.1
16.4a	**16.C2**	**CURB & GUTTER-PINE**	2	3	3	1	2	11			Y	Y		Y	Y	Y	Y	Y		B	$166.1
16.4b	16.C3	Storm Drain-Pine Street	2	1	3	1	3	10			Y	Y		Y	Y	Y	Y	Y		B	$331.0
16.5	**16.C4**	**CROSS GUTTER-RAMONA**	3	2	3	1	4	13			Y	Y		Y	Y	Y	Y	Y		B	$6.5
Area 17: Los Osos Valley Road																					
17.1	17.1	No Project	-	-	-	-	-	-													
17.2a	**17.2a**	**FERRELL RECHARGE BASIN**	2	2	1	3	2	10			Y									D	$304.0
17.2b	**17.2b**	**SANTA YNEZ STORM DRAIN**	3	3	2	3	2	13			Y									D	$175.2
17.3a	**17.3a**	**SAN LUIS STORM DRAIN**	2	3	3	2	2	12			Y									D	$152.5
17.3b	17.3b	Ferrell/Nipomo Storm Drain	1	3	3	2	2	11			Y	Y		Y	Y	Y	Y	Y		B	$392.6
17.4	17.4	Curb & Gutter	2	3	3	1	2	11			Y										$46.2

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	POSSIBLE PERMITS: [redacted]	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 18: Nipomo, 1200 Block to Mountain View																			
18.1	18.1	No Project	-	-	-	-	-	-											
18.2	**18.2**	**STORM DRAIN**	**1**	**2**	**3**	**2**	**2**	**10**		**Y**								**D**	**$392.6**
18.3	18.3	Retention Basin	2	2	2	3	2	11		Y								D	$94.1
Area 19: Santa Ynez at Mountain View																			
19.1	19.1	No Project	-	-	-	-	-	-											
19.2	19.2	Retention Basin	2	2	1	3	3	11		Y						Y*		D	$22.4
19.3	19.3	Storm Drain	2	2	3	2	2	11		Y									$9.7
19.4	**19.4**	**SWALE**	**3**	**3**	**2**	**3**	**2**	**13**		**Y**									**$8.1**
Area 21: Vons Basin																			
21.1	**21.1**	**NO PROJECT**	-	-	-	-	-	-											
21.2	21.2	Retention Basin	2	2	1	3	3	11		Y								D	$44.6
21.3	21.3	Storm Drain	1	3	3	2	3	12		Y									$392.6
Area 22: Fairchild Basin																			
22.1	22.1	No Project	-	-	-	-	-	-											$44.6
22.2	**22.2**	**RETENTION BASIN**	**2**	**2**	**1**	**3**	**3**	**11**		**Y**									**$392.6**
22.3	22.3	Storm Drain	1	3	3	2	3	12		Y									

*Possible endangered snail habitat

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA						POSSIBLE PERMITS								DISCHARGE POINT	COST (In thousands)
			COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE		
Area 23: South Bay Boulevard & Los Osos Valley Road to Los Osos Creek																		
23.1	23.1	No Project	-	-	-	-	-	-										
23.2	23.2	Storm Drain	2	2	2	1	2	9	Y	Y	Y				Y	Y	C	$7.9
23.3	**23.3**	**CROSS GUTTER**	3	2	3	1	2	11	Y	Y	Y				Y	Y	C	$6.1
Area 25: Cabrillo Estates																		
Cabrillo Estates																		
25.1a	25.A1	No Project	-	-	-	-	-	-										
25.1b	**25.A2**	**MAINTENANCE**	3	3	3	3	2	14										$2.5
25.1c	25.A3	Grading	2	3	3	2	2	12	Y									$11.3
Vista de Oro																		
25.2a	**25.B1**	**NO PROJECT**	-	-	-	-	-	-										
Redfield Woods (see Area 16)																		
25.3a	**25.C1**	**NO PROJECT**	-	-	-	-	-	-										
25.3b	25.C2	Rock Berm	3	2	3	1	1	10	Y									$90.0
25.3c	25.C3	Intercept Channel	2	2	2	2	2	10	Y									$222.0
Los Osos Valley Road at Pecho Valley Road																		
25.4a	25.D1	No Project	-	-	-	-	-	-										
25.4b	**25.D2**	**MAINTENANCE**	3	3	3	1	1	11										

Y=Possible Requirement

Preferred projects in Bold

ITEM (WP No. 2)	ITEM (Draft Report)	DESCRIPTION	SCREENING CRITERIA: COST	ENVIRONMENTAL & REGULATORY	LAND AREA	WATER CONSERVATION	FLOOD RISK	TOTAL		POSSIBLE PERMITS:	SLO CO	RWQCB	DFG	DHS	DPR	CCC (Appeal Zone)	USFWS	ACOE	DISCHARGE POINT	COST (In thousands)
Area 27: Los Osos Valley Road at Cimmaron																				
27.1	27.1	No Project	-	-	-	-	-	-												
27.2	27.2	Maintenance	3	3	3	1	1	11												$7.6
27.3	27.3	Swale	3	3	3	2	2	13											C	$25.0
27.4	**27.4**	**STORM DRAIN**	**2**	**2**	**3**	**2**	**3**	**12**											**C**	

APPENDIX F

BENEFIT ANALYSIS

Appendix F1
DISCUSSION

1. COMMUNITY BENEFIT METHOD

- The Community Benefit area would consist of all 5127 properties within the geographically defined Community Service Area 9J. Each of the property owners within CSA 9J would equally contribute to drainage improvements throughout the Service Area.
- Precedence has been set to pursue this methodology with the introduction of the existing $16 per year drainage fee. This may be overturned in court with the passage of Proposition 218.
- Benefits derived from the improvements within the Community may be considered unequally shared. Those residences at or near the improvement would receive a larger portion of the benefit by experiencing reduced flooding. The further away from the improvement the less perceived benefit. However, the entire community would benefit from reduced roadway flooding and exposure to pathogens from failed septic systems.

II. AREA BENEFIT METHOD

- The Area Benefit would consist of only those properties within a physically defined watershed (Areas 1 through 27) that contribute storm water runoff to the problem areas. Properties within the defined surface drainage areas in which the improvements are proposed would pay their fair share cost of constructing the improvements.
- If the drainage area also experiences flooding associated with high groundwater, the defined subsurface drainage region in which the improvements are proposed will also contribute to the fair share cost of constructing the improvements within the area.
- Costs would be equally distributed to each property owner within the surface and/or subsurface area.
- Benefits derived from the improvements within the area may be considered unequally shared. Those residences at or near the improvement would receive a larger portion of the benefit by experiencing reduced flooding. However, the entire community would benefit from reduced roadway flooding and exposure to pathogens from failed septic systems with no contributed cost of the improvement.

ALTERNATIVE METHODS

As an alternative to equal project cost distribution as presented above, costs could be distributed based on the following methodologies. These methodologies would apply to both the *Community Benefit Method* and the *Area Benefit Method.*

A. VOLUME OF FLOOD

- Estimate the flood surface elevation and area of inundation for the 100 year storm event.
- Estimate the total volume of water which drains to the problem areas
- Determine the drainage areas which drain to the problem area
- Calculate the fair share cost of each area equal to:
  1. Overall improvement cost multiplied by the (volume generated per area/total volume of water);
  2. Areas outside of the flood prone area do not contribute financially to the improvements; or,
  3. Other areas pay proportional share based on need by the community as a whole. A mechanism to establish the weight of a community area will need to be determined.

B. DISTANCE FROM PROBLEM

- Determine a problem area and the area in which the problem occurs
- Calculate the fair share cost for the improvement costs within the problem area based on:
  1. Areas outside of the area in which the problem occurs do not contribute financially to the improvements; or,
  2. Areas further away from the flooding area pay a progressively smaller percentage of the cost to construct the improvements within the area. The mechanism for determining the percentage could be inversely proportional to the distance from the problem.

C. AREA WEIGHTING

- Determine the problem areas - i.e., an area which experiences significant flooding.
- Determine the impact of the flooding area on the ability of the community to access homes, commercial area and recreational areas.
- Rank the areas in terms of how much benefit they derive from a particular area within the community
- Rank the flood prone areas in terms of the impact on the community.
- Determine the fair share cost of each area based on the percentage of impact the area has on the flood prone area - could be based on traffic generation rates into the area, volumes of flood water generated by the area, distance from the flood area
- Multiply the fair share cost of the improvements by the weighted rank of the flood area
- Areas which do not generate a benefit from the flood prone area or are below the ranking threshold of the flood area do not contribute to the cost of improvement within the flood prone area.
- Areas outside of the problem drainage area do not contribute financially in the cost to construct the improvements.

Understanding Proposition 218

Elizabeth G. Hill, Legislative Analyst ♦ December 1996

LAO
55 Years of Service

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This report was prepared by Marianne O'Malley under the supervision of Mac Taylor.

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Legislative Analyst's Office

UNDERSTANDING PROPOSITION 218

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APPENDIX II

Text of Proposition 218

This initiative measure adds Articles XIII C and D to the California Constitution

RIGHT TO VOTE ON TAXES ACT

SECTION 1. TITLE. This act shall be known and may be cited as the "Right to Vote on Taxes Act."

SECTION 2. FINDINGS AND DECLARATIONS. The people of the State of California hereby find and declare that Proposition 13 was intended to provide effective tax relief and to require voter approval of tax increases. However, local governments have subjected taxpayers to excessive tax, assessment, fee and charge increases that not only frustrate the purposes of voter approval for tax increases, but also threaten the economic security of all Californians and the California economy itself. This measure protects taxpayers by limiting the methods by which local governments exact revenue from taxpayers without their consent.

SECTION 3. VOTER APPROVAL FOR LOCAL TAX LEVIES. Article XIII C is added to the California Constitution to read:

ARTICLE XIII C

SECTION 1. Definitions. As used in this article:

(a) "General tax" means any tax imposed for general governmental purposes.

(b) "Local government" means any county, city, city and county, including a charter city or county, any special district, or any other local or regional governmental entity

(c) "Special district" means an agency of the state, formed pursuant to general law or a special act, for the local performance of governmental or proprietary

functions with limited geographic boundaries including, but not limited to, school districts and redevelopment agencies.

(d) "Special tax" means any tax imposed for specific purposes, including a tax imposed for specific purposes, which is placed into a general fund.

SEC. 2. Local Government Tax Limitation. Notwithstanding any other provision of this Constitution.

(a) All taxes imposed by any local government shall be deemed to be either general taxes or special taxes. Special purpose districts or agencies, including school districts, shall have no power to levy general taxes.

(b) No local government may impose, extend, or increase any general tax unless and until that tax is submitted to the electorate and approved by a majority vote. A general tax shall not be deemed to have been increased if it is imposed at a rate not higher than the maximum rate so approved. The election required by this subdivision shall be consolidated with a regularly scheduled general election for members of the governing body of the local government, except in cases of emergency declared by a unanimous vote of the governing body.

(c) Any general tax imposed, extended, or increased, without voter approval, by any local government on or after January 1, 1995, and prior to the effective date of this article, shall continue to be imposed only if approved by a majority vote of the voters voting in an election on the issue of the imposition, which election shall be held within two years of the effective date of this article and in compliance with subdivision (b).

(d) No local government may impose, extend, or increase any special tax unless and until that tax is submitted to the electorate and approved by a two-thirds vote. A special tax shall not be deemed to have been increased if it is imposed at a rate not higher than the maximum rate so approved.

SEC. 3. Initiative Power for Local Taxes, Assessments, Fees and Charges Notwithstanding any other provision of this Constitution, including, but not limited to, Sections 8 and 9 of Article II, the initiative power shall not be prohibited or otherwise limited in matters of reducing or repealing any local tax, assessment, fee or charge. The power of initiative to affect local taxes, assessments, fees and charges shall be applicable to all local governments and neither the Legislature nor any local government charter shall impose a signature requirement higher than that applicable to statewide statutory initiatives.

SECTION 4. ASSESSMENT AND PROPERTY RELATED FEE REFORM

Article XIII D is added to the California Constitution to read:

ARTICLE XIII D

SECTION 1. Application. Notwithstanding any other provision of law, the provisions of this article shall apply to all assessments, fees and charges, whether imposed pursuant to state statute or local government charter authority. Nothing in this article or Article XIII C shall be construed to:

(a) Provide any new authority to any agency to impose a tax, assessment, fee, or charge.

(b) Affect existing laws relating to the imposition of fees or charges as a condition of property development.

(c) Affect existing laws relating to the imposition of timber yield taxes.

SEC. 2. Definitions. As used in this article:

(a) "Agency" means any local government as defined in subdivision (b) of Section 1 of Article XIII C.

(b) "Assessment" means any levy or charge upon real property by an agency for a special benefit conferred upon the real property. "Assessment" includes, but is not limited to, "special assessment," "benefit assessment," "maintenance assessment" and "special assessment tax."

(c) "Capital cost" means the cost of acquisition, installation, construction, reconstruction, or replacement of a permanent public improvement by an agency.

(d) "District" means an area determined by an agency to contain all parcels which will receive a special benefit from a proposed public improvement or property-related service.

(e) "Fee" or "charge" means any levy other than an ad valorem tax, a special tax, or an assessment, imposed by an agency upon a parcel or upon a person as an incident of property ownership, including a user fee or charge for a property related service.

(f) "Maintenance and operation expenses" means the cost of rent, repair, replacement, rehabilitation, fuel, power, electrical current, care, and supervision necessary to properly operate and maintain a permanent public improvement.

(g) "Property ownership" shall be deemed to include tenancies of real property where tenants are directly liable to pay the assessment, fee, or charge in question.

(h) "Property-related service" means a public service having a direct relationship to property ownership.

(i) "Special benefit" means a particular and distinct benefit over and above general benefits conferred on real property located in the district or to the public at large. General enhancement of property value does not constitute "special benefit."

SEC. 3. Property Taxes, Assessments, Fees and Charges Limited. (a) No tax, assessment, fee, or charge shall be assessed by any agency upon any parcel of property or upon any person as an incident of property ownership except:

(1) The ad valorem property tax imposed pursuant to Article XIII and Article XIII A.

(2) Any special tax receiving a two-thirds vote pursuant to Section 4 of Article XIII A.

(3) Assessments as provided by this article.

(4) Fees or charges for property related services as provided by this article.

(b) For purposes of this article, fees for the provision of electrical or gas service shall not be deemed charges or fees imposed as an incident of property ownership.

SEC. 4. Procedures and Requirements for All Assessments. (a) An agency which proposes to levy an assessment shall identify all parcels which will have a special benefit conferred upon them and upon which an assessment will be imposed. The proportionate special benefit derived by each identified parcel shall be determined in relationship to the entirety of the capital cost of a public improvement, the maintenance and operation expenses of a public improvement, or the cost of the property related service being provided. No assessment shall be imposed on any parcel which exceeds the reasonable cost of the proportional special benefit conferred on that parcel. Only special benefits are assessable, and an agency shall separate the general benefits from the special benefits conferred on a parcel. Parcels within a district that are owned or used by any agency, the State of California or the United States shall not be exempt from assessment unless the agency can demonstrate by clear and convincing evidence that those publicly owned parcels in fact receive no special benefit.

(b) All assessments shall be supported by a detailed engineer's report prepared by a registered professional engineer certified by the State of California.

(c) The amount of the proposed assessment for each identified parcel shall be calculated and the record owner of each parcel shall be given written notice by mail of the proposed assessment, the total amount thereof chargeable to the entire district, the amount chargeable to the owner's particular parcel, the duration of the payments, the reason for the assessment and the basis upon which the amount of the proposed assessment was calculated, together with the date, time, and location of a public hearing on the proposed assessment. Each notice shall also include, in a conspicuous place thereon, a summary of the procedures applicable to the completion, return, and tabulation of the ballots required pursuant to subdivision (d), including a disclosure statement that the existence of a majority protest, as defined in subdivision (e), will result in the assessment not being imposed.

(d) Each notice mailed to owners of identified parcels within the district pursuant to subdivision (c) shall contain a ballot which includes the agency's address for receipt of the ballot once completed by any owner receiving the notice whereby the owner may indicate his or her name, reasonable identification of the parcel, and his or her support or opposition to the proposed assessment.

(e) The agency shall conduct a public hearing upon the proposed assessment not less than 45 days after mailing the notice of the proposed assessment to record owners of each identified parcel. At the public hearing, the agency shall consider all protests against the proposed assessment and tabulate the ballots. The agency shall not impose an assessment if there is a majority protest. A majority protest exists if, upon the conclusion of the hearing, ballots submitted in opposition to the assessment exceed the ballots submitted in favor of the assessment. In tabulating the ballots, the ballots shall be weighted according to the proportional financial obligation of the affected property.

(f) In any legal action contesting the validity of any assessment, the burden shall be on the agency to demonstrate that the property or properties in question receive a special benefit over and above the benefits conferred on the public at large and that the amount of any contested assessment is proportional to, and no greater than, the benefits conferred on the property or properties in question.

(g) Because only special benefits are assessable, electors residing within the district who do not own property within the district shall not be deemed under this Constitution to have been deprived of the right to vote for any assessment. If a court determines that the Constitution of the United States or other federal law requires otherwise, the assessment shall not be imposed unless approved by a two-thirds vote of the electorate in the district in addition to being approved by the property owners as required by subdivision (e).

SEC. 5. Effective Date. Pursuant to subdivision (a) of Section 10 of Article II, the provisions of this article shall become effective the day after the election unless otherwise provided. Beginning July 1, 1997, all existing, new, or increased assessments shall comply with this article. Notwithstanding the foregoing, the following assessments existing on the effective date of this article shall be exempt from the procedures and approval process set forth in Section 4:

(a) Any assessment imposed exclusively to finance the capital costs or maintenance and operation expenses for sidewalks, streets, sewers, water, flood control, drainage systems or vector control. Subsequent increases in such assessments shall be subject to the procedures and approval process set forth in Section 4.

(b) Any assessment imposed pursuant to a petition signed by the persons owning all of the parcels subject to the assessment at the time the assessment is initially imposed. Subsequent increases in such assessments shall be subject to the procedures and approval process set forth in Section 4.

(c) Any assessment the proceeds of which are exclusively used to repay bonded indebtedness of which the failure to pay would violate the Contract Impairment Clause of the Constitution of the United States.

(d) Any assessment which previously received majority voter approval from the voters voting in an election on the issue of the assessment. Subsequent *increases in those assessments shall be subject to the procedures and approval process set forth in Section 4.*

SEC. 6 Property Related Fees and Charges. (a) Procedures for New or Increased Fees and Charges. An agency shall follow the procedures pursuant to this section in imposing or increasing any fee or charge as defined pursuant to this article, including, but not limited to, the following:

(1) The parcels upon which a fee or charge is proposed for imposition shall be identified. The amount of the fee or charge proposed to be imposed upon each parcel shall be calculated. The agency shall provide written notice by mail of the proposed fee or charge to the record owner of each identified parcel upon which the fee or charge is proposed for imposition, the amount of the fee or charge proposed to be imposed upon each, the basis upon which the amount of the proposed fee or charge was calculated, the reason for the fee or charge, together with the date, time, and location of a public hearing on the proposed fee or charge.

(2) The agency shall conduct a public hearing upon the proposed fee or charge not less than 45 days after mailing the notice of the proposed fee or charge to the record owners of each identified parcel upon which the fee or charge is proposed for imposition. At the public hearing, the agency shall consider all protests against the proposed fee or charge. If written protests against the proposed fee or charge are presented by a majority of owners of the identified parcels, the agency shall not impose the fee or charge.

(b) Requirements for Existing, New or Increased Fees and Charges. A fee or charge shall not be extended, imposed, or increased by any agency unless it meets all of the following requirements:

(1) Revenues derived from the fee or charge shall not exceed the funds required to provide the property related service.

(2) Revenues derived from the fee or charge shall not be used for any purpose other than that for which the fee or charge was imposed.

(3) The amount of a fee or charge imposed upon any parcel or person as an incident of property ownership shall not exceed the proportional cost of the service attributable to the parcel.

(4) No fee or charge may be imposed for a service unless that service is actually used by, or immediately available to, the owner of the property in question. Fees or charges based on potential or future use of a service are not permitted. Standby charges, whether characterized as charges or assessments, shall be classified as assessments and shall not be imposed without compliance with Section 4.

(5) No fee or charge may be imposed for general governmental services including, but not limited to, police, fire, ambulance or library services, where the service is available to the public at large in substantially the same manner as it is to property owners. Reliance by an agency on any parcel map, including, but not limited to, an assessor's parcel map, may be considered a significant factor in determining whether a fee or charge is imposed as an incident of property ownership for purposes of this article. In any legal action contesting the validity of a fee or charge, the burden shall be on the agency to demonstrate compliance with this article.

(c) Voter Approval for New or Increased Fees and Charges. Except for fees or charges for sewer, water, and refuse collection services, no property related fee or charge shall be imposed or increased unless and until that fee or charge is submitted and approved by a majority vote of the property owners of the property subject to the fee or charge or, at the option of the agency, by a two-thirds vote of the electorate residing in the affected area. The election shall be conducted not less than 45 days after the public hearing. An agency may adopt procedures similar to those for increases in assessments in the conduct of elections under this subdivision.

(d) Beginning July 1, 1997, all fees or charges shall comply with this section.

SECTION 5. LIBERAL CONSTRUCTION. The provisions of this act shall be liberally construed to effectuate its purposes of limiting local government revenue and enhancing taxpayer consent.

SECTION 6. SEVERABILITY. If any provision of this act, or part thereof, is for any reason held to be invalid or unconstitutional, the remaining sections shall not be affected, but shall remain in full force and effect, and to this end the provisions of this act are severable.

APPENDIX G

SUPPORT DOCUMENTATION

G1: County of San Luis Obispo Contract
G2: Short Term Solutions

AGREEMENT FOR PROFESSIONAL ENGINEERING SERVICES FOR PRELIMINARY ENGINEERING EVALUATION, LOS OSOS / BAYWOOD PARK COMMUNITY DRAINAGE PROJECT FOR SAN LUIS OBISPO COUNTY

THIS AGREEMENT is made by and between the COUNTY OF SAN LUIS OBISPO ("COUNTY") on behalf of San Luis Obispo County Service Area No. 9J ("CSA 9J"), and Engineering Development Associates ("ENGINEER"), at San Luis Obispo, California, on May 28, 1996.

In consideration of the mutual promises contained herein, it is hereby mutually agreed as follows:

ARTICLE I. DESCRIPTION OF PROJECT

The project shall be known as the "Preliminary Engineering Evaluation, Los Osos / Baywood Park Community Drainage Project for San Luis Obispo County Service Area No. 9J", ("PROJECT").

The PROJECT will consist of the preparation of a report investigating drainage problems and solutions to eliminate flooding within CSA 9J. The report will be based upon research, meeting with community representatives and members of the public, engineering calculations and judgement, and regulatory and environmental requirements.

ARTICLE II. ENGINEER'S SERVICES

A. Performance and Control

ENGINEER agrees that all of ENGINEER'S work hereunder shall be performed to the satisfaction of COUNTY, in strict accordance with all applicable statutory provisions, and with the provisions of this AGREEMENT, as all such rules, regulations, laws and/or other applicable provisions are extant during the life of this AGREEMENT.

In the event of conflict between any of such requirements, the order of priority shall be:

1. Applicable Statutory Provisions.

2. This AGREEMENT.

B. Scope of Services

The ENGINEER will perform the services which are described in the tasks which follow:

1. Phase I: Project Initiation and Alternatives Selection

a. Task 1: Attend Initial Meetings and Gather Information

Attend an initial meeting at the County Engineering office to discuss the project and expectations regarding the project. Submit a rough outline of Working Papers(Task 3 and 9) and Report(Task 11 and 13). Submit a timeline for the completion of all Tasks in the PROJECT.

Review and tabulate flooding problems within the community, beginning with the list of flood-related damage in Los Osos during 1995 (CSA-9 Advisory Group Water/Drainage Committee) and including those set forth in Task 2.

Attend initial meeting in the Community of Los Osos to meet the Water/Drainage Subcommittee of the CSA-9 Advisory Group ("Water/Drainage Subcommittee") and gather information on community concerns and areas of interest.

Review existing County files documenting community drainage problems and those efforts made in implementing drainage solutions within the community. ENGINEER shall identify the need for any additional information or data. Review timeline and adjust if necessary.

The ENGINEER will identify, quantify and evaluate all existing storm drain facilities in CSA 9J and the tributary area of the identified problem zones including inlets, pipes, pumps, channels, basins and discharges for current hydraulic capacity.

Deliverables for Task 1:	Presentation materials, Agendas, and Minutes for Task 1 meetings
Meetings for Task 1:	Initial meeting w/County (1) Community Meeting (1)

b. Task 2: Problem Identification

The ENGINEER will identify and describe the source, cause, impact, and outlet of flooding/high ground water problems in the areas on the following list:

1) El Moro Corridor from 11th Street west to 3rd Street
2) The Ramona Avenue/Pismo Avenue swale from 11th Street west to 3rd Street
3) Paso Robles Avenue between 14th and 18th Street
4) Santa Ynez at Fairchild westerly to 11th Street
5) The Pine/Ash/Broderson area
6) Pecho Road and Grove Street
7) Los Osos Valley Road from 10th Street to the area west of Palisades Avenue
8) Los Osos Valley Road at Cimmaron and the northerly drainage
9) Other sites as identified through initial investigations and discussions with the Water/Drainage Subcommittee and the community.

The analysis of these localized flooding problems in CSA 9J may require analysis of the entire drainage basin.

All work performed for Task 2 to Task 13 will utilize one foot topographic mapping. This mapping will be provided by the COUNTY to the ENGINEER on June 3, 1996. However, the ENGINEER should be prepared if the mapping is delayed. The TIME OF PERFORMANCE will be extended one and a half days for every day of delay. No additional compensation will be provided for any delay in providing one foot contour topographic mapping.

Prepare exhibits of each area that will serve as a basis for future discussion and depiction of projects to solve the flooding problems.

Prepare a map of shallow groundwater elevations for the Spring of 1995.

Prepare a map of depth to groundwater contours.

Submit summary of problems identified with exhibits and maps to the COUNTY and address comments received.

Deliverables for Task 2: Summary of problem areas including exhibits of each area.

Map of shallow groundwater elevations for the Spring of 1995. (based upon previous studies)

Map of depth to groundwater contours.

c. Task 3: Develop Solutions

Identify and discuss solutions to each drainage problem identified including but not limited to the solutions in the following list:

Traditional Solutions
Pipes, outlets and basins.
Place drainage pipe concurrently with sewer pipe.
Place sewer immediately for use short-term for drainage.
Drain over fault line to low groundwater.
Curb and gutter, swales, and regrading.
Drainage diversion around community.

Non-Traditional Solutions
Wetlands construction.
Parks/retention basin property acquisition including homes.
Enhanced recharge and retention.
Minimize flows with low flush toilets, non-tile roofs, more pervious surfaces.
Localized pumping of groundwater into sewer system.
Creek management.
 Property owner maintained program.
 Property Acquisition.
Utility trenches as French drains.
Storm drain easements as pedestrian corridors.
Change water use from ower acquifer to upper acquifer.

There may be other solutions which may resolve problems or the ones above may not be viable. The ENGINEER is responsible for conceiving and evaluating potential solutions. Solutions must address current need and that needed to meet anticipated build out of the CSA 9J.

Meet with COUNTY and consultant for Los Osos sewer project to discuss the status of the sewer project and to coordinate sharing of information.

Establish criteria for evaluating and prioritizing solutions. This criteria should include consideration of financial affordability. Use criteria to qualitatively screen potential solutions to analyze further. Document screening process.

Prepare Working Paper No. 1, Problem Identification and Solutions Development, compiling the work completed in Tasks 1, 2, and 3.

Submit Working Paper No. 1 and discuss comments with COUNTY.

Deliverables for Task 3:	Working Paper No.1 (9 bound originals, one unbound, and on 3.5" disk in approved format), Minutes for meetings
Meetings for Task 3:	Coordinate with Sewer Project (1). Discuss comments on Working Paper No.1 with COUNTY (1).

2. **Phase II : Preliminary Analysis**

a. <u>Task 4: Determine Impacts on Flooding</u>

Analyze the solutions identified for further analysis in Task 3 to determine the impact on flooding. Each project site will be addressed independently and then with respect to a community wide solution. Determine potential solution requirements and the apparent best routing locations for projects. Prepare a list with supporting exhibits of potential solutions for each of the problem areas. Recommended solutions may be different then those determined for analysis in Phase I.

b. <u>Task 5: Determine Groundwater and Water Quality Impacts</u>

Evaluate each solution's impact in terms of groundwater recharge and quality, potential discharges to Morro Bay, water quality of discharges, and overall water use strategies involving domestic and agricultural water use, high ground water problems, reclamation and recharge and direct bay discharge. Consider the impact of normal, wet, and dry year climatic conditions on each solution.

Estimate the relative contributions to shallow groundwater problems from increased urban run-off from property development and septic tank discharge. Estimate the degree to which existing shallow groundwater conditions will continue to be problems with implementation of the sewer project, or contribute to problems resulting from increased urban run-off.

c. <u>Task 6: Determine Environmental and Regulatory Impacts and Requirements</u>

Prepare a preliminary analysis to determine the probable environmental impacts of recommended solutions and probable mitigation measures. Environmental impacts for each solution will be identified and discussed. A matrix, checklist, or table will summarize environmental information. The preliminary analysis shall include potential regulatory impacts, water quality impacts, and a review of County development policies and standards.

Identify all regulatory agencies that have authority to regulate permitting for applicable aspect of solutions including construction improvements. Determine applicable requirements of permitting agencies and local, state, and federal law including but not limited to NPDES and Best Management Practices. In addition, determine mitigation measures for potential impacts of solutions.

Determine the potential need for solutions which address first flush treatment and/or recharge permits. The analysis will include and estimation of surface runoff water quality and recharge water quality.

Review and evaluate County development policies and standards with regard to drainage conditions based on their performance in actual flood events. Provide independent evaluations and recommendations regarding said standards.

d. <u>Task 7: Determine Other Impacts</u>

Determine other impacts including social and political which are relevant to each project. These might include the *impact on* community character or whether the project is growth inducing.

e. Task 8: Calculate Costs

Develop preliminary cost estimates for alternatives and identify the area of direct and indirect benefit for each alternative. These estimates should include requirements for land acquisition, rights-of-way, and any probable mitigation of environmental impacts.

f. Task 9: Prepare Working Paper No. 2

Refine the screening criteria for the selection of solutions. Apply the screening criteria utilizing the information and analysis prepared in Task 1 through Task 8. Prepare and submit Working Paper No. 2, Alternatives Analysis, compiling the material completed in Task 1 through Task 9. Discuss comments on Working Paper No. 2 with COUNTY.

Deliverables for Task 9:	Working Paper No.2 (9 bound originals, one unbound, and on 3.5" disk in approved format), Minutes for meeting
Meetings for Task 9:	Discuss comments on Working Paper No.2 with COUNTY (1).

3. Phase III: Draft Report

b. Task 10: Refine Preferred Project

Develop a schedule and estimated costs for annual operation and maintenance of preferred project.

Prioritize all improvements of the preferred solution in terms of implementation schedules and costs to include: a) individual, stand alone improvements; b) phased improvements, requiring integration with other identified improvements; c) regional or sub-basin improvements, as compared to, d) a communitywide total drainage improvement project. Cost estimates shall be developed for individual improvements, combined and phased improvements, regionally and as one total communitywide project.

Benefit assessment areas shall be determined for each improvement in terms of property: a) direct benefit; b) indirect benefit and c) overall communitywide benefit. Said determination shall be limited to property identifications by area only. Cost spread per individual parcel shall not be included.

For each improvement, the ENGINEER will identify any applicable regulations/requirements of other agencies including but not limited to: San Luis Obispo County Flood Control and Water Conservation District, California Water Code, California Environmental Quality Act, California Health Department, California Department of Fish and Game, Caltrans, CAL OSHA, US Army Corps of Engineers, US Bureau of Reclamation, US Fish and Wildlife Service, EPA, USDA, Natural Resources Conservation Service, California Coastal Commission.

c. <u>Task 11: Prepare a Draft Report</u>

Prepare a Draft Report, Preliminary Engineering Evaluation, of findings and conclusions to include all of the above determinations, supporting data and the preliminary environmental analysis. The Draft Report will include Working Paper No. 1, Working Paper No. 2, and discussion and presentation of work completed in Task 10 and 11.

The Draft Report will address groundwater issues and the influence of the proposed sewer collection system on groundwater level, and issues related to water quality discharge. It will also discuss the influence of surface water runoff in relation to high groundwater levels throughout the watershed. Water use strategies for agricultural runoff, reclamation, bay discharge and water quality will be addressed. Infrastructure capacities and efficiencies will be described in the report and recommendations for implementing projects to rectify current flooding problems will be given.

Submit Draft Report to the CSA 9 Advisory Group and the County Board of Supervisors. Submit Draft Report for comment by various regulatory agencies.

Deliverables for Task 11: Draft Report (9 bound originals, one unbound, and on 3.5" disk in approved format)

4. Phase IV : Final Report

a. Task 12: Meeting with COUNTY

Meet with COUNTY to discuss comments on the Draft Report and provide guidance for any changes to the Draft Report.

Deliverables for Task 12:	Minutes for meeting
Meetings for Task 12:	Discussion with COUNTY (1)

b. Task 13: Prepare Final Report

Assist the COUNTY in the preparation of a project description to be used as part of a public material information, and to be used to solicit a design consultant for the purpose of financing and constructing the preferred project.

Prepare Final Report, "Preliminary Engineering Evaluation of Flooding Problems in CSA 9J", including revisions based upon comments and discussion regarding the Draft Report.

Deliverables for Task 13:	Final Report (9 bound originals, one unbound, and on 3.5" disk in approved format)
Meetings for Task 13:	Presentation to CSA 9 Advisory Group and County Board of Supervisors(2)

D. Special Services

Tasks which may be required of ENGINEER as Special Services have not been defined as of the date of this AGREEMENT. If required by COUNTY, such special services will be defined by written Amendment(s) to this AGREEMENT.

ARTICLE III. TIME OF PERFORMANCE

A. Schedule. All work called for shall be completed by ENGINEER within one hundred twenty (120) calendar days after being notified by COUNTY, in writiing, to proceed under this AGREEMENT. The schedule may be extended pursuant to Task 2.

B. Time of Performance for any Special Services will be negotiated by the COUNTY with ENGINEER as appropriate and will be designated with any written amendment(s) to this AGREEMENT.

ARTICLE IV. TERM

The term of this AGREEMENT shall be one year from the date first above written.

ARTICLE V. COMPENSATION

The COUNTY shall pay ENGINEER in accordance with this AGREEMENT an amount not to exceed the lesser of: (a) the total costs for all time and materials expended by ENGINEER on the tasks described in the Scope of Services in accordance with the rate schedule included in Exhibit B, "Rate Schedule", or (b) the sum of fifty one thousand dollars (**$51,000.00**). No payments shall be made unless a Notice to Proceed is issued by the COUNTY to the ENGINEER for this AGREEMENT.

The COUNTY shall pay ENGINEER for any Special Services called for under ARTICLE II an amount not to exceed the lesser of: (a) the total of all time and materials expended by ENGINEER on the Special Services in accordance with the rate schedule included in Exhibit B, "Rate Schedule", or in accordance with the terms of those Special Services as described in any Amendment(s) to this AGREEMENT. No payments shall be made unless a Notice to Proceed is issued by the COUNTY to the ENGINEER for the Special Services.

No additional compensation will be provided for any delay by County in providing one foot topographic mapping to ENGINEER. Other delays in completion of ENGINEER's services beyond the schedule in ARTICLE III for completion of these tasks, which delays are beyond ENGINEER's control, may result in an increase in cost to the ENGINEER. In this event, ENGINEER may request COUNTY for additional compensation in the amounts provided for in Exhibit B, but COUNTY shall not be required to pay any such requested additional compensation if the County Engineer determines, in the sole discretion of the County Engineer, that such additional compensation is not justified or appropriate.

ARTICLE V. BILLING AND PAYMENT

A. Billing:

The ENGINEER shall submit an invoice each month for services performed in accordance with this AGREEMENT in an amount not to exceed the lesser of: (a) the cost of time and materials expended by ENGINEER, or (b) the total of the estimated percentage of work completed for each task multiplied by the amount budgeted for each task. The amount budgeted for each task is shown in Exhibit A, "Fee Schedule", and in any Amendment(s). All invoices are subject to consideration of approval by the COUNTY based upon verification of time and materials expended by ENGINEER and percent of work completed for each task.

Invoices will show for each task billed, the budgeted amount, amount previously billed, current bill, and percent complete. Each invoice shall be accompanied with a brief description of the work associated with the invoice and a status report of the project to date.

Billing for any Special Services will be in accordance with the terms of the Amendment(s) to this AGREEMENT providing for any such Special Services.

B. Payment:

Payment shall be made to ENGINEER by COUNTY within thirty (30) days after approval of invoice by COUNTY ENGINEER, provided all work thereunder has been performed to COUNTY'S satisfaction and in strict accordance with this AGREEMENT and with all its attachments. The County Engineer will determine if an invoice is approved or unacceptable within 7 days of receipt.

In the event any such payment is not paid within thirty (30) days after approval by COUNTY of the invoice, it shall commence bearing interest on the date said invoice was approved by COUNTY, at the rate of six point five percent (6.5%) per annum (or such rate as may be the maximum interest rate permissible under applicable law) and COUNTY agrees to pay all accrued interest, together with the charges for approved services rendered.

ARTICLE VI. GENERAL

A. Authority

ENGINEER is not authorized to incur any debt, obligation or liability on behalf of COUNTY or to execute any agreement, contract or other commitment on behalf of COUNTY.

B. Indemnification

ENGINEER shall defend, indemnify and save harmless COUNTY, its officers, agents and employees, from any and all claims, demands, damages, costs, expenses, judgments, attorney fees or any liability arising out of this AGREEMENT or attempted performance of the provisions hereof, including but not limited to those predicated upon theories of violation of statute, ordinance, or regulation, professional malpractice, negligence, or recklessness including negligent or reckless operation of motor vehicles or other equipment, furnishing of defective or dangerous products or completed operations, premises liability, inverse condemnation, violation of civil rights and also including any adverse determination made by the Internal Revenue Service or the State Franchise Tax Board with respect to ENGINEER'S "independent contractor" status that would establish a liability for failure to make social security and income tax withholding payments, or any act or omission to act, whether or not it be willful, intentional or actively or passively negligent on the part of the ENGINEER or his agents, employees or other independent Consultants directly responsible to ENGINEER; providing further that the foregoing shall apply to any wrongful acts or any active or passively negligent acts or permissions to employees or other independent contractors and COUNTY, its agents, employees or independent profession contractors involved in this PROJECT. Nothing contained in the foregoing indemnity provision shall be construed to require indemnification for claims, demands, damages, costs, expenses, judgements, attorney fees resulting solely from the negligence or willful misconduct of the COUNTY. Nothing contained in the foregoing indemnity provisions shall be construed to require ENGINEER to indemnify COUNTY, against any responsibility or liability in contravention of Section 2782 of the Civil Code.

C. Arbitration Procedures

Arbitration shall only be used under this AGREEMENT in the event both parties consent in writing thereto in regard to any specific claim, counter-claim, dispute, other matter in question between COUNTY and ENGINEER arising out of or related to this AGREEMENT, or any breach of this AGREEMENT. Should arbitration be chosen by the parties hereto for the interpretation of this AGREEMENT, the parties shall arbitrate as follows:

1. COUNTY and ENGINEER shall each select an arbitrator of its own choosing, which arbitrators shall mutually select a third arbitrator.

2. The arbitrators may select the procedure for reviewing and determining the dispute.

3. The fees of the arbitrators shall be borne equally by COUNTY and ENGINEER.

4. The parties shall be bound by the decision of the arbitrators.

D. Responsibility of COUNTY

COUNTY will:

1. Assist ENGINEER in obtaining any information previously compiled in coherent form by COUNTY or others in connection with the Project, including but not necessarily limited to: pertinent maps, plans, studies, reports, computer files, record drawings, and right-of-way and easement information, which information is available to COUNTY and which is required in connection with ENGINEER'S services under this AGREEMENT. ENGINEER is entitled to rely on the accuracy of all such information furnished by COUNTY unless such information contains errors which should be apparent to an Engineer having ENGINEER's qualifications and experience.

2. Provide distribution for all Project documents, status and/or progress reports.

3. Provide front-end documents, and general and supplementary conditions for the Project. ENGINEER shall use COUNTY provided documents and conditions, or provide ENGINEER's own documents and conditions subject to COUNTY review and approval.

4. Attend appropriate Project meetings with representatives of the Drainage Subcommittee of the CSA 9 Advisory Group.

5. Provide site access and all necessary temporary rights of entry.

6. Pay all required permit fees, internal County Department fees and those fees not specifically identified within this AGREEMENT.

7. Review all of ENGINEER's submittals and provide written comments thereon on a timely basis on one copy.

E. Insurance

ENGINEER shall procure the following required insurance coverages at its sole cost and expense and maintain in full force and effect for the period covered by this AGREEMENT such insurance. All insurance coverages are to be placed with insurers which (1) have a Best's rating of no less than B+VIII, and (2) are admitted insurance companies in the State of California.

1. Professional Liability Insurance: ENGINEER shall maintain in full force and effect during the entire term of this AGREEMENT, professional liability "errors and omission" insurance with limits of liability of not less than $500,000.00 per occurrence to cover all services rendered by ENGINEER pursuant to this AGREEMENT. Where claims made coverage is provided, a tail of two (2) years shall be provided or current policy maintained.

2. Comprehensive General Liability: ENGINEER shall maintain in full force and effect, for the period covered by this AGREEMENT, Comprehensive General Liability insurance with the following coverages.

    a. Personal Injury and Bodily Injury, including death resulting therefrom.
    b. Property damage.
    c. Automobile coverage which shall include owned and non-owned vehicles.

    The amount of insurance shall be not less than the following: single limit coverage applying to bodily and personal injury, including death resulting therefrom, and property damage, and automobile coverage in the total amount of $1,000,000.

    The following endorsements must be provided in the policy:

    a. If the insurance policy covers on an "accident" basis, it must be changed to "occurrence."

    b. The policy must cover personal injury as well as bodily injury.

    c. Blanket contractual liability must be afforded and the policy must contain a cross liability or severability of interest endorsement.

    d. The COUNTY, its officers, employees and agents shall be named included as additional insureds under the policy. The policy shall provide that the insurance will operate as primary insurance. No other insurance effected by COUNTY, whether commercial or self-insurance will be called upon to contribute to a loss hereunder.

3. Workers' Compensation Insurance: In accordance with the provisions of Labor Code Section 3700, ENGINEER, if ENGINEER has an employees, is required to be insured against liability for Workers' Compensation or to undertake self-insurance. ENGINEER agrees to comply with such provisions before commencing the performance of the work of this AGREEMENT, and during the terms of this AGREEMENT.

4. The following requirements apply to all insurance to be provided by ENGINEER:

   a. A certificate of insurance shall be furnished to COUNTY prior to commencement of work. Upon request by the COUNTY, ENGINEER shall provide a certified copy of any insurance policy to the COUNTY within ten (10) working days.

   b. Policies shall not be canceled or reduced in coverage or changed in any other material aspect without thirty (30) days prior written notice to COUNTY.

   c. Approval of the insurance by COUNTY shall not relieve or decrease the extent to which the ENGINEER may be held responsible for payment of damages resulting from ENGINEER'S services or operations pursuant to this AGREEMENT.

The parties expressly agree that the indemnification and insurance clauses in this AGREEMENT are an integral part of the performance exchanged in this AGREEMENT. The compensation stated in this AGREEMENT includes compensation for the risks transferred to ENGINEER by the indemnification and insurance clauses.

F. Termination of AGREEMENT

This AGREEMENT may be terminated by either party upon thirty (30) days written notice to the other party. Termination shall have no effect upon the rights and obligations of the parties arising out of any transaction occurring prior to the effective date of such termination. ENGINEER shall be paid for all work satisfactorily completed prior to the effective date of said termination.

G. Assignment

ENGINEER shall not assign or transfer this AGREEMENT or any interest herein.

H. Binding

This AGREEMENT and each and every provision hereof shall be binding on the heirs, administrators, trustees, transferees, and successors of the parties hereto, provided that this paragraph shall not be construed to authorize any assignment or transfer of this AGREEMENT or any interest therein by ENGINEER.

I. Waiver

No waiver by COUNTY of any failure by ENGINEER to comply with any term or condition hereof shall be or shall be construed to be a waiver by COUNTY of any similar or other failure by ENGINEER to comply with any term or condition hereof.

J. ENGINEER is Independent Contractor

At no time shall ENGINEER be or be construed to be an employee of COUNTY. On the contrary, ENGINEER at all times under this AGREEMENT shall be and shall be construed to be an independent contractor.

K. ENGINEER'S Endorsement

ENGINEER shall sign and seal all reports, maps, plans, specifications and/or other documents prepared by ENGINEER under this AGREEMENT in accordance with applicable provisions of the Professional Engineers Act of the State of California.

L. Documents, Information and Materials Ownership

All documents, information and materials of any and every type prepared by ENGINEER pursuant to this AGREEMENT shall be the property of COUNTY. Such documents shall include but not be limited to data, drawings, specifications, reports, estimates, summaries, and such other information and materials as may have been accumulated by ENGINEER in performing under this AGREEMENT, whether completed or in process. ENGINEER shall assume no responsibility for the use by others of any such documents, information, or materials except as these are applied to PROJECT.

M. Access to Records

1. ENGINEER shall keep complete and accurate records for the services performed pursuant to this CONTRACT and any records required by law or government regulation, and shall make such records available to COUNTY at all reasonable times. ENGINEER shall retain these records for a period of two (2) years following fulfillment of all of ENGINEER'S responsibilities hereunder, of for such longer time(s) as may be required by law.

2. ENGINEER shall assure the confidentiality of any records that are required by law to be so maintained.

N. Time is of the Essence

Time is hereby made the essence of this AGREEMENT.

O. Subcontracts

1. Any subcontractors and outside associates or consultants required by ENGINEER in connection with service under this AGREEMENT will, unless a change is approved in writing by COUNTY, be limited to such individuals or firms as are specifically identified below:

The Morro Group
Philip Williams & Associates

P. Organization and Staffing for ENGINEER

The following identifies the general roles and responsibilities for key staff of the ENGINEER No changes shall be made therein without prior written approval of COUNTY.

Dan Lloyd will act as Project Manager for the ENGINEER, and will be responsible for maintaining the project schedule and production of all reports and exhibits. He will also provide analysis of regulatory agency review and permitting issues, drainage policy, and standards review, and benefit assessment analysis.

Keith Crowe will be responsible for analysis of all existing infrastructure and improvements. He will work with Don Asquith and Jeff Haltiner to develop solutions for each problem area.

Don Asquith will be specifically responsible for all issues related to groundwater, water quality, geologic conditions, groundwater recharge and appropriateness of proposed solutions. He will coordinate with Mary Reents in identifying potential environmental impacts relative to groundwater and bay discharge.

Mary Reents will have the responsibility of identifying all non-water related potential environmental impacts associated with proposed solutions for each problem area, and preparing initial studies that address environmental considerations.

Jeff Haltiner will assist in the development of solutions for drainage problems.

Q. Duty of ENGINEER

ENGINEER shall provide all labor, materials and equipment required for ENGINEER'S performance of this AGREEMENT, unless other provisions of this AGREEMENT specifically requires provision by COUNTY of any specific labor, material or equipment.

R. Designation of COUNTY'S Authorized Representative

Mr. Timothy P. Nanson, County Engineer, or other duly authorized representative as may be designated in writing by said County Engineer or by County's Board of Supervisors, is hereby designated to act as COUNTY'S authorized representative with respect to work to be performed under this AGREEMENT.

S. Notices

Notices hereunder to the parties hereto shall be sent by certified mail, return receipt requested, postage prepaid, addressed as follows:

1. To ENGINEER:

Engineering Development Associates
1320 Nipomo Street
San Luis Obispo, CA 93401

Attention: Mr. Dan Lloyd/Keith Crowe

2. To COUNTY:

County Engineering Department
County Government Center
San Luis Obispo, CA 93408

Attention Mr. George Gibson/Mr. Greg Martin

T. Entire AGREEMENT

This document, together with the attached Exhibit A, "Fee Schedule" and Exhibit B, "Rate Schedule" is the entire AGREEMENT between the parties, and supersedes any and all prior written or verbal agreements, representations and/or discussions between the parties. No changes, amendments or alterations to this AGREEMENT, or any term thereof, shall be effective unless in writing and signed by both parties hereto.

U. Venue

All performance under this AGREEMENT shall be in the State of California, and California shall be venue for any court proceedings.

IN WITNESS WHEREOF, this AGREEMENT has been executed by the parties hereto, upon the date first above written.

SAN LUIS OBISPO COUNTY

By: ______________________________
Chairman of the Board of Supervisors
of the County of San Luis Obispo

ATTEST:

JULIE L. RODEWALD
____
County Clerk and Ex-officio Clerk
of the Board of Supervisors of
the County of San Luis Obispo

By: ______________________________
Deputy Clerk

____

By: ______________________________
Dan Lloyd
Project Manager

APPROVED AS TO FORM AND LEGAL EFFECT:

JAMES B. LINDHOLM, JR.
County Counsel

By: ______________________________
Deputy County Counsel

Dated: 17 MAY 96

"Exhibit A"

Fee Schedule

Phase	Task	Fee
Phase I:	1	$7,200
	2	$5,600
	3.	$7,495
Phase II:	4	$3,300
	5	$2,900
	6	$4,700
	7	$675
	8	$2,500
	9	$3,355
Phase III:	10	$4,600
	11	$5,000
Phase IV	12	$1,175
	13	$2,500
Total:		$51,000

"Exhibit B"

Rate Schedule

Name, Title	Rate/hour
Dan Lloyd, Project Manager	$95
Keith Crowe, Principal Engineer	$85
Glenn Marshall, Staff Engineer	$60
Jeffrey Haltiner, Water Resource Specialist	$125
Don Asquith, Hydrogeologist	$90
Mary Reents, Planner	$85

Appendix G2
SHORT TERM SOLUTIONS

The following tables summarize short term solutions initially presented in Working Paper Number 1 as temporary measures prior to the construction of permanent drainage infrastructure. Each table is specific to the individual drainage areas as presented in the draft report.

Area 1: Short Term Solutions

Item	Problem	Solution	Description
1.1	Pasadena Road	Temporary Road Closure	Continue temporary road closure during storm events.
1.2	Lot Flooding	Sandbagging	

Area 2: Short Term Solutions

Item	Problem	Solution	Description
2.1	3rd Street Sedimentation	Maintenance	Clean sand/silt deposition as required.

Area 3: Short Term Solutions

Item	Problem	Solution	Description
3.1	Lot Flooding	Sandbagging	
3.2	Sedimentation	Maintenance	Clean sand/silt as required.
		Erosion Control	Haybales or silt fences at identified sources of erosion.

Area 4: Short Term Solutions

Item	Problem	Solution	Description
4.1	14th Ponding	Sandbag & pump	Sandbag water to retain and use portable pump to pump water easterly towards Area 5 (eventual discharge to basin) or discharge to bay.
4.2	Cross lot drainage	Sand Bagging	

Area 5: Short Term Solutions

Item	Problem	Solution	Description
5.1	Sedimentation	Maintenance	Clean sand/silt as required.
		Erosion Control	Haybales or silt fences at identified sources of erosion.

Area 6: Short Term Solutions

Item	Problem	Solution	Description
6.1	Road Flooding	Continued pumping	
		Road Closure	
6.2	Residential Flooding	Sand Bagging	
6.3	Septic Tank Failure	Provide Portable Bathroom	Install portable bathrooms for residents have septic tank failure. Would not alleviate problems associated with cooking and cleaning.

Area 7: Short Term Solutions

Item	Problem	Solution	Description
7.1	Road Flooding	Continued pumping	
		Road Closure	
7.2	Residential Flooding	Sand Bagging	
7.3	Septic Tank Failure	Provide Portable Bathroom	Install portable bathrooms for residents have septic tank failure. Would not alleviate problems associated with cooking and cleaning.

Area 8: Short Term Solutions

Item	Problem	Solution	Description
8.1	Road Flooding	Road Closure	
8.2	Ramona Lake	Road Closure	
8.3	Residential Flooding	Sand Bagging	

Area 9: Short Term Solutions

None required.

Area 10: Short Term Solutions

Item	Problem	Solution	Description
10.1	Road Flooding	Road Closure	

Area 11: Short Term Solutions

Item	Problem	Solution	Description
11.1	Road Flooding	Road Closure	

Area 12: Short Term Solutions

None required.

Area 13: Short Term Solutions

Item	Problem	Solution	Description
13.1	Road Flooding	Road Closure	
13.2	Residential Flooding	Sand Bagging	

Area 14: Short Term Solutions

Item	Problem	Solution	Description
14.1	Road Flooding	Road Closure	
		Pump	Place portable pumps with discharge to bay
14.2	Residential Flooding	Sand Bagging	
14.3	Septic Tank Failure	Provide Portable Bathroom	Install portable bathrooms for residents having septic tank failure. Would not alleviate problems associated with cooking and cleaning.

Area 15: Short Term Solutions

Item	Problem	Solution	Description
15.1	Road Flooding	Road Closure	
15.2	Residential Flooding	Sand Bagging	

Area 16: Short Term Solutions

Item	Problem	Solution	Description
16.1	Road Flooding	Road Closure	
		Pump	Install temporary pumps at existing culverts.
16.2	Residential Flooding	Sand Bagging	
16.3	Silt Deposition	Erosion Control	Haybales or silt fences to retain slides off of Highland Drive

Area 17: Short Term Solutions

Item	Problem	Solution	Description
17.1	Road flooding	Road Closure	
17.2	Lot Flooding	Sand Bagging	

Area 18: Short Term Solutions

Item	Problem	Solution	Description
18.1	Road Flooding	Road Closure	Restrict access to residents of the area only.

Area 19: Short Term Solutions

Item	Problem	Solution	Description
19.1	Road Flooding, Mountain View	Road Closure	Restrict access to Mountain View to residents of the area only.
		Pump	Temporary pumps to culvert 23.3

Area 20: Short Term Solutions

None required.

Area 21: Short Term Solutions

None required.

Area 22: Short Term Solutions

Item	Problem	Solution	Description
22.1	Los Olivos Flooding	Road Closure	Close Los Olivos to through traffic
		Pump	Pump to basin 22.A, 21.A or 22.B if possible or pump to Mountain View

Area 23: Short Term Solutions

Item	Problem	Solution	Description
23.1	Nipomo at Eto Cr.	Road closure	Close road during severe storm events when Eto Creek may breach roadway.
23.2	Willow at DI 23.1	Road closure	Alternate route would be Andre Avenue to Nipomo
		Pump	Pump from Willow to Eto Creek.

Area 24: Short Term Solutions

None required.

Area 25: Short Term Solutions

	Problem	Solution	Description
25.1	Madera Basin	Redirect spill	Sandbag spill to redirect away from Monarch subdivision. May not be necessary because Monarch subdivision will install curb and gutter on Pecho Valley Road.
25.2	Madera St. erosion	Sand bagging	Protect residence with sandbags.
		Silt Fences	Install silt fences or haybales to limit amount of sediment from uphill undeveloped lots on Madera and San Ricardo Lane.
25.3	Vista at Los Arboles	Silt Fences	Install silt fences or haybales to limit amount of sediment from southerly hills.
25.4	Highland at Alexander	Silt Fences	Install silt fences or haybales to limit amount of sediment from southerly hills.
25.5	Pecho Valley at LOVR	Lane closure	

Area 26: Short Term Solutions

None required.

Area 27: Short Term Solutions

Item	Problem	Solution	Description
27.1	Flooding of LOVR	Road Closure	Close LOVR
		Temporary Pumping	Pump with discharge to Los Osos Creek
27.2	Residential Flooding	Sand bagging	